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GENERAL

The Pilot's Operating Manual has been prepared in compliance with the FAA Approved Airplane Flight Manual (AFM). Procedures which differ from the FAA AFM have been designed to assure an equivalent level of safety.

The Pilot's Operating Manual is designed for use by qualified crew members. Each pilot is issued the manual, which remains the property of Delta Air Lines, Inc. Each pilot must keep the entire manual in a current status.

The procedures, techniques, and operations in the Pilot's Operating Manual establish the standard to which pilots will be trained and by which the aircraft should be operated.

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This Pilot's Operating Manual has been prepared for the use of Flight Operations Personnel in operating aircraft under the auspices of Delta Air Lines, Inc.

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REVISIONS

A. Normal Revision —
Such Revisions are printed on white (or appropriate color for revised "differences" pages) paper and will be accompanied by a Transmittal Sheet covering the Highlights of the Revision and filing instructions.

NOTE: ▌ Indicates Approved Manual Material

B. Temporary Revision —
Such Revisions will be printed on yellow paper and are used for rapid notification of change. The Temporary Revision carries its own Transmittal and filing instruction. If a Temporary Revision has an effective date and/or a termination date, such date(s) will be printed on the Revision.

C. Flight Crew Bulletin —
These bulletins will be printed on green paper and should be filed in the front of the POM and retained until advised.

PILOT OPERATING MANUAL

CONTENTS:
EMERGENCY PROCEDURES
DITCHING/EVACUATION PROCEDURES
ABNORMAL PROCEDURES
NORMAL PROCEDURES
LIMITATIONS
FLIGHT TRAINING

EMERGENCY PROCEDURES

This section contains all emergency procedures in expanded check list format. One Emergency Checklist covers all models within an aircraft fleet operated by Delta and any "differences" are noted within the text or on blue pages at the end of the section.

The Ditching and Evacuation Section of Emergency Procedures contains procedures, policy and station assignments to be used by all flight crewmembers in the event the aircraft must be ditched or abnormally evacuated.

ABNORMAL PROCEDURES

Procedures in this section are those requiring crew action to either counteract a system malfunction or prevent an emergency condition from developing. These procedures are abnormal since, due to the malfunction, the aircraft may be in an abnormal condition and effort must be made to obtain or restore as much of a normal condition as possible. These procedures are in expanded check list format.

NORMAL PROCEDURES

This section contains the expanded normal check list (Second Officer's and Pilot's). It includes the procedures for a qualified flight crew to operate the aircraft from before engine start to shutdown after a normal flight. Items will be arranged in the same order as listed on the check list.

Information, procedures, and techniques not directly bearing on a check list item are not found in this section, but are included in other sections, such as Flight Training.

LIMITATIONS

This section includes the required Operational and System Limitations arranged with General Limitations first followed by Systems Limitations arranged in the same order as Systems Sections in the Pilot's Reference Manual.

FLIGHT TRAINING

This section contains information used to standardize Line Operations of the aircraft. The maneuvers, techniques, and procedures in this section should be used as the standard in flight operations. Where applicable, significant "training" differences are noted.

GLOSSARY

The following terms and abbreviations are listed to provide information about new terms or those peculiar to the L–1011.

TERM	DEFINITION	REMARKS
ACM	Air Cycle Machine	Major Air conditioning component.
ADC	Air Data Computer	Provides processed pilot/static data to flight instruments.
ADI	Attitude Director Indicator	Includes Flight director.
AFCS	Avionic Flight Control System	Interface of autopilot, flight director and flight controls.
AL	Autoland	
A/L	Approach/Land	Command mode of APFDS
ALPHA MODE		Airspeed commands referenced to angle of attack.
ANS	Automated Navigation System	
APFDS	Autopilot Flight Director System	
APU	Auxiliary Power Unit	
ASM	Airspeed Mach Indicator	
ATM	Air Turbine Motor	Pneumatically operated hydraulic pump.
ATS	Autothrottle System	
AVM	Airborne Vibration Monitor	Monitors vibration levels in engines.
BITE	Built In Test Equipment	Provides circuit and gauge test of most systems.
BRG	Bearing	Referenced to generators.
BTB	Bus Tie Breaker	
CADC	Central Air Data Computer	Used interchangeably with ADC.
CAWP	Caution And Warning Panel	Formerly called Annunciator Panel. However, to distinguish from other annunciator groups, new term is used in reference to panel on lower left of Engine Instrument Panel or on upper right of Second Officer's Panel.
CDU	Control & Display Unit	Part of auto-nav system.
CMD	Command	Engagement position of autopilot when command modes are in use.
CWS	Control Wheel Steering	Basic mode of autopilot operation.
DLC	Direct Lift Control	Modulation of spoilers 1 through 4 in response to pitch signals through control column anytime flaps are 30° or more.
EACS	Electronic Automatic Chart System	Component of auto-nav system.
ECS	Environmental Control System	Combination of engine bleed, air conditioning, and pressurization systems.
EFDARS	Expandable Flight Data Acquisition & Recording System	Flight recorder.
ESS	Essential	
FCES	Flight Control Electronic System	
FDSU	Flight Data Storage Unit	Component of auto-nav system.
FIRM	Fault Isolation Reporting Method	Malfunction procedure and code forwarded to maintenance. Usually, in relation to Abnormal Procedures.

TERM	DEFINITION	REMARKS
GB GCU	Generator Breaker Generator Control Unit	Provides power for closing the generator field relay, generator breaker, and bus tie breakers. If a malfunction occurs, they provide power for tripping the breakers.
GF GFR	Generator Field Generator Field Relay	
HSI	Horizontal Situation Indicator	
IDG	Integrated Drive Generator	Combined generator/CSD.
KVAR	Kilovolt/Amps Reactive	Indicates reactive load on the generator.
LRS	Load Relief System	Flap load relief system prevents excessive airloads on the flaps.
MLG	Main Landing Gear	
NCU NLG	Navigation Computer Unit Nose Landing Gear	Component of auto-nav system.
PDU PEA PFCS PHE PMG	Power Drive Unit Prismatic Electromechanical Annunciator Primary Flight Control System Primary Heat Exchanger Permanent Magnet Generator	Used as component of AFCS and Instrument Warning Panels. Movable surfaces that control the aircraft around the three control axes. Component of the air cycle machine. Component of generator permitting the generator to provide its own control power.
PTS PTU	Pitch Trim System Power Transfer Unit	Enables transferring hydraulic power from one system to another without transferring fluid.
RAT RCCB RDDMI R NAV	Ram Air Turbine Remote Control Circuit Breaker Radio Digital Distance Magnetic Indicator Automated (or Area) Navigation System	Propeller driven hydraulic pump which may be extended in emergency. Combined instrument (RMI – DME)
SAS SCS SPI SSC	Stability Augmentation System Speed Control System Surface Position Indicator Static System Comparator	Provides stability functions. Displays position of stabilizer, rudder, spoilers, and inboard and outboard ailerons. Yellow flag on altimeter indicates failure of air data computer to correct for static error.
TGT	Turbine Gas Temperature	
YSAS	Yaw Stability Augmentation System	

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GENERAL POLICIES

The information contained in this section is company policy. Each crewmember is expected to remain thoroughly familiar with the contents of this section as well as the 'Emergencies' section of the Flight Operations Procedures Manual. However, if an emergency exists for which these procedures are not adequate or applicable, the Captain's best judgment shall prevail.

EMERGENCY CHECKLIST

The Emergency Checklist card contains the critical items required to stabilize and protect the aircraft. When these items are accomplished, complete the remaining items for the procedure contained in this section.

The Emergency Checklist is to be stowed in the Emergency Checklist holder.

If a situation develops for which an emergency procedure applies, the Captain identifies the emergency, calls for the reading of the checklist, and determines that either he or the F/O will fly the aircraft during the emergency. The S/O reads aloud the challenge and response of each item which requires action by the Captain or F/O, and the appropriate crewmember responds accordingly. He also reads aloud any S/O items, which will cause warnings/systems interruptions affecting Captain or F/O duties. All other S/O items may be accomplished silently.

Some emergency situations require INITIAL ACTION. These steps are contained in a box. Such items should be accomplished without the aid of a checklist.

Except for the INITIAL ACTION items, the emergency checklist and expanded material will be used so that a crewmember need not rely on his memory for items to be checked.

The S/O will state when all items of the appropriate emergency checklist have been completed.

Crew duties are assigned by placing a letter code as the first part of the expanded remarks. The letter **C** indicates Captain duties, **F** indicates F/O dutes, and **S** indicates S/O duties. However, the Captain may direct any crewmember to accomplish any checklist item.

NOTIFICATION OF EMERGENCY

Notify ATC as soon as possible; tranponder code 7700 and VHF frequency 121.5 may be used. Notify Delta Flight Control as soon as conditions permit.

OXYGEN

In an emergency requiring the use of oxygen masks use protective (100%) oxygen and establish communications immediately.

Each crewmember's microphone selector must be set to OXY.

When the degree of emergency has been determined, a changeover to supplemental (NORMAL) may be made to conserve oxygen supply.

AURAL/VISUAL WARNINGS

If warnings occur during an emergency, the appropriate crewmember turns off the warning promptly and calls out which warning has been silenced or turned off. Such items may not be included on the checklist, but are assumed to be performed automatically.

CONCURRENT FLIGHT ATTENDANT DUTIES

Concurrent flight attenant ditching/evacuation duties are shown on the crew duties chart in the DITCHING/EVACUATION section.

COCKPIT VOICE RECORDER (CVR)

In the event of an emergency landing or an incident requiring immediate notification of the National Transportation Safety Board, the CVR information must be retained. This would include:

- Aircraft accident/incident.
- Flight control system malfunction.
- Incapacitated crewmember as a result of injury or illness.
- In-flight fire.
- In-flight collision.

If conditions require immediate securing of the cockpit, the Voice Recorder C/B must be pulled prior to reinstating power on the aircraft. If conditions do not require immediate securing of the cockpit, pull the Voice Recorder C/B before leaving the aircraft.

EMERGENCY REQUIRING UNSCHEDULED LANDING

Some emergency situations may require early consideration of landing. Begin making such a decision while performing emergency procedures. If the nature of the emergency permits, the choice of landing area should be considered based on the following order:

- Delta on-line station.
- Commercial airport (not Delta line station).
- Military airfield.
- Public non-commercial airport.

Whenever the emergency requires a landing at the nearest suitable airport the following should be considered in selecting the airport:

- Nature of the malfunction and possible mechanical difficulties that could occur if flight is continued.
- Altitude, weight, and usable fuel.
- Weather conditions en-route and at possible landing points.
- Air traffic congestion.
- Kind of terrain.
- Familiarity with the airport to be used.

Time permitting, consult Flight Control.

OFF AIRPORT LANDING

If an emergency landing should occur at a place other than an airport, the senior crewmember, in order of command, is responsible for:

- Notifying Flight Control and the nearest Delta official as soon as possible.
- Notifying local authorities so arrangements can be made for medical aid, transportation, and accommodations.
- Posting a guard to see that no mail, baggage, or parts of the aircraft are disturbed.
- Cooperating with the FAA and/or NTSB until released by their representative.

NOTE: In any emergency situation, make no comments to press, radio, etc. Refer them to the Director - Public Relations.

CABIN FIRE/SMOKE

Use the correct fire extinguisher for the type of fire involved. Do not use water or other liquid on an electrical fire until power to area is off. Halon can be used as it does not conduct electricity. However, it is normally effective only after the power is off. Halon can be used in confined areas without making the atmosphere unbreathable. However, when fighting any fire, an oxygen bottle with full-face mask should be worn to protect against toxic smoke.

Follow smoke evacuation procedure as required for existing conditions. Unless the source of smoke/fire can be definitely identified and positively eliminated, land at the nearest suitable airport.

FIRES ON THE GROUND

If any fire occurs or continues on the ground the aircraft should be stopped so that wind will blow fire away from the aircraft structure. Unless the fire is extinguished or conditions are definitely under control, evacuate the aircraft.

ENGINE MALFUNCTIONS

In all cases of engine malfunctions, the first priority is to control the aircraft and prevent further complications created by loss of systems. Initiate shutdown only after indications are verified and the engine is specifically identified. In reading checklist **items which effect shutdown or loss of thrust**, the Second Officer should **identify the engine.**

DO NOT RESTART AN ENGINE FOR ANY OVERTEMP CONDITION, DAMAGE, OR LOW OIL PRESSURE UNLESS A GREATER EMERGENCY EXISTS.

ENGINE FIRE/DAMAGE

Severe damage or separation is indicated by airframe vibration with abnormal and/or inconsistent engine indications.

1. **THROTTLE ..... IDLE** C-F
   Check autothrottles OFF.
2. **FUEL AND IGNITION SW ..... OFF** C-F
3. **FIRE PULL HANDLE ..... PULL** C-F
4. ***IF FIRE WARNING:***
   FIRE BOTTLE ..... DISCHARGE C-F
   Start timing.
5. **IF FIRE WARNING PERSISTS AFTER 30 SECONDS:**
   SECOND BOTTLE ..... DISCHARGE C-F

   NOTE: If both bottles are discharged for No. 2 engine, no protection is available for the APU.
6. **HYD PUMP S/O SW ..... UNLATCH** OFF S
7. **IDG DISCONNECT ..... DEPRESS** S
8. **ENGINE SHUTDOWN FOLLOW-UP ..... ACCOMPLISH** S
   See page 8.
9. ***IF FIRE WARNING PERSISTS AFTER BOTH BOTTLES HAVE BEEN DISCHARGED:***

   ACCELERATE TO V_{mo}/M_{mo} C-F

   LAND AT NEAREST SUITABLE AIRPORT C
   If engine 1 or 3 on fire avoid extending speedbrakes or flaps until landing is assured.

END OF PROCEDURE

-500 BLUE P6-1

ENGINE TURBINE AIR OVERHEAT

Continued engine operation with TURB AIR OVHT illuminated may cause severe engine damage.

1. **THROTTLE .....IDLE** C-F
   Check autothrottles OFF.

2. **FUEL AND IGNITION SW .....OFF** C-F

3. **ENGINE SHUTDOWN**
   FOLLOW-UP.....ACCOMPLISH S
   See page 8.

NACELLE/PYLON OVERHEAT

NACELLE OVHT (Pilot's Annunciator Panel) indicates a broken pneumatic duct in the nacelle/pylon area.

1. **THROTTLE .....IDLE** C-F
   Check autothrottles OFF.

2. **ENG HI-PRESS SW .....UNLATCH** OFF S
   HI-PRESS valve should have automatically closed when overheat condition was sensed.

∨∨

∨∨ <<<<<<<<<<<<<<<<*IF*>>>>>>>>>>>>>>>> ∨∨

NACELLE OVHT
EXTINGUISHES WITHIN 30 SECONDS:

∨∨

3. **ENGINE OPERATION.....CONTINUE** C-F
   Continue operation at thrust setting which keeps **NACELLE OVHT** extinguished.

STOP

NACELLE OVHT
REMAINS AFTER 30 SECONDS:

∨∨

3. **FUEL AND IGNITION SW .....OFF** C-F

4. **ENGINE SHUTDOWN**
   FOLLOW-UP.....ACCOMPLISH S
   See page 8.

TAILPIPE FIRE

- An engine tailpipe fire in itself is not a hazardous event. However, if improperly handled, it can result in unwarranted passenger emergency evacuation or unnecessary damage to the airplane.
- Tailpipe fires are generally associated with engine rundown, but can occur during starting as well as following cancellation of reverse after landing and during taxi.
- A tailpipe fire may create high TGT indications, above 550°C (-22B) 600°C (-524B4), or there may be no indication on the flight deck.
- Fire extinguishing bottles on the engine will have no effect, since the fire is in the core of the engine, not the accessory section.
- A low oil pressure indication, accompanied by the loss of electrical and hydraulic systems associated with that engine, would indicate a possible engine rundown.

If There Is A Tailpipe Fire:

GROUND COMMUNICATION ... ESTABLISH
- Establishing communication with ground personnel or Ramp Tower is essential to confirm that a tailpipe fire exists, and appropriate action is being taken to alleviate the condition.

THROTTLE ..... CLOSE

FUEL AND IGNITION SWITCH ..... OFF

ENGINE ISLN VALVE CB ..... PULL
- No.1 ENG, 1G10
- No.2 ENG, 1G11
- No.3 ENG, 1G12
  - This will ensure that the isolation valve remains open allowing the engine to be motored.

FIRE PULL HANDLE ..... PULL
- Do not discharge the fire bottles as they have no effect on a tailpipe fire.

When N3 is below 30%:

GROUND START SWITCH ..... PUSH
- Motor engine until TGT is less than 200C or until the tailpipe fire is extinguished.
- Starter engagements above 20% N3 require a logbook entry.

ENG TANK VALVE SWITCH (1 OR 3 ONLY) .. .. UNLATCH
- Leave No. 2 ENG TANK VALVE switch latched, unless the APU is not required.

After the fire is observed to be extinguished:

GROUND START RELEASE SWITCH .... PUSH
- Continuous operation of the starter should be limited to 5 minutes unless the fire continues.

P.A. ANNOUNCEMENT ..... ACCOMPLISH
- A wing engine tailpipe fire observed from the cabin can have an alarming effect on passengers. The crew should consider that a carefully worded P.A. announcement will give assurance that although menacing in appeareance, the situation is not threatening and is under control. The following suggested script should suffice:

"Ladies and Gentlemen: We are experiencing an abnormal condition with one of our engines. Some of you have perhaps observed smoke or flames emitting from the rear of the (left/right) engine. Although it may appear menacing, please be assured that the condition is not a threat to your safety. We are in communication with ground personnel who will take necessary actions as we direct. Please remain seated with your seat belt fastened as we expect to continue taxiing very shortly. Thank you."

————END OF PROCEDURE————

(OPPOSITE SIDE BLANK)

REVERSE THRUST IN-FLIGHT

If any reverser light illuminates **without** accompanying yaw, buffet or loss of airspeed, see Abnormal Procedures, Powerplant Section.

IF ANY REVERSER LIGHT ILLUMINATED ACCOMPANIED BY YAW, BUFFET OR LOSS OF AIRSPEED, ACCOMPLISH THE FOLLOWING PROCEDURE:

1. **REVERSER LEVERS ..... FULL DOWN** C-F
   DO NOT CYCLE REVERSER

2. **AIRSPEED ..... REDUCE** C-F
   (Conditions permitting, max 200K)
   - Consider altitude and weight.
   - If possible visually inspect reverser condition.

IF

REVERSER STOWS:

3. **OPERATION...CONTINUE AT REDUCED AIRSPEED** C-F

STOP

REVERSER DOES NOT STOW:

3. **ENGINE SHUTDOWN CHECKLIST ..... ACCOMPLISH** ALL
   - Continue at reduced airspeed.
   - See page 8.

4. **LAND AT NEAREST SUITABLE AIRPORT** C

IF

5. ***NO. 2 ENGINE REVERSED:***

USE STANDARD ENGINE INOP PROCEDURE ALL

STOP

5. ***NO. 1 OR 3 ENGINE REVERSED:***

FLAPS MAXIMUM ..... 22° ALL

SET AIRSPEED BUG..... V_{REF}+30 (Min 160K)
Be alert for roll tendency toward engine with deployed reverser.

GPWS ..... INHIBIT

EXAMPLE

L-1011 LANDING DATA

FLIGHT NO _____ ATIS _____ RWY _____

GWT 310,000 LBS

FLAPS 0 (VREF+60) 193 KTS

FLAPS 4 (VREF+40) 173 KTS

FLAPS 10 (BUG) 163 KTS

FLAPS 22 (BUG) 163 KTS

BUG (VREF+30 160 MIN.) 163 KTS

LANDING FLAPS 22 VREF 133

WX/NOTAMS #1 OR #3 ENGINE IN REVERSE (FLAPS 22 MAX)

GO AROUND / FLAP RETRACT SCHEDULE

EPR 1.522

SELECT FLAPS	AT
10 (BUG)	163
4 (BUG +10)	173
0 (BUG +30)	193

END OF PROCEDURE

ENGINE FAILURE / SHUTDOWN

Engine shutdown should be accomplished or considered for any of the following indications/conditions:

- Fire/damage (Emergency Procedures page 5).
- High AVM indications accompanied by abnormal engine indications or airframe vibration (Powerplant Abnormals page 10).
- TURB AIR OVHT (Emerg. Procedures page 6).
- NACELL OVHT for more than 30 seconds (Emergency Procedures page 6).
- Reverser deployed in flight (Emergency Procedures page 7).
- IDG fails to disconnect - conditions permitting (Electrical Abnormals page 11).
- Oil FILTER PRESSURE illuminates (Powerplant Abnormals page 11).
- OIL PRESS ENGINE illuminates. Engine should be shutdown if oil pressure remains in the 18 to 35 psi range for more than five minutes, or drops below 18 psi for more than 45 seconds (Powerplant Abnormals page 11).
- Oil Temperature exceeds 100°C for 15 minutes, or exceeds 135°C for any period (Powerplant Abnormals page 10).
- TGT exceeds limits (Limitations).

	5 minutes	2 minutes	20 seconds
-22B	728°C	738°C	750°C
-524B4	785°C	- - -	800°C

- Engine overspeeds (Limitations)

	N_1*	N_2*	N_3*
-22B	103.0%	106.0%	96.2%
-524B4	104.0%	107.0%	98.3%

*RPM limits are for up to 20 seconds. Any RPM above these values require immediate shutdown.

1. [redacted] IDLE C-F
   Check autothrottles OFF.

2. [redacted] C-F

CAUTION:
IN THE EVENT OF OIL QUANTITY LOSS, REFER TO OIL QUANTITY LOW, POWER PLANT ABNORMAL PROCEDURE.

ENGINE SHUTDOWN FOLLOW-UP

The following clean-up items are to be accomplished after any engine shutdown

1. **PTU/ATM'S.....ON** s
   - No. 1 or 3 engine: Turn appropriate PTU on -FB-.
   - No. 2 engine: Turn ATM's ON.

2. **PNEU CROSSBLEED VALVE SWS .....LATCH, -FB-** s
   Ensure bleed air is available for ATM operation.

3. **PACK FLOW CONTROL SW (1)...UNLATCH** s
   Limit number of packs used to number of engine bleed sources available.
   - Normally deactivate No. 1 pack since it does not supply trim air.
   - Continue operating No. 2 pack if at all possible.

4. **HI-PRESS & ENG ISLN VALVE SWS.....UNLATCH OFF** s
   For affected engine.

5. **FUEL CROSSFEED VALVE SWS .....LATCH -FB-** s
   - Aids balanced fuel burnoff.
   - Maintain normal fuel distribution.

6. **ENG TANK VALVE SW (1 or 3 ONLY).....UNLATCH** s
   Leave No. 2 ENG TANK VALVE switch latched, unless the APU is inoperative.

7. **AC ESS PWR SEL.....CHECK** s
   Select position with an operating alternate source if possible.

8. **KW MAXIMUM.....81** s
   If necessary to reduce loads, unlatch;
   - GALLEY POWER switches.
   - AC HYD PUMPS switches.
   - FLOOR HEAT (if installed).
   - One TANK PUMPS switch in each tank; either all left or all right.

9. **FUEL DISTRIBUTION.....MONITOR** s
   Consider need for fuel jettison.

-100/200/500 AIRCRAFT REFER TO DIFFERENCES SECTION OF EMERGENCY PROCEDURES.

ENGINE SHUTDOWN FOLLOW-UP (CONT'D)

One Engine Inoperative: Approach/Landing, (See Two Engine Inoperative If Required).

The following information is placed here for your convenience. It is not considered an emergency procedure.

10. **APU.....START** S
    - APU start reliability is increased significantly below 10,000'.
    - Parallel APU generator.

11. **V_2+70K .....COMPUTE** S
    Enter one engine inoperative climb speed on landing data card.

12. **NORMAL DESCENT, APPROACH & BEFORE LANDING CHECKLISTS.....ACCOMPLISH** ALL

13. **RUDDER TRIM (ON COMMAND)...ZERO** F-S

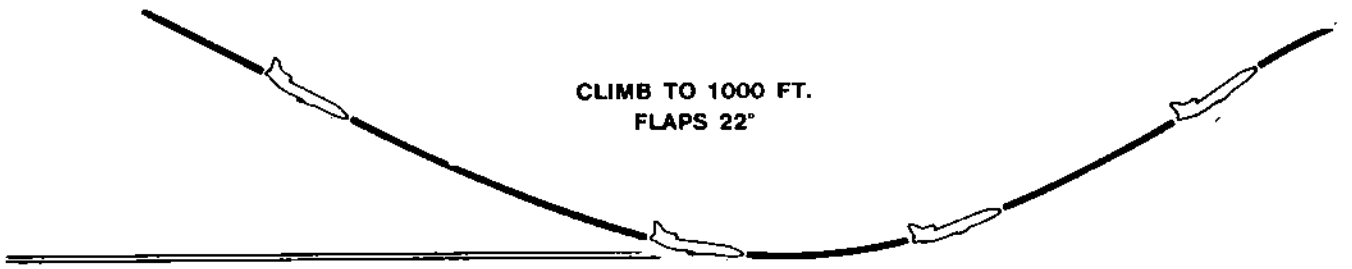
NOTE: Fill out ENGINE FLAMEOUT or LOSS OF THRUST/IN-FLIGHT SHUTDOWN/STALL Report(SP 4017) located in back of Logbook prior to next flight.

ONE ENGINE INOPERATIVE GO-AROUND

1. PRESS [GO-AROUND] .
2. APPLY GO-AROUND THRUST WHILE ROTATING TO CLIMB ATTITUDE.
3. RETRACT FLAPS TO 22°.
4. POSITIVE RATE OF CLIMB - GEAR UP.
5. PRESS [HDG] AND [ALT ARM] .

WHEN CLEAR OF OBSTACLES AND AT NOT LESS THAN 1000 FEET AGL:

1. PRESS [ALT] , ACCELERATE AND RETRACT FLAPS ON SCHEDULE.
2. AT V_2+70 K PRESS [IAS] .



FLAP RETRACTION SCHEDULE

22° to 10°	V_{REF}+10 KTS
10° to 4°	V_{REF}+20 KTS
4° to 0°	V_{REF}+60 KTS

END OF PROCEDURE

TWO ENGINES INOPERATIVE

Conditions permitting complete ENGINE SHUTDOWN FOLLOW-UP checklists for each failed engine before accomplishing this procedure.

1. **RAT (On Captain's Command) ....DEPLOY** S
   - Ensures B system pressure.
   - Deployment is unnecessary if #2 engine is operating.

2. **APU.....START** S
   - APU start reliability is increased significantly below 10,000'.
   - Parallel APU generator.

3. **FUEL JETTISON.....INITIATE** C-S
   See Abnormal Procedures, FUEL.

4. **FUEL CROSSFEED VALVE SWITCHES .....LATCH FEB 'S** S

5. **AFTER RAT PRESS (GREEN):**
   B_2 ATM.....AUTO S

6. ***IF APU AVAILABLE:*** S
   BLEED AIR S/O SW.....LATCH OPEN
   MODE SELECTOR.....NORM
   ALL ENG ISLN VALVE SWS.....UNL OFF
   Increases available thrust on operating engine.

7. **SET AIRSPEED BUG.....**
   .....V_{REF}+20(160KTS MIN.) C-F
   - Reduce to bug (plus wind additive) over threshold, but not less than 160KIAS.

8. **TWO ENGINE INOPERATIVE GO-AROUND CHART .....CONSULT** S
   Advise Captain of go-around capability.

9. **GPWS.....INHIBIT** C-F

10. **CABIN ALT SET .....1500' AGL** S

11. ***WHEN DESCENDING THROUGH 1500' AGL:***
    ALL PACK SWS .....UNLATCH S

12. ***PRIOR TO 1000' AGL:***
    ENGINE ANTI-ICE SWS .....UNLATCH C-F
    Two engine inoperative go-around performance based on packs and engine anti-ice off.

13. **RUDDER TRIM (ON COMMAND).....ZERO** ALL

14. **AFTER TOUCHDOWN, GROUND SPOILERS.....MANUALLY ACTUATE** C
    Auto spoiler deployment will occur only if two or three throttles are positioned to reverse range.

DRIFTDOWN - TWO ENGINES INOPERATIVE

A driftdown descent profile is applicable after the loss of one or two engines, and it is necessary to continue the flight for a period of time due to the non-availability of any landing facility. Due to gross weight, terrain clearance may be a factor in determining target cruise altitude.

EMERGENCY/ABNORMAL CHECKLISTS . . . . . COMPLETE

- Complete appropriate checklists.
  - Engine Fire/Damage
  - Engine Failure/Shutdown
  - Flameout/Immediate Relight
  - Engine Start; In-flight (Power Plant Abnormals)
  - Shutdown follow-up
  - Two engines inoperative

MAX CONTINUOUS THRUST (MCT) . . . . . SET

- Set Maximum Continuous Thrust (MCT) on remaining engine, as determined from the appropriate ODM Driftdown chart. On the dash one aircraft (RB 211-22B engines) **DO NOT** use the EPR value displayed on the FMS ENG OUT CRT page. (An engine thrust rating increase has made the FMS data inaccurate.)

ODM DRIFTDOWN AIRSPEED . . ESTABLISH

- Refer to the ODM, Abnormal Section.

DRIFTDOWN DESCENT . . . . . COMMENCE (TURN OFF TRACK)

- Begin descent after airspeed has been reduced to the driftdown speed. Make subsequent airspeed adjustments during the descent as altitude and gross weight are reduced.

ODM DRIFTDOWN CHARTS . . . . . CONSULT

- Refer to the ODM Abnormal Section for appropriate Driftdown Chart to determine stabilizing weight and altitude. Determine if gross weight at TOD requires fuel jettison.

CONTROLLING AGENCY (WHEN TIME PERMITS) . . . . . NOTIFY

- Advise Air Traffic Control Agency of the nature of the emergency and position while radio contact remains available. Request relay assistance of other airborne traffic as necessary.

CABIN CREW . . . . . ADVISE

- When time permits, brief the In-flight Service Coordinator on possible contingencies and crew duties in case of ditching.

FUEL JETTISON . . . . . AS REQUIRED

- As explained in the chart notes for heavier gross weights at T.O.D., fuel jettisoning may be necessary to assure a terrain clearance at end of descent of at least 2,000 ft. Carefully monitor driftdown performance before jettisoning fuel in excess of the minimum amount required. Since the flight path below 10,000 ft is very shallow, the decision to jettison fuel may be safely delayed to that point of the driftdown. If the APU is operating, adjust the fuel burn data by an additional 400 lbs/Hour.

STABILIZED SPEED & FUEL FLOW DETERMINE

- After level off, maintain MCT and accelerate to Long Range Cruise speed. If sufficient altitude is available ABOVE 2,000 ft, a shallow dive may aid in acceleration. DO NOT DESCEND BELOW 2,000'.

AIRCRAFT RANGE . . . . . COMPUTE

- Additional available range at the end of driftdown can be estimated by dividing the fuel flow into the fuel remaining, and then multiplying the time thus obtained by the true airspeed. The values for fuel flow, true airspeed and indicated airspeed found on the appropriate Driftdown charts are based on LRC speed and are to be used only to estimate the available range.

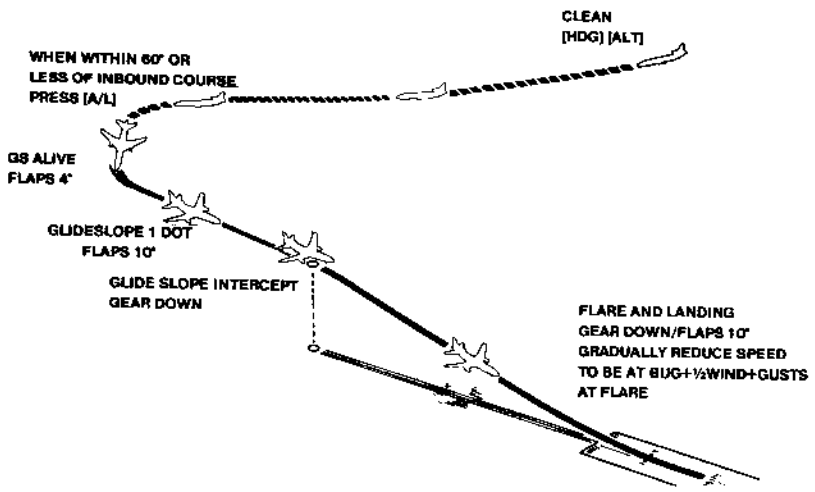
DITCHING PROCEDURES . . . . . REVIEW

- When time permits, review the Ditching Procedures in the DITCHING/EVACUATION Section.

———END OF PROCEDURE———

OPPOSITE SIDE BLANK

TWO ENGINE INOPERATIVE ILS APPROACH



L-1011 LANDING DATA

FLIGHT NO _____ ATIS _____ RWY _____

GWT 306,000 LBS

FLAPS ~~0~~ (VREF+60) 192 KTS

FLAPS 4 (VREF+40) 172 KTS

FLAPS 10 (VREF+30) 162 KTS

~~FLAPS 22~~ _____ KTS

BUG (VREF+20) 160 KTS (160 MIN)

LANDING FLAPS 10 VREF 132

WX/NOTAMS TWO ENGINES INOPERATIVE

GO AROUND / FLAP RETRACT SCHEDULE

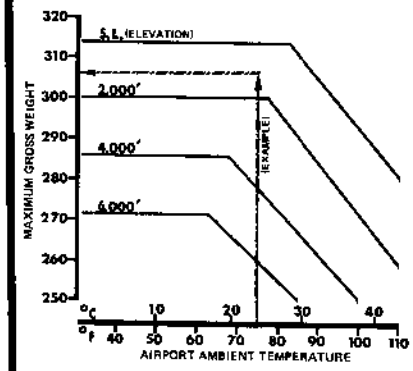
EPR 1.522

SELECT	AT
FLAPS ~~22~~	
~~10~~	
4	GO-AROUND
0	180 CLIMB AT 200

EXAMPLE

MAX GROSS WEIGHT FOR GO-AROUND WITH TWO ENGINES INOPERATIVE

Chart is for L1011-1



(PACKS OFF/ANTI-ICE OFF)

AT 1000' AGL and bug+10 (min), a successful go-around can be made only at or below the gross weight shown in the chart for the respective airport elevation & temperature.

DO NOT ATTEMPT A GO-AROUND BELOW 1000' AGL.

FOR:
-100 AIRCRAFT
* Same as -1

-200 or 500 AIRCRAFT
* Add 55 thousand lbs. to the -1 max gross weight.

2-ENGINE INOP GO-AROUND PROCEDURE

ACCOMPLISH ITEMS 1 THRU 4 TOGETHER.

1. THROTTLE ..... MAX THRUST C-F
2. SINK RATE TO ACCELERATE ..... AS REQ C-F
3. LANDING GEAR ..... UP C-F
4. FLAPS ..... 4° C-F
5. FLAPS AT 180 K (APPROX) ..... UP C-F
   As airspeed increases through 180K retract flaps.
6. AT 200 K ..... INITIATE CLIMB C-F
   Continue descent until airspeed reaches 200 knots. At this point, level off gradually then climb.

TWO ENGINES INOPERATIVE CHECKLISTS

The following checklists are provided to eliminate the need to refer to the Normal Checklist.

The S/O reads both challenge and response in the following checklists, and the crewmember(s) assigned each item repeat(s) the response after assuring that the item is completed.

DESCENT - APPROACH

1. APU START
2. PRESSURIZATION SET 1500' AGL
3. CROSSBLEED FEL'S
4. HYD PANEL RAT, PTU'S/ATM'S & PRESS
5. ELEC PANEL
6. FUEL PANEL
7. EPR MODE SET GA
8. LANDING DATA→2 ENG INOP
9. SHOULDER HARNESS ..... ON
10. CONTINUOUS IGNITION ..... LCH ON
11. PILOTS ANNUN PANEL .... RECALL, CHECK
12. SEAT BELT/NO SMOKING ..... LCH ON
13. AUTOFLIGHT PANELS ..... CHECK
14. ALT/FLT & NAV INST ..... CHECK
15. RADIO & BARO ALT BUGS ..... ____/____
16. AIRSPEED/EPR BUGS ..... ____/____
17. GPWS ..... INHIBIT
18. SPEEDBRAKE LEVER ..... FWD
19. LOWER GALLEY CLEAR

BEFORE LANDING

1. PNEU PRESSURE
2. HYD PRESSURE
3. PACKS 1500' AGL, UNL
4. FLAPS/SLATS ..... 10°/10° GREEN LT
5. SLAT MONITOR 14 GREEN
6. GEAR ..... DOWN/3 GREEN
7. ENG ANTI-ICE 1000' ..... UNL
8. RUDDER TRIM (ON COMMAND) ..... ZERO

MAKE STANDARD CALLOUTS

END OF PROCEDURE

ENGINE FLAMEOUT/RELIGHT

NOTE: If engine has been shutdown also refer to ENGINE START IN-FLIGHT, Powerplant Abnormal Procedure.

1. **THROTTLE ..... IDLE** C-F
   Do not attempt start unless there is a positive indication of N_3 rotation (i.e. RPM or oil pressure).

2. ***N_3 RPM BELOW 20%***
   GND START SW .... LATCH VALVE OPEN C-F
   V
   V
   OR
   V
   V
   N_3 RPM ABOVE 20%
   WINDMILL AIR START SW... LATCH ON C-F

3. **FUEL CROSSFEED VALVES SWS..... LATCH** OPEN S

4. ***IF NO RELIGHT WITHIN 90 SECONDS:***
   AIR START ..... TERMINATE C-F

   ENGINE SHUTDOWN CHECKLIST ..... ACCOMPLISH ALL
   See page 8.

END OF PROCEDURE

THREE ENGINE FLAMEOUT

ATTEMPT IMMEDIATE RELIGHT.
IF UNSUCCESSFUL:

1. **STANDBY POWER SW ..... ON** C-F
   A charged battery supplies 40 minutes of operation.

2. **RAT ..... DEPLOY** S
   - Press RAT switch.
   - Verify PRESS (green) when DC ESS power is restored.

3. **TARGET AIRSPEED ..... APPROX 250K** C-F
   Refer to HOLDING SPEED (Flaps Up) table on the power chart. Hold speed for weight and altitude approximates best L/D speed and provides a glide path clean of 2½ n.m. per 1,000' of altitude (15:1 ratio).

4. **SPEEDBRAKE LEVER ..... FWD** C-F
   Do not use speedbrakes. May deplete available hydraulic pressure for flight controls.

5. **GPWS ..... INHIBIT** C-F

6. **HYD AC PUMPS ..... UNLATCH** S

7. **GALLEY POWER ..... UNLATCH** S

8. **APU (BELOW 25,000) ..... START** S
   APU start reliability is increased significantly below 10,000'.
   NOTE: An unsuccessful APU start reduces battery operating time by about ½.
   V
   V
   THEN >>>>>>>>>>>>>>>>>>>>

THREE ENGINE FLAMEOUT (CONT'D) >>>>

<<<<<<<<<<<<<<<<*IF*>>>>>>>>>>>>>>>>

9. *APU IS AVAILABLE:*

APU ELECTRICAL POWER ... ESTABLISH S
Reduce electrical loads and ensure AC TIE BREAKERS are closed.

APU BLEED AIR S/O SW .... LATCH OPEN

APU MODE SELECTOR ..... NORM

B_2 ATM ..... AUTO
Provides RAT back-up.

C_2 ATM ..... ON

PTU'S ..... FBW'S

PACK FLOW CONTROL SWS (3) .... UNL
Assures adequate air supply to ATM's.

DLC/AUTO SPLR SWS ... UNLATCH OFF C-F

RUDDER HYDRAULIC LIMITER ..... UNLATCH OVRD C-F

FUEL JETTISON ..... INITIATE C-S

GEAR ..... DOWN/3 GREEN C-F
Use normal gear extension procedures.

9. *APU IS NOT AVAILABLE:*

---MANUALLY EXTEND LANDING GEAR---

GEAR LEVER ..... DOWN C-F

NOSE MECH RELEASE HANDLE .... PULL S
Speed may have to be reduced to as low as 190K for nosegear to extend to the down-and-locked position.

L & R MAIN MECH RELEASE HANDLES ..... PULL S

IF ANY GREEN LIGHT REMAINS EXTINGUISHED:

ALTERNATE HYD LANDING GEAR EXTENSION SW ..... ACTUATE S

MECH DOWN LOCK INDIC(S) ... CHECK S

10. LANDING FLAPS MAXIMUM ..... 10° C

11. APPROACH SPEED MINIMUM ..... 160 K C-F
- 160 K required to assure adequate flight control response.
- During flare maintain speed at 160 K or above to prevent stalling RAT.

12. EMERGENCY LANDING & EVACUATION CHECKLIST ..... COMPLETE C-F
See DITCHING/EVACUATION Section.

END OF PROCEDURE

RAPID DEPRESSURIZATION

Whenever any unscheduled loss of pressurization occurs, the S/O should immediately accomplish steps 3 through 8.

IF CABIN ALTITUDE EXCEEDS 10,000':

1. **OXYGEN MASKS.....ON** ALL
   Silence horn.

2. **DESCENT.....INITIATE** ALL
   - S/O advises crew of cabin altitude controllability.
   - If cabin altitude cannot be controlled initiate Emergency Descent.

3. **ENG ISLN VALVE SWS .....LATCH FEB 'S** S

4. **CROSSBLEED SWS .....UNLATCH OFF** S

5. **DUCT PRESSURE .....CHECK NORMAL** S

6. **PACK FLOW CONTROL SWS...LCH FEB 'S** S

7. **COOL AIR OVBD .....UNLATCH CLOSE** S

8. **OUTFLOW VALVES .....CHECK CLOSED** S
   Manually close outflow valves, if necessary.

9. ***IF CABIN ALTITUDE EXCEEDS 14,000':***
   PASSENGER OXYGEN
   MANUAL SW .....LATCH MASKS DEPLD S
   - Latch MANUAL MASKS DEPLD switch.
   - Check OXYGEN FLOW.

   SEAT BELT/NO SMOKING.....LATCH ON C-F
   Both signs automatically illuminate when oxygen system activated, but unless the switch is latched signs will extinguish when cabin altitude descends below 14,000'.

   CABIN ALTITUDE.....CHECK S
   Inform crew when cabin altitude descends below 10,000'.

10. ***WHEN CABIN BELOW 10,000':***
    MANUAL MASKS DEPLD SW....UNLATCH S
    PASSENGER OXYGEN MANUAL Switch must be unlatched, and **MASKS DEPLD** extinguished to reset the system for servicing.

11. **BEFORE LANDING**
    OUTFLOW VALVES.....OPEN S
    Outflow valves will not open upon landing if Pressurization MODE SEL is in STBY or Outflow Valve Switches are in MNL.

END OF PROCEDURE

EMERGENCY DESCENT

This procedure assumes the structural integrity of the aircraft. If structural integrity is in doubt, limit speed as much as possible and avoid high maneuvering loads.

1. **CONTINUOUS IGNITION....LATCH ON** F

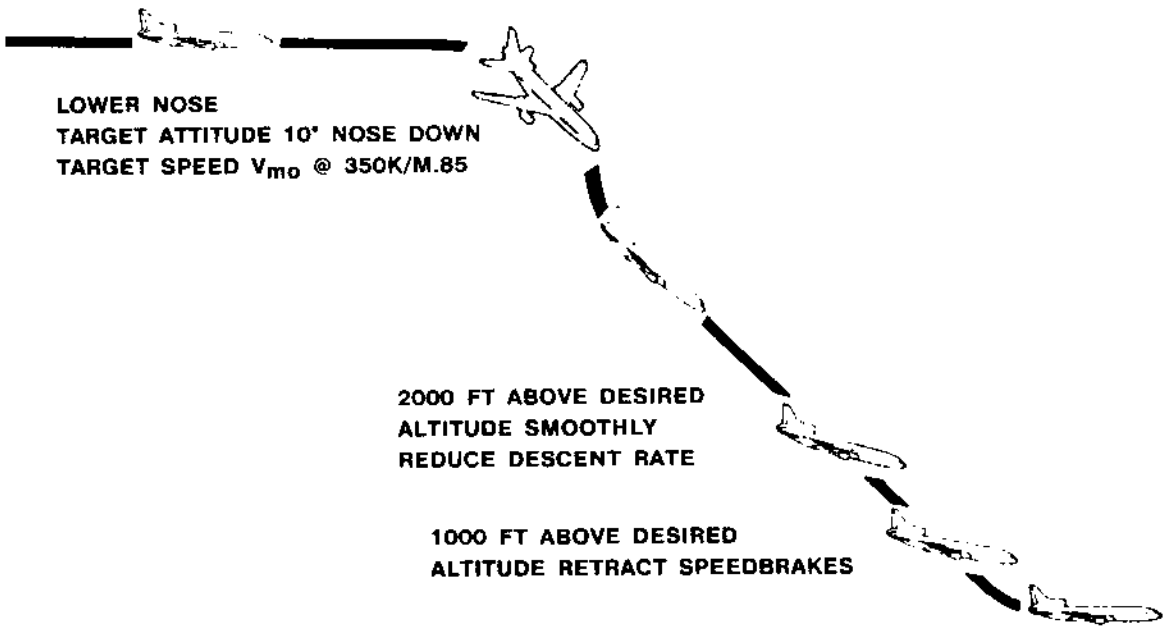
2. **SEAT BELT/NO SMOKING...LATCH ON** F
   Conditions permitting notify Flight Attendants.

3. **THROTTLES.....IDLE** C

4. **SPEEDBRAKES .....EXTEND** C
   On -500 aircraft, slowly pull speedbrake handle aft to avoid rapid pitch-down tendency when spoilers are extended.

5. **ATC.....NOTIFY** F
   - Request altimeter setting.
   - Set altitude select for level-off altitude.

6. **TURN (IF DESIRED) .....INITIATE** C
   Do not exceed 45° bank angle.



NOTE: WHEN PASSENGER OXYGEN SUPPLY IS DEPLETED, MAX OPERATING ALTITUDE IS 10,000'.

END OF PROCEDURE

APU FIRE

With AUTO FIRE SHUTDOWN ARMED, APU shutdown and main fire bottle discharge should take place automatically.

1. **APU FIRE PULL HANDLE ..... PULL** s

2. ***AFTER 10 SECONDS:***
   MAIN FIRE BOTTLE ..... DISCHARGE s
   • Check MAIN DISCH.

   NOTE: If APU was only source of AC power **MAIN DISCH** ***light remains extinguished even if bottle discharges (no power to light).***

3. ***IF FIRE WARNING PERSISTS AFTER 30 SECONDS:***
   ALTN FIRE BOTTLE..... DISCHARGE s
   No fire protection available to No. 2 engine.

   LAND AT NEAREST SUITABLE AIRPORT
   If fire warning persists after both bottles are discharged, land as soon as practical. Consider emergency evacuation.

END OF PROCEDURE

WHEELWELL FIRE

1. **DLC/AUTO SPLR SWS....UNLATCH** OFF C-F
   DLC/AUTO SPLR switches must be deactivated anytime landing gear is extended and gear lever is not down.

2. **LANDING GEAR LEVER .....NEUTRAL** C-F

3. **L & R MAIN MECH RELEASE HANDLES .....PULL** S
   - Upon Captain's command, pull release handles.
   - Desired speed is 250 KIAS.
   - Verify gear door lights on S/O Annunciator Panel.
   - Gear down with doors open will allow slipstream to blow out fire or cool overheated brakes.

AFTER WHEELWELL FIRE EXTINGUISHED FOR FIVE MINUTES (MINIMUM):

MASTER FIRE, WHEELWELL FIRE, AND A & B loop lights extinguished.

4. **L & R MAIN MECH RELEASE HANDLES.....STOW** S

5. **LANDING GEAR LEVER.....DOWN** C-F

6. **DLC/AUTO SPLR SWS .....LATCH** C-F
   Restore DLC/AGS only after gear handle DOWN.

7. **LANDING GEAR LEVER....AS DESIRED** C
   Gear may be retracted if Captain determines flight **must** be continued, and range is marginal with gear down.

CONSIDERATIONS:

- Probable tire, wheel, and brake damage.
- Consider landing. If necessary to continue flight with gear extended refer to ODM, Abnormal Section, 'Gear Down Trip Fuel Estimate'.

END OF PROCEDURE

GALLEY SMOKE/FIRE

For -500 aircraft refer to DIFFERENCES section of Emergency Procedures.

1. **GALLEY POWER SWS (3).....UNL OFF** s

2. ***FLASHING*** **GALLEY SMOKE** :
   COOL AIR OVBD.....LCH OPEN s
   Aids in exhausting smoke.
   This is the normal position for flight, but must be checked to insure the galley vent valve is open for smoke removal.

   STEADY **GALLEY SMOKE** ***(FIRE):***
   COOL AIR OVBD.....UNL CLOSE s
   Aids in extinguishing fire.

3. **PACK FLOW CONTROL SWS...LCH FB'S** s

4. **AFT OUTFLOW VALVE.....LATCH MNL & CLOSE** s
   FWD outflow valve must also be manually controlled if it opens beyond the green band at aircraft altitudes above 15,000'.

5. **ESTABLISH COMMUNICATIONS WITH GALLEY PERSONNEL** s
   - Attempt to determine size, cause of fire and need for assistance. Inspect galley when duties permit.
   - If unable to contact galley, or if immediate assistance required:
     - Obtain Halon Fire Extinguisher and walk-around oxygen.
     - Don mask, and enter galley through lift if feasible.
   - Oven Fire:
     - Close damper.
     - Unlatch oven switch.
   - Exhaust Duct Fire:
     - Close all oven dampers.
     - Discharge fire extinguishing agent into oven exhaust duct (opening below oven nearest the sink).

END OF PROCEDURE

AIR CONDITIONING SMOKE

Smoke in the air conditioning system may be from an engine, air conditioning pack, or a bleed air duct rupture.

1. **ONE ENG ISLN VALVE & PACK FLOW CONTROL SW .... UNLATCH** S
   Flowbar extinguished when valve closed.

2. ***IF SMOKE CONTINUES:***
   ENG ISLN VALVE & PACK ..... RESTORE S

REPEAT ISOLATION FOR REMAINING ISOLATION VALVES/PACKS.

3. ***AFTER SOURCE ISOLATED:***
   ENG ISLN VALVE SW ..... LATCH FEB S
   Pack remains off.

4. ***IF SMOKE REAPPEARS:***
   ENG ISLN VALVE SW..... UNLATCH OFF S
   Use no more packs than available bleed sources.

END OF PROCEDURE

SMOKE EVACUATION

1. **SMOKE GOGGLES/OXYGEN MASKS ..... ON-100%** ALL
   - Use oxygen masks whenever smoke is present in the cockpit.
   - Establish crew communications through interphone.

2. **PACK FLOW CONTROL SWS... LCH** FEB **S** S

3. **AFT OUTFLOW VALVE ..... LATCH** MNL **& CLOSE** S
   FWD outflow valve must also be manually controlled if it opens beyond green band at aircraft altitudes above 15,000'.

4. **CAB ALT SET ..... 10,000'** S

5. **NORM RATE ..... FULL INCREASE** S
   If MODE SEL in STBY set STBY RATE to full ASCD' then HOLD at 10,000' cabin altitude.

6. **SEAT BELT/NO SMOKING ... LATCH** ON C/F

7. **SOURCE OF SMOKE/FIRE ..... IDENTIFY** S
   If source of smoke is unknown, consider:
   - Pneumatic/air conditioning systems.
   - Electrical system.
   - Galley.
   - Contents of the cargo compartments.

8. **CABIN/COCKPIT COMMUNICATIONS ..... ESTABLISH** S

9. ***BEFORE LANDING***
   OUTFLOW VALVES ..... OPEN S
   Outflow valves will not open upon landing if Pressurization MODE SEL is in STBY or Outflow Valve Switches are in MNL.

END OF PROCEDURE

ELECTRICAL SMOKE/FIRE

This procedure should be followed for any electrical smoke or fire of unknown origin whether in the cockpit, cabin, forward or mid avionics compartments.

IF SOURCE CANNOT BE IDENTIFIED AND ISOLATED:

1. **SMOKE GOGGLES/OXYGEN MASK .....ON - 100%** ALL
   Use oxygen whenever smoke is present in the cockpit.

2. **THUNDERSTORM LTS SW....LATCH ON** C-F
   Assures adequate cockpit lighting while troubleshooting

3. **ISOLATE AC & DC BUSES:** S

   AC TIE BREAKERS.....OPEN

   DC BUS ISOLATION SW...LATCH OPEN

   AC & DC METERS.....CHECK
   - Check generator KW/KVAR's, FREQ and AC VOLTS.
   - Check DC AMPS and DC VOLTS.

WHEN ACCOMPLISHING THE FOLLOWING STEPS, STOP WHEN SOURCE OF SMOKE IS ELIMINATED. WHEN FAULTY UNIT IS IDENTIFIED, ISOLATE AND RESTORE POWER TO ALL REMAINING SYSTEMS.

4. **OUTFLOW VALVE SWS .....LATCH MNL** S
   - Automatic pressurization control will be lost when AC bus No. 3 is unpowered. Control cabin pressure manually.

5. **REMOVE POWER FROM LOAD BUSES:** S

   AC ESSENTIAL POWER SEL...AUTO G1(G2)

   GENERATOR BREAKERS .....OPEN
   (F/O instruments inoperative)
   - #2 and #3 radios will be inoperative.
   - Standby and Capt's. flight instruments remain operative.

6. ***IF SMOKE CONTINUES RESTORE LOAD BUSES:***
   GENERATOR BREAKERS .....CLOSE S
   Do not reparallel when Generator Breakers are closed.

7. ***IF NO. 3 AC BUS RESTORED:***
   OUTFLOW VALVE SWS.....UNL S
   Restores automatic pressurization.

8. **REMOVE POWER FROM ESSENTIAL/ STANDBY BUSES.** S
   Wait until F/O instruments erect (after power is restored to No. 2 AC Bus).

   RAT AUTO DEPLOY C/B 1L3.....PULL

   STANDBY POWER SW .....OFF

   AC ESSENTIAL POWER SEL.....OFF
   (Captain's instruments inoperative)

   DC STBY PWR C/B 3F1 .....PULL
   Prevents DC ESS bus from supplying power to DC STBY bus.

   AC STBY PWR C/B 3F12.....PULL
   Prevents AC ESS bus from supplying power to AC STBY bus.

   ENG START PWR C/B 3F10.....PULL
   Prevents DC ESS bus from supplying power to the ENG START bus.

   BATTERY SW .....OFF

   ESSENTIAL RADIO SW .....UNLATCH
   - Captain's instruments and standby horizon are inoperative until standby power is restored.
   - Reset RAT AUTO DEPLOY C/B (1L3) after standby power is restored.
   - PA and FLT INT are inoperative with the BATTERY switch turned OFF and ESSENTIAL radio switch unlatched.
   - VHF-1 is inoperative until ESSENTIAL radio switch is latched.

   NOTE: If smoke continues consider possibility of cabin or cargo compartment fire.

9. ***IF OUTFLOW VALVE SWS IN MNL:***
   BEFORE LDG, OUTFLOW VALVES...OPEN

END OF PROCEDURE

LOSS OF ALL GENERATORS

1. **STANDBY POWER.....ON** C-F Flow bar
   A fully charged battery provides 40 mins. of operation.

2. **AC TIE BREAKERS.....OPEN** S
   Isolates generator buses.

3. **DC BUS ISOLATION SW.....LATCH** S
   OPEN extinguished until DC ESS BUS restored.

4. **GENERATOR FIELDS.....CLOSE** S

5. **AC ESS POWER SEL.....CHECK** S
   Select operating power source.

IF

NO GENERATOR/OR ONE RESTORED

6. **ELECTRICAL LOADS.....REDUCE** S
   - Unlatch GALLEY POWER switches.
   - Unlatch AC HYD PUMPS switches.
   - Unlatch FLOOR HEAT (if installed).
   - Unlatch one TANK PUMP in each tank; either all left or all right.
   - Limit APU electrical load to 54 KW above 14,000'. Otherwise limit APU load to 81 KW.

7. **APU (BELOW 25,000').....START** S
   APU start reliability is increased significantly below 10,000'.

   NOTE: An unsuccessful APU start reduces battery operating time by about ⅓.

8. **ACCOMPLISH COMMON ITEMS BELOW**

2 OR MORE ENGINE GENERATORS RESTORED:

6. **ACCOMPLISH COMMON ITEMS BELOW**

COMMON ITEMS ····· COMMON ITEMS ····· COMMON ITEMS

1. **AC TIE BREAKERS.....CLOSE** S
   (Do Not Random Parallel)
   - Crew is expected to evaluate situation before attempting auto-parallel.
   - With only one or two generators operative, limit total electrical load to 81 KW. This assures that loads do not exceed the max continuous rating of an IDG.

   NOTE: If unable to restore power to No. 3 AC BUS, control outflow valves manually.

2. ***IF NO GENERATOR/OR ONE RESTORED:***
   LAND AT NEAREST SUITABLE AIRPORT C

GO to ELEC ABN
OPERATION ON BATTERY
PG 20

3. ***IF AT LEAST 2 AC BUSES POWERED:***
   DC BUS ISOLATION.....UNLATCH S
   Any two T/R's can carry normal DC loads.

   STANDBY POWER.....ARM C-F
   Restores battery charger operation provided AC BUS 1 is powered.

   EMERGENCY LIGHTS.....OFF/ARM C-F
   Emergency lights OFF to reset; then ARM.

   ATM'S.....CHECK S
   With loss of power to DC BUS 1 and/or 3, ATM's may be tripped. Switch ATM's to OFF to reset; then AUTO.

4. **DC BUS 2 & 3.....CHECK** S
   IF BOTH UNPOWERED:
   LANDING GEAR MANUAL EXTENSION.....ACCOMPLISH S
   See Abnormal Procedures, Landing Gear.

END OF PROCEDURE

ROLL JAM

- Indicated by FLT CONT PANELS (Pilot's Annunciator Panel), Aileron ////, SPOILER PUSH, and PULL ROLL DISC.
- For roll jam on the ground see Abnormal Procedures, Flight Controls.
- Cable failure may not be accompanied by abnormal control forces.

BOTH PILOTS MAINTAIN FIRM CONTROL WHEEL POSITION AND:

- Use rudder to assist roll control.
- Disconnect autopilot.

1. **ROLL DISC HANDLE.....PULL** C-F
   - ROLL DISC.
   - Rotate handle 90° to lock.

2. **ILLUMINATED SPOILER**
   PUSH SWS.....UNLATCH OFF C-F
   - DO NOT USE SPEEDBRAKES.
   - Pulling speedbrake lever aft will result in asymmetric spoiler extension unless SPOILER Switch 5&6 is unlatched for opposite wing.

3. ***IF MORE THAN 40° CONTROL WHEEL DEFLECTION REQD TO HOLD WINGS LEVEL:***
   ILLUMINATED AILERON
   //// SWS.....UNLATCH OFF C-F
   - If Captain's side unlatched OFF.
     - Aileron trim inoperative.
     - Autopilots inoperative.
   - On -500 aircraft, ACS is inoperative if either OUTBD AILERON switch is unlatched OFF.

4. **LAND AT NEAREST SUITABLE AIRPORT** C

END OF PROCEDURE

RUNAWAY TRIM

Unwarranted mechanical trim wheel motion.

1. **CONTROL PITCH ... CONTROL COLUMN/ MECHANICAL TRIM** C-F
   - Runaway trim can be stopped by physically holding mechanical trim wheel.
   - If autopilot engaged, hold control column firmly before disengaging.

2. **BOTH PITCH TRIM SWS ... UNLATCH OFF** C-F
   Mechanical trim may be used to relieve control column forces.

WARNING:
IF UNABLE TO CONTROL PITCH, COMPLETE PITCH JAM PROCEDURE ON PAGE 24.

3. **PITCH TRIM SWS**
   (One at a time) ..... RESTORE & CHECK C-F
   Continue with operative channel.

END OF PROCEDURE

PITCH JAM

PROBLEM	INDICATIONS
Broken Cable	Immediate FLT CONTROL PANELS and (2) STABILIZER PUSH. Controls remain operating before pitch disconnect pulled. Pitch trim remains operative.
Jammed Cable	90 lbs of force may be required before FLT CONTROL PANELS and (2) STABILIZER PUSH. Controls inoperative until pitch disconnect pulled. Pitch trim remains operative.
Jammed Pitch Trim	Pitch trim inoperative. Up to 90 pounds of force may be required to fully control pitch. Any number of STABILIZER PUSH may illuminate. Pitch disconnect will have no effect.
Jammed Stabilizer or Elevator	Control and trim inputs will have limited to no effect. Pitch disconnect will have no effect. any number of STABILIZER PUSH may illuminate. Pitch control available through use of selected spoilers, speeds and configurations, differential thrust, bank angle.

1. **ATTEMPT TO CONTROL PITCH .....CONTROL COLUMN/MECH TRIM** C-F

2. **AUTOPILOT .....DISCONNECT** C-F
   - Use electric trim if effective.
   - More than 90 lbs. of force may be required to regain some control.

∨∨

∨∨ **<<<<<<<<<<<<<<<<IF>>>>>>>>>>>>>>>>** ∨∨

STABILIZER PUSH ILLUMINATED: BOTH PILOTS FIRMLY HOLD COLUMN AND:

∨∨

3. **STABILIZER PUSH SWS.....UNLATCH INOP** C-F
   INOP, AFT COUPLER OPEN, and **PULL PITCH DISC.**

4. **PITCH DISC HANDLE .....PULL** C-F
   - **PITCH DISC** indicates forward coupler has separated.
   - Full control available to pilot whose servos remain latched.

5. **AIRSPEED MAXIMUM.....250** C-F

6. **LAND AT NEAREST SUITABLE AIRPORT** C

STOP

LIGHTS EXTINGUISHED: BOTH PILOTS FIRMLY HOLD COLUMN AND:

∨∨

3. **PITCH DISC HANDLE .....PULL** C-F
   PITCH DISC indicates forward coupler has separated.

   NOTE: Ignore light indications which occur after PITCH DISC pulled. Indications valid only with controls coupled.

4. **CONTROL.....INDIVIDUALLY CHECK** C-F

∨∨

THEN>>>>>>>>>>>>>>>>>>>>>>>>

PITCH JAM (CONT'D) >>>>>>>>>>>>>>>>>

<<<<<<<<<<<<<<<<<IF>>>>>>>>>>>>>>>>>

JAM PATH EVIDENT

5. STABILIZER SWS ON AFFECTED SIDE.....UNLATCH INOP C-F
   - INOP and AFT COUPLER OPEN.
   - Full control available to pilot whose servos remain latched.

6. AIRSPEED MAXIMUM.....250 C-F

7. LAND AT NEAREST SUITABLE AIRPORT C

STOP

JAM PATH NOT EVIDENT AND PITCH CONTROL NOT REGAINED:

Use the following techniques to create the desired change in pitch attitude. Pitch changes may occur slowly when using these procedures. Be alert to reverse pitch requirements as speed and configuration changes are made.

<<<<<<<<<<<<<<<<<TO<<<<<<<<<<<<<<<<<

PITCH DOWN

SPOILERS (OUTBD) L & R3, L & R4, L5 & 6, AND R5 & 6.....UNL OFF
SPEEDBRAKE LEVER ...EXTEND AS REQUIRED
CENTER ENGINE THRUST .....INCREASE
WING ENGINE THRUST.....DECREASE
AIRSPEED (Conditions Permit) ...DECREASE
BANK ANGLE (Conditions Permit) ...INCREASE
DLC/AUTO SPLR SWS.....UNLATCH OFF
FLAPS (As Needed).....EXTEND

LAND AT NEAREST SUITABLE AIRPORT
USE NORMAL FLAPS AND SPEEDS
MANUALLY EXTEND SPOILERS ON LANDING

PITCH UP

SPOILERS (INBD)
L & R1 and L & R2.....UNL OFF
SPEEDBRAKE LEVER ...EXTEND AS REQUIRED
WING ENGINE THRUST .....INCREASE
CENTER ENGINE THRUST.....DECREASE
AIRSPEED.....MAINTAIN OR INCREASE
BANK ANGLE .....MINIMUM
DLC/AUTO SPLR SWS.....UNLATCH OFF
FLAPS.....RETRACT

LAND AT NEAREST SUITABLE AIRPORT
IF PROBLEM CAUSE BY STUCK PITCH TRIM USE NORMAL FLAPS AND SPEED OF V_{REF} + 10. OTHERWISE EXTEND FLAPS AS REQUIRED DEPENDING ON ABILITY TO CONTROL PITCH ATTITUDE. USE 200-210K APPROACH SPEED IF USING 0° FLAP.
MANUALLY EXTEND SPOILERS ON LANDING

END OF PROCEDURE

HYD FAILURE 2 OR 3 SYSTEMS

1. **AIRSPEED MAXIMUM .....250** C-F
   DO NOT USE SPEEDBRAKES.
   -500 AIRCRAFT ALSO DESCEND TO FL300 OR BELOW.
   - Reduced airspeed, and lower altitude on -500, assures adequate stabilizer authority with single hydraulic system operating.

2. **DLC/AUTO SPLR SWS ....UNLATCH OFF** C-F

3. ***IF A AND C SYSTEMS FAILED***
   RUDDER HYDRAULIC LIMITER...UNL OVRD C-F

4. ***IF A, B, AND C SYSTEMS FAILED:***
   ROLL DISC.....PULL F
   - Flying must be done from F/O's side.
   - Left wing ailerons will float up.
   - 40 lbs of wheel force may be required to control roll.
   - 2R spoiler will provide roll assist if:
     - Flaps extended beyond 3°, or
     - Speedbrake lever is pulled aft and **held** in desired position.

5. **FUEL JETTISON .....AS REQUIRED** C-S

6. **SYSTEMS FAILED ITEMS....ACCOMPLISH** ALL

7. **LAND AT NEAREST SUITABLE AIRPORT** C

8. **AFTER TOUCHDOWN,**
   GROUND SPOILERS...MANUALLY ACTUATE C-F

---------SYSTEMS FAILED ITEMS---------

A, B, AND C FAILED

6. ***IF SYSTEM B QTY INDICATED:***
   RAT .....DEPLOY S
   May restore B system.

7. **NO FLAP OR PARTIAL FLAP LANDING**
   CHECKLIST .....ACCOMPLISH ALL
   See Abnormal Procedures, Flight Controls.

8. **LANDING GEAR MANUAL EXTENSION**
   CHECKLIST .....ACCOMPLISH ALL
   See fold-out checklist.

9. **BRAKE SYS SELECT .....ALT SYS C** C-F
   If C system drops below 1000 psi or braking action deteriorates after landing switch to B system. Excessive braking may cause loss of accumulator pressure.

10. **RUDDER SW .....UNLATCH OFF** C-F
    - Avoid crosswind landing.
    - During approach use roll control and asymmetric thrust to remain on runway centerline. Reduce asymmetric thrust gradually in the flare to avoid swerve.
    - Nosewheel steering not available; must be towed clear of the runway.

11. **AT COMPLETION OF LANDING ROLL:**
    ANTI-SKID .....UNLATCH OFF C-F

CAUTION:
DO NOT SET PARK BRAKES UNLESS SYSTEM B BRAKE PRESSURE IS AVAILABLE.
Pulling PARK brake knob automatically selects NORM SYS B brakes. Unless NORM SYS B accumulator pressure is available, brakes must be held manually until chocks are in place.

ITEMS AVAILABLE

RH Inbd and Outbd Ailerons
2R Spoiler
B & C Accumulator Brakes
Manual Gear Extension
D System to Stabilizer

STOP

SYSTEM FAILED ITEMS — SYSTEM FAILED ITEMS — SYSTEM FAILED ITEMS

A AND B FAILED

6. **BRAKE SYS SELECT** ..... **ALT SYS C** C-F
   Use gentle rudder inputs above 190 K.

   ON LANDING ROLL, SPOILER HANDLE MUST BE HELD IN AFT POSITION. C-F
   A or B pressure required for handle to remain in position selected.

CAUTION:
DO NOT SET PARK BRAKES UNLESS SYSTEM B PRESSURE IS AVAILABLE.
Pulling PARK brake knob automatically selects NORM SYS B brakes. Unless NORM SYS B accumulator pressure is available, brakes must be held manually until chocks are in place.

ITEMS LOST

Both Autopilots
Normal Brakes
Auto Ground Spoilers/DLC
Left Outbd Aileron
2L, 1L&R, 4L&R, 6L&R Spoilers
Automatic Rudder Hydraulic Backup
Tailskid
Yaw SAS Channels 1 & 2
ACS Channels 1 & 2 (-500)

STOP

A AND C FAILED

6. **NO FLAP OR PARTIAL FLAP LANDING CHECKLIST** ..... **ACCOMPLISH** ALL
   See Abnormal Procedures, Flight Controls.

   LANDING GEAR MANUAL EXTENSION CHECKLIST ..... **ACCOMPLISH** ALL
   See fold-out checklist.

   AFTER LANDING DIRECTION CONTROL ... BRAKES AND ASYMMETRIC THRUST C
   Nosewheel steering not available; must be towed clear of the runway.

ITEMS LOST

Autopilot B
Flaps and Slats
Normal Gear Extension
Auto Ground Spoilers/DLC
Nosewheel Steering
Rudder Hydraulic Limiter
Alt SYS C Brakes
PTU Backup for SYS D
2L, 3L & R; 5L & R Spoilers
Tailskid
Yaw SAS Channel 2
ACS Channel 2 (-500)

STOP

A AND D FAILED

ITEMS LOST

Autopilot B
Automatic Rudder Backup
2L & 2R Spoilers
Tailskid
Yaw SAS Channel 2
ACS Channel 2 (-500)

STOP

B AND C FAILED

6. **LANDING GEAR MANUAL EXTENSION CHECKLIST** ..... **ACCOMPLISH** ALL
   See fold-out checklist.

   BRAKE SYS SELECT ..... **ALT SYS C** C-F
   If C system drops below 1000 psi or braking action deteriorates after landing, switch to B system. Excessive braking may cause loss of accumulator pressure.

   AFTER LANDING DIRECTIONAL CONTROL ... BRAKES AND ASYMMETRIC THRUST C
   Nosewheel steering not available; must be towed clear of runway.

   AT COMPLETION OF LANDING ROLL:
   ANTI-SKID ..... **UNLATCH** OFF C-F

CAUTION:
DO NOT SET PARK BRAKES UNLESS SYSTEM B BRAKE PRESSURE IS AVAILABLE.
Pulling PARK brake knob automatically selects NORM SYS B brakes. Unless NORM SYS B accumulator pressure is available, brakes must be held manually until chocks are in place.

ITEMS LOST

Autopilot A
Normal Gear Extension
Normal & Alternate Brakes
Autoground Spoilers/DLC
Regulated Rudder Power in Cruise
1L & R, 3L & R, 4L & R, 5L & R, 6L & R Spoilers
Nosewheel Steering
PTU Backup for A & D
YAW SAS Channel 1
ACS Channel 1 (-500

STOP

B AND D FAILED

6. **BRAKE SYS SELECT** ..... **ALT SYS C** C-F

CAUTION:
DO NOT SET PARK BRAKES UNLESS SYSTEM B BRAKE PRESSURE IS AVAILABLE.
Pulling PARK brake knob automatically selects NORM SYS B brakes. Unless NORM SYS B accumulator pressure is available, brakes must be held manually until chocks are in place.

ITEMS LOST

Autopilot A
Normal Brakes
PTU Backup for SYS A
2R, 1L & R, 4L & R, 6L & R Spoilers
R Outboard Aileron
Yaw SAS Channel 1
ACS Channels 1 & 2 (-500)

STOP

(OPPOSITE SIDE BLANK)

C AND D FAILED

6. **LANDING GEAR MANUAL EXTENSION CHECKLIST** ..... **ACCOMPLISH** ALL
   See fold-out checklist.

   AFTER LANDING DIRECTIONAL CONTROL ... BRAKES AND ASYMMETRIC THRUST C
   Nosewheel steering not available; must be towed clear of runway.

ITEMS LOST

Normal Gear Extension
Auto Ground Spoiler/DLC
Nosewheel Steering
Regulated Rudder Power in Cruise
2R, 3L & R, 5L & R Spoilers
PTU Backup for D
ALT SYS C Brakes
ACS Channel 2(-500)

STOP

HYDRAULIC FAILURE - 2 OR 3 SYSTEMS

The following checklists are provided to eliminate the need to refer to the NORMAL checklist.

The S/O reads both challenge and response after assuring that the item is completed.

DESCENT - APPROACH CHECKLISTS

1. **PRESSURIZATION**
2. **CROSSBLEED** ON
3. **FUEL PANEL**
4. **EPR MODE SET GA**
5. **LANDING DATA:**
   IF 'A & C' INOP ... AVAIL FLAP/SLAT CONFIG
   OTHERWISE ..... NORMAL CONFIG
6. **SHOULDER HARNESS ..... ON**
7. **DLC/AUTO SPLR ..... UNLATCH** OFF
8. **CONTINUOUS IGNITION ..... LATCH** ON
9. **PILOT'S ANNUN PANEL ... RECALL, CHECK**
10. **SEAT BELT/NO SMOKING ..... LATCH** ON
11. **AUTOFLIGHT PANELS ..... CHECK**
12. **ALT/FLT & NAV INST ..... CHECK**
13. **RADIO & BARO ALT BUGS ..... ____/____**
14. **AIRSPEED/EPR BUGS ..... ____**
15. **IF 'A & C' INOP, GPWS ..... INHIBIT**
16. **IF BRAKE 'B' INOP, ALT SYS C ..... SELECT**
17. **SPEEDBRAKE LEVER ..... FWD**
18. **LOWER GALLEY CLEAR**

BEFORE LANDING

1. **IF 'C' INOP, GEAR ..... MANUAL EXT**
   OTHERWISE ..... NORMAL EXT
2. **IF 'A & C' INOP, FLAPS/SLATS ..... ____**
   OTHERWISE ..... ____/____ GREEN LT
3. **IF 'A & C' INOP ..... SLAT MONITOR ____**
   OTHERWISE ..... 14 GREEN

LANDING GEAR - MANUAL EXTENSION

1. **GEAR LEVER ..... DOWN** C-F
2. **NOSE MECH RELEASE HANDLE ... PULL** S
   Speed may have to be reduced to as low as 190K for nosegear to extend to the down-and-locked position.
3. **L & R MAIN MECH. RELEASE HANDLES ..... PULL** S
4. **IF ANY GREEN LT REMAINS EXTING: ALTERNATE HYD LANDING GEAR EXTENSION SWITCH ..... ACTUATE** S
   MECH DOWN LOCK INDIC(S) ... CHECK S

MAKE STANDARD CALLOUTS

END OF PROCEDURE

ENGINE FIRE/DAMAGE (-500 AIRCRAFT)

If fire or severe damage on engines 1 or 3, has resulted in degradation of the electrical wiring in the center wing area, the the potential for a fire exists due to the proximity of Fuel Tanks 1A and 3A.

ENGINE FIRE/DAMAGE CHECKLIST . . . . . **COMPLETE**

ENGINE SHUTDOWN FOLLOW-UP CHECKLIST . . . . . **COMPLETE**

WHEELWELL LIGHT SW . . . . . **OFF**

SERVICE INTERPHONE SW . . . . . **UNL OFF**

C/B's 2K1, 3J15, 3J16, 3Z15 . . . . . **PULL**

- Pull the Wheel well lights Control (2K1), Lower Anti-Collision Light (3J15 & 16) and Passenger Service Bus 2 (3Z15) circuit breakers.

NOTE: If subsequent electrical load reduction is required, reset 3Z15, if required. It is not possible to remove all galley power as long as circuit breaker 3Z15 is pulled.

———END OF PROCEDURE———

OPPOSITE SIDE BLANK

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CARGO COMPARTMENT SMOKE, (–500)

This procedure applies when:
-One or both detector lights ([1],[2]) are illuminated in each circuit (A and B), with the circuit selector in BOTH; or
-One or both detector lights ([1],[2]) are illuminated in the selected circuit (A or B).

Other indications will be:
- [SMOKE] on PCAWP.
- [SMOKE] on S/O Annunciator.
-Alternating tone warning.

1. MAIN FIRE BOTTLE.....DISCHARGE	-MAIN [DISCH] illuminates after 1 to 3 min. -FWD cargo fan stops.
	NOTE: Since the FWD cargo compartment (also AFT, Ship 754-756) is fully sealed, the SMOKE lights will probably remain and it is not possible to verify that the source of smoke has been neutralized.
2. *IF THERE IS VISIBLE SMOKE OR ODOR OF SMOKE:*	Burn through to cabin has occurred.
SMOKE GOGGLES/OXYGEN MASKS...ON-100%	All flight crew members don oxygen masks whenever smoke is present in the cockpit.
ALL PACK FLOW CONTROL SWS...LCH/FB'S AFT OUTFLOW VALVE...LCH [MNL] & CLOSE	FWD outflow valve must also be manually controlled if it opens beyond green band at aircraft altitudes above 15,000'.
CAB ALT SET.....10,000' NORM RATE.....FULL INCREASE	If MODE SEL in STBY, set STBY RATE to full ASCD, then HOLD at 10,000' cabin altitude.
3. LAND AT NEAREST SUITABLE AIRPORT	
4. *AFTER ONE HOUR:* ALTN FIRE BOTTLE.....DISCHARGE	ALTN [DISCH] illuminates.
5. BEFORE LANDING OUTFLOW VALVES----------OPEN	Outflow valves will not open upon landing if Pressurization MODE SEL is in STBY or Outflow Valve Switches are in MNL.

END OF PROCEDURE

GALLEY DUCT/OVERHEAT(-500)

Illumination of FWD, MID, or AFT in either selector position, (A or B) is considered a valid indication of a Galley Duct Overheat condition.

- SMOKE on PCAWP.
- Alternating tone warning.

1. **GALLEY POWER SWS (3).....UNL OFF**

2. **COOL AIR OVBD SW.....LCH OPEN**
   This is the normal position for flight, but must be checked to insure the exhaust flow control valve is open for smoke removal.

3. **PACK FLOW CONTROL SWS....LCH/ FB'S**

4. **ESTABLISH COMMUNICATIONS WITH GALLEY PERSONNEL**
   - Attempt to determine cause of overheat and need for assistance. Inspect galley when duties permit.
   - If immediate assistance required:
     - Obtain a Halon fire extinguisher and walkaround oxygen before proceeding to galley area.
       NOTE: The forward and aft galleys each have one ceiling grill opening to the galley exhaust duct. The mid galley has two ceiling grills (one on each side of centerline). If necessary, direct halon into the ceiling grill(s).

To restore power to an unaffected galley:

5. **RESPECTIVE GALLEY POWER SW....LCH**
   - BUS 1 for MID galley.
   - BUS 2 for FWD galley.
   - BUS 3 for AFT galley.

END OF PROCEDURE

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EMERGENCY LANDING AND EVACUATION

BEFORE LANDING

1. **FUEL JETTISON.....ACCOMPLISH** C-S
   - Manage fuel to permit slowest possible approach speed.
   - Jettison/burn as much fuel as possible from inboard tanks if landing with gear retracted, or partially extended.
   - Ensure fuel jettisoning system is secured prior to landing or selecting flaps beyond 22°.

2. **EMERGENCY LIGHTS.....ON** C-F
   Turn **ON** before landing. Have flashlights available.

3. **PACK FLOW CONTROL SWS.....UNL** S

4. **OVERHEAD HATCH .....OPEN** S
   Stow handle flush after opening.

5. **PASSENGERS.....BRIEF** C-F
   Final briefing should be given at least 1 minute prior to impact or landing.

6. **BEFORE LANDING**
   OUTFLOW VALVES.....OPEN S
   Assure both outflow valves are full open before landing.

(PROCEDURE CONTINUED ON NEXT PAGE)

EMERGENCY LANDING AND EVACUATION (CONT'D)

AFTER LANDING

1. **TOWER/GROUND.....NOTIFY** F
   Tower should be notified as to nature of situation and assistance needed (i.e., fire trucks, portable ramps, amulances, etc).

2. **FLIGHT ATTENDANTS.....NOTIFY** C
   - Flight Attendants should be informed of any conditions such as high winds, irregular ground conditions and/or structural damage that could alter or affect deployment or status of the escape slides.
   - Consider factors such as location of any fire, etc., which would preclude the use of certain exits.
   - Insure all preparations for the evacuation of non-ambulatory passengers are made.

3. **PARK BRAKE.....SET** C

4. **EMERGENCY LIGHTS.....ON** C-F
   Verify EMERGENCY LIGHTING Switch ON.

5. **FUEL AND IGNITION.....OFF** C-F

6. **ENGINE/APU FIRE PULL HANDLES.....PULL** C-F
   Discharge fire bottles if needed.

7. **EVACUATION COMMAND.....GIVEN** C-F
   - Considering conditions, latch EVAC switch, or alert Flight Attendants/passengers by PA of need to evacuate.
   - Time permitting, advise Flight Attendants of any additional conditions which may affect evacuation.

8. **BATTERY SWITCH.....OFF** S

9. **ALL CREWMEMBERS PROCEED TO EVACUATION STATIONS WITH ALL NECESSARY EMERGENCY EQUIPMENT**
   - Captain, Forward door area (1R).
   - F/O, Mid-cabin area (2R)
   - S/O, Mid-cabin area (3L).

POST EVACUATION

CLEAR THE AREA
Available crewmembers assemble passengers for orderly departure from hazardous area. Also provide directions and assistance to those who might be injured.

END OF PROCEDURE

DITCHING PROCEDURE

When flying overwater it is imperative that the Captain initiate alerting procedures whenever doubt begins to exist as to the safety of the aircraft. (If time permits, refer to ditching notes in the domestic Jeppesen Manual EMERGENCY, Pgs. US-13 thru US-17.)

PREPARATORY

1. **RADIOS.....AS REQUIRED** C-F
   - Advise any station that is raiseable of your situation and action to be taken.
   - Give position, heading, IAS, altitude, etc., as time permits.
   - Indicate assistance required.
   - Set transponder code to 7700.
   - Make last broadcast of ditching intention and position.

2. **LOCATE AND HEAD FOR NEAREST SHIP** C

3. **FLIGHT ATTENDANTS.....NOTIFY** C
   Advise crew on situation and duties.

4. **SEAT BELT/NO SMOKING...LATCH ON** C-F

5. **GPWS.....INHIBIT** C-F

6. **FUEL JETTISON.....AS REQUIRED** C-S
   At appropriate time jettison fuel.

7. **PACK FLOW CONTROL SWS...UNLATCH** S
   Depressurize cabin.

8. **OVERHEAD HATCH.....OPEN** S
   Stow handle flush after opening.

9. **OUTFLOW VALVES....LCH MNL & CLOSE** S

10. **COOL AIR OVBD SW....UNLATCH CLOSE** S

11. **LOOSE EQUIPMENT.....STOWED** ALL

12. **LIFE JACKETS, SHOULDER HARNESS & SEAT BELTS.....DON** ALL

FINAL

13. **AURAL WARNING C/B 1L8.....PULL** S

14. **AIRCRAFT....CONFIGURE FOR IMPACT** C
    Gear up, flaps 33° and speed V_{REF}.

15. **EMERGENCY LIGHTS.....ON** C-F
    Also turn on flashlights, and pull pins on life vest lights.

16. **AT 500'.....ADVISE CABIN** C-F
    - Command 'Brace position'.
    - Give warning to crew by PA, bell, or light signal.

17. **TOUCHDOWN UNDER FULL CONTROL AT MINIMUM SPEED AND SINK RATE. DO NOT PERMIT AIRCRAFT TO STALL.** C
    - Turn to ditching heading and commence approach.
    - Touchdown should be be parallel to wave or swell, windward side of trough or top of swell.

ABANDON SHIP

18. **EMERGENCY RADIO.....OBTAIN** F
    F/O takes emergency radio from cockpit and proceeds to evacuation station.

19. **PROCEED TO EVACUATION AREA, DIRECT SLIDE/RAFT DEPLOYMENT & EVACUATION OF PASSENGERS INTO SLIDE/RAFTS.** ALL
    - Captain, Forward cabin area (1R).
    - F/O - Mid cabin area (2R).
    - S/O - Mid cabin area (3L).

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BUOYANCY AFTER DITCHING

Model tests indicate that the aircraft will come to a stable flotation attitude as shown within 5 minutes after touchdown. The 4L and 4R doors (3L and 3R on -500) will be very close to the waterline; 1L and 1R doors will be between 5 and 6 feet above the water. The forward cargo and galley compartments probably will not be flooded unless the forward outflow valve is open. A forward center of gravity and light weight are beneficial; thus it is advisable to burn off as much fuel, particularly in tank 2, as possible. the tests indicate that the aircraft should remain afloat for ample time to permit safe egress.

SLIDE LAUNCHING NOTES:

1. Tell passengers to inflate life vests after they are outside the aircraft. Evacuate immediately and as rapidly as possible.

2. S/O should assure 30 man raft(-1 aircraft only) is obtained from storage area between #3L and #3R doors. Launch from any available exit.

3. Evacuate passengers directly into slide rafts. If it is not possible to accomodate all passengers on a particular slide raft at the moment, have passengers hold onto life lines.

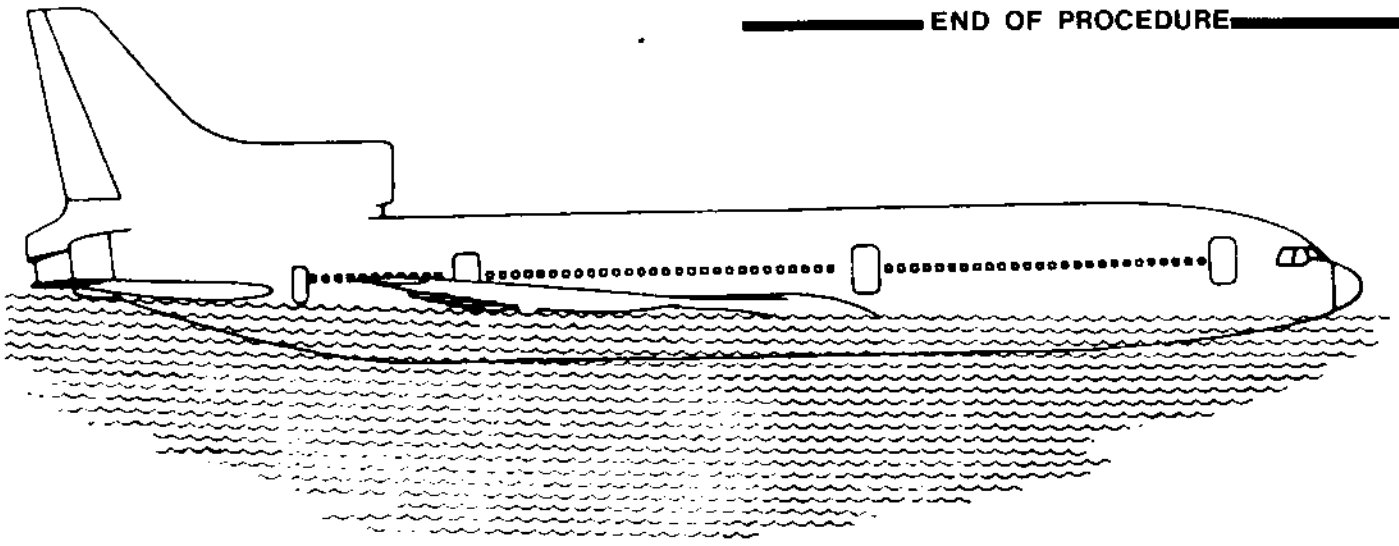
4. Have one/two persons help others to board the raft - all others evenly spaced on the far end of raft. When slide rafts are full and no one is left aboard aircraft, lift fabric girt flap at outboard edge of sill, and pull handle to release raft from door. Also cut mooring line.

5. Assemble rafts away from aircraft. Tie rafts closely together only if the sea is calm.

6. Capsizing is possible. Tie children to adults. Tie one person to raft all times to control it if it capsizes.

7. Know the total number of persons (passengers & crew) aboard aircraft. Take a count as soon as possible and advise Captain.

END OF PROCEDURE



PLANE ATTITUDE AFTER DITCHING

FLIGHT CREW DUTIES SUMMARY FOR EMERGENCY LANDING/DITCHING EVACUATION

The following Flight Crew duties summary is designed to assist the crewmembers in preparing the aircraft's occupants for emergency landing and evacuation. Time is essential in preparing passengers for the for the evacuation (especially non-ambulatory). Flight Attendants should be advised of the problem(s) as soon as flight safety is in doubt. Additionally, the Flight Attendants should be informed of any conditions such as high winds, irregular ground condition, sea state, structural damage and/or fire that affect or alter status of the escape slides/raft deployment.

PRE LANDING/DITCHING

POST LANDING/DITCHING

CAPTAIN

- Advise crew to prepare for emergency landing (or ditching) and order distress message sent.
- Set course for most logical point of landing under existing circumstances.
- Order cockpit emergency preparation as conditions dictate.
- If ditching, don life vest.
- Fasten seat belt and shoulder harness.
- Signal cabin crew/passengers when touchdown is imminent, using PA system if operative.

- Order evacuation.
- Proceed to **forward cabin area (1R)**.
- Assist in evacuating passengers as conditions dictate.
- Check that all persons have been evacuated, if possible.
- Exit through 1R if operable.
- After exiting, assemble pax's/rafts away from the aircraft.

FIRST OFFICER

- Send distress message (MAY DAY), giving aircraft identification, type, position, heading, airspeed, altitude, fuel remaining in hours and minutes, nature of distress, intentions, and assistance desired.
- Assist in cockpit emergency preparations as directed by the Captain and as conditions dictate.
- If ditching, don life vest.
- Fasten seat belt and shoulder harness.

- Proceed to **mid cabin area (2R)**.
- If ditching, take radio beacon.
- Assist in evacuating passengers as conditions dictate.
- Exit through 2R if operable.
- Assist in assembling passengers/rafts away from the aircraft.

SECOND OFFICER

- Assist in cockpit emergency preparations as directed by the Captain and as conditions dictate.
- Open cockpit door; stow loose equipment.
- If ditching don life vest.
- Fasten seat belt and shoulder harness.

At Captain's discretion:
- Assist with cabin preparation.
- Sit in cabin during touchdown.

- Proceed to **mid cabin area (3L)**.
- Assist in evacuating passengers as conditions dictate.
- Obtain and launch 30 man life raft(-1 aircraft) from storage area between 3L & 3R doors. On -500 aircraft 3L &3R Slide/Rafts may have to be launched from other doors due to the waterline. There are no 30 man life rafts on the -500 or -200 .
- Exit through 3L if operable.
- Assist in assembling passengers/rafts away from aircraft.

EMERGENCY EVACUATION DUTIES - FLIGHT ATTENDANTS

L-1011 ANTICIPATED EMERGENCY - GENERAL DUTY ASSIGNMENTS

F/A Position	Station	Pre-Landing	Nosewheel Collapse	Main Gear Collapse	Belly Landing	Exterior Fire
Coordinator	1L Door	Receive instructions from cockpit. Brief other F/A's and F/C passengers. Coordinate all cabin preparation. Assign F/A briefing areas. Advise Capt when preparations are complete.	Man 1L door. Direct evacuation of forward cabin.	Man forward low door. Direct evacuation of forward cabin.	Man 1L door. Direct evacuation of forward cabin.	Man forward door opposite fire. Direct evacuation of forward cabin.
2nd F/A	2L Door	Receive instructions from Coordinator. Brief passengers as assigned and assist in preparation of A and B zones. Advise Coordinator when preparations are complete.	Man 2L door. Direct evacuation of passengers forward and aft of the exit.	Man or assist at low #2 door. Direct evacuation of passengers in B and forward half of C zone.	Man 2L door. Direct evacuation of passengers forward and aft of the exit.	Man or assist at #2 door opposite fire. Direct evacuation of passengers in B and forward half of C zones.
3rd F/A	3L Door	Receive instructions from Coordinator. Brief passengers as assigned and assist in preparation of C zone. Advise Coordinator when preparations are complete.	Man 3L door. Direct passengers in C and D zones forward.	Man or assist at low #3 door. Direct evacuation of passengers in aft half of C zone.	Man 3L door. Direct evacuation of passengers forward and aft of the exit.	Man or assist at #3 door opposite fire. Direct evacuation of passengers in aft half of C zone.
4th F/A	4L Door	Receive instructions from Coordinator. Brief passengers as assigned & prepare D zone. Advise Coordinator when preparations are complete.	Man 4L door. Direct evacuation of D zone, directing passengers forward, if necessary	Man or assist at low #4 door. direct evacuation of passengers in D zone	Man #4 doors. Direct evacuation of passengers forward of the exit.	Man or assist at #4 door opposite fire. Direct evacuation of passengers in D zone.
5th F/A	2r Door	Receive instructions from Coordinator. Brief passengers as assigned and assist in preparation of B and C zones. Advise Coordinator when preparations are complete.	Man 2R door. Direct evacuation of passengers forward and aft of the exit.	Man or assist at low #2 door. Direct evacuation of passengers in B and forward half of C zones.	Man 2R door direct passengers forward and aft of the exit.	Man or assist at #2 door opposite fire. Direct evacuation of passengers in B and forward half of C zones.
6th F/A	3R Door	Receive instructions from Coordinator. Brief passengers as assigned and assist in preparation of C zone. Advise Coordinator when preparations are complete	Man 3R door. Direct passengers in C and D zones forward.	Man or assist at low #3 door direct evacuation of passengers in aft half of C zone.	Man 3R door. Direct evacuation of passengers forward and aft of the exit.	Man or assist at #3 door opposite fire. Direct evacuation of passengers in aft half of C and D zones.
7th F/A	1R Door	Receive instructions from Coordinator. Brief passengers as assigned and assist in the preparation of A and B zones. Advise Coordinator when preparations are complete	Assist at 1R door. Direct evacuation of forward cabin.	Assist at forward low door Direct evacuation of forward cabin.	Man 1R door. Direct evacuation of forward cabin.	Assist at forward door opposite fire. Direct evacuation of forward cabin.
8th F/A (If assigned)	4R Door	Receive instructions from Coordinator. Brief passengers as assigned and assist in the preparation of D zones. Advise Coordinator when preparations are complete.	Assist in directing passengers C and D zones forward.	Assist at low #4 door Direct evacuation of passengers in D zone.	Assist at #4 doors. Direct evacuation of passengers forward of the exit.	Man or assist at #4 door opposite fire. Direct evacuation of passengers in D zone.
9th F/A (If assigned)	Mid Cabin F/A Seat	Receive instructions from Coordinator. Brief passengers as assigned and assist in the preparation of B and D zones.	Assist at 2L door. Direct evacuation of passengers forward and aft of the exit.	Assist in evacuation as needed.	Assist at 2L door. Direct evacuation of passengers forward and aft of the exit	Assist in evacuation as needed.
10th F/A (If assigned)	Mid Cabin F/A Seat	Receive instructions from Coordinator. Brief passengers as assigned and assist in preparation of aircraft.	Assist at 2R door. Direct evacuation of passengers forward and aft of the exit.	Assist in evacuation as needed.	Assist at 2R door. Direct evacuation of passengers forward and aft of the exit.	Assist in evacuation as needed.

L-1011 ANTICIPATED EMERGENCY - DITCHING - GENERAL DUTY ASSIGNMENTS

POSITION	STATION	PREPARATION	EVACUATION
Coordinator	1L Door	Receive instructions from cockpit. Brief other F/A's. When captain initiates, brief passengers in A zone. Coordinate all cabin preparations. Advise Captain when preparations are complete.	Man 1L door. Launch slide/raft and evacuate A zone. Board 1L slide/raft.
2nd F/A	2L Door	Receive instructions from Coordinator. Brief passengers and prepare cabin in B and forward half of C zone. Advise Coordinator when preparations are complete.	Man 2L door. Launch slide/raft and evacuate B and forward half of C zones. Board 2L slide/raft.
3rd F/A	3L Door	Receive instructions from Coordinator. When directed, brief passengers and prepare cabin in aft half of C and all of D zones. Advise Coordinator when preparations are complete.	Man 3L door. Launch slide/raft and evacuate aft half of C and all of D zones. Board 3L slide/raft.
4th F/A	4L Door	Receive instructions from Coordinator. When directed, brief passengers and prepare cabin in D zone. Advise Coordinator when preparations are complete.	Man No. 4 doors, directing D zone passengers to No. 3 doors. Board 3L slide/raft. If necessary activate slides at No. 4 doors.
5th F/A	2R Door	Receive instructions from coordinator. Brief passengers and prepare cabin in B and forward half of C zone. Advise Coordinator when preparations are complete.	Man 2R door. Launch slide/raft and evacuate B and forward half of C zones. Board 2R slide/raft.
6th F/A	3R Door	Receive instructions from Coordinator. Brief passengers and prepare cabin in aft half of C and all of D zones. Advise Coordinator when preparations are complete.	Man 3R door. Launch slide/raft and evacuate aft half of C and all of D zones. Board 3R slide/raft.
7th F/A	1R Door	Receive instructions from Coordinator. Assist in passenger briefing and cabin preparation as needed.	Assist at 1R door. Launch slide/raft and evacuate A Zone. Board 1R slide/raft.
8th F/A (If assigned)	4R Door	Receive instructions from Coordinator. Assist in passenger briefing and cabin preparation as needed.	Assist in directing D zone passengers to No. 3 doors. Board 3R slide/raft. If necessary assist in activating slides at No. 4 doors.
9th F/A (If assigned)	Mid-Cabin F/A Seat	Receive instructions from Coordinator. Assist in passenger briefing and cabin preparation as needed.	Assist at 2L door. Launch slide/raft and evacuate B and forward half of C zones. Board 2L slide/raft.
10th F/A (If assigned)	Mid-Cabin F/A Seat	Receive instructions from Coordinator. Assist in passenger briefing and cabin preparation as needed.	Assist at 2R door. Launch slide/raft and evacuate B and forward half of C zones. Board 2R slide/raft

(OPPOSITE SIDE BLANK)

END

GENERAL

The procedures in this section require crewmember action to either counteract a system malfunction or prevent an emergency condition from developing.

If an abnormal situation develops, the Captain should:

- Determine that he or the First Officer will fly the aircraft while the abnormal procedure(s) are accomplished.
- Initiate those action step(s) necessary to isolate the malfunction based on his knowledge of the abnormalty.
- Refer to the specific abnormal procedure(s).

CIRCUIT BREAKERS

If a circuit breaker trips, allow a cooling period of 90 seconds, if practical, before reset. Normally, only attempt one reset.

FAULT ISOLATION REPORTING METHOD (FIRM)

A FIRM manual is installed on each aircraft.

The FIRM system (Fault Isolation Reporting Method) does not provide procedures. It is used after an abnormal procedure or other type of malfunction procedure has been accomplished. FIRM asks questions about symptoms that occurred before or during the failure or malfunction.

After accomplishing required procedure, use the FIRM manual to determine the appropriate fault code. Each FIRM diagram includes the switches and indicators that provide fault symptoms. A related series of questions are asked on the diagrams. These questions deal with those symptoms that occurred at the time of the fault before corrective action was taken. The answers to the questions results in a specific FIRM fault code and a related text "flight report" for entry into the aircraft logbook.

- Relay by radio, as soon as practicable, the FIRM fault code (plus any required system identification and operating parameters) to the Maintenance Coordinator.
- The Maintenance Coordinator relays the fault codes and other related information to the appropriate Maintenance facility for planning action needed to fix the aircraft, or place the item on carryover to a point where the fix is to be accomplished.
- Enter the FIRM fault code and its related flight report in the aircraft log.

INDEX

ABNORMAL PROCEDURES

DOORS

CARGO DOOR WARNING IN-FLIGHT ..... DOOR OPEN 2
PASSENGER DOOR WARNING ..... DOOR OPEN 3

GALLEY

LIFT MALFUNCTION 4

WASTE/WATER

LAVATORY OVERFLOWING 4
WASTE WATER PUMP ..... FWD or AFT 5
WATER COMPRESSOR ..... WATER CPRSR 1 or WATER CPRSR 2 5
WATER LINE HEATER ..... WATER LINE HTR 5
WATER PRESSURE LOW 5

CROSS REFERENCE

ANNUNCIATOR PANEL LIGHTS ..... (PRM) AIRCRAFT GENERAL
AURAL WARNINGS ..... (PRM) AIRCRAFT GENERAL

CARGO DOOR WARNING IN-FLIGHT

- Normally associated with a no-pack takeoff or misaligned proximity switches.

CARGO DOOR OPEN ***LIGHT ILLUMINATED:***

IF

DURING TAKEOFF, BUT EXTINGUISHES AFTER TAKEOFF WITH ONE PACK ON:

NORMAL OPERATION. .CONTINUE
- Make logbook entry.

END OF PROCEDURE

DURING TAKEOFF, BUT DOES NOT EXTINGUISH AFTER TAKEOFF WITH ONE PACK ON:

LAND AS SOON AS POSSIBLE
- Do not pressurize cabin.

END OF PROCEDURE

IN-FLIGHT:

CAB ALT SET .....10,000'

NORM RATE.....1000 FT/MIN

DESCENT.....ESTABLISH
- Flight idle and V_{MO}.
- Emergency descent is not required if cabin pressure is controllable.

1.5 PSI DIFF PRESS.....MAINTAIN
- Cargo door is designed to prevent further opening as long as cabin differential pressure remains above 1.0 PSI.
- As aircraft descends to 14,000', differential pressure will be reduced to 1.5 PSI.

WHEN DESCENDING THROUGH 14,000':

CAB ALT SET. .FIELD ELEVATION

NORM RATE.....ADJUST
- Adjust cabin rate of descent as required to match aircraft rate of descent and maintain 1.5 PSID until cabin altitude reaches field elevation.

END OF PROCEDURE

PASSENGER DOOR WARNING

DOOR OPEN

- Light remains illuminated if:
  - Door not fully closed.
  - Door T-Handle not fully stowed.
  - Misalignment of lock pin/hole.
  - Failure of proximity switch.

DOOR CLOSE SW.....DEPRESS

DOOR T-HANDLE.....CK

CAUTION:
BEFORE PUSHING T-HANDLE IN, MOVE SLIDE LEVER TO "DETACH"

- Remove plastic guard and firmly push handle to the fully stowed position.

AFFECTED DOOR C/B'S.....CYCLE

- Pull and reset the circuit breakers for the affected door:

SHIPS 712 - 741

- L1 or R1 doors = C/B's 4A14, 17 & 19.
- L2 or R2 doors = C/B's 4A8, 11 & 20.
- L3 or R3 doors = C/B's 4A2, 5 & 21.

SHIPS 751-756

- L1 or R1 doors = C/B's 4A2, 5 & 19.
- L2 or R2 doors = C/B's 4A8, 11 & 20.
- L3 or R3 doors = C/B's 4A14, 17 & 21.

MANUAL HAND CRANK.....OPERATE

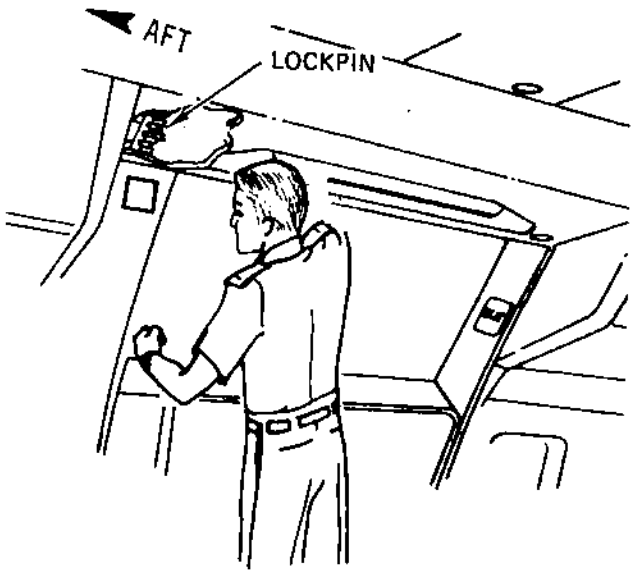
- Stowed in Forward Avionics Compartment
- Turn clockwise (counterclockwise on L1 door) to close door manually.
  - Should overcome improper rigging or a track that is binding and allow the lock pin to engage the door track.

LOCKPIN POSITION.....VERIFY

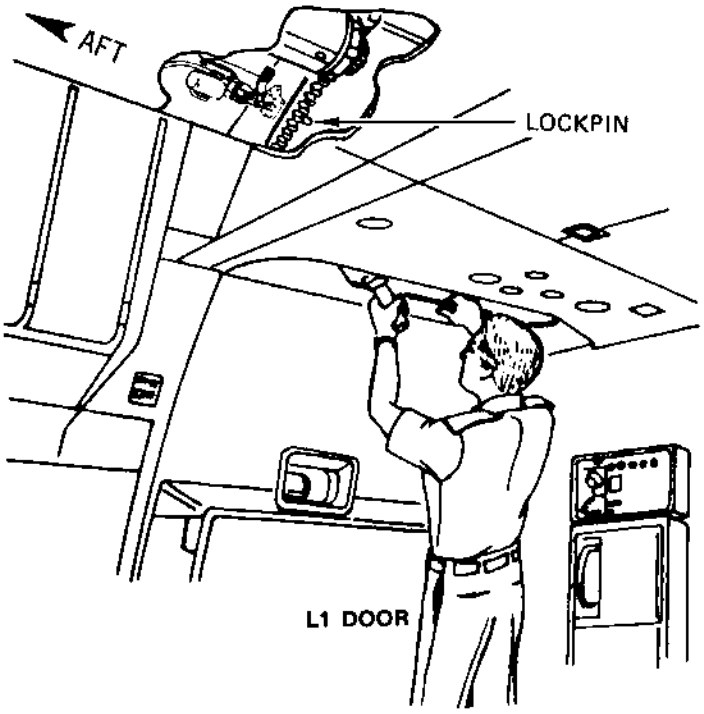
- Lockpin is on the **aft** side of all doors.
- Lockpin on L1 door is visible through the inspection opening.
- On all other doors ask Maintenance to verify the lockpin is protruding through the door track by feeling or observing with a hand held mirror. There is an inspection panel just below the track.

When Door Verified Locked:

SLIDE LEVER.....ENGAGE



ALL DOORS EXCEPT L1



DOOR LOCK PIN INSPECTION

END OF PROCEDURE

GALLEY LIFT MALFUNCTION

If Lift Will Not Operate Electrically:

MASTER KEY SW...“OFF” THEN “BOTH”

- Key is stored above coffee maker next to Captain's lift, and also in aft coffee bar.

TOP OF LIFT CLEAR.....CK

- Check that top of lift does not have any items stowed on it.

LIFT C/B'S.....CYCLE

- Pull and reset C/B's 4C2 & 5G11.

If Lift Still Inoperative:

MECHANICAL HAND CRANK ...OPERATE

- Mechanical hand cranks are located in the lower galley, behind the hinged panel, directly below the normal lift controls.
- Deploy crank and turn as necessary to lower lift to the full down position to assure flight attendant emergency escape route.

END OF PROCEDURE

LAVATORY OVERFLOWING

The pneumatic system provides ventilation of the lavatory waste tanks on the ground. Failure of the pneumatic lavatory vent shutoff to close in-flight will cause the lavatories to overflow if the overboard vent also becomes clogged.

If Forward Lavatory Overflowing:

NO.2 PACK FLOW CONTROL SW ...UNL

- Removes air source to forward lavatories vent system.

If Aft Lavatory Overflowing:

NO.2 ENG ISLN VALVE SW ...UNL OFF

FUSELAGE ISLN VALVE SW....UNL OFF

APU BLEED AIR S/O SW.....UNL

- Preceding 3 steps removes pneumatic sources to:
  - Aft lavatories vent system.
  - B_2 ATM.
  - #2 & 3 cargo compartment heating.

For Landing:

ONE PACK FLOW CONTROL SW ...UNL

- Limit number of packs used to number of engine bleed sources available.
  - Normally, deactivate No. 1 pack, since it does not supply trim air.
  - Continue operating No. 2. pack if at all possible.

END OF PROCEDURE

WASTE WATER PUMP

FWD OR AFT

If any one of the three pumps fail in the forward or aft lavatory flush systems, the respective FWD or AFT light illuminates. Normal operation should continue automatically as long as one pump is operating in each system.

FWD C/B's.....CYCLE
- Pull and reset C/B's 2B3, 6 & 9 to reset the three forward pumps.

AFT C/B's.....CYCLE
- Pull and reset the affected circuit breakers to reset the three aft pumps.

SHIPS 712 - 741

C/B's 5B5, 8, & 11

SHIPS 751 - 756

C/B's 4I2, 4H8 & 17

If FWD or AFT Illuminates After One Reset:

MAINTNENANCE.....ADVISE
- Normal lavatory operation can be maintained as long as any one pump remains operational in each system.

END OF PROCEDURE

WATER LINE HEATER

WATER LINE HTR

AFFECTED C/B's.....CYCLE
- Pull and reset the affected circuit breakers.

SHIPS 712 -741

C/B's 5D6 & 7

SHIPS 751 -756

C/B's 4K11 & 12

- There are two water line heater systems. Normally the No.1 system maintains water line temperatures. If the temperature drops too low, the WATER LINE HTR light will illuminate and the No.2 system will be activated.
- The **WATER LINE HTR** light extinguishes when normal temperature is restored. Water lines will not freeze as long as one heater system is operating.

END OF PROCEDURE

WATER COMPRESSOR

WATER CPRSR 1 OR WATER CPRSR 2

AFFECTED C/B'S.....CYCLE
- Pull and reset the affected circuit breakers for the affected compressor. Operation of either compressor will maintain normal water pressure.

SHIPS 712 -741

C/B's 5G2 & 4G20 or 5G5 & 4H20

SHIPS 751 -756

C/B's 4E19 & 20 or 4K14 & 17

END OF PROCEDURE

WATER PRESSURE LOW

- The WATER CPRSR 1 and WATER CPRSR 2 light may also be illuminated.

WATER FILL VALVE.....CK CLOSED
- Check lower galley fill valve (behind access panel above sink) is closed.

END OF PROCEDURE

END

WATER COMPRESSOR – WATER CPRSR 1 OR WATER CPRSR 2

1. C/B 4K14 and 4E20, or 4K17 and 4E19----------RESET	Operation of either compressor will maintain normal water pressure.

[redacted]

[redacted]

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(MALFUNCTION) (LIGHT INDICATIONS)

AIR CONDITIONING

AREA/DUCT OVERHEAT

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-100/200/500 DIFFERENCES (Blue Pages)

INS Cooling Fan LO FLO ----------1

CROSS REFERENCE

Area Overheat D, J, E, or H---------- PNEUMATICS ABNORMALS
Area Overheat Loop Check---------- PNEUMATICS ABNORMALS
Duct Overheat - No. 1, 2 or 3---------- PNEUMATICS ABNORMALS
High Flow Trip---------- PNEUMATICS ABNORMALS
Wing Anti-Ice Duct Failure---------- ICE/RAIN ABNORMALS

AREA OVERHEAT A, B, OR C (ONE LIGHT) · AREA OVHT

1. **AREA OVHT LOOPS.....CK**
   See **Pneumatic Abnormal Section** for description of Loop Check.

   Structure surrounding ducts is capable of withstanding maximum temperatures for at least five minutes.

2. **PACK FLOW CONTROL SW.....UNL**
   Flowbar should extinguish.
   - **IF AREA OVHT EXTINGUISHES, TERMINATE PROCEDURE AT THIS POINT.**

IF

FLOWBAR EXTINGUISHED, BUT AREA OVHT REMAINS AFTER 5 MINS:

3. **PACK FLOW CONTROL SW.....LCH FB**

4. **ADJACENT PACK FLOW CONTROL VALVE SW.....UNL**
   - The parallel ducting leading to the air conditioning packs run close to each other. A ruptured duct may cause an adjacent AREA OVHT.
   - If three packs were operating, an inhibiting circuit could have prevented the ruptured duct AREA OVHT light from illuminating.
   - Pack flow indications may assist in determining ruptured duct.
   - AREA OVHT should extinguish when the faulty duct is isolated.

NOTE: With only one pack operational:
(1) Maximum altitude is 25,000'
(2) COOL AIR OVBD unlatch CLOSE

AREA OVHT AND FLOWBAR REMAIN ILLUMINATED:
Indicates PACK FLOW CONTROL VALVE did not close.

3. **AREA A OR C OVERHEAT:**
   ENG ISLN VALVE SW.....UNL OFF
   CROSSBLEED SW .....UNL OFF

4. **AREA B OVERHEAT:**
   FUSELAGE ISLN VALVE SW ....UNL OFF
   BOTH CROSSBLEED SWS.....UNL OFF
   Isolates faulty PACK FLOW CONTROL VALVE from pressurized manifold.

END OF PROCEDURE

AREA OVERHEAT A, B, AND C (THREE LIGHTS) –

AREA OVHT , AREA OVHT , AREA OVHT

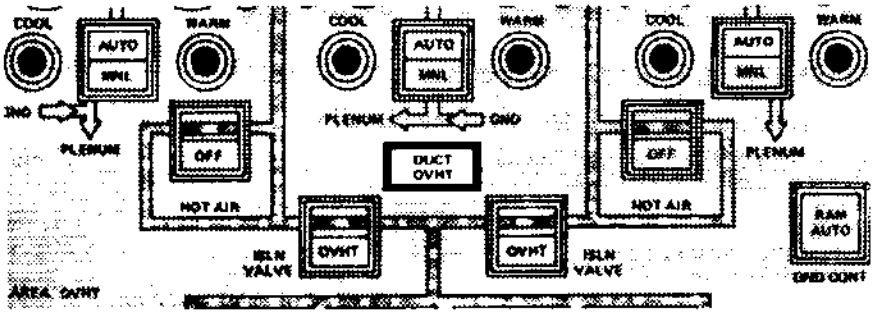
The Forward Cargo Compartment Heat Exchanger is monitored by one switch. If a leak develops in this area, Channel A, B, and C AREA OVHT lights illuminate simultaneously.

1. CARGO HEAT FWD SW----------UNL	Stops circulation across heat exchanger.
2. PACKS (ONE AT A TIME)----------CK	- Unlatch any PACK FLOW CONTROL switch. . Wait 5 minutes for AREA OVHT'S to extinguish. - Restore operation and repeat for remaining packs until source is isolated.
3. *WHEN* AREA OVHT's *EXTINGUISH:*	- Leave associated PACK FLOW CONTROL switch unlatched.
CARGO HEAT FWD SW----------LCH	- Restores heat exchanger fan operation.

NOTE:
With only one pack operational:
(1) Maximum altitude is 25,000'.
(2) COOL AIR OVBD unlatch CLOSE.

END OF PROCEDURE

HOT AIR DUCT OVERHEAT – DUCT OVHT



A hot air manifold overheat will automatically lock both HOT AIR valves and both hot air ISLN VALVEs closed, and the four flowbars extinguish.

1. ECS TEMP SEL----------HOT MANF — Indicates temperature in manifold upstream of hot air ISLN VALVE.

2. PACK SELECT SW----------2,3 — The pack indicating temperature above 145°C caused DUCT OVHT.

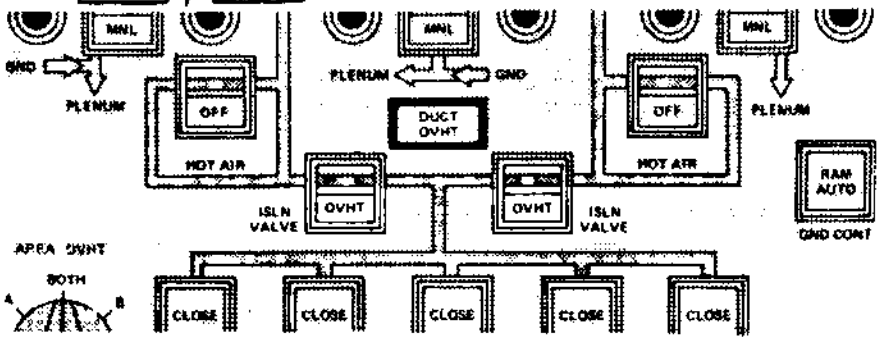
3. BOTH HOT AIR SWS----------UNL OFF

4. BOTH ISLN VALVE SWS----------UNL

5. *AFTER DUCT OVHT EXTINGUISHED:*
   UNAFFECTED HOT AIR SW----------LCH
   BOTH ISLN VALVE SWS----------LCH

END OF PROCEDURE

ISOLATION VALVE OVERHEAT'S – OVHT, OVHT



A single overheat sensor, located in the forward avionics compartment, will lock both hot air ISLN VALVEs closed (flowbars extinguished) if the hot manifold ruptures in this compartment. Both HOT AIR valve flowbars will remain illuminated.

1. BOTH HOT AIR SWS----------UNL OFF

2. BOTH ISLN VALVE SWS----------UNL

A. *IF OVHT's EXTINGUISH:*

CAUTION:
DO NOT LATCH HOT AIR AND ISLN VALVE SWS.

Opening the valves would reintroduce hot air into forward avionics compartment endangering electronic components.

3. ALL ZONE TRIM SWS EXCEPT MID CABIN----------UNL CLOSE

4. MID CABIN TEMP CONTROL----------AS REQD

- The MID CABIN TEMP CONTROL knob now controls ACM discharge temperature of all operating packs.
- All zones receive the same temperature air.

OR

STOP **STOP** **STOP**

B. *IF OVHT's REMAIN:*

Suspect nuisance trip.

3. *OPEN ACCESS DOOR TO FORWARD AVIONICS COMPARTMENT, AND IF HIGH TEMPERATURE IS NOT VERIFIED:*

- Compartment temperature in excess of 130°F/55°C will illuminate OVHT's.

HOT AIR MANF
ISLN NO.3 C/B 3W8----------PULL

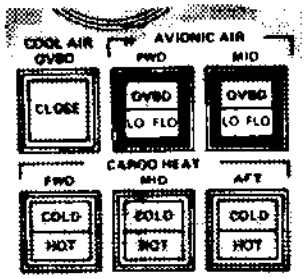
- Removes power from overheat sensor.
- Removes overheat protection to forward avionics compartment.
- Deactivates No. 3 pack HOT AIR ISLN VALVE.

NO. 2 PACK HOT AIR SW---------LCH FB
NO. 2 PACK ISLN VALVE SW------LCH FB

Hot air now available to trim system through No. 2 hot air manifold.

END OF PROCEDURE

AVIONIC AIR LOW FLOW, FWD OR MID – LO FLO



LO FLO indicates insufficient cooling for the forward or mid avionics compartment.

1. AVIONICS AIR MON C/B 2L5----------PULL THEN RESET — Cycling this circuit breaker may restore system to normal. If so, terminate procedure at this point.

2. AFFECTED PASS SVCE BUS C/B------PULL
   - 3Z9 for MID LO FLO.
   - 3Z10 for FWD LO FLO.
   - Ensures fan deactivation and opens OVBD valve.

A. *IF OVBD ILLUMINATES, AND LO FLO EXTINGUISHES:*

3. AFFECTED AVIONICS FAN C/B------Pull
   -C/B's in lower galley:
   .4D14 for MID avionics compartment fan.
   .5E14 for FWD avionics compartment fan.

4. AFFECTED PASS SVCE BUS C/B-----RESET — Restores Passenger Service Bus while leaving fan deactivated.

OR

5. SEE COMMON ITEMS ON NEXT PAGE.

STOP STOP STOP

B. *IF LO FLO REMAINS ILLUMINATED, AND OVBD REMAINS EXTINGUISHED:*

3. AFFECTED PASS SVCE BUS C/B-----RESET

4. ALL PACK FLOW CONTROL SWS---LCH FB'S — Ensures maximum airflow through FWD and MID avionics compartments.

5. AFT OUTFLOW VALVE----------LCH MNL
   TOGGLE SW--------------------CLOSE — FWD outflow valve must also be manually controlled if it opens beyond green band at aircraft altitudes above 15,000'.

6. SEE COMMON ITEMS ON NEXT PAGE

STOP STOP STOP

COMMON ITEMS . . . . . COMMON ITEMS . . . . . COMMON ITEMS

1. *IF MID* [OVBD]:
   BAT CHG C/B 3A15----------PULL
   - Pulling 3A15 ensures battery charger deactivated.
   - [BATTERY CONDITION] will illuminate on modified aircraft.

   [LO FLO] will illuminate as aircraft depressurizes at lower altitudes.

2. *PRIOR TO APPROACH:*
   UNNECESSARY ELECTRICAL EQUIPMENT----------OFF

   DEPENDING ON TYPE APPROACH REQUIRED, CONSIDER:

   For FWD avionics compartment, consider:
   - No. 2 HF COMM
   - Weather Radars
   - Autothrottles 1A1, 2, 20
   - Pitch and Roll Computers 1A6, 24
   - One ILS Receiver 1G4, or 22
   - One VOR Receiver 1G1, 2, or 19, 20
   - Two VHF Comm's 1A11, 1C23 or 2L4
   - One TR 3E17 or 18

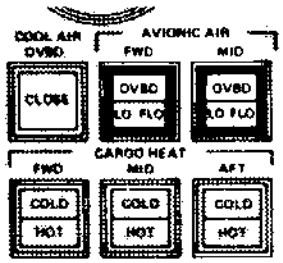
   For MID avionics compartment, consider:
   - Radio Altimeters 1D4 or 22

3. BEFORE LANDING
   OUTFLOW VALVES----------OPEN

   Outflow valves will not open upon landing if Pressurization MODE SEL is in STBY or Outflow Valve Switches are in MNL.

END OF PROCEDURE

AVIONIC AIR OVERBOARD, FWD OR MID – [OVBD]



[OVBD] in-flight indicates:
- Failure of FWD or MID avionics compartment fan.
- Opening of FWD or MID cooling air overboard valve.

1. AFFECTED AVIONICS
   FAN C/B----------PULL THEN RESET

   -C/B's in lower galley:
   .4D14 for MID avionics compartment fan.
   .5E14 for FWD avionics compartment fan.
   -May restore fan operation to respective compartment.

2. IF [OVBD] *REMAINS:*
   SEE COMMON ITEMS AT TOP OF THIS PAGE.

END OF PROCEDURE

CARGO HEAT – FWD, MID, OR AFT HOT – HOT

A. *ON GROUND:*

1. CARGO HEAT SW----------UNL — HOT is a normal indication at temperatures above 95°F.

2. *LEAVE UNLATCHED UNTIL AIRBORNE, THEN:*
   CARGO HEAT SW----------LCH

OR

STOP **STOP** **STOP**

B. *IN FLIGHT:*

1. CARGO HEAT SW----------UNL — Ensures fan deactivation.

2. *WHEN* COLD*:*
   CARGO HEAT SW----------LCH — COLD illuminates at 45°F.

3. *AFTER COLD EXTINGUISHES, IF* HOT *ILLUMINATES AGAIN:*
   CARGO HEAT SW----------UNL — Cycle as necessary throughout flight.

END OF PROCEDURE

CARGO HEAT – FWD, MID, OR AFT COLD – COLD

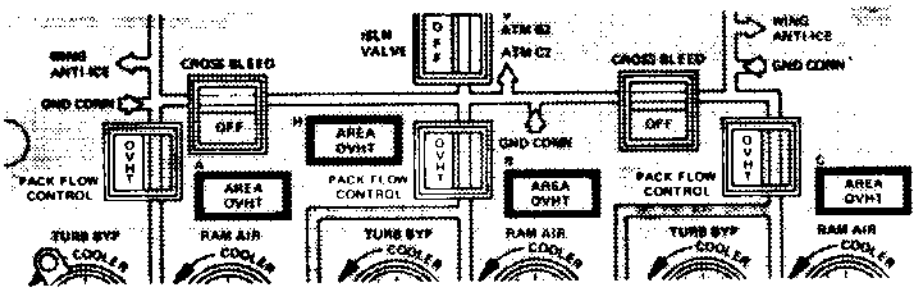
On the ground no action is required if COLD occurs on a cold-soaked aircraft.

IN-FLIGHT:

1. AFFECTED COMPT
   FAN C/B----------PULL THEN RESET
   - May restore fan operation.
   - C/B's in lower galley:
     . FWD CARGO FAN 4B8
     . MID CARGO FAN 4B11
     . AFT CARGO FAN 4B5
   - Consider possible effect on live animals if COLD remains in aft cargo compartment.

END OF PROCEDURE

PACK FLOW CONTROL OVERHEAT – OVHT



1. PACK FLOW CONTROL SW----------UNL

   Pack flow control valve should lock closed automatically. Switch must be unlatched before valve can be reopened.

2. PACK SELECT SW--------AFFECTED PACK

3. ECS TEMPERATURE SELECTOR-------ACM DISCH/COMP DISCH

   OVHT occurs when:
   - ACM DISCH exceeds 96°C.
   - COMP DISCH exceeds 220°C.

4. *WHEN OVHT EXTINGUISHES:*
   IF IN MNL,
   SELECT----------AUTO

   Should re-position TURB BYP and RAM AIR towards cool.

   IF IN AUTO,
   SELECT----------MNL

   - To reduce ACM DISCH, operate COOL button.
   - To reduce COMP DISCH, operate WARM button.

5. PACK FLOW CONTROL SW----------LCH

6. ACM DISCH/COMPR DISCH-------MONITOR

7. *IF UNABLE TO CONTROL ACM DISCH OR COMP DISCH TEMPERATURE:*
   PACK FLOW CONTROL SW.....UNL

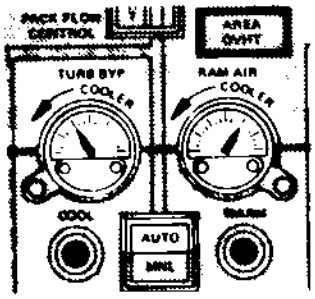
NOTE:
With only one pack operational:
(1) Maximum altitude is 25,000'.
(2) COOL AIR OVBD unlatch CLOSE.

END OF PROCEDURE

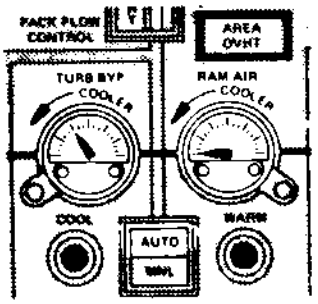
PACK OPERATION WITH FLOWBAR EXTINGUISHED

- Procedure applies after bulbs have been tested and replaced, but flowbar still remains extinguished.
- Pack operation verified by observing PACK FLOW and TEMP's.
- Loss of PACK FLOW CONTROL switch flowbar with pack operating could indicate automatic temperature control is inoperative.
- The TURB BYP and RAM AIR indicators should assume the following pre-positions.

IN FLIGHT



ON GROUND

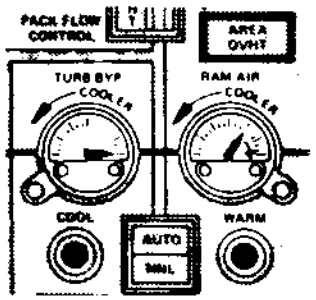


1. AUTO/MNL SW----------MNL

2. COOL/WARM BUTTONS----------AS REQD

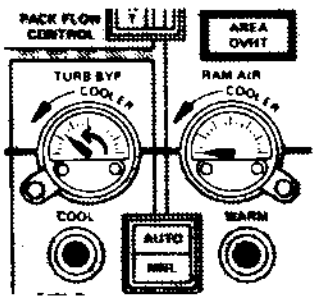
TO OPERATE TO WARM:

TURB BYP moves to full travel before RAM AIR moves.



TO OPERATE TO COOL:

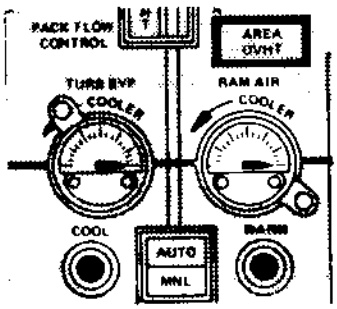
RAM AIR moves to full travel before TURB BYP moves.



END OF PROCEDURE

PACK RAM AIR LOUVER NOISE (CHUGGING)

Pack RAM AIR louver position must be changed. The pack does not have to be operating for vibration to occur.



1. *AFFECTED PACK:*
   AUTO/MNL SW----------MNL

2. *IF RAM AIR LOUVERS ARE CLOSED:*
   COOL BUTTON----------DEPRESS

   A brief actuation of the button is all that is required to reduce the noise level.

3. *WHEN OTHER PACKS' RAM AIR LOUVERS BEGIN TO OPEN:*
   AUTO/MNL SW----------AUTO

END OF PROCEDURE

LOSS OF ZONE TEMPERATURE CONTROL

Unusually hot or cold temperatures in one or more zones may be caused by failure of the zone trim valves to respond to CABIN TEMP CONTROL knobs.

1. ZONE/DUCT TEMP----------CK — **Select DUCT / ZONE temperatures for each zone to detect faulty trim air valve(s).**
2. AFFECTED TEMP CONT
   C/B'S 3V3, 4, 9-16--PULL THEN RESET

A. *ZONE HOT*

3. *IF HOT TEMPERATURE REMAINS:*
   AFFECTED ZONE
   TRIM SWS----------UNL CLOSE — Depending on valve position several seconds may be required before CLOSE.

4. *IF HOT TEMPERATURE STILL REMAINS:*
   BOTH ISLN VALVE SWS----------UNL
   - One or more zone trim valves have jammed open.
   - Ensure at least one zone trim switch remains latched. This provides for its CABIN TEMP CONTROL knob to automatically regulate all packs to the temperature selected.
   - MID CAB is the preferred zone, if operable.

OR

STOP **STOP** **STOP**

B. *ZONE COLD*

3. AFFECTED ZONE
   TRIM SWS----------UNL THEN LCH — May free sticking valve.

END OF PROCEDURE

SEE Pg 7 Ref. Man.

OUTFLOW VALVE FAULT – FAULT

Caused by:
(1) Activation of oxygen avoidance system. The outflow valves are cycling to maintain cabin between 11,000 - 11,500'.

(2) Outflow valve(s) open beyond the green band at aircraft altitude above 15,000'.

A. *IF CABIN ALTITUDE ABOVE 11,500':*

1. MODE SEL----------STBY

2. STBY RATE----------DSCD — Adjust as required to stabilize cabin altitude at normal differential pressure for aircraft altitude.

3. *WHEN CABIN BELOW 10,000':*
MANUAL SWS----------LCH THEN UNL — FAULT remains until both MANUAL switches are cycled.

OR

4. BEFORE LANDING
OUTFLOW VALVES----------OPEN — Outflow valves will not open upon landing if Pressurization MODE SEL in in STBY or Outflow Valve Switches are in MNL.

STOP **STOP** **STOP**

B. *IF EITHER OUTFLOW VALVE BEYOND GREEN BAND AND AIRCRAFT ALTITUDE ABOVE 15,000':*

1. BOTH MANUAL SWS----------LCH MNL — Both outflow valves are locked in position until MNL is selected.

2. BOTH OUT FLOW VALVE
TOGGLE SWS----------CLOSE — When both outflow valves are positioned in green band, FAULT extinguishes.

3. NORM RATE----------MIN
STBY RATE----------HOLD

4. *WHEN CABIN BELOW 10,000':*
MANUAL SWS
(ONE AT A TIME)----------UNL — Restores cabin pressurization control to NORM or STBY mode.

5. BEFORE LANDING
OUTFLOW VALVES----------OPEN — Outflow valves will not open upon landing if Pressurization MODE SEL is in STBY or Outflow Valve Switches are in MNL.

END OF PROCEDURE

SAFETY VALVE OPEN – OPEN

If operating in NORM or STBY when a safety relief valve opens, raise cabin altitude.

1. *IF IN NORM MODE:*
   MODE SEL----------STBY
   STBY RATE----------ASCD

OR

   IF IN STBY MODE:
   STBY RATE----------ASCD

2. *IF OUTFLOW VALVES DO NOT RESPOND WITHIN 10 SECONDS:*
   BOTH MANUAL SWS----------LCH MNL
   BOTH OUTFLOW VALVE
   TOGGLE SWS----------OPEN

END OF PROCEDURE

AFT CABIN VENTILATION

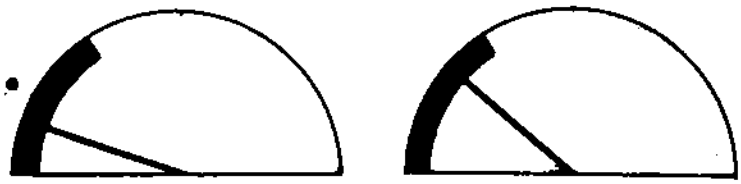
This procedure may be used to reduce tobacco smoke concentration in the aft cabin during flight provided:

- The cabin altitude is stabilized at the value set on the Cabin Pressure Controller, and
- All operating ECS packs are ON and have failed to disperse the smoke.

1. **ALL ECS PACKS.....ON**

2. **FWD OUTFLOW VALVE MANUAL SW.... .....LATCH** MNL
   - The ECS light on the Pilot's Annunciator Panel will illuminate when MNL mode is selected.

3. **FWD OUTFLOW VALVE....CLOSE TO 9:30**



OUTFLOW VALVE POSITION WITH THREE PACKS

NOTE: With one ECS pack inoperative, aft outflow valve will be open half as much as shown.

   - Slowly close the FWD OUTFLOW VALVE to the 9:30 o'clock position (just below the dwell dot) on the FWD valve position indicator.
   - Monitor the AFT valve position indicator to ensure the AFT OUTFLOW VALVE remains in the green band.
   - Do not close the FWD OUTFLOW VALVE beyond the 9:30 o'clock position to ensure proper avionic cooling.

4. **AFT OUTFLOW VALVE.....CHECK AUTO**
   - AFT OUTFLOW VALVE should remain in automatic mode and indicate in the green band.
   - If the AFT OUTFLOW VALVE opens beyond the green band, MNL will have to be selected to reposition it to the green band. Open the FWD VALVE slightly and then return the AFT VALVE to AUTO.

5. ***PRIOR TO DESCENT:***
   FWD OUTFLOW VALVE MANUAL SW.... .....UNLATCH

6. **FWD and AFT OUTFLOW VALVES..... .....CHECK AUTO**

-END-

INS COOLING FAN [LO FLO]

INS computers are extremely sensitive to excessive temperatures.

1. INS COOLING FAN SW--------- LCH [ON]	- Fan should operate automatically when [LO FLO] illuminates. - Latch INS COOLING FAN switch to assure fan has actuated. Verify [ON] illuminated.
IF [LO FLO] REMAINS:	
2. FWD AVIONIC AIR----------CK	Check LO FLO extinguished. If FWD AVIONIC AIR [LO FLO] illuminated, see Avionic Air Abnormal Procedures.
3. PACKS----------MAX NUMBER ON	
4. AFT OUTFLOW VALVE-------[MNL] CLOSE	- Manually begin closing AFT outflow valve to increase airflow through FESC. - Monitor FWD outflow valve to prevent opening beyond green band.
5. *IF [LO FLO] REMAINS:* NON-ESSENTIAL EQUIPMENT---------OFF	Turn off all unnecessary equipment to reduce temperature in FESC.
INS SYSTEMS----------MONITOR	- Monitor operation of INS units. - If INS [WARN] illuminates, check warning code. If -1 indicated turn INS Mode Selector OFF. Turning overheated unit OFF may extinguish the INS COOLING FAN LO FLO.

END OF PROCEDURE

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(MALFUNCTION) (FLAG INDICATIONS) (LIGHT INDICATIONS)

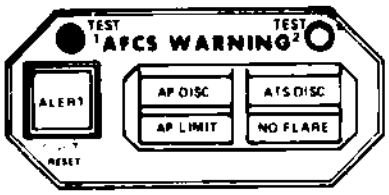
AFCS WARNINGS

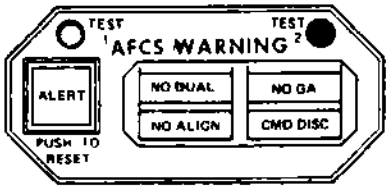
AFCS Warnings, General----------2
Autopilot Disconnect----------AP DISC----------2
Autopilot Limit----------AP LIMIT----------2
Autothrottle Disconnect---------ATS DISC----------3
Command Disconnect----------CMD DISC----------4
No Align----------NO ALIGN----------4
No Dual----------NO DUAL----------4
No Flare----------NO FLARE----------5
No Go-Around----------NO GA----------5

MISCELLANEOUS

Dual Autoland Not Available (DANA)----------DUAL A/L NOT AVAIL------5

AFCS WARNINGS





- ALERT flashes for all 8 warnings.
- Pressing ALERT once on either panel extinguishes ALERT on both panels.
- Pressing ALERT twice on either panel will clear all warnings (except NO DUAL) on both panels.
- The Autopilot Disconnect button on each control wheel will also reset AP DISC.
- The Autothrottle Disconnect buttons on the throttles will also reset the ATS DISC warning.

AUTOPILOT DISCONNECT – AP DISC

Indicates disengagement of autopilot(s), and is accompanied by a two second wailer.

1. ALERT----------PRESS — ALERT extinguished.
2. OPERATIVE AUTOPILOT---------ENGAGE — AP DISC warning will clear.

END OF PROCEDURE

AUTOPILOT LIMIT – AP LIMIT

- Autopilot has reached the limit of its authority to position the horizontal stabilizer.
- Autopilot pitch axis is in an out of trim condition.
- Warning may appear during periods of heavy autopilot demands, or in turbulence.

1. MECHANICAL TRIM---------ACCOMPLISH
2. *IF UNABLE TO RETRIM WITH AUTOPILOT ENGAGED:*
   AUTOPILOT----------OFF

To prevent abrupt pitch change, firmly hold column before disengaging autopilo

END OF PROCEDURE

AUTOTHROTTLE DISCONNECT – ATS DISC

ATS DISC appears when:
- ATS engage lever is placed in OFF.
- ATS is overriden by IAS switch.
- Autothrottle disconnect button on throttles is pressed.
- ATS computer fails. ATS FAIL illuminated on FCES panel.
- Comparison difference exists between ATS channels. ATS FAIL illuminated on FCES panel.

1. ALERT----------PRESS	ALERT extinguished. NOTE: ALERT will not illuminate if AUTO THROT SERVO C/B 1A1 is popped.
2. *IF ATS FAIL ILLUMINATED:* ATS SWS----------BOTH UNL OFF	Both ATS channels are inoperative and cannot be reset until both channels are unlatched OFF.
ATS SWS (ONE AT A TIME)----------LCH	- A discrepancy may exist between air data computers. Reset only one channel if difference exists between airspeed indications. If airspeed indicator difference is reduced at lower airspeeds, both channels may be latched. - For good channel to work, channel showing FAIL must be unlatched. . All functions of ATS will be operative. . Speed Command System (donut) visible only on ADI associated with operative channel (No. 1 - Capt. ADI, No. 2 - F/O ADI).
IF FAIL REMAINS: ATS SWS----------UNL OFF	Speed Command and autothrottles inoperative.

END OF PROCEDURE

COMMAND DISCONNECT – CMD DISC

- Autopilot engage lever trips to CWS.
- Indicates incompatible VHF NAV frequency (VOR for ILS mode, or ILS for VOR mode), or
- Indicates faulty input to autopilot computer.

1. AFFECTED AUTOPILOT----------OFF

2. OPERATIVE AUTOPILOT----------CMD CMD DISC warning will clear.

END OF PROCEDURE

NO ALIGN

Indicates automatic alignment and rollout guidance not provided under the following conditions:
- Flight Director approach
- Autopilot approach using LOC mode
- Autopilot approach using APR mode
- Autopilot approach using A/L mode when malfunction occurs.

1. ALERT----------PRESS ALERT extinguished.

2. *IF MAKING DUAL A/L APPROACH:*
   COURSE SELECTOR----------CK Course selections of over 6 degrees difference will cause NO ALIGN.

END OF PROCEDURE

NO DUAL

- NO DUAL can only appear while in the A/L mode below 1,500' AGL.
- Indicates that only one autopilot is engaged, or
- Indicates an autopilot failure occurred after both autopilots engaged in the A/L mode.

1. ALERT----------PRESS
   - ALERT extinguished.
   - The NO DUAL warning cannot be reset by pressing ALERT.

2. BOTH AUTOPILOTS----------CK If both autopilots remain in CMD, failure exists only in one autopilot channel.

END OF PROCEDURE

NO FLARE

- NO FLARE is a normal advance warning that flare and rollout guidance will not be provided under the following conditions:
  . Flight Director approach.
  . Autopilot approach using LOC mode.
  . Autopilot approach using APR mode.
- During an autopilot approach using A/L mode, an error in flare computation would result in total disconnect of the autopilot(s) instead of the NO FLARE warning.

1. ALERT----------PRESS — ALERT extinguished.

END OF PROCEDURE

NO GO-AROUND – NO GA

NO GA appears after glideslope capture if fault detected in go-around computations.

1. ALERT----------PRESS
   - ALERT extinguished.
   - Retain NO GA warning.

2. *IF MISSED APPROACH:*
   AUTOPILOT DISCONNECT BUTTON---PRESS
   FLIGHT DIRECTORS----------OFF — Flight Director pitch indications are unreliable.

3. MANUAL GO-AROUND---------ACCOMPLISH

END OF PROCEDURE

DUAL AUTOLAND NOT AVAILABLE (DANA) – DUAL A/L NOT AVAIL

Appears for various malfunctions with autopilot in CMD or CWS; unless instrument flags are evident, fault may be transient. If dual autoland capability is desired, take following action prior to initiating approach.

1. AUTOPILOTS AND
   FLIGHT DIRECTORS----------OFF → did not reset trip YAW SAS IAS-23

2. PITCH & ROLL C/B'S
   1A6, 24----------SIMULTANEOUSLY, PULL-PAUSE-RESET — Pause 5 seconds before reset.

3. FLIGHT DIRECTORS AND
   AUTOPILOTS----------ON/CMD — Reprogram APFDS.

4. PCAWP----------CK — If DUAL A/L NOT AVAIL:
   - NO DUAL will appear at A/L capture.
   - Dual autoland capability not available.

END OF PROCEDURE

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(MALFUNCTION)	(FLAG INDICATIONS)	(LIGHT INDICATIONS)	(PAGE)
AUTOMATIC SHUTDOWNS/NO START			
Abnormal Start/No Start			3
High Temp Oil	[FAULT]	Low Press Oil may be in view	5
Inlet Icing		INLET FLOW	6
Low Press Oil	[FAULT]		4
Over Speed N_2	[FAULT]	Low Press Oil may be in view	4
Over Temp TGT	[FAULT]		5
BLEED AIR S/O VALVE MALFUNCTION			7
LOW OIL QUANTITY (Ground Only)		LOW OIL QUANTITY	6
-500 DIFFERENCES			
None			
CROSS REFERENCE			
APU Fire			EMERGENCY PROCEDURES
BATTERY CONDITION			ELECTRICAL ABNORMALS
APU Gen Oil OVHT			ELECTRICAL ABNORMALS
APU Gen Oil PRESS			ELECTRICAL ABNORMALS

(OPPOSITE SIDE BLANK)

ABNORMAL START/NO START

- APU will not start, or an auto-shutdown occurs during start with no [FAULT] flag in view.
  - If N_G RPM is in green band when an auto-shutdown occurs, the LOW PRESS OIL [FAULT] flag will appear as RPM decreases to zero.

1. **ENG 2 TANK VALVE SW .....LCH**
   If ENG 2 TANK VALVE is closed, DC BUS 2 must be powered to open the valve.

2. **APU C/B'S.....PULL THEN RESET**
   - 3B10 BAT PWR.
   - 3S7 FIREWALL SHUTOFF PRIM.
   - 3S8 FIREWALL SHUTOFF SEC.
   - 3S9 INLET DOOR.
   - 3S11 IGNITION.
   - 3S12 CONT PWR.
   - 3S13 POWER CONTROL.
   - 3S15 EJECTOR & VENT VALVE.

3. ***IF* LOW PRESS OIL [FAULT] *FLAG APPEARED AND AUTOMATIC SHUTDOWN IS COMPLETE:***

   MASTER POWER SW .....OFF THEN ON
   Power to the APU controller must be interrupted before [FAULT] flag can be reset.

   [FAULT] FLAG .....RESET

4. **APU RESTART.....ACCOMPLISH**
   Two restarts may be attempted.
   NOTE: APU starter limits: 3 attempts with 30 seconds between attempts, then wait 1 hour.

CAUTION:
IF N_G RPM HANGS IN GREEN BAND FOR MORE THAN 5 SECONDS WITH DON'T LOAD ***, PRESS STOP BUTTON.***
Heat damage may occur in APU.

5. ***IF RESTART ATTEMPTS UNSUCCESSFUL, WAIT UNTIL* DOORS IN TRANSIT *LIGHT EXTINGUISHED, THEN:***

   MASTER POWER SW.....OFF
   NOTE: If the APU fails to accelerate into the green band before an auto-shutdown occurs (no* [FAULT] *flags visible), it will be necessary to press the STOP button before turning the MASTER POWER switch OFF. This action complete the close sequence for the engine inlet and ejector doors.

END OF PROCEDURE

AUTOMATIC SHUTDOWN OVERSPEED N_2 — [FAULT]

- If N_2 overspeed causes an auto-shutdown, OVER SPEED N_2 [FAULT] will be the first flag to appear.
- If N_G RPM was in green band, the LOW PRESS OIL [FAULT] flag will also appear as RPM decreases to zero. Disregard the LOW PRESS OIL [FAULT] flag in this instance.

1. ***AFTER AUTO-SHUTDOWN COMPLETE:***
   MASTER POWER SW .....OFF THEN ON
   Power to the APU controller must be interrupted before OVERSPEED N_2 and LOW PRESS OIL [FAULT] flags can be reset.

2. **[FAULT] FLAG(S) .....RESET**

3. **APU RESTART.....ACCOMPLISH**
   One restart may be attempted.

CAUTION:
IF N_G RPM HANGS IN GREEN BAND FOR MORE THAN 5 SECONDS WITH DON'T LOAD, ***PRESS STOP BUTTON.***
Heat damage may occur to APU.

4. ***IF RESTART ATTEMPT UNSUCCESSFUL, WAIT UNTIL*** **DOORS IN TRANSIT** ***LIGHT EXTINGUISHED, THEN:***

   MASTER POWER SW.....OFF

END OF PROCEDURE

AUTOMATIC SHUTDOWN LOW PRESS OIL — [FAULT]

- When N_G is in the green band, low oil pressure will cause LOW PRESS OIL [FAULT] flag and initiate auto-shutdown. This should be the only [FAULT] flag to appear for this condition.
- If other [FAULT] flags appear, refer to their respective procedures. Low oil pressure was not the cause of the shutdown.
- If no [FAULT] flags appear **until N_G RPM decreases to zero**, refer to Abnormal Start/No Start procedure on page 3. Low oil pressure was not the cause of the shutdown.

1. ***AFTER AUTO-SHUTDOWN COMPLETE:***
   MASTER POWER SW .....OFF THEN ON
   Power to the APU controller must be interrupted before [FAULT] flag can be reset.

2. **[FAULT] FLAG .....RESET**

3. ***AFTER 30 SECONDS, AND IF*** **LOW OIL QUANTITY** ***LIGHT EXTINGUISHED:***

   APU RESTART.....ACCOMPLISH
   One restart may be attempted.

CAUTION:
IF N_G RPM HANGS IN GREEN BAND FOR MORE THAN 5 SECONDS WITH DON'T LOAD, ***PRESS STOP BUTTON.***
Heat damage may occur in APU.

4. ***IF RESTART ATTEMPT UNSUCCESSFUL, WAIT UNTIL*** **DOORS IN TRANSIT** ***LIGHT EXTINGUISHED, THEN:***

   MASTER POWER SW.....OFF

END OF PROCEDURE

AUTOMATIC SHUTDOWN HIGH TEMP OIL — [FAULT]

- Auto-shutdown occurs if oil temperature exceeds maximum.
- IF N_G RPM was in green band, the LOW PRESS OIL [FAULT] flag will also appear as RPM decreases to zero.
- When HIGH TEMP OIL [FAULT] flag appears, it is the cause of auto-shutdown and other [FAULT] flags should be disregarded.

CAUTION: DO NOT RESTART APU.

1. ***AFTER* DOORS IN TRANSIT *EXTINGUISHED:***
   MASTER POWER SW.....OFF

END OF PROCEDURE

AUTOMATIC SHUTDOWN OVER TEMP TGT — [FAULT]

- Auto-shutdown occurs if TGT reaches 760° before N_G RPM reaches green band, or if TGT reaches 1066° with N_G in green band.
- If N_G RPM was in green band, the LOW PRESS OIL [FAULT] flag will also appear as RPM decreases to zero.
- When OVER TEMP TGT [FAULT] flag appears, it is the cause of auto-shutdown and other [FAULT] flags should be disregarded.

1. ***AFTER AUTO-SHUTDOWN COMPLETE:***
   MASTER POWER SW.....OFF THEN ON
   Power to the APU controller must be interrupted before LOW PRESS OIL [FAULT] flag can be reset.

2. **[FAULT] FLAG(S).....RESET**

3. **APU RESTART.....ACCOMPLISH**
   One restart may be attempted.

CAUTION:
IF N_G RPM HANGS IN GREEN BAND FOR MORE THAN 5 SECONDS WITH DON'T LOAD ***, PRESS STOP BUTTON.***
Heat damage may occur in APU.

4. ***IF RESTART ATTEMPT UNSUCCESSFUL, WAIT UNTIL* DOORS IN TRANSIT *LIGHT EXTINGUISHED, THEN:***

   MASTER POWER SW.....OFF

END OF PROCEDURE

AUTOMATIC SHUTDOWN
INLET ICING — INLET FLOW

- An auto-shutdown accompanied by an INLET FLOW light indicates icing of the load compressor and its inlet duct.
- Occurs when temperature is between −5° and +5°C with visible moisture present. Inlet flow auto-shutdown is inhibited in-flight.

1. ***AFTER AUTO-SHUTDOWN COMPLETE:***
   MASTER POWER SW.....OFF
   - **INLET FLOW** extinguished.
   - Resets warning system.

2. ***WAIT AT LEAST 3 MINUTES, AND WHEN READY FOR ENGINE START:***

   APU RESTART.....ACCOMPLISH
   Allows time for ice blockage to melt.

   BLEED AIR S/O SW .....LCH OPEN
   - During engine start, inlet flow shutdown feature is deactivated while APU is in MAX MODE.
   - Minimize APU operation until out of icing conditions.

END OF PROCEDURE

LOW OIL QUANTITY — (GROUND ONLY)

- When LOW OIL QUANTITY first illuminates, quantity remaining should last 20 hours at the maximum normal consumption rate.
- **LOW OIL QUANTITY** is inhibited in-flight.

1. **APU OPERATION.....MINIMIZE**
   Record elapsed time that APU is operated with LOW OIL QUANTITY illuminated in logbook.
   NOTE: IF LOW OIL QUANTITY illuminated before APU start & extinguished with APU operating, record indications in logbook.

END OF PROCEDURE

BLEED AIR S/O VALVE MALFUNCTION

V
V

V <<<<<<<<<<<<<<<<<IF >>>>>>>>>>>>>>>>> V
V V

BLEED AIR S/O OPEN EXTINGUISHED WITH SWITCH LATCHED:

V
V

1. **APU BLEED AIR VALVE C/B 3S18.....PULL THEN RESET**
   The BLEED AIR S/O valve must be electrically energized in order to OPEN with pneumatic pressure.

STOP

BLEED AIR S/O OPEN REMAINS WITH SWITCH UNLATCHED

V
V

1. **MODE SELECTOR .....MIN MODE**

2. **NO. 2 ENG ISLN VALVE SW...UNL OFF**

3. **FUSELAGE ISLN VALVE SW ...UNL OFF**

CAUTION:
WHETHER OR NOT APU IS OPERATING, DO NOT CONNECT ANY OTHER SOURCE OF AIR TO THE ISOLATED MANIFOLD UNTIL BLEED AIR S/O VALVE IS VERIFIED CLOSED.
Possibility exists that pneumatic air will be dumped overboard through APU.

4. ***IF OPEN REMAINS:***
   APU BLEED AIR VALVE C/B 3S18 ...PULL
   - BLEED AIR S/O valve de-energizes to close.
   - **OPEN** extinguishes since it is powered through C/B 3S18.

   NO. 2 DUCT PRESSURE INDICATOR...CK
   With APU operating, a pressure drop to zero verifies BLEED AIR S/O valve is closed.

5. ***IF CONTINUED APU OPERATION REQUIRED:***
   APU RPM AND TGT .....MONITOR
   - If surging occurs, the APU is unable to compensate for the excess pneumatic capacity.
   - Load compressor failure could result.
   - Reconfigure pneumatic panel to operate pack(s) and/or ATM's from APU until demand exceeds capacity and surging ceases.

   NOTE: APU BLEED AIR S/O valve must be closed for takeoff.

CAUTION:
DO NOT MIX APU AIR WITH ANY OTHER PNEUMATIC SOURCE.

END OF PROCEDURE

END

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VHF COMM INOPERATIVE

1. **CORRECT FREQUENCY ..... VERIFY**

2. **AUDIO SELECTOR PANEL..... CK**
   - Check MIC selection.
   - Check receiver selector and set volume level.

3. **COMM TEST BUTTON..... PRESS**
   - Static should be heard. If not:
     - Check speaker volume control.
     - Check circuit breakers:
       1A11 - VHF NO. 1
       2L4 - VHF NO. 2
       1C23 - VHF NO. 3
     - Select alternate AMP on Audio Selector Panel.
     - Check operation using headset.
     - Check operation using different receiver/transmitter.
     - Check operation using different audio Selector Panel.
   - If static is heard, check operation with different microphone.

END OF PROCEDURE

HF COMM INOPERATIVE

1. **CORRECT FREQ./SIDEBAND..... VERIFY**
   Check correct frequency and sideband selected (See Avigation Section of the International Jeppesen Manual for frequencies).

2. **AUDIO SELECTOR PANEL..... CK**
   - Check MIC selection.
   - Check receiver selector and set volume level.

3. **ANTENNA TUNING ..... CK**
   - Key mic and listen for tone indicating antenna tuning. If no tone:
     - Check speaker volume control.
     - Check circuit breakers:
       1C1,3 - HF NO. 1
       1C19,21- HF NO. 2
     - Select alternate AMP on Audio Selector Panel.
     - Check operation using headset.
     - Check operation using different receiver/transmitter.
     - Check operation using different audio Selector Panel.
   - If tone is heard, check operation with different microphone.

END OF PROCEDURE

WEATHER RADAR INOPERATIVE

1. **FLIGHT CONTROL & MTC..... ADVISE**
   Advise both departments regardless of whether in-flight or on the ground.

2. **OPERATIONS ..... ADVISE**
   A revised Dispatch Released must be obtained before departure.
   - If only the antenna stabilization system is inoperative, the radar is considered operational for dispatch purposes.

END OF PROCEDURE

MULTIPLEX SYSTEM FAILURE

If there are MPX problems, consideration may be given to resetting the Multiplex Logic. This is accomplished by performing the following steps. Before performing this procedure, consider making a P.A. to advise passengers that control of reading lights, entertainment system, Flight Attendant call bell/lights, and air outlets will temporarily be lost while the system is being reset.

1. **MPX C/B'S 2D10, 11 ..... PULL**
   Removes all power from multiplex system.

2. ***AFTER 15 MINUTES:***
   MPX C/B'S 2D10, 11 ..... RESET
   Provides cooldown period if failure caused by overheat.

IF MULTIPLEX SYSTEM REMAINS INOPERTIVE:

3. **MPX C/B'S 2D10, 11 ..... PULL**

4. **MULTIPLEX TEST SELECTOR... NORMAL**
   - Multiplex Test Panel at door 1R.
   - Check selector in NORMAL.

5. **POWER/PASS SERV MDL C/B'S 4F1,THRU 7 ..... PULL & RESET**
   Galley circuit breaker panel next to sink.

6. **POWER SUPPLY**
   PASS SERVICE C/B 5E4... PULL & RESET
   Galley circuit breaker panel above door to Mid Avionics Compt.

7. **MULTIPLEX POWER SUPPLY..... CHECK**
   - Enter Mid Avionics Compt.
   - Locate Multiplex Power Supply on extreme left hand equipment rack (Capt's side).
     - The power supply can be identified by the 15 circuit breakers on the front of the box. Check these breakers are in.
     - Check NORMAL/TRIP switch in NORMAL.

8. **MPX C/B'S 2D10,11 ..... RESET**
   If multiplex system remains inoperative, make logbook entry.

END OF PROCEDURE

PA SYSTEM INOPERATIVE

1. **FLT ATTENDANTS..... NOTIFY**
   - Contact IFSC by interphone and brief on communication methods to be used for both normal and emergency conditions. Include at least the following:
     - Use of standard cockpit/cabin call signals.
     - Advise IFSC to review location and operation of portable megaphones with F/A's.
     - Use of evacuation signal.
   - Advise IFSC 20 minutes and 5 minutes before landing.

   NOTE: With the PA inoperative, The F/A's must individually (few seats at a time) brief passengers before takeoff and landing. Coordinate as required to provide sufficient time to meet these requirements.

END OF PROCEDURE

CABIN INTERPHONE SYSTEM INOPERATIVE

1. **FLT ATTENDANTS..... NOTIFY**
   Contact IFSC and establish plan for cockpit/cabin coordination.
   - Use standard call signals.
   - Avoid use of PA to direct messages to F/A's if practicable.
   - Lower galley must be clear for all taxi operations.

END OF PROCEDURE

COCKPIT/CABIN CALL INOPERATIVE

1. **INTERPHONE ..... MONITOR**
   When lower galley is occupied, the S/O must monitor the **cabin interphone** at all times. If PA or cabin interphone fails remove all personnel from galley.

END OF PROCEDURE

END

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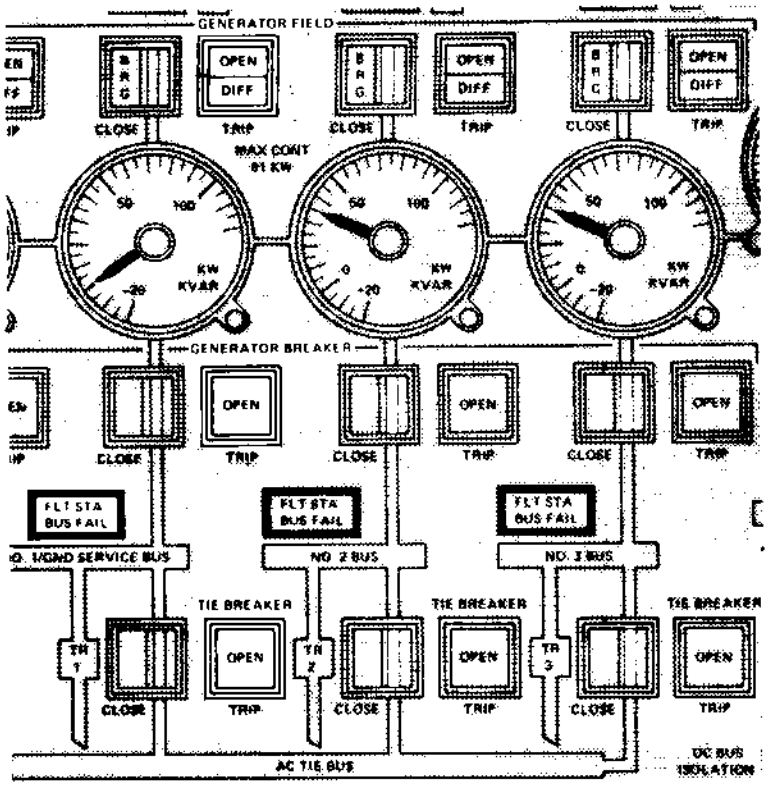
FLIGHT STATION BUS FAILURE, DIFFERENTIAL FAULT

FLT STA BUS FAIL, **OPEN** AND **DIFF**



- This fault is indicated by:
  - **FLT STA BUS FAIL**.
  - GENERATOR FIELD **OPEN** & **DIFF**.
  - GENERATOR BREAKER **OPEN**.
  - Affected AC TIE BREAKER **OPEN**, or affected AC TIE BREAKER **-FB-**, but remaining AC Tie Breakers **OPEN**.
- **DIFF**, with one or more AC TIE BREAKER **OPEN** lights, indicates a short circuit between the GENERATOR BREAKER and the AC TIE BUS.
  - Which AC TIE BREAKER(s) **OPEN** depends on the location of the fault.
- The GENERATOR BREAKER and affected AC TIE BREAKER(s) will lock **OPEN** and cannot be reset in-flight.

NOTE: If No. 3 AC Bus is faulty, control outflow valves manually.

1. **AC ESS PWR SEL.....CK**
   Select operating primary and secondary source for essential power.

2. ***GENERATOR NO. 1 AND NO. 2 (ONLY) MAY BE RESET AS A BACKUP SOURCE FOR ESSENTIAL POWER, IF DESIRED:***

   GENERATOR FIELD
   CLOSE SW.....PRESS -FB-
   - Do not reset No. 3 generator since it cannot provide essential power.
   - **DIFF** extinguishes even though fault remains on the load bus.

CAUTION: RESET ONE TIME ONLY.

VVVVV

~~THEN~~ >>>>

FLIGHT STATION BUS FAILURE, DIFFERENTIAL FAULT (CONT'D)

FLT STA BUS FAIL, OPEN AND DIFF

3. ***IF THE AC TIE BREAKER FB FOR THE FAULTED BUS REMAINS ILLUMINATED:***

   AFFECTED AC TIE BREAKER TRIP SW..... PRESS OPEN

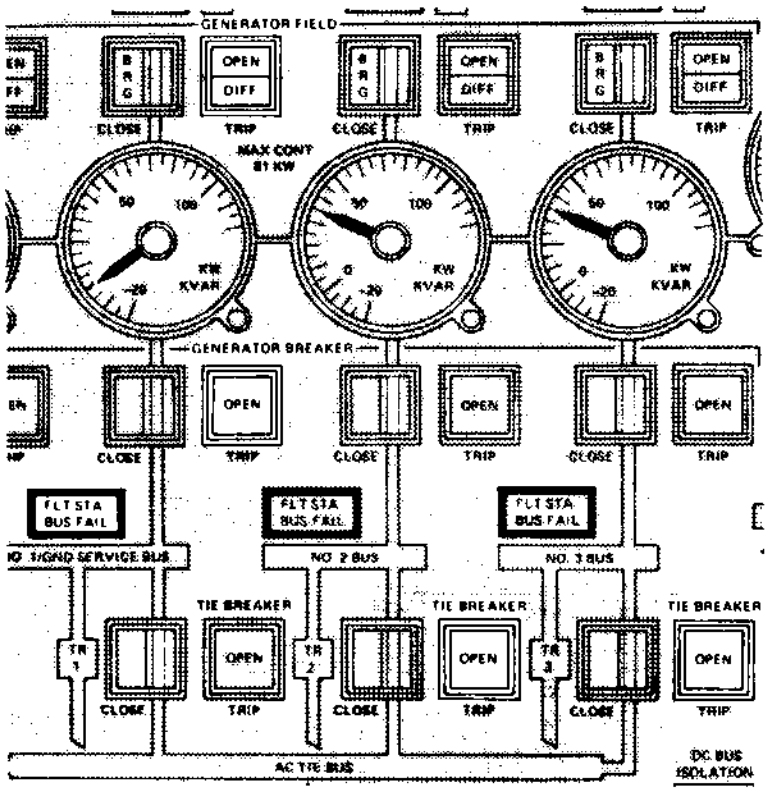
   - Isolates faulted bus from AC TIE BUS.
   - Operating generators will be isolated for the duration of flight due to locked OPEN TIE BREAKERS.

   CAUTION:
   IF FAULTED AC TIE BREAKER DOES NOT OPEN, DO NOT APPLY APU OR EXTERNAL POWER TO THE AC TIE BUS.

   Indicates the fault is within the TIE BREAKER or AC TIE BUS wiring.

4. **GENERATOR(S) INOPERATIVE PROCEDURE.....ACCOMPLISH**

   See page 12.

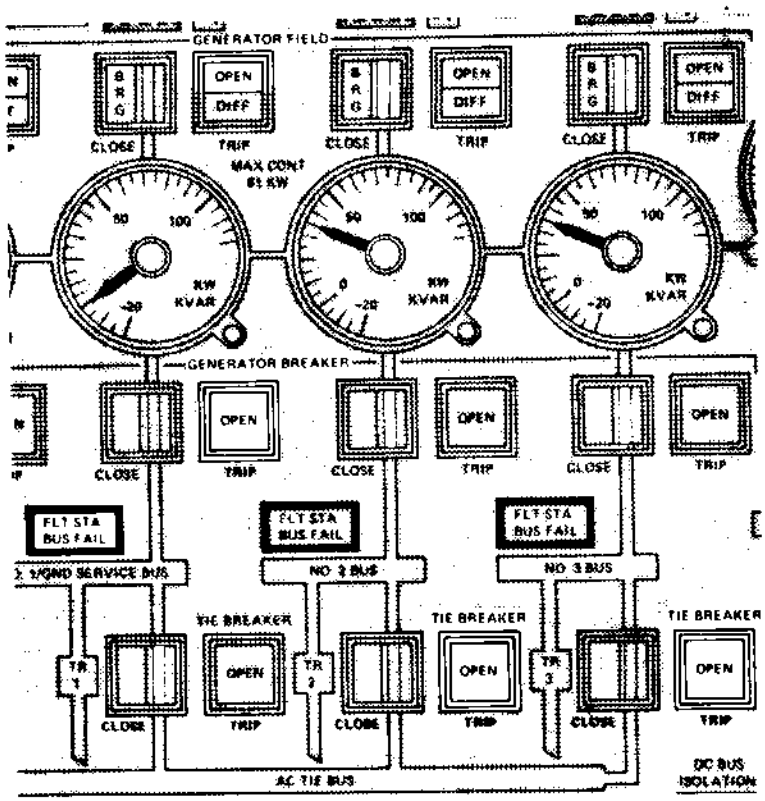


END OF PROCEDURE

FLIGHT STATION BUS FAILURE WITH ASSOCIATED OPEN LIGHTS

FLT STA BUS FAIL, OPEN

- This fault is indicated by:
  - FLT STA BUS FAIL.
  - GENERATOR FIELD OPEN.
  - GENERATOR BREAKER OPEN.
  - Affected AC TIE BREAKER FB.
  - Remaining AC TIE BREAKERS OPEN.
- A fault has occurred between the GENERATOR BREAKER and its AC TIE BREAKER, but outside the differential fault protection area.
- Galley power and AC hydraulic pumps (if in use) may be unpowered due to load shedding.



CAUTION:
DO NOT REPOWER THE FAULTED BUS.

NOTE: If No. 3 AC Bus is faulty, control outflow valves manually.

1. **AC ESS PWR SEL.....CK**
   Select operating primary and secondary source for essential power.

2. **FAULTED GENERATOR BREAKER TRIP SW .....PRESS**
   Locks GENERATOR BREAKER OPEN.

3. ***GENERATOR NO. 1 AND NO. 2 (ONLY) MAY BE RESET AS A BACKUP SOURCE FOR ESSENTIAL POWER, IF DESIRED:***

   GENERATOR FIELD CLOSE SW.....PRESS FB

CAUTION: RESET ONE TIME ONLY.

4. **FAULTED AC TIE BREAKER TRIP SW.....PRESS OPEN**

CAUTION:
IF FAULTED AC TIE BREAKER DOES NOT OPEN, DO NOT PARALLEL REMAINING GENERATORS OR APPLY APU OR EXTERNAL POWER.
Fault is within the TIE BREAKER, or AC TIE BUS wiring. Continue operation with remaining generators isolated.

5. ***IF FAULTED AC TIE BREAKER OPEN ILLUMINATES:***

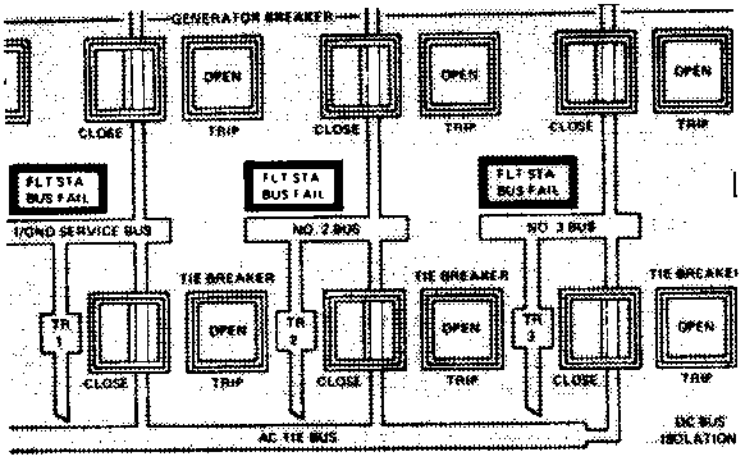
   GENERATOR PARALLEL PROCEDURE .....ACCOMPLISH
   (Do not random parallel)
   See page 13. Evaluate situation before attempting to parallel remaining generators.

6. **GENERATOR(S) INOPERATIVE PROCEDURE .....ACCOMPLISH**
   See page 12.

END OF PROCEDURE

FLIGHT STATION BUS FAILURE (ONE LIGHT) — FLT STA BUS FAIL

Illumination of a single FLT STA BUS FAIL indicates the main load bus is powered, but the flight station extension bus is unpowered. Probable cause is a tripped circuit breaker.



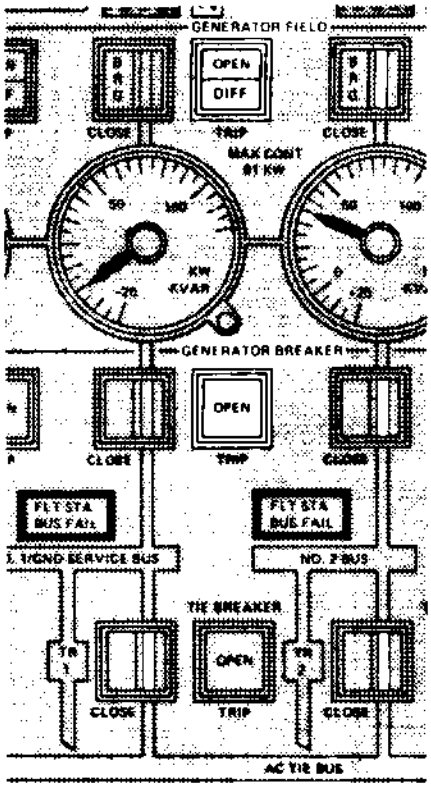
1. **AFFECTED FLIGHT STA PWR C/B.....PULL THEN RESET**
   Attempt **one** reset.
   - 3E9 BUS 1.
   - 3E10 BUS 2.
   - 3E11 BUS 3.

   NOTE: IF FLT STA BUS FAIL remains for BUS 3, AC essential power is still available through B3, since main load bus remains powered.

END OF PROCEDURE

GENERATOR FIELD OPEN, DIFFERENTIAL FAULT — OPEN, DIFF

- GENERATOR BREAKER OPEN is *illuminated*.
- **FLIGHT STA BUS FAIL** is *extinguished*.
- DIFF, with AC TIE BREAKER **OPEN** lights *extinguished*, indicates a short circuit between the generator and the GENERATOR BREAKER.



1. **AC ESS PWR SEL.....CK**
   Select operating primary and secondary source for essential power.

2. **GENERATOR BREAKER TRIP SW .....PRESS**
   Locks GENERATOR BREAKER OPEN.

   One Generator reset may be attempted.
   Because the differential fault sensing may react to transient differentials, one attempt to reset this differential fault may be made. However, if the problem was not transient, the reaction time to again trip the GFR is instantaneous, thereby minimizing any hazard which could result from re-connecting the generator to a fault.

3. **GENERATOR FIELD CLOSE SWITCH .....PRESS** -FB-
   - **DIFF** extinguishes to indicate GENERATOR FIELD closure.
   - If short exists, GENERATOR FIELD immediately trips OPEN without appearing to have closed, and **DIFF** remains extinguished.

CAUTION: RESET ONE TIME ONLY.

IF OPEN ***REMAINS:***

4. **IDG DISCONNECT PROCEDURE.....ACCOMPLISH**
   See page 11.

STOP

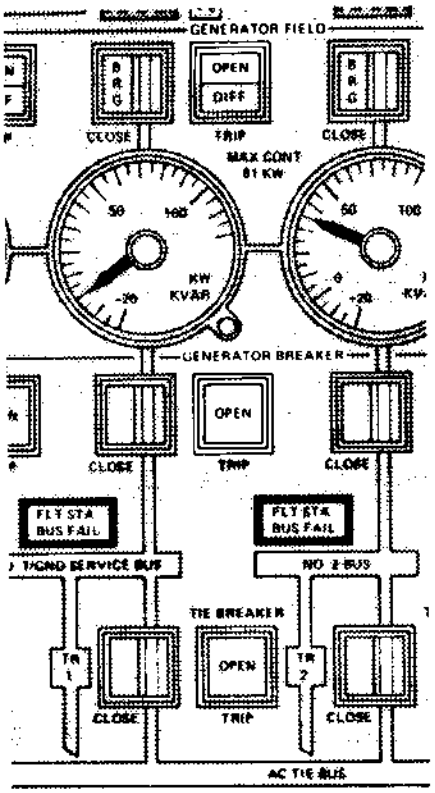
GENERATOR RESETS, & VOLTS & FREQ NORMAL: (VOLTS 117±3, FREQ 400±4)

4. **GENERATOR PARALLEL PROCEDURE.....ACCOMPLISH**
   (Do not random parallel)
   See page 13.

END OF PROCEDURE

GENERATOR FIELD OPEN — OPEN

GENERATOR BREAKER OPEN will also be illuminated.



1. **ENGINE OPERATION .....VERIFY**
   OPEN may be first indication alerting crew to engine failure.

2. **AC ESS PWR SEL.....CK**
   Select operating primary and secondary source for essential power.

3. **GENERATOR BREAKER TRIP SW .....PRESS OPEN**
   Locks GENERATOR BREAKER OPEN.

4. **GENERATOR FIELD CLOSE SW.....PRESS FB**
   Check volts and frequency.
   - Volts 117±3.
   - Frequency 400±4.

CAUTION: RESET ONE TIME ONLY.

IF

GENERATOR FIELD FAILS TO CLOSE:

5. **GENERATOR(S) INOP PROCEDURE. .ACCOMP**
   See page 12.

STOP

GENERATOR FIELD CLOSES FB BUT FREQ EXCEEDS 420:

5. **IDG DISCONNECT PROCEDURE...ACCOMP**
   See page 11.

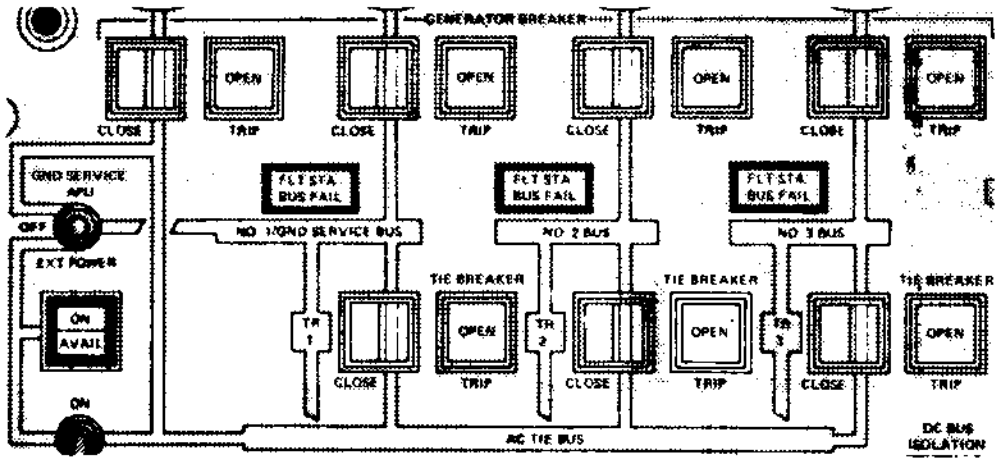
STOP

GENERATOR FIELD CLOSES FB & VOLTS & FREQ NORMAL:

5. **GENERATOR PARALLEL PROCEDURE...ACCOMP**
   (Do not random parallel)
   See page 13.

END OF PROCEDURE

AC TIE BREAKER OPEN (ONE) — OPEN



1. **ENGINE OPERATION ..... VERIFY**
   May be first indication alerting crew to engine failure.

2. **AC ESS PWR SEL ..... CK**
   Prior to tripping any GENERATOR BREAKER, check operating primary and secondary source available for essential power.

3. **GENERATOR BREAKER TRIP SW ..... PRESS OPEN**
   AC TIE BREAKER FEB should illuminate and **OPEN** extinguish because of dead bus sensing.

4. ***IF AC TIE BREAKER OPEN REMAINS:***
   AC TIE BREAKER CLOSE SW ..... PRESS FEB

CAUTION: RESET ONE TIME ONLY.

5. **AFFECTED GENERATOR VOLTS AND FREQ ... CK**
   - Volts 117±3.
   - Frequency 400±4.

IF FREQ EXCEEDS 420:

6. **IDG DISCONNECT PROCEDURE ..... ACCOMPLISH**
   See page 11.

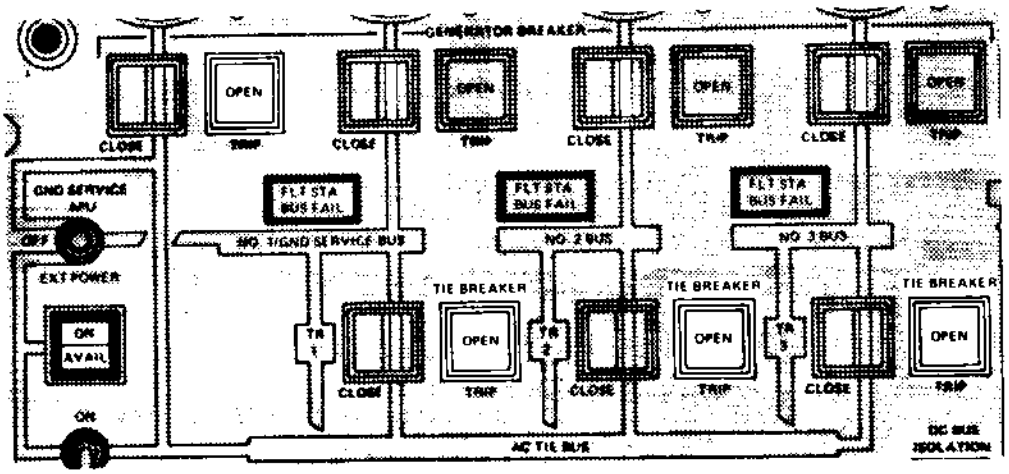
STOP

VOLTS AND FREQ NORMAL AND PARALLEL DESIRED:

6. **GENERATOR PARALLEL PROCEDURE ..... ACCOMPLISH**
   (Do not random parallel)
   See page 13.

END OF PROCEDURE

AC TIE BREAKERS OPEN (ALL THREE) — OPEN, OPEN, OPEN



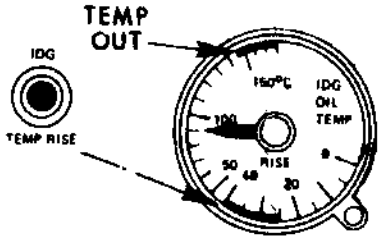
- A short has occurred on the AC TIE BUS.
- When APU is operating, its GENERATOR BREAKER OPEN illuminates.

1. **AC TIE BREAKERS .....DO NOT RESET**
   Remainder of flight must be completed with all generators isolated.

CAUTION:
DO NOT APPLY APU OR EXTERNAL POWER TO THE AC TIE BUS.

END OF PROCEDURE

IDG OIL TEMP OR TEMP RISE HIGH



- Continued IDG operation with temperature in caution range will cause extensive damage.
- Prolonged holding on the ground, in hot weather, may cause IDG oil temperatures to enter the caution range.
- When operating with generators paralleled and IDG OIL TEMP stabilized, make an entry in the logbook if any IDG OIL TEMP indicates more than 15° above the other two.

1. **GENERATOR BREAKER..... TRIP OPEN**
   - Unloading generator may arrest temperature rise.
   - Monitor IDG temperature closely, especially during engine acceleration, since rapid rise may indicate severe internal damage is occurring.

2. **AFFECTED GENERATOR VOLTS AND FREQ .....CK**
   - Volts 117±3.
   - Frequency 400±4.

IF

FREQ EXCEEDS 420:

3. **IDG DISCONNECT PROCEDURE.. ACCOMP.**
   See page 11.

STOP

VOLTS NORMAL, FREQ LESS THAN 420, AND AIRCRAFT ON THE GROUND

3. ***IF IDG OIL TEMP OR TEMP RISE SHOWS AN ABNORMAL INCREASE:***

   N_1 RPM. .INCREASE 10%
   Increased fan air flow should reduce IDG OIL TEMP by 30°C.

4. **IF IDG OIL TEMP OR TEMP RISE REACHES CAUTION BAND:**

   IDG DISCONNECT PROCEDURE...ACCOMP.
   See page 11.

STOP

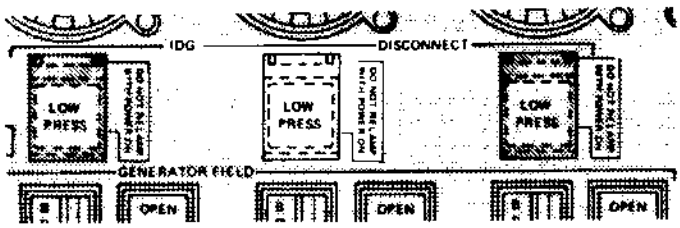
VOLTS NORMAL, FREQ LESS THAN 420, AND AIRCRAFT IN-FLIGHT:

3. **IF IDG OIL TEMP OR TEMP RISE REACHES CAUTION BAND:**

   IDG DISCONNECT PROCEDURE...ACCOMP.
   See page 11.

END OF PROCEDURE

IDG LOW PRESSURE — LOW PRESS



Verify normal engine operation. LOW PRESS may be a result of engine failure. With normal engine indications:

- Steady LOW PRESS requires IDG disconnect.
- Intermittent LOW PRESS does not require disconnect provided volts, frequency, and IDG OIL TEMP are normal.

1. ***IF IDG LOW PRESS ILLUMINATES STEADY:***

   IDG DISCONNECT PROCEDURE .....ACCOMPLISH

END OF PROCEDURE

IDG DISCONNECT

To insure proper IDG disconnect verify that N_3 is greater than 20%

1. **AC ESS PWR SEL.....CK**
   Select operating primary and secondary source for essential power.

2. **GENERATOR FIELD TRIP SW ...PRESS OPEN**

3. **GENERATOR BREAKER TRIP SW ...PRESS OPEN**

4. **PMG TEST SW .....PRESS & HOLD**
   - Check AC Meter Selector on desired generator.
   - To verify disconnect, press and hold PMG TEST switch and observe PMG voltage drops to PMG OFF when IDG DISCONNECT is pressed.

   WITH N_3 RPM ABOVE 20%:
   IDG DISCONNECT SW .....PRESS

IF

PMG VOLTS IN OFF RANGE:

5. **GENERATOR(S) INOPERATIVE PROCEDURE .....ACCOMPLISH**
   See page 12.

STOP

PMG VOLTS ARE INDICATED:

5. **ENGINE SHUTDOWN PROCEDURE (Conditions Permitting)....ACCOMPLISH**
   - IDG has failed to disconnect.
   - Continued engine operation may create a fire hazard, or cause severe engine damage.
   - In-flight, if continued engine operation is required, monitor engine instruments closely. Take appropriate action if abnormal indications are observed.

END OF PROCEDURE

GENERATOR(S) INOPERATIVE

Observe restrictions contained in MEL when operating with IDG assembly inoperative.

- Any **two** generators can supply all electrical loads.

1. **ALL AC TIE BREAKER SWS...CK FB 'S**
   AC TIE BREAKER(s) close automatically to power a dead load bus unless locked open manually or by a fault.

2. **AC ESS PWR SEL.....CK**
   - With the No. 1 IDG inoperative, select AUTO B3(G2).
   - With the No. 2 IDG inoperative, select AUTO B3(G1).
   - With the No. 3 FLT STA BUS FAIL, and associated OPEN lights, select AUTO G1(G2).

3. **KW MAXIMUM.....81**
   If necessary to reduce loads, unlatch:
   - GALLEY POWER switches.
   - AC PUMPS switches.
   - FLOOR HEAT (if installed).
   - One boost pump in each tank; either all left or all right.
   - Limit APU electrical load to 54 KW above 14,000'.

4. **APU (BELOW 25,000') .....START**
   APU start reliability is increased significantly below 10,000'.

5. ***IF TWO ENGINE DRIVEN GENERATORS ARE INOPERATIVE:***

   LAND AT NEAREST SUITABLE AIRPORT

END OF PROCEDURE

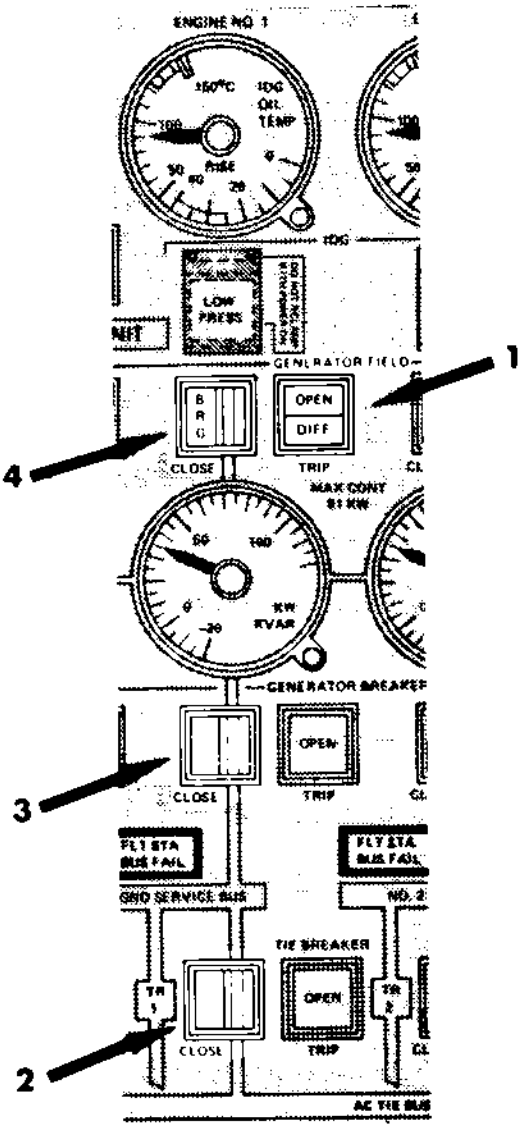
GENERATOR PARALLEL

1. GENERATOR FIELD
   TRIP SW ..... PRESS OPEN

2. *IF AC TIE BREAKER OPEN ILLUMINATED:*
   AC TIE BREAKER CLOSE SW ... PRESS FB

3. GENERATOR BREAKER
   CLOSE SW ..... PRESS

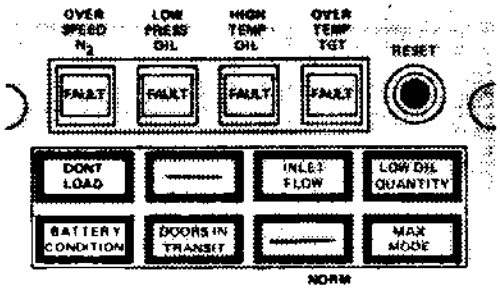
4. GENERATOR FIELD
   CLOSE SW ..... PRESS FB



END OF PROCEDURE

(OPPOSITE SIDE BLANK)

BATTERY CONDITION LIGHT - BATTERY CONDITION



Indicates the battery charger is disabled. May be caused by:

- An overheated battery.
- Transfer of the AC or DC STBY BUS to the battery.
- Mid Avionics fan inoperative (MID OVBD light).
- Battery charger C/B popped.

1. **DC VOLTS & AMPS .....CK BAT**
   - Normal volts 28-34.
   - Normal Amps 0 with -40 amp pulse charge.

<<<<<<<<<<<<<<<<<IF>>>>>>>>>>>>>>>>>

POSITIVE DC AMPS ARE INDICATED: (BATTERY SUPPLYING A STANDBY BUS)

2. **OPERATION WITH BATTERY SUPPLYING AC OR DC STANDBY BUS POWER PROCEDURE .....ACCOMPLISH**
   See page 20.

STOP

ZERO DC AMPS ARE INDICATED: (INDICATES CHARGER IS DISABLED)

2. **BAT CHG C/B 3A15...PULL THEN RESET**

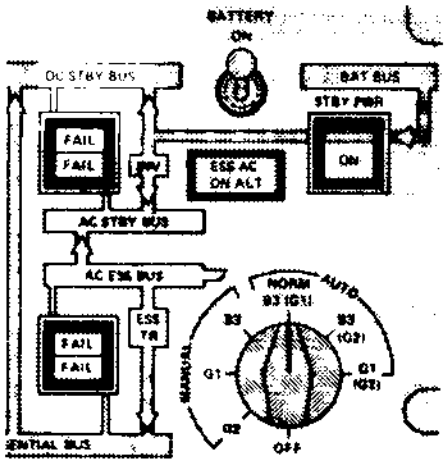
3. ***IF*** **BATTERY CONDITION** ***REMAINS:***
   FOLLOWING C/B'S.....CK IN
   Any one of the following C/B's may disable the battery charger:
   1B12, 1B13, 1B15, 1K10, 1K12, 1K13, 1K18, 1L9, 1J14.
   2H9, 2L6.
   3F1, 3F6, 3F10, 3G13, 3G16.
   C/B 3F12 also disables the battery charger, but to prevent RAT deployment should not be pulled.

4. **MID AVIONIC AIR OVBD LIGHT EXTINGUISHED.....CK**
   OVBD indicates fan is inoperative. Pull & reset FAN AVIONICS RACK MAIN C/B 4D14 (-500 4D2).

5. ***IF BATTERY CHARGER REMAINS INOPERATIVE:***
   BATTERY VOLTS & AMPS.....MONITOR
   - Battery is probably overheated.
   - **BATTERY CONDITION** should extinguish, and normal pulse charging be restored after cooling has occurred.

END OF PROCEDURE

DC STBY BUS FAILURE — FAIL



The DC STBY BUS receives power from one of two sources:

- DC ESSENTIAL BUS (normal).
- BATTERY (alternate):
  - —When the STANDBY POWER switch is ON, **or**
  - —When the BATTERY switch is ON with the DC ESSENTIAL BUS unpowered.

1. **STANDBY POWER SW.....ON**
   AC and DC STBY BUSes should now be powered by the BATTERY.

2. **BATTERY SW.....CK ON**

3. **DC STBY PWR C/B 3F1 ...PULL THEN RESET**
   This C/B is between the DC ESSENTIAL BUS and the DC STBY BUS, and if tripped, will interrupt normal supply from the DC ESSENTIAL BUS.

4. **STANDBY POWER SW.....ARM**
   Confirm STBY PWR -**FB**- and **ON** lights extinguished.

V V

V V <<<<<<<<<<<<<<<<***IF***>>>>>>>>>>>>>>>> V V

NORMAL SOURCE OF DC STBY BUS POWER IS RESTORED:

V V

5. **NORMAL OPERATION.....RESUME**

STOP

NORMAL SOURCE OF DC STBY BUS POWER IS NOT RESTORED:

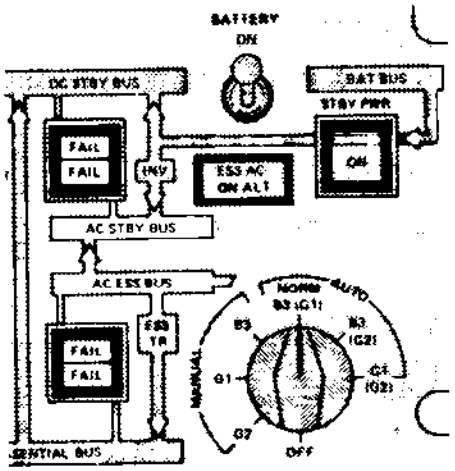
V V

5. **STANDBY POWER SW.....ON**

6. **OPERATION WITH BATTERY SUPPLYING AC OR DC STANDBY BUS POWER PROCEDURE.....ACCOMPLISH**
   See page 20.

END OF PROCEDURE

AC STBY BUS FAILURE — FAIL



The AC STANDBY BUS receives power from either of two sources:

- AC ESS BUS (normal).
- The battery powered inverter (INV), if AC ESS BUS power is lost (alternate).
  - Requires STANDBY POWER switch in ARM and BATTERY switch must be ON; **or**
  - STANDBY POWER switch ON.

An AC STBY BUS failure causes the RAT to deploy because the N_3 tachometers are unpowered.

1. **STANDBY POWER SW.....ON**
   AC and DC STBY BUSes should now be powered by the BATTERY.

2. **INVERTER VOLTS AND FREQ.....CK**

3. **AC STBY BUS PWR C/B 3F12..PULL THEN RESET**
   C/B 3F12 is between the AC ESS BUS and the AC STBY BUS, and if tripped, will interrupt normal power supply from the AC ESS BUS.

4. **STANDBY POWER SW.....ARM**
   Confirm STBY PWR -**FB**- & **ON** lights extinguished.

IF

NORMAL SOURCE OF AC STBY BUS POWER IS RESTORED:

5. **NORMAL OPERATION.....RESUME**

STOP

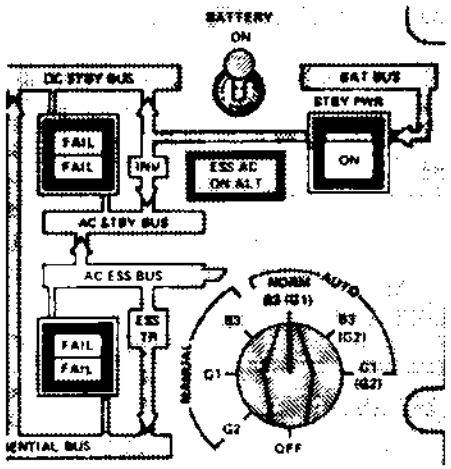
NORMAL SOURCE OF AC STBY BUS POWER IS NOT RESTORED

5. **STANDBY POWER SW.....ON**

6. **OPERATION WITH BATTERY SUPPLYING AC OR DC STANDBY BUS POWER PROCEDURE.....ACCOMPLISH**
   See page 20.

END OF PROCEDURE

AC ESS BUS FAILURE — FAIL



With **FAIL** illuminated:

- AC STBY BUS should be powered by the BATTERY.
- STBY PWR **ON** should be illuminated.
- **BATTERY CONDITION** should be illuminated.

1. **STANDBY POWER SW.....ON**
   Ensures stable power on the STBY BUSes until AC essential power is restored.

2. **AC ESS POWER SEL ....MANUAL B3, G1, or G2**
   Provides direct power source to AC ESS BUS.

3. **AFFECTED ESS POWER C/B'S .....PULL THEN RESET**
   - 3E12 GEN 1
   - 3E13 GEN 2
   - 3E14 BUS 3
   - If desired, AC ESS PWR SEL may be rotated to an AUTO position to provide a backup source of essential power.

V V

V V <<<<<<<<<<<<<<<<*IF*>>>>>>>>>>>>>>>> V V

AC ESSENTIAL BUS IS RESTORED:

V V

4. **STANDBY POWER SW .....ARM**
   Confirm STBY PWR **-FB- & ON** extinguished.

STOP

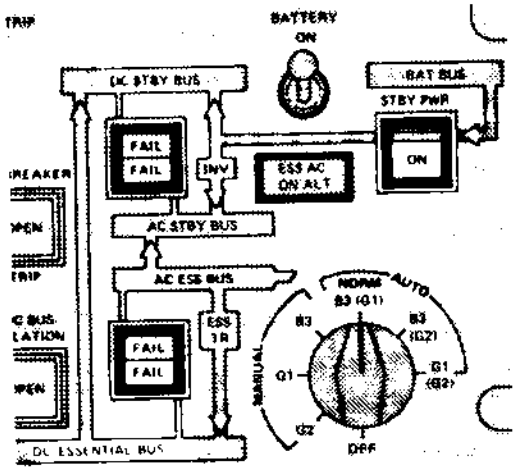
AC ESSENTIAL BUS POWER IS NOT RESTORED:

V V

4. **OPERATION WITH BATTERY SUPPLYING AC OR DC STANDBY BUS POWER PROCEDURE .....ACCOMPLISH**
   See page 20.

END OF PROCEDURE

DC ESSENTIAL BUS FAILURE — FAIL



The DC ESSENTIAL BUS receives power from two sources:

- ESS T/R.
- DC TIE BUS.

With **FAIL** illuminated:

- DC STBY BUS should be powered by an automatic transfer to the BATTERY.
- STBY PWR **ON** should be illuminated.
- **BATTERY CONDITION** should be illuminated.

1. **STANDBY POWER SW.....ON**
   Ensures stable power to the STBY BUSes.

2. **DC BUS ISOLATION SW .....UNL**
   Ensures correct switch position, since its **OPEN** light is powered from DC ESSENTIAL BUS.

3. ***IF* FAIL *REMAINS:***
   DC TIE BUS AND T/R C/B'S ... PULL THEN RESET
   - 3F2 CONT.
   - 3F3 PWR.
   - 3F17 ESS T/R PWR.
   - 3E16 T/R POWER 1.
   - 3E17 T/R POWER 2.
   - 3E18 T/R POWER 3.

IF

DC ESSENTIAL BUS IS RESTORED:

4. **STANDBY POWER SW .....ARM**
   Confirm STBY PWR -**FB**- & **ON** extinguished.

STOP

DC ESSENTIAL BUS POWER IS NOT RESTORED:

4. **OPERATION WITH BATTERY SUPPLYING AC OR DC STANDBY BUS POWER PROCEDURE .....ACCOMPLISH**
   See page 20.

END OF PROCEDURE

OPERATION WITH BATTERY SUPPLYING AC OR DC STANDBY BUS POWER

- Procedure applies anytime an electrical drain on the battery exists in-flight.
- Associated indication may include any of the following:
  - BATTERY CONDITION.
  - STBY PWR ON or FB.
  - Any STBY or ESS BUS FAIL.

1. **DC VOLTS & AMPS ..... CK BAT**
   - Normal volts 28-34.
   - Positive amps indicated:
     - Battery charger is deactivated,
     - Battery is powering the AC or DC STBY BUS.

V V

V V <<<<<<<<<<<<<<<<*IF*>>>>>>>>>>>>>>>> V V

BATTERY CHARGER MODE SWITCH IS INSTALLED:

V V

2. **STBY MODE (C/B POS 3K2) ..... SELECT**
   With switch in STBY, the battery charger maintains the BAT and DC STBY buses at a maximum of 30 volts.

3. **BAT VOLTS & AMPS ..... MONITOR**
   - Voltage should remain above 28 volts.
   - Amperage indications should remain on the negative side to indicate charger is operating.

IF BATTERY CHARGER FAILS:
PERFORM PROCEDURE IN NEXT COLUMN

STOP

BATTERY CHARGER MODE SWITCH NOT INSTALLED, OR CHARGER FAILS:

V V

2. **LAND AT NEAREST SUITABLE AIRPORT**
   Loss of control of essential systems will occur when battery is depleted.

BATTERY DEPLETION CAUSES LOSS OF:
- PRESSURIZATION CONTROL.
- PASSENGER OXYGEN CONTROL.
- FIRE DETECTION AND EXTINGUISHING.
- LANDING GEAR & DOOR INDICATIONS.
- THRUST REVERSERS.
- RAT DEPLOYMENT.
- INSTRUMENT PANEL FLOODLIGHTS.

V V V

CONTINUE >>>>>>>>>>>>>>>>

OPERATION WITH BATTERY SUPPLYING AC OR DC STANDBY BUS POWER (CONT'D)

3. **LOAD REDUCTION.....CONSIDER**
   Consider pulling the following breakers:
   - 1L4 GALLEY & LAV LIGHTS.
   - 1L5 AISLE LIGHTS.
   - 1F9 INST PNL FLOOD LIGHTS.

   Reduce battery drain as necessary to assure battery power for expected landing time.

PROBABLE BATTERY LIFE		
For Average Amperage Drain	Useful Battery Life (Minutes)	Reduce Battery Life For Each Unsuccessful APU START BY (Minutes)
60	40-50	14
50	48-60	17
40	60-75	21
30	80-100	28
20	129-150	42
10	240-300	84

IF ADDITIONAL LOAD REDUCTION REQUIRED:
STANDBY POWER SWITCH...OFF UNARM
- Captain's instruments will be lost if AC STBY BUS is unpowered.
- Restore standby power before landing.

4. **EMERGENCY LTS.....CK**
   If emergency lights are on:
   - Power packs will operate for 20 minutes.
   - Consider time remaining before landing. It may be desirable to switch EMERGENCY LIGHTING to OFF to conserve power packs.
   - Switch ON just before landing.
   - Have flashlights available.

5. ***AFTER LANDING:***

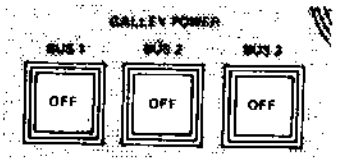
ENGINE FAILS TO SHUTDOWN
PROCEDURE .....REVIEW
See Powerplant Abnormal section.

END OF PROCEDURE

GALLEY POWER OFF (ALL THREE) — OFF, OFF, OFF

All Three OFF lights illuminate simultaneously if:

- The load monitoring system has sensed a high load condition and has shed the galley power and AC hydraulic pumps (if in use); or
- The Galley Power Emergency Off switch, located in the galley, is actuated.



1. **ELECTRICAL LOADS.....CK**
   Determine cause.

V V

V V <<<<<<<<<<<<<<<<*IF*>>>>>>>>>>>>>>>> V V

LOAD SHEDDING OCCURRED, AND RESET OF GALLEY POWER OR AC PUMPS IS DESIRED:

V V

2. **GALLEY POWER BUS SWS (ALL).....UNL OFF**
   All three GALLEY POWER BUS switches must be unlatched before the power can be restored to any galley bus.

CAUTION:
ENSURE TWO AC POWER SOURCES ARE OPERATING PRIOR TO RESSETTING GALLEY POWER SWITCHES.

3. **GALLEY POWER BUS SWS (ONE AT A TIME).....LCH**

4. **AC PUMPS SWS.....UNL**
   Both switches must be unlatched before power can be restored to either pump.

5. **AC PUMPS SWS.....AS REQ**

STOP

GALLEY POWER EMERGENCY OFF SWITCH HAS BEEN ACTUATED IN THE GALLEY:

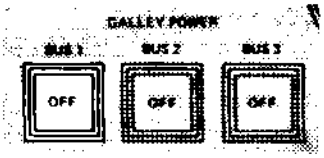
V V

2. **GALLEY PERSONNEL.....CONTACT**
   Coordinate to determine advisability of re-establishing power.

3. **SELECTIVE ISOLATION OF GALLEY CIRCUITS.....CONSIDER**
   - 5F18 GALLEY POWER BUS 1.
     - 5E16 OVEN 1.
     - 5E19 OVEN 4.
   - 5F19 GALLEY POWER BUS 2.
     - 5E17 OVEN 2.
     - 5E20 OVEN 5.
   - 5F20 GALLEY POWER BUS 3.
     - 5E18 OVEN 3.
     - 5F16 OVEN 6.
   - -500 circuit breakers located on each individual galley control panel.

END OF PROCEDURE

GALLEY POWER OFF (ONE) — OFF

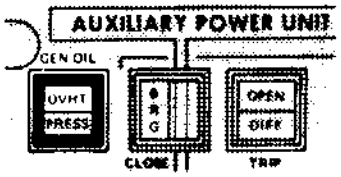


1. **ASSOCIATED GALLEY POWER C/B's.....PULL THEN RESET**
   - 5F18 GALLEY POWER BUS 1.
   - 5F19 GALLEY POWER BUS 2.
   - 5F20 GALLEY POWER BUS 3.

   -500 circuit breakers located on each individual galley control panel.
   - A galley power switch is also provided in each galley.

END OF PROCEDURE

APU GEN OIL OVERHEAT — OVHT

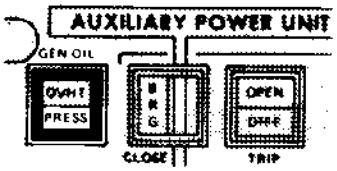


1. APU GENERATOR FIELD ....TRIP OPEN

2. *IF OVHT REMAINS AFTER 30 SECONDS:*
   APU SHUTDOWN.....ACCOMPLISH

END OF PROCEDURE

APU GEN OIL PRESSURE — PRESS



1. APU GENERATOR FIELD .....TRIP OPEN

2. *IF PRESS REMAINS:*
   APU PMG VOLTS.....CK

IF

PMG VOLTS ARE NORMAL:

3. APU SHUTDOWN.....ACCOMPLISH
   - Normal PMG volts 127.
   - Gear box is rotating without proper lubrication.

STOP

VOLTS READ PMG OFF:

3. APU BLEED AIR .....AS REQ
   Generator shaft has sheared.

END OF PROCEDURE

END

THERE ARE NO ABNORMAL PROCEDURES FOR EMERGENCY EQUIPMENT

FIRE OR OVERHEAT LOOP MALFUNCTION - A OR B

Procedure applies if either A or B illuminates on following Test panels:
- ENG or APU Fire Detection Loop Test
- Nacelle/Pylon OVHT DET Test
- Wheel Well Fire Test

1. *ADVISE OTHER FLIGHT CREWMEMBERS PRIOR TO TEST, THEN:*
   EXTINGUISHED LOOP----SELECT AND TEST

If APU Master Power switch is ON with Auto Fire Shutdown ARMED, selection of illuminated loop will result in shutdown of APU and discharge of fire bottle.

A. *IF FIRE OR OVERHEAT WARNING TEST IS NORMAL:*

2. CONTINUE WITH GOOD LOOP SELECTED

NOTE:
If A or B for Nacelle/Pylon OVHT DET had been illuminated, it will be necessary to cycle HI PRESS switch to remove valve lockout.

OR

STOP **STOP** **STOP**

B. *IF TESTED LOOP FAILS TO ILLUMINATE:*

2. OPPOSITE LOOP----------SELECT — Provides full fire/overheat warning.

3. APPROPRIATE EMERGENCY PROCEDURE----------ACCOMPLISH — See Emergency Procedures.

END OF PROCEDURE

CARGO COMPARTMENT SMOKE DETECTOR MALFUNCTION - 1 / 2

This procedure applies when the detector lights (1 and/or 2) illuminate in only one circuit (A or B), with the circuit selector in BOTH.

1. *ADVISE OTHER FLIGHT CREWMEMBERS PRIOR TO TEST, THEN:*

   CIRCUIT WITH EXTINGUISHED DETECTOR LIGHTS.....SELECT AND TEST

A. *IF DETECTOR TEST IS NORMAL:*

2. CONTINUE WITH GOOD CIRCUIT SELECTED.

OR

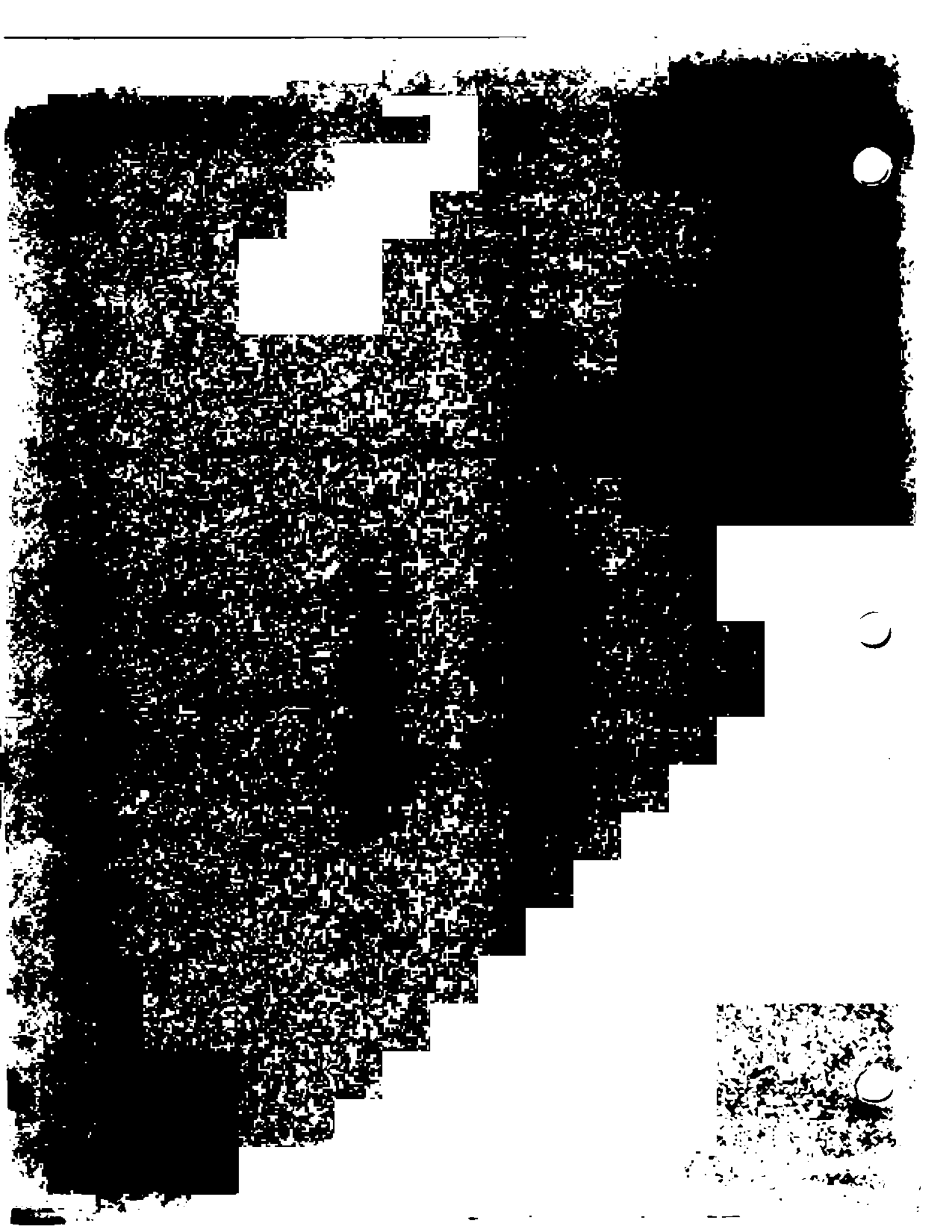
STOP **STOP** **STOP**

B. *IF TESTED DETECTOR LIGHTS FAIL TO ILLUMINATE:*

2. OPPOSITE DETECTOR CIRCUIT.....SELECT — Provides full smoke warning.

3. FWD CARGO SMOKE EMERGENCY PROCEDURE.....ACCOMPLISH — See -500 Emergency Procedures.

END OF PROCEDURE



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ROLL JAM INDICATIONS - ON THE GROUND

FLT CONT PANELS (Pilot's Annun. Panel), AILERON ////, SPOILER PUSH, and PULL ROLL DISC.

Caused by one of the following:
- Jam in the roll axis.
- Nuisance indication.

1. **CONTROL WHEEL...ROLL LEFT & RIGHT**
   - Neutralizes jam sensing.
   - May be accomplished with or without hydraulic systems pressurized.

2. **BOTH PFCS MONITOR ROLL SWS .....UNL THEN LCH**
   All roll jam indications should extinguish.

3. **ROLL CONTROL.....CK**
   - Pressurize hydraulic system and accomplish a complete roll control check.
   - Do not use AC pumps alone to pressurize hydraulic systems.

4. ***IF ROLL JAM INDICATIONS RECUR:***
   GROUND MAINTENANCE .....ALERT
   An actual roll jam is indicated.

END OF PROCEDURE

ROLL MONITOR FAIL - FAIL

Indicates failure of system that monitors for jammed cables.

1. **PFCS MONITOR ROLL SW(S).....UNL PAUSE LCH**

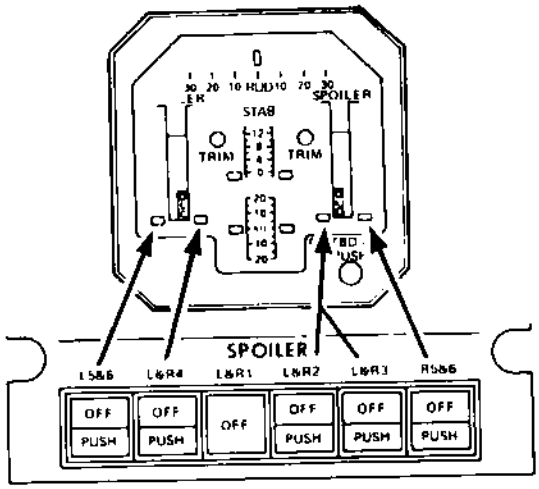
2. ***IF FAIL AGAIN:***
   PFCS MONITOR ROLL SWS(S).....UNL OFF
   - With **one** channel inoperative:
     - Normal Roll Monitor operation will still be provided.
   - With **both** channels inoperative:
     - AILERON ////, SPOILER **PUSH**, and **PULL ROLL DISC** will not illuminate to indicate a cable malfunction.
     - Jammed cables can only be detected by abnormal control feel.

END OF PROCEDURE

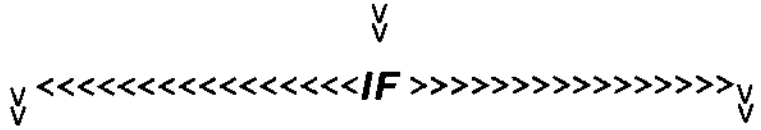
ROLL CONTROL PROBLEMS AFTER TAKEOFF

If roll control problems are encountered after takeoff without any roll jam indication, spoiler panel(s) may be extended.

1. SURFACE POSITION INDICATOR (SPI).....CK



- SPI indices are directly related to spoilers 5L, 4L, 2R, and 6R as indicated above.
- The following spoilers are directly cable connected:
  - L5&6.
  - L&R4.
  - L&R2, L&R3.
  - R5&6.



SPOILER EXTENSION INDICATED ON SPI:

2. AFFECTED SPOILERS SW(S)...UNL OFF

3. *IN ADDITION, IF AFFECTED SPOILER SW IS L5&6 OR R5&6:*
OPPOSITE 5&6 SW .....UNL OFF

STOP

NO SPOILER EXTENSION INDICATED ON SPI:

2. SPOILER SWS (ONE AT A TIME).....UNL PAUSE LCH
- Cycle SPOILER switches one at a time until extended spoiler identified (unlatching switch forces spoiler panel to retract).
- Leave affected SPOILER switch unlatched.

CAUTION:
DO NOT UNLATCH ANY AILERON SWITCH.

END OF PROCEDURE

ROLL SPEED BRAKE - ROLL SPEED BRAKE

Spoiler L & R1 through 4 are not all in the correct mode for the flap position. The correct procedure to follow depends on whether flaps are extended or retracted.

V V

V <<<<<<<<<<<<<<<<*IF*>>>>>>>>>>>>>>>> V

V V

FLAPS EXTENDED

V V

1. **SPOILER SWS.....CK**
   If L & R1 switch is unlatched, this is the cause of ROLL SPEED BRAKE. Latch the L & R1 switch.

2. **SURFACE POSITION INDICATOR.....CK**
   All spoiler indices should move in response to roll inputs.

3. ***IF SPOILER MOVEMENT IS CORRECT AND ROLL SPEED BRAKE REMAINS:***
   SPOILER L & R1 SW.....UNL OFF
   V Spoilers L & R1 will not deploy on touchdown.
   V This will result in a pitch up tendency which can
   V be counteracted by applying forward control
   V column pressure and moderate braking before
   V reverse thrust is selected on engine No. 2.
   V
   V

   OR

   V
   V

   IF NO MOVEMENT IS EVIDENT:
   ROLL AUGMENTATION...NOT AVAILABLE

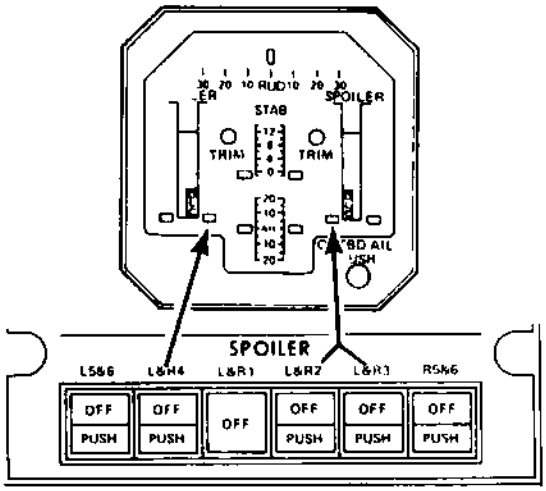
STOP

FLAPS RETRACTED:

V V

1. **SPOILER L & R1 SW.....UNL OFF**
   For -500 PROCEDURES, see blue DIFFERENCES PAGES located at the end of this section.

2. **SURFACE POSITION INDICATOR.....CK**
   Verify that no spoiler movement is indicated while banking left and right.



3. ***IF LEFT INBOARD INDEX MOVES:***
   L & R4 SW.....UNL OFF

   IF RIGHT INBOARD INDEX MOVES:
   L & R2 and L & R3 SWS.....UNL OFF

4. ***WHEN FLAPS ARE EXTENDED:***
   ALL SPOILER SWS.....LCH

   SURFACE POSITION INDICATOR.....CK
   Observe normal spoiler movement while banking aircraft left and right.

END OF PROCEDURE

SPOILERS L5 & 6 AND R5 & 6 - PUSH, PUSH

Spoilers may not be in the correct mode for flap position. The correct procedure to follow depends on whether flaps are extended or retracted.

IF

FLAPS EXTENDED:

1. **SPOILER L5 & 6 AND R5 & 6 SWS ..... UNL OFF**
   - Outboard spoilers have remained in speed brake mode, and have not switched to roll augmentation function.
   - Unlatching both switches prevents asymmetric spoiler movement.
   - Roll control response is reduced.

2. ***AFTER FLAPS ARE RETRACTED:***
   SPOILER L5 & 6 AND R5 & 6 SWS ..... LCH

3. ***IF PUSH AGAIN:***
   SPOILER L5 & 6 AND R5 & 6 SWS ..... UNL OFF

STOP

FLAPS RETRACTED:

1. **SPOILER L5 & 6 AND R5 & 6 SWS ..... UNL OFF**
   - Outboard spoilers have remained in roll augmentation, and have not switched to speed brake function.
   - Unlatching both switches prevents asymmetric spoiler movement.
   - If speed brakes are used, be alert to pitch down tendency.

2. ***AFTER FLAPS EXTENDED ON APPROACH:***
   SPOILER L5 & 6 AND R5 & 6 SWS ..... LCH

3. ***IF PUSH AGAIN:***
   SPOILER L5 & 6 AND R5 & 6 SWS ..... UNL OFF

END OF PROCEDURE

DLC/AUTO SPLR FAILURE · FAIL

For -500 procedures, see blue differences pages located at the end of this section.

1. **SPEED BRAKE AUTOMATIC DISABLE SW.....CK**
   If Speed Brake Automatic Disable switch has been actuated during DLC or automatic ground spoiler (AGS) operation, DLC/AUTO SPLR FAIL , FAIL will occur. It will be necessary to press the Speed Brake Automatic Disable switch (amber lights extinguished) and cycle both DLC/AUTO SPLR switches to regain auto spoiler operation.

WARNING:
IF THE DISABLE SWITCH WAS USED TO STOW THE SPOILERS FOLLOWING AN UNSCHEDULED DEPLOYMENT PROCEED TO STEP 5 - DO NOT RESET DLC/AUTO SPLR SWITCHES.

2. **DLC/AUTO SPLR SW(S)...UNL PAUSE LCH**

3. ***IF FAIL AGAIN:***
   DLC/AUTO SPLR SW(S).....UNL OFF
   - With one channel inoperative:
     – Normal DLC and AGS will still be provided.

4. ***IF BOTH CHANNELS DEACTIVATED OFF:***
   SPEED BRAKE LEVER CONTROL FORCE .....CK
   If control force is high and speed brake lever must be held in the deployed position, the hydraulic assist from hydraulic systems A and B is inoperative.

5. ***AFTER TOUCHDOWN:***
   GROUND SPOILERS...MANUALLY ACTUATE
   - AUTO GND SPLRS INOP on Pilot's Annun. Panel.
   - If hydraulic assist is inoperative, the lever must be held in the deployed position upon spoiler extension. Control force will be high.

END OF PROCEDURE

AUTOMATIC GROUND SPOILERS INOPERATIVE AUTO GND SPLRS INOP

Automatic ground spoiler operation is not available for landing.

1. **DLC/AUTO SPLR FAIL LIGHTS .....CK**
   If FAIL illuminated, see DLC/AUTO SPLR FAILURE procedure on this page.

2. ***AFTER TOUCHDOWN:***
   GROUND SPOILERS...MANUALLY ACTUATE
   If AUTO GND SPLRS INOP caused by loss of hydraulic assist (systems A **and** B) to the speed brake lever, the lever must be held in the deployed position upon spoiler extension. Control force will be high.

END OF PROCEDURE

ABNORMAL RUDDER DEFLECTION

Unwanted rudder displacement can be caused by false signals from the YAW SAS. YAW SAS input can be overridden by applying opposite rudder.

1. **BOTH YAW SAS SWS.....UNL OFF**

IF

ABNORMAL RUDDER DEFLECTION CORRECTED:

2. **YAW SAS SWS (ONE AT A TIME) .....RESTORE & CK**
   Continue with operative channel.

STOP

ABNORMAL RUDDER DEFLECTION PERSISTS:

2. **RUDDER SW.....UNL OFF**
   - Rudder will streamline. No rudder control is available.
   - Avoid crosswind landing.
   - During approach use roll control and asymmetric thrust to remain on runway centerline. Reduce asymmetric thrust gradually in the flare to avoid swerve.

END OF PROCEDURE

YAW SAS FAILURE - FAIL

1. **HYDRAULIC SYSTEM A & B PRESSURE...CK**
   - Channel No. 1 FAIL with loss of hydraulic system B.
   - Channel No.2 FAIL with loss of hydraulic system A.

2. **YAW SAS SW(S) .....UNL PAUSE LCH**

3. ***IF FAIL AGAIN:***
   YAW SAS SW(S).....UNL OFF
   - With **one** channel inoperative:
     - Normal yaw damping, turn coordination, autopilot runway alignment, and rollout guidance will still be provided.
   - With **both** channels inoperative:
     - Yaw damping, turn coordination, autopilot runway alignment, and rollout guidance will **not** be provided.

END OF PROCEDURE

RUDDER HYDRAULIC LIMITER - RUDDER HYDR LMTR

IF

PUSH *EXTINGUISHED:*
(Indicates excessive hydraulic pressure to rudder)

1. **USE GENTLE RUDDER INPUTS ABOVE 200 KTS.**
   Avoids overstressing rudder hinges.

STOP

PUSH *ILLUMINATED*
(Indicates insufficient hydraulic pressure to rudder)

1. **HYDRAULIC PRESSURES.....CK**
   If loss of pressure in any system, refer to Hydraulics Abnormals after completion of this procedure.
   - With flaps extended loss of pressure in A, or B, or C will illuminate light.
   - With flaps retracted loss of pressure in A and C will illuminate light.

2. **C/B 2H12, 2H20....PULL PAUSE RESET**
   Resets LRS computer (provides speed input).

3. ***IF* PUSH *REMAINS:***
   RUDDER HYDRAULIC LIMITER SW .....UNL OVRD
   Restores all available hydraulic pressure to the rudder.

END OF PROCEDURE

RUDDER FUSING - ON THE GROUND - PUSH HYDRAULIC LIMITER, FAIL YAW SAS 2

A hydraulic fuse is installed in hydraulic system 'A' plumbing to the rudder to prevent complete loss of system fluid in the event of a rupture in the plumbing.

- Light indications are:
- FAIL - YAW SAS Channel 2.
- PUSH - RUDDER HYDRAULIC LIMITER - Illuminates when flaps extended.
- FLT CONT PANELS - Pilot's Annun. Panel.
- RUDDER HYDR LMTR - Pilot's Annun. Panel.

CAUTION:
IF THE ABOVE INDICATIONS ARE ACCOMPANIED BY A LOSS OF HYDRAULIC SYSTEM 'A' QUANTITY DO NOT ATTEMPT RESET.

IF NO HYDRAULIC SYSTEM 'A' FLUID LOSS APPARENT:

1. **AIRCRAFT ..... STOP**
   Set parking brakes.

2. **MLG GND SENSE C/B 2L8 ..... PULL**
   - Places aircraft in flight mode.
   - Powers the rudder fusing system.
   - Rudder pedal steering is inoperative, but steering wheel control is still available.
   - Brakes not available if ANTI-SKID ON, and taxi speed less than 10 kts.

3. **RUDDER FUSING SYS C/B 2L16 ..... PULL-PAUSE-RESET**
   - Pause at least four seconds before reset.
   - This step may be repeated three times, if necessary.

IF

FAIL *EXTINGUISHES:*

4. **MLG GND SENSE C/B 2L8..... RESET**

STOP

FAIL *REMAINS:*

4. **HYDRAULIC SYSTEM 'A'... DEPRESSURIZE**

5. ***AFTER 10 SECONDS:***
   HYDRAULIC SYSTEM 'A'.... PRESSURIZE

6. **RUDDER FUSING SYS C/B 2L16 ..... PULL-PAUSE-RESET**

7. ***IF* FAIL *EXTINGUISHES:***
   MLG GND SENSE C/B 2L8 ..... RESET

END OF PROCEDURE

MACH FEEL FAILURE - FAIL

1. **MACH FEEL SW(S).....UNL PAUSE LCH**
   If both channels FAIL a discrepancy may exist between air data computers. Reset only one channel if differences exist between Mach, airspeed, or altitude indications. If Mach/airspeed/altitude differences are reduced at lower altitudes and airspeeds, both channels may be latched.

2. ***IF FAIL AGAIN:***
   MACH FEEL SW(S).....UNL OFF
   - With **one** channel inoperative:
     - Normal Mach feel will still be provided.
     - Monitor single channel operation by comparing Mach Feel indicator with Mach/airspeed indicators.

     NOTE: Failure of channel 2 may cause Mach Feel indicator to disagree with feel actually being supplied by channel 1. Power loss in channel 2 will cause Mach Feel indicator to indicate .73M regardless of feel being provided by channel 1.

   - With **both** channels inoperative:
     - Control feel existing at time of failure will remain for all airspeeds.
     - Autopilot operation is prohibited. Aircraft limited to Category I minimums only.
     - If failure occurs below 28,000' do not exceed 300 KIAS or climb above 28,000'.
     - If failure occurs above 28,000' do not exceed Mach indicated on Airspeed/Mach indicator at the time of failure. Do not use the MACH FEEL indicator.

END OF PROCEDURE

MACH TRIM FAILURE - FAIL

1. **MACH TRIM SW(S).....UNL PAUSE LCH**
   If both channels FAIL, a discrepancy may exist between air data computers. Reset only one channel if differences exist between Mach, airspeed, or altitude indications. If Mach/airspeed/altitude indicator differences are reduced at lower altitudes and airspeeds, both channels may be latched.

2. ***IF FAIL AGAIN:***
   MACH TRIM SW(S).....UNL OFF
   - With **one** channel inoperative:
     - Normal Mach Trim will still be provided.

3. ***IF MACH TRIM SYSTEM IS INOPERATIVE ABOVE .55M (.75M on -500):***
   AUTOPILOT.....ENGAGED

END OF PROCEDURE

PITCH TRIM FAILURE - FAIL

1. **PITCH TRIM SW(S).....UNL PAUSE LCH**
   If both channels FAIL, reset one at a time.

2. ***IF FAIL AGAIN:***
   PITCH TRIM SW(S).....UNL OFF
   - With **one** channel inoperative:
     - Thumbwheel and autopilot trim occur at half the normal rate.
   - With **both** channels inoperative:
     - Thumbwheel trim is inoperative; but
     - Mechanical trim is available.
     - Autopilots can not be engaged.

END OF PROCEDURE

PITCH MONITOR FAILURE - FAIL

Indicates failure of system that monitors for jammed or broken pitch control cables.

1. **PFCS MONITOR**
   PITCH SW(S).....UNL PAUSE LCH

2. ***IF FAIL AGAIN:***
   PFCS MONITOR PITCH SW(S)...UNL OFF
   - With **one** channel inoperative:
     - Normal pitch monitor operation will still be provided.
   - With **both** channels inoperative:
     - Stabilizer **PUSH** will **not** illuminate to indicate a cable malfunction.
     - Jammed or broken cables can only be detected by abnormal control feel.

END OF PROCEDURE

STALL WARNING FAILURE - FAIL

NOTE: Stall Warning TEST button is inoperative in-flight.

1. **STALL WARNING SW(S)...UNL PAUSE LCH**

2. ***IF FAIL AGAIN:***
   STALL WARNING SW(S).....UNL OFF
   For operative channel to function, channel showing FAIL must be unlatched.
   NOTE: A double failure, FAIL FAIL, plus a HDG flag on Capt.'s HSI would be caused by popped C/B 1F5 INSTR XFMR NO. 1.

END OF PROCEDURE

ATS FAILURE FAIL FAIL

- Procedure applies if ATS (Speed Command System fails while ATS engage lever is OFF.
- If autothrottles are being used, ATS DISC also occurs - See Autoflight ATS DISC Abnormal Procedure.

1. **ATS SWS.....BOTH UNL OFF**
   The ATS will be inoperative with failure of either channel and cannot be reset until both channels are first unlatched OFF.

2. **ATS SWS (ONE AT A TIME).....LCH**
   - A discrepancy may exist between air data computers. Reset only one channel if difference exists between airspeed indications. If airspeed indicator difference is reduced at lower airspeed, both channels may be latched.
   - For good channel to work, channel showing FAIL must be unlatched.
     - All functions of ATS will be operative.
     - Speed Command System (donut) will be visible only on ADI associated with operative channel (No.1 - Capt. ADI, No.2 - F/O ADI).

3. **IF FAIL *REMAINS:***
   ATS SWS.....UNL OFF
   Speed Command & autothrottles inoperative.

END OF PROCEDURE

FLAP ASYMMETRY DETECTOR FAULT - FLAP ASYM DET FAULT

Indicates a possible failure in the flap asymmetry detector system. Attempt one reset.

1. **FLAP C/B'S**
   1J11, 1J13 & 2H21... PULL PAUSE RESET
   - Removes power from flap comparator circuits to reset system.
   - If light remains extinguished after circuit breakers reset, continue normal operation and make logbook entry.

2. ***IF*** FLAP ASYM DET FAULT ***REMAINS:***
   FLAP POSITION INDICATOR... MONITOR
   During flap extension or retraction be prepared to stop flaps with handle if split occurs.

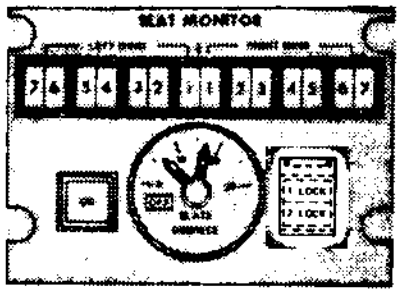
END OF PROCEDURE

SLAT ASYMMETRY DETECTOR FAULT - SLAT ASYM DET FAULT

Indicates a possible failure in the slat asymmetry detector system. Attempt one reset.

1. **SLAT C/B'S**
   1J10, 1J12 & 2H22... PULL PAUSE RESET
   - Removes power from slat comparator circuits to reset system.
   - If light remains extinguished after circuit breakers reset, continue normal operation and make logbook entry.

2. ***IF*** SLAT ASYM DET FAULT ***REMAINS:***
   SLAT POSITION INDICATOR... MONITOR
   During slat extension or retraction be prepared to stop slats by latching the guarded 1 LOCK/2 LOCK switch if split occurs.



END OF PROCEDURE

FLAP/SLAT LOCK - FLAP/SLAT LOCK

Indicates flaps or slats have locked in position shown on their respective indicators. Light will also illuminate when 1 LOCK/2 LOCK switch is latched.

1. **FLAP OR SLAT MALFUNCTION PROCEDURE ..... ACCOMPLISH**
   Refer to:
   - Flap Malfunction procedure page 13, or
   - Slat Malfunction procedure page 17.

END OF PROCEDURE

FLAP MALFUNCTION

Procedure applies when flaps fail to extend or retract properly. If flap asymmetry (split flap) condition exists, FLAP/SLAT LOCK on S/O Annun. Panel should illuminate.

1. **FLAP HANDLE ..... _____°**
   Position flap handle to detent nearest the lesser of the two flap positions indicated. However, the lowest detent selected should be 4°. This allows slats to remain extended for approach.

CAUTION:
TO AVOID AGGRAVATING FLAP MALFUNCTION, DO NOT MOVE FLAP HANDLE AGAIN.

2. **FLAP MALFUNCTION LANDING PROCEDURE .... ACCOMPLISH**
   - No Flap/No Slat ..... Page 14.
   - No Flap/Full Slat ..... Page 15.
   - Partial Flap/Full Slat ..... Page 16.

END OF PROCEDURE

NO FLAP/NO SLAT LANDING

1. **LANDING GROSS WEIGHT...CONSIDER**
   - Reduce gross weight as much as possible.
   - Tire damage may occur if landing speed exceeds 195 knots (gross weight in excess of 360,000).

2. **SET AIRSPEED BUG.....V_{REF}+50**

3. **GPWS.....INHIBIT**

4. **AIRSPEED .....REDUCE TO BUG (PLUS WIND ADDITIVE) OVER THRESHOLD**
   Do not prolong flare.

5. **AURAL WARNING.....CONSIDER**
   There may be no gear down aural warning.
   - System not armed until airspeed below 180.
   - Ensure that Before Landing checklist is accomplished.

6. ***AFTER TOUCHDOWN:***
   GROUND SPOILERS...MANUALLY ACTUATE
   - Auto ground spoilers are not armed to actuate on touchdown.
   - Auto ground spoilers will actuate when reverse thrust is selected with two throttles.

   NOTE: With flaps less than 4°, spoiler panels 2 through 6 will extend when reverse thrust is selected. This will result in a pitch up tendency which can be counteracted by applying forward control column pressure and moderate braking before reverse thrust is selected on engine No. 2.

7. **BRAKE ENERGY CHART.....CONSULT**
   Determine if brake energy limits shown on chart in ODM indicate that special handling is required.

EXAMPLE

L-1011 LANDING DATA

FLIGHT NO_____ ATIS_____ RWY_____

GWT 310,000 LBS

FLAPS 0 BUG + 60 (V_{REF}+60) 193 KTS

~~FLAPS 4 BUG + 40 ____ KTS~~

~~FLAPS 10 BUG + 30 ____ KTS~~

~~FLAPS 22 BUG + 20 ____ KTS~~

BUG (V_{REF}+50) 183 KTS

LANDING FLAPS 0 VREF 133

~~WX/NOTAMS~~ NO FLAP/NO SLAT

GO AROUND / FLAP RETRACT SCHEDULE

EPR 1.522

SELECT FLAPS	AT
~~22 (BUG + 20)~~	
~~10 (BUG + 10)~~	
~~4 (BUG + 20)~~	
0 (V_{REF} (BUG + 60))	193

END OF PROCEDURE

NO FLAP/FULL SLAT LANDING

Procedure applies when flaps are extended less than 4° for landing with all slats fully extended.

1. **LANDING GROSS WEIGHT...CONSIDER**
   Reduce gross weight as much as possible.

2. **SET AIRSPEED BUG.....V_{REF}+35**

3. **GPWS.....INHIBIT**

4. **FLAP HANDLE .....4° DETENT**
   - LE EXT
   - Slat Monitor 14 green.

5. **AIRSPEED .....REDUCE TO BUG (PLUS WIND ADDITIVE) OVER THRESHOLD**
   Do not prolong flare.

6. **AURAL WARNING.....CONSIDER**
   There may be no gear down aural warning.
   - System not armed until airpseed below 180.
   - Ensure Before Landing checklist accomplished.

7. ***AFTER TOUCHDOWN:***
   GROUND SPOILERS...MANUALLY ACTUATE
   - Auto ground spoilers are not armed to actuate on touchdown.
   - Auto ground spoilers will actuate when reverse thrust is selected with two throttles.

   NOTE: With flaps less than 4°, spoiler panels 2 through 6 will extend when reverse thrust is selected. This will result in a pitch up tendency which can be counteracted by applying forward control column pressure and moderate braking before reverse thrust is selected.

EXAMPLE

L-1011 LANDING DATA

FLIGHT NO_____ ATIS_____ RWY_____

GWT 310 LBS

FLAPS 0 ~~BUG +60~~ (V_{REF} +60) 193 KTS

FLAPS 4 ~~BUG +40~~ (V_{REF} +55) 188 KTS
SLATS EXTENDED

~~FLAPS 10~~ ~~BUG +30~~ _____ KTS

~~FLAPS 22~~ ~~BUG +20~~ _____ KTS

BUG (V_{REF} +35) 168 KTS

LANDING FLAPS 0 VREF 133

~~WX/NOTAMS~~ NO FLAP/FULL SLAT

GO AROUND / FLAP RETRACT SCHEDULE

EPR 1.522

SELECT	AT
FLAPS ~~22~~ ~~BUG +~~	
~~10 (BUG + 10)~~	
~~4 (BUG + 20)~~	
0 (BUG + 60) / (V_{REF} + 60)	193

END OF PROCEDURE

PARTIAL FLAP/FULL SLAT LANDING

Procedure applies when flaps are extended for landing to at least 4°, but less than 33°, with all slats extended.

1. **SET AIRSPEED**
   BUG .....1.3V_S FOR FLAP POSITION
   See Landing Data Power Chart/ODM.

MANUEVER AT NORMAL PATTERN SPEED FOR FLAP POSIT.ON.

2. **GPWS.....INHIBIT**

3. ***AFTER TOUCHDOWN:***
   GROUND SPOILERS... MANUALLY ACTUATE
   - Auto ground spoilers are not armed to actuate on touchdown.
   - Auto ground spoilers will actuate when reverse thrust is selected with two throttles.

CAUTION:
IF GO-AROUND REQUIRED DO NOT RETRACT FLAPS.

EXAMPLE

L-1011 LANDING DATA

FLIGHT NO_____ ATIS_____ RWY_____

GWT 310,000 LBS

FLAPS 0 ~~BUG + 60~~ (V_{REF} +60) 193 KTS

FLAPS 4 ~~BUG + 40~~ (V_{REF} +40) 173 KTS

~~FLAPS 10 BUG + 30 _____ KTS~~

~~FLAPS 22 BUG + 20 _____ KTS~~

BUG (1.3 V_S FOR 4) 148 KTS

LANDING FLAPS 4 VREF 133

~~WX/NOTAMS~~ PARTIAL FLAP 4/ FULL SLAT

GO AROUND / ~~FLAP RETRACT SCHEDULE~~

EPR 1.522

SELECT	AT
~~FLAPS 22 BUG~~	
~~10 (BUG + 10)~~	DO NOT
4 (~~BUG~~ + 20)	RAISE
0 (~~BUG~~ + 60)	FLAPS

END OF PROCEDURE

SLAT MALFUNCTION

Procedure applies when any slat segment fails to extend or retract fully. If slat asymmetry (split condition) exists **FLAP/SLAT LOCK** should illuminate.

AIRSPEED MAXIMUM ..... **AS REQUIRED**
- With slats and flaps retracted, the airspeed limit is Vmo/Mmo.
- With slats extended, or with an asymmetric slat condition, limit airspeed to 250 KIAS max.

FLAPS MAXIMUM ..... **22°**
- If any green slat light remains extinguished upon flap extension, but complete slat extension is visually verified, flap settings beyond 22° are permissible.

WARNING:
DO NOT EXTEND FLAPS BEYOND 22° UNLESS ALL SLAT SEGMENTS ARE FULLY EXTENDED.

A pitch up tendency exists if flaps are extended beyond 22° with slats retracted.

SLAT LOCK SW ..... **LCH**
- Check 1 **LOCK/2 LOCK**

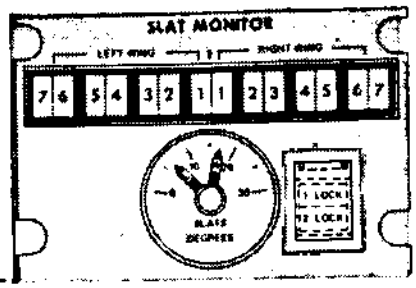
SET AIRSPEED BUG ..... **1.3 V_S + 20**
- See Landing Data Power Chart to determine 1.3 V_S for flap position. The 20 knot additive compensates for incomplete/zero slat extension.

GPWS ..... **INHIBIT**

After Touchdown:

GROUND SPOILERS . **MANUALLY ACTUATE**
- Auto ground spoilers are not armed to actuate upon touchdown.
- Auto ground spoilers will actuate when reverse thrust is selected with two throttles.

NOTE: The disparity between approach/landing speeds and the go-around speeds is due to the "reference" computation system of adding increments to a fixed speed. In the example below, BUG is <u>not</u> equal to V_{REF}, thus causing the disparity.



L-1011 LANDING DATA

FLIGHT NO_____ ATIS_____ RWY_____

GWT 310,000 LBS

FLAPS 0 BUG + 60 (VREF +60) 193 KTS

FLAPS 4 BUG + 40 (VREF +60) 193 KTS

FLAPS 10 BUG + 30 (VREF +50) 183 KTS

FLAPS 22 BUG + 20 (VREF +40) 173 KTS

BUG (1.3 VS 22 +20) 157 KTS

LANDING FLAPS 22 (MAX) VREF 133

WX/NOTAMS SLAT MALFUNCTION

GO AROUND / FLAP RETRACT SCHEDULE

EPR 1.522

SELECT		AT
FLAPS 22	(BUG)	157
10	(BUG + 10)	167
4	(BUG + 20)	177
0	(BUG + 60)	217

——END OF PROCEDURE——
-END-

DLC/AUTO SPLR FAILURE - FAIL

1. **SPEED BRAKE AUTOMATIC DISABLE SW.....CK**
   If Speed Brake Automatic Disable switch has been actuated during DLC or automatic ground spoiler (AGS) operation, DLC/AUTO SPLR FAIL, FAIL will occur. It will be necessary to press the Speed Brake Automatic Disable switch (amber lights extinguished) and cycle both DLC/AUTO SPLR switches to regain auto spoiler operation.

WARNING:
IF THE DISABLE SWITCH WAS USED TO STOW THE SPOILERS FOLLOWING AN UNSCHEDULED DEPLOYMENT PROCEED TO STEP 5 - DO NOT RESET DLC/AUTO SPLR SWITCHES.

2. **DLC/AUTO SPLR SW(S).....UNL PAUSE LCH**

3. ***IF FAIL AGAIN:***
   DLC/AUTO SPLR SW(S) .....UNL OFF
   With one channel inoperative, normal DLC and AGS will still be provided.

IF BOTH CHANNELS DEACTIVATED OFF:
- MDLC is inoperative. Refer to MDLC Inoperative Altitude Limit chart in ODM.
- FAIL extinguishes and OFF.
- FLT CONT PANELS and AUTO GND SPLRS INOP on Pilot's Annun. Panel.

4. **EITHER DLC/AUTO SPLR SW.....LCH**
   - Provides MDLC stick shaker function.
   - If unable to maintain one switch latched, do not exceed M 0.85.

5. ***PRIOR TO APPROACH:***
   BOTH DLC/AUTO SPLR SWS..UNL OFF

6. ***AFTER TOUCHDOWN:***
   GND SPOILERS..MANUALLY ACTUATE
   If AUTO GND SPLRS INOP caused by loss of hydraulic assist (A **and** B hydraulics) to the Speedbrake Lever, the lever must be held in the aft position. Control force will be high.

END OF PROCEDURE

ROLL SPEED BRAKE - ROLL SPEED BRAKE

FLAPS RETRACTED:

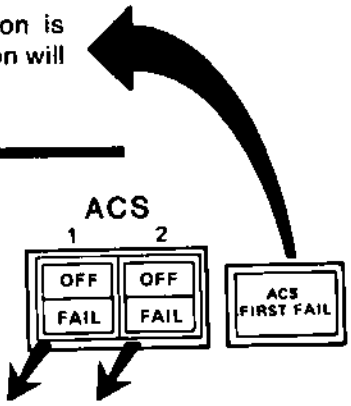
1. **SPOILER L & R1 SWS .....CK**
   If **L & R1** Switch is unlatched, this is cause of ROLL SPEED BRAKE.

COMPLETE REMAINING WHITE PAGE ITEMS.

ACS FIRST FAIL

Light is advisory only. No flight crew action is required except logbook entry. ACS operation will continue normally in both channels.

END OF PROCEDURE



ACS FAIL
Indicates affected ACS channel(s) has failed and disengaged from ACS control.

1. **ACS SW(S) .....UNL OFF**
   - Unlatch switch(es) for failed channel(s).
   - **FAIL** extinguishes; **ACS FIRST FAIL** and **FLT CONT PANELS** remain illuminated.

IF

ON THE GROUND:

2. **BOTH ACS SWS.....UNL OFF**

3. **ACS C/B'S.....PULL-PAUSE-RESET**
   - Pull C/B's 3Y - 4, 9, 10, 15 and 16.
   - Wait 5 seconds then reset.

4. **AFTER 30 SECONDS**
   ACS SWS .....LCH ONE-AT-A-TIME
   Flight is permitted provided one channel is operative.

STOP

IN FLIGHT:

IF ONLY ONE CHANNEL UNLATCHED OFF;

2. **SINGLE CHANNEL OPN.....CONTINUE**
   - Do not attempt to reset.
   - Do not pull ACS circuit breakers.
   - Normal ACS operation will continue through remaining channel.

IF BOTH CHANNELS UNLATCHED OFF

2. **WAIT 30 SECONDS THEN;**
   EITHER ACS CHANNEL.....LCH
   - If **FAIL** remains extinguished continue with single channel ACS operation.
   - If **FAIL** illuminates unlatch affected switch and latch remaining channel.
   - Do not pull ACS circuit breakers.

3. ***IF NEITHER CHANNEL WILL RESET:***
   AVOID TURBULENCE
   - Continue flight without ACS.

END OF PROCEDURE

YAW SAS FIRST FAIL

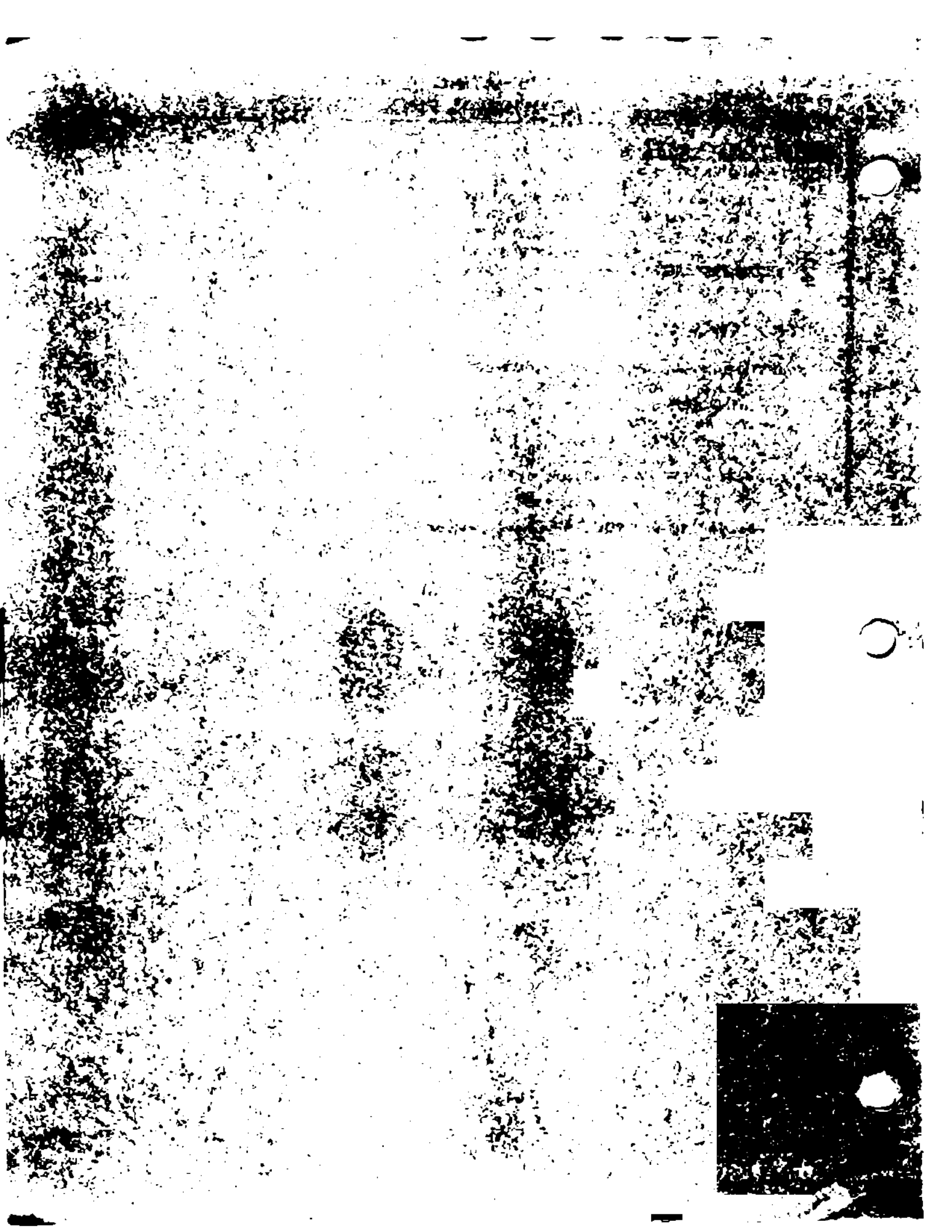
(Both FAIL lights extinguished)

Light is advisory only, Both channels of YAW SAS will continue to function normally. Indicates failure of a redundant element in the yaw SAS system. FLT CONT PANELS and DUAL A/L NOT AVAIL lights on the Pilot's Annunciator Panel will also be illuminated.

ATTEMPT ONE RESET:

1. **BOTH YAW SAS SWS.... UNL-PAUSE-LCH**
   - Unlatch both YAW SAS switches.
     - Both FAIL lights illuminate.
     - Wait five seconds.
   - Latch both YAW SAS switches.
     - Both **FAIL** lights extinguish.
     - **YAW FIRST FAIL** extinguishes if fault has cleared.

END OF PROCEDURE



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-100/200/500 DIFFERENCES (BLUE PAGES)

ADI ATT FLAG		1
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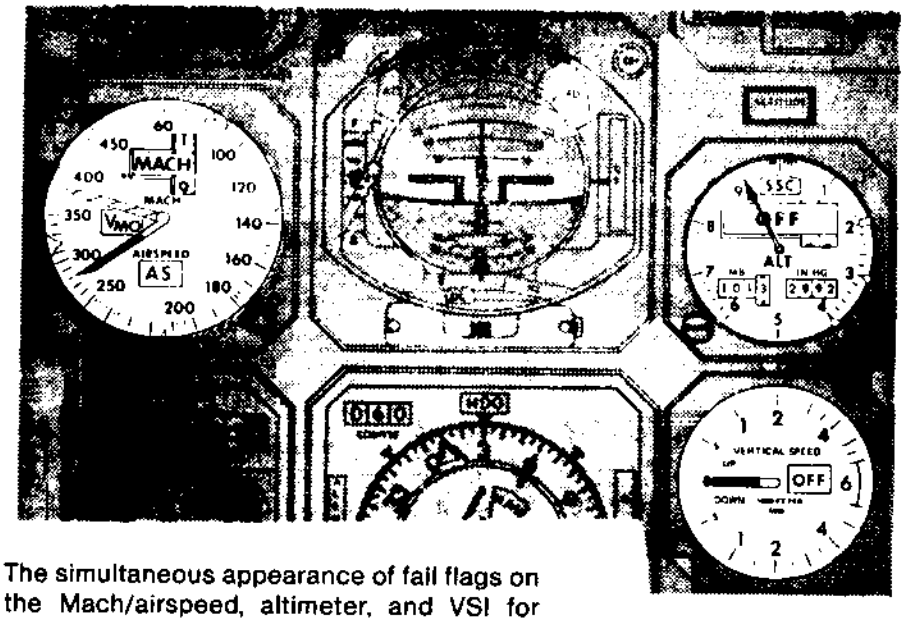
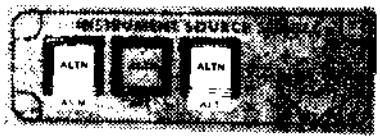
AIR DATA COMPUTER FAILURE



The simultaneous appearance of fail flags on the Mach/airspeed, altimeter, and VSI for either the Captain or First Officer indicates that the related ADC is not providing correct data. The flight director flag on the affected side will also be in view and the command bars withdrawn from view, if the related F/D switch is on.

1. **AFFECTED AIR DATA COMPUTER C/B**
   .....PULL THEN RESET
   - 1G8 AIR DATA CMPTR (CAPT).
   - 1G27 AIR DATA CMPTR (F/O).

2. ***IF FAIL FLAGS REMAIN ON MACH/AIRSPEED, ALTIMETER, AND VSI:***
   AS/M INSTR SOURCE
   SELECT SW.....LCH ALTN

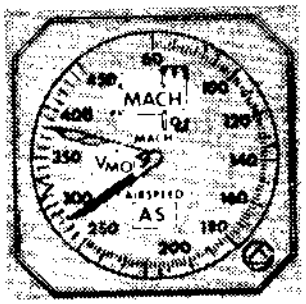
   

   ALT INST SOURCE
   SELECT SW.....LCH ALTN
   - If flag clears, instruments are receiving information from opposite ADC.
   - If flag remains in view, instrument is at fault.
   - First side selected locks out opposite side.

3. **OPERABLE APFDS.....SELECT**

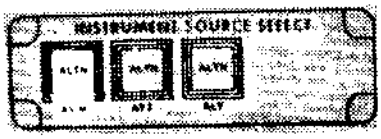
END OF PROCEDURE

AIRSPEED, MACH OR V_{MO} FLAGS – AS, MACH, V_{MO}



Indicates either an instrument failure or an ADC failure.

1. AS/M INSTR SOURCE
   SELECT SW----------LCH [ALTN]



- If flag disappears, instrument is receiving information from opposite ADC.
- First side selected locks out the opposite side.

2. *IF FLAG REMAINS IN VIEW, OR NORMAL SYSTEM RESET DESIRED:*
   AFFECTED
   IAS/MACH C/B--------PULL THEN RESET

- 1F1 CAPT IAS/MACH.
- 1F19 F/O IAS/MACH.
- If flag remains in view, instrument is at fault.

   AS/M INSTR SOURCE
   SELECT SW----------UNL

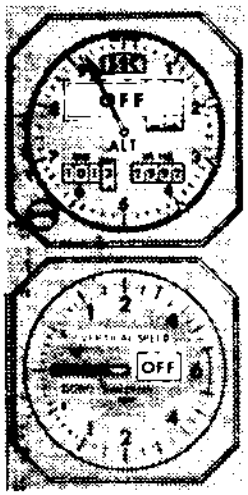
May be able to regain normal operation, otherwise return to [ALTN].

3. *IF NO AIRSPEED/MACH INDICATIONS AVAILABLE:*
   ODM, ABNORMAL SECTION "OPERATION WITHOUT AIRSPEED INDICATORS"-----CK

Cross check standby airspeed indications against ODM information.

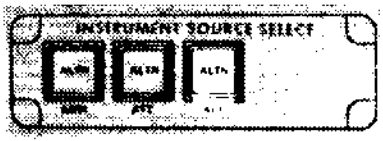
END OF PROCEDURE

ALTIMETER OR VERTICAL SPEED OFF FLAGS – OFF



Indicates either an instrument failure or an ADC failure.

1. ALT INSTR SOURCE
   SELECT SW----------LCH [ALTN]



- If flag clears, instrument is receiving information from opposite ADC.
- First side selected locks out the opposite side.

2. *IF FLAG REMAINS IN VIEW, OR NORMAL SYSTEM RESET DESIRED:*
   AFFECTED ALTM OR
   VERT SP IND C/B'S---PULL THEN RESET

- CAPT:
  . 1F4 ALTM
  . 1E4 VERT SP IND

- F/O:
  . 1F22 ALTM
  . 1E21 VERT SP IND

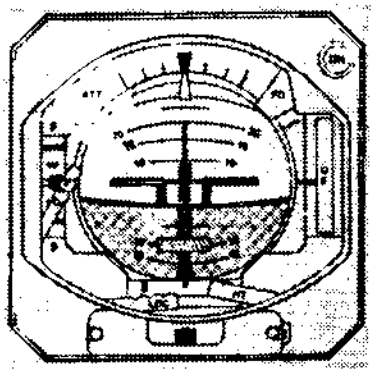
- If flag remains in view, instrument is at fault.

   ALT INSTR SOURCE
   SELECT SW----------UNL

May be able to regain normal operation, otherwise return to [ALTN].

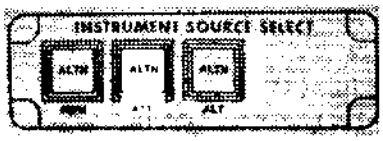
END OF PROCEDURE

ATTITUDE FLAG – ATT



Indicates failure of gyro supplying information to the ADI.

1. ATT INSTR SOURCE SELECT SW----------LCH [ALTN]



- Selects No. 3 vertical gyro for attitude information.
- May be selected by both pilots at the same time.
- Autopilot associated with failed system should not be used.

A. *IF FLAG CLEARS AND NORMAL SYSTEM RESET DESIRED:*

2. AFFECTED ATT C/B----------PULL THEN RESET

- 1F2 CAPT ADI
- 1F20 F/O ADI
- 1G6 VG/INS-1 (CAPT ADI)
- 1G24 INS/VERT GYRO (F/O ADI)
- 1E24 INS-3/GYRO 3 (Alternate, both sides)

OR

3. ATT INSTR SOURCE SELECT SW----------UNL — May be able to regain normal operation, otherwise return to [ALTN].

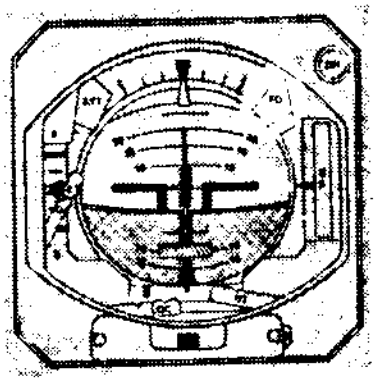
STOP **STOP** **STOP**

B. *IF ATT FLAG REMAINS:*

2. ATTITUDE DISPLAY----------DISREGARD — Use standby horizon indicator.

END OF PROCEDURE

FLIGHT DIRECTOR FAIL FLAG — FD



Indicates one of the following:

- Flight director data output from the affected APFDS computer has failed.
- ADI has lost the capability to correctly display flight director data.
- VHF NAV frequency selected is not compatible with captured APFDS mode.

1. **VHF NAV FREQUENCY .....CK**

2. **FLIGHT DIRECTOR SW.....CYCLE**
   If failure was due to a momentary nuisance condition, normal indications should be recovered.

END OF PROCEDURE

GPWS - GLIDE SLOPE ALERT — GS

1. ***IF GS OCCURS WHILE RECEIVING A VALID GLIDE SLOPE SIGNAL AND THE PILOT FLYING INTENDS TO REMAIN ON GLIDEPATH:***
   RETURN AIRCRAFT TO GLIDE SLOPE OR EXECUTE MISSED APPROACH

   V
   V
   V

   OR

   V
   V
   V

   IF GS IS EVALUATED TO BE A NUISANCE, OR IF THE PILOT FLYING SPECIFICALLY INTENDS NOT TO FOLLOW A VALID GLIDE SLOPE SIGNAL:
   GS .....PRESS
   - Either pilot can disarm GS.
   - Permissible to deactivate Glide Slope Alert mode when:
     - An ILS approach is made to one runway and the landing is made on a parallel runway.
     - An ILS approach is made to circling minimums followed by a circling approach to another runway.
     - The glide slope touchdown point is substantially displaced from the runway threshold and the Captain elects to use this additional runway for landing.
     - Making a backcourse approach.

END OF PROCEDURE

GPWS

PULL UP WARNING – PULL UP

- When PULL UP warning occurs and the cause is not apparent, IMMEDIATELY ALTER THE AIRCRAFT FLIGHT PATH SUFFICIENTLY TO STOP WARNING.

- When PULL UP warning occurs and it can be determined that:
  . Adequate terrain clearance will be assured to produce a safe approach and landing by visual or electronic glideslope reference, and
  . Aircraft is in proper gear/flap configuration, then
  The system may be deactivated.

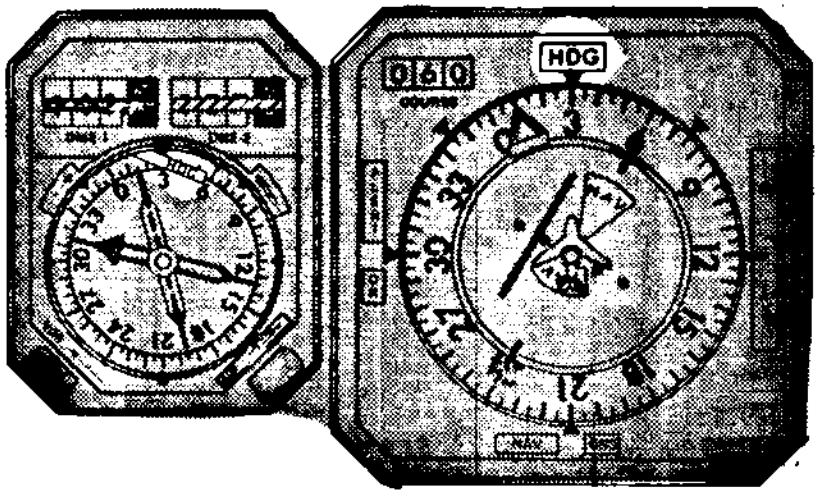
1. *IF THE GPWS IS DEACTIVATED (INHIBIT SWITCH USED):*
   RECORD IN THE AIRCRAFT LOGBOOK

   - Whenever the GPWS is inhibited, the date and time must be entered in the Aircraft Logbook.
   - Inhibit GPWS for the following emergency or abnormal conditions that would produce a "not in landing configuration" warning:

     GEAR HANDLE NOT DOWN
     . Ditching
     . Gear Up Landing
     . Manual Gear Extension

     FLAPS LESS THAN 30°
     . Two Engines Inoperative
     . Three Engine Flameout
     . No Flap - No Slat Landing
     . No Flap - Full Slat Landing
     . Partial Flap - Full Slat Landing
     . Slat Malfunction.
     . Reverse Thrust In Flight (Engine 1 or 3)

END OF PROCEDURE



HSI HDG FLAG AND/OR RMI HDG FLAG

Indicates unreliable compass card information.

1. **C/B's** ..... **PULL THEN RESET**

No. 1 Compass System		No. 2 Compass System	
1G5	DIR GYRO	1G23	DIR GYRO
1G7	CMPS COUPLER	1G26	CMPS CPLR
1K19	CMPS CPLR-1	1J19	CMPS CPLR-2
1K24	CMPS CPLR-1	1D27	INSTR XFMR NO. 3
1F3	CAPT HSI	1F21	F/O HSI
1F5	INSTR XFMR NO. 1	1D9	INSTR XFMR NO. 2
1E20	CAPT RDDMI	1E3	F/O RDDMI

2. ***IF HDG FLAG REMAINS:***
COMPASS CONTROL PANEL ..... **SELECT DG**

3. **HEADING SET CONTROL** ..... **SLEW AS NEEDED**
   - Update to correct heading for remainder of flight.

END OF PROCEDURE

CIRCUIT BREAKER GUIDE CHART

The following chart is not intended to be procedural, but to provide guides which may be helpful in relation to instrument conditions observed.

CONDITION/FLAG	CIRCUIT BREAKERS	REMARKS
AS, MACH or V_{mo} in view.	CAPT IAS/MACH ..... 1F1 F/O IAS/MACH 1F19	Crosscheck against standby instruments. If no airspeed/Mach data available due to damaged radome, pitot, etc., see ODM Abnormal Section for "Operation Without Airspeed Indicators."
Altimeter OFF and/or SSC in view.	CAPT ALTM ..... 1F4 F/O ALTM 1F22	Crosscheck with other altimeters.
VSI OFF in view.	CAPT VERT SP IND ..... 1E4 F/O VERT SP IND 1E21	Crosscheck for VSI and altimeter disagreement.
SAT and/or TAS OFF flags in view.	SAT/TAS ..... 1F27 F/O IAS/MACH ..... 1F19 F/O ADC 1G27	No. 2 ADC provides SAT/TAS data. There is no alternate source selection. Pull C/B; wait five seconds before reset. On the ground, TEMP PROBES operating will cause SAT and TAS OFF flags due to no cooling airflow.
ATTITUDE or ATT MON on comparator in view.	CAPT ADI ..... 1F2 F/O ADI ..... 1F20 VG/INS-1 ..... 1G6 INS/VERT GYRO 1G24	The associated autopilot (A or B) should not be used. The affected radar system may not be stabilized.
	INS-3/GYRO 1E24	Alternate ADI attitude source.
HEADING	**CAPTAIN:** CAPT RDDMI ..... 1E20 CAPT HSI ..... 1F3 INSTR XFMR NO. 1 ..... 1F5 DIR GYRO ..... 1G5 CMPS CPLR 1 ..... 1K19 RDDMI NO. 1 ..... 1K25 **F/O:** INSTR XFMR NO. 3 ..... 1D27 F/O RDDMI ..... 1E3 F/O HSI ..... 1F21 DIR GYRO ..... 1G23 CMPS CPLR ..... 1G26 RDDMI 2 ..... 1J20	APFDS computer on affected side will not provide heading data. Heading failure causes fail flag in HSI and opposing RDDMI. Dir gyro 1 provides for Captain's HSI, F/O's RDDMI and APFDS computer A. Dir gyro 2 provides for F/O's HSI, Captain's RDDMI and APFDS computer B.

(OPPOSITE SIDE BLANK)

ADI ATT FLAG OPERATING IN RADIO MODE

1. **ATT INSTRUMENT SOURCE SELECT.....ALTN**
   - Latch affected ATT switch.
   - Selects INS 3 for attitude information to affected ADI.
   - Both pilots may be selected to ALTN at the same time.

END OF PROCEDURE

ADI ATT FLAG OPERATING IN INS / NAV

1. **AUTOPILOT .....DISCONNECT**

2. **ATT SOURCE SELECT .....ALTN**
   Latch affected ATT switch to provide roll and pitch information from No. 3 INS.

3. **INS MODE SELECTOR.....DSTRK/STS**
   - 03 code should appear on right hand display.
   - Check and record malfunction codes.

4. **INS & NAV C/B's.....CHECK**
   Check circuit breakers on panel No. 1

END OF PROCEDURE

HSI NAV FLAG OPERATING IN INS / NAV MODE

1. **NAV SWITCH .....ALTN**
   - Latch affected NAV switch.
     - 724 located on center console.
     - 500 located on FWD panel.
   - Selects INS 3 data for display on selected HSI.
   - On Ship 724, first selected locks out the other side. On -500 aircraft, both pilots may select ALTN NAV at the same time.

END OF PROCEDURE

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Transfer Failure Tank 1A/3A		3

NONSTANDARD FUEL LOADING

Due to magnastick location, nonstandard fuel loading must be considered for dispatch fuel loads between 30,000-60,000 lbs. if either of the following occurs:
- Tank 2L or 2R quantity gauge inoperative.
- Fuel added on fuel service record is not within acceptable tolerances (±4%) for indicated fuel quantity.

TOTAL FUEL LBS.	TANKS 1 & 3 (EACH) LBS.	TANKS 2L & 2R (EACH) LBS.
30,000	5,000	10,000
32,000	6,000	↓
34,000	7,000	
36,000	8,000	
38,000	9,000	
40,000	10,000	10,000
42,000	11,000	↓
44,000	12,000	
46,000	13,000	
48,000	14,000	
50,000	15,000	10,000
52,000	16,000	↓
54,000	17,000	
56,000	18,000	
58,000	19,000	
60,000	20,000	

-Nonstandard fuel distribution for fuel loads between 30,000 and 60,000 lbs. consists of 10,000 lbs. each in 2L and 2R with remaining fuel equally distributed between tanks 1 and 3. Above 60,000 pounds use standard fuel distribution.

-This Nonstandard fuel distribution complies with all fuel limitations including "Minimum Fuel Required for Flight."

2. *FOR TAKEOFF:*
   FUEL MANAGEMENT----------NORMAL

3. *AFTER TAKEOFF:*
   CROSSFEED----------ACCOMPLISH

Crossfeed fuel from tanks 2L and 2R in accordance with Fuel Distribution/Usage chart in Book 2 or Second Officer's Checklist.

END OF PROCEDURE

RAPIDLY DECREASING FUEL QUANTITY INDICATION, TANKS 1 OR 3

Failure/separation of a fuel line fitting in the pylon (upstream of the EMERGENCY SHUTOFF VALVE) can be followed by the subsequent loss large amounts of fuel from tanks 1 or 3 within a very short period of time.

1. **ALL FUEL CROSSFEED VALVES .... CLOSE**

2. **ALL FUEL QUANTITY INDICATORS . . MONITOR**
   If fuel quantity gauge can be determined to be faulty, refer to Fuel Quantity Gauge Malfunction procedure, this section.

IF

FUEL QUANTITY IN TANKS 1 AND 3 DECREASES AT A NORMAL RATE:

3. **NORMAL OPERATION ..... RESUME.**
   Continue to periodically monitor fuel system. Re-evaluate current engine performance by comparing it to data contained in the ODM.

- - - - - - - - - - - S T O P - - - - - - - - - - -

FUEL QUANTITY IN TANKS 1 OR 3 CONTINUES TO DECREASE ABNORMALLY:

3. **AFFECTED TANK FUEL BOOST PUMPS . . OFF**

4. **AFFECTED ENGINE ..... SHUTDOWN**
   Refer to Engine Shutdown checklist, Emergency Procedures section.

5. **AFFECTED TANK VALVE ..... CLOSE**
   To control a leak occurring between the TANK VALVE and the EMERGENCY SHUTOFF VALVE, the TANK VALVE must be closed.

6. **FUEL QUANTITY INDICATOR ..... MONITOR**
   - If quantity in affected tank continues to decrease, opening crossfeed valves may cause further loss of fuel from other fuel tanks.
   - If fuel quantity ceases to decrease in affected tank, remaining fuel may be crossfed to other engines, as required.

7. **AIRCRAFT RANGE ..... COMPUTE**
   If unable to land immediately, refer to appropriate cruise data in the ODM to determine range and performance.

LAND AT NEAREST SUITABLE AIRPORT

END OF PROCEDURE

(OPPOSITE SIDE BLANK)

FUEL MIGRATION, TANK 2L OR 2R

A long time lapse between fueling and flight (with Tank 2L/2R boost pumps OFF) and/or a malfunctioning flapper valve can result in fuel migration from outboard to inboard compartment of Tank 2L and/or 2R.

1. TANK 2L and 2R PUMP SWS----------LCH

   - Operating TANK 2 pumps transfers excess fuel in the inboard compartments to the outboard compartments.
   - Transfer rate is approximately 50 lbs. per minute in each tank.
   - Using at least one tank pump in both 2L and 2R prevents unwanted fuel transfer from one tank to the other.

2. IF UNABLE TO REDISTRIBUTE FUEL PROPERLY BEFORE PUSHBACK:
   SP 3921----------CK

   - In the event of fuel migration from one tank 2L/2R compartment into another, ground transfer of fuel prior to flight is required unless ALL of the following conditions are met:

   SP 3930 - L-1011-100/200
   SP 3935 - L-1011-500

   (a) Each compartment contains at least the minimum fuel specified in the "Minimum Fuel - Tank 2" Chart (SP 3921.9)

   (b) The total fuel migration plus the wing-to-wing lateral fuel imbalance is less than 1500 lbs.

   (c) The ZFW and Takeoff C.G. is at least 0.1 MAC unit inside the loading envelope limits (SP 3921. 10) for each 300 lbs. of migrated fuel.

3. IF LIMITS ARE EXCEEDED:
   TANK TO TANK TRANSFER-----ACCOMPLISH

   See SP 3583 for Tank-to-Tank Transfer procedure.

   - This can only be accomplished by a fueling crew on the ground.

END OF PROCEDURE

TANK PUMP LOW – LOW

1. AFFECTED TANK QTY----------CK
   - Verify tank quantity.
   - If 2L or 2R tanks affected, check INBD QTY.
   - If tanks 1 or 3 affected on -100/200/500 aircraft, check TANK 1A/3A QTY. If migrated fuel contained in either alternate refer to ALTERNATE TANK FUEL MIGRATION procedure.
2. TANK PUMP SW----------UNL
3. TANK PUMP C/B'S----------CK
   Check circuit breakers on row 3U.

A. *IF ANY BOOST PUMP CIRCUIT BREAKER POPPED:*

4. AFFECTED TANK PUMP SW--LEAVE UNL
   Do not reset popped breaker.

OR

B. *IF BOOST PUMP CIRCUIT BREAKERS ARE IN:*

4. AFFECTED C/B'S---PULL THEN RESET
   Pull and reset one time.

5. TANK PUMP SW----------LCH

6. *IF* LOW *AGAIN:*
   TANK PUMP SW----------UNL
   Normal fuel system operation is possible with one pump in each tank inoperative.

   IF INOP PUMP IS IN TANK 2L OR 2R:
   ONE PUMP SW IN OPPOSITE NO. 2 TANK----------UNL
   - Assists fuel flow equalizer to maintain lateral balance.
   - If both pumps fail in either No. 2 tank, unlatch both TANK PUMPS switches in opposite No. 2 tank to prevent a lateral imbalance from developing.

7. *IF BOTH PUMPS IN A TANK ARE INOPERATIVE ABOVE 25,000':*
   ALL CROSSFEED VALVES SWS---------LCH
   LATERAL BALANCE----------MONITOR
   AIRCRAFT RANGE----------CK

   Until Crossfeed Valves are opened: FUEL PRESSURE may illuminate above 30,000'.

   AT 25,000' AND BELOW:
   FUEL MANAGEMENT----------CONSIDER

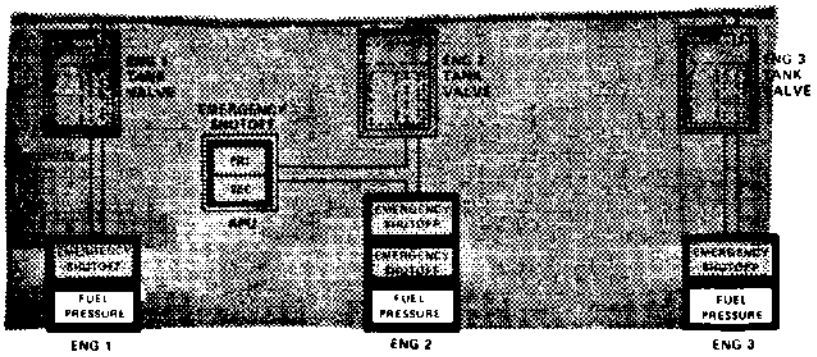
   FOR LANDING:
   ALL OPERABLE TANK PUMPS SWS------LCH
   ALL CROSSFEED VALVES SWS---------LCH

   - Normal fuel management can be maintained if:
     . At fuel loads less than 154,000 lbs., tank with inoperative pumps is 1 or 3.
     . At fuel loads above 154,000 lbs., tank with inoperative pumps is 2L or 2R.
   - Do not attempt to suction feed more than one engine from the affected tank.

If fuel jettison is necessary, overall dump rate will be reduced because of inability to dump from affected tank.

END OF PROCEDURE

FUEL PRESSURE LOW — FUEL PRESSURE



FUEL PRESSURE may be caused by:
- Fuel starvation
- Clogged fuel filter
- Engine driven low pressure pump failure
- Gear box failure

1. **TANK PUMPS SWS** (Boost) ..... **LCH**
   Verify all switches are latched.

2. **CROSSFEEDS** ..... **LCH**
   Assures fuel supply available while troubleshooting.

3. **ENG TANK VALVE SWITCH** ..... **CK**
   Verify engine tank valve switch is latched and flowbar is illuminated.

4. **AFFECTED TANK QTY** ..... **CK**
   - Verify tank quantity.
   - If 2L or 2R tanks affected, check INBD QTY.
   - If tanks 1 or 3 affected on –100/200/500 aircraft, check TANK 1A/3A QTY. **If migrated fuel contained in either alternate refer to ALTERNATE TANK FUEL MIGRATION procedure.**

WHEN TIME PERMITS:

5. **N_1 RPM** ..... **REDUCE 5%** (AGRESSIVE)
   Causes a momentary decrease in differential across the fuel filter.

   FUEL PRESSURE ..... **CK**
   - If **FUEL PRESSURE** blinks, filter is clogged.
   - If **FUEL PRESSURE** steady, low pressure pump or gear box has failed.

6. **N_1 RPM** ..... **RESTORE**
   Record above indications.

7. ***IF INDICATION OF GEAR BOX FAILURE OCCURS:***
   - Gear box failure will be indicated by abnormal operation of:
     - Fuel flow regulator.
     - High pressure fuel pumps (engine will flameout if this fails).
     - Hydraulic pump
     - IDG
     - N_3 Tachometer generator
     - Oil pumps

   ENGINE SHUTDOWN ..... **ACCOMPLISH**
   - See Emergency Procedures.

END OF PROCEDURE

FUEL IMBALANCE IN-FLIGHT —TANKS 2L OR 2R

Procedure applies if unequal quantity exists between 2L & 2R

1. **TANK PUMPS SWS (HIGH QUANTITY TANK).....LCH FB'S**

2. **TANK PUMPS SWS (LOW QUANTITY TANK).....UNL**
   Flow equalizer stops. Fuel bypass opens allowing fuel to feed only from the tank with PUMPS switches latched.

3. FUEL QUANTITY.....MONITOR
   Fuel imbalance between tanks should begin to decrease.
   NOTE: If fuel imbalance increases, or remains unchanged, an internal plumbing failure is indicated. CROSSFEED VALVES and 2L and 2R TANK PUMPS will have to be unlatched to prevent additional transfer of fuel.

4. **WHEN TANK QUANTITIES ARE EQUAL: NORMAL OPERATION.....RESUME**

END OF PROCEDURE

FUEL IMBALANCE IN-FLIGHT — TANKS 1 OR 3

(See Blue Pages for -500 or Ship 724)

Procedure applies if unequal quantity exists between 1 & 3.

1. **TANK PUMPS SWS (HIGH QTY TANK SYSTEM) ...LCH FB'S**

2. **ALL CROSSFEED VALVE SWS ...LCH FB'S**

3. **REMAINING TANK PUMPS SWS.....UNL**

4. ***WHEN TANK QUANTITIES ARE EQUAL:*** **NORMAL OPERATION.....RESUME**

END OF PROCEDURE

2L OR 2R INBD QUANTITY LOW – LOW

LOW indicates inboard quantity is below 700 lbs.

1. ALL CROSSFEED VALVES SWS--------LCH

2. AFFECTED INBD SW----------LCH QTY

   - Monitor inboard quantity.
   - Confirm fuel is transferring from the outboard compartment to the inboard.

   NOTE:
   Nose high attitudes or maneuvering may cause LOW whenever 2L or 2R inboard quantity is less than 1,000 lbs. even though fuel transfer is normal.

3. *IF OUTBOARD FUEL IS NOT TRANSFERRING:*
   TANK 2L AND 2R PUMP SWS---------UNL

   - Maintains lateral balance between tanks 2L and 2R.
   - Ensure all other TANK PUMPS switches are latched.

   AIRCRAFT RANGE----------CK

   Determine range based on useable fuel in tanks 1 and 3.

END OF PROCEDURE

FUEL QUANTITY GAUGE MALFUNCTION

When any fuel quantity gauge is inoperative:
- Operate equal number of tank pumps in 2L and 2R to maintain equal quantity in both tanks.
- If tanks 1 and 3 are used to crossfeed fuel to all engines operate equal number of tank pumps in tanks 1 and 3.
- During jettisoning, minimum fuel quantity protection is not provided for the tank with the inoperative gauge.

1. AFFECTED FUEL QUANTITY INDICATOR C/B--------PULL THEN RESET
   - Indicated fuel quantity will remain at last powered indication.
   - 3T2 (Tank) 1
   - 3T3 (Tank) 2L
   - 3T4 (Tank) 2R
   - 3T5 (Tank and Totalizer) 3

2. *IF MALFUNCTION PERSISTS:*
   QUANTITY TEST BUTTON----------PRESS
   - Hold to produce a full scale signal.
   - A quantity sensing malfunction is indicated if readings are less than full scale.
   - Do not use any quantity indicator or totalizer unless it reads full scale during test.

   FUEL QUANTITY AND FUEL USED INDICATIONS----------COMPARE

   Consider the following if fuel crossfeeding has <u>not</u> been accomplished:
   - If totalizer operation is normal, quantity should equal departure fuel minus the total of the FUEL USED indications.
   - Individual tank quantity should equal the fuel in that tank at departure minus that engine's FUEL USED.
   - Fuel quantity in the tank with a malfunctioning indicator will equal totalizer quantity minus the sum of the remaining quantity indicators.

   If crossfeed required with both a quantity gauge <u>and</u> totalizer inoperative, refer to worksheet on facing page.

   FOR APPROACH AND LANDING:
   ALL TANK PUMPS SWS----------LCH
   ALL CROSSFEED VALVES SWS---------LCH

END OF PROCEDURE

FUEL QUANTITY GAUGE AND TOTALIZER INOPERATIVE WORKSHEET

A fuel log should be maintained if both a quantity gauge and a totalizer are inoperative and crossfeeding is required. A fuel log is illustrated for your convenience.

INSTRUCTIONS FOR USE

1. ADD TOTAL FUEL USED
2. ADD TOTAL SHOWN ON GAUGES
3. INSERT TAKEOFF FUEL LOAD
4. SUBTRACT TOTAL FUEL USED
5. GIVES FUEL REMAINING
6. SUBTRACT QTY SHOWN ON GAUGES
7. GIVES QTY IN TANK WITH INOP GAUGE

	CONFIGURATION	TANK TO ENG	REGN X FEED	END X FEED	BEFORE LDG	
	READING	1	2	3	4	
FUEL USED	1	2950	4,010	10,900	23,640	
	2	3020	4,150	11,190	23,950	
	3	2990	4,020	10,950	23,700	
	TOTAL	8960	12,180	33,040	71,290	
OPERATIVE	2L	INOP	INOP	INOP	INOP	
GAUGE	1	22,050	21,000	21,000	8,050	
QUANTITY	3	21,900	20,850	20,850	8,020	
	2R	21,050	20,400	10,400	4,050	
	TOTAL	65,000	62,250	52,250	20,120	
TAKEOFF FUEL LOAD		96,000	96,000	96,000	96,000	
–TOTAL FUEL USED		8,960	12,180	33,040	71,290	
=FUEL REMAINING		87,040	83,820	62,960	24,710	
–TOTAL OPER GAUGE QTY		65,000	62,250	52,250	20,120	
=INOP GAUGE QTY		22,040	21,570	10,710	4,590	
TAKEOFF GROSS WEIGHT		407,000	407,000	407,000	407,000	
–TOTAL FUEL USED		8,960	12,180	33,040	71,290	
=ACTUAL GROSS WEIGHT		398,040	394,820	373,960	335,710	

CONFIGURATION						
READING						
FUEL USED	1					
	2					
	3					
TOTAL						
OPERATIVE	2L					
GAUGE	1					
QUANTITY	3					
	2R					
TOTAL						
TAKEOFF FUEL LOAD						
–TOTAL FUEL USED						
=FUEL REMAINING						
–TOTAL OPER. GAUGE QTY						
=INOP GAUGE QTY						
TAKEOFF GROSS WEIGHT						
–TOTAL FUEL USED						
=ACTUAL GROSS WEIGHT						

FUEL JETTISON

Fuel jettison/dump is not required in order to reduce to maximum structural landing weight if the Captain determines the aircraft can be landed safely at the existing weight; and the Overweight Landing requirements contained in Section 5 of the Flight Operations Procedures Manual (FOPM) are observed.

- Flaps up: jettison only between 180 and 300 knots.
- Flaps down: from 4 to 22 degrees, V_2 +20 maximum.
- Should automatically terminate with 24,000 lbs. remaining (1 & 3 ..8000 lbs. ea., 2L & 2R ..4000 lbs. ea.).
- Fuel Jettison Time Table is provided on page 11.

1. **DESIRED FUEL QUANTITY....DETERMINE**
   - Monitor fuel dumping carefully to ensure fuel jettison is terminated with the desired amount of fuel on board.

2. **ALL TANK PUMP SWS .....LCH**
   - It is not possible to dump fuel from a tank, if both of its tank pumps are inoperative.
   - If only one tank pump is operating in a tank, the jettison rate is reduced.

3. **FUEL JETTISON MASTER SW ...LCH** OPEN
   - The cross-ship isolation valve and both wingtip jettison valve disagreement lights illuminate momentarily, as the valves (3) open.
   - OPEN illuminates to indicate switch position.
   - TANK DUMP switches are armed.

4. **TANK DUMP SWITCH(ES)....LCH** DUMP
   - Latch DUMP switch(es) for tank(s) from which fuel is to be dumped.
   - Disagreement light(s) illuminate momentarily as valve(s) open. The 2L and 2R disagreement lights cycle once inboard quantity reaches 900 pounds.
   - DUMP illuminates to indicate switch position.

CAUTION:
IF AFTER THE NEXT TWO STEPS FUEL JETTISON FAILS TO TERMINATE, CLOSE FUEL CROSSFEED VALVES IMMEDIATELY, AND CHECK CIRCUIT BREAKERS.
- 3U 11,12 - JTSN & DEFUEL 1 & 3
- 3U3 - JTSN & DEFUEL 2L & 2R

When Fuel Jettison Is Complete:

5. **TANK DUMP SWS .....UNL**
   - Disagreement lights should illuminate momentarily as the valves close, unless they have already been closed by the automatic shutoff system.
   - DUMP lights extinguish.

6. **FUEL JETTISON MASTER SW.....UNL**
   - Disagreement lights (3) should illuminate momentarily as the cross-ship isolation valve and both wingtip jettison valves close.

END OF PROCEDURE

MINIMUM FUEL APPROACH

Procedure applies if fuel quantity is less than 2,000 lbs. in any tank (1,000 lbs. in 2L or 2R):

1. **ALL TANK PUMPS SWS.....LCH**
   TANK PUMPS LOW may illuminate momentarily during maneuvering.

2. **ALL CROSSFEED VALVES SWS .....LCH**

CAUTION;
AVOID STEEP TURNS, SUSTAINED NOSE HIGH ATTITUDES, AND RAPID ACCELERATIONS.

END OF PROCEDURE

FUEL JETTISON TIME TABLE

- The following table displays the time required to jettison from various fuel loads to 24,000 lbs. with all pumps operating. The time required to jettison fuel to reduce to maximum landing weight at nominal fuel loads is contained on the Takeoff Data Power Chart.

TOTAL FUEL LOAD	TIME TO JETTISON TO 24,000 LBS.	OVERALL AVERAGE JETTISON RATE TO 24,000 LBS.
210,000	44.0 minutes	3,900 lbs. per min.
200,000	41.0	↓
190,000	37.5	
180,000	37.0	
170,000	↓	
160,000		3,600
150,000		3,400
140,000		3,100
130,000		2,800
120,000		2,600
110,000		2,400
100,000	35.5	2,200
90,000	34.0	1,900
80,000	31.5	1,800
70,000	26.5	1,700
60,000	23.0	1,600
50,000	17.5	1,500
40,000	10.5	↓
30,000	4.0	
24,000	- 0 -	

The jettison rate shown is the overall average rate from the total fuel load down to 24,000 lbs. remaining. For example, the average jettison rate from 80,000 lbs. down to 24,000 lbs. is 1,800 lbs. per minute.

NOTE:
Time required to jettison total fuel loads between 110,000 and 170,000 lbs. is constant because of the time required to jettison from tanks 2L and 2R.

-The following tables display the time required to jettison from each tank from various fuel loads to minimum fuel for the respective tank.

TANK 1 OR 3		
FUEL	TIME TO JETTISON TO 8,000 LBS.	AVERAGE JETTISON RATE
80,000	44.0 minutes	1,725 lbs. per minute(EACH TANK)
70,000	38.0	↓
60,000	32.0	
50,000	26.0	
40,000	19.5	
30,000	13.5	
20,000	7.5	
10,000	1.0	
8,000	- 0 -	

TANK 2L OR 2R		
FUEL	TIME TO JETTISON TO 4,000 LBS.	AVERAGE JETTISON RATE
25,700	37.0 minutes	1,150 lbs. per minute(EACH TANK)
22,000	34.0	↓
18,000	30.5	
14,000	26.5	
10,000	22.5	
9,000	20.0	250
8,000	16.0	↓
7,000	12.0	
6,000	8.0	
5,000	4.0	
4,000	- 0 -	

END

FUEL MIGRATION ALTERNATE TANK 1A/3A

If total fuel is 160,000 lbs. or less, any fuel in tanks 1A or 3A should be considered as having migrated.

1. AFFECTED MAIN TANK PUMP SWS----------LCH — Ensures fuel pressure available to transfer migrated fuel.

2. 1A/3A XFR SW(S)----------CK/LCH

3. 1A/3A QTY SW(S)----------LCH — Monitor fuel quantity to verify migrated fuel is transferring to main tanks.

IF FUEL QUANTITY IN ALTERNATE DOES NOT DECREASE:

4. 1A/3A XFR SW(S)----------UNL — Stops normal transfer of fuel.

5. Affected GRAVITY SW(S)----------LCH

ALT TANK QTY 1A or 3A	TOTAL QTY 1+1A or 3+3A
10000	17700
9000	15100
8000	12700
7000	10500
6000	8500
5000	6800
4000	5400
3000	4700
2500	3500

- The gravity transfer is designed to supply fuel at a rate faster than it can be used by an engine. However, it may not begin until main tank fuel has been significantly reduced. Therefore close monitoring of quantities is required.
- The accompanying chart shows the fuel level that must exist in the alternate tank in relation to total main and alternate fuel for gravity transfer to begin.
- Main tank pumps will begin to lose prime when main tank quantity drops below approximately 1200 lbs. If Gravity XFR is selected after Tank Pump LOW lights illuminate, it will take approximately three minutes for gravity flow to transfer sufficient fuel to re-prime the pumps.
- Gravity transfer will continue until all but 1400 lbs. (800 lbs. on Ship 724) is remaining in the alternates.

END OF PROCEDURE

FUEL JETTISON

Fuel jettison/dump is not required in order to reduce to maximum structural landing weight if the Captain determines the aircraft can be landed safely at the existing weight; and the Overweight Landing requirements contained in Section 5 of the Flight Operations Procedures Manual (FOPM) are observed.

- Flaps up: jettison only between 180 and 300 knots.
- Flaps down: from 4 to 22 degrees, V_2 +20 maximum.
- Should automatically terminate with 24,000 lbs. remaining (1 & 3 ..8000 lbs. ea., 2L & 2R ..4000 lbs. ea.).
- Fuel Jettison Time Table is provided on page 11.

1. **DESIRED FUEL QUANTITY....DETERMINE**
   - Monitor fuel dumping carefully to ensure fuel jettison is terminated with the desired amount of fuel on board.

2. **ALL TANK PUMP SWS .....LCH**
   - It is not possible to dump fuel from a tank, if both of its tank pumps are inoperative.
   - If only one tank pump is operating in a tank, the jettison rate is reduced.

3. **FUEL JETTISON MASTER SW ...LCH** OPEN
   - The cross-ship isolation valve and both wingtip jettison valve disagreement lights illuminate momentarily, as the valves (3) open.
   - OPEN illuminates to indicate switch position.
   - TANK DUMP switches are armed.
   - TANK 1A and TANK 3A GRAVITY TRANSFER VALVE disagreement lights illuminate momentarily, and XFR illuminates as valves open.
   - (-500 only) TANK 1A and TANK 3A normal TRANSFER VALVE disagreement lights illuminate momentarily and OPEN extinguishes as valves close automatically to ensure adequate fuel flow to the engines.

4. **TANK 1A/3A NORMAL XFR SWS ....UNL**
   - (-500) - Ensures transfer valves are closed during jettison. Check OPEN lights extinguished.
   - (-200) Normal transfer switches are unlatched to reduce motive flow to ejectors. Disagreement lights illuminate momentarily and XFR lights extinguish as valves close. The 1A/3A scavenge system will augment gravity transfer during fuel jettison.

5. **1A/3A GRAVITY TRANSFER SWS .....**
   .....CK XFR
   - If XFR is not illuminated, latch the GRAVITY TRANSFER switch(es).

6. **TANK DUMP SWITCH(ES)....LCH** DUMP
   - Latch DUMP switch(es) for tank(s) from which fuel is to be dumped.
   - Disagreement light(s) illuminate momentarily as valve(s) open.
   - Tank 2L, 2R, 1 main and 3 main disagreement lights will cycle as the automatic shutoff level is reached in these tanks because the transfer rate is lower than the jettison rate.

   CAUTION:
   IF AFTER THE NEXT TWO STEPS FUEL JETTISON FAILS TO TERMINATE, CLOSE FUEL CROSSFEED VALVES IMMEDIATELY AND CHECK CIRCUIT BREAKERS.
   - 3U11, 12 - JTSN & DEFUEL 1 & 3
   - 3U3 - JTSN & DEFUEL 2L & 2R

When Fuel Jettison Is Complete:

7. **TANK DUMP SWS .....UNL**
   - Disagreement lights should illuminate momentarily as the valves close unless they have been closed by the automatic shutoff system.
   - DUMP lights extinguish.

8. **FUEL JETTISON MASTER SW.....UNL**
   - Disagreement lights(3) should illuminate momentarily as the cross-ship isolation valve and both wingtip jettison valves close.
   - XFR should be extinguished in 1A/3A GRAVITY TRANSFER SWS.

9. **TANK 1A/3A NORMAL XFR SWS ....LCH**

10. **1A/3A QTY .....CK**
    - If 1A/3A still contain fuel, check that normal transfer is continuing.

END OF PROCEDURE

FUEL IMBALANCE IN-FLIGHT — TANKS 1 OR 3

Procedure applies if unequal quantity exists between 1 & 3.

1. **BOTH TANK PUMPS SWS (HIGH QTY TANK SYSTEM)...LCH FB'S**

2. **ALL CROSSFEED VALVES SWS ...LCH FB'S**

3. **ONE TANK PUMP SW FOR LOW QUANTITY TANK SYSTEM .....UNL**
   - Leave one TANK PUMP switch latched in tank systems 1 and 3 at all times to assure continuous fuel transfer and scavenging of the alternate tanks.
   - Fuel will be consumed from the heavier tank due to greater flow available from two operating tank pumps.

4. ***WHEN TANK QUANTITIES ARE EQUAL:***
   NORMAL OPERATION.....RESUME

END OF PROCEDURE

TRANSFER FAILURE TANK 1A/3A FUEL

Procedure applies when fuel in either 1A and/or 3A tanks fails to transfer into the respective main(s).

1. **1A/3A XFR SWS.....UNL**
   Blue disagreement and **OPEN** lights extinguish when valve is closed.

2. **GRAVITY TRANSFER SW(S) ...LCH XFR**
   XFR illuminates to indicate switch position. Blue disagreement light extinguishes when valve is open.

3. **FUEL QUANTITY .....MONITOR**
   Gravity transfer will not begin until fuel level in affected main tank is reduced to levels indicated in chart on page 1 of -100/200/500 Fuel Abnormals.
   - If gravity transfer is selected after TANK PUMP **LOW** lights illuminate, it will take approximately three minutes for gravity flow to transfer sufficient fuel to re-prime the pumps.
   - Gravity transfer will continue until all but 1400 lbs. (800 lbs. on Ship 724) is remaining in the alternate(s).

END OF PROCEDURE

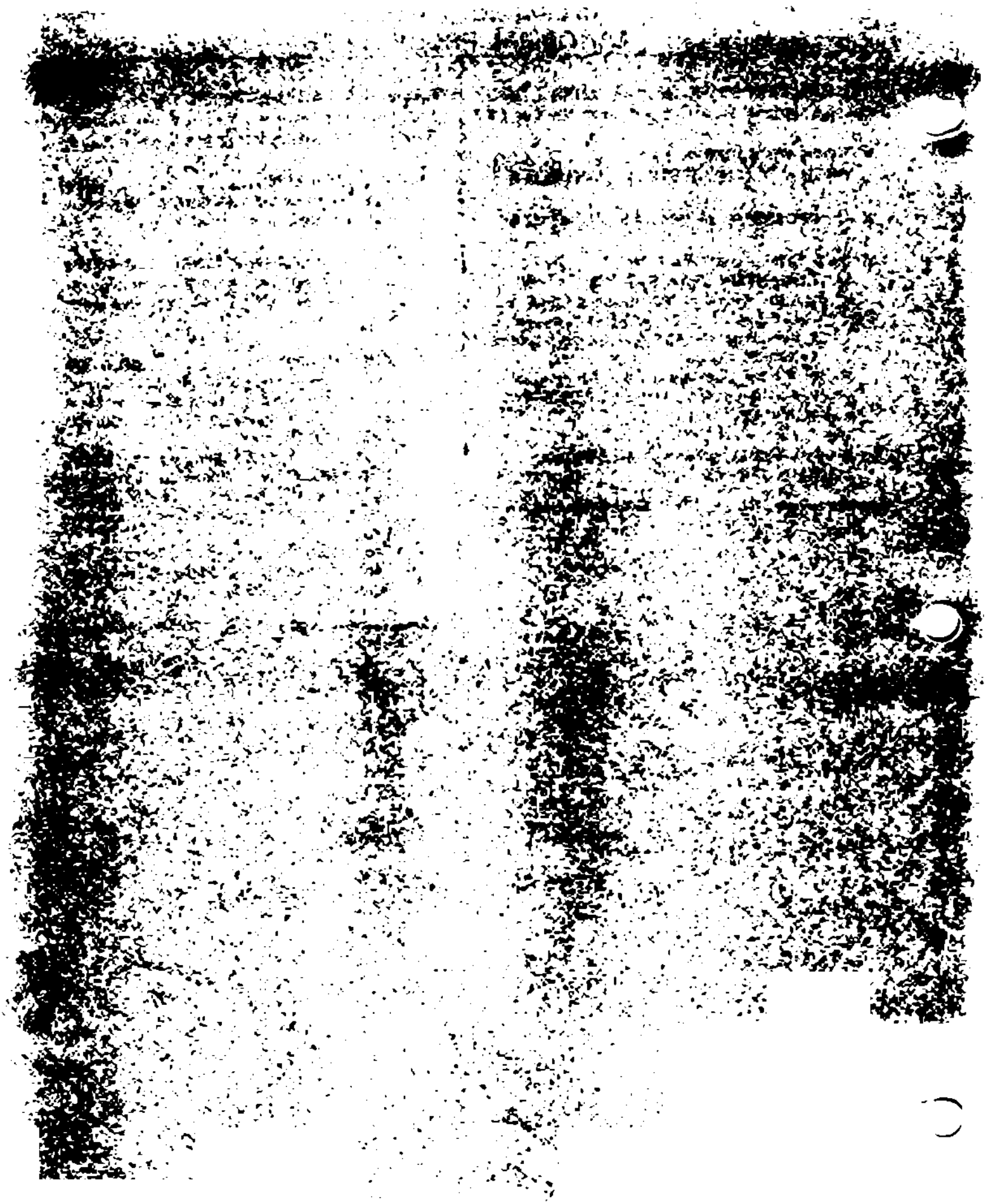


TABLE OF CONTENTS

(MALFUNCTION) (LIGHT INDICATIONS)

ATM
- Case Drain High Temperature ..... HI TEM 2
- Lube Low Pressure ..... LO PR 2
- Lube High Temperature ..... HI TEM 2
- Pump Output Low Pressure ..... LO PR 2

ENGINE DRIVEN PUMP
- Case Drain High Temperature ..... HI TEM 3
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RESERVOIR
- High Temperature ..... HI TEM 4
- Low Quantity ..... LO QTY 5
- Quantity Decreasing (Leak) 5

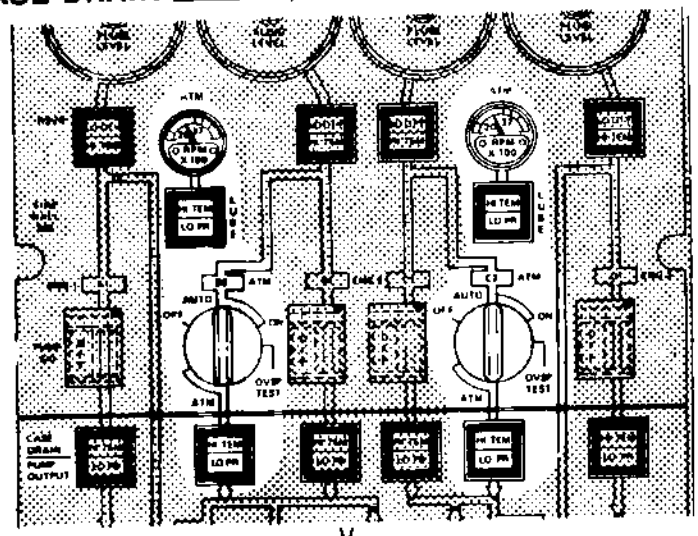
SINGLE SYSTEM FAILURE
- A Failed 6
- B Failed 6
- C Failed 7
- D Failed 7

TAKEOFF WITH RAT EXTENDED 8

-500 DIFFERENCES
- None

CROSS REFERENCE
- Hydraulic System Failure -2 or 3 Systems ..... EMERGENCY PROCEDURES

ATM LUBE LO PR, LUBE HI TEM, CASE DRAIN HI TEM, OR PUMP OUTPUT LO PR



<<<<<<<<<<<<<<<<< *IF* >>>>>>>>>>>>>>>>>

LUBE HI TEM OR CASE DRAIN HI TEM OR LUBE LO PR:

1. **ATM ..... OFF**

2. ***FOR TAKEOFF AND LANDING:***
   B_3 OR C_3 AC PUMP ..... LCH ON
   Provides hydraulic backup for system with inoperative ATM.

3. ***IF C_2 ATM IS INOPERATIVE:***
   GEAR DOWN RUNWAY ALLOWABLE AND CLIMB LIMIT WEIGHT SP3923...CHECK
   Climb Limit Weight may be restrictive.

   FOR TAKEOFF ...USE NORMAL THRUST

STOP

PUMP OUTPUT LOW PR:

1. **PNEUMATIC PRESSURE ..... CK**
   May be caused by insufficient pneumatic pressure.

2. **ATM RPM ..... CK**
   If no RPM, attempt one reset.

3. ***IF LO PR REMAINS:***
   ATM ..... OFF

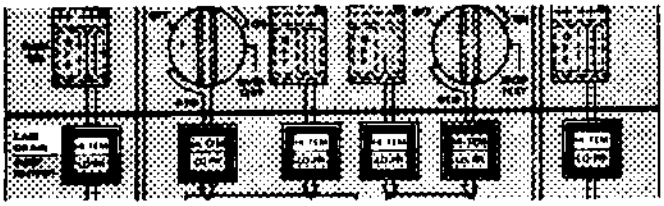
4. ***FOR TAKEOFF AND LANDING:***
   B_3 OR C_3 AC PUMP ..... LCH ON
   Provides hydraulic backup for system with inoperative ATM.

5. ***IF C_2 ATM IS INOPERATIVE:***
   GEAR DOWN RUNWAY ALLOWABLE AND CLIMB LIMIT WEIGHT SP3923...CHECK
   Climb Limit Weight may be restrictive.

   FOR TAKEOFF ...USE NORMAL THRUST

END OF PROCEDURE

ENGINE DRIVEN PUMP CASE DRAIN - HI TEM



Indicates an overheated pump.

1. **ATM OR PTU.....ON**

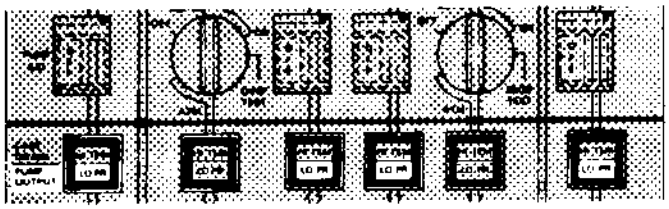
2. **ENG PUMP S/O SW.....UNL OFF**
   - Unlatching the switch depressurizes the pump to reduce heat generation.
   - If the B system engine driven pump is unlatched consider use of the RAT if all other pumps in B system system are inoperative. However, for operational planning purposes, B system must be considered "FAILED" if the RAT is the only means of supplying B system pressure (See B FAILED procedure on page 6 of this section).

3. ***LANDING WITH B OR C PUMP UNL OFF:***
   B_3 OR C_3 AC PUMP.....LCH ON
   Provides hydraulic backup for ATM.

   CAUTION:
   EXCEPT IN AN EMERGENCY, DO NOT USE AC PUMPS ALONE TO POWER B OR C HYDRAULIC SYSTEM.
   Hydraulic flight control components could be damaged due to low volume output of AC pumps.

END OF PROCEDURE

ENGINE DRIVEN PUMP PUMP OUTPUT - LO PR



1. **FLUID LEVEL.....CK**
   If LO QTY, see page 5.

2. **ATM OR PTU.....ON**

3. **PUMP S/O SW.....UNL OFF**
   LO PR extinguishes.

4. ***IF HYDRAULIC PRESSURE REMAINS LOW:***
   ATM OR PTU.....OFF

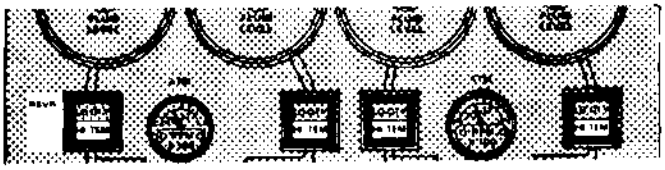
   SINGLE SYSTEM FAILURE PROCEDURE.....ACCOMPLISH
   See pages 6 and 7.

5. ***LANDING WITH B OR C PUMP UNL OFF:***
   B_3 OR C_3 AC PUMP.....LCH ON
   Provides hydraulic backup for ATM.

   CAUTION:
   EXCEPT IN AN EMERGENCY, DO NOT USE AC PUMPS ALONE TO POWER B OR C HYDRAULIC SYSTEM.
   Hydraulic flight control components could be damaged due to low volume output of AC pumps.

END OF PROCEDURE

RESERVOIR
HIGH TEMPERATURE - HI TEM



- High reservoir temperatures can be caused by excessive internal leakage and high ambient temperatures.
- After **HI TEM** extinguishes, record total time and highest temperature reached while HI TEM illuminated.

1. **HYDRAULIC SYSTEM TEMP.....CK**
   Verify condition. HI TEM is set to illuminate in caution band.

IF

ON THE GROUND:

2. **FLIGHT CONTROLS .....ACTUATE**
   Smoothly operate flight controls to cause flow through system and cool hydraulic fluid.

3. ***IF HI TEM REMAINS:***
   ATM OR PTU.....ON
   ENG PUMP S/O .....UNL OFF
   Shutting off engine driven pump should provide system cooling.
   NOTE: When HI TEM extinguishes, the Engine Driven Pump may be restored.

4. ***IF HI TEM STILL REMAINS:***
   ATM OR PTU.....OFF
   Have maintenance investigate.

CAUTION:
IF B SYSTEM SHUTDOWN:
SELECT C SYSTEM BRAKES BEFORE TAXI

STOP

IN-FLIGHT:

2. **NORMAL OPERATION .....CONTINUE**

3. ***IF ENG CASE DRAIN HI TEM ALSO ILLUMINATES:***
   ATM OR PTU.....ON
   ENG PUMP S/O .....UNL OFF
   Shutting off engine driven pump should provide system cooling.

4. ***IF HYDRAULIC SYSTEM TEMP CONTINUES TO RISE:***
   ATM OR PTU.....OFF

   SINGLE SYSTEM FAILURE PROCEDURE .....ACCOMPLISH
   See pages 6 and 7.
   NOTE: In an emergency, the system may be pressurized until after landing.

END OF PROCEDURE

RESERVOIR QUANTITY DECREASING (LEAK)

Fluid level is steadily decreasing. Failure of hydraulic quantity temperature compensator may cause indicator to slowly drop to as low as ½. Consider any drop below ½ to be a valid indication of a system leak.

1. **ATM OR PTU.....ON**

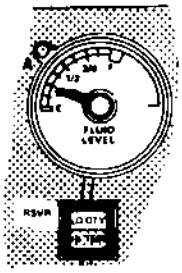
2. **PUMP S/O SW.....UNL OFF**

3. ***IF FLUID LOSS CONTINUES:***
   ATM OR PTU.....OFF

   SINGLE SYSTEM FAILURE PROCEDURE.....ACCOMPLISH
   See pages 6 and 7.

END OF PROCEDURE

RESERVOIR LOW QUANTITY - LO QTY



1. **FLUID LEVEL.....CK**
   Verify condition. LO QTY is designed to illuminate at ¼ tank.

2. ***IF LO QTY VERIFIED:***
   ENG PUMP S/O SW.....UNL OFF
   ATM OR PTU.....OFF
   FLUID LEVEL.....CK

IF

FLUID LOSS CONTINUES:

CAUTION:
DO NOT RE-PRESSURIZE THE SYSTEM.
Fluid depletion is imminent and pump will ingest air, contributing to pump failure.

3. **SINGLE SYSTEM FAILURE PROCEDURE.....ACCOMPLISH**
   See pages 6 and 7.

STOP

IF NO FURTHER FLUID LOSS:

3. **ATM OR PTU.....ON**

4. ***IF FLUID LOSS CONTINUES:***
   ATM OR PTU.....OFF

CAUTION:
DO NOT RE-PRESSURIZE THE SYSTEM.
Fluid depletion is imminent and pump will ingest air, contibuting to pump failure.

5. **SINGLE SYSTEM FAILURE PROCEDURE.....ACCOMPLISH**
   See pages 6 and 7.

END OF PROCEDURE

SINGLE SYSTEM FAILURE

A FAILED

IF THIS IS THE SECOND SYSTEM FAILURE SEE EMERGENCY PROCEDURES SECTION: HYD FAILURE 2 OR 3 SYSTEMS ***ON PAGE 26.***

ITEMS LOST:

Autopilot B	2L Spoiler
Dual Autoland	A System to Flaps/Slats
Automatic Rudder Backup	Tailskid
A System to Rudder	YAW SAS Channel 2
A System to Stabilizer	ACS Channel 2 (-500)

STOP

SINGLE SYSTEM FAILURE

B FAILED

For operational planning purposes, in accordance with the AFM, B system must be considered failed if the RAT is the only means of supplying pressure. The RAT will provide B hydraulic system pressure at reduced flow at airspeeds above 150 KIAS. B hydraulic sytem will be unavailable for landing.

IF THIS IS THE SECOND SYSTEM FAILURE SEE EMERGENCY PROCEDURES SECTION: HYD FAILURE 2 OR 3 SYSTEMS ***ON PAGE 26.***

1. **BRAKE SYSTEM SELECTOR . . . ALT SYS C**

CAUTION:
DO NOT SET PARK BRAKES UNLESS SYSTEM B BRAKE PRESSURE IS AVAILABLE.
Pulling PARK brake knob automatically selects NORM SYS B brakes. Unless NORM SYS B accumulator pressure is available, brakes must be held manually until chocks are in place.

ITEMS LOST:

Autopilot A	1, 4, & 6L & R Spoilers
Dual Autoland	RAT for B System Backup
Norm Sys B Brakes	PTU Backup For System A
B System to Rudder	YAW SAS Channel 1
B System to Stabilizer	ACS Channel 1 (-500)

STOP

SINGLE SYSTEM FAILURE

C FAILED

IF THIS IS THE SECOND SYSTEM FAILURE SEE EMERGENCY PROCEDURES SECTION: HYD FAILURE 2 OR 3 SYSTEMS *ON PAGE 26.*

1. DLC/AUTO SPLR SWS ..... UNL OFF

2. LANDING GEAR MANUAL EXTENSION CHECKLIST ..... ACCOMPLISH

3. *AFTER TOUCHDOWN:*
   GROUND SPOILERS... MANUALLY ACTUATE

   DIRECTIONAL CONTROL... BRAKES AND ASYMMETRIC THRUST
   Nose wheel steering not available; aircraft must be towed clear of the runway.

ITEMS LOST:

Auto Ground Spoilers/DLC
Normal Gear Extension
Nose Wheel Steering
Alternate Sys C Brakes
C System to Rudder
Regulated Rudder Power in Cruise
C System to Stabilizer
3 & 5 L&R Spoilers
C System to Flaps/Slats
PTU Backup for System D

STOP

SINGLE SYSTEM FAILURE

D FAILED

IF THIS IS THE SECOND SYSTEM FAILURE SEE EMERGENCY PROCEDURES SECTION: HYD FAILURE 2 OR 3 SYSTEMS *ON PAGE 26.*

ITEMS LOST:

D System to Stabilizer
2R Spoiler
ACS Channel 2 (-500)

STOP

END OF PROCEDURE

TAKEOFF WITH RAT EXTENDED

- Not permitted on runways contaminated with snow or slush, or heavy rain when temperatures are below 40°F (4.5°C).
- Environmental considerations not withstanding RAT Extended Takeoffs are permitted if:
  - A visual inspection is performed before each takeoff for damage and/or evidence of hydraulic leaks.

As Soon as Possible After Takeoff, Verify that the RAT Can pressurize B System:

B-1 HYD SYS ENGINE DRIVEN PUMP . . . . . UNL/OFF

B-2 ATM CHECK . . . . . NOT RUNNING

B SYS HYD PRESS . . . . . 2850 PSI MIN

- **If B system cannot be pressurized with the RAT, land as soon as practical.**

B-1 PUMP . . . . . LATCH/FB

ENTER RAT EXTENDED TIME (TAKEOFF TO LANDING) IN LOG BOOK.

- Cannot exceed 40 hours

———END OF PROCEDURE———

TABLE OF CONTENTS

(MALFUNCTION) (LIGHT INDICATIONS)

AIR DATA HEAT

Alpha Probe Heat Failure---------- OFF ----------3
Pitot Heat Failure---------- OFF ----------2
Temperature Probe Heat Failure---------- OFF ----------3

WINDSHIELD/SIDE WINDOW

Damage In-Flight----------7
Electrical Arcing----------8
Heat---------- FAULT ----------6

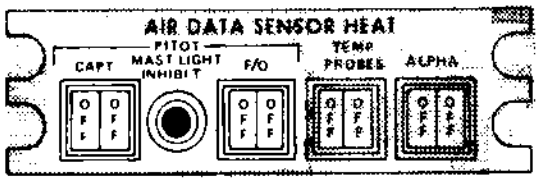
WING ANTI-ICE

Duct Failure---------- DUCT FAIL ----------4
Overheat---------- OVHT ----------5
Valve Failed Closed----------4

MISCELLANEOUS

Drain Mast Heater---------- MID 1 or AFT 1, MID 2 or AFT 2--8

PITOT HEAT FAILURE - OFF



- Failure of a pitot probe heater or pitot mast heater will illuminate PITOT OFF.
- Formation of ice on the affected pitot/static port may cause erroneous indications of airspeed, altitude, and rate of climb. Other systems affected could be autothrottles, Mach trim, Mach feel, rudder limiting, LRS, autoflight modes, altitude reporting, and GPWS.

1. AFFECTED PITOT C/B--- PULL THEN RESET

CAPT:
- Right OFF, 2E18 CAPT SEC
- Left OFF, 3H14 PRI PITOT HEAT

F/O:
- Right OFF, 2E16 F/O SEC
- Left OFF, 2E17 F/O PRIM

2. *IF OFF REMAINS:*
MAST LIGHT INHIBIT BUTTON------PRESS

A. *IF OFF REMAINS:*

3. FLIGHT INSTRUMENTS AND SYSTEMS----------MONITOR

- Pitot probe heater has failed.
- Respective air data computer information may be inaccurate.
- Refer to Flight Instruments, POM Book II, for items affected by ADC 1 and 2.
- In the event both Capt's and F/O's pitot heat is lost, refer to the Operational Data Manual, Abnormal Section, for "Operation Without Airspeed Indicators."

OR

STOP STOP STOP

B. *IF OFF EXTINGUISHES:*

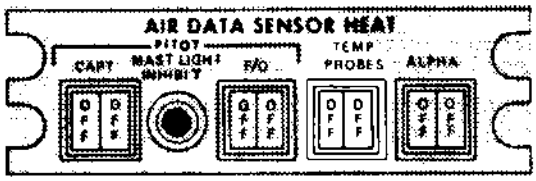
3. NORMAL OPERATION----------CONTINUE

- Pitot mast heater has failed.
- OFF remains extinguished when MAST LIGHT INHIBIT button released.

NOTE:
Do not cycle the PITOT switch, otherwise OFF will illuminate again, and pitot probe heater monitoring will not be available.

END OF PROCEDURE

TEMPERATURE PROBE HEAT FAILURE - OFF

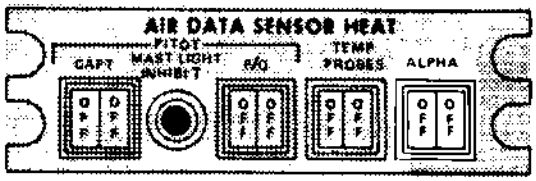


- Indicates loss of probe heat to respective side.
- Temperature related indications remain valid unless ice forms on probe.
- If icing is present, autopilot bank angles may be excessive in heading select mode. SAT, TAT, TAS, and rated EPR indications may not be valid.

1. AFFECTED TOTAL TEMP C/B----------PULL THEN RESET
   - Left OFF , 2E19
   - Right OFF , 2E20

END OF PROCEDURE

ALPHA PROBE HEAT FAILURE - OFF



Formation of ice on the affected alpha probe may cause nuisance stall warnings and autothrottle failure (ATS FAIL , FAIL).

1. AFFECTED C/B'S-------PULL THEN RESET

   For left ALPHA OFF:
   - 1B5 L AOA
   - 2E12 LEFT ALPHA HEAT

   For right ALPHA OFF:
   - 2F1 R AOA
   - 2E22 RIGHT ALPHA HEAT

2. *IF OFF REMAINS:*

   FOR LEFT ALPHA:
   ATS 1 SW----------UNL OFF
   OR STALL WARN 1 SW----------UNL OFF

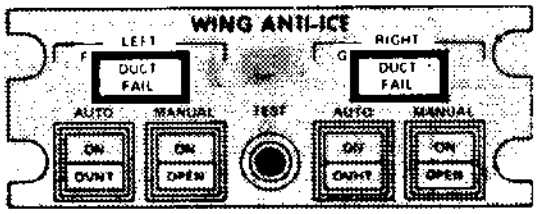
   FOR RIGHT ALPHA:
   ATS 2 SW----------UNL OFF
   STALL WARN 2 SW----------UNL OFF

   - ATS:
     . Prevents dual channel failure.
     . ATS and Speed Command operation continue on remaining channel.
   - Stall Warning:
     . Prevents nuisance stick shaker action.
     . Stall warning operation continues on remaining channel.

END OF PROCEDURE

WING ANTI-ICE DUCT FAILURE - DUCT FAIL

- Structure surrounding ducts is capable of withstanding maximum temperatures for at least five minutes.



1. AREA OVHT LOOPS----------CK - See Pneumatic Abnormal Section for description of Loop Check.

2. *IF* DUCT FAIL *VERIFIED:*
   LEFT AND RIGHT
   WING ANTI-ICE AUTO/MANUAL SWS---UNL
   Isolates affected duct, and prevents assymetric wing anti-ice.

3. *AFTER 30 SECONDS, IF* DUCT FAIL *REMAINS:*
   AFFECTED
   ENG ISLN VALVE SW----------UNL OFF
   AFFECTED CROSSBLEED SW------UNL OFF
   HI PRESS SW----------UNL OFF

END OF PROCEDURE

WING ANTI-ICE VALVE FAILED CLOSED

IF ONE OR BOTH WING ANTI-ICE VALVES FAIL CLOSED:

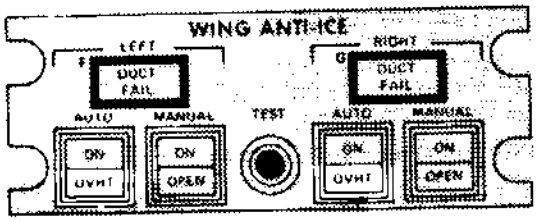
1. MANUAL SW(S)----------LCH ON
   OPEN should also illuminate.

2. *IF OPEN REMAINS EXTINGUISHED:*
   WING ANTI-ICE CONT
   C/B 2D22----------PULL THEN RESET

3. *IF OPEN REMAINS EXTINGUISHED AND WING ANTI-ICE REQUIRED:*
   WING ANTI-ICE
   TEST BUTTON----------PRESS AND HOLD
   - Bypasses air/ground sensing switch.
   - Avoid icing conditions unless both wing anti-ice valves OPEN.

END OF PROCEDURE

WING ANTI-ICE OVERHEAT - OVHT



Slat skin temperature has exceeded normal limits.

1. AFFECTED WING ANTI-ICE
   AUTO SW----------UNL
   - OPEN extinguishes.
   - OVHT extinguishes as slat skin cools.

A. *WHEN* OVHT *EXTINGUISHES:*

2. AFFECTED WING ANTI-ICE
   MANUAL SW----------LCH ON
   Continue to cycle the MANUAL switch as OVHT illuminates and extinguishes.

OR

STOP **STOP** **STOP**

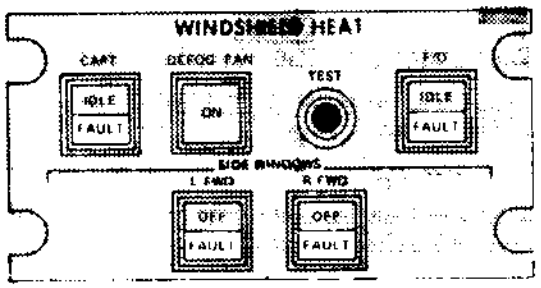
B. *IF* OPEN *REMAINS AFTER AUTO SWITCH UNLATCHED:*
Wing anti-ice valve has failed to close.

2. AFFECTED WING
   ENG ISLN VALVE SW----------UNL OFF

3. AFFECTED
   CROSSBLEED VALVE SW---------UNL OFF
   - The No. 1 or 3 pack will not be available.
   - Cycle the ENG ISLN VALVE switch as OVHT illuminates and extinguishes.

END OF PROCEDURE

WINDSHIELD/SIDE WINDOW HEAT FAULT - FAULT



A flashing FAULT indicates the overheat protection circuit is operating to prevent windshield overheating, and no crew action is required.

A steady FAULT indicates insufficient heat is being applied to the affected window. Attempt one reset.

1. AFFECTED CONT C/B----------PULL

   - Control C/B must be out before resetting power C/B.

   - CAPT WINDSHIELD HEAT:
     . 2B15 CONT
     . 2B16 PWR

   - F/O WINDSHIELD HEAT:
     . 2B18 CONT
     . 2B19 PWR

   - L FWD SIDE WINDOW:
     . 2B20 FWD CONT
     . 2B12 FWD PWR

   - R FWD SIDE WINDOW:
     . 2B20 FWD CONT
     . 2B21 FWD PWR

2. AFFECTED PWR C/B-----PULL THEN RESET

3. CONT C/B----------RESET

END OF PROCEDURE

WINDSHIELD DAMAGE IN-FLIGHT

- The front windshields have a thin glass outer layer that protects the basic windshield from abrasion.
- Strength of the windshield is unaffected if the outer glass layer shatters.

1. **AFFECTED WINDSHIELD C/B'S .....PULL**
   - CAPT WINDSHIELD HEAT:
     - 2B15 CONT
     - 2B16 PWR
   - F/O WINDSHIELD HEAT:
     - 2B18 CONT
     - 2B19 PWR
     - Outer glass layer should contract and break away as windshield chills.

2. ***IF FORWARD VISIBILITY IS UNSATISFACTORY:***
   WINDSHIELD WASHER FLUID .....DISCHARGE
   - Accelerates glass break away.
   - May be used in freezing temperatures.
   - Windshield wiper may be used sparingly at approach speeds to help clear away glass and increase visibility.
   - Use washer fluid on Captain's side first until windshield is cleared up or until fluid is gone. Apply remaining fluid to F/O's windshield.

   CAUTION:
   DO NOT DISCHARGE RAIN REPELLENT FLUID.

   NOTE: Flight through rain also accelerates glass break away.

3. ***IF FORWARD VISIBILITY IS UNSATISFACTORY DURING APPROACH:***
   AUTOLAND.....ACCOMPLISH
   - Ensure proper facilities available.
   - The soft underlayer of the windshield may be distorted by impact of hail or heavy rain. Extending flight as feasible in warm ambient temperatures may allow the surface to smooth and improve vision.

END OF PROCEDURE

WINDSHIELD/SIDE WINDOW ELECTRICAL ARCING

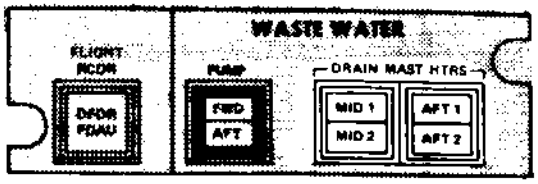
Electrical arcing, hot spots or fine burnout lines will be visible on windshield or side windows. Lamination separation or "bubbling" may occur.

1. AFFECTED WINDSHIELD OR SIDE WINDOW C/B'S----------PULL

   - CAPT WINDSHIELD HEAT:
     . 2B15 CONT
     . 2B16 PWR
   - F/O WINDSHIELD HEAT:
     . 2B18 CONT
     . 2B19 PWR
   - L FWD SIDE WINDOW:
     . 2B20 FWD CONT
     . 2B12 FWD PWR
   - R FWD SIDE WINDOW:
     . 2B20 FWD CONT
     . 2B21 FWD PWR

END OF PROCEDURE

DRAIN MAST HEATER FAILURE - MID 1 OR AFT 1, MID 2 OR AFT 2



- With switches latched, No. 1 heaters operate.
- With switches unlatched, No. 2 heaters operate.

1. OPPOSITE HEATER----------SELECT

   - Latch or unlatch appropriate switch to extinguish legend.
   - Selected heater's legend illuminates until DRAIN MAST reaches proper temperature.

END OF PROCEDURE

END

TABLE OF CONTENTS

(MALFUNCTION)	(LIGHT INDICATIONS)	(PAGE)
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Gear Lever - NEUTRAL		4
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LANDING GEAR LEVER WILL NOT MOVE TO UP POSITION		3
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MANUAL LANDING GEAR EXTENSION		6
NOSE/MAIN GEAR UP LANDING		8

BRAKE ANTI-SKID FAILURE — OFF OR F / R

Anti-skid system failure may be indicated by:

- OFF illuminated with Landing Gear Lever DOWN, park brakes released, and ANTI-SKID switch latched.
- Any F and/or R lights illuminated except during test, or when actual skid detected.
- Any F and/or R lights remaining extinguished during test.

1. **C/B'S 2F22, 2G17, 2G18 AND 2G22.....PULL THEN RESET**

2. **ANTI-SKID SYSTEM .....TEST**
   - To test system:
     - Park brakes released.
     - BRAKE SYS SELECT switch NORM SYS B.
     - Landing Gear Lever DOWN.
     - ANTI-SKID switch latched ON
   - When TEST is pressed, ON and all F and R lights (8) should illuminate.
   - Test both NORM and ALT systems.

IF

OFF REMAINS ILLUMINATED FOLLOWING TEST:

3. **BRAKE SYS SELECT .....ALT SYS C**
   If OFF extinguishes, anti-skid protection is available using alternate C system.

4. ***IF OFF REMAINS:***
   ANTI-SKID SW.....UNL
   - **Apply Brakes Cautiously.**
   - Anti-skid protection is not available. Use Anti-Skid Inop. performance in ARM.

STOP

F OR R LIGHT(S) REMAIN EXTINGUISHED DURING TEST

3. **BEST SYSTEM...SELECT**
   - F or R light(s) which remain extinguished during test indicates anti-skid protection is not available for associated wheel(s).
   - Select brake system which provides the greatest number of wheels with anti-skid protection. Apply brakes carefully.

STOP

F OR R LIGHT(S) REMAIN ILLUMINATED FOLLOWING TEST:

3. **BEST SYSTEM...SELECT**
   - F or R light(s) which remain illuminated following test indicate affected wheels will not provide any braking while anti-skid system is ON
   - Select brake system which provides the greatest number of wheels with brakes.

4. **BRAKING REQUIREMENTS.....CONSIDER**
   If more than one wheel is affected anti-skid braking effectiveness may be reduced significantly. Depending on conditions consider turning Anti-Skid system OFF and using Anti-Skid Inop. performance in ARM.

END OF PROCEDURE

LANDING GEAR LEVER WILL NOT MOVE TO UP POSITION

Check for following annunciations:

- TRUCK indicates one or both main trucks are not level.
- FWD AVIONIC AIR OVBD indicates left main gear strut is not extended. MID OVBD indicates right main gear strut is not extended.

IF

ANY TRUCK OR OVBD LIGHT ILLUMINATED:

DO NOT RETRACT GEAR UNLESS EMERGENCY REQUIRES GEAR UP CLIMB PERFORMANCE

- Damage to main gear wheel well(s) may occur if gear is retracted.
- If retraction required, press DOWN LOCK REL button to release gear lever downlock.

1. **DLC/AUTO SPLR SWS.....UNL OFF**
   Prevents inadvertent deployment of ground spoilers when landing flaps selected.

2. ***AFTER TOUCHDOWN:***
   GROUND SPOILERS...MANUALLY ACTUATE

STOP

ALL* TRUCK *AND* OVBD *LIGHTS EXTINGUISHED:

1. **PILOT AND S/O WARNING, CAUTION, ADVISORY LIGHTS.....TEST**

2. ***IF ALL OF THE ABOVE LIGHTS TEST:***
   TRUCK LEVEL C/B 2F16...PULL THEN RESET
   2F16 energizes both the TRUCK light and the landing gear downlock solenoid.

3. ***IF ALL OF THE ABOVE LIGHTS REMAIN EXTINGUISHED, LANDING GEAR MAY BE RETRACTED:***
   - Trucks are level, and struts are extended.

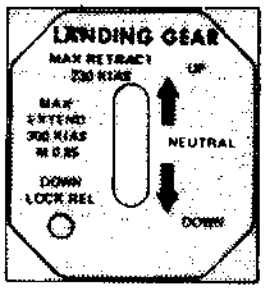
   DOWN LOCK REL BUTTON.....PRESS
   LANDING GEAR LEVER.....UP

END OF PROCEDURE

LANDING GEAR DOOR OPEN - DOOR , IN TRANS

GEAR LEVER — NEUTRAL

Malfunctioning door can be identified on S/O's annunciator panel.



1. **GEAR LEVER.....UP**
   If **DOOR** and **IN TRANS** lights extinguish, continue flight with gear lever UP.

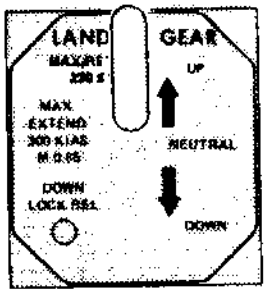
2. ***IF*** **DOOR , IN TRANS** ***REMAIN:***
   GEAR LEVER — UP
   PROCEDURE.....ACCOMPLISH
   See following procedure.

END OF PROCEDURE

LANDING GEAR DOOR OPEN - DOOR , IN TRANS

GEAR LEVER — UP

Malfunctioning door can be identified on S/O's annunciator panel.



1. ***WHEN BELOW 300 KIAS:***
   GEAR LEVER.....DOWN

2. **ALTERNATE HYDRAULIC LANDING GEAR EXTENSION SW.....DOWN PAUSE UP**
   Repositions the uplock hooks to allow proper engagement during subsequent retraction.

<<<<<<<<<<<<<<<<<*IF*>>>>>>>>>>>>>>>>>

DOOR , IN TRANS ***REMAIN:***

3. **LEAVE GEAR EXTENDED**
   Retraction may cause damage to doors.

4. **AIRSPEED MAXIMUM.....270**
   Review S.P. 3923 in ARM.

STOP

DOOR *AND* IN TRANS *EXTINGUISH:*

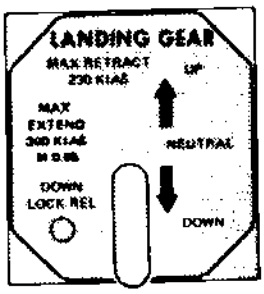
3. **NOSE STEERING WHEEL.....CENTER**

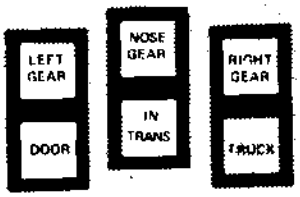
4. **GEAR LEVER.....UP**

5. ***IF*** **DOOR , IN TRANS** ***AGAIN:***
   AIRSPEED MAX.....270
   Review S.P. 3923 in ARM.

END OF PROCEDURE

LANDING GEAR DOOR OPEN - DOOR, IN TRANS GEAR LEVER — DOWN





Malfunctioning door can be identified on S/O's annunciator panel.

1. ***WITH THREE GREEN LIGHTS ALSO ILLUMINATED:***
   LANDING GEAR ..... LEAVE EXTENDED
   Retraction may damage doors.

2. **AIRSPEED MAXIMUM 270**

END OF PROCEDURE

MAIN LANDING GEAR GREEN LIGHT WITH GEAR LEVER UP

Main landing gear failing to retract may be caused by a bypass valve malfunction. Cycling the MECHANICAL RELEASES as rapidly as possible may reset the valve.

1. **LANDING GEAR LEVER ..... UP**

2. **AIRSPEED MAXIMUM 230**
   Establish speed before cycling MECHANICAL RELEASES.

3. **AFFECTED MAIN MECHANICAL RELEASE ..... PULL THEN STOW AS RAPIDLY AS POSSIBLE**
   May be necessary to repeat this step several times.

4. ***IF GEAR WILL NOT RETRACT:***
   AIRSPEED MAXIMUM 270

END OF PROCEDURE

MANUAL LANDING GEAR EXTENSION

This procedure applies when one or more landing gear fails to extend and lock normally.

- May be caused by:
  - Loss of C hydraulic system.
  - Loss of DC Buses 2 and 3.
  - Electrical failure of control valve.
  - Cocked nose wheel.
- The MECHANICAL RELEASES are the primary backup to the normal landing gear extension system.
- The ALTERNATE HYDRAULIC LANDING GEAR EXTENSION switch is used if the MECHANICAL RELEASES fail to provide gear down indications.
- A test of green lights should be accomplished before initiating this procedure if that is the only indication of a malfunction after extending the gear normally.

1. **AIRSPEED MAXIMUM.....230**
   Speed may have to be reduced to as low as 190K for nose gear to extend to the down-and-locked position.

2. ***IF IT IS ONLY THE NOSE GEAR THAT WILL NOT EXTEND:***
   NOSE GEAR STEERING WHEEL.....CENTER & HOLD
   Nose gear may not extend unless gear is centered in wheel well.

   GEAR LEVER.....UP
   Relieves jammed nose gear.

3. **GEAR LEVER.....DOWN**
   - Nose gear will extend if jam due to cocked wheel. Release nose gear steering wheel.
   - Gear lever must be down before flaps are extended beyond 30° to prevent inadvertent auto ground spoiler deployment in-flight.

4. ***IF LANDING GEAR LEVER CANNOT BE MOVED TO THE DOWN POSITION:***
   DLC/AUTO SPLR SWS.....UNL OFF
   After touchdown, manually actuate spoilers.

5. **NOSE AND BYPASS MECHANICAL RELEASE HANDLE...PULL**
   - **Nosewheel steering will not be available after landing.**
   - Bypasses C hydraulic system, and ports fluid in the extend and retract lines to return.
   - Monitor C system reservoir temperature. With bypass handle pulled, high fluid flow rates through the bypass valve may cause an increase in fluid temperature.

CAUTION:
DO NOT STOW NOSE AND BYPASS HANDLE IF NO GEAR OPERATED NORMALLY WHEN THE GEAR HANDLE WAS ORIGINALLY PLACED IN THE DOWN POSITION OR IF THE GEAR HANDLE CANNNOT BE PLACED IN THE DOWN POSITION.

NOTE: If ANY gear operated normally when the gear handle was originally placed in the DOWN POSITION, NOSE AND BYPASS HANDLE may be stowed to restore nosewheel steering.

6. **LEFT AND RIGHT MAIN MECHANICAL RELEASES.....PULL**
   Normal final indications:
   - Three green.
   - Two red, DOOR, and IN TRANS, since main gear doors remains open.
   - Disregard TRUCK if illuminated.

7. ***IF ANY GREEN LIGHT REMAINS EXTINGUISHED:***
   LIGHTS, WARNING, CAUTION, ADVISORY TEST.....ACCOMPLISH
   Relamp as necessary, then repeat test.

   IF GREEN LIGHTS ILLUMINATE DURING TEST:
   ALTERNATE HYDRAULIC LANDING GEAR EXTENSION SW.....ACTUATE
   Ports C hydraulic system brake accumulator pressure to release uplocks, and then pressurizes the downlock actuators.

   V
   V
   THEN >>>>>>>>>>>>>>>>>>>>

MANUAL LANDING GEAR EXTENSION (CONTINUED)

8. ***IF ANY GREEN LIGHTS STILL REMAIN EXTINGUISHED:***
AFFECTED MECHANICAL DOWNLOCK INDICATOR .....CK
- To view main gear indicators:
  - Latch WG FLOOD ON at night.
  - Indicators are visible through the overwing cabin windows (⅔ aft on wing in front of No.1 spoiler panel).
  - Indicators protrude 1/2 inch above wing surface when gear is down and locked.
- To view nose gear indicator:
  - Latch WHL WELL ON.
  - Nose gear viewer is located on aft bulkhead of forward avionics compartment.
  - Pull knob adjacent to view lens to remove dust cover from view lens.
  - Look for two red rods aligned within one rod diameter.
  - The nose gear position may also be determined by turning the NOSE WHEEL LANDING and TAXI light ON. These lights will only illuminate if the nose gear is down and locked.

NOTE: Unless all three landing gear are down and locked, an unsilenceable horn sounds when flaps are extended to 33°. If horn is silent with flaps in this position, it is a further indication that all three landing gear are safely extended.

- Power may be removed from the warning horn by pulling C/B 1L12.

9. ***UNLESS ALL THREE GEAR ARE CONFIRMED TO BE DOWN AND LOCKED:***
NOSE/MAIN GEAR UP LANDING PROCEDURE....ACCOMPLISH
- See Page 8.
- Unless all three gear are definitely down and locked, prepare for the affected gear(s) to retract during landing.
- Do not taxi, if unsafe gear indication remains after landing, until gear pin(s) have been installed.

END OF PROCEDURE

NOSE/MAIN GEAR UP LANDING

Preference is to land with any gear available, rather than all retracted, even if only one gear extends and locks.

1. **TOWER.....NOTIFY**
   Ensure availability of fire trucks, ambulances, etc.

2. **FLIGHT ATTENDANTS .....NOTIFY**
   Ensure Coordinator briefs all flight attendants regarding their Emergency Evacuation duties.

3. **FUEL JETTISON .....ACCOMPLISH**
   - Manage fuel to permit slowest possible approach speeds.
   - Jettison and burn as much fuel as possible from inboard tanks.
   - Ensure fuel jettisoning system is secured prior to landing or selecting flaps beyond 22°.

4. **EMERGENCY LIGHTS .....ON**
   - Switch ON just before landing.
   - Power packs will operate for 20 minutes.
   - Have flashlights available.

5. ***IF ANY MAIN IS DOWN AND LOCKED:***
   DLC/AUTO SPLR SWS .....UNL OFF
   Prevents automatic extension of ground spoilers after touchdown.

6. **CABIN ALT SET.....2000' AGL**

7. ***WHEN DESCENDING THROUGH 2000' AGL:***
   ALL PACK SWS.....UNL
   Cabin must be depressurized prior to landing.

8. **OVERHEAD HATCH.....OPEN**
   Stow handle back into hatch cover.

9. **GPWS.....INHIBIT**

10. **CREW OXYGEN BOTTLE VALVE ...CLOSE**
    Minimizes possibility of oxygen fed fire in flight station after landing.

11. **PASSENGERS.....BRIEF**
    Final briefing should be given at least 1 minute prior to landing.

12. **BEFORE LANDING CHECKLIST .....ACCOMPLISH**

13. ***AFTER FLAPS EXTENDED TO 33°:***
    LANDING GEAR WARN HORN C/B 1L12 .....PULL
    When any gear fails to extend, aural warning cannot be silenced with Gear Horn Cutout button.

14. **GEAR UP ITEMS.....ACCOMPLISH**
    Complete appropriate items on page 9.

GEAR UP ITEMS ---- GEAR UP ITEMS ---- GEAR UP ITEMS ---- GEAR UP ITEMS

NOSE GEAR UP

15. *AFTER TOUCHDOWN:*
ENGINES NO. 1 AND 3
FUEL AND IGNITION SWS ..... OFF
ENGINES NO. 1 AND 3
FIRE PULL HANDLES ..... PULL
ENGINES NO. 1 AND 3 FIRE
EXTINGUISHER (AS REQD) ... DISCHARGE
– Use reverse thrust on engine No. 2 only.
– Be aware of nose up tendency when No. 2 is placed in reverse.
– Use manual spoilers as desired.
– As speed decreases, gently lower nose to runway prior to losing pitch control.

16. *WHEN AIRCRAFT HAS STOPPED:*
ENGINE NO. 2
FUEL AND IGNITION SW ..... OFF
ENGINE NO. 2/APU
FIRE PULL HANDLES ..... PULL
FIRE EXTINGUISHERS ..... DISCHARGE
If APU had been operating, discharge one of the No. 2 engine bottles into APU.

COMMON ITEMS (Last column) ... ACCOMPLISH

ONE MAIN GEAR UP

Plan touchdown on good gear side of runway.

15. *AFTER TOUCHDOWN, BEFORE ENGINE POD TOUCHES:*
ENGINE NO. 1 *OR* 3
FUEL AND IGNITION SW ..... OFF
ENGINE NO. 1 *OR* 3
FIRE PULL HANDLE ..... PULL
ENGINE NO. 1 *OR* 3 FIRE
EXTINGUISHER (AS REQD) ... DISCHARGE
– Immediately lower nosewheel to runway.
– **Do not deploy spoilers.**
– Maintain directional control with brakes, rudder, nosewheel steering, and reverse thrust on good gear side.
– As speed decreases, gently lower wing prior to losing lateral control.

16. *WHEN AIRCRAFT HAS STOPPED:*
ALL ENGINES
FUEL AND IGNITION SWS ..... OFF
ALL ENGINES/APU
FIRE PULL HANDLES ..... PULL

COMMON ITEMS (Last column) ... ACCOMPLISH

BOTH MAIN GEAR UP, ALL GEAR UP

- Plan flat approach.
- Touchdown at V_{REF}.

15. *AFTER TOUCHDOWN:*
ALL ENGINES
FUEL AND IGNITION SWS ..... OFF
ALL ENGINES/APU
FIRE PULL HANDLES ..... PULL
ENG 2 TANK VALVE SW ..... UNL
ALL ENGINES
FIRE EXTINGUISHERS ..... DISCHARGE
– Discharge all bottles into engines.
– If APU had been operating, discharge one of the No. 2 engine bottles into APU.

16. *WHEN AIRCRAFT HAS STOPPED:*

COMMON ITEMS (Last column) ... ACCOMPLISH

COMMON ITEMS ---- COMMON ITEMS

17. EVACUATION COMMAND ..... GIVEN
- Considering conditions, latch EVAC or alert flight attendants/passengers by PA of need to evacuate.
- Time permitting, advise flight attendants of any additional conditions which may affect evacuation.

18. BATTERY SW ..... OFF
All crewmembers proceed to evacuation station with all necessary emergency equipment.
- Captain, Forward door area (1R).
- F/O, Mid-cabin area (2R).
- S/O, Mid-cabin area (3L).

19. *POST EVACUATION:*
CLEAR THE AREA
Available crewmembers assemble passengers for orderly departure from hazardous area. Also provide directions and assistance to those who might be injured.

END OF PROCEDURE

END

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DME FAIL FLAG

- Four white dashes indicate no computed data.
- An orange (or black) and white barber pole indicates receiver failure.

If Four White Dashes:

DME IN NORM . . . . . **CK**

- Flag also appears when:
  - Station more than 200 NM away.
  - If in OVRD, station more than 400 NM away.
  - Station inoperative.

If Barber Pole:

AFFECTED DME C/B'S . **PULL THEN RESET**

- CAPT:
  - 1D5 DME
  - 1G1 VOR RCVR
  - 1E20 RDDMI
- F/O:
  - 1D23 DME
  - 1G19 VOR RCVR
  - 1E3 RDDMI

———END OF PROCEDURE———

NAV FLAG

- Indicates that reliable NAV data is not being displayed:
  - A VHF NAV radio failure or
  - A weak or invalid VOR or ILS signal.
  - FMS
  - ONS invalid

If VHF NAV failure in the VOR system, a VOR fail flag (red arrow) may also appear in the RDDMI:

VHF NAV FREQUENCY . . . . . **CK**

- Incorrect frequency may have been tuned.

RAD/NAV . . . . . **RAD**

AFFECTED VOR/HSI C/B'S . . . . . **PULL THEN RESET**

- CAPT:
  - 1F3 HSI
  - 1G1 VOR RCVR
  - 1G2 PREAMP
  - 1K21 VOR-1
- F/O:
  - 1F21 HSI
  - 1G19 VOR RCVR
  - 1G20 PREAMP
  - 1J22 VOR-2

———END OF PROCEDURE———

ONS MASTER WARNING

- A solid WRN annunciator at any time (except during a display test) indicates that the system has failed.
- A flashing WRN annunciator indicates failure of a subassembly, loss of aircraft inputs, or insufficient input data by the operator.

CLEARING A FLASHING ONS WRN ANNUNCIATOR

- The malfunction codes will automatically cycle once every two seconds.
- A flashing WRN annunciator can be extinguished (along with the accompanying malfunction code) by pressing the HLD and CLR push buttons after each code is displayed as follows:

DISPLAY SWITCH . . . . . **DTK STS**
- Malfunction code is displayed in the least significant digit position of the right display.

HOLD . . . . . **PRESS**

CLR . . . . . **PRESS**
- This clears the first displayed malfunction.
- WRN annunciator will re-illuminate if additional code is displayed.
- Continue this procedure to clear the remaining malfunction codes. When 00 is displayed, no additional malfunction codes are present.

To Recall Malfunction Codes:

CLR . . . . . **PRESS**
- Malfunction code will again appear and WRN will begin to flash.

Repeat procedure to clear all malfunction codes again.

ONS MALFUNCTION CODES			
MALF CODE	PROBLEM INDICATED	RECOMMENDED ACTION	WRN ANNUN
01	Computer check sum failed	Replace RPU.	FLASHES
02	Arithmetic check failed.	↓	↓
03	A/D converter failed.	↓	↓
04	Memory address failed.	↓	↓
05	Data check failed.	Check TAS input. If not reasonable, manually enter TAS. If problem persists, replace RPU.	↓
06	Multiple input discretes selected	Request maintenance to check discretes.	↓
7	RF/ACU failed.	Replace ACU. If problem persists, request maintenance to check RPU and cable.	↓
8	Oscillator out of tolerance.	Replace RPU.	↓
9	Oscillator not up to temperature.	Replace RPU.	↓
10	No TAS to ONS.	Check 1G8,27 Air Data Computer CB's. If ok, manually enter TAS.	↓
11	No HDG to ONS.	Check 1G5,23 DIR GYRO CB's. If ok, manually enter mag hdg.	↓
12	Neither TAS nor HDG to ONS.	Check 1G5,23 DIR GYRO CB's. If ok, manually enter TAS and MAG HDG.	↓
13	Power interrupt longer than 7 seconds.	Check POS, UTC, and DAT. If POS is estimated to have changed by more than 8 nm, update. Update UTC and DAT as necessary.	↓
14	System not synched with Omega transmission at 3 minutes from turn on.	None. System will continue sync. Usually occurs only on ground in poor reception areas.	↓
15	Incomplete initial data entry.	Make sure POS, UTC and DAT entered.	↓
17	No 26 vac to RPU.	Check 1G9 ONS1, 1E23 ONS2 CB's. Codes 19, 20 and 21 will be present.	OUT. Aircraft instrument flags indicate failure.
18	No autopilot exec.	Check autopilot CB and system.	↓
19	Synchro No. 1 output failed.	Do not use ONS for steering or HSI drive. Record codes for maintenance.	↓
20	Synchro No. 2 output failed.	↓	↓
21	Synchro No. 3 output failed.	↓	↓
22	Steering output failed.	↓	↓
23	XTK deviation output failed.	↓	↓

ONS CLEAR AMBIGUITY PROCEDURE

To Clear the Ambiguity Light, Proceed as Follows:

DISPLAY SWITCH . . . . . **AUX**

WPT **0**

- Display will be shown with **0** in the **TO** position of the **FROM/TO** display and most significant digit in upper right display is "**R**".

STA 0 . . . . . **PRESS**

CLR . . . . . **PRESS**

- The ambiguity light should extinguish within 15 seconds.
- If **AMB** annunciator remains extinguished, ambiguity is cleared. It will re-illuminate if another ambiguity occurs.
- If AMB annunciator remains illuminated or re-illuminates, ambiguity is not cleared. If aircraft is in a sunrise or sunset area, carefully watch present position display and check for reasonableness. Also, the GDOP (Geometric Dilution of Precision) and QI (Quality Index) should be checked.

To Observe These Values:

DISPLAY SWITCH . . . . . **AUX**

WPT **4**

- The left window displays GDOP.
  - If the value is 2.5 or larger, relaning is inhibited.
- The right window displays QI.
  - If the value is 07 or greater, the AMB annunciator will remain illuminated.

To Clear the AMB Annunciator, Perform the Following:

- If a known fixed point is available, perform a precision position update using VOR/DME, INS or other geographic position information. (See POM Navigation Operating Procedures)
- If a known fixed point is not available, but a "best estimate" present position (known to be within 60 nautical miles of the actual present position) is available, perform a non-precision position update. (See POM Navigation Operating Procedures)
- If neither of the above is possible, and present position displayed is known to be within 60 nautical miles of actual present position, perform the relane procedures, keeping in mind that the GDOP is 2.5 or larger relaning is inhibited.

ONS RELANE

- In a relane operation, the computer essentially goes through start-up procedures and re-synchronizes itself to the three strongest station in an attempt to resolve position discrepancies which it has detected.

To Perform Relane, Proceed as Follows:

DISPLAY SWITCH . . . . . **AUX**

WPT **4**

- The left display shows GDOP.

If GDOP Is 2.5 or Larger:

RELANING . . . . . **INHIBITED**

If GDOP Is Less Than 2.5:

WPT **0**

- **FROM/TO** display shows **0** in the **TO** position and "**R**" appears as most significant digit of right display.

STA 0 . . . . . **PRESS**

ENT . . . . . **PRESS**

- The DR annunciator will illuminate and the AMB annunciator remains illuminated.
- The computer is now comparing its displayed present position with the new data coming in during the resynchronizing process.
- The **AMB** and **DR** annunciators will extinguish when normal OMEGA/VLF navigation resumes.

ONS DR DEAD-RECKONING

- It is normal for DR light to illuminate during ground set-up and to remain until NAV status is gained.
- In flight, DR indicates that ONS automatic navigation has reverted to the dead-reckoning mode.

DISPLAY SELECTOR ..... **POS**

DISPLAY SELECTOR ..... **DTK/STS**

If No Code Displayed:

DISPLAY SELECTOR ..... **STA**

If Operating In DR Mode For Extended Periods Consider:

WIND, DRIFT ANGLE, GROUND SPEED UPDATE

- Note present position.
- Check for action/malfunction code(s)
  - Take appropriate action (see flashing WARN procedure).
- Check station status/quality to determine that reception is adequate.
- Manual update of wind, drift angle, and ground speed may be required to maintain accurate **DR** navigation. (Refer to appropriate ABNORMAL PROCEDURE for manual entry of these values.)

———END OF PROCEDURE———

ONS POWER INTERRUPTS (DISPLAYS BLANK)

- The ONS is designed to retain all essential information to resume automatic operation after a power loss. Return of power will result in one of the following.

If Power Interrupt Of Less Than Seven Seconds:

CDU ..... **OBSERVE**

OPERATOR ACTION ..... **NONE**

If Power Interrupt Greater Than Seven Seconds:

CDU ..... **OBSERVE**

HOLD BUTTON ..... **PRESS (LIGHT OFF)**

- Pressing HOLD button again will display fault codes.
- Fault code explanation is located in this section.

GMT ..... **UPDATE**

HOLD BUTTON ..... **PRESS (LIGHT ON)**

PRESENT POSITION ..... **UPDATE**

- Accomplish if position has changed by more than 8 miles by performing a precision or non-precision update.

HOLD BUTTON ..... **PRESS (LIGHT OFF)**

NAVIGATION DATA ..... **CHECK**

- DR, Status 60 or 30.

NOTE: DR will not illuminate on the ground if navigation mode (Status 01) is achieved within 2 minutes.

- Lights should extinguish within 3 minutes.
- DR, HOLD, WARN flashing, Action Code 2, Status 60 or 30.

NOTE: DR will not illuminate on the ground if navigation mode (Status 01) is achieved within 2 minutes.

- Verify that navigation information and the latitude and longitude of the waypoints are correct.

———END OF PROCEDURE———

ONS MANUAL ENTRY OF WIND

- A manual entry of wind parameters should not be made if the system is in the OMEGA/VLF navigation mode because navigation accuracy could be affected.
- Accuracy of DR navigation can be improved by manually entering wind direction and speed, which are not calculated in the DR mode.
- True airspeed must exceed 140 knots before the system will accept the entries.
- After entry, wind direction is shown in the left display and speed in the right.
- When OMEGA navigation is resumed, these values are automatically updated based on received OMEGA data.

NOTE: Both wind direction and speed must be entered before ENT push button will extinguish.

If **DR** *Annunciator Is Illuminated (System Status 03).*

DISPLAY SWITCH . . . . . **WIND**

GMT L7 . . . . . **PRESS**
- Display changes to:
  - Left display has blanked and **ENT** push button is illuminated.

WIND DIRECTION . . . . . **ENTER**
- Enter wind direction to nearest degree.

NOTE: OMEGA winds are always referenced to TRUE NORTH, so add or subtract local variation as necessary if only mag winds are available.

To Verify That Left Display Shows Entered Value.

ENT . . . . . **PRESS**
- Note that it remains illuminated.

DAT R9 . . . . . **PRESS**
- Note that right display blanks.

WIND SPEED . . . . . **ENTER**
- Enter wind speed to the nearest knot. Verify that right display is value entered.

ENT . . . . . **PRESS**
- Press ENT push button.

Note: The ENT push button is now extinguished and the displays indicate the entered values. Winds should be updated as better data or different data becomes available. If and when the OMEGA system exits the DR mode, it will automatically begin again to calculate wind, with no input from the operator.

ONS MANUAL ENTRY OF DRIFT ANGLE AND GROUND SPEED

- This function is used only in the DR mode to manually enter drift angle (DA) and ground speed (GS).
- In flight, these parameters may be periodically updated to maintain accurate DR navigation.
- When OMEGA navigation is resumed, these values are automatically updated based on received OMEGA data.

NOTE: Both drift angle and ground speed must be entered before ENT push button will extinguish.

When **DR** *Annunciator Is Illuminated:*

DISPLAY SWITCH . . . . . **AUX**

WPT SWITCH **1**

GMT L7 . . . . . **PRESS**
- Left display has blanked and **ENT** push button has illuminated.

DRIFT ANGLE . . . . . **ENTER**
- Enter drift angle to the nearest tenth of a degree. Verify entry.

Note: Drift angle must be less than 39.9°.

ENT . . . . . **PRESS**

DAT R9 . . . . . **PRESS**
- Note that right display blanks.

GROUND SPEED . . . . . **ENTER**
- Enter ground speed to the nearest knot. Verify entry.

ENT . . . . . **PRESS**
- **ENT** extinguishes.
- Press ENT push button. ENT extinguishes.
  - Verify that entered data is correct and that value of calculated wind is reasonable.

ONS MANUAL ENTRY OF TAS

When the System Displays a Flashing WRN *Annunciator With a Malfunction Code 10, a Manual TAS Input Must Be Made as Follows:*

DISPLAY SWITCH . . . . . **MH TAS**

DAT R9 . . . . . **PRESS**
- Verify that the right display blanks and ENT push button illuminates.

TAS . . . . . **ENTER**
- Enter TAS (10 to 650 knots) and verify entry.

ENT . . . . . **PRESS**

When Flashing WRN Annunciator Extinguishes:
- MAN annunciator illuminates and right numerical display flashes.
  - Update true airspeed as required.

When Manual TAS Entry Is No Longer Required:
- Repeat above steps except enter zeros.
  - **MAN** annunciator extinguishes and system resumes using aircraft input.

ONS MANUAL ENTRY OF HEADING

When the System Displays a Flashing WRN *Annunciator with a Malfunction Code 11, a Manual Heading (Magnetic) Input Must Be Made as Follows:*

DISPLAY SWITCH . . . . . **MH TAS**

GMT L7 . . . . . **PRESS**
- Verify that the left display blanks and ENT push button illuminates.

HEADING . . . . . **ENTER**
- Enter heading (zero to 359.9°) to nearest tenth of a degree.
  - Verify entry.

ENT . . . . . **PRESS**

When Flashing WRN Annunciator Extinguishes:

MAN annunciator illuminates and left display flashes.
- Update aircraft heading as required.

When Manual Heading Entry Is No Longer Required:
- Repeat above steps, except enter zero.
  - **MAN** annunciator extinguishes and system resumes using aircraft input.

INS INITIAL POSITION LOADED IN ERROR (RAMP COORDINATES)

If Error Discovered At Gate:

INS MODE SELECTOR(S) ..... OFF/ALIGN

- Momentarily switch affected mode selector(s) to OFF then return to ALIGN.

RAMP COORD/WAYPOINTS ..... RELOAD

- Reload correct ramp coordinates and, if appropriate, waypoints.

If Error Discovered In-Flight with FMS Operating, Inoperative, Or Not Installed:

LAND AT BEST AVAILABLE AIRPORT

- INS units will have to be realigned on the ground.

———END OF PROCEDURE———

INS PRESENT POSITION UPDATE (NOT WITH FMS)

- If the Captain determines INS navigation errors are excessive, an update may be made when an accurate ground position fix is available.
- It is essential that an accurate fix be established before up-dating INS unit to avoid increasing navigation errors.
- Updates may be made while the INS units are operating independently, or in triple-mix.

REMOTE SWITCHES . . . . . **PRESS**
- Press each INS REMOTE switch. Check **REMOTE** illuminates.

DATA SELECTORS . . . . . **POS**

When Directly Over Fix:

HOLD SWITCH . . . . . **PRESS**
- Press any HOLD switch when over known fix.
- Check **HOLD** illuminates on each CDU.

DATA SELECTORS . . . . . **DIS/TIME**
- Check NM difference between INS units.
- INS will continue to update distance and time on the displays.

If Raw INS Position Display Desired, Or If Triple-Mix Is In Use:

DATA SELECTOR(S) . . . . . **WAY PT**
- Place Data selector(s) in WAY PT and position waypoint selector in any position from 1 thru 9.

POSITION . . . . . **CHECK**
- Raw (without update) position is displayed on CDU.

If INS Accuracy Is Adequate:

AFFECTED REMOTE & HOLD SWITCHES . . . . . **PRESS**
- If the position is accurate no update of the affected units is required.
- Press affected unit **REMOTE** and **HOLD** switches, check lights extinguished.

To Update INS Units:

FIX POSITION . . . . . **LOAD**
- Load latitude and longitude of fix.Check latitude and longitude indicated on each unit is being up-dated.
- If displays are correct INSERT.
- Check **HOLD** extinguishes.
- Update can be accomplished while operating in triple-mix.

REMOTE SWITCHES . . . . . **PRESS**
- Check **REMOTE** extinguishes.

If Warn Light Illuminates (Codes 02-56):

LOADED LAT & LONG . . . . . **CHECK**
- Failure of the **HOLD** light to extinguish together with illumination of a **WARN** light indicates unit(s) considers updated latitude and longitude unreasonable and update has not been accepted. 3IN-FMS Program will not accept any update in excess of 3+3T, max 18 miles.
- Check loaded present position. If incorrect, reload and insert.

ILLUMINATED HOLD SWS . . . . . **PRESS**
- Check **HOLD** extinguishes

INS TEST SW . . . . . **PRESS**
- Repeatedly press TEST switch until **WARN** extinguishes indicating INS unit has accepted updated latitude and longitude.

———END OF PROCEDURE———

INS COMPARATOR WARN LIGHT ILLUMINATED (SHIP 724)

- In-Flight, WARN and a 02 action code with malfunction code of 56 is annunciated if computed present position differs from inertial (raw) present position by more than 3 miles plus 3 miles for each hour of operation in NAV to a maximum of 18 miles.

ILLUMINATED COMPARATOR LIGHT ..... **PUSH TWICE**

- Light extinguishes on first push. Light re-appears on second push if fault remains.

If Light Remains Extinguished:

NORMAL OPERATION ..... **CONTINUE**

- Indicates momentary fault.

If Light Re-Appears:

INS PRESENT POS ..... **CK**

- Compare present position indicated on each INS unit. Verify affected unit significantly disagrees with other two.

If Significant Error Exists:

AFFECTED UNIT ..... **UPDATE**

- Update present position of affected unit using a ground based fix, if possible.
  - If accurate ground position cannot be determined, an average latitude and longitude, calculated from the two unaffected units, may be used to update the faulty unit. Triple-mix is inhibited while WARN exists.

———END OF PROCEDURE———

MULTIPLE INS WARN AND/OR FMS WARNING

- Procedure applies to FMS WARN and also INS WARN on INS #1 and/or INS #2. Disregard those steps referring to INS on aircraft not equipped with INS #1 and #2.

APFDS HDG MODE . . . . . CK ENGAGED
- Prevents inadvertent course change while accomplishing procedure.

APFDS PITCH MODE . . . . . CHECK
- In level flight check **ALT** remains engaged.
- If climbing or descending select VS mode and check **ALT** arm remains.

ATS DISENGAGED
- Prevents unscheduled throttle movement while accomplishing procedure.

FMS NAVIGATION . . . . . DISCONTINUE
- Use VHF NAV, #3 INS, or ONS #1 or #2 as appropriate, for navigation.
- On A/C with an ALT NAV SOURCE switch – if the #3 INS is the only available nav source, latch in the ALT NAV SOURCE switch to display #3 INS nav data to the HSI.

INS DATA SELECTORS (INS #1 AND #2 . . . . . DSRK/STS

INS TEST SWITCH (INS #1 AND #2) . . . . . PRESS
- Continue to press TEST switch to check for action/malfunction codes. An INS WARN code 05–54 indicates a loss of data flow between the FMS and INS.
- An INS WARN code of 02–56 indicates that the present updated position of the INS disagrees with its own raw platform position by at least 3 NM + 3 NM/hr of INS NAV operation.

If an FMS RESTART is DESIRABLE, Refer to the FMS RESTART Procedure To Resume Normal FMS Operation. The FMS is not a required Transoceanic navigation system.

If an FMS RESTART Is NOT Desirable, Continue As Follows:

FMS C/B'S 1E8 AND 1E26 . . . . . PULL
- Deactivates FMS system.

ON BOTH INS'S, WYPT – CHG KEYS . . . . . PRESS/INSERT
- INSERT and WYPT CHG extinguishes to indicate INS is now operating independent of FMS.

INS KEY #1 (INS #1 AND #2) . . . . . PRESS/INSERT
- Check last digit in right display changes to a 5 and INSERT extinguishes to indicate updates removed.

INS TEST SW (INS #1 AND #2) . . . . . PRESS
- Continue to press until WARN light and all action/malfunction codes are cleared.

INS #1 AND #2 . . . . . TRIPLEMIX
- Three INS units must be operating for triple mix capability.
  - Select DSTRK/STS, press key 4 and INSERT.
  - Verify 1–54.

INS FROM – TO WAYPOINTS (INS #1 & #2) . . . . . CHECK
- Check the coordinates of the INS FROM – TO waypoints for the current route segment and correct if necessary.
- Initiate a WYPT CHG to the next waypoint along the route of flight. (INS #1 and #2).

NAV STEERING . . . . . SELECT
- Select and use the best NAV steering source available.

REMAINING INS WAYPOINTS (INS #1 and #2) . . . . . LOAD
- Manually check and load remaining route waypoints in operating INS's.
- Set INS AUTO – MAN switches to AUTO for automatic leg switching. (INS #1 and #2).

———END OF PROCEDURE———

FMS RESTART

- Following a failure of the FMS, the crew should **carefully** consider an FMS restart, provided suitable navigation has been established independent of the FMS.
- During this procedure the INS WARN will illuminate, and the displayed positions on INS #1 and INS #2 may drift significantly until the procedure is completed.
- On aircraft not equipped with INS #1 and #2, DISREGARD those steps referring to INS.

APFDS HDG MODE ..... CK ENGAGED
- Prevents inadvertent course change while accomplishing procedure.

APFDS PITCH MODE ..... CHECK
- In level flight check **ALT** remains ENGAGED. If climbing or descending select VS mode and check **ALT ARM** remains.

ATS ..... CHECK DISENGAGED
- Prevents unscheduled throttle movement while accomplishing procedure.

FMS NAVIGATION ..... DISCONTINUE
- Use VHF radio nav, #3 INS, or ONS #1 or #2, as appropriate, for navigation.
- On A/C with an ALT NAV SOURCE switch if the #3 INS is the only available nav source, latch in the ALT NAV SOURCE switch to display 3 INS nav data on the HSI.
- Check INS #3 waypoint coordinates that identify the leg being flown.
- Exit triple mix and slush updates on INS #1 and #2 by selecting **DSTRK/STS**, press 1, and **INSERT**.

FMS C/B's 1E8 AND 1E26 ... PULL & RESET
- **RTE DATA** page will appear when FMS computer is ready to operate.

FMS DATA TO INS ..... CHECK ON

CAUTION:
IN ACCOMPLISHING THE NEXT STEP DO NOT INDEX OR EXECUTE WAYPOINTS.

NAV START ..... INDEX & EXECUTE
- Initializes navigation by setting all INS NAV inputs to IN and the nav radio station select mode to AUTO.

NAV FUNCTION BUTTON PRESS/PAGE FWD

FIX ..... INDEX
- FIX POS BY page appears.
- Choose appropriate nav aid to fix position by.

INS, ONS, DME/DME, DME/VOR, OR LAT/LON CHOICE ... INDEX & EXECUTE
- Check position error to the appropriate nav system reads zero by pressing **NAV FUNCTION** button, **PAGE FWD**, and index **FIX.**

INS DATA SELECTORS (INS #1 & #2) ..... DSTRK/STS

INS TEST SWITCH (INS #1 & #2) ... PRESS
- Check for code 05-54 and/or 02-56.
- Continue to press **TEST.** WARN should extinguish and all action/malfunction codes should disappear.

If INS WARN And 05-54 or 02-56 Remains:

FMS WARN AND/OR MULTIPLE INS WARN PROCEDURE ..... ACCOMPLISH
- See abnormal procedures this section.

If INS #1 and #2 WARN Lights Are Extinguished And All Action/MALF Codes Disappear Continue Procedure As Follows:
- Press the NAV function button.
- Index WPT LIST.
- Review the flight plan and modify, as required, using the CHG RTE function.

WAYPOINT LIST ..... CHECK
- Confirm flight plan route and waypoint coordinates with the Master Flight Plan.

INS WAYPOINT PAIR (INS #1 & #2) ..... CHECK
- Check INS **FROM-TO** displays 1-2.
- Position INS data selector to **WAYPOINT.**
- Confirm desired TO waypoint coordinates appear in position 2.

FMS L-NAV STEERING ..... RESUME
- Intercept the L-NAV course using **HDG SEL** or **CWS.**
- Reengage APFDS L-NAV mode.

GMT ..... INSERT
- Insert the correct time using the **NAV START** function.

NAV RADIO TUNING ..... CHECK
- Resume Nav radio **AUTO TUNE** as desired.

PERFORMANCE SET UP ..... CHECK
- Press the **PERF MGT** function key and page **AFT to SET UP.**
- Check and correct gross weight, fuel and cruise altitude as required.
- Page **FWD tto CLMB-CRZ-SET UP** page.
- Check and correct climb and cruise set up as required.

PERFORMANCE MANAGEMENT ... RESUME
- Engage **THRUST MANAGEMENT** mode as desired.

———END OF PROCEDURE———

SINGLE INS WARN

- Procedure applies when one INS WARN occurs.
- FMS STATUS (when installed) may also occur.

AFFECTED AUTOPILOT ..... DISCONNECT
- Disconnect autopilot A for INS 1 WARN
- Disconnect autopilot B for INS 2 WARN
  - Unaffected autopilot may be engaged in heading select and altitude hold.

INS DATA SELECTOR ..... DSTRK/STS
- Check action code.

ACTION CODES AND PROCEDURES

DISPLAY DARK (No Code; Ground Only)
MODE SELECTOR ..... OFF

MAINTENANCE ..... ADVISE
- Unit has shutdown due to overtemp.
- Will not occur with Mode Selector in NAV.

DISPLAY DARK, WARN LIGHT
BAT Light on MSU (No Code)
MODE SELECTOR ..... OFF

MAINTENANCE ..... ADVISE
- Both normal and battery power have failed to INS.

01 (System Failure)
INS TEST ..... PRESS
- Check and record malfunction codes.

Unless All Malfunction Codes Were Transient and Warn Extinguishes:

MODE SELECTOR ..... OFF
NOTE: Continued operation with WARN illuminated and an 01 action code may cause severe damage to unit.

02 (NAV Computer Failure)
INS TEST ..... PRESS
- Check and record malfunction codes. If action/malfunction codes clear, fault(s) were transient.

If Action/Malfunction Codes Do Not Clear:
NAVIGATION ACCURACY ..... MONITOR

If Navigation Accuracy Degrades:
NAV SOURCE SELECT ..... ALTN
- Latch affected switch to display No. 3 INS information on HSI.

MODE SELECTOR ..... ATTITUDE
- Retains attitude information for instruments.

04 (Ground Only)
(Alignment malfunctions)
INS TEST ..... PRESS
- Check and record malfunction codes.

MODE SELECTOR ..... OFF, THEN ALIGN

PRESENT POSITION ..... LOAD

WAYPOINTS ..... LOAD

05 (Invalid data from FMS)
(When Installed)
- Accomplish multiple INS WARN and/or FMS WARN procedure.

06 (Check Present Position)
INS TEST ..... PRESS
- Check and record malfunction codes.

PRESENT POSITION ..... CHECK
- Check accuracy of loaded present position. Clear malfunction if loaded position is correct.

If Present Position In Error:
MODE SELECTOR ..... STBY THEN ALIGN

PRESENT POSITION ..... LOAD

WAYPOINTS ..... LOAD

———END OF PROCEDURE———

INS MALFUNCTION CODES

The following partial list of INS malfunction codes is provided for information only.

MALF CODE	FAILED TEST	MODES OF OPERATION	ACTION CODES
18	Excessive time in PI of 8	ALIGN	04
22*	TK or TKE + DA Converter	ALIGN	03
23*	DA Converter	ALIGN, NAV	03
24*	TKE or Steering Converter	ALIGN, NAV	03
25*	HDG or Steering Converter	ALIGN, NAV	03
26*	XTK Converter	ALIGN, NAV	03
31	Ground Speed	NAV	02
32	Memory	STBY, ALIGN, NAV	02
33	Azimuth Stabilization	STBY, ALIGN, NAV	01
34	Roll Stabilization	STBY, ALIGN, NAV	01
35	Pitch Stabilization	STBY, ALIGN, NAV	01
36	Accelerometer	STBY, ALIGN, NAV	01
37	Z Platform Overtemperature	NAV	01
38	XY Platform Overtemperature	NAV	01
39	Oven Overtemperature	NAV	01
41	Inserted/Computed Latitude Comparison	STBY, ALIGN	06
42	Dirft Angle 45° or Greater	NAV	02
43	Intersystem Comparison	ALIGN	06
45	Loaded Latitude or Gyro Scale Factor	ALIGN	04
54	FMS Inputs	NAV	05
56	Displayed present position differs form inertial position by more than 3 + 3T (T = NAV time in hours) up to a maximum of 18 miles.	NAV	02

* ***INS WARN will not illuminate.***

PMS TWO ENGINE DRIFTDOWN CRUISE

ENGINE-OUT DRIFTDOWN - MRC MODE

- The MAX RANGE CRUISE (MRC) mode is used to maintain maximum altitude in relation to driftdown distance – i.e., the shallowest possible descent angle. This option is not available if the airplane is below the optimum 2–engine cruise altitude.

APFDS ALT MODE ..... **SELECT**
- The 2 ENG CRZ MRC driftdown is not available unless ALT has been selected.

2 ENGINE CRUISE MRC MODE .... **SELECT**
- Press the PERF MGT button to display CRUISE page (P–7).
- Index CRZ to display CRUISE SELECT page (P–4).
- Index 2 ENG CRZ MRC to display 2 ENG CRUISE MRC page (P–15). The optimum altitude can be read on this page.

ALT SELECT ..... **SET**
- An altitude must be selected to arm the MRC driftdown mode. Do not select an altitude greater than the OPT altitude displayed on the 2 ENG CRUISE MRC page (P–15) to assure that an altitude is not captured during a MRC driftdown.

NOTE: Do not capture an altitude during an MRC driftdown. when maximum altitude is no longer required, select the 2 ENG CRUISE LRC driftdown mode.

ATS–TM ..... **CHECK ENGAGED**

APFDS – VNAV ..... **SELECT**
- Thrust will advance to MCT and be maintained at MCT. Airplane will decelerate in level flight to AFM driftdown speed and driftdown at that speed.
- If an APFDS pitch mode, other than VNAV, is subsequently selected, power will be maintained at MCT and pitch controlled by the selected mode (i.e., VS or IAS).

RES FUEL ..... **INSERT**
- Index RES FUEL and insert fuel reserve for destination.

———END OF PROCEDURE———

ENGINE-OUT DRIFTDOWN - LRC MODE

- The LONG RANGE CRUISE (LRC) mode is used to driftdown to an altitude where 2 ENGINE CRUISE can be maintained. This option is not available if the airplane is below the optimum 2–engine cruise altitude.

APFDS ALT MODE ..... **SELECT**
- The 2 ENG CRZ LRC driftdown is not available unless either ALT has been selected or it has been initiated from a 2 ENG CRZ MRC driftdown.

2 ENG CRUISE LRC MODE ..... **SELECT**
- Press the PERF MGT button to display CRUISE page (P–7).
- Index CRZ to display CRUISE SELECT page (P–4).
- Index 2 ENG CRZ LRC to display 2 ENG CRUISE LRC page (P–16).
  - The 2 ENG CRUISE LRC mode can also be initiated druing a 2 ENG CRUISE MRC driftdown by indexing 2 ENG CRZ LRC on the 2 ENG CRUISE MRC page (P–15).

ALT SELECT ..... **SET**
- Select the altitude to be captured for 2 engine cruise. The optimum altitude can be read from the 2 ENG CRUISE LRC page (P–16).

NOTE: Do not select an altitude above the OPT altitude displayed on the 2 ENG CRUISE LRC page (P–16). The displayed OPT altitude is the maximum recommended cruise altitude that the aircraft can maintain LRC speed at MCT.

ATS–TM ..... **CHECK ENGAGED**

APFDS – VNAV ..... **SELECT**
- Thrust will advance to LRC EPR – 0.12 EPR. Airplane will decelerate in level flight to 2 engine LRC speed and driftdown at that speed.
- If an APFDS pitch mode other than VNAV, is subsequently selected, power will advance toMCT, pitch will be controlled by the selected mode and the display will change to the 2 ENG CRUISE MRC page (P–15).

PMS

ENGINE-OUT DRIFTDOWN - LRC MODE CONTD.

RES FUEL ..... INSERT

- Index RES FUEL and insert fuel reserve for destination.
- When a LRC driftdown has been accomplished and an altitude is captured by the APFDS, the CDU will change automatically to 2 ENG CRUISE LRC page (P-17) and the system will maintain LRC.

To Resume PMS 3-Engine Functions if Desired:

- Check that APFDS ALT mode is selected.
- Disengage ATS-TM mode.
- Press the PERF MGT button (P-17).
- Page FWD to the FLIGHT SETUP page (P-2).
- Index 2 ENG CRZ LRC (P-4).
- Index desired cruise option (P-7).
- Reengage ATS-TM mode.

———END OF PROCEDURE ———

2 ENGINE LRC CRUISE

- The 2 engine LRC cruise mode will be automatically established when an altitude is captured by the APFDS following a PMS driftdown from above the optimum 2-engine cruise altitude. The following procedure may be used to establish a 2 engine LRC cruise condition if the airplane is below the optimum altitude.

APFDS ALT MODE ..... SELECT

ATS-TM ..... CHECK ENGAGED

2 ENG CRUISE LRC ..... SELECT

- Press the PERF MGT button to display the CRUISE page (P-7).
- Index CRZ to display the CRUISE SELECT page (P-4).
- Index 2 ENG CRZ LRC to establish 2 engine LRC (p-17).

To Reestablish the 2 Engine LRC Cruise Condition At a Different Altitude:

- Disengage ATS-TM mode.
- Climb/descend to the new altitude using non-PMS procedures.
- Check that APFDS ALT mode is selected.
- Press the PERF MGT button and check that the 2 ENG CRUISE LRC page (P-17) is displayed.
- Reengage ATS-TM mode.

To Resume PMS 3-Engine Functions, If Desired:

- Check that APFDS ALT mode is selected.
- Disengage ATS-TM mode.
- Press the PERF MGT button (P-17).
- Page FWD to the FLIGHT SETUP page (P-2).
- Index 2 ENG CRZ LRC (p-4).
- Index the desired cruise option (P-7).
- Reengage ATS-TM mode.

———END OF PROCEDURE ———

PMS COMPUTER CDU FAILURES

PMS WARN LIGHT

- A WARN light on the PMS CDU indicates a fault of serious enough nature to disable the system. All PMS functions are inoperative. This condition will be accompanied by most of the following indications:
  - Automatic Failure Message (BIT failure)
    - DIG OUTPUT FAIL
    - DIG CHK INOP
  - Illuminated CDU STS light.
  - ATS disconnect.
  - Autopilot Command Disconnect (VNAV)
  - ADI Flight Director Flags (VNAV)

AUTOPILOT . . . . . **CHECK**
- Reestablish autopilot operation if required in suitable pitch and roll modes.

THRUST . . . . . **CHECK**
- Control thrust manually or use ATS-AT mode.

PMS RESET . . . . . **ATTEMPT**
- It is possible that the failure condition is transient in the nature and resumption of normal operation may be possible.
- Cycle the FLT MGT CB (1-E-8) to attempt to clear the failed condition.

If The WARN Light Remains:
- Continue operation without PMS.

If the WARN Light Clears, or If It Clears Itself, Proceed As Follows to Resume Normal PMS Operation:

PMS SETUP . . . . . **CHECK**
- Press the PERF MGT button (P-6, P-7, P-9).
- Page FWD to the FLIGHT SETUP page (P-2).
- Check climb/cruise setup and correct, if necessary.
- Page FWD to the TAKEOFF page (P-1).
- Index GW and insert the correct gross weight.
- Index FUEL and insert the correct fuel remaining.

PMS OPERATION . . . . . **RESUME**
- If in cruise, select APFDS ALT mode.
- Engage ATS-TM mode.
- If in climb, select APFDS VNAV mode.

———END OF PROCEDURE———

FROZEN CDU - NO WARN LIGHT

- A frozen CDU display may be caused by a stuck CDU button, or, it may be an indication of a significant computer/CDU problem.

CDU BUTTONS . . . . . **CHECK**
- Check all CDU buttons and free any stuck buttons.

If CDU Remains Frozen:

PMS OPERATION . . . . . **DISCONTINUE**
- Establish autopilot operation in a suitable pitch mode, other than VNAV.
- Control thrust manually or use ATS-AT mode.

PMS RESET . . . . . **ATTEMPT**
- It is possible that the failure condition is transient in nature and resumption of normal operation may be possible.
- Cycle the FLT MGT CB (1-E-8) to attempt to clear the failed condition.

If The CDU Remains Frozen:
- Continue operation without PMS.

If The Condition Clears, or If It Clears Itself, Proceed As Follows to Resume Normal PMS Operation:

PMS SETUP . . . . . **CHECK**
- Press the PERF MGT button (P-6, P-7, P-9).
- Page FWD to the FLIGHT SETUP page (P-2).
- Check climb/cruise setup and correct, if necessary.
- Page FWD to the TAKEOFF page (P-1).
- Index GMT and insert the correct time.
- Index GW and insert the correct gross weight.
- Index FUEL and insert the correct fuel remaining.

PMS OPERATION . . . . . **RESUME**
- If in cruise, select APFDS ALT mode.
- Engage ATS-TM mode.
- If in climb, select APFDS VNAV mode.

———END OF PROCEDURE———

PMS STS LIGHT (FAULT MESSAGE)

- The CDU STS light illuminates to indicate a fault associated with data inputs to the PMS computer. Pressing the STS light/key will display a message/s associated with the specific faults. Paging FWD will display any other messages. When all messages have been displayed, the light will extinguish. The message will remain as long as the fault condition exists and can be recalled at any time by pressing the STS key and paging FWD

XXX 2 FAIL (SINGLE AIR DATA INPUT FAILURE)

- The PMS receives PAL, BAL, TAS, CAS, MAC and TAT inputs from the digital air data computers (DADCD). This message indicates that the associated input from DADC No. 2 has failed. All air data inputs are being received from the No. 1 side. PMS operation is not affected.

————END OF PROCEDURE————

XXX 1 AND XXX 2 FAIL (DUAL AIR DATA INPUT FAILURE)

- Any air data input failure on the No. 2 side will cause the PMS to shift to the No. 1 side for all air data inputs. A subsequent failure of an air data input on the No. 1 side will invalidate PMS functions with the following additional indications.
  - Autopilot Command Disconnect (VNAV).
  - ADI Flight Director Flags (VNAV)
  - ATS Disconnect.

AUTOPILOT . . . . . **CHECK**
- Reestablish autopilot operation, if required, in suitable pitch and roll mdoes.

THRUST . . . . . **CHECK**
- Control thrust manually or use ATS-AT mode.

DADC STATUS . . . . . **MONITOR**
- Press the STS button occasionally and check the fault messages to see if the dual failure condition may have cleared itself. This would be indicated by the absence of the XXX 1 and XXX 2 FAIL messages.

If the Dual Failure Condition Clears:

PMS OPERATION . . . . . **RESUME**
- If in cruise, select APFDS ALT mode.
- Engage ATS-TM mode.
- If in climb, select APFDS VNAV mode.

————END OF PROCEDURE————

FCC B DATA FAIL (SINGLE AFCS DATA FAILURE)

- The PMS receives AFCS selected altitude and AFCS discrete inputs from the flight control computers. Inputs from FCC B are normally used. This message indicates that a failure has occurred with the FCC B data and the PMS is receiving AFCS data inputs from FCC A. PMS operation is not affected.

————END OF PROCEDURE————

FCC B AND FCC A DATA FAIL (DUAL AFCS DATA FAILURE)

- An AFCS data input failure from FCC B will cause the PMS to shift to FCC A for AFCS data inputs. A subsequent failure of an AFCS data input from FCC A will invalidate PMS functions with the following additional indications.
  - Autopilot Command Disconnect (VNAV).
  - ADI Flight Director Flags (VNAV).
  - ATS Disconnect (TM).

AUTOPILOT . . . . . **CHECK**
- Reestablish autopilot operation if required in suitable pitch and roll modes.

THRUST . . . . . **CHECK**
- Control thrust manually or use ATS-AT mode.

FCC B AND FCC A DATA FAIL (DUAL AFCS DATA FAILURE) (CONTD)

FCC DATA STATUS . . . . . MONITOR

- Press the STS button occasionally and check the fault messages to see if the dual failure condition may have cleared itself. This would be indicated by the absence of the FCC B and/or FCC A DATA FAIL messages.

If The Dual Failure Condition Clears:

PMS OPERATION . . . . . RESUME

- If in cruise, select APFDS ALT mode.
- Engage ATS-TM mode.
- If in climb, select APFDS VNAV mode.

———END OF PROCEDURE———

INS 2 INVALID

- The PMS receives inertial velocity and true heading data from INS No. 2. This message indicates loss of these inputs. There is no alternate data source.
- PMS operation will be normal, except for the following:
  - Top-of-climb, step climb, descent to BOD and engine out range advisory information will be based on a no-wind condition.
  - PMS throttle control in turns will be slightly degraded due to loss of heading data.
  - Ground speed (GS) will not be displayed on the LANDING DATA page (P-18).

———END OF PROCEDURE———

INPUT CONV FAIL

- This message indicates a fault in the analog to digital conversion of EPR and/or TGT inputs. This condition could cause abnormal PMS throttle control.

ATS-TM . . . . . DISCONTINUE

- Control thrust manually.

———END OF PROCEDURE———

ENGINE DATA FAIL

- This message indicates that EPR, TGT, and/or Fuel Flow on one or more engines has exceeded reasonable limits for at least three minutes during stabilized climb or cruise conditions. The ENG DATA FAIL page will be displayed indicating the "failed" inputs. If 2 or 3 inputs from a single engine have failed low, the message "ENGINE OFF" is displayed.

ENGINE INSTRUMENTS . . . . . CHECK

- Check engine instruments for abnormal indications.

If The Engine Instruments Confirm the "Failed' Condition:

- Refer to EPR or TGT and/or FUEL FLOW malfunction procedures, as appropriate.

If The Engine Instruments Do Not Confirm the "Failed" conditions:

- For Failed EPR or TGT, discontinue use of ATS-TM.
- For failed FUEL FLOW, periodically check/update GW and FUEL on the TAKEOFF page (P-1), as required.

———END OF PROCEDURE———

SUM CHECK FAIL

- This message indicates that the PMS computer has failed a self check of its operating instructions. Abnormal PMS operation may be experienced.

PMS OPERATION . . . . . DISCONTINUE

- Deselect APFDS VNAV mode, if engaged.
- Deselect ATS TM mode, if engaged.

———END OF PROCEDURE———

EPR OR TGT MALFUNCTION (UNWANTED THROTTLE REDUCTION)

- The ATS THR MGT (TM) mode controls and limits EPR/TGT based on the input signal from the highest engine. Malfunctioning EPR or TGT inputs to the PMS may cause erratic operation including undesired throttle retard commands associated with an attempt to control or limit a high EPR or TGT. If an EPR or TGT is erratic or fails, or if unexpected throttle reductions are experieced, proceed as follows:

ATS - TM . . . . . **DISCONTINUE**

- Control thrust manually.

FUEL FLOW MALFUNCTION

- The PMS computer uses fuel flow inputs to continually compute current gross weight and fuel remaining. A malfunctioning fuel flow input can cause errors in these parameters and significantly affect PMS functions.

AFFECTED FUEL FLOW CB . . . . . **PULL**

- Pull the instrument CB for the malfunctioning fuel flow.

GROSS WEIGHT/FUEL REMAINING . . . . . **MANUALLY UPDATE**

- Press the PERF MGT function button.
- Page FWD to the TAKEOFF page (P-1).
- Update GW and FUEL.
  - Determine best estimate of gross weight and fuel remaining from other instrumentation and frequently update these parameters.

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Cabin Altitude Above 13,000 Feet 3

Crew Oxygen 3

Passenger Oxygen 3

FIRM TABLE OF CONTENTS

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CABIN ALTITUDE ABOVE 13,000 FEET

Cabin altitude of 13,000 feet or more causes automatic deployment of passenger oxygen. Flight crewmembers must be on oxygen when cabin altitude is greater than 10,000 feet.

CREW OXYGEN

1. Cabin Altitude Warning Horn sounds at approximately 10,000 feet.

2. Crewmembers (flight) don oxygen masks using 100% initially.

3. Flow indicators show white for oxygen flow.

PASSENGER OXYGEN

1. The green OXYGEN FLOW light illuminates showing that the sytem is in operation.

   The system cannot be reset in flight.

   Approximately 18 minutes of oxygen are available.

2. Initiate descent to at least 14,000 feet, if possible, to protect passengers.

3. Press the oxygen MANUAL switch. The ON light illuminates. This is done as backup to automatic deployment of masks.

4. If necessary, use the MANUAL switch to initiate deployment of oxygen masks and oxygen system.

NOTE: Do not permit smoking or open flame in the vicinity of oxygen. Turn on the No Smoking sign and, when practicable, make PA advising passengers not to smoke.

(OPPOSITE SIDE BLANK)

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(MALFUNCTION) (LIGHT INDICATIONS)

GENERAL

Area Overheat Loop Check 5
Overheat Light – D, E or H ..... AREA OVHT 4
Overheat Light – J ..... AREA OVHT 4
Overheat Light – 1,2 or 3 ..... DUCT OVHT 6
Overpressure Light ..... BLEED DUCT OVPRESS 3
Pneumatic Lockout 3

-500 DIFFERENCES

None

CROSS REFERENCES

Duct Fail Light – F or G ..... DUCT FAIL ..... ICE/RAIN
Duct Ovht Light – Hot Air Manifold ..... AIR COND/PRESS
Isolation Valve – Ovht Light – Hot Air Manifold ..... AIR COND/PRESS
Nacelle/Pylon Ovht Light – 1, 2 or 3 ..... EMERGENCY
Overheat Light – A, B or C ..... AREA OVHT ..... AIR COND/PRESS
Pack Flow Control Ovht Light ..... AIR COND/PRESS

(OPPOSITE SIDE BLANK)

PNEUMATIC LOCKOUT

- BLEED DUCT OVRPRESS may also be indicated.
- Cabin pressurization control is lost until pneumatic pressure is restored.

ALL PNEUMATIC PANEL SWS ..... **UNL OFF**
- HI PRESS VALVES (3)
- ENG ISLN VALVES (3)
- CROSSBLEED VALVES (2)
- FUSELAGE ISLN VALVE

All of the above switches must be unlatched before being relatched to release all lockouts.

PACK FLOW CNTRL VALVE SWS (3) ..... **UNL**
- Releases lockouts.

CAUTION:
If any Hi Press Flowbar Remains illuminated, Do Not Latch Its Associated Engine Isolation Valve In The Next Step.

ENG ISLN VALVE SWS ..... **LCH FB's**
FUSELAGE ISLN VALVE SW ..... **LCH FB**
PACK FLOW CONTROL SWS ..... **LCH FB's**
- Latch one at a time.

WING ANTI-ICE SWS ..... **UNL**
HI PRESS SWS ..... **LCH FB's**
- Latch one at a time.
- Monitor pressure as each HI PRESS switch is latched. If any large pressure fluctuation is observed, unlatch associated HI PRESS switch immediately.

CROSSBLEED SWS ..... **LCH FB's**

WING ANTI-ICE ..... **AS REQUIRED**

———END OF PROCEDURE———

BLEED DUCT OVERPRESSURE LIGHT

- If all pneumatic flowbars are extinguished, refer to PNEUMATIC LOCKOUT procedure, left column.

- Indicates overpressure downstream of an Engine Isolation Valve. An overpressure shutoff valve protects ducting against excess pressure by closing, should the Engine Isolation Valve fail to regulate pressure properly.

AFFECTED HI PRESS SW ..... **UNL OFF**

After High PRESS Flowbar Extinguishes:

CAUTION:
If HI PRESS Flowbar Remains, Do Not Continue The Checklist.

ENG ISLN VALVE SW ..... **UNL, THEN LCH**
- Removes lockout and restores LOW PRESSURE air.
- BLEED DUCT OVPRESS extinguishes when Engine Isolation Valve Switch is unlatched.

If HIGH PRESSURE Air Is Required:
HI PRESS SW ..... **LCH FB**

If BLEED DUCT OVPRESS Occurs Again:
- Repeat BLEED DUCT OVERPRESSURE procedure and operate with low pressure only.

———END OF PROCEDURE———

1 CROSS 3

AREA OVHT - D E OR H

- *AUTOMATIC* lockout (closing of associated valves occurs in that channel (D, E or H), **whichever sensed the overheat first.**
- On Ships 712 thru 732, and 751 thru 753, more than one AREA OVHT may illuminate.
- With three Pack switches latched, an inhibit circuit prevents more than one automatic channel lockout from occuring.
- If Area D, E or H have automatically isolated although no AREA OVHT light was observed, it must be assumed that a valid AREA OVHT occurred, regardless of the results of any Area Overheat Loop test. Unless a greater emergency exists, proceed with the applicable isolation procedure described below for Area D, E or H.

If D or E **AREA OVHT**

AREA OVERHEAT LOOP CHECK . ACCOMPLISH
- Loop Check is described on page 5.

CAUTION:
If practical, delay unlatching associated switches until AREA OVHT has extinguished.

AFCTD ENG ISLN SW (1 or 3) ..... UNL OFF
AFCTD CROSSBLEED SW (L or R) .. UNL OFF
AFCTD PACK FLOW CNTRL SW (1 or 3) .. UNL

If Single Pack Operation Results:
COOL AIR OVBD SW .. UNL CLOSE
MAX ALTITUDE ..... FL 250

——END OF PROCEDURE——

If H **AREA OVHT**

AREA OVERHEAT LOOP CHECK . ACCOMPLISH
- Loop Check is described on page 5.

CAUTION:
If practical, delay unlatching associated switches until AREA OVHT has extinguished.

FUSELAGE ISLN VALVE SW ..... UNL OFF
CROSSBLEED SWS ..... UNL OFF
- C2 ATM will be inoperative. Check Airport Restrictions Manual (ARM) for gear down performance.

NO. 2 PACK FLOW CNTRL SW ..... UNL

If Single Pack Operation Results:
COOL AIR OVBD SW .. UNL CLOSE
MAX ALTITUDE ..... FL 250

——END OF PROCEDURE——

2

AREA OVHT LIGHT - J

- *No Lockout* (automatic closing) of associated valves occurs.

NO. 2 ENG ISLN VALVE SW ..... UNL OFF
FUSELAGE ISLN VALVE SW ..... UNL OFF
APU BLEED AIR S/O VALVE SW ..... CLOSED
- B2 ATM will be inoperative.

AREA OVERHEAT LOOP CHECK . ACCOMPLISH
- Loop Check is described on page 5.

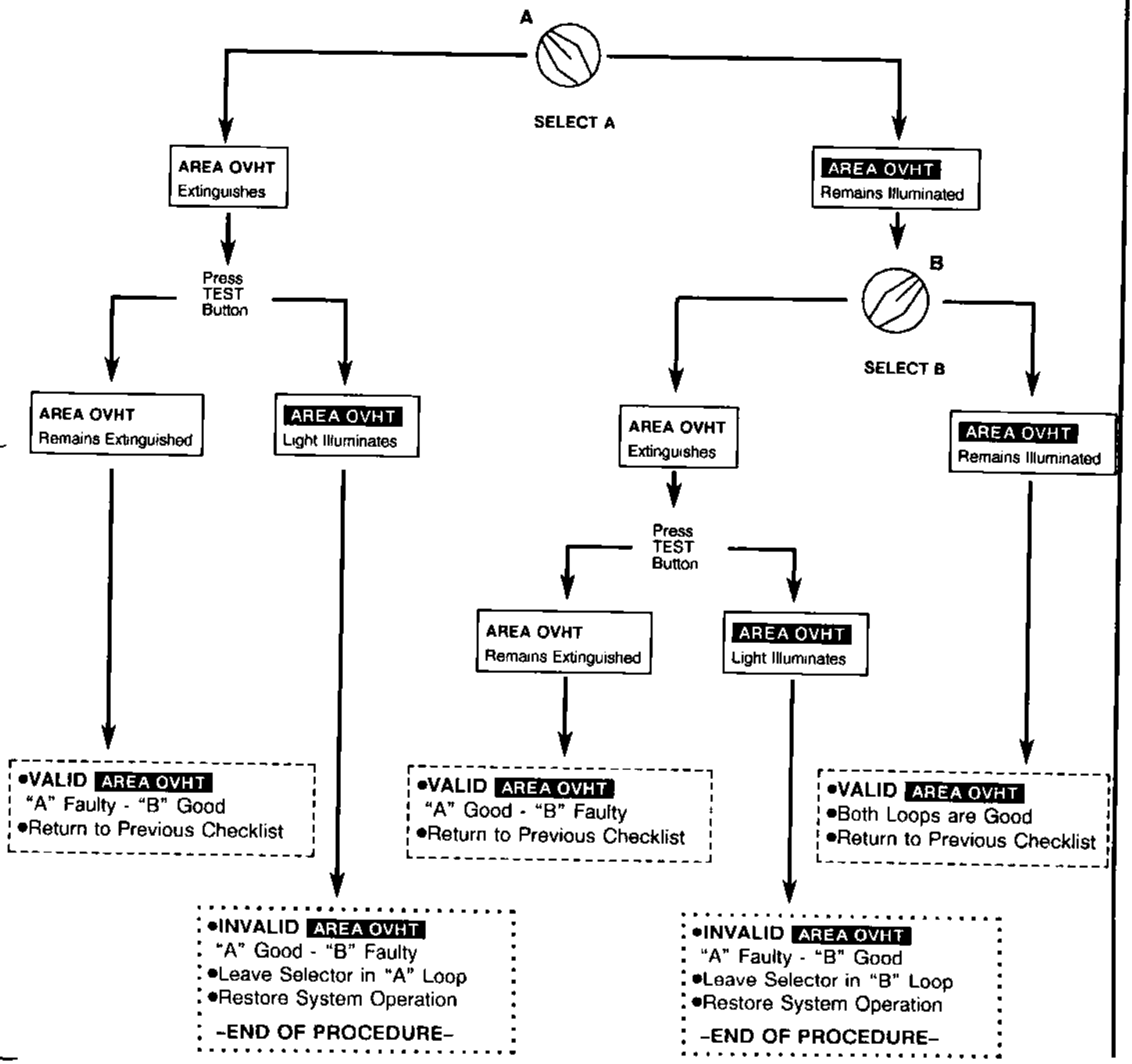
If Single Pack Operation Results:
COOL AIR OVBD SW .. UNL CLOSE
MAX ALTITUDE ..... FL 250

——END OF PROCEDURE——

AREA OVERHEAT LOOP CHECK

To Verify If AREA OVHT *Indication Is Valid:*

AREA OVHT *Light Illuminated:*



DUCT OVHT LIGHT

- Indicates high temperature upstream of the Engine Isolation Valve.

AFFECTED HI PRESS SW ..... **UNL** OFF
ENG ISLN VALVE SW ..... **UNL** OFF
- Releases lockout

After DUCT OVHT Extinguishes:

CAUTION:
If HI PRESS flowbar remains, do not continue the checklist.

ENG ISLN VALVE SW ..... **LCH** FB

If High Pressure Air Is Required:
HI PRESS SW ..... **LCH**

If DUCT OVHT ***Occurs Again:***
- Repeat DUCT OVHT procedure and operate with low pressure only.

———END OF PROCEDURE———

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ENGINE START
ABANDON - GROUND

- Abandon an engine start for any of the following conditions.

RESTART PERMITTED

- No light off within 30 seconds after FUEL and IGNITION SWITCH–ON.
- N_3 RPM abruptly fluctuates through 40% shortly after FUELand IGNITION SWITCH–ON.
- Hung start; N_3 and TGT rise stagnates or begins to drop.
- Hot start; TGT rising rapidly through 475C; abandon start to prevent exceeding 550C.

NO RESTART

- Rapid N3 and oil pressure rise when start valve opens (sheared accessory drive).
- No oil pressure within 30 seconds.
- No N_1 or N_2 rotation by 35%.

To Terminate Any Start Attempt On the Ground:

FUEL AND IGNITION SWITCH . . . . . OFF

- Check that TGT and RPM decrease.

If Engine Fails to Shutdown:

ENG ISLN VALVE C/B . . . . . PULL

- No.1 Eng. 1G10
- No.2 Eng. 1G11
- No.3 Eng. 1G12
- Pull the appropriate green code C/B to permit motoring of the engine when N3 is below 10%. Reset after completing the procedure.
- Engine ISLN VALVE flowbar will remain extinguished.
- Verify air pressure is available to the start valve by start VALVE OPEN illuminated.

FIRE PULL HANDLE . . . . . PULL

- EMERGENCY SHUTOFF illuminates then extinguishes. Engine will continue to run for as long as one minute.

If Start VALVE OPEN Remains:

When Necessary to Cool Engine or Clear Fuel:

ENGINE . . . . MOTOR 30 SECONDS AND UNTIL TGT IS BELOW 100C

- Refer to GROUND RESTART PROCEDURE this section, if restart attempt is desired.

If No Restart Desired:

GND START RELEASE . . . . . PUSH

If Start Valve Open Extinguished:

GND START RELEASE . . . . . PUSH

- If a malfunction is indicated, the condition of the engine will have to be determined before attempting another start.

If Necessary to Cool the Engine or a Restart Attempt Is Desired:

GND START SWITCH(AT 10% N_3 MAX) . . . . . PUSH

- If engine cooling is required, the starter may be re–engaged up to 10% N3. However, when operationally prcaticable, it is recommended that N3 be allowed to run down to zero before re–engaging the starter.
- VALVE OPEN illuminated.
- Refer to GROUND RESTART PROCEDURE this section.

ENGINE START; RESTART - GROUND

Do not attempt to restart an engine until cause of malfunction is determined if:

- Rapid N_3 and oil pressure rise when start valve opens (sheared accessory drive).
- No N_1 or N_2 rotation by 35%.
- No oil pressure within 30 seconds.
- Hot start; TGT exceeded 550°C on prior start attempt.
- Engine failed to shutdown after FUEL AND IGNITION OFF.
- Tailpipe fire.

If normal start procedures fail to obtain satisfactory start, or if engine is a known hard starter, the following procedure may be used as needed to improve starting. **Avoid Tailwind.**

1. **GND START SW (At 0% N_3) ..... PUSH**

2. ***WHILE MOTORING ENGINE, OR ACCELERATING TO MAX MOTORING SPEED:***
   IGNITION ..... BOTH

3. **PACKS ..... ALL UNL**
   One pack may be used if pneumatic pressure is adequate.

4. ***IF MAKING CROSSBLEED START:***
   OPER. ENGINES .... INCREASE THRUST
   If conditions permit, increase available pneumatic pressure.

10 windmill
15 B → Both
30 Normal
60 Cold
90 Relight

AFTER 30 SECONDS MOTORING, OR UPON REACHING MAX MOTORING SPEED AND TGT BELOW 100°C AND AT LEAST 10% N_2:
- 25% N_3 preferred; 20% N_3 minimum.
- Motoring until N_2 reaches 10% also improves starts.

5. **N_3OVERRIDE SW ..... PUSH AND HOLD**
   Use digital readout if N_3 RPM indicator fluctuating.

6. **FUEL AND IGNITION SW ..... ON**

7. ***IF NO LIGHTOFF WITHIN 10 SECONDS:***
   WINDMILL AIR START ..... LCH ON

8. **NORMAL ENRICH PROCEDURE ... OBSERVE**

9. **ONE PACK AT 50% N_3 ..... LCH** FB
   When using APU air at least one pack must be operating before N_3 OVERRIDE is released.

10. ***AT 53% N_3:***
    N_3 OVERRIDE ..... RELEASE
    Record on Mtc log that N_3 OVERRIDE has been used.

11. **WINDMILL AIR START SW ..... UNL**

12. **STARTER DUTY TIME ..... OBSERVE**
    5 minutes of engagement followed by;
    5 minutes off followed by;
    5 minutes of engagement then;
    30 minutes off (at OAT's colder than −10°C, cooling time may be reduced to 10 minutes off).

END OF PROCEDURE

ENGINE START; STARTER VALVE FAILS TO OPEN

May be caused by insufficient pneumatic pressure, a faulty start valve or engine isolation valve.

1. **PNEUMATIC PRESSURE.....CK**

Cycle Isolation Valve <<<<<<<<<<<<<<<<<**IF**>>>>>>>>>>>>>>>>>

ENG ISLN VALVE* -FB- *EXTINGUISHED

2. **ENG ISLN VALVE C/B (1G10, 11, OR 12).....PULL**
   The ENG ISLN VALVE **-FB-** will remain extinguished with respective circuit breaker pulled.

3. **APU/GND AIR TO REVERSER SW...ACTUATE**
   The ENG ISLN VALVE should remain open as long as the switch (located at base of center console) is actuated.

4. **ENGINE.....START**
   - If **VALVE OPEN** remains extinguished request Maintenance to manually open the ENG ISLN VALVE.
   - Use normal engine start procedure.
   - Do not latch GND START switch until APU/GND AIR TO REVERSER switch has been actuated.

5. ***AT 46% N_3:***
   APU/GND AIR TO REVERSER SW...RELEASE
   If start valve manually opened advise Maintenance to close.

6. **C/B 1G10, 11, OR 12.....IN**

STOP

ENG ISLN VALVE* -FB- *ILLUMINATED, BUT VALVE OPEN REMAINS EXTINGUISHED:

2. **SVC INTERPHONE SW.....CK ON**

3. **INT CABIN/SERVICE RECEIVE SW....IN**

4. **COMMUNICATIONS.....ESTABLISH**
   Establish communications with Maintenance to open the start valve.

5. **GND START SW.....LCH**

6. **START VALVE.....MANUALLY OPEN**
   Advise Maintenance to open start valve.

7. **VALVE OPEN.....CK**

8. ***AT A MINIMUM OF 20% N_3:***
   FUEL AND IGNITION SW.....ON

9. ***AT 46% N_3:***
   START VALVE.....MANUALLY CLOSE
   Advise Maintenance to close and visually inspect start valve.

10. **VALVE OPEN LIGHT.....EXTINGUISHED**

11. ***AT 55% N_3:***
    GND START RELEASE SW.....CK
    PUSH extinguished.

END OF PROCEDURE

ENGINE START; VALVE OPEN AFTER START

1. *IF* **PUSH** *ILLUMINATED AFTER 55% N_3:*
   GND START RELEASE SW ..... **PUSH**
   PUSH extinguishes.

2. **IF VALVE OPEN** *REMAINS:*
   HI PRESS AND
   ENG ISLN VALVE SWS ..... **UNL OFF**
   Reduces bleed air supply to starter prior to engine shutdown.

   FUEL AND IGNITION SW ..... **OFF**

CAUTION:
DESTRUCTIVE STARTER FAILURE MAY RESULT IF ENGINE IS OPERATED AT IDLE OR ABOVE WITH THE START VALVE OPEN.

END OF PROCEDURE

ENGINE START; N_3 INDICATOR - INOPERATIVE

Accomplish normal start procedures and consider the following:

1. **OIL PRESSURE** ..... **CK**
   Increasing oil pressure indicates N_3 rotation.

2. *AT 2% N_1 MIN:*
   FUEL AND IGNITION SW ..... **ON**
   - 2% N_1 approximates 20% N_3.
   - 3% N_1 approximates 25% N_3.

3. *AT 17% N_1:*
   GND START RELEASE SW ..... **PUSH**
   - **PUSH** extinguishes.
   - **VALVE OPEN** extinguishes.
   - 17% N_1 approximates 54% N_3.

4. *AT 19% N_1 or 500°C TGT:*
   ENRICH (IF USED) ..... **DISCONTINUE**
   19% N_1 approximates 59% N_3.

END OF PROCEDURE

ENGINE START; BATTERY

- Make battery start of a wing engine only.
- Start **VALVE OPEN**, Ground Start Release **PUSH** lights & pneumatic **-FB-** remain extinguished.

1. **COCKPIT SAFETY INSPECTION CHECKLIST ..... ACCOMPLISH**

2. **ENGINE START CHECKLIST ... ACCOMPLISH**

3. **STANDBY POWER SW ..... ON**

4. **START IGNITION ..... BOTH**

5. **COMMUNICATION ..... ESTABLISH**
   - Only Flight Interphone (INT) is powered (cockpit to nose wheelwell).
   - Establish communications with Maintenance to operate the start valve.

   CAUTION: WHEEL CHOCKS MUST BE IN PLACE AT EACH MAIN GEAR.

6. **GND AIR SOURCES ..... APPLY**
   Minimum of 2 sources.

7. **GND START SW ..... LCH**

8. **START VALVE ..... MANUALLY OPEN**
   - Advise Maintenance to open start valve.
   - Monitor N_3 for rotation. Only N_3 and TGT operative until AC power is applied.

9. ***AT 20% N_3 MIN:***
   FUEL AND IGNITION SW ..... ON
   Observe normal ENRICH procedures.

10. **N_1 ROTATION ..... VERIFY**
    Have Maintenance advise for rotation.

11. ***AT 46% N_3:***
    START VALVE ..... MANUALLY CLOSE
    Advise Maintenance to close; then visually inspect start valve.

12. ***AT 55% N_3:***
    GROUND START RELEASE ..... CK
    Verify Ground Start Release **PUSH** and **VALVE OPEN** lights extinguished after generator power is applied.

13. **STANDBY POWER SW ..... ARM**

14. **S/O PANEL PREPARATION CHECKLIST ..... ACCOMPLISH**

15. **PILOT'S BEFORE START CHECKLIST ..... ACCOMPLISH**

END OF PROCEDURE

ENGINE START; IN - FLIGHT

1. **THROTTLE ..... IDLE**

2. **FUEL AND IGNITION SW ..... OFF**

3. **FIRE PULL HANDLE ..... IN**

4. **HI PRESS SW ..... UNL OFF**

5. **CROSSBLEED SWS ..... LCH -FB- 'S**

6. **ENG TANK VALVE SWS ..... LCH -FB- 'S**

7. **FUEL TANK PUMPS ..... LCH -FB- 'S**

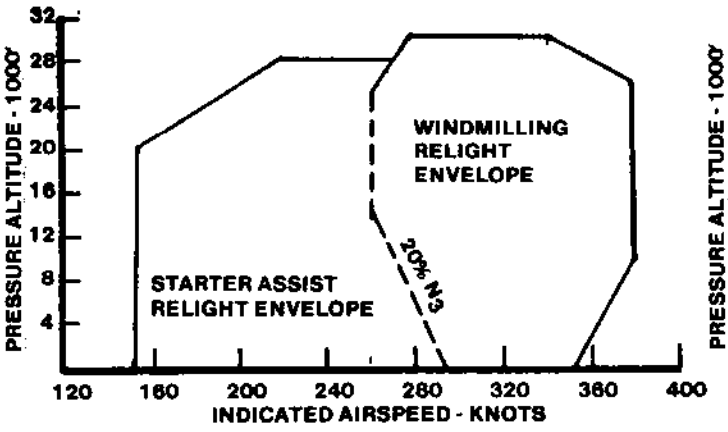
8. **GENERATOR FIELD SW ..... TRIP OPEN**
   To lock field open until engine is stabilized.

9. **ENG OIL TEMP ..... CHECK**
   Do not start below −40°C, do not accelerate below −10°C.

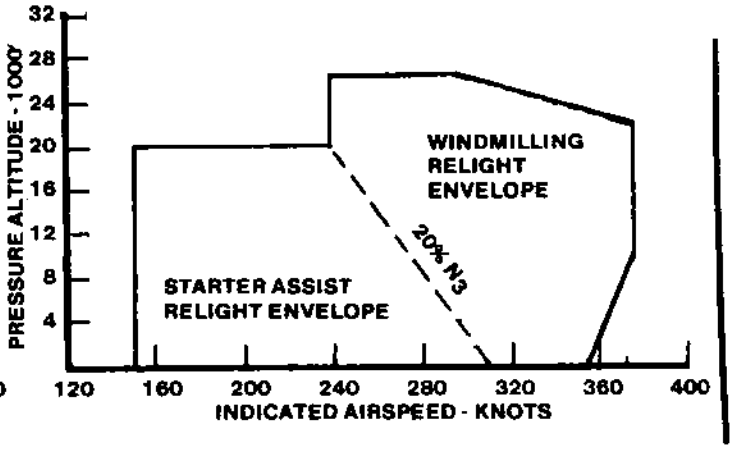
10. **IN-FLIGHT START ENVELOPE ..... CK**

THEN >>>>>>>>>>>>>>>>>>>>>>>>>

ENGINE START IN-FLIGHT (CONT'D)



-22B ENGINE IN-FLIGHT START ENVELOPE



-524B4 ENGINE IN-FLIGHT START ENVELOPE

<<<<<<<<<<<<<<<<<*IF*>>>>>>>>>>>>>>>>>

ASSISTED AIR START

CAUTION:
DO NOT ATTEMPT AN ASSISTED AIR START WITH MORE THAN 20% N_3.

11. **ENG ISLN VALVE.....LCH**

12. **GND START SW .....LCH**
VALVE OPEN Do not attempt start unless there is a positive indication of N_3 rotation (i.e. RPM or oil pressure).

13. ***AT 20% N_3 MIN:***
FUEL AND IGNITION SW .....ON
Use normal start procedures.

If start must be abandoned, or no light off within 90 seconds:
- FUEL AND IGNITION SW.....OFF
- GRD START RELEASE SW.....PUSH
Allow engine to drain for 30 seconds; another start may be attempted at a lower altitude.

14. ***AFTER ENGINE STABILIZES AT IDLE:***
SYSTEMS.....RESTORE

STOP

WINDMILL AIR START

11. **ENG ISLN VALVE .....UNL** OFF

12. **WINDMILL AIR START SW.....LCH** ON
Do not attempt start unless there is a positive indication of N_3 rotation (i.e. RPM or oil pressure).

13. **FUEL AND IGNITION SW .....ON**
Use normal ENRICH procedures.

If start must be abandoned, or no light off within 90 seconds:
- FUEL AND IGNITION SW.....OFF
- WINDMILL AIR START SW .....UNL
Allow engine to drain for 30 seconds; another start may be attempted at a lower altitude.

14. ***AFTER ENGINE STABILIZES AT IDLE:***
WINDMILL AIR START SW.....UNL

SYSTEMS.....RESTORE

END OF PROCEDURE

ENGINE; FAILURE TO DEVELOP TAKEOFF THRUST, THROTTLE STAGGER OR / UNSCHEDULED THRUST REDUCTION

A throttle advanced significantly beyond the other two throttles to produce equal thrust may indicate a VIGV problem, Fuel Control Amplifer failure or improper rigging.

1. **N_1, TGT, & ESPECIALLY N_2 TGT.....CK**
   - An RPM or TGT at the red line limit is an indication that fuel control amplifier is functioning normally.
     - TGT is not monitored on -524 engines.
     - N_1 is not monitored on -22B engines.
   - A high N_2 reading may indicate VIGV's are not operating on schedule. Be prepared for sudden thrust change and possible overboost if VIGV's shift back onto correct schedule.

V V

V V <<<<<<<<<<<<<<<<<*IF*>>>>>>>>>>>>>>>> V V

AIRSPEED BELOW V_1

V V

2. **TAKEOFF.....REJECT**

3. **BRAKE ENERGY CHART (ODM)...CONSULT**
   Refer to the Brake Energy Chart, contained in the Abnormal section of the ODM, to determine brake cooling time and if any additional actions are required.

4. ***IF N_2 WAS AT RED LINE LIMIT:***
   MAINTENANCE.....CONTACT
   - Probable cause is sticking VIGV's.
   - Return to gate for maintenance.

   STOP

   OR

   IF N_2 WAS NOT AT RED LINE LIMIT:
   FUEL CONTROL AMP. SW ...LCH OVRD
   Removes overspeed and overtemperature limiting.

5. **OPERATION WITH FUEL CONTROL AMPLIFIER SW IN** OVRD **PROCEDURE....ACCOMPLISH**
   See page 9.

STOP

AIRSPEED ABOVE V_1, OR IN-FLIGHT

V V

2. **TAKEOFF...CONTINUE ON AVAIL. THRUST**

3. ***AT OR ABOVE 1,000' AGL AND 2 OR 3 ENGINE CLIMB SPEED:***
   AFFECTED THROTTLE.....IDLE
   Prevents exceeding engine limits in next step.

4. **FUEL CONTROL AMP. SW ...LCH** OVRD
   Removes overspeed and overtemperature limiting.

5. **OPERATION WITH FUEL CONTROL AMPLIFIER SW IN** OVRD **PROCEDURE....ACCOMPLISH**
   See page 9.

6. ***IF THROTTLE STAGGER REMAINS***
   FUEL CONTROL AMPLIFIER SW ....UNL
   - Restores speed and temperature limiting.
   - Throttle improperly rigged (-22B) engines.

   ON -524 ENGINES
   AFFECTED FFR C/B (-500), OR HP3 BLEED AIR C/B (SHIP 724) ...PULL
   - 1E16 (No.1 engine).
     1E17 (No.2 engine).
     1E18 (No.3 engine).
   - Above FL250, after making any thrust reduction, let engine parameters stabilize on affected engine before increasing thrust.

END OF PROCEDURE

ENGINE: OPERATION WITH FUEL CONTROL AMPLIFIER IN OVRD

1. **TAKEOFF THRUST .....SET STATICALLY**
   - Use rolling takeoff procedure at aircraft weights less than 293,000 lbs.
   - Traffic and wind conditions may preclude a static engine run up to full takeoff EPR.

2. **THROTTLE .....OPERATE SMOOTHLY & SLOWLY**
   - S/O should closely monitor N_2 while Captain is advancing throttles.
   - Observe TGT and RPM limitations carefully.

   CAUTION:
   THERE IS NO OVERSPEED/TEMPERATURE PROTECTION

3. **ATS.....OFF FOR CLIMB & DESCENT**
   For CAT II or lower landing minimums engage ATS when **stabilized** on final approach.

END OF PROCEDURE

ENGINE; FAILS TO ACCELERATE IN-FLIGHT

An engine which has been operating at idle thrust at high altitude may fail to accelerate when throttle is advanced (N_3 may have dropped below 70%).

1. **THROTTLE .....IDLE**

2. **WINDMILL AIR START SW.....LCH ON**

3. **HI PRESS & ENG ISLN VALVE SWS.....UNL OFF**
   Aids acceleration by changing compressor air flow.

4. **FUEL AND IGNITION SW.....ENRICH**

   NOTE: If this procedure is not successful, engine may accelerate normally at lower altitude.

END OF PROCEDURE

ENGINE; VIB HIGH - ENG VIB FLTR PRESS

Procedure applies when engines are operating in a steady running condition and any VIB indicator increases above 2.5 units:*

1. **ENGINE INSTRUMENTS.....MONITOR**
   Observe for evidence of engine malfunction.

2. **AVM PICKUP SELECT....UNL A/LCH B ON**
   Normally switch A is latched, and all engines are monitored by the A pickups. Unlatching A and latching B selects the B pickup for all engines.

3. ***IF ABNORMAL ENGINE INDICATIONS EXIST, HIGH VIB IS INDICATED ON B PICKUP, OR ONLY ONE AVM PICKUP OPERATIVE:***

   V
   V **ENGINE SHUTDOWN**
   V **PROCEDURE .....ACCOMPLISH**
   V • See Emergency Procedures page 8.
   V • Do not restart unless a emergency exists.
   V
   V **STOP**

   OR

   V
   V

   IF ENGINE INDICATIONS AND B PICKUP VIB INDICATIONS ARE NORMAL:

   ENGINE OPERATION.....CONTINUE

   VIBRATION MONITOR .....TEST
   Press and release vibration monitor TEST button to extinguish amber VIB light and ENG VIB FLTR PRESS light.

END OF PROCEDURE

***NOTES NOTES NOTES NOTES:**

During takeoff roll, momentary AVM fluctuations without other indications of engine malfunction are not cause for engine shutdown.

When holding or descending in icing conditions, AVM indications may gradually increase to above 2.5 units. No action is required unless other indications of engine malfunction are observed. This condition can alleviated by increasing N_1 to 90% for 5 seconds when ice accumulation (gradual vibration increase) is first detected.

If both AVM channels become inoperative in flight, continue normal operation to next point of intended landing. Monitor engine for the remainder of the flight. If there is any evidence of engine malfunction, shut down the engine.

If, following any suspected bird strike, engine noise is increased or unusual vibration is sensed shutdown engine (conditions permitting) regardless of AVM readings.

OIL; QUANTITY LOW

Sustained climb angles of 15° or more may result in a low oil quantity indication. High climb angle may be continued as long as other engine oil indications are normal. Climb attitude and/or thrust should be reduced if the quantity decreases to 5 quarts.

1. **OIL PRESSURE/TEMPERATURE.....CHECK**
   Quantity less than 5 quarts requires close monitoring of oil pressure. Oil temperature should also be checked.

If Oil Pressure In Red Band or Oil Temperature Out Of Limits:

2. **THROTTLE .....IDLE**
   Check autothrottles OFF.

3. **FUEL AND IGNITION SWITCH.....OFF**

4. **AFFECTED HYD PUMP AND FIREWALL SHUTOFF VALVE CONT C/B(s) .....PULL**
   - If No. 1 Engine - 1L15
   - If No. 2 Engine - 1L16 and 1L17
   - If No. 3 Engine - 1L18

   Prevents destruction of the engine-driven hydraulic pump by allowing hydraulic fluid to continue to circulate after next step.

5. **FIRE PULL HANDLE.....PULL**
   Closes the fuel emergency shutoff valve(s) (and the tank valve for engine 1 or 3). This is a precautionary measure in case loss of oil was caused by accessory gearbox failure. Engine fire detection loops probably would not be activated by a fire in the accessory gearbox.

If Engine Fire Warning Does Occur, Complete the ENGINE FIRE/DAMAGE Emergency Procedure.

6. **ENGINE SHUTDOWN FOLLOW-UP.....**
   .....ACCOMPLISH
   Refer to EMERGENCY PROCEDURES, Page 8.

If Hydraulic Quantity Decreases:

7. **AFFECTED HYD PUMP AND FIRE WALL SHUTOFF VALVE CONT C/B(s) .....RESET**

OIL; TEMPERATURE HIGH

Log any stabilized oil temperature and time, in excess 90°C.

1. **FUEL TEMP .....CK**
   Approximate oil temp will be 15°C higher than fuel temperature (-22B only). This can be used to crosscheck oil temperature indication.

2. ***IF OIL TEMP EXCEEDS 100°C:***
   THROTTLE .....ADVANCE
   Increasing fuel flow may lower oil temperature.

3. ***IF OIL TEMPERATURE EXCEEDS 100°C FOR 15 MINUTES, OR EXCEEDS 135°C FOR ANY PERIOD:***
   ENGINE SHUTDOWN PROCEDURE .....ACCOMPLISH
   See Emergency Procedures page 8.

END OF PROCEDURE

OIL-FILTER-CLOGGED-FILTER PRESSURE

- Could indicate an impending engine failure.
- ENGINE VIB FILTER PRESS also illuminates on the Pilots Annunciator Panel.

ENGINE SHUTDOWN PROCEDURE . . . . . ACCOMPLISH

- See Emergency Procedures Section.

———END OF PROCEDURE———

OIL-PRESSURE LOW OIL PRESS ENG

- Low oil pressure is indicated by the OIL PRESS ENG light illuminated on the Pilots Annunciator Panel and /or oil pressure in the red band. Low oil quantity may also be indicated.

CAUTION
IN THE EVENT OF OIL QUANTITY LOSS, REFER TO THE OIL QUANTITY LOW, ABNORMAL PROCEDURE,THIS SECTION.

If Oil Pressure Is Less Than 18 PSI, or If Oil Quantity Is Low or Decreasing:

AFFECTED THROTTLE . . . . . IDLE

- Loss of oil pressure and/or quantity may be due to oil migration.
- Reducing thrust to idle may permit scavenge pump to regain prime.

OIL QUANTITY/PRESSURE . . . . . MONITOR

- If oil migration has occurred, quantity and pressure should begin to increase, and normal engine operation may be resumed.

If Pressure and Quantity Does Not Begin to Recover Within 45 Seconds:

ENGINE SHUTDOWN PROCEDURE . . . . . ACCOMPLISH

- Loss of oil quantity indicates a system failure.
- See Emergency Procedures Section

If Oil Pressure Is Between 18 and 35 PSI with a Steady Oil Quantity:

OIL TEMPERATURE AND THROTTLE POSITION . . . . . CHECK

- If the oil temperature is high, advancing the throttle may lower the oil temperature due to an increase in fuel flow through the fuel oil heat exchanger. However, oil pressure may not increase until after a drop in the oil temperature.
- If oil temperature is normal, retarding the throttle may increase the oil pressure provided no increase in oil temperature occurs.

If Oil Pressure Remains in the Red Band for 5 Minutes:

ENGINE SHUTDOWN PROCEDURE . . . . . ACCOMPLISH

- See Emergency Procedures Section.

REVERSE THRUST; REVERSER PRESSURE - IN-FLIGHT

See Emergency Procedures, Reverse Thrust In-Flight procedure, if yawing, buffeting or loss of airspeed occurs. Otherwise:

1. **N_3 MAXIMUM.....80%**
   Reducing engine thrust minimizes damage to reverser motor.

END OF PROCEDURE

REVERSE THRUST; TRANSIT - IN-FLIGHT

See Emergency Procedures, Reverse Thrust In-Flight procedure, if yawing, buffeting, or loss of airspeed occurs. Otherwise:

1. **AIRSPEED.....250**
   - Continue at reduced speed, monitoring reverser light indications.
   - If possible, make visual inspection to confirm reverser is stowed.

END OF PROCEDURE

REVERSE THRUST; REVERSE, REVERSER PRESSURE, OR TRANSIT - ON THE GROUND

Do not operate an engine for more than 10 minutes with it actually in reverse to prevent damage to reverser components.

1. **THROTTLE .....IDLE**

2. **HI PRESS AND ENG ISLN VALVE SW.....UNL OFF**

3. ***APPROACHING GATE, IF ANY LIGHT REMAINS ILLUMINATED:***
   REVERSER.....CYCLE
   Avoid rapid cycling of reverse lever.

4. **IF ONLY REVERSER PRESSURE REMAINS: N_1 MAXIMUM (FOR 5 SECS) 70%**

5. **NORMAL SHUTDOWN.....COMPLETE**
   Advise maintenance if any light remained illuminated before shutdown.

END OF PROCEDURE

ENGINE; S DUCT DOOR UNLOCKED - FWD S DUCT - AFT S DUCT

Light on S/O Annun. Panel indicates that FWD or AFT latch on S duct door may be unlocked.

V
V

V <<<<<<<<<<<<<<<<<IF >>>>>>>>>>>>>>>>V
V V

ON THE GROUND

V
V

1. **S DUCT DOOR .....CK**
   Have maintenance ensure S duct door is locked.

STOP

DURING FLIGHT

V
V

1. ***IF EITHER LIGHT ILLUMINATES:***
   NORMAL FLIGHT .....CONTINUE

2. **IF BOTH LIGHTS ILLUMINATE:**
   AIRSPEED MAXIMUM.....270
   Engine shutdown not required.

END OF PROCEDURE

ENGINE; FAILS TO SHUTDOWN

May be caused by failure of the fuel control shutoff valve or battery (last engine shutdown only).

1. **FIRE PULL HANDLE.....PULL**
   Engine continues to run up to one minute.

2. **BATTERY VOLTAGE.....CHECK**
   Normal shutdown procedures will not work on last engine if battery voltage is less than 22, unless APU/EXT POWER is available.
   - If Battery Charger Mode switch installed, positioning switch to STBY restores power to the DC Standby Bus to permit normal engine shutdown.

IF REQUIRED TO MOTOR ENGINE AFTER SHUTDOWN:

ENG ISLN VALVE C/B
(1G10, 11, OR 12).....PULL
Pull appropriate C/B (green coded) to permit motoring engine.

AT 10% N_3, GROUND START SW.....LCH

IF ENGINE FAILS TO SHUTDOWN:

WITH

BATTERY VOLTAGE 22 OR MORE:

3. **MAINTENANCE.....ALERT**
   Fuel must be shutoff manually.

STOP

BATTERY VOLTAGE LESS THAN 22, AND NO EXT POWER OR APU:

3. **LAST ENGINE SHUTDOWN MUST BE A WING ENGINE**
   A significant delay is required for Maintenance to manually shutoff fuel control, it may be desirable to restart wing engine so No. 2 engine can be shutdown from the cockpit.

IF ONLY NO. 2 ENGINE OPERATING:

NO. 2 FIRE PULL HANDLE.....RESET
NO. 2 FUEL & IGNITION SW.....ON
NO. 2 GENERATOR FIELD.....CLOSE
WING ENGINE.....START
NO. 2 ENGINE.....SHUTDOWN

TO SHUTDOWN WING ENGINE:

FIRE PULL HANDLE.....RESET
FUEL AND IGNITION SW.....ON
GENERATOR FIELD.....CLOSE
FUEL TANK VALVE.....UNL CLOSE
- FUEL AND IGNITION switch ON assures electrical power to instruments and TANK VALVE until flameout.
- Engine continues to run up to one minute.
- Engine generator trips OPEN when flameout occurs.

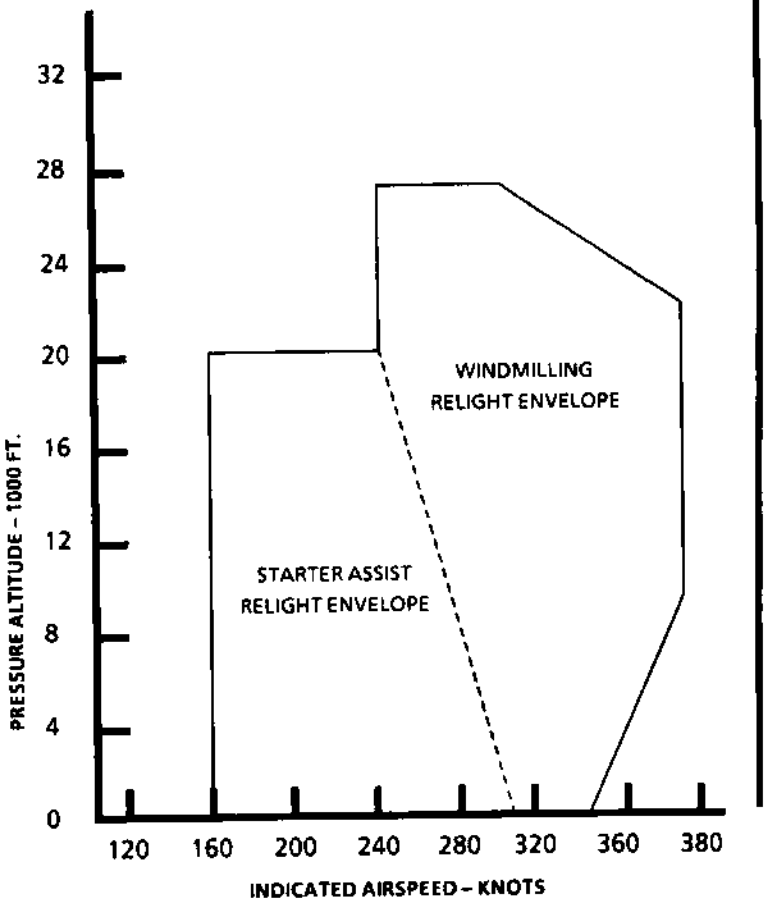
AFTER FLAMEOUT OCCURS:
FUEL AND IGNITION SW.....OFF

END OF PROCEDURE

END

524 INFLIGHT START PROCEDURE

The In-Flight Start procedure for 524B engines is identical to the -22B, however, the start envelope is different as shown.



524B UNSCHEDULED THRUST REDUCTION

May be caused by a malfunctioning Fuel Control Amplifier or Fuel Flow Regulator (FFR) Slugger Control Valve.

N3 MAXIMUM **80%**

- Prevents exceeding TGT/RPM limits when Fuel Control Amplifier is deactivated.

AFFECTED FUEL CONTROL AMPLIFIER SW . . . . . **LCH OVRD**

- Cancels automatic overtemperature and overspeed limiter.

***If* RPM Increases When OVRD:**

THROTTLES . . . . . **OPERATE NORMALLY**

- Observe TGT/RPM limitations.
- Manually control throttles.

CAUTION:

MONITOR RPM AND TGT CLOSELY DURING HIGH THRUST APPLICATION.

———END OF PROCEDURE———

If* RPM *Remains Unchanged:

FUEL CONTROL AMPLIFIER SW . . . . . **UNL**

- Restores automatic overtemperature and overspeed limiter.

AFFECTED FFR C/B (-500) or HP3 BLEED AIR)-100/200) . . . . . **PULL**

- C/B 1E 16 (No. 1 Engine)
- 1E17 (No. 2 Engine)
- 1E 18 (No. 3 Engine)
  - Above FL 250, after making any thrust reduction, let engine parameters stabilize on effected engine before increasing thrust again.

———END OF PROCEDURE———

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(OPPOSITE SIDE BLANK)

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INTRODUCTION

GENERAL

Normal operating procedures are presented in detail in this section. The procedures set forth in this section will be used at all times under normal operating conditions; however, if an abnormal or emergency exists, the procedures and checks described are not intended to limit or restrict the command authority of the Captain. The items and responses in this section coincide with cockpit checklists but have been expanded and explained as necessary.

WARNING
IF AN "AIRCRAFT OUT OF SERVICE" TAG IS PRESENT (NORMALLY PLACED OVER THE THROTTLE QUADRANT OR CONTROL COLUMN), THE AIRCRAFT IS THE RESPONSIBILITY OF MAINTENANCE. NO SYSTEM SHOULD BE ACTIVATED WITHOUT VERBAL APPROVAL OF AND COORDINATION WITH MAINTENANCE PERSONNEL.

PILOT'S CHECKLIST (Abbreviated)

The Pilot's checklist is designed to verify that checks and procedures essential to flying safety have been accomplished. The checklist is **not** a do list. When a Normal Procedures checklist is to be read, the challenges must not be recited from memory. The crew member reading the checklist should visually verify switch position or action while reading the challenge portion of the checklist.

When the printed response to any checklist item is "AS REQD", the proper response is the actual position of that switch/system.

Certain challenge and response items which reflect the position of the controls critical to the safety of flight require the pilots to verbally identify the observed position of the control. The responding crew member will state the position of the control and verify that its position is correct. Items requiring this action are identified by a "_____" in the challenge and/or response and are explained in the expanded procedures.

On the initial flight of the day by a crew on an aircraft, ALL items on the BEFORE START Checklist should be noted and properly positioned for flight. On intermediate stops, only items which appear with the small BLACK SQUARES beside them need to be accomplished.

If maintenance is performed in the cockpit, cockpit left unattended, or unsupervised visitors are allowed in the cockpit, the entire BEFORE START Checklist should be accomplished to ensure correct switch positioning.

REVERSE PRINT

- Challenges and responses printed in reverse print on the checklist require a response from both pilots (C&F), unless other crew members are designated.

DUAL LINE BOXED

- Items to be Challenge and Response. The crew member designator indicates which crew member is responsible for verifying and responding to the challenge.

SILENT ITEMS

- Items located outside the dual line box do not require Challenge and Response. The checklist item should be accomplished or observed as appropriate and the checklist subsequently read silently to verify compliance.

■BLACK SQUARES

- Intermediate Stop items.

DESIGNATORS

- Each item will have a designator included indicating the crew member(s) responsible for verifying that a particular item has been accomplished. Also, the designator indicates the crew member(s) who respond(s) aloud to the checklist item if the item is a **CHALLENGE & RESPONSE** or a **CRITICAL ITEM**. The following symbology is used:

C	Captain
F	First Officer
S	Second Officer
C&F	Captain and First Officer
C&S	Captain and Second Officer
PF	Pilot Flying
PNF	Pilot Not Flying
ALL	All crew members

(Continued on next page)

CHECKLIST PHILOSOPHY

Crew members call for and respond to the various checklists as follows:

- The Captain calls for all checklists during ground operation.
- The BEFORE START checklist will normally be read by the First Officer. The Captain and Second Officer respond to the items. However, the Captain retains the latitude to read to the other crew members. In this case the First Officer will respond to those items designated as a "C". Reverse print items are answered by both pilots or specifically designated crew members.
- When the aircraft is in **motion on the ground**, after the Captain calls for the checklist(s), the Second Officer will challenge and the First Officer will verify and respond to the challenge unless designated "S". The Second Officer will respond to his own challenge if "S". Reverse print items are answered by both pilots.
- When in flight, the Pilot Flying will call for the checklist. The Second Officer will challenge and the Pilot Not Flying will verify and respond to the challenge unless designated "S". The Second Officer will respond to his own challenge if "S". Reverse print items are answered by both pilots.
- Upon completion of an individual checklist, the crew member completing the checklist will state "(CHECKLIST NAME) CHECKLIST COMPLETE".
- Even though the preceding delineates crew member responsibility, it does not alleviate the other crew members from bringing to the Captain's attention a checklist he feels has been overlooked or delayed too long.
- Items on the AFTER LANDING Checklist will be accomplished **only** after the **aircraft has cleared** the active runway.

NOTE: If a system test is desired and not procedurally covered in the expanded portion of the NORMAL checklist, see either the appropriate SYSTEM OPERATION or SUPPLEMENTAL INFORMATION section.

NOTE: the checklist must not be modified in any way, i.e., lines drawn through challenges and responses, etc.

MONITORING ENGINE AND SYSTEMS OPERATION

The Second Officer will advise the captain of abnormal engine or systems indications throughout the flight including landing, and the Captain will direct the action to be taken. The Second Officer's seat position should be such that his/her attention can be split between the S/O panel and the front of the aircraft during takeoff and approach/landing. This will enable him/her to monitor engine instruments and participate in outside vigilance.

At the **Captains direction**, the Second Officer may operate:

- Wing Anti-ice
- Engine Anti-ice
- Seat Belt Sign
- No Smoking Sign
- Ignition
- Wipers

Additionally, and at the Captain's **DIRECTION** the Second Officer may **REFINE** climb and/or cruise throttle settings but the initial throttle movement must be made by the PF.

AIRCRAFT DIFFERENCES

In most instances the expanded procedure descriptions for the Pilot's and Second Officer's Normal Check refer to the L-1011-1 aircraft. Where equipment configurations or the type operation differs from those in domestic L-1011-1 operations, the aircraft model or type operation will be identified, e.g., (-250/500), (Transoceanic), etc. preceding the applicable procedure.

-250/-500 Aircraft

- Operating limitations, emergency and abnormal procedures are contained in the POM blue pages.
- Basic systems description differences are contained in the PRM blue pages.
- INS system descriptions are contained in the NAVIGATION blue pages of the PRM.
- Use the L-1011-250 or L-1011-500 Operational Data Manual (ODM) white takeoff pages to determine Flaps 18, 22 or 14 V speeds. Brake energy limits are incorporated into the ODM speeds.
- At times, Flaps 14 CEARWAY performance will be required. When this occurs, use the ODM or Aircraft Restrictions Manual (ARM) salmon colored pages to determine V speeds.
- Takeoff EPR and stabilizer settings will be on the tabletop chart or green (-250) power chart.

AIRCRAFT DIFFERENCES (CONT'D.)

Ship 724

- Operating limitations, emergency and abnormal procedures, while operating in the -100 or -200 configuration, are contained in the POM blue pages.
- Basic systems description differences are contained in the PRM.
- INS system descriptions are contained in the NAVIGATION blue pages of the PRM.

-100 Configuration

This configuration occurs when -250 aircraft or Ship 724 are equipped for international flights and three -22B engines or an intermix of -22B and -524B4 engines exists. A pink placard will be installed on the F/O's instrument panel to identify the aircraft as being in the -100 configuration. Heavy duty tires, wheels and brakes are installed. The maximum takeoff weight for international flights is 466,000 pounds. For domestic operations, the takeoff weight is restricted by company policy to 430,000 pounds.

three INS units are installed for international flights. For domestic operations, normal gyros can be installed.

Use the L-1011-100 ODM white takeoff pages to determine Flaps 10 or 14 V speeds. Brake energy limits are incorporated into the ODM speeds.

At times IMPROVED PERFORMANCE or CLEARWAY performance will be required. When this occurs, use the ODM or ARM salmon colored pages to determine Flaps 4, 10 or 14 V speeds.

Takeoff EPR and stabilizer settings will be on a pink power chart.

-200 Configuration

For Ship 724, this is the configuration most likely to be encountered. A yellow placard on the F/O's instrument panel identifies the aircraft when it is a -200.

- Heavy duty tires, wheels and brakes are installed. The maximum takeoff weight for international flights is 474,000 pounds. For domestic operations the takeoff weight is restricted by company policy to 430,000 pounds.
- Three INS units are installed for international flights. For domestic operations, normal gyros can be installed.
- Use the L-1011-200 ODM white takeoff pages to determine Flaps 18, 22 or 14 V speeds. Brake energy limits are incorporated into the ODM speeds.
- At times, Flaps 14 CLEARWAY performance will be required. When this occurs, use the ODM or ARM salmon colored pages to determine V speeds.
- Takeoff EPR and stabilizer settings will be on a yellow power chart.

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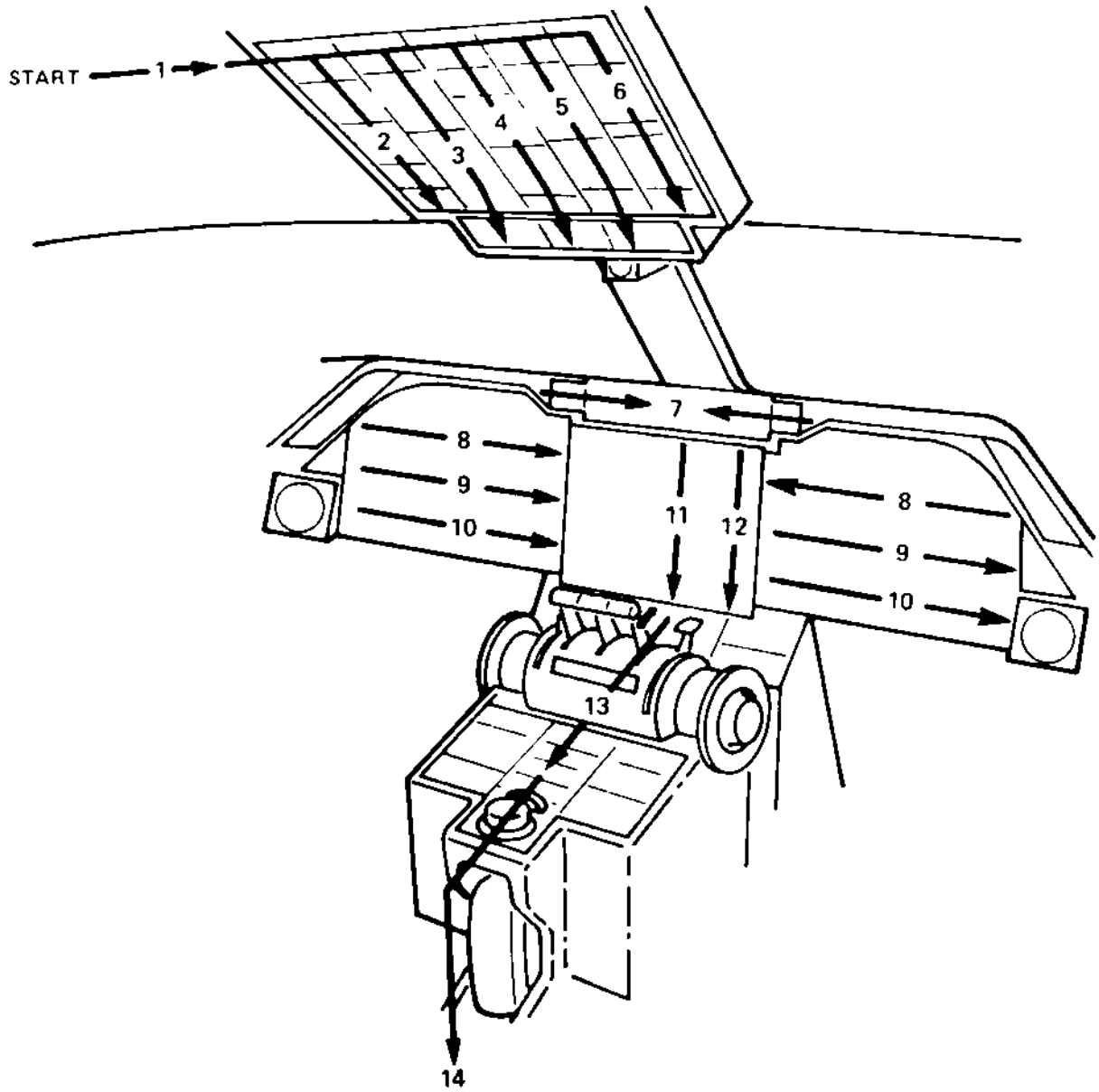
CURRENT CHECKLISTS/POWER CHART

ITEM	DATE
Pilot's Checklist	2-20-89
Second Officer's Checklist	2-20-89
Emergency Checklist	6-23-83
Takeoff/Landing Data Power Chart (White)	4-15-88
Climb/Cruise Data Power Chart (White)	8-5-80
-100:	
Takeoff/Landing Data Power Chart (Pink) Use ODM for V speeds	3-21-86
-200	
Takeoff/Landing Data Power Chart (Yellow)	3-21-86
Climb Data Power Chart (Yellow)	1-31-85
For Cruise And Descent Data: **USE THE ODM**	
-250	
Takeoff/Landing Data Power Chart (Green) Use OMD for V Speeds	3-26-87
-500	
For International Flights: **USE ODM FOR V SPEEDS**	
Takeoff/Landing Data Power Chart (Blue) **Domestic** only	7-24-86

NOTE: If you receive a Checklist or Power Chart dated later than as listed above, retain it pending revision of this listing

GENERAL (CONT'D.)



CAPTAIN/FIRST OFFICER PANELS – FLOW PATTERN

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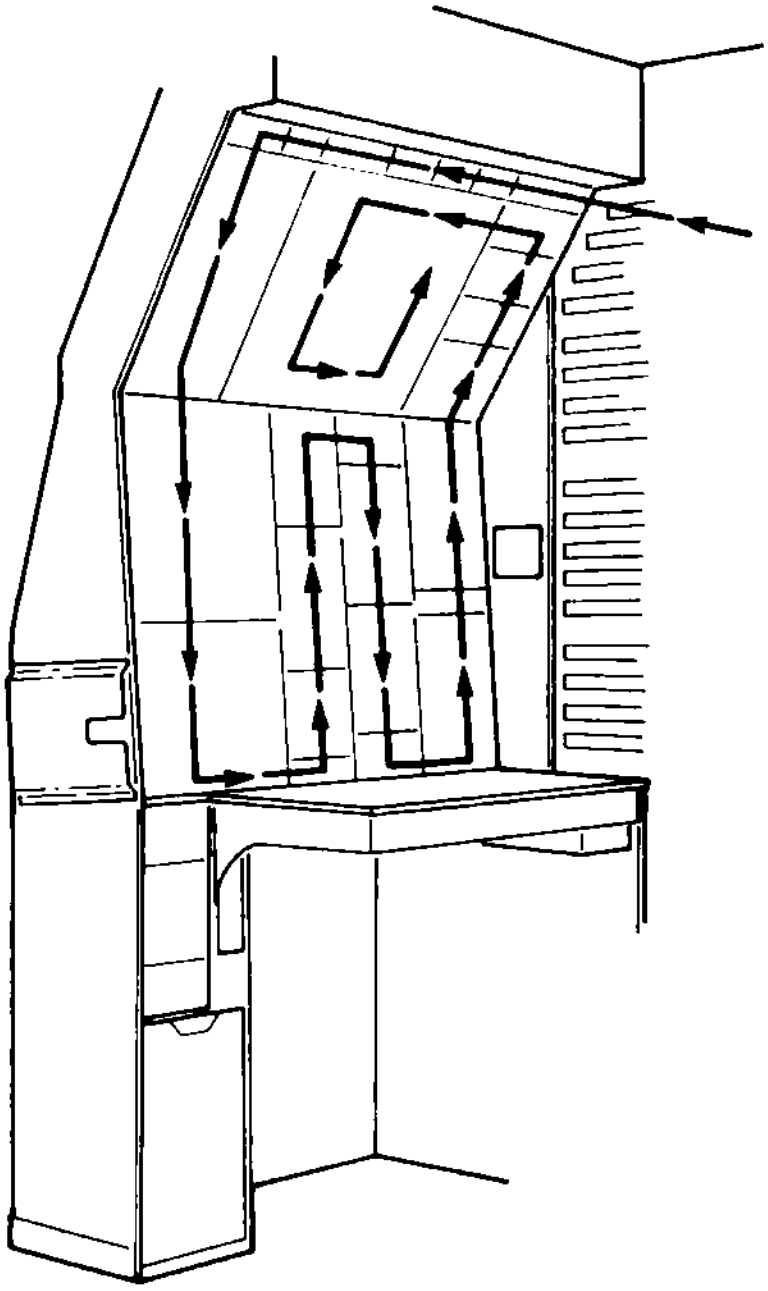
GENERAL (CONT'D.)



S/O PANELS - FLOW PATTERN

EXTERIOR PREFLIGHT INSPECTION

The exterior preflight inspection should be conducted in accordance with the flow pattern shown. On originating or crew change flights, the complete check must be made. At intermediate stops, emphasis should be on tire wear, controls, damage, or leaking fluids.

On international flights, in addition to the regular requirements for exterior preflight inspection the S/O should pay additional attention to the following:

- Condition of tires, wheels and brakes.
- Aerodynamic cleanliness of airframe, including fairings, doors, flight controls, etc.
- Evidence of fluid leaks.

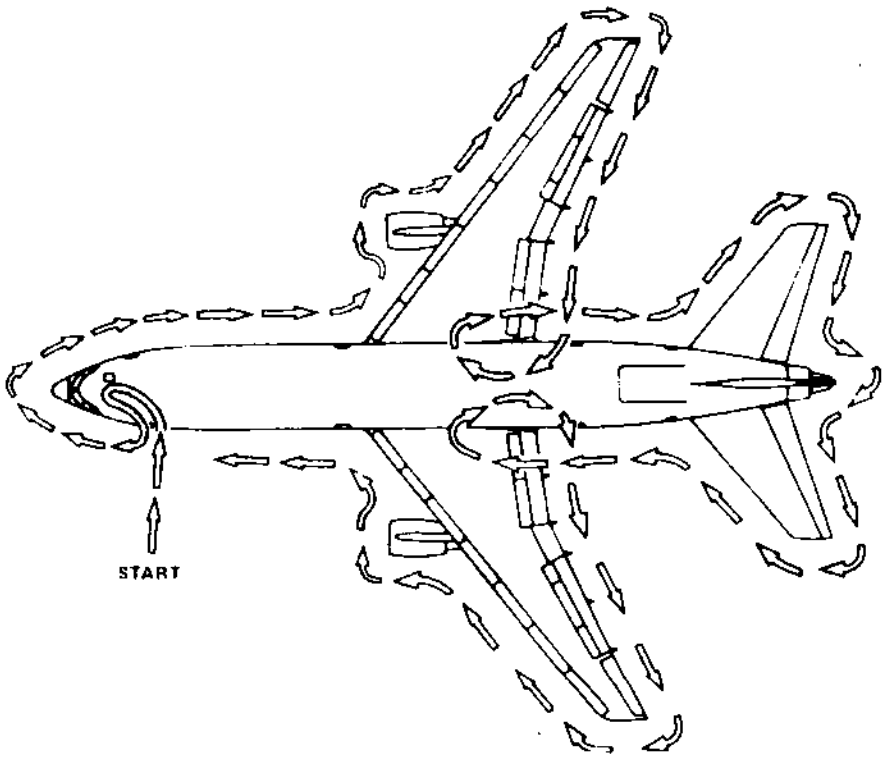
If maintenance is in progress, check with Maintenance personnel to determine if work will prevent activation of any system.

Make a general inspection of all surfaces, fuselage, empennage, wings, etc., windows, antennas, landing gear, engines, cowling, etc. Check for cleanliness, damage, fluid leakage, discoloration of lights, all access panels and doors secure, and no obstructions. In cold weather insure static ports are clear of ice.

WARNING

DO NOT PRESSURIZE ANY HYDRAULIC SYSTEM AND DO NOT PRESSURIZE ANY PNEUMATIC SYSTEM UNTIL MAINTENANCE CLEARANCE IS OBTAINED IF:

- ***AIRCRAFT OUT OF SERVICE TAG INSTALLED***
- ***ANY FLIGHT CONTROL SURFACE IS NOT CLEAR***
- ***SLATS OR TRAILING EDGE FLAPS EXTENDED***
- ***ANY MAIN GEAR DOOR IS OPEN (ASSURE DOOR RELEASE HANDLE LOCKED IN OPEN POSITION)***
- ***ANY REVERSER NOT STOWED***



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EXTERIOR PREFLIGHT INSPECTION (CONT'D.)

NOSE WHEEL WELL

- Downlock Safety Pin Removed
- Nose Wheel Well Lighting
  - Check wheel well light for operation (control switch in cockpit).
- External Power Access Door
  - Door secured unless external power is in use.
- NLG Actuating Cylinder
  - Condition and no leaks.
- Nose Gear Steering Mechanism
  - Condition and steering lockout pin in position.
- Strut, Wheel and Tires
  - Condition; strut extension; no visible leaks. Tire inflation and chocks.
- Steering Linkage
  - Normally disconnected for Push–back.
- Taxi and Landing Lights
  - Condition and evidence of overheating.
- Wheel Well Area
  - Condition and no leaks. Gear pin container closed and secure. Visual downlock indicators condition.
- Doors and Linkage
  - Front doors closed; condition and security.

NOSE SECTION

- No. 1 Pack
  - Ram air inlet clear, exhaust louvers open, and access panels secured.
- Forward Lavatory Ground Service Panel
  - Closed and secured, no leaking fluid.
- Pitot and Static Probes
  - Clear and unobstructed.
- Angle of Attack Sensor
  - Clear and unobstructed.
- Avionics Compartment Access Door
  - Closed and secure.
- Left and Right Total Temp Probes
  - Clear and unobstructed.
- Ice Detector Probe
  - Clear and unobstructed.
- Radome and Nose
  - Radome latches secure.
- Oxygen Thermal Discharge Indicator
  - Green disc intact.
- No. 2 and 3 Packs
  - Ram air inlets clear, exhaust louvers open, and access panels secured.
- Avionics Compartment Vent
  - Unobstructed and fan operating.

RIGHT FORWARD FUSELAGE

- Preconditioned Air Connection Access Panels
  - Closed and secure.
- Angle of Attack Sensor
  - Clear and unobstructed.
- Safety Valve Fairings
  - General condition and flush.
- Potable Water Service Access
  - Panel closed and secure.
- On -500 aircraft check water tank quantity and pressure through access panel located in bottom of fuselage below R2 door.

  NOTE: On Ships 754–756 and 759–762 water tank quantity gauges are installed on the S/O's panel.

- Doors
  - Condition of forward passenger, forward cargo, galley entrance, mid passenger and mid electrical service center doors.
- High Pressure Air Connection Access Panels
  - Closed and secure.
- RAT Panel/Safety Bar
  - Closed and secure; RAT bar removed.

  CAUTION
  DO NOT WALK DIRECTLY BENEATH RAT AREA.

- Exterior Lights
  - Anti–collision, landing and runway turnoff lights condition and no evidence of overheating.

RIGHT WING

- Inboard Undersurface and Leading Edge Slats
  - Condition, no fluid leaks, and all panels closed and secure. Note flap/slat position.
- Fire Extinguisher Thermal Discharge Indicator
  - Check pressure and discharge indicator intact.
- -524 wing engines do not have visible fire bottle indicators. Maintenance checks bottle pressure at each letter check.
- Number 3 Engine
  - Reversers stowed (translating cowl forward of red strip on drain mast); cold stream lock indicators; engine inlet, P_1 probe, cowl, fan blades; fan exit and tailpipe areas; blocker flaps flush; cowl and nacelle access panels. No fluid leaks.

EXTERIOR PREFLIGHT INSPECTION (CONT'D.)

RIGHT WING (CONT'D.)

- Pylon
  - Condition. No leaks.
- Outboard Undersurface and Leading Edge Slats
  - Condition, no evidence of fluid leaks and all panels closed and secure. Note slat position.
- Pressure Fueling Station
  - Access panel closed and secure; no leaks.
- Wing Tip
  - Fuel vent scoop and wing tip lights condition.
- Fuel Jettison Nozzle, Ailerons, Flaps and Spoilers
  - Fuel jettison nozzle; inboard & outboard ailerons; trailing edge flaps and spoilers retracted. (All ailerons will droop without system pressure.)

NOTE: Any extended spoiler panel must stow when appropriate hydraulic system is pressurized.

RIGHT MAIN GEAR AND WHEELWELL

- Main Gear
  - Tire wear and inflation; downlock safety pin removed; strut linkage and no leaks; hydraulic line condition and no leaks; check brake wear indicators and brake assemblies condition.
- Wheel Well
  - Entire wheel well area condition and no leaks. Brake fuse plugs flush and bypasses safetied.
- Gear Doors
  - Closed, condition and linkage.

CAUTION

IF DOORS ARE OPEN ASSURE DOOR RELEASE HANDLES ARE LOCKED IN THE OPEN POSITION.

- Hydraulic Compartment Access (2)
  - Access doors closed and latched.
- APU Panel
  - Closed and secure.

AFT RIGHT FUSELAGE

- Doors
  - Condition of aft passenger, emergency exit, mid and aft cargo and ATM access doors.

EMPENNAGE CONTROL SURFACES AND NO. 2 ENGINE

- Aft Lavatory Servicing Access
  - Closed and secure, no leaking fluid.
- APU
  - Inlet; exit doors; area condition no leaks, fire extinguisher pressure discharge indicator intact, and exhaust area clear.
- Tail Skid
  - Skid extended, condition and no leaks.
- Vertical and Horizontal Stabilizers and Control Surfaces
  - Vertical stabilizer leading edge and rudder. Horizontal stabilizer leading edge and elevators.
- Number 2 Engine
  - Check same as No. 3 engine except for those items which cannot be inspected from the ground.

AFT LEFT FUSELAGE

- Doors
  - Condition of aft emergency exit doors.
- Aft Outflow Valve
  - Open and unobstructed.
- Fuel shroud and Hydraulic Drain Masts
  - Unobstructed and no leaks.
- Fuel Shroud & APU Compartment Drain Mast
  - Unobstructed and no leaks.
- Hyd Service Center & Fuel Shroud Drain Mast
  - Unobstructed and no leaks. (Inboard and aft of the right main gear door).

LEFT MAIN GEAR AND WHEEL WELL

- Inspect same as right side.

LEFT WING

- Inspect same as right side.

LEFT FORWARD FUSELAGE

- Mid Passenger Door
  - Closed and secure.
- Mid Electrical Service Center Vent
  - Unobstructed and fan operating
- Cabin Press Control Static Ports
  - Clear and unobstructed.
- Galley Compartment Vent
  - Unobstructed and fan operating.
- Forward Outflow Valve
  - Open and unobstructed

COCKPIT SAFETY INSPECTION

Perform on each originating trip or crew change.

RED "OUT-OF-SERVICE" TAG .... STOWED
- If an Aircraft Out of Service Tag is evident, the aircraft is still the responsibility of Maintenance, and no checklist should be initiated or any system activated without prior approval from Maintenance.

LOGBOOK
- Check the Aircraft Log Book and MCO's to be familiar with the history and maintenance status of the aircraft. Report significant items to the Captain.
- Determine that the Airworthiness Release has been signed before leaving the ramp.

MANUALS
Check the following items are on board and stowed in the proper place:
- Aircraft Restrictions & Operational Data Manuals.
- Pilot's Second Officer's, and Emergency Checklists.
- FMS Data Bank Manual, check currency.
- Takeoff/Landing, Climb/Cruise Data Charts.
- Takeoff and Landing Data Forms.
- Engine Performance Log.
- Spare bulbs.

- **-500 AIRCRAFT:**
  - FMS PILOT'S DATA BANK Book.
  - 555-9 Series Aircraft Restrictions Manual.
  - -500 Operational Data Manual.

- **SHIP 724:**
  - 555-10, -11 or -14 Series Aircraft Restrictions Manual as appropriate.
  - -200, -100-1 Operational Data Manual as appropriate.

- **-250 AIRCRAFT**
  - FMS PILOT'S DATA BANK Book.
  - 55-13 Series Aircraft Restrictions Manual.
  - -250 Operational Data Manual.

CIRCUIT BREAKERS IN
- On Ships 730 & subsequent, check that BATTERY CHARGER MODE Switch in C/B position 3K2 is in NORMAL.

PASSENGER OXYGEN MANUAL SW UNL
- Assure switch is unlatched before applying power.

FIRE PULL HANDLES IN

H.F. RADIOS OFF

MASTER RADIOS LCH
- Latch ESSENTIAL and No. 2 Switches.
- Confirm **OFF** extinguished.

GEAR HANDLE DOWN
- Confirm gear handle down.

STABILIZER TRIM ZERO
- Set trim indicator to zero degrees to eliminate mismatch between column and stabilizer position when hydraulic system is pressurized.

FLAP/SPEEDBRAKE
- Handle positions should agree with actual position of flaps and speedbrakes as observed during exterior walkaround inspection.

RADAR OFF

TRANSPONDER STBY

MECHANICAL GEAR RELEASE COMPARTMENT
Under cover at aft base of center console.
- All switches guarded.
- Mechanical release handles stowed.

OBSERVER'S AREA
- Rain repellent fluid level; pressure in green band.
- Radio beacon.
- Escape hatch closed and inertial reel handles secured.
- FIRM Manual.
- Walkaround oxygen bottle (1650 PSI min).
- Fire extinguisher secured and lead seal installed.
- Hand axe secured.
- Smoke goggles condition; minimum one pair for each flight crew member on duty.
- MCO pouch (underside of FWD Avionics hatch); items correspond to Log Book status.
- Emergency medical kit secured and lead seal installed.
- Security Kit (back of Captain's seat).

COCKPIT SAFETY INSPECTION (CONT'D.)

COCKPIT DOOR
- Hinge, lock and frame security; door release operative.
- Viewport clear.
- Key available.

COAT COMPARTMENT AREAS
- Assure **all items** stowed in compartment **belong to the crew.**
- In right hand compartment, no items may be stowed on floor.
- Assure restraint strap is fastened across baggage area.

BATTERY ON
- DC Meter Selector BAT. Nominal battery voltage is 28V (22V min.).
- Check **BATTERY CONDITION** (APU panel). If illuminated, notify Maintenance. Do not attempt APU start.

Before Applying APU/External Power:

FIRE DETECTION LOOP TEST
- If APU is operable, perform test of Fire Detection Loop Panel as outlined later in this section. Only ENG/APU FIRE DETECTION LOOP TEST available with battery power.

AC PUMPS UNL; ATM'S OFF

GALLEY POWER UNL

TANK PUMPS UNL

ENG NO.2 TANK VALVE LCH

FUEL JETTISON UNL

APU START

NOTE: Minimize operation of APU in ambient temperatures of 25° to 40°F with visible moisture present.

If APU is Operable:
- APU MASTER POWER ON:
  - PRI illuminates then extinguishes.
  - **LOW OIL QUANTITY** should remain extinguished.
  - AC Meter Selector - APU.
  - AUTO FIRE SHUTDOWN ARMED & latched.
  - BLEED AIR S/O unlatched.
  - Select MIN MODE.
- Press START:
  - **DOORS IN TRANSIT** extinguishes after about 10 seconds, then DONT LOAD until on speed.
- BAT volts and amps.
- Monitor RPM and TGT.
  - TGT should rise smoothly and continuously until **DON'T LOAD** extinguishes.
  - If N_G hangs in green band for more than 5 seconds with DONT LOAD, press STOP.

  NOTE: APU starter limits are 3 attempts with 30 seconds between attempts; then wait 1 hour.

APU OR EXT POWER ON

If APU Electrical Power is to Be Used:
(APU stabilized on speed, **DON'T LOAD** extinguished):
- APU GENERATOR FIELD AND GENERATOR BREAKER FLOWBARS should illuminate as the APU generator automatically assumes the buses (TIE BREAKER FLOWBARS). If not, close manually.
- Check APU Volts and Freq.
- Check APU KW less than 81.
- Check battery charger operation.
- Latch any TANK PUMP (CROSSFEED VALVES as required) to assure positive fuel pressure.

If EXT POWER is to Be Used:
- EXT POWER AVAIL .
- AC Meters Selector EXT PWR; Check Volts and Freq.
- EXT POWER switch ON; check ON .

NOTE: External power has electrical priority over the APU.

- Assure all buses powered (TIE BREAKER FLOWBARS).
- Check battery charger operation.

ENGINE BLEED CONTROL PANEL
- Accomplish entire Engine Bleed Control Panel Section of S/O Checklist.

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COCKPIT SAFETY INSPECTION (CONT'D)

INS ALIGN/CHECKED
(Non-Transoceanic)
Flights dispatched between domestic U.S. Cities, and Mexico may operate with INS units selected to the ATT mode or NAV mode. If NAV mode will be selected for flight, present position must be initialized and alignment must be completed prior to selecting NAV. Refer to INS Quick Reference Procedures (Domestic crews only).
NOTE: Both 115V AC & 28V DC battery power are needed for INS alignment. CAUTION: insure that cooling air is available to navigation units before turning INS MSU switches on.

Check the INS COOLING SW is unlatched. The ON and LO FLO lights are extinguished. Ship 724, INS COOLING SW latched ON.

PARKING BRAKES . . . . . **SET**

(Transoceanic)
INS MODE SELECTORS . . . . . **ALIGN**
- The airplane must not be towed or taxiied during INS alignment.
- For all transoceanic operations use the actual ramp position lat/long to establish present position.
  Before any transoceanic operation, if INS MODE Selectors already in ALIGN, downmode selectors to OFF then back to ALIGN to assure navigation accuracy.
- Check INSERT on each CDU.
- From-TO displays indicate 1-2.
- INS 1 & 2 AUTO-MAN switches; AUTO.
- INS 3 AUTO-MAN switch MAN.

INS LIGHTS . . . . . **TEST**
- Position DIM control to set desired light intensity on displays. If control is in **full DIM**, displays will appear blank.
- Place Data Selectors in DSTRK/STS.
- Press TEST switch:
  - All lights on the CDU and MSU illuminate except keyboard and CLEAR switches.
  - 8's illuminate in both data displays. FROM-TO indicator, and DISTANCE, TIME, and GND SPD indicators on HSI.
  - INS and EW and decimal points illuminate in data displays.

INS MALFUNCTIONS . . . . . **CHECK**
- Press and release TEST switch. No action or malfunction codes should appear in the right data display.
- Red **WARN** and amber **BAT** lights should be extinguished (during alignment, at a PI (performance index) of 8, BAT illuminates briefly then extinguishes as battery is checked).

31 N FMS PROGRAM . . . . . **VERIFY**
- Data Selectors; DSRTK/STS.
- Press HOLD.
- Check 25-04 annunciated in left display to confirm proper program is loaded in the INS.
  - Ships 759-762 must annunciate 25-11 in left data display for INS units 1 and 2. Either program may be installed in INS unit 3.
- Press **HOLD** extinguished.

INS PRESENT POSITION . . . . . **LOAD**
PI (Performance Index) will not progress below 7 until present position is loaded.
- Present position must be loaded into each INS unit separately.
- Place Data Selectors in POS.
- Press keyboard switch to select appropriate parallel (2N or 8S). Enter present position latitude coordinates, and check correct latitude indicated in left display.
- Press INSERT; check correct latitude remains in display.
- Press keyboard switch to select appropriate meridian (4W or 6E). Enter present position longitude coordinates and check correct longitude indicated in right display.
- Press INSERT; check correct longitude remains in display.
- Check **INSERT** extinguished.

DATA SELECTOR . . . . . **DSTRK/STS**
- Check desired PI of 5 and actual PI is continuing to count down.
- Check no action or malfunction codes indicated.

REPEAT PROCEDURE FOR EACH INS UNIT IF INSTALLED.

COCKPIT SAFETY INSPECTION (CONT'D)

CREW OXYGEN ON
- Check Crew Oxygen bottle valve OPEN.
- Minimum pressure 1,000 PSI

OXY MASK/REGULATOR/INTERPHONE/AUDIO SELECTOR/SELCAL
- Install face piece; check hose connections.
- Regulator set NORMAL - 100% - ON.
- Don masks, adjust straps; check Oxygen FLOW.
- Hold regulator selector in TEST MASK; check high pressure flow; return selector to NORMAL.
- Test mask microphone using interphone system.
- Set Audio Selector Panel. Insure RANGE and VOICE switches unlatched and BOOM/OXY switch in appropriate position.
- Perform company radio SELCAL check on VHF radios (and HF radios, if appropriate).

NOTE: Do not transmit on HF if fueling is in progress.

- Check operation of cabin interphone with flight attendant.

S/O PANEL LIGHT TEST
- WARNING, CAUTION, ADVISORY TEST ON.
- All S/O panel lights illuminate except:
  - FIRE DETECTION LOOP TEST panel.
  - APU FIRE PULL Handle.
  - WHEEL WELL FIRE TEST panel.
  - APU GEN FLOWBAR and OPEN DIFF (if APU MASTER is **OFF**).
- Unlatch TEST; **ON** extinguishes.
- Reset APU FAULT flags.
- Before replacing switchlight bulbs for the following equipment, pull respective C/B's:
  - RAT C/B's 3G10, 1L3, and 1B14.
  - IDG DISCONNECT C/B 3G15.
  - FUEL JETTISON C/B's 3U3, 3U11, 3U12, and 3U18.
  - Passenger Oxygen manual control C/B's1J15, 1J16, 1J17, and 1J18.
  - Evacuation signal C/B 1B17.

ON-500 AIRCRAFT
- FWD (also AFT on ships 754 - 756 and 759 - 762) cargo compartment ALTN and MAIN DISCH illuminate during this test.
- Before replacing bulbs in either of these lights pull appropriate CARGO FIRE EXT C/B's FWD, 1A17 or 1A18, AFT, 1B17 or 1B18.

SECOND OFFICER PANEL PREPARATION

FIRE/OVERHEAT PANELS

WHEEL WELL FIRE TEST
- Place loop selector to BOTH.
- Press A & B TEST buttons simultaneously.
- Press BELL CUTOUT to silence bell; check:
  - A and B.
  - Both master FIRE.
  - WHEEL WELL FIRE.
- Release TEST; all extinguish.

ENGINE TURB COOLING AIR TEST
- Press A and B TEST switches individually; none of the lights should illuminate.
- Press A & B TEST buttons simultaneously; check:
  - Three OVHT.
  - Three TURB OVHT (Pilot Annun. Panel).
- Release TEST; all extinguish.

NACELLE/PYLON OVHT DET TEST
- Place loop selectors to BOTH.
- Press TEST button; check:
  - Three A and B.
  - Three NACELLE OVHT (Pilot Annun Panel).
- Release TEST; all extinguish.

FIRE DETECTION LOOP TEST
- Place loop selectors to BOTH.
- Press A & B TEST buttons simultaneously.
- Press BELL CUTOUT to silence bell; check:
  - Four A and B.
  - Both master FIRE.
  - FIRE DET LOOP (Pilot Annun Panel).
  - Four Fire Handles PULL.
- Release TEST; all extinguish.

FIRE EXTINGUISHER TEST
- Press TEST button; check four MAIN and ALTN.
- Press SHORT button while holding TEST; check all extinguish.

HYDRAULIC SYSTEM TEMP
- Rotate selector to A - B - C - D while monitoring temperature.
- Return selector to B.

APU FIRE PULL HANDLE IN/LTS OUT
- Fire PULL Handle fully in.
- **DISCH** lights extinguished.

HYDRAULIC PANEL

RSVR LO QTY/HI TEM LIGHTS OUT
- Four **LO QTY** and **HI TEM** extinguished.

ENG PUMP S/O FLOWBAR'S
Four PUMP S/O switches latched; FLOWBAR'S.

ATM'S OFF
- ATM switches **OFF**; **LUB HI TEM** and **LO PR** extinguished.
- If necessary to operate ATM's at the gate obtain ground clearance.

CASE DRAIN HI TEM LIGHTS (6) OUT

ENG PUMP LO PR LIGHTS (4) ON

RAT LIGHT OUT

WARNING
IF ANY GEAR DOOR LIGHT IS ILLUMINATED OBTAIN GROUND CLEARANCE BEFORE ACTIVATING ANY PUMP.

AC PUMPS ON
- Latch switches one at a time; check ON and pressures normal in systems B and C.
- Avoid operating AC pumps for more than 15 minutes at a time on the ground.
- Do not restart an AC pump for at least 90 seconds after any shutdown.
- Do not operate any flight control using only AC pumps.

PTU FLOWBAR'S
- Activate A & D PTU's; check FLOWBAR'S and pressure.
- With 3000 psi input from the AC pumps, PTU output pressure will normally be 2600 psi. If flow demands are low, PTU output pressure may vary from 2200 to 3500 psi. There is no minimum pressure with only the AC PUMPS operating the PTU's.
- With all hydraulic systems pressurized, check that all 4 STABILIZER **INOP**, 2 YAW SAS **FAIL** and the HYDRAULIC LIMITER **PUSH** lights are extinguished on the pilots' overhead panel.

HYDRAULIC PANEL

BRAKE ACCUM LIGHTS OUT
- Both BRAKE ACCUM **LO PRESS** extinguished; BRAKE PRESS normal.

HYDRAULIC FLUID LEVELS NORMAL
- Check the reservoir quantities remain in green band with systems pressurized.
- It is desired that hydraulic quantities be high in green band prior to international flights.

AC PUMPS OFF

PTU'S OFF
- **FLOWBAR's** extinguished.

ELECTRICAL PANEL

IDG OIL TEMP NORMAL

GALLEY POWER BUS 2 LIGHT OUT

IDG LO PRESS LIGHTS
- IDG DISCONNECT switch guards down, and LO PRESS.

AC METER SELECTOR
- Check Volts and Freq. of electrical power source.

APU GEN OIL OVHT/PRESS LTS OUT

APU GENERATOR FIELD
- If APU generator in use, check FLOWBAR'S

ELECTRICAL PANEL

APU GENERATOR BREAKER
- If APU generator in use, check FLOWBAR'S

ENG GENERATOR FIELDS ARM
- Press engine GENERATOR FIELD CLOSE switches (3) to arm for auto-paralleling on start; **FLOWBAR'S** extinguished.
- If engine has history of being hard to start, press TRIP to lock FIELD OPEN for start.

KW/KVAR METERS
- If APU in use, check KW less than 81.
- Engine KW's zero.

ENG GENERATOR BREAKERS ARM
- Press engine GENERATOR BREAKER CLOSE switches (3) to arm for auto-paralleling on start; **FLOWBAR'S** extinguished.

DC METER SELECTOR
- Check all T/R's volts equal and amps indicated (inoperative T/R amps will be zero).
- Select BAT for flight monitor. In BAT, charger will show steady 40 amp charge if battery volts less than 30, and pulse if above 30V.

(Battery charger must be operative for dispatch MEL 24-32-04).

TIE BREAKER FLOWBAR'S

DC BUS ISOLATION UNL

ESSENTIAL POWER SELECTOR NORM
B3(G1).

FUEL PANELS (WHEN FUELING IS COMPLETE)

REFUEL POWER LIGHT OUT
- Verify **ON** extinguished.

FUEL QUANTITY/DISTRIBUTION
- Indicated fuel quantity agrees with Dispatch Release and Fuel Servicing Record.
- Fuel properly distributed.
- Fuel load distribution is contained in SP 3583, Aircraft
- Restriction Manual.
- Fuel loading and management schedule for fuel loads is also contained in FUEL chapter, Book II (PRM) and on the back of the S/O's Checklist.
- (724) Unless fuel loads exceed 160,000 pounds, no fuel should be contained in tanks 1A or 3A.

FUEL QUANTITY TEST

NOTE: Do not test while fueling is in progress.

(-1)
- Press TEST
  - FUEL quantity indicators (4) pointers and digital readouts drive toward full.
  - TOTAL FUEL and GROSS WT indicator increasing.
  - TANK 2L and 2R LOW.
- Release TEST; indicators return to previous indications.

SHIP 724
- Latch 1A and 3A XFR switches.
  - Switches must be latched for LOW lights to illuminate during following test.
  - Check blue disagreement lights illuminate then extinguish and XFR (open).
    NOTE: If main tanks 1 and 3 are full, the disagreement and XFR lights remain extinguished (indicates transfer valves remain closed).
- Press TEST.
  - FUEL quantity indicators (4) pointers and digital readouts drive toward full.
  - TOTAL FUEL and GROSS WT indicator increasing.
  - Tank 2L and 2R low, and 1A and 3A low.
- Release TEST; indicators return to previous indications.
- Unlatch 1A and 3A **XFR** switches. Check blue disagreement lights illuminate then extinguish and XFR extinguishes. Switches must be unlatched for **main** tank scavenged to function.

NOTE: If main tanks 1 and 3 are full, the disagreement lights will not illuminate (indicates transfer valve remained closed).

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FUEL PANELS
(WHEN FUELING IS COMPLETE) (CONT'D.)

INBOARD QUANTITY CHECK/UNL

- Latch 2L & 2R INBD switches; check QTY.
- 2L & 2R indicators display inboard tank quantity. Check for proper distribution of inboard and outboard compartment fuel.
  - If fuel migration exists, latch respective TANK PUMPS. Migration must be within limits before departure (See SP3921.9 fuel loading limitations).
- Unlatch switches; **QTY** extinguishes, and **LOW** remains extinguished.

1A AND 3A QTY CK/UNL
(-724)

- Latch 1A & 3A QTY switches; check QTY and tank 1A & 3A quantity displayed on tank 1 and 3 indicators. 1A & 3A should contain less than 100 lbs.

NOTE: While operating in the -1 configuration 1A & 3A tanks must be empty.

(-100/-200/-250/-500)

- Check 1A and 3A Switches on the Alternate Fuel Quantity Monitor panel (when installed) are latched, and the OFF and FAULT lights extinguished.
  - Check ALT FUEL MONITOR Light extinguished. (Note: ALT FUEL MONITOR system not installed on 759-762.)

NOTE: If each main plus alternate tank contains less than 40,000 lb. (32,000 ship 724) the alt fuel monitor on the Pilot's Annunciator Panel will illuminate if either alternate tank exceeds 1,000 lbs. Also, the FAULT light on the S/O panel will flash until 1A/3A QTY is pressed or the MONITOR switch is unlatched.

- Latch 1A and 3A QTY switches; check QTY
  - Check tank 1 and 3 indicators display proper quantity in tanks 1A and 3A.
  - Tanks 1A and 3A should indicate less than 100 lbs. unless fuel load exceeds 160,000 lbs.

If 1A OR 3A Contain Unwanted Fuel:

- Latch 1 and 3 main TANK PUMP switch(es).
- Latch 1A/3A XFR switch(es). Fuel will transfer into the mains at the rate of 400-500 pounds per minute until the mains are full.
- Due to aircraft attitude on the ground, the last 300 pounds (100 pounds in flight) of fuel will not transfer. Remaining fuel can only be removed by sump draining.

SHIP 724 (-100/-200)

- Latch respective (1 and/or 3 main) TANK PUMPS switches.
- Latch 1A/3A XFR switch(es).
- Fuel will transfer into the mains at the rate of 400-500 pounds per minute until mains are full.
- Due to aircraft attitude on the ground, the last 300 pounds of fuel in each alternate will not transfer (100 pounds in flight). Since alternate tank scavenge will not function on ship 724 on the ground, remaining fuel can only be removed by sump draining, or the max zero fuel weight reduced accordingly.

(724-1) GRAVITY TRANSFER SWS UNL

1A & 3A GRAVITY TRANSFER switches unlatched; lights extinguished and guarded.

(-100/-200/-250/-500)

- Latch the 1A & 3A GRAVITY TRANSFER switches.
  - Check XFR.
  - Blue disagreement lights illuminate then extinguish to indicate that valves have opened.
- Unlatch the 1A & 3A GRAVITY TRANSFER switches.
  - Check **XFR** extinguishes.
  - Blue disagreement lights illuminate the extinguish indicating valves have closed.

TANK PUMPS CHECK/LTS OUT

- Latch TANK PUMP switch; check:
  - FLOWBAR
  - Check LO remains extinguished.
  - FUEL PRESSURE will normally extinguish except on No. 2 engine.
- Unlatch TANK PUMP switch.
- Check each pump.
- Leave one pump latched to supply the APU.
- If fuel migration exists in 2L or 2R (also 1A or 3A Ship 724) leave respective switches latched.

CROSSFEED VALVE FLOWBAR'S

- Latch CROSSFEED VALVES (3); blue disagreement lights blink on then off; FLOWBAR'S.
- If CROSSFEED VALVES are already latched, cycle valves closed then open to verify proper operation.

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FUEL PANELS
(WHEN FUELING IS COMPLETE) (CONT'D.)

ENG TANK VALVE FLOWBAR **'S.**

NOTE: #2 Tank Valve controlled by #2 fuel and ignition switch.

EMERGENCY SHUTOFF LIGHTS OUT

FUEL TEMP SELECT, CHECK/TANK
- Check selector in all positions.
- Place TEMP SELECT to TANK.

FUEL JETTISON LTS OUT
- Verify all FUEL JETTISON switches (5) unlatched and guarded.
- **OPEN**, DUMP and disagreement lights extinguished.

FUEL CONTROL AMPLIFIER OVRD LTS OUT

FUEL USED COUNTERS TEST/RESET
- Turn test knobs clockwise; FUEL USED begins increasing at rate of 10,000 lb/hr. FF indicators drive to 12 O'clock (10,000 lb/hr) position.
- Press and hold FUEL USED RESET until all indicators read zero.

VIB/TEST/LCH A/NORM
- Unlatch PICKUP switches A and B.
- Press vibration monitor TEST button:
  - VIB pointers (3) drive to position 4 ± .5;
  - Check amber VIB warning lights (3) illuminate.
  - After two **second** delay check the amber ENG VIB FLTR PRESS (Pilot Annun Panel).
- Release TEST button;
  - The three amber VIB lights remain illuminated.
  - The amber ENG VIB FLTR PRESS light remains illuminated.
- Press and release TEST button; all lights (4) extinguish.
- A PICKUP SELECTION latched ON; B PICKUP SELECTION unlatched **ON** extinguished.
- Selector NORM.
- Review Turbine Engine Performance reports for past history of engine VIB readings.

NOTE: Lockheed states that more reliable vibrations are provided by latching the A PICKUP and unlatching the B PICKUP (single channel monitoring).

N_2 RPM MAX POINTERS
- Check N_2 max pointer. Before resetting an overspeed indication, refer to log book for appropriate documentation.

REVERSER PRESSURE LIGHTS OUT

ENGINE PANELS

FILTER PRESSURE LIGHTS OUT

OIL PRESS/TEMP/QUANTITY
- Push PRESS IND TEST switch; PRESS pointers (3) drive to 9 O'clock position.
- Press QUANTITY and TEMP test switches and respective pointers drive to 12 O'clock position.
- Minimum oil quantity for dispatch - 14 quarts.

(-100/-200/-250/-500)
- All oil tanks are to be filled to capacity and visually checked full by Maintenance prior to each international operation. Verify oil quantity indicators show approximately full (21 qts).

MISCELLANEOUS

CLOCK SET

APU PANEL NORMAL
- No lights; N_G, TGT and selected mode correct for conditions.

FLIGHT RCDR SET/LCH/RECORD
- Set trip number and date.
- Latch FLIGHT RCDR switch;
  - **DFDR** immediately extinguishes.
  - **FDAU** extinguishes in about 30 seconds.
- Press RECORD after all lights extinguish.

WASTE WATER LIGHTS OUT
- Verify **PUMP** and **DRAIN MAST HTRS** lights extinguished.

Continued on next page

MISCELLANEOUS (CONT'D.)

(-500) CARGO COMPARTMENT FIRE DETECTOR PANEL(S) CHECK

- Position DETECTOR Selector to BOTH.
- Press TEST button:
  - Check a 1 2 and b 1 2.
  - Aural warning sounds; press TONE CUTOUT button to silence horn.
  - Check SMOKE on FWD CARGO compartment panel and Pilot's Annunciator Panel illuminate.
  - Check SQUIB MAIN ALTN.
- While holding TEST button, press SHORT TEST button.
  - Check Squib MAIN and ALTN extinguish.
- Release TEST and SHORT TEST buttons.
- Check ALTN and MAIN switches guarded; DISCH extinguished.

(-500) GALLEY DUCT OVERHEAT TEST

- Position selector to either A or B.
- Press TEST button.
  - Check FWD, MID, and AFT.
  - Aural warning sounds; press TONE CUTOUT button to silence horn.
  - Check SMOKE on Pilot's Annunciator Panel.
- Release TEST button and check all lights extinguish.

HUMIDITY CONTROL ON ABOVE 50°F

PASSENGER OXYGEN PANEL

- MANUAL switch guarded; **OXYGEN FLOW** extinguished.

S/O ANNUNCIATOR LTS

AURAL WARN TEST

- Test each warning mode; leave selector in UNSAFE TAKEOFF position.
- Test **GALLEY SMOKE**.
- ON -500 AIRCRAFT:
  - ALTITUDE ALERT test position added.
  - AUTOPILOT DISC test position added.
  - GALLEY SMOKE panel deleted.

SLAT MONITOR

- L & R SLATS pointers indicate same position (normally zero); **OFF** flag retracted (if installed).
- Green lights agree with pointer status.
- Slat LOCK switch unlatched, guarded; lights extinguished.

NOTE: Slat monitor ON/OFF switch light is active on Ship 759-762.

Ships 759-762

FAULT ISOLATION DATA DISPLAY . . . . SET

- Latch in the FLIGHT RCDR switchlight; check DFDR and FDAU lights off.
- Push the ON key; check for FIDDS panel CDU display.
- Push the DOCUMENTARY DATA ENTRY line key.
- Check that UTC is correct. To reset:
  - S/O's GMT SET.
  - Time advanced on S/O's clock will be indicated on FIDD'S.
- Push the CLR key.

NOTE: If the airplane number is not correct, push BCK switch until the cursor (-1) appears under AIRPLANE NO., then enter three zeroes and the airplane number.

- Enter UTC month and day.
- Enter the flight number (four digits), and flight day (month and day - four digits), and LEG.
- Push INSERT and note "DATA ENTERED" appears on screen.
- Push ON key.
- Unlatch the FLIGHT RCDR switchlight; check DFDR and FDAU lights on.

ENGINE BLEED CONTROL PANEL (UNLESS PREVIOUSLY CHECKED)

AREA OVHT TEST

- AREA OVHT selector A; press and hold TEST:
  - Seven AREA OVHT on S/O panel.
  - Two DUCT FAIL on Pilot's Wing Anti-Ice Panel.
  - AREA DUCT OVERHEAT (Pilot Annun Panel).
- Repeat test with selector in B.
- Return selector to BOTH.

HI PRESS OFF

- With pneumatic pressure in manifold, leakage past a HI PRESS valve may illuminate the FLOWBAR.

ENGINE BLEED CONTROL PANEL (UNLESS PREVIOUSLY CHECKED) (CONT'D.)

ENG ISLN VALVES LCH
- Leakage may illuminate flowbar.

FUS ISLN VALVE/CROSSBLEED FLOWBAR'S
- Check FLOWBAR if manifold already pressurized.

AUTO/MNL SWITCHES AUTO

ZONE TRIM SWS LCH
- -500 galley zone trim not installed.

ZONE TRIM SWS SET
- Below 50°F set at 12 O'clock position.
- Above 50°F set 12 O'clock or warmer for humidity control.

(724) FLOOR HEAT LCH
- Latch FLOOR HEAT switch; check **FAIL** and **OFF** extinguished.

GND CONT SET
- For fast aircraft warm-up unlatch RAM AUTO.

PACK OPERATION CHECK/SET

If manifold unpressurized and APU operating:
- Check TURB BYPASS and RAM AIR LOUVER position.
- Latch one pack valve before latching APU BLEED AIR S/O OPEN.
  - FUS ISLN VALVE and CROSSBLEED FLOWBAR's.
  - Pack FLOWBAR.
  - Cycle HOT AIR/ISLN VALVE switches as needed; latch, check FLOWBAR's.
  - Check pack operation.
- Repeat steps for remaining packs. Operate a minimum of two packs with passengers on board

With packs operating using APU air, select NORM mode if manifold pressure drops below 15 PSI or FLOWBAR blinks.

If manifold already pressurized; complete above steps except for APU BLEED AIR S/O item.

ECS MONITOR PANEL

COOL AIR OVBD LCH
- COOL AIR OVBD switch also controls:
  - GALLEY CONTROL VALVE
  - EXHAUST CONTROL VALVE

AVIONICS AIR OVBD OVBD

(-100/-200/-250/-500)
INS COOLING SW UNL
- Check switch unlatched.
- ON and LOFLO lights extinguished.
- When ship 724 is operating as a -1, INS units are normally removed and the switch should be unlatched. However, if INS units remain installed the INS COOLING fan must be ON when INS ATT/NAV is used.

CARGO HEAT LCH
- CARGO HEAT COLD HOT lights may illuminate in response to weather conditions.

TEMP SELECT DUCT
- Monitor zone periodically.

TEMP SELECTOR, ACM DISCH

PACK SELECT SET

CABIN PRESSURE CONTROL PANEL

MODE SEL NORM

NORM RATE SET
- Dot position is 500 FPM up; 300 FPM down.

STBY RATE SET HOLD

MANUAL TEST/LIGHTS OUT
- Latch FWD and AFT MANUAL switches.
  - MNL illuminates.
  - Press and hold both manual control switches CLOSE and observe both pointers moving toward CLOSE. Then press and hold both switches OPEN and observe pointers moving toward OPEN.
- Unlatch FWD and AFT MANUAL switches.
  - Outflow valve pointers drive to full open position.
  - **MNL** extinguished.

FAULT LIGHT OUT

ALT/BARO/CABIN SET
- Set ALT SET to planned cruise altitude; BARO SET and CABIN SET to local altimeter.

SAFETY VALVE LIGHTS EXTINGUISHED

PILOT'S CHECKLIST

BEFORE START

PRELIMINARY

EXTERIOR PREFLIGHT INSPECTION . . . . . COMPLETED
- S/O acknowledges the exterior inspection was performed.

LOG BOOK & AIRCRAFT STATUS . CKD___
- S/O acknowledges the Aircraft Log Book has been examined to determine recent history and maintenance status of aircraft. S/O will report significant items and status of MCO's.
- The Captain will acknowledge his acceptance of the aircraft.

CIRCUIT BREAKER . . . . . CKD
- S/O verifies all circuit breakers are in.

BATTERY SWITCH . . . . . ON
- S/O verifies switch positioned to ON and battery voltage has been checked for 28V DC (22V min).

MASTER RADIOS . . . . . ON
- Verify master radio, essential and No. 2 switches are latched, and OFF is extinguished.

OXY MASKS/REGULATORS/ INTERPHONE/AUDIO . . . . . CK
- Refer to cockpit safety inspection for expanded procedures.
- Check that all 3 crewmembers oxygen masks are installed and checked.

RUDDER PEDAL STEERING . . . . . OFF

ADVISORY LIGHTS . . . . . CK
- Latch WARNING, CAUTION, ADVISORY TEST switch ON. All indicator lights illuminate except fire warning, and marker beacon lights.
- Unlatch WARNING, CAUTION, ADVISORY TEST switch to extinguish indicator lights.

HSI HEADING SW . . . . . MAG
- For all Takeoffs and Landings.
- Not installed on Ships 724, 759–762.

OVERHEAD PANEL

FIRE PULL HANDLES/DISCH LIGHTS . . . CK
- FIRE PULL Handles in.
- **DISCH** extinguished.

INS MODE SELECTORS . . . . . AS REQD

(Transoceanic)
- 10 minutes prior to pushback with READY NAV light(s) illuminated, Mode Selector(s) should be positioned to NAV. An alignment countdown to a P. I. of 4 is recommended for full alignment.
  - READY NAV extinguishes when the Mode Selector is placed in NAV.
  - DSRTK/STS display will change to [1 55] when INS unit has switched to NAV mode.
- Leave Mode Selector(s) in ALIGN if alignment is not complete.

(Non-Transoceanic)
- May select NAV Mode or ATT Mode.
  - If NAV Mode is selected, refer to previous Transoceanic procedure description.

COMPASS PANELS . . . . . MAG
- MAG DG switch latched MAG.
- Check **MAG** flag appears in HSI.
- Sync indicator needle centered.

HF RADIOS . . . . . OFF
- Do not operate HF transmitter while fueling.

ANTI-SKID . . . . . CK OFF
- BRAKE SYS SELECT, NORM SYS B.
- PARK BRAKE release.
- Latch ANTI-SKID switch, check ON.
- Press NORM and ALT buttons separately. Verify F (4), R (4) and ON illuminate with each test. Unlatch ANTI-SKID switch; verify OFF illuminates.

a

BEFORE START (CONT'D.)

(-500) ACS SWITCHES ..... CK/LTS OUT
- Check both ACS switches are latched.
- Check **FIRST FAIL** and **2 FAIL** extinguished.

NOTE: **FAIL** ***light(s) illuminate unless hydraulic systems are pressurized, and may also illuminate when electrical power is transferred (ground/APU/generators). When this occurs see Flight Controls Abnormal Procedures.***

STALL WARN ..... CK
- Unlatch either STALL WARN switch; check **OFF**.
- Press TEST; appropriate stick shaker activates. Latch previous switch and unlatch other STALL WARN switch and repeat test.
- Latch both STALL WARN switches. Check **OFF** and **FAIL** extinguished.

(-500)
- Unlatch both DLC/AUTO SPLR switches. Switches must be unlatched to test STALL WARN.
- Unlatch either STALL WARN switch; check **OFF**.
- Press TEST; appropriate stick shaker activates.
- Latch previous switch and unlatch other STALL WARN switch and repeat test.
- Latch both STALL WARN switches. Check **OFF** and **FAIL** extinguished. This completes test of stall warning system.

FCES/PFCS PANELS ..... CK
- All FCES and PFCS switches latched and lights extinguished.
- ATS **FAIL** illuminates until inertial platform has erected.
- **ACS FIRST FAIL** and **YAW SAS FIRST FAIL** lights are not valid until systems are fully powered.

NOTE: With hydraulic pumps off (4) STABILIZER **INOP** ***and (2) YAW SAS*** **FAIL** ***will be illuminated.***

EXTERIOR LIGHTS ..... AS REQD

MACH FEEL ..... ON
- Switches latched, lights extinguished and indicator at .4 Mach.

RUDDER HYD LIMITER ..... CK
- HYDRAULIC switch latched. Without hydraulic pressure **PUSH** will illuminate.

VOICE RECORDER ..... CK
- Press and hold TEST approximately 5 seconds. Observe indicator remains in green band, except for momentary dip during channel switching.

NOTE: If indicator fails to remain in the green band, plug headset into recorder jack. A tone should be heard for each channel during TEST.

ENGINE START PANEL ..... CK
- All lights extinguished.
- At crew change start engines on B ignition. Alternate A/B on subsequent legs. If B inop, consult MEL.
- Use BOTH with COLD WEATHER ENGINE START PROCEDURE.

INSTR STBY LTS ..... BRIGHT

EMERGENCY LIGHTING .. ARMED/LTS OUT
- Switch in ARM (guarded).
- **UNARM** extinguished.
- Cockpit emergency light extinguished.

STANDBY POWER ..... CK/LT OUT
- Place STANDBY POWER switch ON.
  - STBY PWR **FLOWBAR** on S/O panel illuminates.
    On aircraft which have a BATTERY CHARGER MODE switch, the STBY PWR **ON** light will also illuminate 5 seconds after illumination of the **FLOWBAR**.
  - Check **BATTERY CONDITION**.
  - Check inverter Volts 115, Freq 400; STBY DC BUS volts 22 Min.
- Place switch in ARM (guarded).
  - STBY PWR **FLOWBAR** extinguished.
  - **UNARM** extinguished.
  - **BATTERY CONDITION** extinguished.
- DC Meter Sel to BAT; check battery charger.

a

BEFORE START (CONT'D.)

EVACUATION SIGNAL PANEL ..... **CK**
- Lights extinguished.

PITOTS ..... **CK/ OFF**
- Latch Captain & F/O pitot switches; **OFF** extinguished.
- Unlatch switches **OFF**.

TEMP PROBES/ALPHA HEAT ..... **OFF**

WINDSHIELD HEAT ..... **IDLE/ON**
- WINDSHIELD HEAT switches unlatched **IDLE**.
- SIDE WINDOW switches latched.

WING/ENG ANTI-ICE ..... **CK**
- Switches unlatched; lights extinguished.
- Perform the following wing anti-ice check only if operation in icing conditions is anticipated.
  - With pneumatic pressure available latch MANUAL switches; check **ON**.
  - Press TEST; check **OPEN**.
  - Release test; **OPEN** extinguishes.
  - Unlatch MANUAL switches; **ON** extinguishes.

SEAT BELTS/NO SMOKING ..... **ON**
- Both switches latched **ON**.

GLARESHIELD

(-250/-500) RADIO/NAV SWS ..... **RADIO**

VHF NAV RADIOS ..... **CK/MNL**
- Insure AUTO-TUNE is OFF.
- Tune VHF NAV radios to VOT frequency if available.
  - Set 000° (from) or 180° (to) on COURSE selectors.
  - Check HSI needle centers; max deviaiton ±3° on either HSI.
- Set radios as desired for departgure.

DME'S ..... **CK/STBY**
- Hold selector in TEST. Check:
  - fail flag, then
  - four dashes, then
  - four zeroes.
- Place selector to STBY.

AUTOFLIGHT PANEL ..... **CK**
- With hydraulic pressure available (B AC PUMP and B-A PTU on), place one autopilot selector to CMD.
  - Press autopilot disconnect switch on control wheel.
  - Autopilot selector drops to OFF; wailer sounds, **ALERT** flashes and AP DISC appears on AFCS WARNING panel.
  - Depress **ALERT**.
  - Wailer silences and **ALERT** extinguishes. (Wailer will silence after two seconds regardless.)
  - Depress autopilot disconnect on control wheel and AP DISC disappears.
- Repeat check for other autopilot.
- Unlatch B AC PUMP; turn off B-A PTU.
- Complete FD check.
  - Both FD switches ON; select HDG and VS.
  - AFCS MODES show **HDG SEL** and **VS**.
  - Rotate HEADING and VERT SPEED knobs. Check appropriate command bar movement.

ALTITUDE ALERT/SELECT ..... **CK**
- Perform the following checks with both FD switches ON.
- Position NORM/STBY switch to STBY.
- Select altitude 1,000 feet above indicated field elevation.
- Press and hold **TEST** switch for remainder of the check.
- Press ALT SELECT ARM; light illuminates and **ALT ARM** appears in AFCS MODES.
  - Begin decreasing selected altitude.
  - At 750 feet difference check **ALTITUDE**.
  - At 250 feet difference, **ALTITUDE** extinguishes and chime sounds.
  - At indicated field elevation **ALT ARM** switches to **ALT** in AFCS MODES; **ARM** light extinguishes and **ALT** light illuminates on autoflight panel.
- Position NORM/STBY switch to NORM.
- Press **ALT**; light extinguishes and **ALT** disappears from AFCS MODES.

BEFORE START (CONT'D.)

The following checks not required at airports with less than 250' field elevation.

- Adjust ALTITUDE SELECT below indicated field elevation.
  - At 250 feet difference check ALTITUDE flashes and chime sounds.
  - Press ALT SELECT ARM; light illuminates and **ALT ARM** appears in AFCS MODES.
  - Begin increasing selected altitude.
  - At 250' difference **ALTITUDE** extinguishes.
  - At indicated field elevation **ALT ARM** switches to **ALT** in AFCS MODES; **ARM** light extinguishes and **ALT** illuminates on autoflight panel.
- Release TEST switch.
- Press ALT; light extinguishes and **ALT** disappears from AFCS MODES.
- FD switches OFF.

CAPT – F/O INSTRUMENT PANELS

INSTR COMPARATOR, AFCS WARNING AND AFCS MODES . . . . . CK

- Check INSTRUMENT COMPARATOR.
  - Either pilot press and hold TEST 1; all comparator flags appear on both comparators; ATT flag appears in ADI on side being tested.
  - Other pilot actuates TEST 1; ATTITUDE in comparators and ATT flag in ADI disappear; check ATT 3 on Pilots' Annunciator Panel.
  - (ATT3) (VERTICAL GYRO 3 ship 724) on Pilot's Annunciator Panel monitors INS NO. 3 gyro platform. Light will illuminate when both TEST 1 buttons are pressed at the same time. Light will also be illuminated unless INS NO. 3 is in NAV, ATT, or ALIGN modes with a PI of 8 or better.
  - First pilot release TEST 1;
  - ATT flag appears in second ADI; other pilot release TEST 1.
  - Either pilot press TEST 2; all monitor flags appear.
- Each pilot check AFCS WARNING by pressing TEST 1, then TEST 2. Observe all indications.
- Each pilot check AFCS MODES by pressing TEST 1, then TEST 2. Observe all indications.

ALTIMETERS/ FLIGHT INSTRUMENTS . . . . SET/CROSS CK

- Clocks set and agree.
- IAS/Mach indicators.
  - Max airspeed pointers approximately 350K.
  - Airspeed needles 60.
  - No flags.
- ADI indicators erect and no flags.
- Captain and F/O confirm all three altimeters are set.
  - No flags.
  - Crosscheck indicated altitude.
- Radio altimeters indicate zero and no flags.
- RDDMI heading agrees with HSI and mag compasses; no flags.
- RDDMI selector switches set VOR or ADF as desired.

NOTE: Compass errors may occur when servicing equipment or jetways are positioned in vicinity of wing tips. Recheck compasses after leaving the ramp.

- HSI indicators' course and heading cursors correct; MAG annunciated; flags appropriate for conditions.
- Vertical speed needle on zero; no flags.

-250/-500

- Verify signal source 1 in Capt's HSI and 2 in F/O's HSI.
- Verify that MAG is annunciated in both HSI's and NAV flag out of view.

SHIP 724

- With RADIO/NAV switches in RADIO,
  - Check MAG annunciated in HSI.
  - Either ILS or VOR 1 or 2 annunciated in lower window.

MARKER BEACON LIGHTS . . . . . CK

- Press-to-test each marker beacon light.

INSTRUMENT SOURCE SELECT . . . . . CK

- All switches unlatched.
- Lights extinguished.

-250/-500

- NAV ALTN switch is installed on INST SOURCE SELECT panels.

SHIP 724

- NAV ALTN switch is installed on center console adjacent to respective RADIO/NAV switch.

BEFORE START (CONT'D)

GPWS ..... **CK**
- Check GPWS INHIBIT switch safetied.
- Press GPWS **PULL UP** light; check aural warning sounds "whoop whoop pull up, whoop whoop glideslope" and GPWS FAIL illuminates.

NOTE: If GS mode previously deactivated by depressing the GS light, cycle VHF NAV 1 frequency selector to illuminate GS.

NOTE: Test switch for Ships 754–756 and 759–762 is located overhead, below the GPWS speaker. An inhibit switch is not installed. C/B 1B1 and 2 must be pulled to deactivate the system.

(-1) RADIO/NAV SWITCHES ..... RADIO
- Check both HSI RADIO/NAV switches in RADIO.
- Verify both HSI source annunciators display RAD and VOR or ILS.

CENTER INSTRUMENT PANEL

STANDBY FLIGHT INSTRUMENTS ..... **CK**
- Standby horizon uncaged, erect, no flags.

ENGINE INSTRUMENTS ..... **CK**
- Check max. pointers. Before resetting any overspeed or overtemp indication, refer to log book for appropriate documentation.

FLAPS/SLATS ..... **CK**
- Capt or F/O verifies flap handle and indicators agree and are in desired position; which is normally up/retracted.
- S/O informs Capt and F/O of reason for any other flap/slat configuration at this point.

GEAR ..... **DOWN/3 GREEN**
- Verify gear handle down; three green lights.

BRAKE PRESS/SELECT ..... **NORM**
- Verify B & C BRAKE PRESS above yellow band.
- BRAKE SYS. SELECT, NORM SYS. B.

BEFORE START (CONT'D)

CENTER CONSOLE

NAVIGATION SYSTEMS SET-UP . COMPLETE
- The PF will verify and acknowledge that the following has been accomplished:
  - FMS Ground Set-Up complete.
  - ONS Ground Set-Up complete.
  - INS Ground Set-Up complete.
- Accomplish FMS GROUND SET-UP as described in the following text or as described in the FLIGHT MANAGEMENT & LONG RANGE NAVIGATION SYSTEMS manual and FMS checklist.

C/B'S 1 E8 & E26 ..... IN
- NAV START page will appear when computer is ready to operate.
- Ignore FMS STATUS lights while at the gate.
- For Transoceanic/Mid-Pacific operations, see appropriate Sections, this manual.

DATA BANK ..... CK
- Check RTE DATA number corresponds with identifier on PILOT"S DATA BANK book.
- Verify PILOT'S DATA BANK book is current.

COMPLETE FMS NAVIGATION FUNCTION:

GMT ..... INSERT
- If indicated GMT is incorrect:
  - Index GMT on ROUTE DATA page.
  - Key-in correct GMT and INSERT.

NAV START ..... INDEX/EXECUTE
- Index NAV START, then index EXECUTE.
- FLT PLAN BY page appears.

FMS GRND SETUP ..... CK

WAYPOINTS ..... INSERT
- Index WPTS, then index EXECUTE.
- Index each waypoint in sequence beginning with aircraft present position as waypoint 000, and key-in the correct identifier from the PILOT'S DATA BANK book, and press INSERT.

NOTE: If the waypoint is not in the data bank, the display will request the location of the waypoint by LAT and LONG or by bearing and distance from a reference waypoint.

- Load all waypoints as listed in flight plan. If time becomes a factor:
- Load flight plan waypoint up to and including the first waypoint in the track, plus destination, while on the ground.
- Load additional waypoints en-route. Load track waypoints as 50W, 40W, etc.

FMS POSITION FIX ..... INSERT/EXECUTE
- Press NAV and page FWD to NAV SELECT 2.
  - Index FIX, and FIX POS BY page appears.
  - Index LAT.
  - Key-in and INSERT latitude then longitude for aircraft ramp position.
  - Index EXECUTE when coordinates are correct.

FLIGHT PLAN WINDS ..... INSERT
- Press NAV and page FWD to NAV SELECT 2.
  - Index WIND INPUT, and the WPT WDIR WSPD page appears.
  - Position HSI HEADING switch to TRUE to load flight plan winds referenced to true north.
- Index reference waypoint for wind to be loaded.
- WDIR? appears on scratchpad line.
- Key-in wind direction in degrees to the nearest tenth of a minute (i.e. 270 is keyed-in as 270 00.0'), and INSERT.
- Scratchpad line changes to WSPD?. Wind direction disappears from CDU until windspeed has been inserted.
- Key-in windspeed in kts, and INSERT.
- Check that proper wind direction and speed appears at reference waypoint.
- Repeat procedure for available flight plan winds.
- When wind set-up is complete, select MAG on HSI Heading switch.

FLIGHT PLAN TAS ..... INSERT
- Index TAS; key-in flight plan average TAS in kts and INSERT.

COMPLETE FMS PERFORMANCE MANAGEMENT FUNCTION:

FMS PROGRAM ..... VERIFY
- Press PERF MGT; check SETUP page appears. Verify program is applicable for –1, –100/–200, –250 or –500, as appropriate.

BEFORE START (CONT'D)

DELTA PERFORMANCE STANDARD .. INDEX
- Index DELTA PERF STD.

NOTE: This action removes gross weight and fuel quantity from previous flight and selects standard min. cost for climb, cruise and descent.

GROSS WEIGHT ..... INSERT
- Insert GWT LBS; key-in expected takeoff GWT, then INSERT.

FUEL WEIGHT ..... INSERT
- Index FUEL LBS; key-in fuel load as indicated on Fuel Service Record, then INSERT. Do not insert a fuel weight in excess of max capacity as listed in PRM, Fuel Section. NOTE: FMS range and fuel calculation cannot be used for inflight planning purposes, e.g., re-clearance.

TEMPERATURE AT ALTITUDE ..... INSERT
- Index A/SAT, and FL will appear on scratchpad line.
- Key-in cruise flight level and INSERT (altitudes are keyed-in by Flight Level; however, after they are inserted, altitudes appear in thousands of feet). Cruise flight level will appear on A/SAT line, and SAT will appear on scratchpad line.
- Enter flight plan SAT by first pressing the 5 key to show M for a minus temperature; then key-in temperature. If no temperature is entered, the FMS will assume standard temperature.

CRUISE ALT ..... INSERT
- Index CRZ ALT; key-in initial cruise three digit Flight Level, and INSERT. This step is necessary to set cruise mode of the FMS.

CLIMB-CRUISE SET-UP ..... COMPLETE
- Press FWD, CLB-CRZ SET-UP page appears.
- Check CLIMB MIN COST and CRZ MIN COST displayed. If another option is required, index appropriate item and select desired option.
- RSRV LBS. 20,000 appears automatically. This value does not affect FMS operation at this time.

REFUEL POINT ..... INSERT
- Index REFUEL AT and REFUEL AT page appears.
- Index desired refuel point.
- Display returns to CLB-CRZ SET-UP page with REFUEL AT line showing the selected option.

END OF DESCENT (E*D) DATA ..... INSERT
- Page FWD to DCNT-E*D SET-UP page.
- Index E*D AT, and END OF DESCENT page appears.
- Index REF WPT and E*D REF WPT page appears.
- Index waypoint to be used to determine E*D.
- Display returns to END OF DESCENT page and selected waypoint appears on REF WPT line.
- Index NMI BFR (distance before) or NMI AFT (distance after) to locate E*D from reference waypoint. Key-in mileage from reference waypoint, then INSERT. DCNT-E*D SET-UP page appears.
- Index E*D ALT; key-in altitude desired at E*D point, then INSERT.
- Index E*D IAS; key-in altitude desired at E*D point, then INSERT.

NOTE: Option of "300 BLO FL 100? speed is provided for international operations. When indexed, speed below 10,000' shown on the top line will change from 250K to 300K.

COMPLETE FMS PERFORMANCE DATA:

PERF DATA ..... PRESS
- Index RATED EPR; TAKEOFF page appears.
- Index RWY TEMP; key-in runway temperature in degrees centigrade (C) beginning with P for plus of M for minus; then INSERT, and EPR rating will appear.

MAINT. LOG ..... CHECK
- Press PERF DATA:
  - Index MAINTENANCE, and MAINTENANCE page appears.
  - Index CLEAR AUTOLOG; index EXECUTE?

LOADED WAYPOINTS ..... CK
- Select NAV function.
- Index WPT LIST, and WPT ETE DIS page appears.
- Index 000, and check correct latitude and longitude for departure airport. Verify distance on B/D (bearing/distance) line.
- Check each waypoint in sequence; page FWD as necessary. Waypoint coordinates should be checked against enroute chart coordinates of fixes used.
- Note that T*D and E*D waypoints are displayed.

This Completes FMS Ground Set-Up.

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BEFORE START (CONT'D)

ACCOMPLISH ONS SET-UP AS OUTLINED IN NAV OPERATING PROCEDURES

ACCOMPLISH DIRECT LOADING OF INS COORDINATES:

INS WAYPOINT . . . . . **LOAD**
(Alignment process should have been initiated by S/O.)

For triple INS Installation:
- Position Data Selectors to WAYPOINT Data displays may indicate O's or previous flight waypoints.
- Press REMOTE switch on INS units 1 and 2; check REMOTE.
- Check HOLD extinguished.
- Select 1 on WAY POINT selector of INS unit being used to load waypoints.

NOTE: Ensure that selector is in detente.

- Check 1 appears in FROM-TO display.
- Press keyboard switch to select appropriate parallel (2N or 8S). Enter latitude coordinates for waypoint.
- Press INSERT; **INSERT** extinguishes indicating waypoint latitude has been loaded into the computer; check correct latitude indicated in left display on each CDU.
- Press keyboard switch to select appropriate meridian (4 W or 6E). Enter longitude coordinates for waypoint.
- Press INSERT; **INSERT** extinguishes indicating waypoint longitude has been loaded into the computer; check correct longitude indicated in right display on each CDU.
- Check all INS displays indicate correct waypoint coordinates.

For Single INS Installation:
- Load each waypoint manually.

REMAINING WAYPOINTS . . . . . **LOAD**
- Repeat waypoint loading procedure for remaining waypoints (2,3,4,etc.). If more than 9 waypoints are required, load remaining waypoints en-route.

REMOTE . . . . . **PRESS ON EACH CDU**
- Check REMOTE extinguished.

DATA SELECTOR(S) . . . . . **DSRTK/STS**

INS MODE SELECTORS . . . . . **NAV**
- 10 minutes prior to pushback and READY NAV light(s) illuminated, switch to NAV mode.

NAVIGATION SYSTEM SET-UP . . . **VERIFIED**
- PNF will verify and acknowledge the following has been accomlished.
  - FMS Ground Set-Up.
  - ONS Ground Set-Up.
  - INS Ground Set-Up.
  - All programmed route fixes and waypoint coordinates verified against navigation chart coordinates.

(724) RADIO/NAV SWITCHES . . . . . **RADIO**

(724) INS COMPARATOR LIGHTS . . **LTS OUT**
- Indications are invalid unless 3 INS units installed and operating in NAV.

PITCH/ROLL DISCONNECT HANDLES . . . . . **CK**
- Handles stowed; lights extinguished.

STABILIZER TRIM . . . . . **ZERO**

SPEED BRAKE LEVER . . . . . **FWD/LTS OUT**
- Verify lever is full forward.
- Press disable switch; check amber disable lights illuminate. Press again & lights extinguish.

THROTTLES . . . . . **IDLE**

FUEL AND IGNITION . . . . . **OFF**

COMM RADIOS . . . . . **CK**

CAUTION

DO NOT OPERATE TRANSPONDER WHILE FUELING, EXCEPT IN STBY MODE.

BEFORE START (CONT'D)

CENTER CONSOLE (CONT'D)

RADAR ..... **STBY**
- Function selector STBY, GAIN control AUTO, ANT TILT 0°.
- Select: SYS 1 odd numbered flights.
- Select: SYS 2 even numbered flights.

CAUTION
DO NOT OPERATE RADAR WHILE FUELING, EXCEPT IN STBY MODE.

MARKER BEACON ..... **LO**

TRANSPONDER ..... **STBY**

AILERON & RUDDER TRIM ..... **ZERO**

S/O PANEL

S/O ADVISORY LTS ..... **CHECKED**
- S/O acknowledges Warning, Caution and Advisory Lights test was performed.

FIRE/OVHT SYSTEMS ..... **CHECKED**
- S/O acknowledges system check was performed and is airworthy.

HYD SYS/AC PUMPS/ATM'S .. **CKD/OFF/OFF**

ELECTRICAL SYSTEM ..... **CHECKED/SET**

FUEL QTY/DIST ..... _____ **LBS/CHECKED**
- S/O states quantity of fuel on board and
- Fuel is distributed in accordance with appropriate guidelines and limitations contained in the PRM, POM and servicing S.P.
- Captain will acknowledge the fuel on board meets minimum fuel quantity required on flight plan/flight release.

TANK VALVES ..... **LCH/FB'S**
- S/O verifies Tank Valves are latched open and flow bars are illuminated.

ENGINE INSTRUMENTS/OIL QUANTITY **CKD**
- Verify normal shutdown indication for:
  - N2
  - Oil pressure
  - Fuel used indicators zeroed.
- Verify oil quantity sufficient for flight.

AURAL WARNING ..... **CHECKED**
- Verify each system warning circuit had been tested.
- Warning Test Selector positioned to unsafe takeoff.

ENGINE BLEED CONTROLS ..... **CKD/SET**

ECS PANEL ..... **CKD**

PRESSURIZATION ..... **CKD/SET**

CABIN INTERIOR INSPECTION **COMPLETED**
- Captain or S/O may respond if either has knowledge the inspection was performed.

BRIEFINGS

FLIGHT ATTENDANT BRIEFING **COMPLETED**

DEPARTURE BRIEFING ..... **COMPLETED**
- The acronym W.A.R.T.S. is an easy guide for remembering all items included in the Departure Briefing.
  - Weather/Winds
    - Takeoff Minimums
    - Takeoff Alternate Requirement
    - Low viz Takeoff Procedures
    - Adjustment to Noise Abatement Procedures due to adverse winds.
  - Abnormals
    - Brief at Captain's discretion after first departure of rotation/month.
    - Prior to/After V1
    - Crew Duties
  - Runway Condsition
  - Terrain Considerations
  - SID/Delta Special pages.

This menu is not intended to restrict or limit the command authority of the Captain if he deems additional briefing or coordination necessary.

BEFORE PUSHBACK

INS MODE SELECTOR(S) . . . . . AS REQD
- Transoceanic or Mid-Pac select NAV mode.
- Domestic select NAV or ATT mode.

NOTE: If aircraft is moved while the Mode Selectors are in ALIGN, entire alignment process will have to be repeated. Downmode to OFF, then back to ALIGN. Reinsert present position and verify correct. Reload waypoints as necessary.

- READY NAV lights extinguished.
- First digit of System Status Display indicates 1, last two digits 55 for FMS/INS operation.
- Ship 724 and 759–762 should have INS 1 & 2 operating in **TRIPLE MIX. To enter triple mix, PRESS the 4 key and INSERT.** The last digit of System Status Display will change to a 4, indicating that set is in triple mix operation.
- Position one INS Data Selector to TK/GS for taxi.

ANTI-COLL . . . . . ON
- Lights should be turned on prior to aircraft movement or starting engines, whichever comes first.

DOOR LIGHTS OUT
- Verify all passengers seated.

IF No.2 ENGINE NotOperating:

B AC PUMP ON
- Leave B AC PUMP ON until brakes are reset, or No. 2 engine is stabilized on speed.

INITIAL ENGINE START

Obtain ground clearance. **PREFERRED START SEQUENCE IS 2-1-3. DELAYED START NO. 1 AND/OR 3.**

- It is preferable to start engine No. 2 first to simplify hydraulic system operation and permit taxi on one engine, if desired. However, if jet blast or system considerations (i.e., No. 2 generator inop.) require, the wing engines may be started first..

FUEL PANEL SET
- Latch any one TANK PUMP (FLOWBAR).
- Latch CROSSFEED VALVES (FLOWBAR's).

APU COMPRESSOR SELECT MIN

PACKS 1 & 3 OFF; NO. 2 ON

If Using External Air:
- Unlatch APU bleed air shutoff before applying external bleed air.
- A minimum of two air supplies required.
- Unlatch all air conditioning packs.

PARK BRAKES . . . . . AS REQD
- The PARK BRAKE need only be set when an engine is to be started at the gate.
- When engine start is initiated during pushback, set PARK BRAKE when pushback is complete.

(-1/-250/-500)
NOTE: Due to weight, it is not recommended that taxi be attempted on only one engine for any mid-pacific or transoceanic departure.

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ENGINE START (CONT'D)

ENGINE START PROCEDURE

NOTE: For delayed start(s) the F/O and S/O will normally perform engine start(s) while taxiing.

CAPTAIN – Command "Start Engine No. _____"

CAPTAIN/FIRST OFFICER	SECOND OFFICER
• Push GND START No. _____. • Note VALVE OPEN. • Start clock.	• Check ENG ISLN VALVE FLOWBAR.
• N_3 RPM within 10 seconds. • Confirm **OIL PRESS** extinguishes (Pilot's Annunciator Panel).	• Check DUCT pressure; advise if below minimum. • Check APU in MAX MODE, pack OFF if duct pressure low. • Call "Oil Pressure" (must be indicated within 30 seconds).
• With TGT below 100° and a minimum of 20% N_3, FUEL AND IGNITION switch ON (Or ENRICH). • Note time. • Note fuel flow. • If no lightoff occurs within 15 seconds, select BOTH ignitions.* • Lightoff must occur within 30 seconds after FUEL AND IGNITION ON. • Monitor TGT and N_3 rise. • Call "N_1 Rotation" (N_1 & N_2 must be indicated prior to 35% N_3.	• Call "N_2 Rotation" (must be indicated prior to 35% N3). • If using APU bleed air, resume one pack operation at 40% N_3.
• Note 46% N_3. • Call "Starter Cut Out" when GND START **VALVE OPEN** extinguishes (43-55% range). • Note time on starter.	• Check APU **MAX MODE** extinguished. • Unlatch APU BLEED AIR S/O switch.
• Note 55% N_3, call "Ground Start Release". • Release ENRICH by 60% N_3 or 500°C TGT whichever comes first. • Allow engine to stabilize at ground idle before initiating next engine start. • Normal stabilized ground idle: – N_1 = 23.3% – TGT = 350°C – N_3 = 61.5% – FF = 1500PPH	• Latch HI PRESS switch (FLOWBAR) after **GROUND START RELEASE**. • Check Hydraulic pressure. • IDG **LOW PRESS** extinguished. • Check Generator VOLTS and FREQ.** • Check GENERATOR FIELD & BREAKER FLOWBAR's.

* ***Make Log Book entry whenever BOTH ignition must be selected to obtain lightoff.***

** ***If generator frequency is pegged at 420, disconnect the IDG.***

ENGINE START (CONT'D)
ENGINE START NOTES

START CONSIDERATIONS
- Avoid starts in a tailwind whenever possible, especially in cold weather or when an engine is a known hard starter.
- Starting history of each engine.
- Local station requirements, position, and blast effects.
- Use of cold weather start procedure contained in Cold Weather Operation portion of Supplemental Information.

APU PNEUMATIC OPERATION DURING START
- Desired pneumatic pressure with the START VALVE OPEN is 25 PSI.

If Pressure Drops Below 20 PSI:
- Unlatch remaining pack; latch one pack by 40% N_3 (i.e., before **VALVE OPEN** extinguishes).
- Reduce electrical loads.
- Unlatch fuselage ISLN VALVE (#2 engine start only).
- If MAX MODE illuminates with Mode Selector in NORM position, reduce electrical and pneumatic loads prior to engine start.

EXTERNAL AIR/POWER START
- Use at least two external pneumatic air sources.
- Set parking brakes.
- Unlatch all packs. Desired pneumatic pressure with Start VALVE OPEN is 25 psi.

After First Engine Start Is Complete:
- Unlatch appropriate ENG ISOL valve and latch one pack ON (FLOWBAR). This will isolate pneumatic manifold to facilitate ground crew in disconnecting external pneumatic air when so directed.
- Select ship's power.
- Direct mechanic to disconnect external power and pneumatic air. After external air is disconnected, latch appropriate ENG ISOL valve and HP valve to repressurize manifold.
- Start remaining engines using crossbleed start procedure.

CROSSBLEED STARTS
- Disconnect external air source or unlatch the APU BLEED AIR S/O switch after first engine is started. Do not mix air sources.
- Captain will advise S/O when ready to start any engine.
- Obtain ground clearance before advancing throttles.
- It may be necessary to increase thrust (70% N_3 max.) to obtain desired duct pressure; HI-PRESS valve closes above 70% N_3. Plan crossbleed starts when engine RPM can be held constant to provide stable duct pressure. Avoid increasing thrust to where HI-PRESS valves close, and avoid sudden thrust reductions.
- Avoid changing bleed air demands while START VALVE OPEN.
- Avoid making large hydraulic demands that might cause the ATM(s) to activate while START VALVE OPEN.
- Do not exceed 50 PSI duct pressure.

USE OF ENRICH

Use of ENRICH Is Recommended if:
- An engine is slow to accelerate after light-off.
- Ambient temperatures are 32°, or below.

When using ENRICH, it is permissible to cycle the FUEL AND IGNITION switch between **ENRICH** and **ON** as necessary to keep TGT and N3 rise together up to 35% N_3. (i.e. approx. 300° TGT at 30% N_3, 350° TGT at 35% N_3).

However, above 35%, and until starter cutout, avoid cycling between **ENRICH** and **ON** to prevent any possibility of disengaging and reengaging the starter. After Starter cutout, cycle as necessary. Avoid using **ENRICH** above 60% N_3 or 500° TGT.

STARTER DUTY CYCLE
Observe starter duty limits of:
- 5 minutes of engagement followed by;
- 5 minutes off; followed by;
- 5 minutes of engagement; then
- 30 minutes off (at OAT's colder than -10°C, cooling time may be reduced to 10 minutes off).

The five minutes of engagement time should permit at least 2 start attempts during each period.

AFTER INITIAL START

Perform After Start Check List after OPERATING engines are at STABILIZED Ground Idle.

ENGINE INSTRUMENTS . . . . . **CK**

ENGINE ANTI-ICE . . . . . **AS REQD**
- Conditions requiring the use of engine anti-ice are covered in the Cold Weather Operation portion of Supplemental Information.
- Both pilots acknowledge.

SHOULDER HARNESS . . . . . **ON**
- All cockpit occupants must don shoulder harnesses during takeoff.
- Assure seat belts locked on both sides.

HYDRAULIC PANEL/POWER
- All ENG PUMP S/O switches latched (FLOWBAR)'s.
- **HI TEM**, **LO PR** and **LO QTY** lights extinguished.

On Operating Engines:
- System pressures normal.

If Taxiing With Engines 1 And/Or 3 Shutdown:
- PTU(s) FLOWBAR's; check system pressures.

If Taxiing With Engine No. 2 Shutdown:
- B and C AC PUMPS ON .
- Check system pressures.

When All Engines Operating:
- PTU's OFF.
- B and C AC PUMPs unlatched.
- Check system pressures.

GALLEY POWER ON
- Assure KW's are within limits.

ELECTRICAL PANEL/POWER
- If EXT Power was used during start, switch OFF.
- Operating generators paralleled.
- KW's within limits.
- After EXT Power switch is OFF, check battery charger (BAT).
  - Battery charger should cycle between zero and –40 amps. Failure to cycle (ammeter reads zero continuously), cycling between + and – indications, or a constant + ammeter indication denotes a system fault.
- Leave DC meter selector in BAT position.

NOTE: BATTERY CONDITION ***illuminates on the APU panel if the battery charger isdeactivated.***

DISCONNECT EXTERNAL POWER & AIR

FUEL TANK PUMPS ON (FLOWBAR'S)

(–250/–500) 1A + 3A TRANSFER SWS LCH

(724) 1A + 3A TRANSFER SWS AS REQD
- Normal position of 1A/3A XFR switches is latched throughout flight. This position provides both fuel transfer and scavenging for the alternate tanks.
  - Main tank scavenging remains operative.
  - If main tanks 1 and 3 a re full, the disagreement and OPEN lights remain extinguished (indicates transfer valves are closed) until fuel quantity in the mains is reduced.
  - Scavenging in tanks 1A & 3A continues after tanks 1A & 3A are empty.
  - If 1A/3A are empty, periodically check fuel remains at 100lbs. or less in each tank.

SHIP 724:
- If tanks 1A/3A contain fuel, latch the 1A/3A SFR switches for normal fuel transfer.
- If main tanks 1 and 3 a re full, the disagreement and XFR lights remain extinguished (indicates transfer valves are closed) until fuel quantity in the mains is reduced.
- When SFR valves are OPEN main tank scavenging is deactivated.
- Alternate tank scavenging will begin at liftoff.
- In flight, when 1A/3A QUANTITY LOW lights are illuminated and tanks are empty, unlatch 1A/3A SFR switches.
- I tanks 1A/3A are empty, verify 1A/3A XFR switches are unlatched.
- Periodically check 1A/3A fuel remains at 100 lbs. or less in each tank.

FUEL CROSSFEEDS AS REQD
- If prolonged taxi expected with engine(s) shutdown, latch CROSSFEED VALVE switches as required to maintain normal fuel distribution.
- When all engines operating,:
  - Unlatch CROSSFEED VALVE switches; check **FLOWBAR** lights extinguished.
  - Verify fuel management is tank-to-engine for takeoff.

S/O ENGINE INSTRUMENTS

APU AS REQD
- Select MIN mode.
- BLEED AIR S/O unlatched.

AFTER INITIAL START (CONT'D.)

If Taxi Planned on One Engine:

- Leave APU operating to provide additional AC power supply.

When Two Engines are Operating:

- Press STOP button; start clock.
- After **DOORS IN TRANSIT** extinguishes, place APU MASTER POWER switch **OFF**.
- All APU annunciator lights extinguished.
- The Delayed Engine Start should be coordinated to allow a two minute warm up time at stabilized idle operation before takeoff power is applied. During the warm–up time frame, all predeparture checklist items should be completed.

AURAL WARN-UNSAFE T/O

Test Unsafe Takeoff mode:

- Check FWD, MID and AFT cargo door lights on the S/O Annunciator Panel and DOOR OPEN on Pilot's Annunciator Panel.
- Check ELEVATOR light on S/O Annunciator Panel and Pilot's Annunciator Panel.
- Check Takeoff Warning Horn sounds.

S/O ANNUNCIATORS

- All door warning lights extinguished.

PRESSURIZATION SET

ENGINE BLEEDS AS REQD

- All 3 ENG ISLN VALVE sws. latched (FLOWBAR)'s.
- Operating engine(s) HI PRESS switch(es) latched (FLOWBAR's).

PACKS ON (FLOWBAR)'S

- Normally, use three packs for ground operation.

NOTE: To prevent engine rundown during TAXI when at IDLE power, it is recommended that no more than two bleed air users be operated at a time. If higher pneumatic loads are necessary (i.e.,3 Packs due to high ambient temperatures), advance the throttle or start another engine.

TAXI CONSIDERATIONS

It may be necessary to start two or three engines to taxi-out from congested gate areas. If prolonged taxi is then anticipated, the Captain may elect to shutdown engine(s) to continue taxi on one engine. Coordinate with S/O before shutting down any engine. S/O must ensure electrical, hydraulic, and pneumatic requirements are met before informing Captain that an operating engine can be shutdown.

Taxi using only No. 2 engine and the APU is permitted at the Captain's discretion, provided that an airport safety or aircraft handling problem would not be created. The Captain should consider the effect of aircraft weight, ramp slopes, active runways to be crossed and jet blast hazard to personnel, equipment, or other aircraft. When taxiing on only No. 2 engine approximately 85% N_3 may be required for breakaway. Acceleration to normal taxi speed is reduced.

Taxi with any two engines operating is permissible. The preferred combination is engines No. 2 and No. 1.

If No. 2 Engine Not Operating During Taxi

B AND C AC PUMPS ON

- Leave B and C AC PUMPS ON until No. 2 engine is stabilized on speed.

ATM'S AUTO

- Provides hydraulic backup.

TAXI

After the Agent's salute is accepted by the Captain, and the AFTER START Checklist (if applicable) is complete, the First Officer may extend the flaps in preparation for taxi. Only after clear of congested areas may the First Officer continue with his taxi check flow pattern in anticipation of the Captain calling for the TAXI checklist.

ATM'S CK/AUTO

- ATM's ON
- Check RPM in green band and ATM warning lights extinguished. Return selector to AUTO.
- To reset an overspeed or OVERSPEED TEST, turn selector to OFF, then check ATM.

GROSS WT INDICATOR UPDATE

- At cities which have radio dispatch, S/O calls station for final weight and balance information after departing the ramp.
- Reset gross weight on final AWABS, or updated weight and balance as determined by radio, into total fuel quantity indicator.

CROSSBLEED FLOWBAR'S

COCKPIT DOOR LOCKED

TAXI (CONT'D.)

TAKEOFF DATA ... COMPLETED RWY ___

- Second Officer completes that Takeoff Data card to agree with Final (AWABS) data or ARMS Manual data for the runway being used for takeoff then hands the completed T/O Data Card to the F/O.
- The F/O will acknowledge receipt of the T/O Data Card completed for the runway being used for takeoff as specified in theTaxi Clearance.

-100 AIRCRAFT

- Refer to ARM series 555-14 for -100 restrictions.
- Refer to the L-1011-100 Operational Data Manual M) to determine V speeds.
- Determine Takeoff EPR from the pink power chart. The TAT EPR computer may be used for TO1, TO2 or GA determination.
- When Flaps 10 and 14 IMPROVED PERFORMANCE or Flaps 4 CLEARWAY performance is necessary, use the salmon colored pages in the ODM or ARM to determine V speeds.

-200 AIRCRAFT

- Refer to ARM series 555-10 for -200 restrictions.
- Refer to the L-1011-200 (ODM) to determine V speeds.
- Determine Takeoff EPR from the yellow power chart. **Do not use TAT EPR Indicator for TO1, TO2 or GA determination.**
- When Flaps 14 CLEARWAY performance is necessary, use the salmon colored pages in the ODM or ARM to determine V speeds.

-500 AIRCRAFT

- Refer to ARM series 555-9 for L-1011-500 restrictions.
- For international operations, refer to -500 ODM for V speeds and -500 Tabletop chart for thrust and stabilizer settings. When Flaps 14 CLEARWAY performance is necessary, use the salmon colored pages in the ODM or ARM to determine the V speeds.
- For domestic operations use the blue L-1011-500 Takeoff Data Domestic Operations power chart.

-100 Aircraft

- For international operations, Flaps 10 Packs On or OFF is primary. Flaps 14 Packs OFF will be the alternate. If additional takeoff capability is needed, then Packs OFF and Flaps 10 or 14 IMPROVED PERFORMANCE or Flaps 4 CEARWAY will be utilized. These options will be controlled by airport and runway by AWABS and the ARM.
- For domestic operations use Flaps 10. In LGA ONLY, FLAPS 18 MAY BE REQUIRED.

-200/-500 Aircraft

- For international operations, Flaps 18 Packs ON or OFF is primary. Flaps 22 Packs OFF will be the alternate. If additional takeoff capability is needed, then Packs OFF and Flaps 14 and Flaps 14 CLEARWAY will be utilized. These options will be controlled by airport and runway by AWABS and the ARM.
- For domestic operations use Flaps 10. In LGA only, Flaps 18 may be required.

(-500) MDLC ..... CK

Test Maneuvering DLC G-Sensitive Stick Shaker as follows:

- Flaps must be **up** and all hydraulic systems **pressurized.**
- Latch either DLC/AUTO SPLR switch. Other switch must be unlatched.
- Press STALL WARN TEST, stick shaker activates. After approximately a two second delay, Speedbrake Lever drives to the upper DLC RANGE limit.
- Release Test button, stick shaker stops and Speedbrake Lever stows after an approximate seven second delay.
- Unlatch DLC/AUTO SPLR switch. Latch other switch and repeat test.
- Latch both DLC/AUTO SPLR switches. Check **OFF** and **FAIL** extinguished. This completes test of MDLC system.

FLAPS/SLATS___-___°/GREEN LT .... ___

- Ensure slats extended before moving flap handle beyond 4°.
- S/O calls flap handle position, TE FLAP tape indication and green LE EXT.
- F/O verifies flap handle and indicators agree and are in desired position.

SLAT MONITOR 14 GREEN

- S/O states "Slat Monitor 14 Green" after checking 14 green lights illuminated. (NOTE: Ships 759-762 have an active slat monitor ON/OFF switch.)

TAXI (CONT'D.)

FMS GROSS WT . . . . . UPDATED
- F/O updates FMS with final gross weight received from S/O. (PERF MGT Page 1)

(-1/724) EPR MODE PANEL SET _____
- Insert latest available temperature in vicinity of runway (normally from SAT gauge).
- Press TO1 (NORMAL) ON or TO2 (ALTERNATE) ON as appropriate.
- TO1 (NORMAL) thrust must be used with:
  - Standing water, snow slush, or ice.
  - Anti-skid inoperative.
  - Other than 10° flap takeoffs.
  - Engine anti-ice in use.
  - When required by MEL.
  - Runway length less than 7,000 ft.
- Callout which mode selected.
- If a significant temperature difference exists from that used for AWABS computations, recompute maximum allowable takeoff weight. Consult the ARM for appropriate weight.

PITOT/ALPHA HEAT . . . . . ON
- Latch PITOT switches; check **OFF** extinguishes.
- Latch ALPHA switch; **OFF** extinguishes when AOA sensors reach operating temperature. Replace ALPHA bulbs with No. 6839 bulbs (28V, 24MA) only. Any other bulb may damage panel.
- Both pilots check and acknowledge.

WINDSHIELD HEAT . . . . . ON
- Latch WINDSHIELD HEAT switches; check SIDE WINDOWS switches latched.
- Lights extinguished.

AUTO FLT/NAV RADIO PANEL . . . . . CK
- NAV Radios set.
- Autopilot A and B **OFF**.
- Both FD switches **ON**.
- TAKEOFF mode selected.
- Runway heading set and HDG engaged.
- Initial altitude selected and armed.
- S/O will visually confirm both Pilot's AFCS Status Annunciator agree. If not, communicate the disagreement to both Pilots.

ALTIMETERS/FLIGHT/NAV INSTRUMENTS . . . . . SET/CROSS CK
- Make final scan of all flight and navigation instruments to assure proper settings and no flags.
- Crosscheck HSI, RDDMI and mag compass headings agree.
- Crosscheck all altimeters set to latest local altimeter setting.
- Both pilots acknowledge.

AIRSPEED/EPR BUGS . . . . . SET/CK
- Set airspeed bugs as shown on the Takeoff/Landing Data Card.
- Check TAT-EPR indicator for agreement with computed EPR, and set EPR bugs. If there are significant differences between computer and Power Chart values, the Power Chart must be used.
- Both pilots acknowledge with their airspeed bug setting. F/O also states EPR setting.

STABILIZER TRIM____° . . . . . ____
- Observe normal trim wheel and stabilizer indicator movement while setting stabilizer trim for takeoff.
- S/O calls out computed stabilizer setting and crosschecks SPI.
- Both pilots check and confirm callout.

FLT CONTROLS/SPLRS . . . TOPS/BOTTOMS
- All four hydraulic systems must be pressurized to complete the flight controls check.

CAUTION

DO NOT PERFORM AILERON AND SPEEDBRAKE CHECKS AT THE SAME TIME. TO DO SO COULD CAUSE SPOILER PANEL TO REMAIN EXTENDED, AND CREATE AN ADVERSE ROLL REACTION AT LIFTOFF.

- Check spoiler/speedbrake operation by pulling speedbrake lever aft. Check SPI SPOILER indications. With flaps at takeoff setting, confirm that the two inboard spoiler indicies move to full up. Return speedbrake handle to forward position and check spoiler panels are retracted on SPI.
- Move control wheel left full deflection then right (sequence helps assure spoilers stow) while observing SPI AIL and SPOILER indications. While control wheel is deflected, push OUTBOARD AIL button on SPI to read outboard aileron position, and release. Repeat for full deflection check in the opposite direction. Check the OUTBOARD AIL position a third time after wheel is returned to neutral. Also observe SPI RUD indications for movement in both directions.
- Move column **slowly and smoothly** full-aft and full-forward while observing SPI STAB indications.
- While holding the nose steering wheel (not required if rudder pedal steering is latched OFF), operate the rudder pedals full travel while observing SPI RUD indications. Both pilots should assure that their seat position allows them to apply full rudder.
- F/O will acknowledge checking the Ail and Spoiler SPI's movements as correct by responding with "TOPS".
- The Captain will acknowledge checking the rudder SPI as correct by responding with "BOTTOMS".

TAXI (CONT'D)

-500 AIRCRAFT

Flight Controls check is identical to -1. However, note that deflection of spoilers 1, 2, and 3 is limited while flaps are retracted. Therefore, if flaps are retracted during the flight controls check, spoiler panel R2 index on the SPI will only move to just above the DLC range.

On the ground, with ACS engaged and the control wheel neutral, the outboard ailerons will be up 8° more than the inboard ailerons (flaps extended or retracted). During the roll control checks the outboard ailerons will indicate 20° up, but only 12° down.

NOTE: In flight, with flaps extended, the outboard ailerons will be up 8° more than the inboard ailerons. In flight, with flaps retracted, the outboard ailerons will be down 2° more than the inboard ailerons.

DELAYED ENGINE START

After completing AFTER START and TAXI Checklists, perform DELAYED ENGINE START CHECKLIST when ready to start remaining engine(s).

NOTE: For delayed start(s) the F/O and S/O will normally perform engine start(s) while taxiing.

- ***The Captain will announce: "Start # ___."***

PACKS AS REQD

- Reduce number of operating packs as required to assure adequate duct pressure throughout engine start.

START ENGINE(S)

- Start engine(s) in sufficient time to assure that all engines can be stabilized at ground idle RPM and temperature for two minutes, before takeoff power is applied and all checklists can be completed prior to taxiing into takeoff position.
- Duct pressure should be held constant during start to prevent starter damage. Avoid starting engines where sudden thrust changes may be required.
- Use normal crossbleed start procedure.

AFTER DELAYED START

Perform **AFTER** all three engines are **STABILIZED** at ground idle.

ENGINE INSTRUMENTS . . . . . **CK**

ENGINE ANTI-ICE . . . . . **AS REQD**

- Conditions requiring the use of engine anti-ice are covered in the Cold Weather Operation portion of Supplemental Information Section.
- Both pilots acknowledge.

HYDRAULIC PANEL

- PTU's **OFF**.
- B and C AC PUMPS **UNLATCHED**.
- Check system pressures.

ELECTRICAL PANEL

- Generators paralleled.

FUEL CROSSFEEDS UNL

- Check FLOWBAR's extinguished.
- For takeoff fuel management is tank-to-engine.

S/O ENGINE INSTRUMENTS

APU STOP

- Press STOP button; start clock.
- After **DOORS IN TRANSIT** extinguishes, place APU MASTER POWER switch OFF.
- All APU annunciator lights extinguished.

ENGINE BLEEDS FLOWBAR'S

- All 3 HI PRESS switches latched FLOWBAR's.

PACKS FLOWBAR'S

- Operate all three packs unless takeoff is imminent.

BEFORE TAKEOFF

NOTE: Do not apply takeoff thrust until all three engines have been operating at ground idle or above for two minutes.

FLIGHT ATTENDANTS . . . . . **NOTIFIED/ACKNOWLEDGED**

- Prior to taking the active runway, the Captain or his designee will make the following PA announcement:

  "Ladies and gentlemen, we will soon be taxiing onto the runway. Will the Flight Attendants please make final preparations for takeoff."

  The In-Flight Services Coordinator will verbally advise that the Flight Attendants and cabin are ready. This will be accomplished personally (verbally) or by use of the chimes for those situations when it cannot be accomplished by the primary means.

  It is the In-Flight Service Coordinator's responsibility to verify the lower galley is clear before responding.

  Takeoff will not be initiated until acknowledgement is received.

START IGNITION . . . . . **BOTH**

- Starter ignition switch must be placed in BOTH after all engines are started.

CONTINUOUS IGNITION . . . . . **AS REQD**

- CONTINUOUS IGNITION ON when operating in precipitation or icing, or if taking off from snow, slush or water covered runways, or if turbulence is anticipated.

ANTI-SKID . . . . . **ON**

DME'S . . . . . **NORM**

PILOT'S ANNUNCIATOR PANEL . . . . . **CK**

- ELECTRICAL SYSTEM light remains illuminated until APU MASTER POWER switch is **OFF**.

FLAPS/SLATS ___-___°/GREEN LT . . . . **___**

- Ensure slats extended before moving flap handle beyond 4°.
- S/O calls flap handle position. TE FLAP tape indication and green LE EXT.
- Captain and F/O verifies flap handle and indicators agree and are in desired position and acknowledge.

After Taking Active Runway:

TRANSPONDER . . . . . **NORM**

- 1 NORM odd numbered flights.
- 2 NORM even numbered flights.

STROBE LTS . . . . . **ON**

- Under adverse weather conditions, strobes may be left **OFF** for takeoff at Captain's discretion.

TEMP PROBES . . . . . **ON**

- All AIR DATA SENSOR HEAT lights extinguished.

LANDING LIGHTS . . . . . **AS REQD**

RUDDER PEDAL STEERING . . . . . **ON**

- Unlatch RUDDER PEDAL STEERING SHUTOFF switch to arm the rudder pedal steering system for takeoff.

TAKEOFF BRIEFING . . . . . **COMPLETED**

- Pilot Flying should verbalize:
  - Heading.
  - Altitude.
  - Airspeed restrictions, if applicable.
- Compliance with Standard Callouts and Policies is assumed.

PACKS . . . . . **AS REQD**

- AWABS or Weight Data Record will note whether takeoff data is based on packs ON or OFF.

NOTE: If your departure routing requires you to enter reported or suspected low altitude wind shear, altering noise abatement procedures to enhance aircraft performance is recommended.

AFTER TAKEOFF AND CLIMB

(-1) EPR MODE SET

- Do not use CL1 (max. climb) unless expedited climb requested by ATC, icing, turbulence or other conditions.
- Select:
  - CRZ when TOGW is 360,000 lbs. or above.
  - CL2 when TOGW is less than 360,000 lbs.
  - CRZ when Vertical Speed is less than 500 FPM.

(724) EPR MODE SET
-200 CONFIGURATION:

- Above 430,000 lbs takeoff st., use CL 1.
- At or below 430,000 lbs takeoff st., use CRZ.
- At or below 410,000 lbs takeoff st., use CL 2.

NOTE: When using CL or CRZ modes above 25,000 ft. crosscheck with appropriate power chart. If values differ, the chart values or ODM must be used.

-500 and SHIPS 738 thru 741:

- When operative the FMS automatically programs correct EPR depending upon weight based on the FMS climb option selected by the crew. If FMS is inoperative on -500 aircraft, refer to ODM. If FMS is inoperative on ships 738 - 741, use the EPR computer or refer to the ODM.

PACKS (400 FT. MINIMUM) ON (FLOWBAR'S)

AIR CONDITIONING/PRESSURIZATION

- Air conditioning system normal.
- Cabin rate-of-climb.
- Avionics Air **OVBD** lights extinguished.
- Set BARO SET and CABIN ALTIMETER to 29.92 passing FL180.

HUMIDITY CONTROL UNL AT 5000 FT

FUEL PANEL SET

- Start crossfeed as specified in fuel management procedure.
- Manage fuel as required to assure equal fuel in all tank systems by the time total fuel load is reduced to 58,000 lbs.

(-100/-200/-250/-500)

- When fuel is contained in tanks 1A/3A, begin crossfeed before 14,000 lbs. has been used. Crossfeed all engines from tanks 1 and 3 until tanks 1A/3A are empty and quantities in tanks 1,2, and 3 are equal.
- Tanks 1,2, and 3 must be equal by the time total fuel is reduced to 58,000 lbs.

-500 and SHIPS 738 thru 741:

- 1A/3A XFR switches should remain latched, and at least one TANK PUMP switch latched in Tanks 1 and 3 throughout the flight.
- With fuel contained in tanks 1A and 3A, the 1A/3A XFR OPEN lights will cycle on and off to automatically maintain fuel in tanks 1 and 3 at the desired level.
- If it is necessary to reduce tank pump pressure in tanks 1 or 3 for inflight fuel balancing, leave one tank pump operating in each of these tanks.
- If both TANK PUMPS switches in either tank are unlatched for any reason, unlatch the respective XFR switch.
- When all fuel has been consumed in the alternate tanks, leave the 1A/3A XFR switches latched to provide continuous scavenging.
- Periodically check 1A/3A fuel quantity to assure quantity remains at 100 lbs. or less.

NOTE: once fuel quantity in each main plus alternate has been reduced to below 40,000 lbs., the ALT FUEL MONITOR light on the Pilot's Annunciator Panel will illuminate if either alternate tank exceeds 1,000 lbs. Also, the FAULT light on the S/O's panel will illuminate until 1A/3A QTY is pressed or the MONITOR switch is unlatched. (Note: ALT FUEL MONITOR system not installed on Ships 759-762.)

SHIP 724

With fuel contained in tanks 1A and 3A, and the 1A/3A XFR switches latched, the 1A/3A XFR lights will cycle on and off to automatically maintain fuel in tanks 1 and 3 at the desired level.

When 1A/3A LOW lights illuminate, verify quantity remaining about 100 pounds each; then unlatch 1A/3A XFR switches,.

NOTE: Once fuel quantity in each main plus alternate has been reduced to below 32,000 lbs., the ALT FUEL MONITOR light on the Pilot's Annunciator Panel will illuminate if either alternate tank exceeds 1,000 lbs. Also, the FAULT light on the S/O'S panel will illuminate until 1A/3A QTY is pressed or the MONITOR switch is unlatched.

NOTE: The following items are checked visually and silently by the S/O using the checklist. Call out any items not completed.

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AFTER TAKEOFF AND CLIMB (CONT'D.)

GEAR ..... **UP/NEUTRAL**
- After positive rate of climb established and TRUCK light "on–then–off", retract the gear.
- S/O monitors ATM operation, hydraulic quantity and S/O annunciator panel.
- After all door lights extinguish, position gear lever to NEUTRAL.

FLAPS/SLATS ..... **UP/LIGHTS OUT**
- For takeoffs with flaps set greater than 10°, retract flaps to 10° at V2 +10 minimum and 400' or obstacle clearance. Then follow normal noise abatement procedures and retract remaining flaps on schedule (V_2 +20 for 4°, V_2 +60 for 0°).
- When flap retraction is complete, confirm flap handle 0°, flap position indicators 0° and both leading edge lights extinguished.
- If TM portion of FMC is to be used for climb, at 1000' AGL (Min) or when climb power called for; latch **TM** to ARM TM section of FMC and engage **ATS** switch. (On Ships 759–762 [digital A/P] it is only necessary to latch TM.)

CONTINUOUS IGNITION ..... **AS REQD**

SEAT BELTS/NO SMOKING ..... **AS REQD**
- At 10,000 ft. or pilot's discretion.
- Normally, the F.A.I.C. will make a PA announcement similar to the following after the seat belt light is turned off.

  "Ladies and gentlemen. Please note that the Captain has turned out the seat belt light. This is so that you may move around, as necessary. However, we suggest that while seated you keep your seat belt securely fastened. This will prevent your discomfort or inconvenience if we should encounter any unexpected rough air. We want you to enjoy your flight. Thank you for your cooperation."

VHF NAV RADIOS ..... **AS REQD**

With FMS installed and operative:
- Press AUTO MNL button on both VHF NAV panels.
- Verify blue AUTO flag appears in both frequency windows.

RADIO/NAV SWS ..... **AS REQD**
- Select either FMS or ONS as desired, if installed.

ALTIMETERS ..... **SET 29.92**
- Above transition altitude reset and crosscheck to 29.92. All crew members acknowledge.

LANDING LIGHTS (ABV FL 180) .. **AS REQD**
- Lights will normally be off above FL 180 unless delayed until clear of all other traffic.

SHIP 724:
- Before leaving land internationally determine INS accuracy from ground fix if practicable crosscheck each INS.

DESCENT

NOTE: On International/Transoceanic flights NOTIFY Flight Attendants when 1 hour from landing.

PRESSURIZATION
- Set ALT SET to destination field elevation.
- Set BARO SET and differential pressure gauge to destination altimeter setting.
- Descend cabin at approximately 300 FPM.

ELECTRICAL PANEL
- Check all DC buses.
- Check IDG OIL TEMP's and RISE; IDG **LOW PRESS** lights extinguished.
- Check KW/KVAR's.
- All FIELD, GENERATOR, and TIE BREAKER's closed (FLOWBAR's); all other lights extinguished.
- Check C/B's.

FUEL PANEL
- All TANK PUMPS latched(FLOWBAR's).
- **LOW** and **FUEL PRESSURE** lights extinguished.

724/–250/–500
- Verify fuel remaining in tanks 1A and 3A has been reduced to 100 lbs or below.
- Verify proper fuel distribution.

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DESCENT (CONT'D.)

COMPUTE LANDING DATA

FLT ATTENDANTS ..... NOTIFIED
- S/O should advise the In-Flight Service Coordinator when approximately 20 minutes away from expected landing.

SHOULDER HARNESS ..... ON
- All cockpit occupants must don shoulder harnesses during landing.
- Assure seat belts locked on both sides.
- All crew members acknowledge.

PILOT'S ANNUNCIATOR PANEL ... RECALL
- Latch and unlatch WARNING, CAUTION, ADVISORY LIGHTS TEST switch to recall all uncorrected annunciations.

HSI HEADING SW ..... MAG

LANDING LTS ..... AS REQD

CONTINUOUS IGNITION ..... ON
- Continuous ignition **ON** for all landings

SEAT BELTS ..... ON

INS DATA SELECTOR(S) ..... CK
- For dual or triple INS installation, set INS 1 & 2 to WIND; INS 3 to desired setting.
- For single INS installation, set to WIND.

AIRSPEED/EPR BUGS ..... SET/CK
- Set one bug on each airspeed indicator to threshold speed.
- Set EPR bugs to GA EPR.
- Both pilots acknowledge airspeed bug setting. F/O states EPR bug setting.

TRANSITION ALTITUDE (DESCENDING)

ALTIMETERS SET_____ ..... _____
- Below transition level (FL 180 domestic) reset and crosscheck all altimeters to destination altimeter setting.
- S/O states destination altimeter setting when available.
- Capt. and F/O reset and both state altimeter setting.

APPROACH

HYDRAULIC PANEL
- Check each system quantity and pressure.
- Check BRAKE PRESS B and C.

CROSSBLEED FLOWBAR's

HUMIDITY CONTROL (5000 FT)
- Below 5,000 ft. with airport ambient temperatures above 50°F, HUMIDITY CONTROL switch can be latched **ON**.

EPR MODE PANEL ..... AS REQD
- (724) TAT/EPR computer cannot be used for go-around EPR

(-1) EPR MODE PANEL TO GA ON

APPROACH BRIEFING ..... COMPLETED
- As a minimum, the following will be verbalized:
  - Runway Assigned/Plate Number
  - Date
  - Frequency
  - Inbound Course

The acronym N.A.T.S. is an easy guide for remembering all items included in the Approach Briefing. Listed below is a menu of items **REQUIRED** to be covered in an actual instrument approach.

- NOTAMS
  - ATIS Advisories
  - Flight Plan Message NOTAMS
- Approach Plate
  - In an actual instrument approach, the approach plate briefing must include but is not necessarily limited to the following items:
    - Designated Approach
    - Chart Number and Date
    - Nav Aid/Freq/Identification
    - Inbound Course/Initial Altitude
    - FAP/FAF Altitude
    - Baro Altitude at Marker Beacon
    - MDA or DH
    - Missed Approach Point and Procedure
- Terrain Considerations
- Special Pages

This menu is not intended to restrict or limit the command authority of the Captain if he deems additional briefing or coordination necessary.

APPROACH (CONT'D)

RADIO/NAV SWITCHES ..... RADIO
- Both RADIO/NAV switches RADIO.
- Verify Data Source Indicators on both HSI's display RAD and VOR or ILS.

AUTOFLIGHT PANELS ..... CK

VHF NAV RADIOS ..... CK/MNL
- If AUTO flag(s) in view press AUTO MNL button(s) on VHF NAV panel(s).
- Verify AUTO flag retracted on both panels.

SPEED BRAKE LEVER ..... FWD/LTS OUT
- Visually and manually check lever full forward; amber disable lights extinguished.

ALTIMETERS/FLIGHT/NAV INSTRUMENTS ..... SET/CROSS CK
- Crosscheck all altimeters set to current destination setting.
- Verify flight and navigation instruments are set.
- Verify radios tuned to proper freq and identified.
- Prior to beginning the approach, consult the appropriate Jeppesen approach chart to determine the altitude at the final approach fix. As the final approach fix is passed, check the barometric altimeters to verify the altitude shown on the chart and note any variations. If variations are noted (improper glide slope, altimeter inaccuracies, lag, and/or altimeter spread), use the altimeter showing the lowest reading.
- Both pilots acknowledge.

RADIO/BARO ALTIMETER BUGS .. ___/___
- Reset radio altimeter DH at 2500' and 1,000' on descent.
- Instrument Conditions:
  - Set baro altimeter orange bug to AH/DH/MDA shown on Jeppesen approach plate (50' above TDZE shown on approach plate for CAT III). The two white bugs will then indicate 200' and 100' above minimums/alert height.
  - Set radio altimeter bugs to RA DH indicated on the plate for CAT II approach. For CAT III approach set 50' AH as specified in Operations Specifications.
  - Set radio altimeter bugs to DH (HAT) shown on approach plate for all ILS approaches other than CAT II/III to serve as a back-up proximity device.
  - Good operating technique would be to set radio altimeter bugs to 250' for all non-precision approaches to serve as a back-up proximity device.
- Visual Conditions:
  - Setting of radio/baro altimeter bugs is not required.
- Check MAG & VOR or ILS annunciated in HSI's.
- Both pilots acknowledge.

At Least 5 Minutes Before Landing:

FLIGHT ATTENDANTS NOTIFIED
- Notify In-Flight Service Coordinator at least five minutes before landing to clear the lower galley.
- All personnel should be out of the lower galley no later than the outer marker.
- Notify Capt. and F/O when galley is clear.

NO SMOKING ..... ON
- Ensure the No Smoking sign is **cycled ON** no later than 5 minutes prior to landing.
- Time and duties permitting, the following PA should be made by the S/O:
  "Flight Attendants, prepare the cabin for landing."

BEFORE LANDING
(GEAR HANDLE DOWN)

HYDRAULIC PANEL
- Check each system quantity and pressure.
- Check BRAKE PRESS B and C.

LOWER GALLEY ..... CLEAR
- S/O will assure galley is clear no later than the outer marker.
- Avoid landing until galley is clear.
- N/A (-500)

GEAR ..... DOWN/3 GREEN
- S/O observes gear handle DOWN, 3 green lights; all other lights extinguished. Bring any discrepancy to Capt. and F/O's attention.
- PF and PNF both acknowledge.

FLAPS/SLATS___-___°/GREEN LT .... ___
- S/O calls flap handle position, TE FLAP tape indication and green LE EXT.
- PF and PNF confirm that flaps are in proper position for landing and both acknowledge.
- Bring any discrepancy to the attention of the pilot flying, and insure desired flap configuration is made for landing.

SLAT MONITOR 14 GREEN
- S/O states "Slat Monitor 14 Green" after checking all 14 SLAT Monitor green lights illuminated.

DLC/ALPHA ..... CK
- With flaps extended beyond 30°:
  - DLC actuates with flap handle position.
  - ALPHA flag appears in ATS window.
  - AOA annunciates in IAS window on Ships 759-762.

AFTER LANDING
(CLEAR OF RUNWAY)

RUDDER PEDAL STEERING ..... OFF
- Latch RUDDER PEDAL STEERING switch (when installed) after reducing to taxi speed and while taxiing straight ahead.

NOTE: The following items are checked visually and silently by the S/O using the checklist. Call out any items not completed.

LANDING LIGHTS ..... OFF

HF RADIOS ..... OFF

ANTI SKID ..... OFF

CONTINUOUS IGNITION ..... OFF

AIR DATA SENSOR HEAT ..... OFF

WINDSHIELD HEAT ..... IDLE OFF

ANTI-ICE ..... OFF

STROBE ..... OFF

FD/AUTOPILOTS/DME'S ..... OFF/STBY

FLAPS/SLATS ..... UP/LTS OUT
- Position flap handle to 4°; pause then position handle to 0°.
- Check indicator tapes 0°.
- **TRANS & LE EXT** lights extinguished.
- **SLAT MONITOR** lights extinguished.

SPEED BRAKE LEVER ..... FWD/LTS OUT

STABILIZER TRIM ..... ZERO

RADAR/TRANSPONDER ..... STBY

ENGINE(S) NO. 3/1 ..... SHUTDOWN
- Captain may elect to shutdown Engine No. 3 and/or 1 on taxi-in to conserve fuel.
- After engine stabilizes at ground idle RPM and temperature, Captain advises S/O when ready to shutdown Engine No. 3 and/or No. 1.
- No. 3 engine shutdown is recommended due to limited effect upon systems as well as expediting work by servicing personnel upon arrival at the ramp.
- Engine No. 1 may also be shutdown if the Captain determines that taxi on one engine can be conducted safely.

NOTE: The APU must be operating and the APU generator supplying the AC TIE BUS before the second engine is shutdown.

When Eng No. 2 Shutdown:

B AND C AC PUMPS ON
- If No. 2 engine is shutdown prior to parking at the gate, latch B & C AC PUMPS ON; ATM's remain in AUTO to provide hydraulic backup.

GALLEY POWER OFF

FUEL PANEL
- CROSSFEED VALVES latched (FLOWBAR 's).
- TANK PUMPS, unlatched; leave one pump switch latched if APU is operating.

APU START
- If APU available:
  - Start APU.
  - Press APU GENERATOR BREAKER CLOSE and FIELD BREAKER CLOSE, if required.
  - Check APU generator parallels.
  - Consider delaying APU start for fuel conservation if long taxi is anticipated.

NOTE: At stations where ground air and electrical power are available it is not necessary to start the APU if taxi-in is conducted on at least two engines and ground power will be applied upon arrival at the gate.

(724) FLOOR HEAT OFF

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SHUTDOWN

SEAT BELTS . . . . . **OFF**

After Power & Air Established:

- Prior to engine shutdown:
  - Check electrical loads.
  - APU generator paralleled, or if EXT PWR AVAIL, EXT PWR ON.
  - Establish pneumatics (APU or external) after engines are shutdown.

FUEL AND IGNITION . . . . . **OFF**

- Close throttles and place the FUEL AND IGNITION switches OFF. Observe Fuel Flow and TGT. Check maximum overspeed/overtemp pointers.

PARK BRAKES (WHEELS CHOCKED AND ALL ENGINES SHUTDOWN) . . . . . **RELEASE**

- After all engines have been shutdown and chocks-in-place signal received, release parking brakes.

ANTI-COLL LIGHTS . . . . . **OFF**

- Leave on until last engine shutdown, and aircraft is parked at the gate.

EXTERIOR LIGHTS . . . . . **CK**

- POSITION lights latched; LANDING and TAXI lights OFF; others as desired.

STANDBY POWER . . . . . **OFF**

- Check UNARM.

NAVIGATION SYSTEMS . . . . . **AS REQD**

- For thru flights, the ONS and FMS systems may be left operating.

INS MODE SELECTOR(S) . . . . . **OFF**

NOTE: In the ATTITUDE mode the INS CDU display is blank. Ensure the INS mode selector is in the OFF position prior to leaving aircraft.

CAUTION

ENSURE THAT COOLING AIR IS AVAILABLE TO NAVIGATION UNITS IF SYSTEMS ARE TO BE LEFT OPERATING. EQUIPMENT COOLING AIR MUST BE CONTINUALLY AVAILABLE UNTIL ALL UNITS ARE TURNED OFF DURING NORMAL SHUTDOWN.

- At termination, pull FMS circuit breakers 1E8 and 1E26, and turn ONS and INS OFF.

ATM'S OFF

AC HYDRAULIC PUMPS UNL

ELECTRICAL PANEL

- Normally, leave power on all buses. BATTERY switch may remain ON unless cockpit is to be unattended for an extended period..

FUEL TANK PUMPS UNL

- Leave one TANK PUMP switch latched if APU will be left operating.

1A + 3A XFR UNL (724/-250/-500)

- Leave 1A + 3A XFR switches unlatched to prevent main tank fuel from seeping into the alternate.

FLT RCDR UNL

- Check DFDR FDAU illuminated.

AIR CONDITIONING

- Operate a minimum of two packs with passengers on board.
  - PACK FLOW CONTROL valves as required.
  - CABIN TEMP CONTROL selectors set.
  - CARGO HEAT lights extinguished.
  - FWD and MID AVIONIC AIR OVBD: respective **LO FLOW** lights extinguished.
  - **COOL AIR OVBD CLOSE** light extinguished.
  - Humidity control ON if airport temperature is above 50°F. For operation in hot humid conditions, refer to SUPPLEMENTAL INFORMATION, HOT WEATHER OPERATION — HUMIDITY CONTROL procedure

CODED C/B'S

- Pull appropriate color coded C/B's for estimated time on the ground. See aircraft placard instructions.

LOGBOOK SIGNED

- Make required entries for maintenance discrepancies and/or Cat III documentation.
- At non-maintenance stations, if oil servicing is required, make the following entry:
  "_____Engine needs_____quarts of oil"

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TERMINATION

- Do not complete following items unless all passengers have deplaned, and aircraft is terminating.

EMERGENCY LIGHTING . . . . . **OFF**

- Check UNARM.

MASTER RADIOS . . . . . **OFF**

RADAR . . . . . **OFF**

BATTERY SWITCH . . . . . **OFF**

APU/EXTERNAL POWER

- To shutdown APU electrical and pneumatic power: BATTERY switch OFF.
- Select MIN mode.
- Bleed air S/O unlatched.
- Press STOP button; start clock.
- After DOORS IN TRANSIT extinguishes place APU MASTER POWER switch OFF.

GND SERVICE SW . . . . . **AS REQD**

- When an aircraft is to be on the ground for more than one hour at a non-maintenace station, configure the aircraft for Ground Service Bus operation.
  - If External Power available, place to EXT PWR.
  - If APU utilized place switch to APU.

CREW DUTIES REFERENCE CHART

The Crew Duties Reference Chart is provided to show where divisions in crew member work load would normally exist. The chart should not be utilized or interpreted as a device which establishes rigid functional crew duties. It is merely a guide to help crew members in coordinating their actions over the course of a typical flight. The chart also delineates areas in which a crew member must remain reasonably proficient if crew coordination is to be maintained at an optimum level. Special situations or unusual occurrences may require some deviations from the charted duties; the Captain ultimately makes that determination.

FUNCTIONAL CREW DUTIES	C	F/O	S/O	PF	PNF
Flight Plan Review/Weather	●	●	●		
• Check F/P Documents	●	●			
• Check F/P Map Lat/Long	●		●		
Check Log Book				●	
Set Up Navigation Equipment (FMS, ONS) (INS)					●
Verify NAV Set-Up					●
Accuracy Check (FMS, ONS, INS)		●	●		
ATIS (S/O In Flight)	●	●	●		
Before Start Checklist	●	●	●		
ATC Clearance				●	
Departure Briefing	●				
Flight Attendant Briefing		●			
Pushback		●			
• Pushback Clearance	●				
• Talk to Tug Driver	●	●	●		
Checklist Initial Engine Start	●	●	●		
Engine Start	●	●	●		
After Start		●			
Taxi Clearance (Ramp or Ground)	●	●	●		
Taxi Checklist				●	
Takeoff Briefing	●	●	●		
Before Takeoff Checklist					●
Gear and Flaps				●	
APFDS UPDATE					●
• Autopilot ON			●	●	
• Autopilot OFF			●	●	●
After Takeoff And Climb Checklist			●	●	●
FMS, ONS, INS Programming/Update			●	●	●
Altitude Awareness			●	●	●
Descent Checklist			●	●	●
Review Star and Alt Restrictions			●	●	●
Review Approach Plate IFR			●	●	●
Approach Checklist				●	
Approach Briefing			●	●	●
Approach Callouts			●	●	●
Before Landing Checklist				●	
Landing				●	
• Reverse					
• Brakes					
Ground Control Communications	●	●	●		
Ramp Control (Gate Assignment)	●	●	●		
After Landing Checklist	●	●	●		
Parking Shutdown Checklist	●		●		
Log Book Entry					

GENERAL POLICIES

CHECKLISTS

In flight, the pilot flying will call for the appropriate checklist.

Items on the AFTER LANDING Checklist will be accomplished only after the aircraft has cleared the active runway.

BRIEFINGS

The Captain will insure that the Pilot Flying adequately briefs the required items on the Departure, Takeoff and Approach Briefing menus. The Captain will conduct the Flight Attendant Briefing. He may, at his discretion, brief other items he deems necessary to conduct the flight. The Captain will determine if aircraft control should be transferred during the approach briefing after considering the complexity of the approach and time required to conduct the brief.

DEPARTURE/TAKEOFF BRIEFING

It is desirable to discuss complex departure requirement well in advance of takeoff. The Briefing for Takeoff should normally be conducted in two parts.

- A Departure briefing should normally be completed prior to engine start.
- A Takeoff briefing will normally be completed prior to the the application of Takeoff power.

The appropriate items will be discussed in enough detail to ensure preparedness and understanding by all crew members. The menu is not intended to restrict the command authority of the Captain if he deems additional briefing or coordination is necessary.

The Second Officer must be aware of this Takeoff Briefing; i.e., know the initial Heading and Altitude for takeoff.

The Second Officer should monitor all inflight ATC clearances and be aware of altitude assignments, etc.

TAKEOFF

The Captain will have his hand on the top part of the THROTTLES after initial power application on every takeoff until V1.

GEAR AND FLAP CHANGES

The Pilot Flying (PF) the aircraft shall call for any landing gear or flaps change and the Pilot Not Flying (PNF) shall accomplish the change. The only exception to this procedure will be:

- If operational necessity requires an immediate configuration change, i.e. the PNF is occupied with other priorities, the PF may announce the configuration change and move the appropriate control. This in no way should be construed as routine, but rather the exception.

ALTITUDE AWARENESS

Set Altitude Alert for all assigned altitudes and the pilot not flying will make the appropriate Standard Callouts.

FLIGHT DIRECTOR AND AUTOPILOT USAGE

The Flight Directors are to be used during all regimes of flight except where abnormal conditions do not permit.

For takeoff, the Flight Director will be used with HDG mode (runway heading) and Takeoff (TOGA) mode selected.

In those instances where operational limitations prohibit the use of the Takeoff Mode (–500 T.O.G.W. < 400,000#), the following procedure will be used:

- Select HDG and align with runway heading.
- In lieu of the Takeoff mode, select VS (vertical speed) and rotate thumbwheel to the maximum rate of climb (approximately 4000 ft./min.). This will displace the pitch command bar to its upper limit on the ADI. Throughout the initial takeoff and climb phase, establish pitch attitudes solely with reference to the "raw pitch" ADI display. **The pitch command bar must be ignored** until reaching that point in the climb where normal climb pitch modes (VS 1,000 FT./MIN. or TM/VNAV) can be employed.

If operable, both the Autopilot(s) and the Flight Director(s) will be utilized for all approaches when the reported visibility is below RVR 4000 ft. or ¾ mile.

APPROACH BRIEFING

Proper approach planning and thorough understanding of procedures are essential elements in accomplishing any approach. Brief all necessary items after considering weather and crew familiarity with the airport and approach.

APPROACH BRIEFING (CONT'D.)

As a minimum for **all** approaches, the following will be verbalized:

- Runway assigned/plate number.
- Date.
- Frequency.
- Inbound course.

All Crew Members should review the Approach Plate prior to the Approach Briefing.

CREW DISCIPLINE ON APPROACH

The aircraft should be stabilized on final approach in the landing configuration at least 1000' AGL except where this conflicts with nonprecision approach procedures. (CAT I/II)

All altitude callouts and the determination of MDA and DH (except CAT II DH and CAT III AH) will be made by reference to the Barometric Altimeter. The Radio Altimeter may be used as a back-up.
It is recommended that the radio altimeters be set to 250' for all VFR and non-precision approaches. This will provide an additional ground proximity warning and is coincidental with the minimum obstruction clearance altitude provided within 1 NM of the runway on non-precision approaches.

On each non-precision approach, the MDA is set on the Barometric Altimeters as the primary altitude reference. Because terrain variations will affect the Radio Altimeter, MDA must be flown by reference to the Barometric altimeter only.

For most CAT II approaches set the Radio Altimeter to the RA DH indicated on the apprach plate. The decision to contiue or to execute a missed apprach will be made at the first indication of DH, either Barometric Altimeter or Radio Altimeter.

For CAT II approaches where the use of the Radio Altimeter is not authorized, the approach plate will state "RA NOT AUTH". In that case the DH is determined by the altitude of the glide slope at the Inner Marker. The decision to continue or to execute a missed approah will be made at the first indication of DH, either Barometric Altimeter or Inner Marker (aural indication or marker beacon light indication).

For CAT III approaches set the radio altimeters to 50' and the barometric altimeter markers to 50' above the touchdown zone elevation (TDZE) indicated on the approach plate. All callouts below 100' AGL will be made by reference to the radio altimeter.

During all instrument approaches, regardless of who is flying, the Captain shall announce his decision to allow the aircraft to continue to a landing or to execute a missed approach. This decision must be made no later than:

- The Missed Approach Point on non-precision approaches.
- DH during CAT I/II ILS approaches.
- Anytime on CAT IIIa/IIIb approaches.

The Captain will state "Runway in sight" if visual reference is established with the runway, or "Missed Approach" if either visual reference is not established or a safe landing cannot be accomplished in the touchdown zone. (CAT I, II, or III)

The "Runway in Sight" callout does not relieve the pilot flying from the responsibility to execute a missed approach if it would be unsafe to continue to a landing.

GOOD INSTRUMENT APPROACH PRACTICES

- Proper seat height is important for both pilots during the approach.
- Proper management of flap position, airspeed, and thrust is important for any approach and is essential for a smooth Autopilot approach.
- Any abnormal condition, such as a tailwind as evidenced by higher than normal sink rate while maintaining glide slope and airspeed, should be brought to the attention of other flight crew members.
- After establishing visual contact, the pilot not flying must continue to monitor the flight instruments through the flare. Call out any significant deviation to minimize the effects of possible visual illusions for the pilot flying.
- After passing the final approach fix using the Autopilot, the pilot flying should follow through on the controls and be prepared to immediately disengage the Autopilot if performance is not satisfactory.
- Use caution during taxi in low visibility conditions. All visual clues including heading information should be used to confirm taxiway position.

LANDING

The pilot flying will perform all braking and reversing unless briefed otherwise by the Captain.

Unless otherwise noted, each flight is dispatched to land on the longest runway at the destination under "WET/LOW MINIMA" conditions. If a different runway, an aircraft malfunction, or a tailwind is encountered, the crew should consult the ARM for the Max Allowable Landing Weight.

APPROACH/LAND OPERATIONS WITH WEATHER ABOVE CAT II MINIMA

Approach/Land may be used for any ILS equipped runway with an autopilot in CMD provided the published TCH (threshold crossing height) is 47' or greater and provided that any autopilot and/or glide slope restrictions published in the notes on the appropriate profile of the Jeppesen approach plate are observed.

When weather conditions are better than CAT II, tower personnel are not required to provide the same ground traffic separation as they do at CAT II or lower. Aircraft on the runway or taxiways may cause bending of the localizer and glide slope beams. This could cause significant differences in approach path, flare and landing, if the approach is conducted using A/L mode with the autopilot(s) in CMD.

For A/L operations (autopilot engaged in CMD) with weather minima above CAT II, the equipment required on board remains identical except for the following:

- Rain removal system is not required.
- One YAW SAS channel may be inoperative.
- Both ATS channels may be inoperative.
- One autopilot channel may be inoperative.
- Instrument Comparator Warning System may be inoperative.

LOWER THAN STANDARD MINIMA

TAKEOFF MINIMA

Delta's Operations Specifications provide a standard takeoff minima of ½ mile for the L1011 at all airports unless a higher minimum is specified in the takeoff section of the Jeppesen plate.

Authorization for lower than standard takeoff minima for a specific runway will be indicated on the Jeppesen plate if certain requirements outlined in the Operations Specifications are met. Either pilot may make the takeoff if the visibility is ¼ mile or 1600 RVR or greater.

Operating procedures for takeoffs with visibility less than ¼ mile /1600 RVR are:

- The Captain will make the takeoff.
- The Flight Director will be used in accordance with the policies discussed under Flight Director and AP Usage, this section.
- Takeoff must be initiated from a stop. No rolling takeoffs.
- A Takeoff Alternate may be required:
  - Required only if the weather at the time is below the lowest landing minima available at the departure airport.
  - A suitable Takeoff Alternate for the L-1011 must be within two hours in still air – 760 n.m.

LANDING MINIMA

For each instrument approach, the landing minima is published on the appropriate Jeppesen approach plate. For that airport to qualify for the listed minima, the various requirements for ground equipment as outlined in the Operations Specifications must have been met. It is the controller's duty to inform the pilot if any required ground component is out of service.

For non-precision and basic ILS approaches the required airborne equipment is listed in FAR 121. For CAT I, CAT II, and CAT III approaches the required airborne equipment is listed on the following page. Consult the Operations Specifications for additional details concerning airborne equipment. The **dispatch** requirements listed in the MEL may differ from the **approach** requirements listed on the following page.

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INSTRUMENT APPROACH EQUIPMENT REQUIREMENTS

This list of equipment may vary from the L-1011 MEL since dispatch requirements may differ from enroute requirements.

EQUIPMENT REQUIRED IN ADDITION TO FAR 121	BASIC ILS DOWN TO AND INCLUDING 4000 RVR, ¾ MI D.H. 250' MANUAL or AUTOLAND	CAT I W/TDZ & CL DOWN TO 1800 RVR, ½ MI. D.H. 200' MANUAL or AUTOLAND	CAT II CAPT ONLY 1200 RVR D.H. 100' MANUAL or AUTOLAND	CAT IIIa [1] CAPT ONLY 700 RVR A.H. 50' AUTOLAND	CAT IIIb [1] CAPT ONLY 300 RVR A.H. 50' AUTOLAND
LOC - G/S RECVRS	1	2	2	2	2
ADC		2	2	2	2
ADI			2	2	2
F/D		2 (1 if A/P Used)	2	2	2
R/A			2	2	2
AFCS MODE ANNUN		1*	2	2	2
AFCS WARN ANNUN		1*	2	2	2
AUTO APPR COUPLER		1 (If F/D Not Used)	1	2	2
PITCH TRIM (CHANNELS)			1	2	2
YAW-SAS (CHANNELS)	1 (If A/L Is Used)	1 (If A/L Is Used)	1 (If A/L Is Used)	2	2
ATS (CHANNELS)				1	1
DLC/AGS (CHANNELS)				1	1
RAIN REMOVAL (Incl both W/S Wipers)			1	1	1
INSTR COMPAR (Both Sides)			1	1	1
A/L MODE			1	1	1
RUDDER PEDAL STEER					1

Dispatch requirements may differ from those of enroute.

- If both channels of the Mach Feel Fail, use of the autopilot is prohibited.
- If both channels of the Pitch Trim Fail, the Autopilot is inoperative.
- CAT IIIa is automatic to touchdown.
- CAT IIIb is automatic through rollout (90 knots).

* Individual AFCS warning and mode annunciations may be inoperative provided landing minimums do not depend upon their use (see MEL).

[1] ***NOTE: CAT III approaches with an engine out are not authorized for Ships 759 - 762***

INSTRUMENT APPROACHES - GENERAL

On each instrument approach the Captain shall ensure all requirements for the approach are met. The duties below are the normal duties for all crewmembers, however the Captain may assign additional duties as required.

The First Officer is allowed to conduct any approach at the discretion of the Captain except for CAT II and III approaches.

If the visibility is less than ¾ mile or 4000 RVR, the landing weight is restricted to the "WET/ LOW MINIMA" weight listed in the ARM for that runway.

The Captain shall conduct all CAT II/III approaches.

The maximum crosswind to initiate a CAT II/III approach is 10 knots.

The maximum crosswind to land from a CAT II/ III approach is the 35 knot crosswind limit of the aircraft or 20 knots if autoland is used. These however are equipment limits and in any case should not override good judgment when all environmental factors are considered.

PILOT FLYING DUTIES

All Approaches

On each instrument approach, the Pilot Flying (PF) shall:

- Conduct an approach briefing as outlined in this manual
- Conduct the approach as outlined in this manual
- Control airspeed and thrust
- Crosscheck all instruments

CAT I, CAT II, AND Non-Precision

- Adjust scan pattern approaching MDA or DH to include outside references
  - Primary duty continues to be accurate aircraft control approaching DH or MDA and maintaining MDA as required
- Either pilot may initially call "Runway in Sight": However, no later than DH on CAT I and CAT II ILS approaches or the Missed Approach Point on non-precision approaches:
  - The Captain must make the decision to continue or to execute a missed approach
  - The Captain shall state either "Runway in Sight" or "Missed Approach"
  - The F/O will acknowledge
- The PF will then continue the approach or execute the missed approach.

CAT III

The primary mode of operation for CAT IIIa is automatic to touchdown, and for CAT IIIb is automatic through touchdown and roll out. A missed approach shall be initiated if, prior to the Alert Height (AH), controlling RVR's are reported to be below the minimum required or any of the required elements of the airborne or ground systems become inoperative. Additionally, a missed approach shall be initiated if, prior to touchdown, the Captain determines that an automatic landing cannot safely be accomplished in the touchdown zone.

PILOT NOT FLYING DUTIES

All Approaches

On each instrument approach, the Pilot Not Flying (PNF) shall:

- Make all required altitude callouts
- Crosscheck all instruments
  - Call attention to any flags or malfunctions
- Monitor airspeed and sink rate
  - Announce any significant deviation from normal

CAT I, CAT II and Non-Precision

- Approaching MDA or DH
  - Closely monitor flight instruments
  - Positively make the required callouts of "200 above", "100 above" & "minimums"
  - Adjust scan to include outside references
  - Call "Runway in Sight" as appropriate
- Continue to closely monitor airspeed and sink rate until flare
- If the approach cannot be continued, assist in executing the missed approach
  - Pay particular attention to rotation, thrust, positive rate-of-climb, airspeed, gear and flap retraction, and the missed approach procedures After landing the F/O should assist the Captain in runway and taxiway identification

CAT III

Approaching ALERT HEIGHT (AH), it is most important that the F/O closely monitor instruments and positively call "200 above," "100 above" and "Alert Height." Monitor sink rate to flare.

- As taxiways are difficult to locate in restricted visibility conditions, when a safe taxi speed is achieved, it is more important that the F/O assist the Captain in runway and taxiway identification than in performing the After Landing Checklist. It may be necessary to monitor heading references in restricted visibility to remain on assigned taxiways.

SECOND OFFICER DUTIES

On each instrument approach, the Second Officer shall:

- Position his seat to best be able to assist during the approach
- Crosscheck all systems and instruments
  - Announce any abnormal conditions which may affect the approach or the landing
- Double check all altitude callouts
- Assist pilots in executing the missed approach as required
- Call out, at the Captain's discretion, Radio Altimeter Altitude (except for CAT III approaches) in 10 foot increments beginning at 70 feet radio altitude.
- On CAT III approaches the S/O altitude callouts will be omitted to prevent a distraction from the more essential AFCS Autoland Status callouts.

VISUAL APPROACHES

The key to a successful VFR approach is proper planning and execution with the aircraft on speed and altitude, positioned to make a touchdown in the touchdown zone. If any of the parameters cannot be met or if there is doubt that touchdown will occur in the touchdown zone, a go-around is the proper course of action.

During a VFR approach and in keeping with good resource management practices, all suitable navigation and approach aids shall be utilized for assistance. If an ILS glideslope or VASI is available, do not descend below the ILS glideslope prior to the middle marker or, in the case of VASI, until a lower altitude is necessary for a safe landing.

When executing a straight in or other VFR approach, plan the approach so as to arrive at a point 3 miles from the end of the runway at approximately 1000 feet AGL. This will coincide with a 3° glideslope. Stability at this point provides a reference for all VFR approaches from which an aproach may be successfully completed in the normal touchdown zone with a touchdown aiming point 1000 feet beyond the end of the runway.

When on a downwind, an abeam position of approximately $1\frac{1}{2}$ miles at 1500 to 1700 feet AGL with the aircraft configured to Flaps 10° and a speed of V_{ref} +30 minimum is ideal. Continue lowering the flaps to 22° and extend the downwind as necessary. As the turn to final is commenced, extend the gear and establish a descent rate of 700–800 fpm. Landing flaps are extended as conditions dictate, however, aircraft sink rate should be stabilized and the landing configuration established by 1000 feet AGL.

At 500 feet AGL, airspeed, descent rate and runway line-up should be established. If they are not, initiate a go-around.

A normal runway descent profile coincides with a 3° glide path. Aircraft position in relation to this glide path can be checked by using the 300 ft./mile formula as a guide, i.e., for every mile from the runway threshold, the aircraft altitude above TDZ elevation should increase by 300 ft. AGL. (At 2 miles, aircraft altitude should be 600 ft. AGL; at 3 miles, 900 ft. AGL, etc.) If available, DME may be checked against altitude. A final altitude check may be made as the approach lights (standard configuration) begin to disappear under the glareshield. At this point, 250–300 feet AGL coincides with a normal glide path. Speed and sink must be firmly established.

STANDARD CALLOUTS

NOTE: PNF denotes Pilot Not Flying

CONDITION	CALLOUTS
TAKEOFF	
• On Takeoff Roll prior to 80 kts. • At V_1, V_R and V_2. • At positive rate of climb.	**PNF** "Power set and engine instruments checked" **PNF** "V_1" – "V_R" – "V_2" **PNF** "Positive Rate"
CLIMB	
• 1,000 feet below each assigned altitude. • Approach transition level.	**PNF** "Out of _____ for _____ ". **PF&PNF** "Altimeters set to 29.92".
DESCENT	
• 1,000 feet above each assigned altitude. • Approaching transition altitude.	**PNF** "Out of _____ for _____ ". **PF&PNF** "Altimeters set to _____".
APPROACH AND LANDING	**Examples:**
• Any significant deviation from planned flight path, airspeed or descent rate.	**PNF** "Bug ± _____ knots" or "Sink _____", etc.
• 1,000 feet above field elevation (Visual Conditions)	**PNF** "1,000 Above"
Below 500 feet AGL: • Any descent exceeding 1,000'/min – Appropriate action will be taken or the approach abandoned.	**PNF** "Sink _____"

CONDITION	CALLOUTS
ALL INSTRUMENT APPROACHES • PNF will call out AFCS Modes Annunciator progression	**Examples:** **PNF** "VOR Captured", "Localizer Armed", "Glideslope Captured" etc.
NON-PRECISION • Within 5° of final approach course • 1000' Above Field Elevation • Approaching Minimum Descent Altitude • At MDA • At VDP (When Published) • When runway in sight • At Missed Approach Point • Prior to leaving MDA	 **PNF** "Approaching Inbound Course **PNF** "1000 Above" **PNF** "200 above" "100 above" **PNF** "Minimums" **PNF** "Visual Descent Point" **PNF** "Runway in Sight" **PNF** "Missed Approach Point" **CAPT** "Runway in Sight" or "Missed Approach" • F/O must acknowledge
ALL ILS APPROACHES • First positive movement of localizer • First positive movement of glideslope bar	 **PNF** "Localizer Captured" or "Localizer Alive" as appropriate **PNF** "Glideslope Alive"
CAT I AND II APPROACHES • 1000' Above Field Elevation • Approaching Decision Height • At DH • At or before DH	 **PNF** "1000 Above" **PNF** "200 above" "100 above" **PNF** "Minimums" **CAPT** "Runway in Sight" or "Missed Approach" • F/O must acknowledge
CAT III APPROACHES • 1000' Above Field Elevation • Approaching Alert Height • At Alert Height	 **F/O** "1000 Above" **F/O** "200 above" **F/O** "100 above" **F/O** "Alert Height"
ALL AUTOLAND APPROACHES • 1500' RA (Approx.) • 1000' Above Field Elevation • 150' RA • 50' RA • 5' RA • If Off Centerline During Rollout	 **PNF** "A/L Capture" "Align Arm" "Flare Arm" **PNF** "1000 Above" **PNF** "Align Capture" **PNF** "Flare Capture" **PNF** "Rollout" Annunciated **F/O** "Steer Right/Steer left"

FLIGHT PATH CONTROL TECHNIQUES

Proper flight path control is fundamental to the safe operation in any weather condition. The following techniques, if properly applied, can prevent a dangerous situation from developing even if an **unsuspected and inadvertent windshear** is encountered. These techniques are so important that each pilot should incorporate them into his personal operation and practice these techniques on each takeoff and approach WHETHER OR NOT **unstable** conditions are present.

Takeoff Techniques

- Be alert for any significant airspeed fluctuations during takeoff and initial climb.
- Know the normal initial climb pitch attitude.
- Make a continuous rotation at the normal rate to this target pitch attitude.
- Minimize reductions from the initial climb pitch attitude until terrain and obstruction clearance is assured.
- Develop an awareness of normal acceleration and vertical speed.
- Know the criteria for recognizing an unstabilized flight path and be prepared to execute an immediate recovery, if it is required.
- The pilot not flying should closely monitor the airspeed, altitude and vertical speed, and call out any significant deviations from normal.

Approach Techniques

- Achieve a stabilized approach no later than 1000' AGL.
- Crosscheck Flight Director commands versus vertical speed, glideslope, pitch attitude and thrust.
- Develop an awareness of normal vertical speed, pitch attitude and throttle position.
- Know the criteria for recognizing an unstabilized flight path and be prepared to execute an immediate recovery, if it is required.
- The pilot not flying should closely monitor the airspeed, vertical speed, altitude, glide slope and throttle position, and call out any significant deviations from normal.

INTRODUCTION

This section contains normal procedures information for all L-1011 long-range aircraft.

Only information which is different from -1 aircraft is included. Therefore, procedures are expanded only when the action to be taken differs from -1 aircraft. In most instances, these procedural differences are in addition to the requirements for operation as a -1 aircraft.

-250/-500 AIRCRAFT

- Operating limitations, normal procedures, emergency and abnormal procedures are contained in the POM blue pages.
- Basic systems description differences are contained in the PRM blue pages.
- INS system descriptions are contained in the NAVIGATION blue pages of the PRM.
- Use the ***Blue*** pilot's checklists.
- Use the L-1011-250 or L-1011-500 Operational Data Manual (ODM) white takeoff pages to determine Flaps 18, 22, or 14 V speeds. Brake energy limits are incorporated into the ODM speeds.

  At times Flaps 14 CLEARWAY performance will be required. When this occurs, use the ODM or Aircraft Restrictions Manual (ARM) salmon colored pages to determine V speeds.

  Takeoff EPR and stabilizer settings will be on the tabletop chart or green (-250) power chart.

SHIP 724

- Operating limitations, normal procedures, emergency and abnormal procedures, while operating in the -100 or -200 configuration, are contained in the POM blue pages.
- Basic systems description differences are contained in the PRM.
- INS system descriptions are contained in the NAVIGATION blue pages of the PRM.
- Use the ***Blue*** pilot's checklists.

-100 CONFIGURATION

This configuration occurs when -250 aircraft or ship 724 are equipped for international flights and three -22B engines or an intermix of -22B and -524B4 engines exists. A pink placard will be installed on the F/O's instrument panel to identify the aircraft as being in the -100 configuration.

- Heavy duty tires, wheels, and brakes are installed. The maximum takeoff weight for international flights is 466,000 pounds. For domestic operations the takeoff weight is restricted by company policy to 430,000 pounds.
- Three INS units are installed for international flights. For domestic operations normal gyros can be installed.
- Use the L1011-100 ODM white takeoff pages to determine Flaps 10 or 14 V speeds. Brake energy limits are incorporated into the ODM speeds.

  At times IMPROVED PERFORMANCE or CLEARWAY performance will be required. When this occurs, use the ODM or ARM salmon colored pages to determine Flaps 4, 10 or 14 V speeds.

  Takeoff EPR and stabilizer settings will be on a pink power chart.

-200 CONFIGURATION

For ship 724, this is the configuration most likely to be encountered. A yellow placard on the F/O's instrument panel identifies the aircraft when it is a -200.

- Heavy duty tires, wheels, and brakes are installed. The maximum takeoff weight for international flights is 474,000 pounds. For domestic operations the takeoff weight is restricted by company policy to 430,000 pounds.
- Three INS units are installed for international flights. For domestic operations normal gyros can be installed.
- Use the L-1011-200 ODM white takeoff pages to determine Flaps 18, 22 or 14 V speeds. Brake energy limits are incorporated into the ODM speeds.

  At times, Flaps 14 CLEARWAY performance will be required. When this occurs, use the ODM or ARM salmon colored pages to determine V speeds.

  Takeoff EPR and stabilizer settings will be on a yellow power chart.

TABLE OF CONTENTS

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CURRENT CHECKLISTS

ITEM	DATE
L-1011-100 -200 -250 -500 Pilot's Checklist (Blue)	7-30-87
L-1011-100 -200 -250 -500 S O's Checklist (Blue	7-30-87
Emergency Checklist (White)	6-23-83

CURRENT POWER CHARTS

ITEM	DATE
-100:	
Takeoff Landing Data Power Chart (Pink) Use ODM for V speeds	3-21-86
-200:	
Takeoff Landing Data Power Chart (Yellow)	3-21-86
Climb Data Power Chart (Yellow)	1-31-85
For Cruise and Descent data ***Use the ODM***	
-250:	
Takeoff Landing Data Power Chart (Green) Use ODM for V speeds	3-26-87
-500:	
For international flights, use ODM for V speeds	
Takeoff Landing Data Power Chart (Blue) ***Domestic only***	1-31-85

NOTE:
If you receive a Checklist or Power Chart dated later than as listed above, retain it pending revision of this listing.

SECOND OFFICER'S CHECKLIST

EXTERIOR PREFLIGHT INSPECTION

In addition to the regular requirements for exterior preflight inspection the S/O should pay additional attention to the following:

- Condition of tires, wheels, and brakes.
- Aerodynamic cleanliness of airframe, including fairings, doors, flight controls, etc.
- Evidence of fluid leaks.

1. **NOSE WHEEL WELL**

2. **NOSE SECTION**

3. **RIGHT FORWARD FUSELAGE**
   On -500 aircraft check water tank quantity and pressure through access panel located in bottom of fuselage below R2 door.

   NOTE: On Ships 754-756 water tank quantity gauges are installed on the S/O's panel.

4. **RIGHT WING**
   -524B4 wing engines do not have visible fire bottle indicators. Maintenance checks bottle pressure at each letter check.

5. **RIGHT MAIN GEAR & WHEELWELL**

6. **AFT RIGHT FUSELAGE**

7. **EMPENNAGE CONTROL SURFACES AND NO. 2 ENGINE**

8. **AFT LEFT FUSELAGE**

9. **LEFT MAIN GEAR & WHEELWELL**

10. **LEFT WING**

11. **LEFT FWD FUSELAGE**

COCKPIT SAFETY INSPECTION

1. **LOGBOOK/OUT OF SVC TAG**

2. **MANUALS**

   -500 AIRCRAFT:
   - FMS PILOT'S DATA BANK Book.
   - 555-9 Series Aircraft Restrictions Manual.
   - -500 Operational Data Manual.

   SHIP 724:
   - 555-10 Series Aircraft Restrictions Manual.
   - -200 Operational Data Manual.

   -250 AIRCRAFT
   - FMS PILOT'S DATA BANK Book.
   - 555-13 Series Aircraft Restrictions Manual.
   - -250 Operational Data Manual.

SECOND OFFICER'S CHECKLIST (Cont'd)

3. **CIRCUIT BREAKERS IN**
   On modified aircraft, check that BATTERY CHARGER MODE switch in C/B 3K2 is in NORMAL.

4. **PASSENGER MANUAL OXYGEN SW UNL**

5. **FIRE PULL HANDLES IN**

6. **HF RADIOS OFF**

7. **MASTER RADIOS LCH**

8. **GEAR HANDLE DOWN**

9. **STABILIZER TRIM ZERO**

10. **FLAP/SPEEDBRAKE**

11. **RADAR OFF**

12. **TRANSPONDER STBY**

13. **MECHANICAL GEAR RELEASE COMPARTMENT**

14. **OBSERVER'S AREA**

15. **COCKPIT DOOR**

16. **COAT COMPARTMENT AREAS**

17. **BATTERY ON**

BEFORE APPLYING APU/EXTERNAL POWER:

18. **FIRE DETECTION LOOP TEST**

19. **AC PUMPS UNL/ATM'S OFF**

20. **GALLEY POWER UNL**

21. **TANK PUMPS UNL**

22. **ENG NO. 2 TANK VALVE LCH**

23. **FUEL JETTISON UNL**

24. **APU START**

25. **APU/EXT POWER ON**

26. **ENGINE BLEED CONTROL PANEL**

SECOND OFFICER'S CHECKLIST (Cont'd)

27. INS ALIGN/CHECKED

DOMESTIC:
Position all **three** INS Mode Selector Switches to ATT. All flights dispatched between domestic U.S. cities will operate with the INS units selected to the ATT mode only.

INTERNATIONAL:
INS MODE SELECTORS.....ALIGN
- The airplane must not be towed or taxied during INS alignment.
- For all international operations use the actual ramp position lat/long to establish present position.
  Before any international operation, if INS MODE Selectors already in* ALIGN, *downmode selectors to* OFF *then back to* ALIGN *to assure navigation accuracy.
- Check INSERT on each CDU.
- From-TO displays indicate 1-2.
- INS 1 & 2 AUTO-MAN switches; AUTO.
- INS 3 AUTO-MAN switch MAN.

INS LIGHTS.....TEST
- Position DIM control to set desired light intensity on displays. if control is **in full DIM**, displays will appear blank.
- Place Data Selectors in DSTRK/STS.
- Press TEST switch:
  - All lights on the CDU and MSU illuminate except keyboard and CLEAR switches.
  - 8's illuminate in both data displays, FROM-TO indicator, and DISTANCE, TIME, and GND SPD indicators on HSI.
  - NS and EW and decimal points illuminate in data displays.

INS MALFUNCTIONS.....CHECK
- Press and release TEST switch. No action or malfunction codes should appear in the right data display.
- Red **WARN** and amber **BAT** lights should be extinguished (during alignment, at a PI [performance index] of 8, BAT illuminates briefly then extinguishes as battery is checked).

31N-FMS PROGRAM .....VERIFY
- Data Selectors; DSRTK/STS.
- Press HOLD.
- Check 25-04 annunciated in left display to confirm proper program is loaded in the INS.
  - If a 63-14 code appears the unit has a 31N program, but it is not compatible with FMS. Such a unit could be installed in position #3 without affecting operation of the FMS.
- Press **HOLD** extinguished.

INS PRESENT POSITION .....LOAD
PI (Performance Index) will not progress below 7 until present position is loaded.
- Present position must be loaded into each INS unit separately.
- Place Data Selectors in POS.
- Press keyboard switch to select appropriate parallel (2N or 8S). Enter present position latitude coordinates, and check correct latitude indicated in left display.
- Press INSERT; check correct latitude remains in display.
- Press keyboard switch to select appropriate meridian (4W or 6E). Enter present position longitude coordinates, and check correct longitude indicated in right display.
- Press INSERT; check correct longitude remains in display.
- Check **INSERT** extinguished.

DATA SELECTOR.....DSTRK/STS
- Check desired PI of 5, and actual PI is continuing to count down.
- Check no action or malfunction codes indicated.

REPEAT PROCEDURE FOR EACH INS UNIT

28. CREW OXYGEN ON

29. OXY MASK/REGULATOR/INTERPHONE/ AUDIO SELECTOR/SELCAL

30. S/O LIGHT PANEL TEST
ON -500 AIRCRAFT
- FWD (also AFT on ships 754 thru 756) cargo compartment ALTN and MAIN DISCH illuminate during this test.
- Before replacing bulbs in either of these lights pull appropriate CARGO FIRE EXT C/B's. FWD, 1A17 or 1A18; AFT, 1B17 or1B18.

SECOND OFFICER'S CHECKLIST (Cont'd)

FIRE/OVERHEAT PANELS

1. WHEELWELL FIRE TEST
2. ENGINE TURB COOLING AIR TEST
3. NACELLE/PYLON OVHT DET TEST
4. FIRE DETECTION LOOP TEST
5. FIRE EXTINGUISHER TEST
6. HYDRAULIC SYSTEM TEMP
7. APU FIRE PULL HANDLE IN/LTS OUT

HYDRAULIC PANEL

1. RSVR LO QTY/HI TEM LIGHTS OUT
2. ENG PUMP S/O FB'S
3. ATM'S OFF
4. CASE DRAIN HI TEM LIGHTS (6) OUT
5. ENG PUMP LO PR LIGHTS (4) ON
6. RAT LIGHT OUT
7. AC PUMPS ON
8. PTU FB'S
9. BRAKE ACCUM LIGHTS OUT
10. HYDRAULIC FLUID LEVELS NORMAL
    It is desired that hydraulic quantities be high in green band prior to international flights.
11. AC PUMPS OFF
12. PTU'S OFF

ELECTRICAL PANEL

1. IDG OIL TEMP NORMAL
2. GALLEY POWER BUS 2 LIGHT OUT
3. IDG LO PRESS LIGHTS
4. AC METER SELECTOR
5. APU GEN OIL OVHT/PRESS LTS OUT
6. APU GENERATOR FIELD
7. APU GENERATOR BREAKER
8. ENG GENERATOR FIELDS ARM
9. KW/KVAR METERS
10. ENG GENERATOR BREAKERS ARM
11. DC METER SELECTOR
12. TIE BREAKER FB'S
13. DC BUS ISOLATION UNL
14. ESS POWER SELECTOR NORM

FUEL PANEL
(WHEN FUELING IS COMPLETE)

1. REFUEL POWER LIGHT OUT
2. FUEL QUANTITY/DISTRIBUTION
   - Fuel load distribution is contained in SP 3583, Aircraft Restrictions Manual.
   - Fuel loading and management schedule for fuel loads is also contained in FUEL chapter, Book II(PRM) and on the back of the S/O's Checklist.
   - Unless fuel load exceeds 160,000 pounds no fuel should be contained in tanks 1A or 3A.

SECOND OFFICER'S CHECKLIST (Cont'd)

3. FUEL QUANTITY TEST

DO NOT TEST WHILE FUELING IS IN PROGRESS.

- Latch 1A and 3A XFR switches.
  - Check blue disagreement lights illuminate then extinguish and OPEN.

  NOTE: If main tanks 1 and 3 are full, the disagreement and OPEN lights remain extinguished (indicates transfer valves remained closed).
  - Unlatch switches.
- Press TEST.
  - FUEL quantity indicators (4) pointers and digital readouts drive toward full.
  - TOTAL FUEL and GROSS WT indicator increasing.
  - Tank 2L and 2R LOW.
- Release TEST; indicators return to previous indications.

SHIP 724

- Latch 1A and 3A XFR switches.
  - Switches must be latched for **LOW** lights to illuminate during following test.
  - Check blue disagreement lights illuminate then extinguish and XFR.

  NOTE: If main tanks 1 and 3 are full, the disagreement and XFR lights remain extinguished (indicates transfer valves remain closed).
- Press TEST.
  - FUEL quantity indicators (4) pointers and digital readouts drive toward full.
  - TOTAL FUEL and GROSS WT indicator increasing.
  - Tank 2L and 2R LOW, and 1A and 3A LOW.
- Release TEST: indicators return to previous indications.
- Unlatch 1A and 3A XFR switches. Check blue disagreement lights illuminate then extinguish and **XFR** extinguishes. Switches must be unlatched for **main** tank scavenging to function.

4. INBOARD QUANTITY CHECK/UNL

5. 1A AND 3A QTY CK/UNL

- Check 1A and 3A Switches on the Alternate Fuel Quantity Monitor panel (when installed) are latched, and the **OFF** and **FAULT** lights extinguished.
  - Check **ALT FUEL MONITOR** Light extinguished.

  NOTE: If each main plus alternate tank contains less than 40,000 lbs. (32,000 ship 724) the ALT FUEL MONITOR on the Pilot's Annunciator Panel will illuminate if either alternate tank exceeds 1,000 lbs. Also, the FAULT light on the S/O panel will flash until 1A/3A QTY is pressed or the MONITOR switch is unlatched.
- Latch 1A and 3A QTY switches; check QTY.
  - Check tank 1 and 3 indicators display proper quantity in tanks 1A and 3A.
  - Tanks 1A and 3A should indicate less than 100 lbs. unless fuel load exceeds 160,000 lbs.

IF 1A OR 3A CONTAIN UNWANTED FUEL:

- Latch respective (1 and/or 3 main) TANK PUMPS switches.
- Latch 1A/3A XFR switch(es).
- Fuel will transfer into the mains at the rate of 400-500 pounds per minute until mains are full.

SHIP 724

- Latch respective (1 and/or 3 main) TANK PUMPS switches.
- Latch 1A/3A XFR switch(es).
- Fuel will transfer into the mains at the rate of 400-500 pounds per minute until mains are full.
- Due to aircraft attitude on the ground, the last 300 pounds of fuel in each alternate will not transfer (100 pounds in flight). Since alternate tank scavenge will not function on ship 724 on the ground, remaining fuel can only be removed by sump draining, or the max zero fuel weight reduced accordingly.

SECOND OFFICER'S CHECKLIST (Cont'd)

6. **GRAVITY TRANSFER SWS CK/UNL**
   - Latch the 1A & 3A GRAVITY TRANSFER switches.
     - Check XFR.
     - Blue disagreement lights illuminate then extinguish to indicate that valves have opened.
   - Unlatch the 1A & 3A GRAVITY TRANSFER switches.
     - Check **XFR** extinguishes.
     - Blue disagreement lights illuminate then extinguish indicating valves have closed.

7. **TANK PUMPS CHECK/LTS OUT**

8. **CROSSFEED VALVE FB 'S**

9. **ENG TANK VALVE FB 'S**

10. **EMERGENCY SHUTOFF LIGHTS OUT**

11. **FUEL TEMP SELECT, CHECK/TANK**

12. **FUEL JETTISON LTS OUT**

13. **FUEL CONTROL AMPLIFIER OVRDS LTS OUT**

14. **FUEL USED COUNTERS TEST/RESET**

ENGINE PANELS

1. **FILTER PRESSURE LIGHTS OUT**

2. **OIL PRESS/TEMP/QUANTITY**
   All oil tanks are to be filled to capacity and visually checked full by Maintenance prior to each international operation. Verify oil quantity indicators show approximately full (21 qts).

3. **VIB TEST/LCH A/NORM**

4. **N_2 RPM MAX POINTERS**

5. **REVERSER PRESSURE LIGHTS OUT**

MISCELLANEOUS

1. **CLOCK SET**

2. **APU PANEL NORMAL**

3. **FLIGHT RECDR SET/LCH/RECORD**

4. **WASTE WATER LIGHTS OUT**

5. **(-500) CARGO COMPARTMENT FIRE DETECTOR PANEL(S) CHECK**
   - Position DETECTOR Selector to BOTH.
   - Press TEST button:
     - Check A 1 2 and B 1 2.
     - Aural warning sounds; press TONE CUTOUT button to silence horn.
     - Check SMOKE on FWD CARGO compartment panel and Pilot's Annunciator Panel illuminate.
     - Check SQUIB MAIN ALTN.
   - While holding TEST button, press SHORT TEST button.
     - Check Squib **MAIN** and **ALTN** extinguish.
   - Release TEST and SHORT TEST buttons.
   - Check ALTN and MAIN switches guarded; **DISCH** extinguished.

6. **(-500) GALLEY DUCT OVERHEAT TEST**
   - Position selector to either A or B.
   - Press TEST button:
     - Check FWD, MID, and AFT.
     - Aural warning sounds; press TONE CUTOUT button to silence horn.
     - Check SMOKE on Pilot's Annunciator Panel.
   - Release TEST button and check all lights extinguish.

7. **HUMIDITY CONTROL ON ABOVE 50°F**

8. **PASSENGER OXYGEN PANEL**

9. **S/O ANNUNCIATOR LTS**

10. **AURAL WARN TEST**
    ON -500 AIRCRAFT:
    - ALTITUDE ALERT test position added.
    - AUTOPILOT DISC test position added.
    - GALLEY SMOKE panel deleted.

11. **SLAT MONITOR**

SECOND OFFICER'S CHECKLIST (Cont'd)

ENGINE BLEED CONTROL
(UNLESS PREVIOUSLY CHECKED)

1. AREA OVHT TEST
2. HI PRESS OFF
3. ENG ISLN VALVES LCH
4. ISLN VALVE/CROSSBLEED -FB- 'S
5. AUTO/MNL SWITCHES AUTO
6. ZONE TRIM LCH
   -500 galley zone trim not installed.
7. ZONE TEMP SET
8. GND CONT SET
9. PACK OPERATION CHECK/SET

ECS MONITOR PANEL

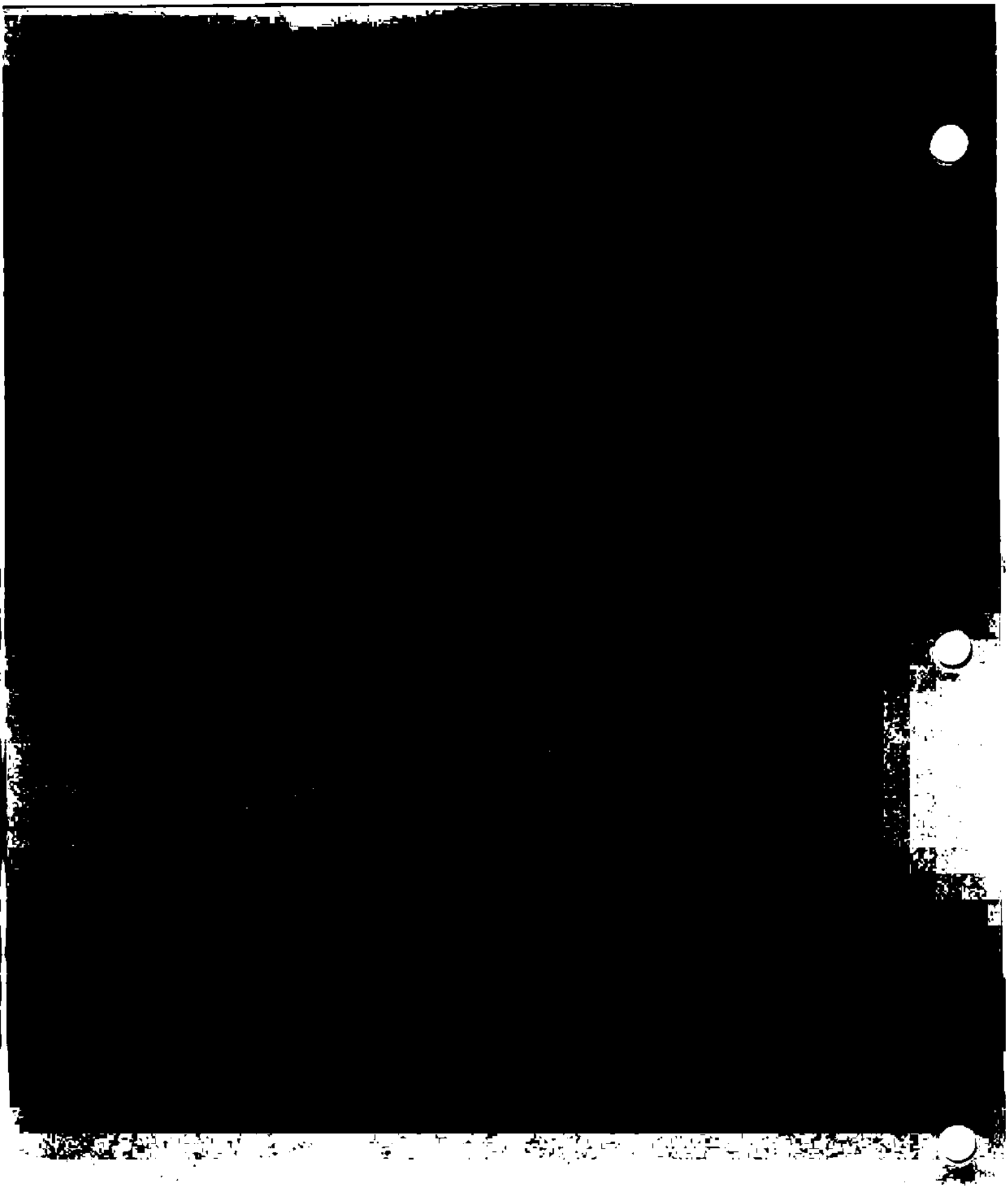
1. COOL AIR OVBD LCH
   COOL AIR OVBD switch also controls:
   - GALLEY CONTROL VALVE.
   - EXHAUST CONTROL VALVE.
2. AVIONICS AIR OVBD
3. INS COOLING SW
   - Check switch unlatched.
   - **ON** and **LO FLO** lights extinguished.

   SHIP 724:
   - INS cooling fan must be ON when INS ATT/NAV is used.
4. CARGO HEAT LCH
5. TEMP SELECT DUCT
6. TEMP SELECTOR ACM DISCH
7. PACK SELECT SET

CABIN PRESSURE CONTROL PANEL

1. MODE SEL NORM
2. NORM RATE SET
3. STBY RATE SET HOLD
4. MANUAL TEST/LIGHTS OUT
5. FAULT LIGHT OUT
6. ALT/BARO/CABIN SET
7. SAFETY VALVE LIGHTS OUT

(OPPOSITE SIDE BLANK)



PILOT'S CHECKLIST

BEFORE START

PRELIMINARY

1. AIRCRAFT STATUS _____
2. FUEL _____
3. OXY MASKS/REGULATORS/INT/AUDIO ....CK
4. RUDDER PEDAL STEERING ..... OFF
5. ADVISORY LIGHTS ..... CK
6. HSI HEADING SW (NOT 724) ..... MAG
   For all takeoffs and landings. Not installed on Ship 724.
7. MASTER RADIOS ..... ON

OVERHEAD PANEL

1. FIRE PULL HANDLES/DISCH LIGHTS ....CK
2. INS MODE SELECTORS

   INTERNATIONAL..... ALIGN
   - IF READY NAV light(s) illuminated, Mode Selector(s) may be positioned to NAV. However, Mode Selectors may be left in ALIGN until just before pushback to provide automatic overheat protection.
     - READY NAV extinguishes when Mode Selector is placed in NAV.
     - DSRTK/STS display will change to 1 55 when INS unit has switched to NAV mode.
   - Leave Mode Selector(s) in ALIGN if alignment is not complete.

   DOMESTIC ..... ATT
   - Use ATT mode only.
   - When operating in ATT, flight may depart as soon as ATT flags retract and **VERTICAL GYRO 3** light extinguishes.

3. COMPASS PANELS..... MAG
4. HF RADIOS..... OFF
5. ANTI-SKID ..... CK/OFF
6. (-500) ACS SWITCHES..... CK/LTS OUT
   - Check both ACS switches are latched.
   - Check **FIRST FAIL** and **2 FAIL** extinguished.

   NOTE: ***FAIL light(s) illuminate unless hydraulic systems are pressurized, and may also illuminate when electrical power is transferred (ground/APU/generators). When this occurs see Flight Controls Abnormal Procedures.***

BEFORE START (Cont'd)

7. **STALL WARNING**.....CK

-500:

- Unlatch both DLC/AUTO SPLR switches. Switches must be unlatched to test STALL WARN.
- Unlatch either STALL WARN switch; check OFF.
- Press TEST; appropriate stick shaker activates.
- Latch previous switch and unlatch other STALL WARN switch and repeat test.
- Latch both STALL WARN switches. Check **OFF** and **FAIL** extinguished. This completes test of stall warning system.

8. **FCES/PFCS PANELS**.....CK
   - ATS FAIL illuminates until inertial platform has erected.
   - ACS FIRST FAIL and YAW SAS FIRST FAIL lights are not valid until systems are fully powered.

9. **EXTERIOR LIGHTS**.....AS REQD

10. **MACH FEEL**.....ON

11. **RUD HYDRAULIC LIMITER**.....CK

12. **VOICE RECORDER**.....CK

13. **ENGINE START PANEL**.....CK

14. **INSTR STBY LTS**.....BRIGHT

15. **EMERGENCY LIGHTS**.....ARMED/LTS OUT

16. **STANDBY POWER**.....CK/LT OUT

17. **EVACUATION SIGNAL PANEL**.....CK

18. **PITOTS**.....CK/OFF

19. **TEMP PROBES/ALPHA HEAT**.....OFF

20. **WINDSHIELD HEAT**.....IDLE/ON

21. **WING/ENG ANTI-ICE**.....CK

22. **SEAT BELT/NO SMOKING**.....ON

BEFORE START (Cont'd)

GLARESHIELD

1. RADIO/NAV SWS (NOT 724) ..... RADIO
2. VHF NAV RADIOS ..... CK/MAN
3. DME'S ..... CK/STBY
4. AUTOFLIGHT PANEL ..... CK
5. ALTITUDE ALERT/SELECT ..... CK

CAPT - F/O INSTRUMENT PANELS

1. INSTR COMPARATOR, AFCS WARNING, & MODES ..... CK

   INSTRUMENT COMPARATOR:

   - ATT 3 (VERTICAL GYRO 3 ship 724) on Pilot's Annunciator Panel monitors INS NO. 3 gyro platform. Light will illuminate when both TEST 1 buttons are pressed at the same time. Light will also be illuminated unless INS NO. 3 is in NAV, ATT, or ALIGN modes with a PI of 8 or better.

2. ALTIMETERS/FLIGHT INSTRUMENTS ..... SET/CROSS CK

   - Verify signal source 1 in Capt's HSI and 2 in F/O's HSI.
   - Verify that MAG is annunciated in both HSI's and NAV flag out of view.

   SHIP 724:
   With RADIO/NAV switches in RADIO,
   - Check MAG annunciated in HSI.
   - Either ILS or VOR 1 or 2 annunciated in lower window.

3. MARKER BEACON LIGHTS ..... CK

4. INST SOURCE SELECT ..... CK

   NAV ALTN switch is installed on INST SOURCE SELECT panels.

   SHIP 724:
   NAV ALTN switch is installed on center console adjacent to respective RADIO/NAV switch.

5. GPWS ..... CK

   NOTE: Test switch for Ships 754-756 is located overhead, below the GPWS speaker. An inhibit switch is not installed. C/B IB1 and 2 must be pulled to deactivate the system.

BEFORE START (Cont'd)

CENTER INSTRUMENT PANEL

1. **STANDBY FLT INST.....CK**

2. **ENGINE INST.....CK**

3. **FLAPS/SLATS.....CK**

4. **GEAR.....DOWN/3 GREEN**

5. **BRAKE PRESS.....NORM**

CENTER CONSOLE

1. **INS UNITS.....CK**
   For International Operations, check the following.

   DATA SELECTORS.....POS
   Verify present position coordinates loaded in each INS are correct.

   IF FMS IS OPERATIVE:
   - The FMS automatically provides waypoint pairs to INS 1 & 2, and the FROM-TO display always remains 1-2. Waypoint positions 3 through 9 are not usable.
   - INS #3 continuously receives the current from - to waypoints from INS 1 & 2 and displays them in waypoint positions 1 & 2 respectively. Waypoint positions 3 through 9 can be loaded as necessary.
   - NAT waypoints, beginning with track entry, must be loaded into INS 3 using positions 3 through 9 to provide an immediate back-up should the FMS fail en-route.
   - Position #3 INS AUTO/MAN switch to MAN to inhibit automatic leg switching.
   - Proceed with Item 2, FMS, GRND SETUP.

   IF FMS INOPERATIVE OR NOT INSTALLED:

   INS WAYPOINTS.....LOAD
   - Position Data Selectors to WAY PT. Data displays may indicate 0's or previous flight waypoints.
   - Press **REMOTE** switch on each INS unit; check **REMOTE** .
   - Check **HOLD** extinguished.
   - Select 1 on WAY PT selector of INS unit being used to load waypoints.
     NOTE: Ensure that selector is in detent.
   - Check 1 appears in FROM-TO display.
   - Press keyboard switch to select appropriate parallel (2N or 8S). Enter latitude coordinates for waypoint.
   - Press **INSERT**; **INSERT** extinguishes indicating waypoint latitude has been loaded into the computer; check correct latitude indicated in left display on each CDU.
   - Press keyboard switch to select appropriate meridian (4W or 6E). Enter longitude coordinates for waypoint.
   - Press **INSERT**; **INSERT** extinguishes indicating waypoint longitude has been loaded into the computer; check correct longitude indicated in right display on each CDU.
   - Check all INS displays indicate correct waypoint coordinates.

   REMAINING WAYPOINTS.....LOAD
   Repeat waypoint loading procedure for remaining waypoints (2, 3, 4, etc.). If more than 9 waypoints are required, load remaining waypoints enroute.

   REMOTE.....PRESS ON EACH CDU
   Check **REMOTE** extinguished.

   DATA SELECTORS.....DSRTK/STS
   - INS MODE SELECTORS.....NAV

   When lowest practical PI's have been reached and READY NAV light(s) illuminated, switch to NAV mode.

BEFORE START (Cont'd)

2. FMS GRND SETUP .....CK

DOMESTIC:
C/B'S 1E8 & 1E26 .....OUT
FMS is not used for domestic operations.

INTERNATIONAL:
C/B'S 1E8 & 1E26.....IN
- NAV START page will appear when computer is ready to operate.
- ignore FMS STATUS lights while at the gate.

DATA BANK.....CK
Check RTE DATA number corresponds with identifier on PILOT'S DATA BANK book.
- Verify PILOT'S DATA BANK book is current.

— COMPLETE NAVIGATION FUNCTION: —

GMT .....INSERT
If indicated GMT is incorrect:
- Index GMT on ROUTE DATA page.
- Key-in correct GMT and INSERT .

NAV START .....INDEX/EXECUTE
- Index NAV START, then index EXECUTE.
- FLT PLAN BY page appears.

WAYPOINTS.....INSERT
- Index WPTS, then index EXECUTE.
- Index each waypoint in sequence beginning with aircraft present position as waypoint 000, and key-in the correct identifier from the PILOT'S DATA BANK book, and press INSERT .

NOTE: If the waypoint is not in the data bank the display will request the location of the waypoint by LAT and LONG or by bearing and distance from a reference waypoint.

It is recommended to:
- Load flight plan waypoint up to and including the first waypoint in the track, plus destination, while on the ground.
- Load additional waypoints enroute. Load track waypoints as 50W, 40W, etc.

FMS POSITION FIX.....INSERT/EXECUTE
Press NAV and page FWD to NAV SELECT 2.
- Index FIX, and FIX POS BY page appears.
- Index LAT.
- Key-in and INSERT latitude then longitude for aircraft ramp position.
- Index EXECUTE when coordinates are correct.

FLIGHT PLAN WINDS.....INSERT
Press NAV and page FWD to NAV SELECT 2.
- Index WIND INPUT, and the WPT WDIR WSPD page appears.
- Position HSI HEADING switch to TRUE to load flight plan winds referenced to true north.
- Index reference waypoint for wind to be loaded.
- WDIR? appears on scratchpad line.
- Key-in wind direction in degrees to the nearest tenth of a minute (i.e. 270° is keyed-in as 270° 00.0'), and INSERT .
- Scratchpad line changes to WSPD?. Wind direction disappears from CDU until windspeed has been inserted.
- Key-in windspeed in kts, and INSERT .
- Check that proper wind direction and speed appears at reference waypoint.
- Repeat procedure for available flight plan winds.
- When wind set-up is complete select MAG on HSI Heading switch.

FLIGHT PLAN TAS .....INSERT
Index TAS; key-in flight plan average TAS in kts and INSERT .

— COMPLETE PERFORMANCE MANAGEMENT FUNCTION: —

FMS PROGRAM.....VERIFY
Press PERF MGT; check SETUP: page appears. Verify program is applicable for -500 or -100 , as appropriate.

DELTA PERFORMANCE STANDARD...INDEX
Index DELTA PERF STD.

NOTE: This action removes gross weight and fuel quantity from previous flight and selects standard min. cost for climb, cruise and descent.

GROSS WEIGHT .....INSERT
Index GWT LBS; key-in expected takeoff GWT, then INSERT .

FUEL WEIGHT .....INSERT
Index FUEL LBS; key-in fuel load, then INSERT .

BEFORE START (Cont'd)

TEMPERATURE AT ALTITUDE.....INSERT
- Index A/SAT, and FL will appear on scratchpad line.
- Key-in cruise flight level and INSERT (altitudes are keyed-in by Flight Level; however, after they are inserted, altitudes appear in thousands of feet). Cruise flight level will appear on A/SAT line, and SAT will appear on scratchpad line.
- Enter flight plan SAT by first pressing the 5 key to show M for a minus temperature; then key-in temperature. If no temperature is entered, the FMS will assume standard temperature.

CRUISE ALT .....INSERT
Index CRZ ALT; key-in initial cruise three digit Flight Level, and INSERT . This step is necessary to set cruise mode of the FMS.

CLIMB-CRUISE SET-UP .....COMPLETE
Press FWD, CLB-CRZ SET-UP page appears.
- Check CLIMB MIN COST and CRZ MIN COST displayed. If another option is required, index appropriate item and select desired option.
- RSRV LBS. 20,000 appears automatically. This value does not affect FMS operation at this time.

REFUEL POINT.....INSERT
- Index REFUEL AT and REFUEL AT page appears.
- Index desired refuel point (Eastbound FOR; Westbound US).
- Display returns to CLB-CRZ SET-UP page with REFUEL AT line showing the selected option.

END OF DESCENT (E★D) DATA...INSERT
Page FWD to DCNT-E★D SET-UP page.
- Index E★D AT, and END OF DESCENT page appears.
  - Index REF WPT and E★D REF WPT page appears.
  - Index waypoint to be used to determine E★D.
  - Display returns to END OF DESCENT page and selected waypoint appears on REF WPT line.
  - Index NMI BFR (distance before) or NMI AFT (distance after) to locate E★D from reference waypoint. Key-in mileage from reference waypoint, then INSERT . DCNT - E★D SET-UP page appears.
- Index E★D ALT; key-in altitude desired at E★D point, then INSERT .
- Index E★D IAS; key-in desired airspeed at E★D point, then INSERT .

NOTE: Option of "300 BLO FL 100?" speed is provided for international operations. When indexed, speed below 10,000' shown on the top line will change from 250K to 300K.

— COMPLETE PERFORMANCE DATA: —

PERF DATA.....PRESS
- Index RATED EPR; TAKEOFF page appears.
- Index RWY TEMP; key-in runway temperature in degrees centigrade (C°) beginning with P for plus or M for minus; then INSERT, and EPR rating will appear.

MAINT. LOG.....CHECK
Press PERF DATA:
- Index MAINTENANCE, and MAINTENANCE page appears.
- Index CLEAR AUTOLOG; index EXECUTE?.

LOADED WAYPOINTS .....CK
- Select NAV function.
- Index WPT LIST, and WPT ETE DIS page appears.
- Index 000, and check correct latitude and longitude for departure airport. Verify distance on B/D (bearing/distance) line.
- Check each waypoint in sequence; page FWD as necessary.
- Note that T★D and E★D waypoints are displayed.

This Completes FMS Ground Set-UP

BEFORE START (Cont'd)

3. (724) RADIO/NAV SWITCHES..... RADIO

4. (724) INS COMPARATOR LIGHTS ... LTS OUT
   Indications are invalid unless 3 INS units installed and operating in NAV.

5. PITCH/ROLL DISCONNECT HANDLES ... CK

6. STABILIZER TRIM ..... ZERO

7. SPEED BRAKE LEVER ..... FWD/LTS OUT

8. THROTTLES..... IDLE

9. FUEL AND IGNITION ..... OFF

10. COMM RADIOS..... CK

11. RADAR..... STBY

12. MKR BCN ..... LO

13. TRANSPONDER ..... STBY

14. AILERON & RUDDER TRIM..... ZERO

15. S/O PANEL PREPARATION COMPLETE

16. CABIN INTERIOR INSP..... COMPLETE

BEFORE PUSHBACK:

INS MODE SELECTORS

INT'L ..... NAV
DOMESTIC..... ATT

- ***Do not move aircraft until all three INS selectors are in NAV.***

NOTE: If aircraft is moved while the Mode Selectors are in ALIGN, entire alignment process will have to be repeated. Down-mode to OFF, then back to ALIGN. Re-insert present position and verify correct. Re-load waypoints as necessary.

- READY NAV lights extinguished.
- First digit of System Status Display indicates 1, last two digits 55 for FMS/INS operation.
- Ship 724 should have INS 1 & 2 operating in triple mix. To enter triple mix, PRESS the 4 key and INSERT. The last digit of System Status Display will change to a 4, indicating that set is in triple mix operation.
- Position one INS Data Selector to TK/GS for taxi.
- **For domestic operation** remain in ATT.

DOOR LIGHTS OUT

IF NO. 2 ENGINE NOT OPERATING

B AC PUMP ON

INITIAL ENGINE START (Cont'd)

PREFERRED ENGINE START SEQUENCE IS 2-1-3. DELAYED STARTS SHOULD BE ON ENGINES 1 AND/OR 3.

Engine operating limits are contained in LIMITATIONS section Blue pages.

1. **FUEL PANEL SET**
2. **APU COMPRESSOR; SELECT MIN**
3. **PACKS NO. 1 & 3 OFF; NO. 2 ON**
4. **PARK BRAKES.....AS REQD**
5. **ANTI-COLL.....ON**
6. **START IGNITION.....AS REQD**

NOTE: Due to weight, it is not recommended that taxi be attempted on only one engine for any international departure.

AFTER INITIAL START

Perform After Initial Start check list after **operating** engines are at stabilized ground idle.

1. **ENG INST.....CK**
2. **ENG ANTI-ICE.....AS REQD**
3. **SHOULDER HARNESS.....ON**
4. **HYDRAULIC PANEL/POWER**
5. **GALLEY POWER ON**
6. **ELECTRICAL PANEL/POWER**
7. **DISCONNECT EXT PWR/AIR**
8. **FUEL TANK PUMPS ALL FB 'S**
9. **1A + 3A TRANSFER SWS LCH**
   (724) 1A + 3A TRANSFER SWS AS REQD

   Normal position of 1A/3A XFR switches is latched throughout flight. This position provides both fuel transfer and scavenging for the alternate tanks.
   - Main tank scavenging remains operative.
   - If main tanks 1 and 3 are full, the disagreement and **OPEN** lights remain extinguished (indicates transfer valves are closed) until fuel quantity in the mains is reduced.
   - Scavenging in tanks 1A & 3A continues after tanks 1A & 3A are empty.
   - If 1A/3A are empty, periodically check fuel remains at 100 lbs. or less in each tank.

   SHIP 724:

   If tanks 1A/3A contain fuel, latch the 1A/3A XFR switches for normal fuel transfer.
   - If main tanks 1 and 3 are full, the disagreement and **XFR** lights remain extinguished (indicates transfer valves are closed) until fuel quantity in the mains is reduced.
   - When XFR valves are OPEN main tank scavenging is deactivated.
   - Alternate tank scavenging will begin at lift-off.
   - In flight, when 1A/3A QUANTITY LOW lights are illuminated and tanks are empty, unlatch 1A/3A XFR switches.

   If tanks 1A/3A are empty, verify 1A/3A XFR switches are unlatched.
   - Periodically check 1A/3A fuel remains at 100 lbs. or less in each tank.
10. **FUEL CROSSFEEDS AS REQD**
11. **S/O ENGINE INSTRUMENTS**
12. **APU AS REQD**
13. **AURAL WARN - UNSAFE T.O.**
14. **S/O ANNUNCIATORS**
15. **PRESSURIZATION SET**
16. **ENGINE BLEED'S AS REQD**
17. **PACKS FB 'S**

IF NO. 2 ENGINE NOT OPERATING DURING TAXI

B AND C AC PUMPS ON

CHECK ATM'S AUTO

TAXI

1. **ATM'S CHECKED/AUTO**
2. **GROSS WT. IND UPDATE/FMS UPDATE**
3. **CROSSBLEED FEB 'S**
4. **COCKPIT DOOR LOCKED**
5. **TAKEOFF DATA CONFIRMED RUNWAY _____**

-100 AIRCRAFT:
- Refer to ARM series 555-14 for -100 restrictions.
- Refer to the L-1011-100 Operational Data Manual (ODM) to determine V speeds.
- Determine Takeoff EPR from the pink power chart. The TAT EPR computer may be used for TO1, TO2, or GA determination.
- When Flaps 10 and 14 IMPROVED PERFORMANCE or Flaps 4 CLEARWAY performance is necessary, use the salmon colored pages in the ODM or ARM to determine V speeds.

-200 AIRCRAFT:
- Refer to ARM series 555-10 for -200 restrictions.
- Refer to the L1011-200 (ODM) to determine V speeds.
- Determine Takeoff EPR from the yellow power chart. ***Do not use TAT EPR indicator for TO1, TO2, or GA determination.***
- When Flaps 14 CLEARWAY performance is necessary, use the salmon colored pages in the ODM or ARM to determine V speeds.
-

-500 AIRCRAFT:
- Refer to ARM series 555-9 for L-1011-500 restrictions.
- For international operations, refer to -500 ODM for V speeds and -500 Tabletop chart for thrust and stabilizer settings. When Flaps 14 CLEARWAY performance is necessary, use the salmon colored pages in the ODM or ARM to determine the V speeds.
- For domestic operations use the blue L-1011-500 Takeoff Data Domestic Opn power chart.

6. **(-500) MDLC ..... CK**
Test Maneuvering DLC G-Sensitive Stick Shaker as follows:
- Flaps must be ***up*** and all hydraulic systems ***pressurized***.
- Latch either DLC/AUTO SPLR switch. Other switch must be unlatched.
- Press STALL WARN TEST, stick shaker activates. After approximately a two second delay, Speedbrake Lever drives to the upper DLC RANGE limit.
- Release Test button, stick shaker stops and Speedbrake Lever stows after an approximate seven second delay.
- Unlatch DLC/AUTO SPLR switch. Latch other switch and repeat test.
- Latch both DLC/AUTO SPLR switches. Check **OFF** and **FAIL** extinguished. This completes test of MDLC system.

7. **PITOT/ALPHA HEAT ..... ON**
8. **WINDSHIELD HEAT ..... ON**
9. **AUTO FLT/NAV RADIO PANEL ..... CK**
In addition to standard procedures check **RADIO/NAV** switches are in **RADIO**.
10. **ALTIMETERS/FLIGHT/NAV INSTRUMENTS ..... SET/CROSS CK**
11. **AIRSPEED/EPR BUGS ..... SET/CK**
12. **FLAPS/SLATS _____-_____/GREEN LT..._____**

-100 AIRCRAFT:
- For international operations, Flaps 10 Packs ON or OFF is primary. Flaps 14 Packs OFF will be the alternate. If additional takeoff capability is needed, then Packs OFF and Flaps 10 or 14 IMPROVED PERFORMANCE or Flaps 4 CLEARWAY will be utilized. These options will be controlled by airport and runway by AWABS and the ARM.
- For domestic operations use Flaps 10. In LGA only, Flaps 18 may be required.

-200/-500 AIRCRAFT:
- For international operations, Flaps 18 Packs ON or OFF is primary. Flaps 22 Packs OFF will be the alternate. If additional takeoff capability is needed, then Packs OFF and Flaps 14 and Flaps 14 CLEARWAY will be utilized. These options will be controlled by airport and runway by AWABS and the ARM.
- For domestic operations use Flaps 10. In LGA only, Flaps 18 may be required.

13. **SLAT MONITOR 14. GREEN**
14. **STABILIZER TRIM _____°..... _____**
15. **FLIGHT CONTROLS/SPLRS ..... CK**

TAXI (CONT'D)

15. FLIGHT CONTROLS/SPLRS.....CK

-500 AIRCRAFT

Flight controls check is identical to -1. However note that deflection of spoilers 1, 2, and 3 is limited while flaps are retracted. Therefore, if flaps are retracted during the flight controls check, spoiler panel R2 index on the SPI will only move to just above the DLC range.

On the ground, with ACS engaged and the control wheel neutral, the outboard ailerons will be up 8° more than the inboard ailerons (flaps extended or retracted). During the roll control checks the outboard ailerons will indicate 20° up, but only 12° down.

NOTE: In flight, with flaps extended, the outboard ailerons will be up 8° more than the inboard ailerons. In flight, with flaps retracted, the outboard ailerons will be down 2° less than the inboard ailerons.

DELAYED ENGINE START

1. PACKS AS REQD
2. START ENGINE(S)

AFTER DELAYED START

1. ENGINE INSTRUMENTS.....CK
2. ENGINE ANTI-ICE.....AS REQD
3. HYDRAULIC PANEL
4. ELECTRICAL PANEL
5. FUEL CROSSFEEDS UNL
6. S/O ENGINE INSTRUMENTS
7. APU STOP
8. ENGINE BLEED FEB'S
9. PACKS FEB'S

BEFORE TAKEOFF

1. TAKEOFF BRIEFING ..... COMPLETED
   See Supplemental Information Section, Standard Policies for suggested content.
2. FLIGHT ATTENDANTS NOTIFIED/ACKNOW
3. START IGNITION ..... BOTH
4. CONTINUOUS IGNITION ..... AS REQD
5. ANTI-SKID ..... sONs
6. DME'S ..... NORM
7. PILOT'S ANNUNCIATOR PANEL ..... CK

—AFTER TAKING ACTIVE RUNWAY—

8. TRANSPONDER (1 OR 2) ..... NORM
9. STROBE LTS ..... ON
10. TEMP PROBES ..... ON
11. LANDING LIGHTS ..... AS REQD
12. RUDDER PEDAL STEERING ..... ON
13. PACKS AS REQD
    - AWABS or Weight Data Record will note whether takeoff data is based on packs ON or OFF.

AFTER TAKEOFF CLIMB

1. **(724) EPR MODE SET**
   -200 CONFIGURATION:
   - Above 430,000 lbs takeoff wt., use CL 1.
   - At or below 430,000 lbs takeoff wt., use CRZ.
   - At or below 410,000 lbs takeoff wt., use CL 2.

   NOTE: When using CL or CRZ modes above 25,000 ft. crosscheck with appropriate power chart. If values differ, the chart values or ODM must be used.

   -500 and SHIPS 738 thru 741:
   When operative the FMS automatically programs correct EPR depending upon weight based on the FMS climb option selected by the crew. If FMS is inoperative on -500 aircraft, refer to ODM. If FMS is inoperative on ships 738 - 741, use the EPR computer or refer to the ODM.
2. **PACKS (400 FT. MIN) ON**
3. **AIR CONDITIONING/PRESSURIZATION**
4. **HUMIDITY CONTROL OFF AT 5,000 FT.**
5. **FUEL PANEL SET**
   - When fuel is contained in tanks 1A 3A, begin crossfeed before 14,000 lbs. has been used. Crossfeed all engines from tanks 1 and 3 until tanks 1A/3A are empty and quantities in tanks 1, 2 and 3 are equal.
   - Tanks 1, 2 and 3 must be equal by the time total fuel is reduced to 58,000 lbs.

   -500 and SHIPS 738 thru 741:
   - **1A/3A XFR switches should remain latched, and at least one TANK PUMP switch latched in Tanks 1 and 3 throughout the flight.**
   - With fuel contained in tanks 1A and 3A, the 1A/3A XFR **OPEN** lights will cycle on and off to automatically maintain fuel in tanks 1 and 3 at the desired level.
   - If it is necessary to reduce tank pump pressure in tanks 1 or 3 for inflight fuel balancing, leave one tank pump operating in each of these tanks.
     - If both TANK PUMPS switches in either tank are unlatched for any reason, unlatch the respective XFR switch.
   - When all fuel has been consumed in the alternate tanks, **leave the 1A/3A XFR switches latched to provide continuous scavenging.**
     - Periodically check 1A/3A fuel quantity to assure quantity remains at 100 lbs. or less.

     NOTE: Once fuel quantity in each main plus alternate has been reduced to below 40,000 lbs., the ALT FUEL MONITOR light on the Pilot's Annunciator Panel will illuminate if either alternate tank exceeds 1,000 lbs. Also, the FAULT light on the S/O's panel will illuminate until 1A/3A QTY is pressed or the MONITOR switch is unlatched.

   SHIP 724
   - With fuel contained in tanks 1A and 3A, and the 1A/3A XFR switches latched, the 1A/3A **XFR** lights will cycle on and off to automatically maintain fuel in tanks 1 and 3 at the desired level.
   - When 1A/3A **LOW** lights illuminate, verify quantity remaining about 100 pounds each; then unlatch 1A/3A XFR switches.
     - Periodically check 1A/3A fuel quantity to assure quantity remains at 100 lbs. or less.

     NOTE: Once fuel quantity in each main plus alternate has been reduced to below 32,000 lbs., the ALT FUEL MONITOR light on the Pilot's Annunciator Panel will illuminate if either alternate tank exceeds 1,000 lbs. Also, the FAULT light on the S/O's panel will illuminate until 1A/3A QTY is pressed or the MONITOR switch is unlatched.

   NOTE: The following items are checked visually and silently by the S/O using the checklist. Call out any items not completed.
6. **GEAR ..... UP/NEUTRAL**
7. **FLAPS/SLATS ..... UP/LTS OUT**
   - Retract flaps to 10° at V2 +10 minimum and 400' or obstacle clearance. Then follow normal noise abatement procedures and retract remaining flaps on schedule (V_2 +20 for 4°, V_2 + 60 for 0°).
8. **CONTINUOUS IGNITION ..... AS REQD**
9. **SEAT BELTS/NO SMOKING .... AS REQD**
10. **VHF NAV RADIOS ..... AS REQD**
11. **RAPID/NAV SWS ..... AS REQD**
12. **ALTIMETERS (above transition) . SET 29.92**
13. **LANDING LIGHTS ..... AS REQD**

VERIFY INS NAV ACCURACY

- Before leaving land internationally determine navigational accuracy by checking FMS FIX POS BY page and comparing distances shown on DME/DME (or VOR/DME) and INS line. FIX if required. If FMS is inoperative, determine INS accuracy from ground fix if practicable and crosscheck each INS.

SHIP 724:

- Before leaving land internationally determine INS accuracy from ground fix if practicable corsscheck each INS.

DESCENT

NOTE: On International flights NOTIFY Flight Attendants when 1 hour from landing.

PRESSURIZATION

ELECTRICAL PANEL

FUEL PANEL
- Verify fuel remaining in tanks 1A and 3A has been reduced to 100 lbs or below.
- Verify proper fuel distribution.

PILOT'S ANNUNCIATOR PANEL . . . RECALL

SHOULDER HARNESS . . . . . ON

LANDING LTS . . . . . AS REQD

FLIGHT ATTENDANTS NOTIFIED

COMPUTE LANDING DATA

SHIP 724:
TAT/EPR computer cannot be used for go-around EPR.

TRANSITION ALTITUDE (DESCENDING)

ALTIMETERS SET _____ . . . . . _____
- Below transition level (FL 180 domestic) reset and crosscheck all altimeters to destination altimeter setting.
- S/O states destination altimeter setting when available.
- Capt. and F/O reset and state altimeter setting.

APPROACH

1. **HYDRAULIC PANEL**
2. **CROSSBLEED** -FB- **'s**
3. **HUMIDITY CONTROL (5000 FT)**
4. **CONTINUOUS IGNITION . . . . . ON**
5. **SEAT BELTS . . . . . ON**
6. **APPROACH BRIEFING . . . . . COMPLETED**
   See Supplemental Information Section, Standard Policies for suggested content of briefing.
7. **HSI READING SW . . . . . MAG**
8. **RADIO/NAV SWS . . . . . RADIO**
   Check Capt.'s and F/O's switches are in RADIO
9. **AUTO FLIGHT PANELS . . . . . CK**
10. **VHF NAV RADIOS . . . . . CK/MNL**
11. **ALTIMETER/FLIGHT/ NAV INSTRUMENTS . . . . . SET/CROSS-CK**
12. **RADIO/BARO ALTIMETER BUGS . ___/___**
    Check MAG & VOR or ILS annunciated in HSI's.
13. **AIRSPEED/EPR BUGS . . . . . CK**
14. **INS DATA SELECTORS . . . . . CK**
    Set INS 1 & 2 to WIND; INS 3 to desired setting.
15. **SPEED BRAKE LEVER . . . . . FWD/LTS OUT**

At Least 5 Minutes Before Landing:
FLIGHT ATTENDANTS NOTIFIED

NO SMOKING . . . . . ON

BEFORE LANDING
(Gear Handle Down)

HYDRAULIC PANEL

GEAR . . . . . DOWN/3 GREEN

FLAPS/SLATS ___-___°/GREEN LT . . ___

SLAT MONITOR 14 GREEN

DLC/ALPHA . . . . . CK

LOWER GALLEY CLEAR (NOT -500)

MAKE STANDARD CALLOUTS

AFTER LANDING
(CLEAR OF RUNWAY)

1. RUDDER PEDAL STEERING ..... OFF

NOTE: The following items are checked visually and silently by the S/O using the checklist. Call out any items not completed.

2. HF RADIOS ..... OFF
3. ANTI-SKID ..... OFF
4. CONTINUOUS IGNITION ..... OFF
5. AIR DATA SENSOR HEAT ..... OFF
6. WINDSHIELD HEAT ..... IDLE /OFF
7. ANTI-ICE ..... OFF
8. STROBE & LANDING LIGHTS ..... OFF
9. FD/AUTOPILOTS/DME'S ..... OFF/STBY
10. FLAPS/SLATS ..... UP/LTS OUT
11. SPEED BRAKE LEVER ..... FWD/LTS OUT
12. STABILIZER TRIM ..... ZERO
13. RADAR/TRANSPONDER ..... STBY
14. ENGINE NO. 3 AND/OR 1 ..... SHUTDOWN
    If engine No. 2 shutdown:
    B & C AC PUMPS ON .
15. GALLEY POWER OFF
16. FUEL PANEL
    • Unlatch 1A + 3A XFR switches.
17. APU START

SHUTDOWN

1. SEAT BELTS ..... OFF

—— AFTER POWER AND AIR ESTABLISHED ——

2. FUEL AND IGNITION ..... OFF
3. PARK BRAKES (WHEELS CHOCKED AND ALL ENGINES SHUTDOWN) ..... RELEASE
4. ANTI-COLL LIGHTS ..... OFF
5. EXTERIOR LIGHTS ..... CK
6. STANDBY POWER ..... OFF
7. INS ..... OFF
8. ATM'S OFF
9. AC HYDRAULIC PUMPS UNL
10. ELECTRICAL PANEL
11. FUEL TANK PUMPS UNL
12. 1A + 3A XFR UNL
    Leave 1A + 3A XFR switches unlatched to prevent main tank fuel from seeping into the alternate.
13. FLT RCDR UNL
14. AIR CONDITIONING
15. CODED C/B'S

—— AT AIRCRAFT TERMINATION ONLY ——
(AFTER ALL PASSENGERS DEPLANED)

16. EMERGENCY LIGHTING ..... OFF
17. MASTER RADIOS ..... OFF
18. RADAR ..... OFF
19. BATTERY ..... OFF
20. APU/EXTERNAL POWER

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DESCENT TO BOD 30
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a

ONS GROUND SET-UP

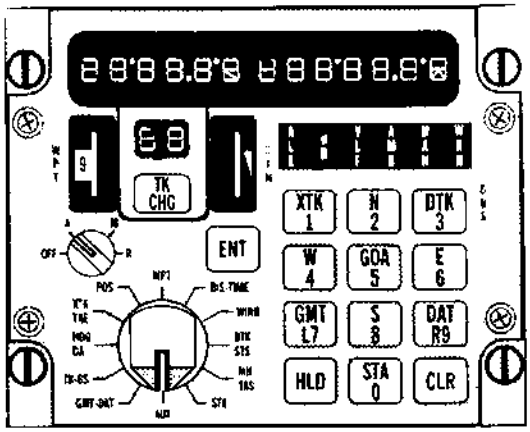
DISPLAY TEST

- Place mode switch from **OFF** to **A**. When activated, the system automatically initiates a self-test sequence for 5 seconds followed by an automatic synchronization with OMEGA transmissions.
- The display test verifies that the CDU displays, the computer controlled push buttons and the annunciators are operating correctly.

DISPLAY SWITCH ..... **AUX**

WPT SWITCH **9**

- Observe "8's" in both displays (all segments illuminated).
- Check for illumination of the following:
  - **FROM/TO** display.
  - All annunciators.
  - TK CHG, ENT, HLD, CLR push buttons.

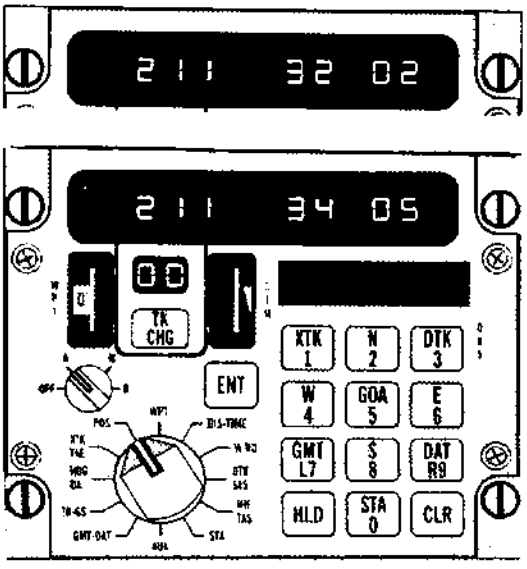


ONS PROGRAM VERIFICATION

To Verify that the OMEGA Receiver Processor Unit Software is the Correct Program:

DISPLAY SWITCH ..... **POS**

- Verify Display indicates 211–32–02 for single ONS or 211–34–05 dual ONS.



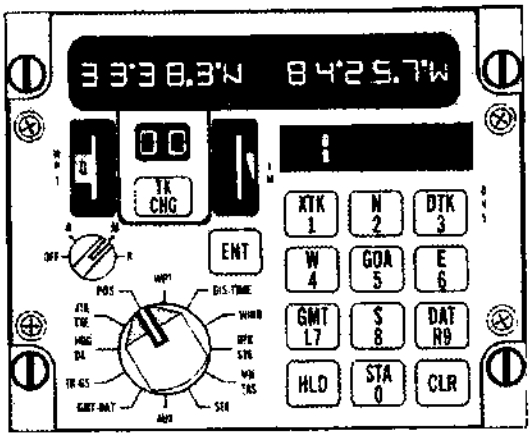
PRESENT POSITION ENTRY

- Aircraft present position must be entered before ONS navigation can be effected. In the following example, aircraft present position is N33.38.3, W84.25.7.

To Enter Present Position:

DISPLAY SWITCH . . . . . **POS**

- Use keyboard to enter latitude starting with N2 (for north). Numbers will move from right to left on display. If a key is pushed in error, push **CLR** key to remove last entry. When latitude is verified, press **ENT**.
- **ENT** light remains **ON**, as computer awaits longitude entry.
- Use keyboard to enter longitude starting with W4 (for west). Numbers will move from right to left on display. When longitude is verified, press **ENT**.
- **ENT** light still remains **ON** as computer now awaits entry of TIME and DATE. **DR** light illuminates as system has now started the synchronization.



NOTE: If OE or flashing characters appear in the data display following an entry procedure, an operational error has been made. Press the CLR push button and re-enter the data.

CAUTION

CHECK ENTRY. IF INCORRECT, ONS SHOULD BE TURNED OFF AND BACK ON TO A OR M TO REENTER PRESENT POSITION.

TIME & DATE ENTRY

- UTC (Coordinated Universal Time) time and date must be entered into the computer before propagation values can be calculated.

DISPLAY SWITCH . . . . . **GMT/DAT**

GMT/L7 . . . . . **PRESS**

- Use keyboard to enter UTC (2341).

After Verifying Time:

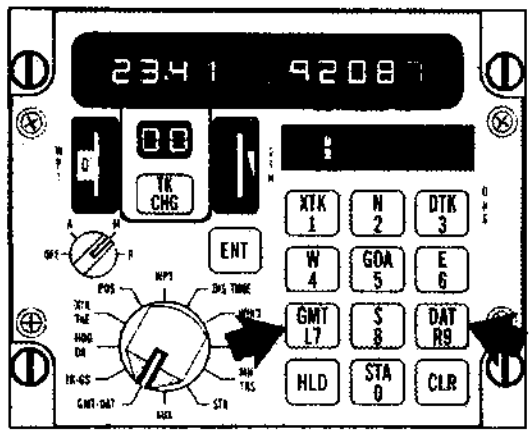
ENT . . . . . **PRESS**

CAUTION:

A 12 HR. MISTAKE IN TIME WILL PRODUCE INACCURATE NAVIGATION.

DAT/R9 . . . . . **PRESS**

- Enter month, day and year.
- The day must be a two digit number such that September 20, 1987 would be entered as 9-20-87.
  - Date must be entered as UTC date for accurate navigation.



After Verifying Date:

ENT . . . . . **PRESS**

- **ENT** light extinguishes, **DR** light remains illuminated.

FLIGHT DIRECTOR INTERFACE TEST

- This test is optional. May be performed time permitting.
- Certain ONS test data can be made available to the Flight Director computer, HSI and Autopilots for interface verification.
- Omega must be initialized (present position loaded).

To Perform the Test When the Aircraft Is On the Ground :

Select a VOR frequency on both NAV 1 and NAV 2. (With an ILS frequency selected, a Flight Director Interface test is not possible.)

FLIGHT DIRECTOR . . . . . **ON**
AUTOPILOT NAV SOURCE SELECTOR . **ONS**
RADIO/NAV SWITCH . . . . . **NAV**
ONS/FMS SWITCH . . . . . **ONS**

- Certain ONS test data is available to the Flight Director Computer, HSI, and Autopilots for interface verification.

DISPLAY SWITCH . . . . . **AUX**
WPT SWITCH **9**

- Observe "8" numbers in all segments of both displays.
- Check for illumination of the following:
  - FROM/TO Display.
  - All Annunciators.
  - TK CHG, ENT, HLD, & CLR Keys.

MODE SWITCH . . . . . **A, M, R**

- Select **A**, then **M**, then **R** and observe the following:
  - In the **A** position, HSI will display the course needle 30° left of the nose. The Flight Director roll bar will displace to the left.
  - In the **M** position, the course needle and Flight Director bars will center.
  - In the **R** position, the HSI and Flight Director displays are the opposite of **A**.

a

LOADING WAYPOINTS

- Coordinates for up to nine waypoints may be entered into the system. These waypoints may be entered during initialization while the aircraft is on the ground or after takeoff. Once entered, waypoints are automatically cleared when the mode switch is set to **OFF**. The initial enroute waypoint coordinates are entered into waypoint 1. Additional waypoints are then entered sequentially. Enter waypoint coordinates as follows:

DISPLAY SWITCH . . . . . **WPT**

WPT SWITCH 1

- **FROM/TO** display indicates which waypoint is selected and lat/long display is all zeros.

ENTER LATITUDE AND LONGITUDE . . . . . **OF THE #1 WAYPOINT**

ENT . . . . . **PRESS**

NOTE: Waypoint 1 should be the first en route waypoint.

NOTE: Waypoint "O" is an automatic function that shows aircraft present position. It is reserved for establishing a track from the present position to a down-stream waypoint and cannot be used to enter a waypoint.

When Display Changes:

VERIFY . . . . . **INITIAL ENROUTE LATITUDE AND LONGITUDE**

WPT SWITCH . . . . . **CHECK REMAINING WAYPOINTS**

- Verify correct latitude and longitude.

If Waypoint Entry Must Be Corrected or Existing Entry Changed:

WPT SWITCH . . . . . **APPROPRIATE WAYPOINT**

- Perform entry procedure.

a

DUAL ONS WAYPOINT CROSSFILL

- The dual ONS program allows WAYPOINT CROSSFILL. This facilitates the loading of waypoints from one ONS to the other, starting with waypoint 1 and incrementing sequentially.

To Perform Waypoint Crossfill:

OMEGA SET UP . . . . . .
. . . . . **PERFORM THE FOLLOWING**

- Display test, Flight Director interface test, present position entry and time and date entry on both ONS units.

On ONS to be Crossfilled:

MODE SWITCH . . . . . **R**

DISPLAY SWITCH . . . . . **WPT**

TK CHG, XTK 1, XTK 1 AND ENT . . . . . .
. . . . . **PRESS**

- The **FROM/TO** display will start flashing.
- This will start the crossfill process.

After Approximately 10 seconds:

- Verify crossfill by sequencing the WPT switch through all positions.

MODE SWITCH . . . . . **A OR M**

- Verify that the **FROM/TO** display stops flashing.

INITIAL TRACK SELECTION . . **ACCOMPLISH**

- This will verify crossfill process was accomplished.
- See this section for Initial Track Selection procedure

STATUS CHECK

- The status of system operation is shown as a two digit code which starts at 90 when system is turned on to an operational mode of 01.

To Display System Status:

DISPLAY SWITCH . . . . . **DTK STS**

- The DR annunciator will illuminate during initial status count from 80 to 03.
- For status 01 to be displayed, all three frequencies of the three respective Omega stations must be satisfactory in SNR (Signal Noise Ratio), range and geometry.

NOTE: The DR annunciators will not illuminate at power transfer if the aircraft is on the ground and NAV status is attained within 3 miutes after power transfer. If system only reaches status 60 the problem may be associated with interference at the gate.

STATUS CODE	SYSTEM STATUS
90	Self-test
80	Not up to temperature
60	Synchronization
30	Station Selection
05*	RHO-RHO Mode
04	Grid Navigation Mode
03	Dead Reckoning
02	VLF Mode Status
01	OMEGA NAV Mode

*Not normally associated with alignment sequence.

INITIAL TRACK SELECTION

- The initial track is the direct great circle route between the aircraft's present position at the time the initial track is selected and the initial enroute waypoint.
- The pilot must select and initiate the initial track. It is recommended to do this prior to departure. If the next sequential waypoint has not been entered, the system will fly the aircraft past waypoint 1 on a track hold path and 9 9 will show in the **FROM/TO** display.
- This initial track procedure also functions as the pre-departure accuracy check.

NOTE: Cross track distance and track angle error (XTK, TKE), distance and time to next waypoint (DIS/TIME) and desired track angle (DTK) data are not available until a track leg is initiated. Also, flags controlled by ONS on aircraft instruments for autopilot and HSI will not be valid until an initial track is established.

PRE-DEPARTURE ACCURACY CHECK

A/M/R SWITCH ..... **A**

TK CHG KEY ..... **PRESS**

0 KEY ..... **PRESS**

1 KEY ..... **PRESS**
- Verify that waypoint display shows 0-1.

ENT KEY ..... **PRESS**

DISPLAY SELECTOR SWITCH .... **DIS/TIME**
- Compare ONS DIS with Flight Plan total distance.

A/M/R SWITCH (For Remote Ranging) ..... **R**

TK CHG KEY ..... **PRESS**

0 KEY ..... **PRESS**

NUMBER OF DESTINATION
WPT KEY (Usually 9) ..... **PRESS**
- Verify the waypoint display shows 0-9.

ENT KEY ..... **PRESS**
- Verify that DIS to the first waypoint is reasonable.

DISPLAY SELECTOR SWITCH .... **DTK/STS**
- Verify that track to waypoint 1 is reasonable.

A/M/R SWITCH ..... **A**

AMBIGUITY

- The AMB annunciator illuminated during OMEGA navigation could indicate an OMEGA ambiguity (mislane) condition exists with position errors possibly resulting.
- Generally, such a condition will occur during sunrise or sunset periods or during abnormal signal disturbances.

To Extinguish the AMB Annunciator:

- Perform ambiguity clear procedures. (See POM Navigation Abnormal Section.)
- Perform a precision position update (See this section).
- Perform a non-precision position update (see this section).
- Perform relane (reference following relane procedure).
  - The basic non-precision update and relane operations are similar.
  - The difference being the non-precision update's "best estimate" present position provides a more accurate starting position than does the relane. Both command the system to redetermine current present position.

a

OMEGA STATION STATUS

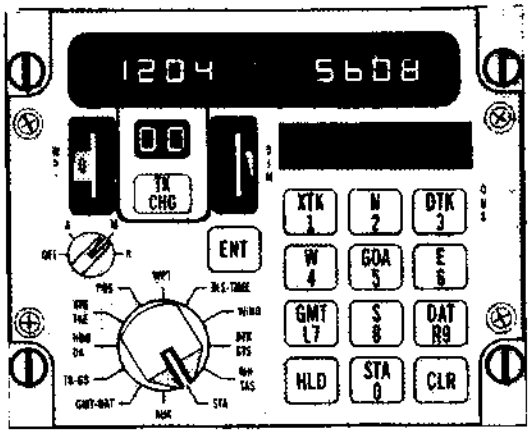
- Since OMEGA navigation is dependent on ground based transmitting stations, it is desirable to know the status of the system with respect to these stations.
- The station status display function shows which stations are in use, available for use and those deselected either automatically by the system or manually by the operator.

To Display Station Status:

DISPLAY SWITCH . . . . . **STA**

- Observe Stations in use in the following table.

Display	Station Status
Steady Sta No.	In Use
Flashing Sta No. . . .	Acceptable Signal Strength, But Not in Use
Steady Zero	Automatically Deselected
Flashing Zero	Manually Deselecteded



OMEGA SIGNAL QUALITY

- Station signal quality displays are available for OMEGA stations.

To Display Signal Quality:

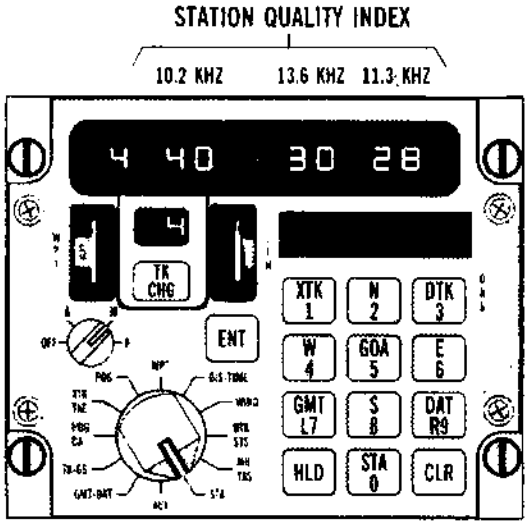
DISPLAY SWITCH . . . . . **STA**

- Enter the number of the station (1–8) whose quality is to be checked. For example, to check station 4, press W4 pushbutton.
- The left and right displays show station quality index numbers for each of the station frequencies as shown.

To Restore Station Number Display:

CLR . . . . . **PRESS**

NOTE: Station signal qualities are displayed as numbers from 0 to 40. However, only stations displaying 13 to 40 are used for navigation.



STATION DESELECTION (AUTOMATIC)

- All stations from 0 to 300 nautical miles (single ONS) or 60 to 300 nautical miles (Dual ONS) of the aircraft are automatically deselected because of modal interference. Stations at ranges of greater than 8000 to 9500 nm are also deselected.

Note: In addition, the Liberia station (Station 2[B]) is automatically deselected at night in the areas between latitude 15° S and 35° N from longitude 60° E to 15° W and from latitude 15°S to 45°N and longitude 15° W to 110°W. Other stations are also automatically deselected based on known modal interference area.

STATION DESIGNATION & LOCATION			LATITUDE	LONGITUDE
OMEGA STATIONS				
1	(A)	Norway	66° 25.2' N	13° 08.2' E
2	(B)	Liberia	6° 18.3' N	10° 39.9' W
3	(C)	Hawaii	21° 24.3' N	157° 49.9' W
4	(D)	North Dakota	46° 21.9' N	98° 20.1' W
5	(E)	La Reunion	20° 58.5' S	55° 17.4' E
6	(F)	Argentina	43° 03.2' S	65° 11.5' W
7	(G)	Australia	38° 28.9' S	146° 56.1' E
8	(H)	Japan	34° 36.9' N	129° 27.2' E

OMEGA STATION DESELECTION (MANUAL)

- Any station or stations declared unusable for navigation by NOTAMS, etc., may be manually deselected for use in the following manner:

DISPLAY SWITCH . . . . . **STA**

STA 0 . . . . . **PRESS**
- Verify that station(s) de-selected indicate flashing zero.
- **ENT** pushbutton illuminates.

STATION TO BE DESELECTED . . . . **PRESS**

ENT . . . . . **PRESS**
- Verify that corresponding digits in the display are flashing zeros indicating that station(s) have been deselected.
- **ENT** push button extinguishes.

NOTE: Switching from ground to ship's power or a change in Essential Power source will cause a momentary power interruption to the OMEGA(s). Waypoints are retained, however, and automatic resynchronization process will reselect deselected stations.

If Any Manually DeSelected Station(s) Need to be ReSelected :

Note: Stations AUTOMATICALLY deselected by the system cannot be manually reselected.

CAUTION

PRESSING PUSH BUTTONS FOR STATIONS WHICH ARE NOT FLASHING ZERO DURING THIS PROCEDURE DE-SELECTS THOSE STATIONS.

DISPLAY SWITCH . . . . . **STA**

STA 0 . . . . . **PRESS**
- Verify **ENT** push button illuminates.

STATIONS TO BE RE-SELECTED . . . . . **PRESS**
- Verify corresponding digits change from flashing zero.

ENT . . . . . **PRESS**
- Light extinguishes.

VLF STATIONS

- The OMEGA/VLF system processes signals from the worldwide communication network operated in conjunction with the U.S. Navy. The VLF station number assignments and location are as listed.
- Use of VLF stations by the computer is secondary to use of OMEGA stations. However, this does not imply that navigational accuracy is affected. VLF is secondary because they are controlled by the U. S. Navy and may not necessarily be transmitting. There is no published notification that a VLF station will be off the air. OMEGA stations are always transmitting unless a NOTAM has been published to the contrary.
- Active VLF stations being used for navigation are automatically selected by the system computer.

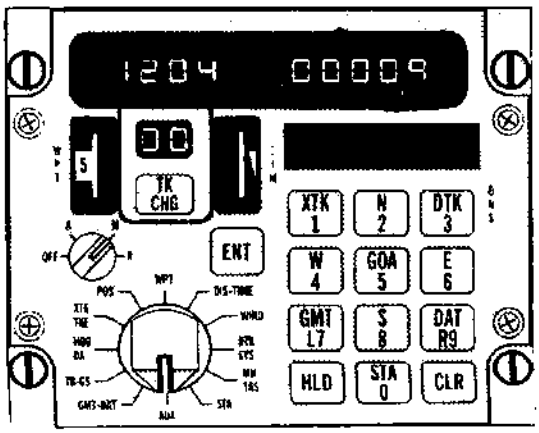
If One or More VLF Stations Are Being Used for Navigation the VLF Light Will Illuminate:

DISPLAY SWITCH . . . . . **AUX**

WPT SWITCH **5**

- Station numbers of the four active stations are displayed on the left and right displays as shown.
  - Solid station number – Station is being used for navigation.
  - Flashing station number – The computer is evaluating the station for potential use.
  - Solid zero – Computer deselection.
  - Flashing zero – Operator manual deselection.
- On Dual ONS systems, station selection criteria have been added which are sensitive to signal quality and station geometry.
  - Brief periods of dead reckoning (DR) and ambiguity (AMB) operation may be encountered and are considered normal.
  - The DR light should extinguish within 5 minutes and the AMB light should extinguish within 15 minutes without operator intervention.
  - Using the AMB clearing procedure should clear the AMB light within 5 minutes.
  - Extended AMB and DR operation usually indicates an antenna or other subsystem failure and is cause for appropriate maintenance action.

STATION DESIGNATION & LOCATION		LATITUDE	LONGITUDE
VLF STATIONS			
1	Norway (Helgeland)	67° 04.0' N	14° 04.0' E
2	Puerto Rico	18° 23.0' N	67° 11.0' W
3	Hawaii (Lulualei)	21° 25.5' N	158° 09.3' W
4	Washington, U.S. (Jim Creek)	48° 12.2' N	121° 55.0' W
5	Maryland, U.S. (Annapolis)	38° 59.1' N	76° 27.2' W
6	Maine, U.S. (Cutler)	44° 30.9' N	67° 16.9' W
7	Australia (Northwest Cape)	21° 49.0' S	114° 09.8' E
8	Japan (Yosami)	34° 58.3' N	137° 01.3' E
9	Great Britain (Anthorne, England)	54° 54.9' N	03° 16.4' W



VLF SIGNAL QUALITY

- Station signal quality displays are available for VLF stations as well as for OMEGA stations.

To Display Signal Quality:

DISPLAY SWITCH ..... **AUX**

WPT SWITCH **5**

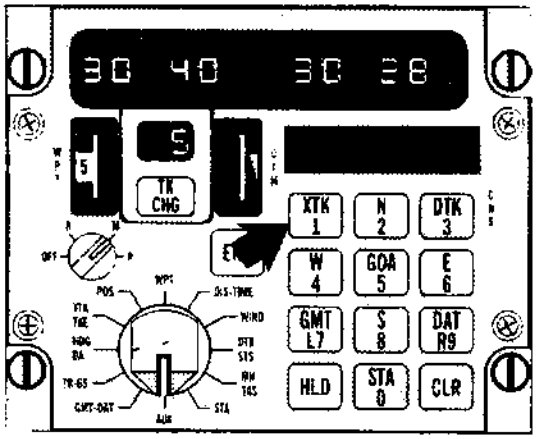
XTK/1 ..... **PRESS**

To Restore Station Number Display:

CLR ..... **PRESS**

- Set display Switch to any position other than **AUX** and then back to **AUX.**

NOTE: Station signal qualities are displayed as numbers from 0 to 40. However, only stations displaying 18 to 40 are used for navigation.



AUTOMATIC TRACK SELECTION

- The terms automatic and manual mode apply only to track selection. When in the navigational mode, the same navigational data is provided whether the mode switch is set to **A** (automatic) or **M** (manual).
- During automatic operation, the ONS navigates through each selected waypoint in sequence and automatically changes track at each waypoint.
- During manual operation, the ONS navigates from waypoint to waypoint, but the pilot must initiate a track change at each waypoint. CDU display selection and waypoint position entry may by accomplished with the mode switch set to either **A** or **M**.

AUTOMATIC MODE

- In automatic mode, the change to the next sequential track leg at each waypoint is initiated automatically by the system. Approximately two minutes before reaching each waypoint, the ALR annunciator illuminates and extinguishes when the track leg change is made. The **FROM/TO** display automatically changes to show the new track.

To Monitor Automatic Track Leg Changes:

MODE SWITCH . . . . . **A**

- Verify the new desired track is reasonable after track leg change.

To Manually Override Automatic Track Leg Change:

TK CHG . . . . . **PRESS**

- Perform manual track change as listed in MANUAL TRACK LEG CHANGE procedures, this section.

If the TO Waypoint Coordinates Have NOT BEEN ENTERED:

ALR INDICATOR . . . . . **ILLUMINATED**

- ALR illuminates approximately two minutes* before reaching the point at which a track leg change would occur. the annunciator begins flashing approximately 0.5 minutes* before reaching the waypoint and continues to flash until action is taken by the operation.
- The operator may enter coordinates for the **TO** waypoint and make a manual track change, make a manual track change to a defined waypoint, or initiate a track hold to continue on the present track.

If 30 Seconds Prior to Crossover Point, No Action Is Taken:

FROM/TO DISPLAY . . . . . **INDICATES 99**

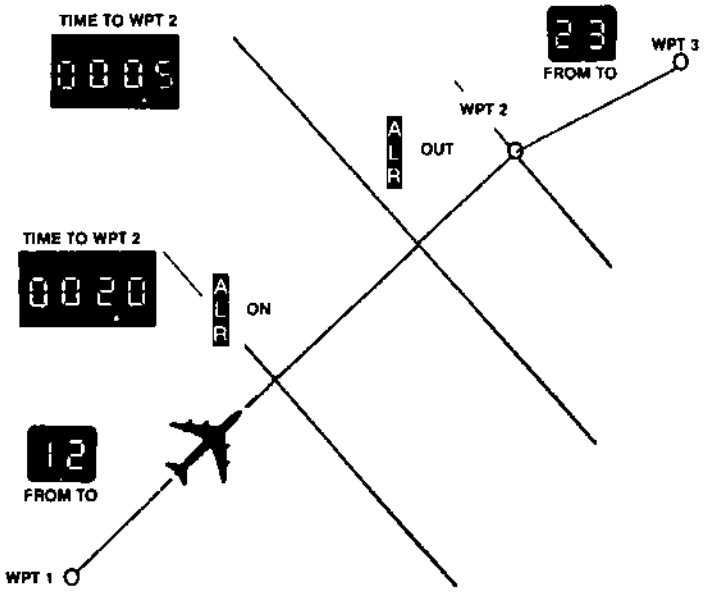
- System enters track hold mode.

HSI FLAG . . . . . **FROM CONDITION**

DIS/TIME . . . . . **NOT AVAILABLE**

* Actual time of ALR annunciation is a function of ground speed and angle of track leg change. Time varies from a maximum of 112 seconds to a minimum of 106 seconds. Actual time of flashing also varies from approximately 76 seconds to 22 seconds.

AUTOMATIC MODE (CONT'D.)



MANUAL TRACK SELECTION

- Manual Mode includes the ability to initiate track leg change at waypoint, track leg change from present position, waypoint bypassing and waypoint position change.

To Initiate Track Leg Change at Waypoint:

- In the example illustration, a new track 1 2 is initiated at WPT 1 as the aircraft approaches on the initial track 01.

When Two Minutes From the Waypoint:

ALR ..... ILLUMINATES

When 0.5 Minutes From the Waypoint:

ALR ..... FLASHES

If the Track Change Is Not Performed:

ALR ..... CONTINUES TO FLASH

- ALR will flash until a track change is made and the aircraft will continue on the 0 1 track.

To Perform Track Leg Change at Waypoint:

MODE SWITCH ..... M

DISPLAY SWITCH .....
..... ANY POSITION OTHER THAN WPT OR AUX

TK CHG ..... PRESS

- TK CHG and ENT illuminate.

XTK 1 ..... PRESS

N2 ..... PRESS

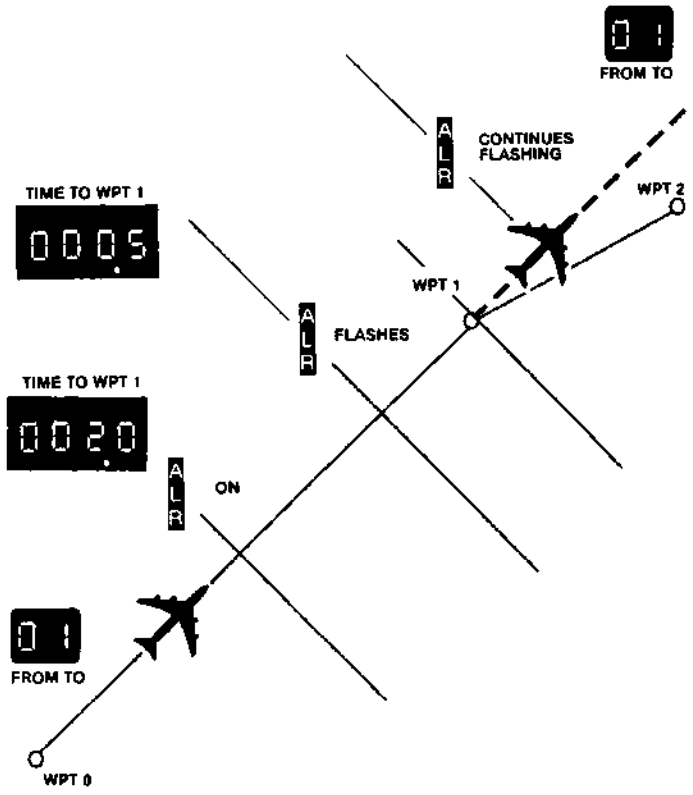
- Verify FROM/TO shows 12

ENT ..... PRESS

ENT, TK CHG, ALR ..... EXTINGUISH

NOTE: The new desired track angle should be checked for reasonableness after the new track leg insertion is made.

MANUAL TRACK SELECTION (CONT'D.)



PRECISION POSITION UPDATE

If The Present Position Is Known to be Incorrect and a Known Fix Point (VOR, Landmark, etc.) Is Available:

DISPLAY SWITCH . . . . . **POS**

- Latitude and longitude is shown

WPT SWITCH . . . . . .
. . . . . **ANY POSITION OTHER THAN 0**

- This will allow a correct present position to be entered.

When Overflying Known Fix:

HLD . . . . . **PRESS**

- Compare displayed position to known fix position.
- HLD button illuminates.

If Displayed Position Is Within 3 to 4 Miles of Known Fix Latitude:

HLD . . . . . **PRESS**

- **HLD** button extinguishes.
- Continue normal navigation.

If Displayed Position Differs From Known Fix Greater than 4 Miles:

ENTER . . . . . **LATITUDE OF KNOWN FIX**

- Verify correct coordinates displayed.

ENT . . . . . **PRESS**

- New latitude is shown and stored in computer until updated longitude is entered.

ENTER . . . . . **LONGITUDE OF KNOWN FIX**

- Verify correct coordinates displayed.

ENT . . . . . **PRESS**

HLD . . . . . **PRESS**

- **HLD** button extinguishes.
- Continue normal navigation.

NON-PRECISION UPDATE

- If the present position displayed is known to be incorrect and a known fix point isn't immediately available, a "best estimate" position can be entered if it is within 30 nautical miles of the present position.
- After a non-precision position is entered, a relane operation is automatically performed.

To Perform a Non-Precision Update:

DISPLAY SWITCH . . . . . **POS**
- Record present position LAT/LONG

WPT **0**

HLD . . . . . **PRESS**
- HLD illuminates and displays freeze.

To Enter "Best Estimate" Position:

ENTER . . . . . **LATITUDE/LONGITUDE**
- Use best estimate of LAT/LONG.

ENT . . . . . **PRESS**
- It is only necessary to enter latitude and longitude to the nearest 10 miles. The original un-updated coordinates reappear.
- AMB and DR light will illuminate until update is completed.

When Original Un-Updated Coordinates Reappear:

HLD . . . . . **PRESS**
- HLD extinguishes and updated present position is displayed.
- Displayed position will change during relaning operation.
- Compare final updated LAT/LONG to previously recorded LAT/LONG for reasonableness.
- The **AMB** and **DR** lights should extinguish in 2 minutes or less after HOLD button is pressed.

TRACK LEG CHANGE FROM PRESENT POSITION

- The pilot can initiate a track from aircraft present position to any waypoint. For example, the aircraft is enroute to WPT 2 on track 1 2. A decision is made to bypass **WPT** 2 and 3, in order to fly directly to WPT 4.

To Perform a Track Leg Change From Present Position to WPT 4:

MODE SWITCH . . . . . **A OR M**

DISPLAY SWITCH . . . .**ANY POSITION OTHER THAN WPT OR AUX**

TK CHG . . . . . **PRESS**
- **TK CHG** and **ENT** illuminate.

STA 0 AND W4 . . . . . **PRESS**
- **FROM/TO** displays 04.

ENT . . . . . **PRESS**
- **ENT** and **TK CHG** extinguish and **FROM/TO** shows 04.
- The new desired track should be checked for reasonableness.

NOTE: A new WPT 0 has been established at the present position at time of track leg change.

WAYPOINT BYPASSING

To Bypass Waypoints:

INITIATE TRACK LEG CHANGE AT A WAYPOINT

OR

INITIATE TRACK LEG CHANGE FROM PRESENT POSITION

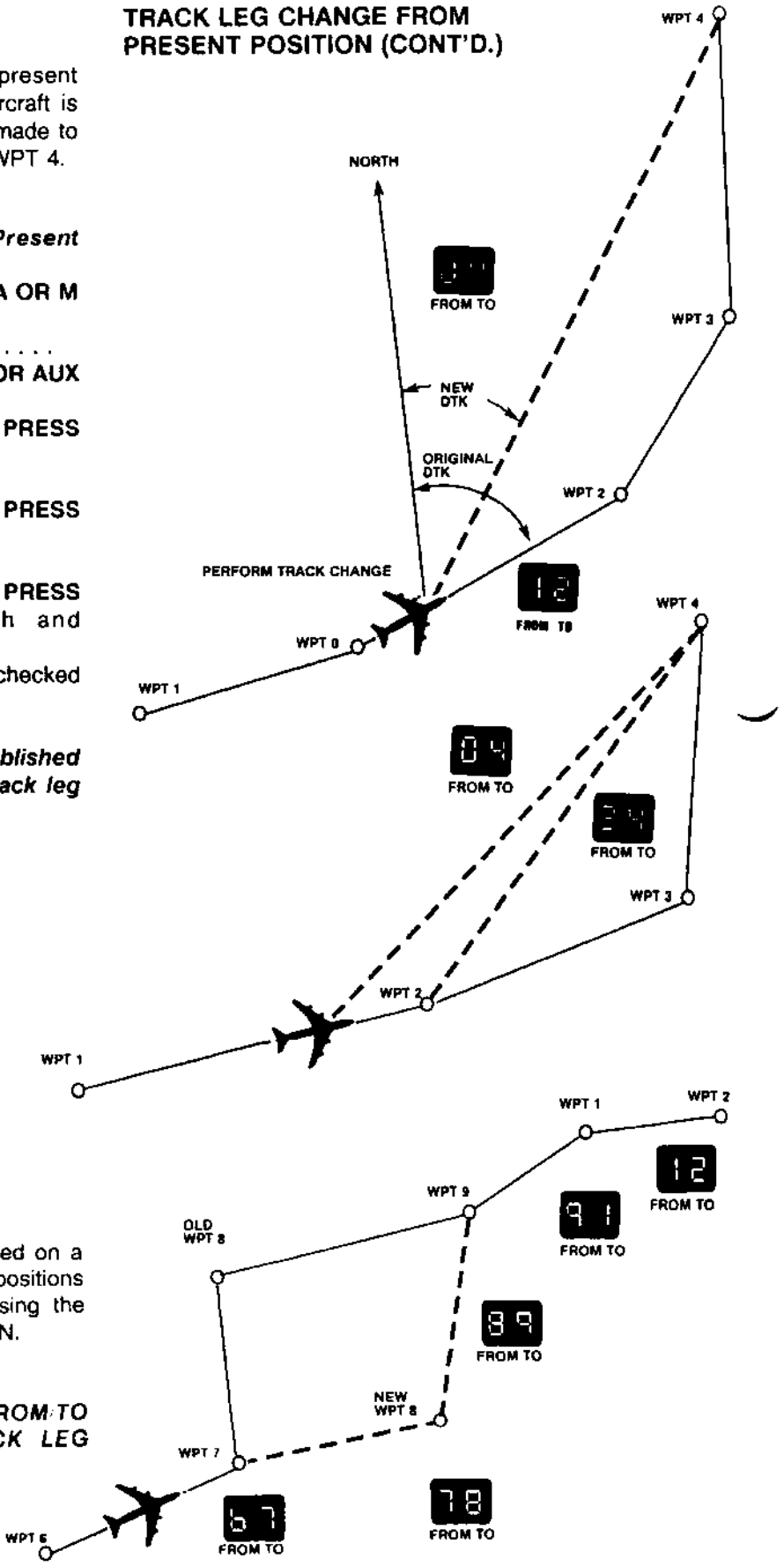
CHANGING WAYPOINT COORDINATES

- The coordinates of waypoints not yet being used on a track leg can be changed or past waypoint positions can be used for entering future waypoints using the procedures in LOADING WAYPOINTS SECTION.

CAUTION

DO NOT CHANGE COORDINATES OF FROM/TO WAYPOINTS WHICH DEFINE THE TRACK LEG PRESENTLY BEING FLOWN.

TRACK LEG CHANGE FROM PRESENT POSITION (CONT'D.)



INSERTING ADDITIONAL WAYPOINTS

- The waypoint editing system also provides editing capability for inserting additional waypoints into the sequence. For example, an additional waypoint can be entered between existing waypoints 1 and 2 by entering it into waypoint 2. This will cause existing waypoints 2 through 8 to shift automatically to become waypoints 3 through 9. The previous waypoint 9 will be deleted.

To Insert An Additional Waypoint:

DISPLAY SWITCH . . . . . **WPT**

HLD . . . . . **PRESS**
- HLD button illuminates.

WPT SWITCH . . . . . **DESIRED NUMBER**
- Enter coordinates of new waypoint.

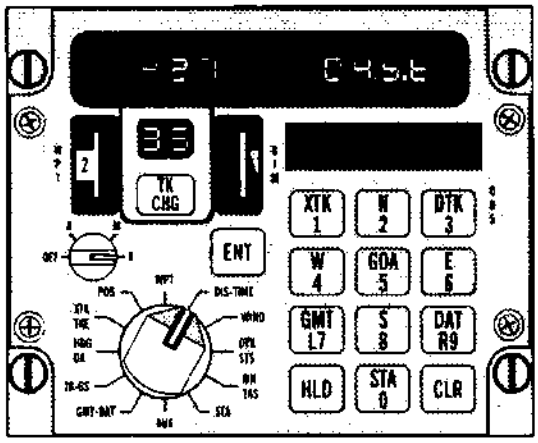
NOTE: When ENT is pressed after latitude entry, latitude coordinates for previous waypoint will reappear. This does not mean that the computer did not take the entry, but that coordinates for both latitude and longitude must be entered before display will change.

HLD . . . . . **PRESS**
- **HLD** extinguishes and entered waypoints appear.

WPT SWITCH . . . . . **CHECK WAYPOINTS**
- Verify that waypoints after the inserted waypoints have re-sequenced.

DISTANCE BETWEEN WAYPOINTS

- The direct great circle distance, time and desired track angle between any two waypoints can be displayed.
- Normal track calculations continue uninterrupted during the displays. The **"R"** position of the Mode switch is used. The **ALR** annunciator and track leg change output function as though the Mode switch were set to **"A"**. The normal **FROM/TO**, **DIS-TIME** and **DTK** displays are restored when the switch is set to **"A"** or **"M"**. Distances, times and desired track angles can be computed and displayed at any time after status 60 is attained.



To Display Distances, Times and Desired Track Angles:

DISPLAY SWITCH . . . . . **DIS-TIME**

MODE SWITCH . . . . . **"R"**

- **FROM/TO** display starts flashing.

TK CHG . . . . . **PRESS**

- Verify that **TK CHG** and **ENT** push buttons illuminate.

DESIRED FROM/TO WAYPOINTS . . . . . **ENTER**

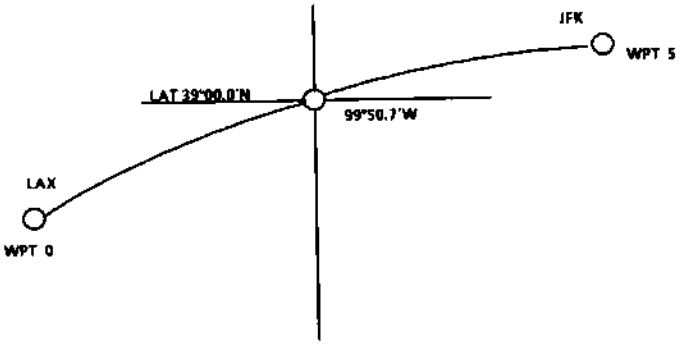
- Verify that display shows desired waypoint pair.

ENT . . . . . **PRESS**

- The direct great circle distance between the two selected waypoints is displayed on the left display.
  - The time between the two selected waypoints is displayed on the right display.
  - Time is based on a fixed velocity of 480 knots when TAS is less than 110 knots, or actual ground speed when TAS is more than 110 knots.
- Set the display switch to **DTK STS** to show the desired track angle between the two waypoints on the left display.

COMPUTING A REPORTING POINT

- The capability exists of calculating reporting waypoints along the great circle route from present position to any waypoint or between any two selected waypoints. Either the latitude or longitude of a desired reporting waypoint is entered and the ONS computer will calculate the corresponding longitude or latitude.
- In the following example, the aircraft will navigate from LAX at 33°56.1'N and 118°24.7'W to JFK at 40°38.2'N and 7346.2'W, and it is desired to establish a reporting waypoint at which the aircraft will cross a latitude of 39°00.0N. The coordinates of this interim waypoint may then be entered into an unused waypoint location and, using the remote ranging feature, DIS–TIME and ETA may be determined.
- For purposes of illustration, the following procedure shows JFK entered into **WPT 5**, thus allowing four reporting waypoints to be stored in location **1** through **4** along the route.



To Display a Reporting Waypoint:

DISPLAY SWITCH . . . . . **POS**

- Verify coordinates of LAX.

DISPLAY SWITCH . . . . . **WPT**

WPT SWITCH **5**

- Enter coordinates of JFK.

Note: If track change is to be made between numbered waypoints such a 1–5, the next step may be omitted.

TK CHG, STA 0 GOA 5 and ENT . . . . . **PRESS**

- This establishes present position of aircraft at LAX.

DISPLAY SWITCH . . . . . **AUX**

WPT SWITCH **7**

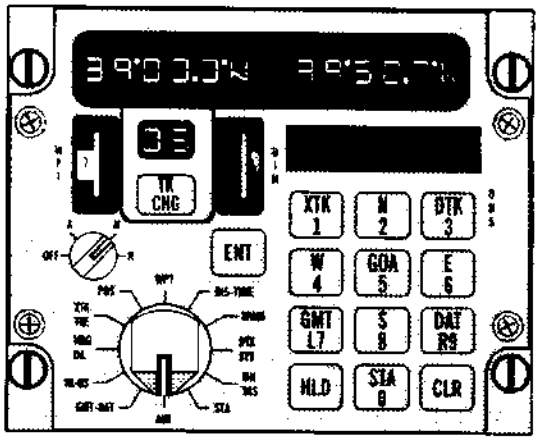
TK CHG, STA 0, GOA 5 and ENT . . . . . **PRESS**

- This will enter a 05 track change.

LATITUDE . . . . . **ENTER**

ENT . . . . . **PRESS**

- The computer will calculate and display, in right display, the corresponding LONGITUDE of the reporting waypoint along the great circle route from LAX to JFK (99°50.7W).
- This procedure can also be used while airborne to establish an interim waypoint with a **TK CHG** entry of **O X**, where **O** represents present position and **X** the terminus of the great circle flight path. Illegal coordinates that do not fall on the great circle route will be displayed on the CDU as flashing entries on the left or right displays and the **CLR** push button will illuminate.



REMOTE RANGING ALONG FLIGHT PATH

- The cumulative distance and time along the flight plan from present position to any waypoint can be displayed. The track angle displayed is computed on the direct great circle route to the selected waypoint from the present position. Normal track calculations continue uninterrupted during the displays.
- When the R position of the mode switch is used, the ALR annunciator functions as though the switch were set to M, and the FROM/TO, DIS/TIME, and DTK displays are restored when the switch is returned to A or M. Distances, times, and track angles can be displayed any time after status 60 is attained.

To Display Distance, Time and Track Angle:

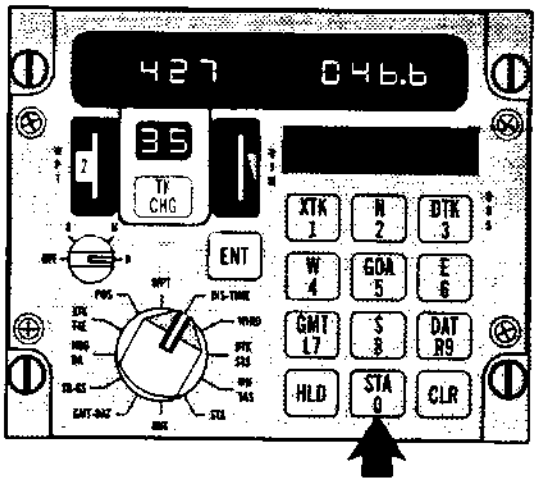
DISPLAY SWITCH . . . . . **DIS/TIME**

MODE SWITCH . . . . . **R**
- Verify **FROM/TO** display starts flashing.

TK CHG . . . . . **PRESS**
- Verify that **TK CHG** and **ENT** illuminate.

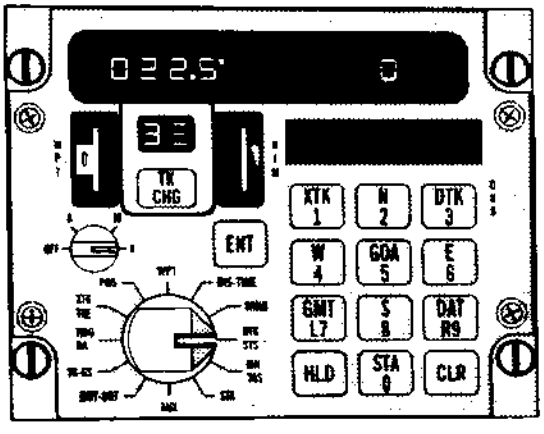
STA 0 . . . . . **PRESS**

WAYPOINT
. . . . . **PRESS DESIRED WAYPOINT BUTTON**
- Verify the **FROM/TO** display shows the selected waypoints.



ENT . . . . . **PRESS**
- Verify **ENT** and **TK CHG** extinguishes.
- The distance along the flight plan and time from present position to the selected waypoint is shown on the left and right display respectively.
- Time is based on 480 knots when TAS is less than 110 knots and on actual ground speed when greater than 110 knots.

DISPLAY SWITCH . . . . . **DTK STS**
- Desired track angle based on the direct great circle route to the selected waypoint from present position is shown on the left display.
- Distance and time displayed will change as the flight progresses.



REMOTE DIRECT RANGING FROM PRESENT POSITION

- The direct great circle distance, time and desired track angle from present position to any waypoint can be displayed using the R position of the mode switch.
- The ALR annunciator functions as though the mode switch were in the M position.
- The normal function of the FROM/TO, DIS/TIME, and DTK will be restored when the mode switch is returned to A or M.
- Information is available after the system status is 60. During this operation, normal track calculations continue uninterrupted.

To Display Distance, Time and Track Angle:

DISPLAY SWITCH . . . . . **DIS/TIME**

MODE SWITCH . . . . . **R**
- Verify **FROM/TO** starts to flash.

TK CHG . . . . . **PRESS**
- Verify TK CHG and ENT illuminate.

WAYPOINT
. . . . . **PRESS DESIRED WAYPOINT BUTTON**

STA 0 . . . . . **PRESS**
- Verify **FROM/TO** display shows correct waypoints.

NOTE: Enter waypoint number to which distance, time and track angle are desired before present position to obtain direct great circle distance.

ENT . . . . . **PRESS**
- Verify **ENT** and **TK CHG** extinguish.
- The direct distance, and time between the present position and selected waypoint are shown on the left and right display respectively.
- Time is based on 480 knots when TAS is less than 110 knots and on actual ground speed when greater than 110 knots.

DISPLAY SWITCH . . . . . **DTK STS**
- Desired track angle from present position to selected waypoint is shown on the left display.

TRACK HOLD MODE

- A track hold mode of operation can be initiated allowing the aircraft to fly on a track referenced to north rather than on a track between waypoints.

To Perform Track Hold:

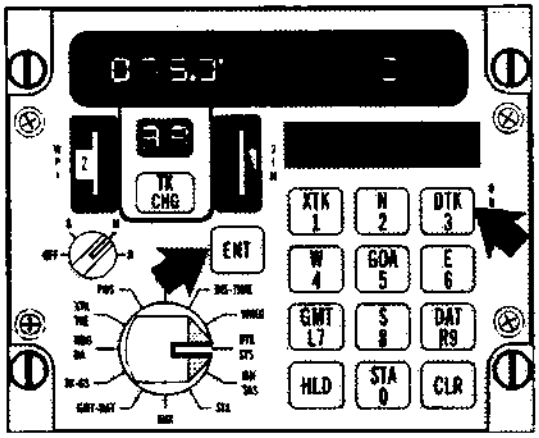
DISPLAY SWITCH . . . . . **DTK STS**

DTK 3 . . . . . **PRESS**
- Left display blanks and **ENT** push button illuminates.

DESIRED TRACK ANGLE . . . . . **ENTER**
- Enter desired track angle to the nearest tenth of a degree.
- Verify left display shows desired track.

ENT . . . . . **PRESS**
- Verify **ENT** extinguishes.
- **FROM/TO** displays 99.
- **DIS/TIME** and **XTK** displays all zeros.

NOTE: When desired, return to a waypoint-to-waypoint mode of navigation by initiating atrack leg change from present position to a waypoint.



OFFSET

To Fly A Parallel Offset:

NOTE: ONS must have an active track leg showing in the FROM/TO display.

DISPLAY SWITCH ..... **XTK/TKE**

XTK 1 ..... **PRESS**

- **ENT** illuminates.
- Enter desired offset track to the nearest tenth of a nautical mile beginning with the direction of offset (L or R). For example, right 7.5:

DAT/R9 ..... **PRESS**

7 ..... **PRESS**

5 ..... **PRESS**

- Verify that right display is the desired offset track entered.

If Incorrect:

CLR ..... **PRESS**

- Enter correct information

If Correct

ENT ..... **PRESS**

- The right display again shows the value displayed prior to insertion of desired offset track and **MAN** annunciator illuminates. The aircraft turns in the direction of the offset track if autopilot is interfaced with the ONS unit.
- Track angle error steadily increases and cross-track distance increments toward inserted offset distance.
- As the offset distance is approached, the aircraft turns and follows the desired track. The **MAN** annunciator remains illuminated as long as the offset is continued.
- As the turn progresses, the track-angle error steadily decreases to zero and right display shows offset distance from original track (in this case the inserted R7.5 NM).

To Display Offset Track:

MODE SWITCH ..... **R**

DISPLAY SWITCH ..... **XTK/TKE**

NOTE: The cross-track offset remains in effect until removed by the operator.

To Return to Original Track:

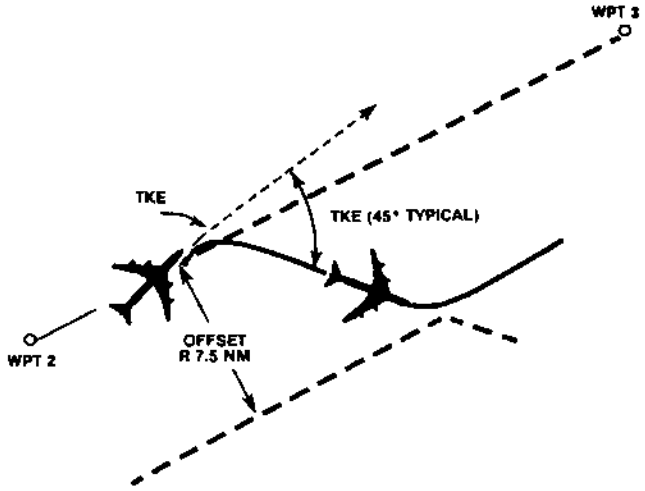
DISPLAY SWITCH ..... **XTK/TKE**

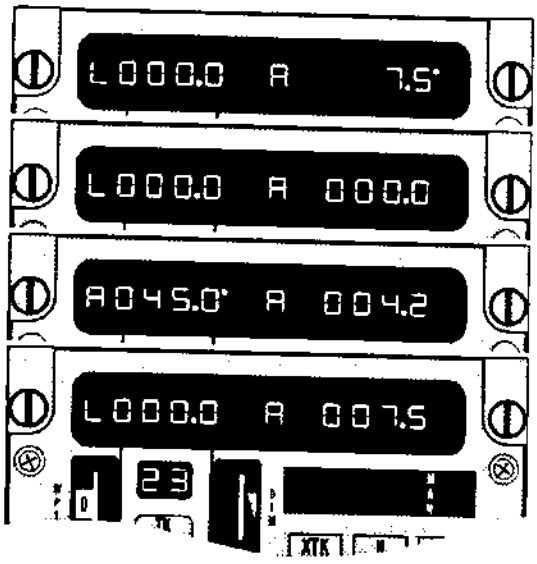
XTK 1 ..... **PRESS**

L or R ..... **PRESS**

ENT ..... **PRESS**

NOTE: A programmed cross-track offset is automatically removed when a 0 cross-track leg is entered.





AUXILIARY FUNCTIONS

- Information pertaining to various inputs and outputs to the Omega system is provided through the use of the AUX position of the display switch and WPT switch. The WPT switch will allow switching to the different levels of the AUX function.

DISPLAY SWITCH ..... **AUX**

WPT SWITCH **0–9**

- This will display the following:

– WPT 0

Waypoint 0 is used during the ambiguity clearing and relaning operation. The function of relaning is to resynchronize the Omega system to the three strongest stations. The procedure to relane is found in Abnormal operations.

– WPT 1

Waypoint 1 provides the ability to manually enter ground speed and drift angle during the DR mode of operation.

– WPT 2

Waypoint 2 is a maintenance function position.

– WPT 3

Waypoint 3 shows the frequencies being used by the various Omega stations. The following graphic will show the definitions of the respective codes.

DISPLAYED DIGIT	FREQUENCY (KHz)		
	10.2	13.6	11.3
0	NONE	NONE	NONE
1			X
2		X	
3		X	X
4	X		
5	X		X
6	X	X	
7	X	X	X

–WPT 4

Waypoint 4 will display two different functions. In the left window is GDOP (Geometric Dilution of Precision) which is useful during a relane procedure. GDOP is the relative geometric position of the stations in comparison to the aircraft. The lower the Geometric Dilution the better the signal.

If relaning is deemed necessary because of an AMB light, the GDOP should be checked due to the fact that if the value is 2.5 or larger, relaning is inhibited.

In the right window is QI (Quality Index). QI is a computed value which looks at actual values of all three frequencies from each station and compares these to an expected (computed) value. These values can range from 00 through 24 with the lower values being better.

If QI increases to 07 or higher for more than two minutes, AMB is illuminated. A precision update should be performed as described in this section. Normal QI should be 03 or less.

– WPT 5

Waypoint 5 will display the status of the best 4 out of the 9 VLF stations.

– WPT 6

Waypoint 6 is not used in our operations.

– WPT 7

Waypoint 7 can be used to select a single waypoint to use as a reporting point. As this waypoint is approached ALR illuminates as a reminder.

– WPT 8

Waypoint 8 is a spare position.

– WPT 9

Waypoint 9 will give a test signal to the CDU. Also, the HSI and Flight Director interface will be tested when properly configured. It will remain in this test position until another waypoint position is selected.

LIST OF PMS ABBREVIATIONS

AFCS	Avionic Flight Control System
AFM	Airplane Flight Manual
ALT	Altitude
APFDS	Autopilot, Flight Director System
AT	Autothrottle
ATS	Autothrottle System
BAL	Barometric Altitude
BCK	Back
BIT	Built-In-Test
BITE	Built-In-Test-Equipment
BLO	Below
BOD	Bottom of Descent
CAS	Calibrated Airspeed
CB	Circuit Breaker
CDU	Control Display Unit
CLB	Climb
CLG	Ceiling
CONV	Converter
CRZ	Cruise
CWS	Control Wheel Steering
DADC	Digital Air Data Computer
DD	Drift Down
DES	Descent
DIS	Distance
DISCON	Disconnect
ENG	Engine
EPR	Engine Pressure Ratio
ETA	Estimated Time of Arrival
FCC	Flight Control Computer
FDBK	Feedback
FL	Flight Level
FWD	Forward
GA	Go-Around
GMT	Greenwich Mean Time
GS	Ground Speed
GSP	Glareshield Panel
GW	Gross Weight
HI	High
IAS	Indicated Airspeed
INS	Inertial Navigation System
ISA	International Standard Atmosphere
KIAS	Knots Indicated Airspeed
LBS	Pounds
LO	Low
LRC	Long Range Cruise
M	Mach
MAC	Mach
MAX	Maximum
MALFS	Malfunctions
MCH	Mach
MCT	Maximum Continuous Thrust
MGT	Management
MRC	Maximum Range Cruise
NA	Not Applicable
N/A	Not Applicable
NM	Nautical Miles
OPT	Optimum
OUTPUT	Output
PA	Pressure Altitude
PAL	Pressure Altitude
PERF	Performance
PGM	Program
PMS	Performance Management System
PR	Pressure
REM	Remaining
RES	Reserve
RNG	Range
SAT	Static Air Temperature
SAVD	Saved
STRT	Start
SPD	Speed
STD	Standard
STS	Status
TAS	True Air Speed
TAT	Total Air Temperature
TGT	Turbine Gas Temperature
THR	Thrust
TM	Thrust Management
TOC	Top of Climb
TOD	Top of Descent
VNAV	Vertical Navigation
VS	Vertical Speed
VTH	Velocity - Threshold
WARN	Warning

EXPANDED PMS NORMAL CHECKLIST

GROUND SETUP

PMS CIRCUIT BREAKERS ..... IN
- Close FLT MGT circuit breakers 1-E-8 and 1-E-26.
  - The CDU display "Turn-on-Time" is related to the setting of the brightness (BRT) control on the face of the CDU Keyboard. To reduce turn-on-time the brightness control should be set at the maximum brightness position (extreme clockwise position) prior to closing the circuit breakers.

PROGRAM NUMBER (1628428-105) . VERIFY
- Press PERF DATA and page FWD to display MAINTENANCE page (P-19).
- Verify program number on first line of MAINTENANCE page.

TAKEOFF SETUP ..... COMPLETE
- Press the PERF MGT button to display TAKEOFF page (P-1).
- Index GMT and insert time.
  - Previous setup data is removed and the Company standard climb, cruise and descent options are automatically selected.
- Index GW and insert gross weight in thousands of pounds.
- Index FUEL and insert fuel weight in thousands of pounds.
- Index SAT and insert runway temperature for takeoff, in °C, preceded by - or P.
- Page FWD to display FLIGHT SETUP page (P-2).

FLIGHT SETUP ..... COMPLETE
- If the FLIGHT SETUP page is not displayed, press the PERF MGT button and page FWD to display this page (P-2).
- Review/modify climb and descent options.
  - Company standard options were selected when the system was initialized (insertion of GMT). These options can be changed if desired by indexing the appropriate line to display select page. After selecting desired option, display will return to the FLIGHT SETUP page (P-2).
- Complete descent setup if desired.
  - Enter BOD distance, altitude and airspeed by indexing the apropriate line, keying the desired numbers on the keyboard, and pressing insert. The descent setup can be entered or modified during flight prior to TOD if desired.
- Page FWD to display TAKEOFF page (P-1).

INITIAL CLIMB

- The PMS is automatically armed for the initial climb.

ALT SELECT ..... SET
- Turn on at least one flight director.
- Select the clearance limit altitude or interim altitude as appropriate prior to or just after takeoff. If the assigned altitude is not entered in the Altitude Select Panel, the aircraft can climb through the clearance altitude.

ATS TM ..... ENGAGE
- Press TM mode switchlight.
  - Throttles are controlled by the PMS computer and will advance or retard to maintain the required climb power rating.
  - A THR MGT climb may be made in the semiautomatic mode, if desired. Compatible pitch modes are CWS, VS or IAS.
  - If FCC A is inoperative, ATS Channel #1 must be selected OFF to permit ATS engagement in the TM mode.

INITIAL CLIMB (CONT'D.)

APFDS-VNAV ..... **SELECT**
- APFDS pitch is controlled by the PMS computer and will command the selected climb speed schedule.

AUTOPILOT ..... **ENGAGE**
- The autopilot pitch axis will maintain the selected PMS climb speed schedule.

If Changes To the Climb Schedule Are Required During a PMS Climb:
- Press PERF MGT button if CLIMB page (P-6) is not displayed.
- Index CLB line to select the CLIMB SELECT Page (P-3).
- Index desired climb option.
  - When the desired option has been selected, the display will return to the CLIMB page (P-6). The climb line will be cleared for insertion of IAS if CLB MANUAL was the option selected.

CRUISE

- APFDS capture of altitude will result in the PMS cruise mode. Speed will be maintained at the selected cruise speed option. The CRUISE page (P-7) will be displayed automatically at altitude capture.

NOTE: The APFDS ALT mode must be engaged to permit ATS-TM operation in the PMS CRUISE mode. If ALT is deselected, or any other pitch mode (except VNAV) is selected, the ATS-TM mode will disengage.

If A Change of Cruise Airspeed Is Required:
- Index the CRZ line to display the CRUISE SELECT page (P-4).
- Index desired cruise option.
  - When the desired option has been selected, the display will return to the CRUISE page (P-7). The cruise line will be cleared for insertion of speed if 3 ENG MANUAL was the option selected.

PMS ROUGH AIR MODE
- If excessive airspeed or vertical speed excursions are sensed by the PMS during cruise, the system will enter the "rough air" mode. The purpose of this mode is to prevent excessive throttle activity during turbulence. Throttles will control to a fixed reference EPR and some speed error may develop. Manual throttle control may be required to control airspeed. Normal throttle control will resume when turbulence is no longer sensed by the PMS.

CLIMB/DESCENT TO NEW ALTITUDE

- This procedure is used for climb to a new altitude at any time, or for a step descent or enroute descent when the airplane is not within plus or minus 10 minutes of TOD.
- To determine if a step climb/descent is worthwhile, refer to the procedure "To Review Step Climb/Descent Data".

ALT SELECT ..... **SET**
- Select the new cruise altitude.
  - The PMS is armed for climb or descent when a new altitude, other than the current flight level, is selected.

APFDS-VNAV ..... **SELECT**
- The display will change to the CLIMB page (P-6) or the ENROUTE DESCENT page (P-11) when VNAV is selected.
  - Climb to the new cruise altitude will be made at the last selected climb option unless the altitude increment is 2000 feet or less, in which case the system will control to the speed at VNAV selection.
  - Descent to the new cruise altitude will be made at the speed existing at the initiation of the descent. Above .80 mach, a constant Mach will be held until transition to constant IAS which occurs as follows: .850/350, .840/340, .830/330, etc.
  - At cruise altitude capture, speed will be maintained at the selected cruise speed option.
  - For descents, if the previous cruise speed selection was MANUAL, the speed will be maintained to the descent speed at altitude capture.

DESCENT TO BOD

- A Descent to BOD will be made when the aircraft is within plus or minus 10 minutes of TOD, a lower cruise altitude is inserted, and TM and VNAV are engaged. The Descent mode annunciator will start flashing two minutes prior to TOD.

DESCENT TO BOD SETUP ..... REVIEW

- Index TOD to display the DES BOD page (P-8).
- Review the descent speed schedule, BOD distance, BOD altitude and BOD speed. Index and insert distance, altitude and/or speed if required.
  - The descent speed schedule cannot be changed if the aircraft is less than 16 NM from TOD or the descent has been initiated.

ALT SELECT ..... SET

- Select the BOD altitude or an interim altitude, as appropriate.

APFDS - VNAV ..... SELECT

- The CDU will automatically display descent information during the descent (P-9).
- Descent will be made at the selected descent speed schedule with level decelerations at 10,000 ft. and BOD altitude, as required. Power will be maintained slightly above idle in the Mach range and at idle in the IAS speed range.
- After descent is initiated, a semi-automatic mode may be used, if desired, i.e., APFDS IAS or VS pitch modes may be selected with throttles remaining under PMS control (ATS-TM). Or, throttles may be controlled manually, with pitch remaining under PMS control (VNAV).
- When BOD altitude is captured, the PMS will change to a cruise mode with a set IAS speed equal to the selected BOD IAS. The CDU changes to a cruise display at altitude capture.

INTERIM ALTITUDE CAPTURE DURING CLIMB/DESCENT

- It is possible to interrupt any PMS climb or descent by capturing an altitude with the Altitude Select function.

ALT SELECT ..... SET FOR CAPTURE

- Select the desired interim altitude.
  - At altitude capture from a climb, speed will be maintained at the selected cruise speed option with the CRUISE page (P-7) displayed.
  - At altitude capture from an enroute descent, speed will normally be maintained at the selected cruise speed option with the CRUISE page (P-7) displayed. If the previous cruise speed selection was MANUAL, speed will be maintained to the actual speed at altitude capture.
  - At altitude capture, from a Descent to BOD, speed will be maintained at the actual speed at altitude capture with a modified cruise page (P-10) displayed.

ALT SELECT ..... SET NEXT ALT

- Select the next altitude desied for capture.

APFDS - VNAV .....
..... SELECT TO RESUME CLIMB/DESCENT

- Climb will be resumed at the selected climb option with the CLIMB page (P-6) displayed. If the MAX ANGLE climb option was being used prior to altitude capture, climb will be resumed with the OPTIMUM option automatically selected.
- An enroute descent will be resumed at the actual speed at VNAV selection with the ENROUTE DESCENT page (P-11) displayed.
- A Descent to BOD will be resumed at the selected descent option with the DES page (P-9) displayed.

NOTE: If BOD distance is set to zero during the interim altitude hold, the descent mode will change to an enroute descent.

PERFORMANCE FUNCTIONS

TO REINITIATE PERF MGT IN FLIGHT

- If the automatic PMS control of Pitch (APFDS–VNAV or ALT) and Thrust (ATS–TM) are discontinued in flight, automatic control may be reinitiated from either a climb or from level flight.

To resume automatic PMS control during a climb:

- Set desired altitude in Altitude Select.
- Press the TM mode switchlight.
- Select APFDS VNAV mode.

To Resume Automatic PMS Control From Level Flight:

- Engage APFDS ALT mode.
- Press PERF MGT button to display CRUISE page (P–7).
- Index CRZ line and change cruise speed, as desired.
- Press TM mode switchlight.

TO MODIFY PERF MGT SETUP PAGES

- Press the PERF MGT button.
- Page FWD, as required (P–1), (P–2).
  - On the ground, the TAKEOFF setup page (P–1) is displayed when the PERF MGT button is pressed. Paging FWD on the ground displays the FLIGHT setup page (P–2). In flight, a PMS mode page is displayed. Paging FWD will display the FLIGHT SETUP page (P–2). Paging FWD again will, in turn, display the TAKEOFF setup page (P–1).
- Index any parameter requiring change.

TO REVIEW STEP CLIMB/DESCENT DATA

- Press the PERF MGT button if the CRUISE page (P–7) is not displayed.
- Check step climb distance/ETA advisory.
  - When the step–climb ETA is reached, the aircraft weight is low enough to make a 4000 ft. step climb. The STEP DATA page should be reviewed to insure that the step climb is worthwhile. In addition, the STEP DATA page can be used to evaluate step climb/descent to other altitudes.
- Index STEP to display the STEP DATA page (P–14).
- Index and insert WIND and temperature (NEW ALT SAT) at the step altitude, if known.
- Evaluate step climbs/descents to other altitudes as desired, by indexing and inserting a new STEP ALT and wind/temperature, if available.
- When a new STEP ALT is inserted, the fuel saved advisory on the STEP DATA page and the step climb ETA advisory on the cruise page will be based on the new altitude.

TO DISPLAY LANDING DATA

- Press the PERF DATA button to display the LANDING DATA page (P–18).

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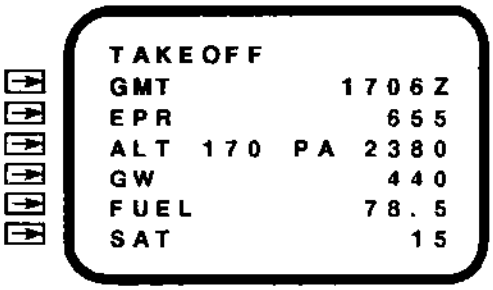
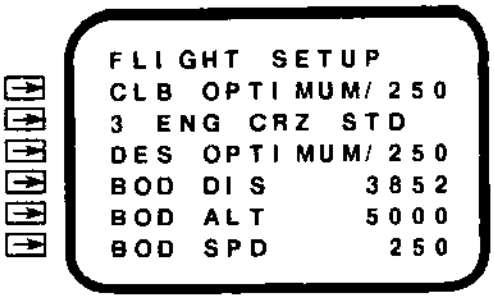
PMS OPERATIONAL PROCEDURES



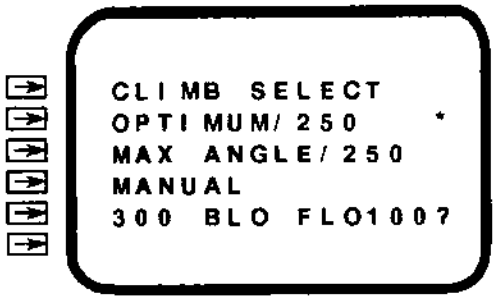
P-1

- This page is the first of two performance set-up pages.
- It is displayed on the ground by pressing the PERF MGT button. It is also presented by paging FWD from the FLIGHT SETUP page (P-20 when either on the ground or in the air.
- GMT (line 1) is a continuous display of time in hours and minutes. The display can be updated at any time by indexing the GMT line and inserting a new time. On the ground, insertion of GMT is used to initialize the system.
- EPR (line 2) is the standard takeoff rating for the engines and is based on a runway temperature inserted by the operator. When the aircraft is airborne, the line will read N/A.
- ALT (line 3) is the altitude currently selected on the GSP, expressed as flight level. PA, the current pressure altitude, is displayed below 10,000 ft.
- GW (line 4) is the aircraft gross weight in thousands of pounds. The gross weight is inserted by the operator prior to engine start and is automatically updated as a function of fuel flow. The line is active whenever the TAKEOFF page is displayed to allow pilot update of gross weight if required.
- FUEL (line 5) is the total fuel weight in thousands of pounds. This value is inserted by the operator prior to engine start and is continuously updated as a function of fuel flow. The line is active whenever the TAKEOFF page is displayed to allow pilot update of the fuel weight if required.
- On the ground, SAT (line 6) is inserted by the operator and is the temperature, in °C, used by the computer to determine takeoff EPR. When in the air, the line displays SAT as a measured quantity.
- Paging FWD displays the FLIGHT SETUP page (P-2).



P-2

- This page is the second of two performance setup pages.
- It is displayed by pressing the PERF MGT button and paging FWD. When the system is first initialized, standard climb, cruise and descent schedules will be displayed.
- The first line displays the selected climb option. When indexed the page changes to the CLIMB SELECT page (P-3).
- The second line displays the selected cruise option. When indexed the page changes to the CRUISE SELECT page (P-4).
- The third line displays the selected descent option. When indexed the page changes to the DESCENT SELECT page (P-5).
- The remaining lines are used for entering BOD distance, altitude and airspeed as part of the preflight or inflight setup. The minimum BOD ALT is 1500 ft. BOD speed range is 195 – 300 KIAS.
- Paging FWD displays the TAKEOFF page (P-1).

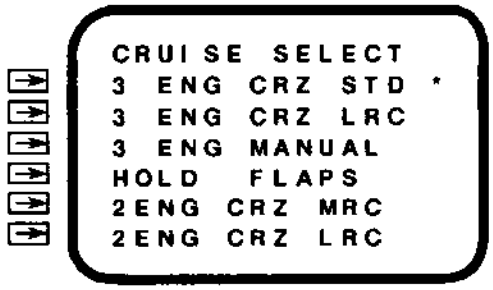


P–3

- This page is a list of the available climb speed schedules. It is used to select the desired schedule, the asterisk indicating the currently selected schedule.
- The page is displayed by indexing CLB (line 1) on the FLIGHT SETUP page (P–2) or by indexing the CLB line (Line 1) on the CLIMB page (P–6).
- OPTIMUM/250 (line 1) is a variable speed schedule for minimum fuel to climb. The schedule follows the speed for maximum level flight miles per pound as a function of weight and altitude at any point in the climb. The schedule transitions to the optimum speed at 10,000 feet. Below 10,000 feet the speed is 250 or 300 KIAS depending on the pilot selection. OPTIMUM is the airline standard and is automatically selected when the system is initialized.
  - Initial climb power is controlled as a function of takeoff gross weight as follows:
  - Initial Climb Power:

Gross Weight	EPR
Above 440,000 lbs	Max Climb – .030
430,000 – 440,000 lbs	Max Climb – .040
420,000 – 430,000 lbs	Max Climb – .050
410,000 – 420,000 lbs	Max Climb – .060
400,000 – 410,000 lbs	Max Climb – .070
390,000 – 400,000 lbs	Max Climb – .080
Below 390,000 lbs	Max Climb – .090

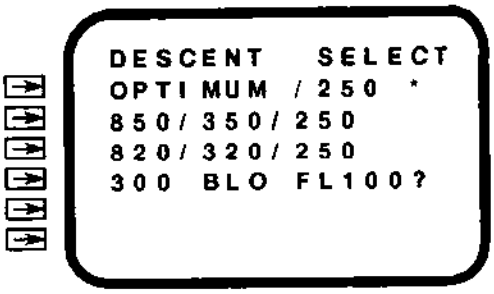
  - When climb rate drops below 650 fpm for approximately one minute, Power is uprated to Max Climb – .030 or to Max Climb, depending on takeoff gross weight.
  - When climb rate again drops below 650 fpm for approximately one minute, power is uprated to Max Climb.
  - When climb is initiated from an in–flight cruise condition, power is set according to the preceding table, or at Max Climb – .030, depending on existing gross weight and altitude. Normal uprates will occur when climb rate drops below 650 fpm.
- MAX ANGLE/250 (line 2) is a variable speed schedule to give a maximum flight path angle climb. The schedule transitions to the max angle speed at 10,000 feet. Below 10,000 feet the speed is 250 KIAS. Power is controlled to maximum climb thrust.
- When the OPTIMUM or CLB MAX ANGLE line is indexed the page will return to the page from which the CLIMB SELECT page was obtained and the climb schedule chosen will be presented on that page.
- MANUAL (line 3) is a two speed schedule, IAS and MACH. The desired IAS is inserted by the operator; the MACH is always .830. Indexing the MANUAL line provides for IAS insert by returning the display to the page from which the CLIMB SELECT page was obtained, i. e., FLIGHT SETUP or CLIMB, with the appropriate line cleared for an insert of IAS. It is possible to insert airspeeds in the region of 240 to 360 KIAS. The CDU will not accept values outside this region.
  - Power for the MANUAL climb option is the same as for the OPTIMUM option.
- The 300 BLO FL100? line (line 4) is provided for the selection of required low altitude speeds for the OPTIMUM schedule. Two speeds are available, 250 and 300 knots. When indexed, the line will toggle to the other speed and the indexed speed will be entered into the optimum schedule. At initialization the display returns to 300 BLO FL100? with 250 knots as the low altitude speed.



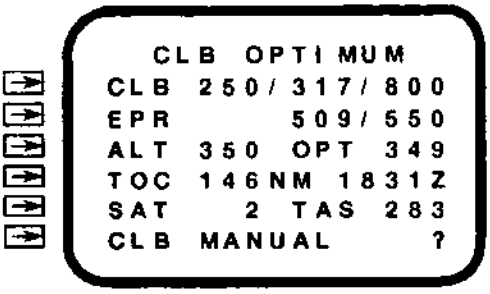
P-4

- This page is a list of the available cruise speed options. It is used to select the desired option, the astrisk indicating the currently selected option. The page is also used to initiate 2-engine driftdown and/or 2-engine cruise.
- The page is displayed by indexing line 2 on the FLIGHT SETUP page (P-2), by indexing CRZ (line 1) on the CRUISE page (P-7) or by indexing HOLD on the HOLD page (P-13).
- 3 ENG CRZ STD is the "standard" cruise speed option and is automatically selected when the system is initialized. This option provides a cruise speed of 250 KIAS below 10,000 ft., 330 KIAS between 10,000 ft. and 28,000 ft., and .830 Mach above 28,000 ft. When the option is selected the CRZ line (line 1) of the CRUISE page (P-7) displays the required cruise speeds.
- 3 ENG CRZ LRC speed is 99% max range speed. When the option is selected the CRZ line (line 1) of the CRUISE page (P-7) will display the required speed.
- 3 ENG MANUAL allows insertion of the desired Mach and IAS. Indexing the 3 ENG MANUAL line (line 3) causes the display to return to the page from which the CRUISE SELECT page was obtained with the appropriate line cleared for an insert of Mach or IAS. The Mach range is .800 to .860 and the IAS range is from buffet nibble to 360 KIAS. The display will show the message MCH (IAS) TOO HI (LO) if values outside of these limits are inserted. If the Mach selected results in a cruise speed in excess of 360 KIAS, the cruise selection will automatically change to a 360 KIAS cruise. If the IAS selected results in a cruise speed in excess of .860 Mach, the cruise selection will automatically change to .860 Mach cruise.
- Indexing HOLD FLAPS (line 4) allows for the selection of the holding speed for the present flight condition for 0° or 4° flaps. When the line is indexed the display changes to the HOLDING SELECT page (P-12).
- The 2 ENG CRZ MRC (Max Range Cruise) line is used to initiate a 2-engine MRC driftdown. If the airplane is above the optimum 2-engine cruise altitude and ALT is selected on the APFDS, indexing 2 ENG CRZ MRC initiates the driftdown with the 2 ENG CRUISE MRC page (P-15) displayed. If ATS-TM is engaged and a vertical mode other than ALT is selected on the APFDS, "DISCON TM FOR" will be displayed. If the vertical mode is then deselected, "ENGAGE ALT" will be displayed. After ALT is selected, the 2 ENG CRZ MRC driftdown will be available if the airplane is above the 2-engine OPT altitude. If the airplane is below the 2-engine OPT altitude and ALT is selected, a driftdown is not available and "2 ENG CRZ MRC NA" will be displayed.
- The 2 ENG CRZ LRC line is used to initiate either a 2-engine LRC driftdown or 2-engine LRC cruise. If the airplane is above the optimum 2 engine altitude and ALT is selected on the APFDS, indexing 2 ENG CRZ LRC initiates a LRC driftdown with the 2 ENG CRUISE LRC page (P-16) displayed. If the airplane is below the optimum 2 engine altitude and ALT is selected on the APFDS, indexing 2 ENG CRZ LRC initiates a 2 engine LRC cruise with the 2 ENG CRUISE LRC page (P-17) displayed.
- MRC is equivalent to "CRITICAL" in FMS.
- LRC is equivalent to "NON-CRITICAL" in FMS.

P-5



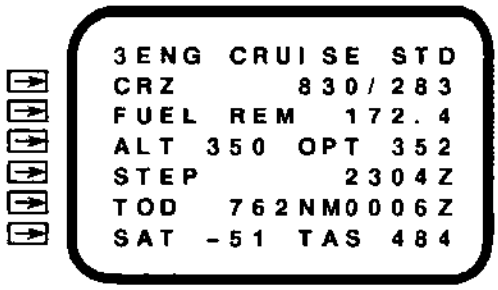
- This page is a list of the available descent speed schedules for a descent to BOD. It is used to select the desired schedule; the asterisk indicating the currently selected schedule.
- The page is displayed by indexing line 3 on the FLIGHT SETUP page (P-2) or by indexing the DES line (line 1) on the DESCENT page (P-8).
- When a schedule is indexed, the page will return to the page from which the descent page was entered; i.e., FLIGHT SETUP page (P-2) or the DESCENT page (P-8) and the descent schedule chosen will be entered on that page.
- The OPTIMUM selection (.80 Mach/300 KIAS) is the standard schedule. The low altitude speed is 250 or 300 KIAS dependent on pilot selection.
- The .850/350/250 is the high speed descent schedule.
- The .820/320/250 is the intermediate speed descent schedule.
- The 300 BLO FL100? line provides for the selection of the low altitude speed for all descent options. Two speeds are available, 250 and 300 KIAS. When indexed, the line will toggle to the other speed and the indexed speed will enter in the selected schedule.



P-6

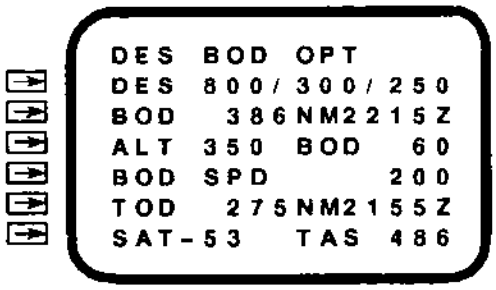
- The CLIMB page displays performance management information during a PMS controlled climb and may be used to initiate changes of climb schedules. The title line indicates the selected climb schedule.
- The page is displayed during a PMS climb when the PERF MGT button is pressed.
- CLB (line 1) indicates the selected climb speed schedule. The climb speed/thrust schedule can be changed by pressing the index button adjacent to CLB (line 1). This action will display the CLIMB SELECT page (P-3). After selection of a new climb schedule, the display automatically returns to the CLIMB page (P-6) with the new schedule displayed.
- EPR (line 2) indicates the required EPR for the power rating of the selected climb speed schedule and the limit climb EPR (Max Climb). When the power rating for the selected climb schedule is the limit EPR, only that EPR is displayed.
- ALT (line 3) is the altitude currently selected on the GSP expressed as flight level. Optimum altitude (OPT) is the maximum practical cruise altitude as a function of gross weight. For short flight sectors, OPT altitude is reduced as a function of distance to BOD.
- The TOP OF CLIMB (TOC) data line (line 4) displays distance to top of climb and ETA at top of climb relative to the altitude displayed in altitude select. TOC data is not available for the CLB MANUAL option.
- The SAT-TAS line displays the current static air temperature and true airspeed as taken from the air data computer.
- The CLB MANUAL? line (line 6) provides the capability of reverting to a manual climb speed schedule. When the line is indexed the page title changes to CLB MANUAL and the IAS part of the climb schedule clears to allow insertion of a new IAS. The Manual line is blank when the aircraft is in the Mach region of the schedule.

P-7

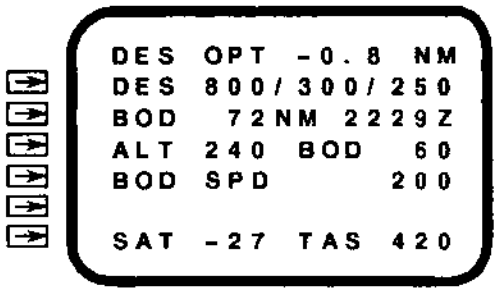


- The CRUISE page displays performance management information during PMS controlled cruise, and is used to initiate cruise speed changes from the cruise condition.
- The page is displayed during PMS controlled cruise, and is used to initiate cruise speed changes from the cruise condition.
- CRZ (line 1) displays the required speed for the selected option. Indexing CRZ leads to a change in the cruise speed option and changes the display to the CRUISE SELECT page (P-4).
- FUEL REM (line 2) displays fuel remaining and is a repeat of fuel data indicated on the TAKEOFF page (P-1).
- ALT (line 3) is the altitude currently selected on the GSP, expressed as flight level. Optimum altitude (OPT) is the maximum practical cruise altitude, as a function of gross weight. For short flight sectors, OPT altitude is reduced, as a function of distance to BOD.
- The STEP line (Line 4) provides step climb advisory information. The time is the time to go before aircraft weight will be low enough to make a step climb. Indexing STEP changes the display to the STEP DATA page (P-14).
- The TOD line (Line 5) displays the distance and ETA at the top of descent point. Indexing TOD leads to review of the descent to BOD set-up, with the DES BOD page (P-8) displayed.
- The SAT - TAS line displays the current static air temperature and true airspeed as taken from the air data computer.

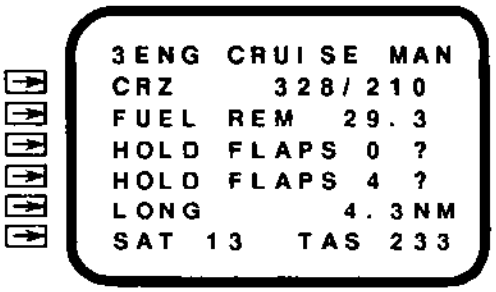
P-8



- This page is used to preview descent information to the operator during cruise flight and allows for insertion of BOD distance, altitude, and speed if not previously accomplished on the FLIGHT SETUP page.
- The page is displayed by indexing TID on the CRUISE page (P-7). The title line will indicate OPT if that schedule is selected.
- Line 1 indicates the selected descent schedule/low altitude IAS. Indexing Line 1 leads to a change in the descent speed schedule, displaying the DESCENT SELECT page (P-5). The descent speed schedule cannot be changed when the airplane is less than 16NM from TOD.
- Line 2 displays distance in nautical miles and the ETA to the bottom of descent (BOD). Indexing BOD leads to an insertion or change of the BOD distance.
- ALT (Line 3) is the altitude currently selected on the GSP, expressed as flight level. BOD is the current bottom of descent flight level. Indexing Line 3 leads to an insertion or change of bottom of descent altitude.
- Line 4 displays the desired end of descent airspeed. Indexing BOD SPD leads to an insertion or change of bottom of descent speed.
- Line 5 displays the distance and ETA to the top of descent (TOD).
- The SAT - TAS line displays the current static air temperature and true airspeed as taken from the air data computer.



P-9

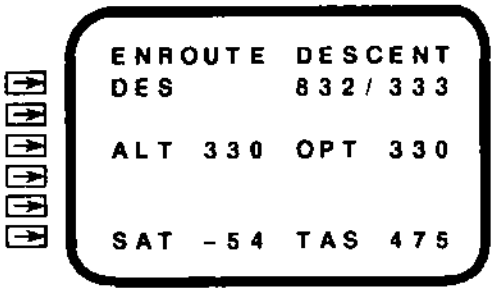


P-10

- This page displays information only during a descent to BOD. the displayed descent setup parameters cannot be changed during descent.
- The page is displayed during DESCENT TO BOD when the PERF MGT button is pressed.
- The title line displays the current airplane position, in NM, relative to a pre-computed descent/deceleration profile which ends at the bottom of descent distance, altitude and airspeed. A minus sign (-) indicates the airplane is short of the computed profile. Lack of a minus sign indicates the airplane is long.
- DES (line 1) is the require descent speed associated with the selected descent speed option.
- BOD (line 2) displays the distance in nautical miles and ETA to the bottom of descent.
- ALT (line 3) is the altitude currently selected on the GSP expressed as flight level. BOD is the inserted bottom of descent flight level.
- BOD SPD (line 4) is the end of descent airspeed.
- The SAT-TAS line displays the current static air temperature and true airspeed as taken from the air data computer.

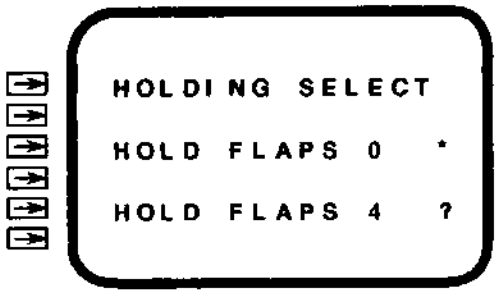
- This page displays information at interim altitude capture or BOD altitude capture during descent to BOD. The page is also used to select holding speeds for zero degree and four degree flap settings.
- CRZ (line 1) is the commanded level flight Mach/IAS. For an interim altitude capture, this is the actual speed at altitude capture. For BOD altitude capture, it is the BOD airspeed.
- FUEL REM (line 2) displays fuel remaining and is a repeat of fuel data indicated on the TAKEOFF page (P-1).
- Indexing HOLD FLAPS 0? (line 3) or HOLD FLAPS 4? (line 4) changes the speed selection and the required speed (line 1) will change to the holding speed for the aircraft weight and altitude.
- Line 5 is the current airplane position in NM relative to a pre-computed descent/ deceleration profile which ends at the bottom of descent distance, altitude and airspeed.
- The SAT-TAS line displays the current static air temperature and true airspeed as taken from the air data computer.

P-11



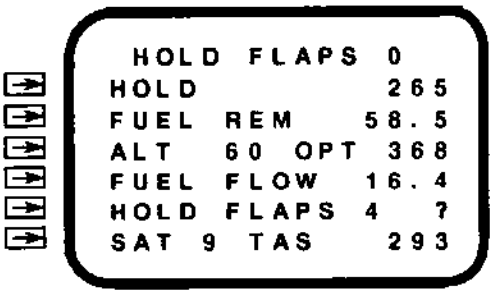
- This page displays data during an enroute descent. The page is displayed during enroute descent when the PERF MGT button is pressed.
- DES (line 1) is the required Mach/IAS schedule for the descent. It is the actual Mach at descent initiation, with transition to constant IAS as follows: .850/350, .840/340, etc.
- ALT (line 3) is the altitude currently selected on the GSP, expressed as flight level. Optimum altitude (OPT) is the maximum practical cruise altitude, as a function of gross weight. For a short flight sector remaining, OPT altitude is reduced, as a function of distance to BOD, but not less than existing altitude.
- The SAT - TAS line displays the current static air temperature and true airspeed as taken from the air data computer.

P-12



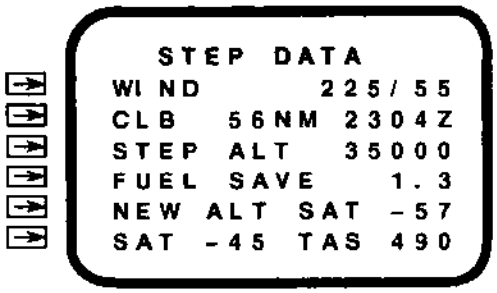
- The HOLDING SELECT page is used to select a holding option, the asterisk indicating the currently selected option.
- The page is displayed by indexing HOLD FLAPS (line 4) on the CRUISE SELECT page (P-4).
- Indexing HOLD FLAPS 0 or HOLD FLAPS 4 commands the associated holding speed, as a function of gross weight and altitude, and changes the display to the HOLD page (P-13).

P-13



- The HOLD page displays information during holding.
- The page is displayed by indexing HOLD FLAPS 0 (line 2) or HOLD FLAPS 4 (line 4) on the HOLDING SELECT page (P-12).
- The title line indicates the PMS selected holding option.
- The HOLD line (line 1) indicates the required speed for the selected option as determined by the system for present gross weight and altitude. The line is continuously updated. Indexing HOLD leads to change of the commanded speed, displaying the CRUISE SELECT page (P-4).
- FUEL REM (line 2) displays fuel remaining and is a repeat of fuel data indicated on the TAKEOFF page (P-1).
- ALT (line 3) is the altitude currently selected on the GSP, expressed as flight level. Optimum altitude (OPT) is the maximum practical cruise altitude, as a function of gross weight. For short flight sectors, optimum altitude is reduced as a function of distance to BOD.
- Line 4 displays the total fuel flow in 1000 lbs/hour.
- Line 5 offers the choice of changing the holding option from 0 to 4 degrees or vice versa. Indexing HOLD FLAPS 4 (0)? changes the title line to HOLD FLAPS 4 (0).
- The SAT - TAS line displays the current static air temperature and true airspeed as taken from the air data computer.

NOTE: Operational Program 1628428-105. An airspeed discrepancy may exist between the auto throttle glareshield panel and the CDU HOLD FLAPS 0 airspeed entry. In all cases, the auto throttle glareshield airspeed value is correct and the airplane will be controlled to this speed.

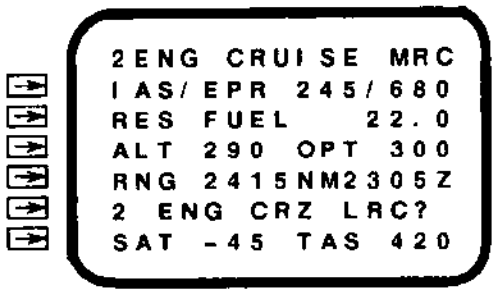


P-14

- The STEP DATA page provides advisory information associated with step climb/descent.
- The page is displayed by indexing STEP (line 4) on the CRUISE page (P-7).
- The WIND line (line 1) displays the wind used for calculating fuel saved by climbing/descending to the new altitude. The direction and velocity of the present wind is displayed unless a new wind is inserted by the pilot. A new wind can be inserted by indexing the WIND line and keying a wind direction and velocity. An asterisk on the wind line indicates a wind has been inserted by the operator. The existing wind is restored by indexing WIND and pressing the Insert key.
- The CLB line (line 2) displays the computed distance and ETA to initiation of the step climb. It is based upon the point at which airplane weight will be low enough to allow climb to the STEP ALT.
- The STEP ALT line (line 3) is the altitude to which the step calculations are made. Normally the system displays and uses an altitude of 4,000 feet above the present altitude. A new altitude can be inserted for evaluation by indexing STEP ALT and keying a new flight level.
- The FUEL SAVE line (line 4) indicates the precomputed fuel saved (or lost) in thousands of pounds by climbing/descending to the STEP ALT at the computed time.
- The NET ALT SAT line (line 5) displays the static air temperature used by the system in evaluating the new altitude. Normally the present SAT adjusted to the new altitude using a standard lapse rate is displayed. The quantity can also be inserted by indexing NEW ALT SAT and keying in a new temperature.
- The SAT-TAS line displays the current static air temperature and true airspeed as taken from the air data computer.

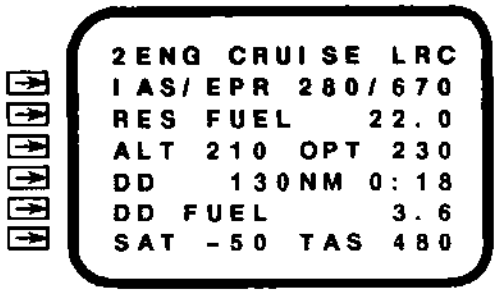
a

P-15



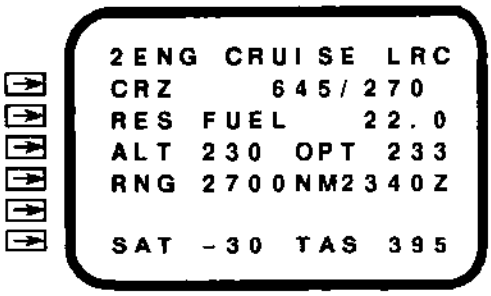
- The 2 ENG CRUISE MRC page displays information for a maximum range driftdown.
- The page is displayed by indexing 2 ENG CRZ MRC (line 5) on the CRUISE SELECT page (P-40.
- IAS/EPR (line 1) is the AFM required driftdown speed and maximum continuous thrust EPR.
- RES FUEL (line 2) is the reserve fuel quantity in thousands of pounds which the system uses in making 2 ENG CRUISE range calculations. The RES FUEL is inserted by the pilot by indexing RES FUEL. The line is zeroed when the system is initialized.
- ALT (line 3) is the altitude currently selected on the GSP, expressed as flight level. OPT is the recommended 2 engine cruise flight level, based on gross weight.
- RNG (line 4) displays the distance in NM and the GMT to the reserve fuel. The system uses present wind and computed MRC speed along the present track to determine range in ground miles.
- The 2 ENG CRZ LRC? line (line 5) allows the pilot to revert to 2 ENG LRC driftdown and control automatically transitions to LRC speed and descent thrust. This function operates one way only, i. e., from MRC to LRC. To return from LRC to MRC it is necessary to page forward to FLIGHT SETUP (P-2) and index cruise to display CRUISE SELECT page (P-4) and reselect MRC.
- The SAT - TAS line displays the current static air temperature and true airspeed as taken from the air data computer.

P-16



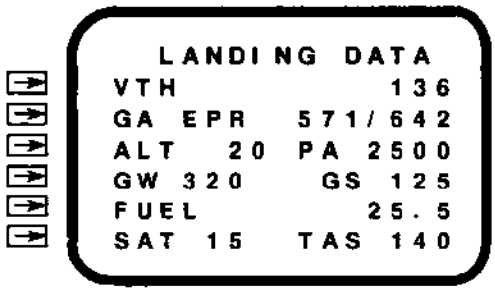
- The 2 ENG CRUISE LRC page, as shown, displays information for a long range cruise driftdown.
- The page is displayed by indexing 2 ENG CRZ LRC (line 6) on the CRUISE SELECT page (P-4).
- IAS/EPR (line 1) is the required LRC driftdown speed and thrust. If acceleration to LRC speed is required, MCT EPR will be displayed during the acceleration.
- RES FUEL (line 2) is the reserve fuel quantity in thousands of pounds which the system uses in making 2 ENG CRUISE range calculations. The reserve fuel is inserted by the pilot by indexing RES FUEL. The line is zeroed when the system is initialized.
- ALT (line 3) is the altitude currently selected on the GSP expressed as flight level. OPT is the recommended 2 engine cruise flight level based on gross weight.
- DD (line 4) and DD FUEL (line 5) display the estimated distance, time and fuel used to the selected altitude (ALT).
- The SAT-TAS line displays the current static air temperature and true airspeed as taken from the air data computer.

P-17



- The 2 ENG CRUISE LRC page, as shown, displays information for two engine long range cruise in level flight.
- The page is displayed automatically when a MRC or LRC driftdown has been accomplished and a stable altitude is captured and held by the APFDS. It is also displayed when a 2 engine cruise condition is initiated from the cruise select page (P-4).
- CRZ (line 1) displays the required LRC speed for the present gross weight and altitude. It is displayed as both Mach and IAS.
- RES FUEL (line 2) is the reserve fuel quantity in thousands of pounds which the system uses in making 2 ENG CRUISE range calculations. The reserve fuel is inserted by the pilot by indexing RES FUEL. The line is zeroed when the system is initialized.
- ALT (line 3) is the altitude currently selected on the GSP, expressed as flight level. OPT is the recommended 2 engine cruise flight level, based on gross weight.
- RNG (line 4) displays the distance in NM and the GMT to the reserve fuel. The system uses present wind and computed LRC speed along the present track to determine range in ground miles.
- (line 5) displays "BELOW NET CLG" if the airplane is 100 feet or more below the 2 engine OPT altitude (LRC).
- The SAT - TAS line displays the current static air temperature and true airspeed as taken from the air data computer.

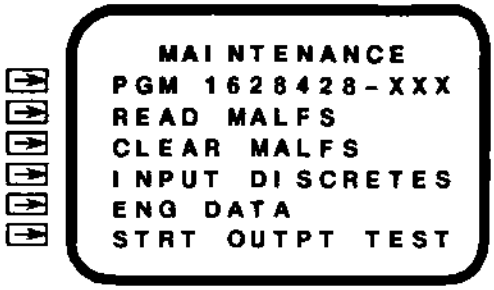
P-18



- This page displays landing data information.
- The page is displayed by pressing the PERF DATA BUTTON.
- Line 1 indicates threshold speed (1.3 V_S) for landing flaps based on the existing gross weight. The display is not corrected for wind component or gust velocity.
- Line 2 displays Go-Around EPR based on existing pressure altitude, IAS, gross weight, and total air temperature. The line displays both the standard and the two engine out GA EPR values. GA EPR is only displayed below 10,000 ft.
- ALT (line 3) is the altitude currently selected on the GSP, expressed as flight level. PA, the current pressure altitude, is displayed below 10,000 ft.
- GW (line 4) displays gross weight and is a repeat of gross weight indicated on the TAKEOFF PAGE (P-1). Gross weight can also be updated using this page by indexing this line and inserting a new weight. GS (Line 4) displays ground speed as taken from the inertial system.
- FUEL (line 5) displays fuel remaining and is a repeat of fuel data indicated on the TAKEOFF PAGE (P-1). Fuel can be updated by indexing this line and inserting a new value.
- The SAT - TAS line displays the current static air temperature and true airspeed as taken from the air data computer.

LANDING DATA

P-19



- The MAINTENANCE page is displayed on the ground by pressing the PERF DATA button and paging FWD.
- Line 1 is the identification of the PMS computer program in use.
- The remaining lines are normally for maintenance use only.

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-100/200/250/500 DIFFERENCES (BLUE PAGES)

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MAXIMUM SPEEDS 1

SYSTEM LIMITATIONS
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(OPPOSITE SIDE BLANK)

GENERAL

This section contains limitations on aircraft and systems operation pertinent to flight crew operation of the aircraft. It is not intended to include items peculiar to aircraft certification data, information peculiar to other manuals on board the aircraft, such as the Aircraft Restrictions Manual (ARM) or the Operational Data Manual (ODM).

L-1011 aircraft must be operated in compliance with Section 1, Certificate Limitations, of the L-1011 FAA Approved Airplane Flight Manual and the Minimum Equipment List (contained in the Aircraft Restrictions Manual).

MAXIMUM WEIGHTS

The weights below may be further restricted by Operating Limitations, Center of Gravity Envelope, Fuel Loading/Management Data, and other data in the ODM and ARM.

(-1) AIRCRAFT

Taxi ..... **432,000 lb**

Takeoff ..... **430,000 lb**
At takeoff weights less than 293,000 lbs, use rolling takeoff procedures.

Landing ..... ***348,000 lb**
*All Delta L-1011 aircraft are dispatched with a maximum landing weight of 348,000 lb. to all airports except Bermuda and San Juan. At Bermuda and San Juan the maximum design landing weights of 358,000 lb. applies (Type Certificate A23E). An overweight landing inspection is not required at any airport as long as actual landing weight is less than 358,000 lb.

Zero Fuel ..... **325,000 lb.**

MISCELLANEOUS LIMITATIONS

Center of Gravity
See Center of Gravity Envelope chart in the ARM Weight and Balance SP 3921.

Crosswind (Max Demonstrated) **35K**

Tailwind (Max Takeoff or Landing) **10K**

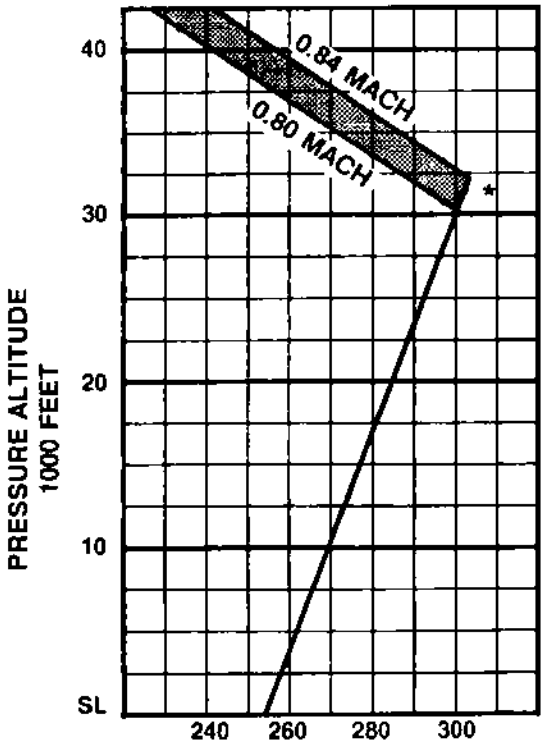
Maximum Altitude
The maximum operating altitude is 42,000 feet pressure altitude. Above FL 410 one crew member must be on oxygen at all times.

MAXIMUM SPEEDS

The maximum operating airspeeds are V_{MO}/M_{MO} as indicated by the maximum speed pointer on the airspeed indicator. Refer to Normal operating Limit Speeds Table in Flight Planning Section of the ODM.

Rough Air Speed

TARGET SPEED RANGE FOR TURBULENT AIR PENETRATION



* Target turbulence penetration speed is 255 KIAS at sea level increasing linearly to 300 KIAS at 30,000'. Above 30,000' a range of M.80-.84 applies.

CONFIGURATION DEVIATION LIST

When the aircraft is operated with a configuration deviation, it must be operated in accord with the certificate limitations as amended by the Configuration Deviation List. Refer to MEL/CDL and SP3922 in the ARM.

SYSTEM LIMITATIONS

AIRCRAFT GENERAL

Door Mounted Slide/Raft
Each door selector lever on the door control panel must be in the ENGAGE position prior to departure from the passenger loading ramp and remain in position until arrival at the unloading ramp.

After the door is closed and selector is in ENGAGE, it must be verified that the girt bar is locked in place.

Galley
Do not occupy galley during takeoff or landing.

Takeoff with an inoperative galley smoke detector system is prohibited.

Interior Doors
All interior doors shall be closed and latched for taxi, takeoff, landing, and turbulence.

Overhead Storage Compartments
Compartments must be closed except for loading and unloading.

AIR CONDITIONING/PRESSURIZATION

Differential Pressure
Takeoff and Landing (Max.) 0.15
Relief Valve Pressure (Max.) . . . . . Red Radial

ECS Packs Off
With all ECS packs off, takeoff is permitted only when airport ambient temperature is 120°F or less.

To assure adequate pre-cooling, operate 2 or more ECS packs prior to and during taxi.

If takeoff is made with ECS packs off (packs off performance), ECS must remain off until at least 400 feet AGL. Pack flow may be re-established at 400 feet AGL or when obstacle clearance is assured, whichever is higher. In no case should all ECS packs be off for more than five minutes.

Unpressurized Flight
Except for takeoff with ECS packs off, unpressurized flight is to be made with one pack operating and an outflow valve open.

APU

Engine
NG RPM – Steady State . . . . . Red Radial
NG RPM – Transient 102.5%
TGT – Start . . . . . 760°C
TGT – Maximum . . . . . Red Radial

Operation
Altitude Limit . . . . . 31,000 ft
Generator Load Limit . . . . . .
. . . . . 81 KW (54 KW above 14,000)

Air Supply
Supplying APU load compressor air and engine bleed air at the same time to a common manifold is prohibited.

AUTOFLIGHT

Regardless of autopilot status (OFF, CWS, or CMD):
- Use of flight director without pitch and roll command modes selected is prohibited.
- Use of flight director takeoff mode requires that runway heading be set in and HDG select engaged.
- The flight director must not be used as a primary speed reference for obtaining AFM performance.

COMMUNICATIONS

HF Radio
A placard will be installed next to the HF radio panel unless No. 2 engine Fuel Control Amplifier is protected for HF radio interference. When a placard is installed, position number two fuel control amplifier to OVRD while transmitting on HF to prevent loss of thrust while transmissions are being made.

ELECTRICAL

Takeoff with a generator breaker failed in the closed position is prohibited.

FLIGHT CONTROLS

Flap Extension Speeds (VFE) . . . . As Placarded

SYSTEM LIMITATIONS (CONTINUED)

FLIGHT MANAGEMENT SYSTEM

- Lateral steering must not be used beyond the top of descent if at any time during the ground set up or during the flight a route change has been made which affects the route beyond top of descent. *
- Range calculations and fuel management must not be predicated on use of FMS. Takeoff, go-around and max. continuous EPR is to be checked against published Power Charts/ODM.
- The automated navigation function of the FMS is not approved for approach.

* Due to program aberration where in a route change affecting any portion of the route after the Top of Descent (T★D), could result in erroneous lateral steering information with respect to End of Descent (E★D)

FUEL

Fuel Jettison
Flaps UP: Fuel may be jettisoned only between 180 and 300 knots with gear up or down.

Flaps DOWN: Fuel may be jettisoned with flaps extended from 4 to 22° at speeds not to exceed V_2 + 20 with gear up or down.

Fuel Temperature (All Engine Types)
Max Temp (Unrestricted by Time) . . . . . + 95°C
Max Temp During Transient Overshoot
Upon Reducing RPM (for 15 mins) . . . . + 115°C

Lateral Imbalance of Fuel Load (All Regimes of Operation)
The maximum allowable lateral imbalance of fuel between wings shall not exceed 1500 lb. This figure is to include the sum of any migrated fuel in both Tank 2L and 2R.

Fuel migration is explained in the Fuel Section of the Pilots Reference Manual (PRM).

Fuel loading and management is specified in the FUEL Section of the Pilots Reference Manual (PRM) and the ARM Fuel and Oil Service SP 3583 and Weight and Balance SP 3921.

Minimum Fuel (All Regimes of Operation)
The minimum fuel in each tank 2 compartment must not be less than the quantities shown in the ARM Weight and Balance SP 3921. There is no minimum fuel requirement for tanks 1 and 3.

HYDRAULICS

Takeoffs with the Ram Air Turbine (RAT) extended are not permitted on runways contaminated with snow or slush, or heavy rain when temperatures are below 40°F (4.5°C).

Takeoffs with the RAT extended are permitted only:

- If it is confirmed by visual inspection before each RAT extended takeoff that the RAT is not damaged and that there is no evidence of hydraulic fluid leaks; and
- If it is verified as soon as practicable after takeoff that the RAT can pressurize the B hydraulic system. (If RAT fails this verification, the aircraft must be landed as soon as practicable.)
- See Pilots Operating Manual Hydraulics Abnormal for System Operational Test.

A series of RAT extended flights, to reach a base where the RAT can be restowed, must not exceed 40 hours time in service.

POWERPLANT LIMITATIONS

EMERGENCY CONDITIONS

The published operating limits for engines relate to predefined normal and abnormal operations. If, however, any crew finds itself in a life-threatening situation which requires an application of thrust beyond the certified takeoff limits, they can feel confident that the engine(s) will operate satisfactorily for whatever reasonable time is required to maintain safe control of the aircraft.

POWER PLANT (RR RB.211-22B)

EPR Computer

The EPR computer system can be used to determine engine rating for all modes of operation. Crosschecks with the appropriate power charts are required for takeoff modes. If values differ, the power chart value must be used.

Thrust Reversers

Do not initiate takeoff with any reverser lights on.

Movement and use of reverse thrust levers to the reverse thrust position in flight is prohibited.

AVM System

- At least one channel (A or B) of the AVM system must be operative for each engine for all flight operations.
- The operative AVM channel (A or B) must be the same for all engines and must be latched.
- When both channels of the AVM system are operative, channel A must be latched. If this channel becomes inoperative (indication goes to zero) inflight, select B.
- For single or dual channel operation, the AVM filter selector must be set to the NORM position.

OIL PRESSURE (MINIMUM)

Ground Operation

Up To 70% N_3 ..... Yellow Arc*
Above 70% N_3 ..... Green Arc

In Flight

To Complete Flight ..... Yellow Arc*

* Except during large thrust reductions when 18 psi is permitted for up to 5 minutes on each occasion.

OIL TEMPERATURE

Min for Start & Relight ..... -40°C
Min Before Advancing Throttle ..... -10°C
Max (Unrestricted) ..... +100°C
Max During Transient Overshoot Upon Reducing RPM (For 15 Mins) ..... +135°C

- Stabilized oil inlet temperature in excess of + 90°C must be reported, and duration recorded for required maintenance procedures.

OPERATING LIMITATIONS (RB 211-22B)

CONDITION	TGT°C	N_1%	N_2%	N_3%	TIME LIMIT
Ground Idle**	460	21-23.3	—	—	Unrestricted
Start/Relight	550	—	—	—	Momentary; not to exceed 2 seconds
Reverse	—	101.3	—	—	30 Seconds
Max Cont	710	Red	Red	Green	Unrestricted
Takeoff	728	Green	Red	Red	5 Minutes
Acceleration	738*	—	—	—	2 Minutes
Overtemp	750	—	—	—	20 Seconds
Oversped	—	103.0	106.0	96.2	20 Seconds

* It is permitted to use 738° for 2 minutes during takeoff provided the 2 minutes is included in the takeoff time limitation.

** Ground idle RPM increased 0.5% for each 15°C and decreases 0.5% for each 15° below 15°C.

a

GENERAL

This section contains those limitations for -100/200/250/500 which are different from -1 aircraft. Unless a difference is listed in this section, the -1 aircraft limitations apply.

MAXIMUM WEIGHTS

The weights below may be further restricted by Operating Limitations, Center of Gravity Envelope, Fuel Loading/Management Data, and other data in the ODM and ARM.

(-250/-500) AIRCRAFT

Taxi	**512,000 lbs**
Brake Release Weight*	**510,000 lbs**

*(-250) Maximum brake release weight is 496,000 lbs. for takeoff with flaps in excess of 18°.

Landing	**368,000 lbs**
Zero Fuel Weight**	**338,000 lbs**

**Maximum zero fuel weight must be reduced by the weight of any fuel in tanks 1A and 3A whenever tanks 1 and 3 are not full.

(-100/200) AIRCRAFT

Taxi (-100)	**468,000 lbs**
Taxi (-200)	**476,000 lbs**
Takeoff (-100)	**466,000 lbs**
Takeoff (-200)	**474,000 lbs**
Landing	**368,000 lbs**

Zero Fuel

Maximum zero fuel weight must be reduced as takeoff weight increases. At takeoff weight of:

	ZFW
440,000 lb or Below	***338,000 lbs**
450,000 lb or Less, But More than 440,000	***330,000 lbs**
More than 450,000 lb	***320,000 lbs**

*Maximum zero fuel weight must also be reduced by the weight of any fuel in tanks 1A and 3A whenever tanks 1 and 3 are not full.

MISCELLANEOUS LIMITATIONS

C-1A Forward Cargo Door (-500)

Dual Warning Indications must be operative prior to each flight.

Crosswind (Max Demonstrated)

-100/200/250	35K
-500	30K

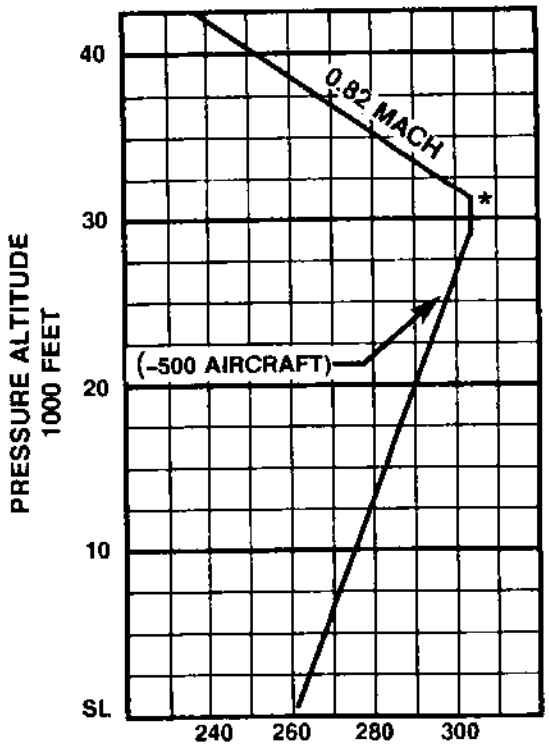
Maximum Altitude (-250/500)

The maximum operating altitude is 43,000 feet pressure altitude. Above FL 410 one crew member must be on oxygen at all times.

MAXIMUM SPEEDS

Rough Air Speed

TARGET SPEED RANGE FOR TURBULENT PENETRATION



*Target turbulence penetration speed for the -500 aircraft is 260 KIAS at sea level increasing linearly to 305 KIAS at approximately 30,000'. Above 30,000' speed is M.82.

SYSTEM LIMITATIONS

APU

Pneumatic Supply In-Flight (-500)

The APU can be used as an essential pneumatic power source up to 10,000 feet under the following conditions:

- All APU pneumatic power must be available to the ATMs.
- The APU generator must be turned off.

AUTOFLIGHT

(-500)

The flight director takeoff mode shall not be used if aircraft gross weight is less than 400,000 pounds.

The flight director must not be used for pitch guidance during an IMPROVED PERFORMANCE takeoff.

***NOTE:** For proper takeoff Flight Director configuration under the above restriction, see Flight Director and Autopilot Usage, Pg. 36, Normal Procedures Section.*

SYSTEMS LIMITATIONS (CONTINUED)

FLIGHT CONTROLS

Maneuvering Direct Lift Control (MDLC) (-500)

- Functional test is required prior to each flight.
- MDLC Inoperative Takeoff - When both channels of MDLC are inoperative:
  - Aft CG limit is 27.5% MAC.
  - DLC/AUTO SPLR switches must be latched, and;
  - DLC/AUTO SPLR circuit breakers must be in.
- MDLC Failure In Flight - If both channels of MDLC become inoperative in flight, do not exceed M.85 when CG is aft of 27.5% MAC.
- With MDLC inoperative observe MDLC Inoperative Altitude Limit. Refer to L-1011-500 ODM Abnormal Section.

G-Sensitive Stick Shaker (-500)

- Functional test is required prior to each flight.
- G-Sensitive Stick Shaker Inoperative Takeoff - When both channels are inoperative
  - The max. operating speed (Vmo) is 270 KIAS.
  - The max. operating altitude is 37,000 feet.
- G-Sensitive Stick Shaker Failure Inflight - If one or both channels become inoperative, do not exceed .85M.

Active Control System (ACS) (-500)

ACS FIRST FAIL OR SINGLE **FAIL**

Flight with **ACS FIRST FAIL** indication is prohibited beyond 72 hours time in service following initial indication of failure. Flight with one channel of ACS inoperative does not require any further limitation.

Both Channels FAIL

Flight with both channels of the Active Control System inoperative is prohibited unless the aircraft is modified in accordance with the conversion instructions specified by Lockheed Drawing No. 1628539 (aileron up-rig). Fuel burn is increased approximately 8%.

Maximum weights are unchanged except as follows:

Taxi: ..... **462,000 lbs**
Takeoff: ..... **460,000 lbs**

FLIGHT MANAGEMENT SYSTEM (-250/-500)

- FMS lateral steering must not be used beyond the Top of Descent. *
- The accuracy of the FMS has not been demonstrated, and therefore airplane range calculation and fuel management must not be predicated on its use.
- The -100/-200 FMS limitation is the same as -1 aircraft.

* Due to program aberration where in a route change affecting any portion of the route after the Top of Descent (T★D), could result in erroneous lateral steering information with respect to End of Descent (E★D).

FUEL SYSTEMS

The Limitations for the -250 fuel system and its operation are the same as the -500 aircraft.

POWERPLANT (RR RB.211-524B4)

EPR Computer (-200)

Do not use for takeoff or go-around thrust settings. When using CL or CRZ modes above 25,000', crosscheck with appropriate power chart. If values differ, the chart values must be used.

Oil Pressure (Minimum)

Ground operation

Up to 70% N3 ..... Yellow Arc*
Above 70% N3 ..... Green Arc

In Flight

To Complete Flight
Above 70% N_3 ..... Yellow Arc

To Complete Flight
Up to 70% N_3 ..... 25 PSI

*Except during large thrust reductions when 18 psi is permitted for up to 5 minutes on each occasion.

POWER PLANT (RR RB.211-524B4) (CONT'D.)

Oil Temperature

Min for Start & Relight . . . . . -50°C
Min Before Advancing the Throttle . . . . . -10°C
Max (Unrestricted) . . . . . +160°C

Slugger Valve Inoperative

If ENG ISLN VALVE is closed on an operating engine that has had the slugger system deactivated per the MEL, descend to 35,000 feet, or lower, as soon as practicable.

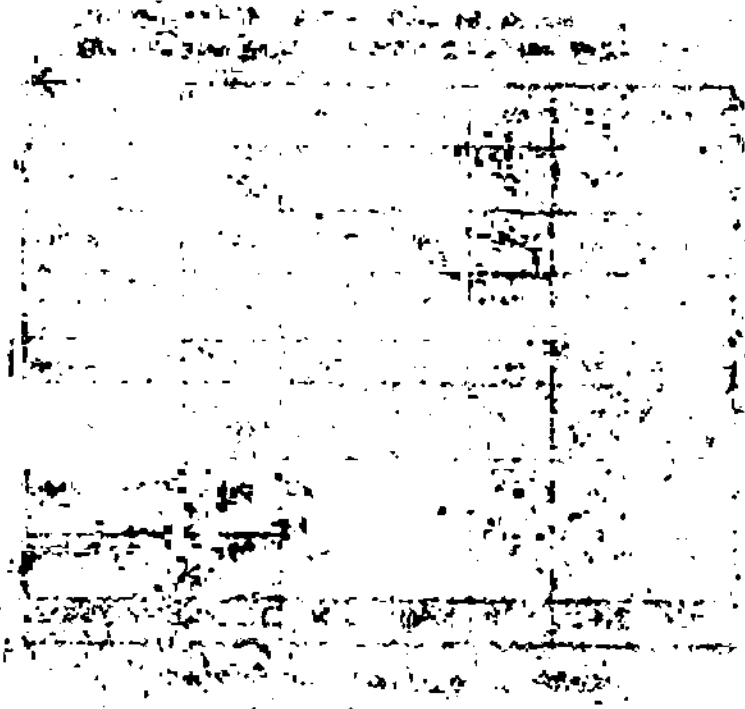
Operating Limitations (RB-211-524B4)

CONDITION	TGT°C	N_1%	N_2%	N_3%	TIME LIMIT
Ground Idle*	460	22.5-23.5	—	—	Unrestricted
Inflight/Relight	550	—	—	—	Momentary; not to exceed 2 seconds
Ground Start	600	—	—	—	Momentary; not to exceed 2 seconds
Reverse	—	90.0	—	—	60 Seconds
Max Cont	732	Red	Red	Green	Unrestricted
Takeoff	785	Green	Red	Red	5 Minutes
Overtemp	800	—	—	—	20 Seconds
Oversped	—	104.0	107.0	98.3	20 Seconds

*** Ground idle RPM increases 0.5% for each 15°C and decreases 0.5% for each 15° below 15°C.**

-END-

(OPPOSITE SIDE BLANK)



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COLD WEATHER OPERATION

The following instructions are intended to supplement the normal operating procedures and should be observed during cold weather.

EXTERIOR INSPECTION

Although removal of surface snow, ice or frost is normally a maintenance function, it is the sole responsibility of the Captain to assure that a takeoff will not be made when frost snow or ice is adhering to the wings or control surfaces of the aircraft. Be alert during preflight checks to changing weather conditions which may affect operations.

- Airplane exterior surface free of frost, ice, or snow. A light coating of frost up to 1/8 inch on the lower surfaces of the wing will not affect takeoff performance.
- APU door, air conditioning inlet and exit doors, outflow valves, landing gear doors, and control surfaces free of impacted snow and unobstructed.
- All doors, controls and other honeycomb areas should be observed for bulges caused by frozen moisture.
- The upper fuselage should be cleared of snow to prevent ingestion into number 2 engine. Check chocks are not frozen to tires or ramp. Check all protective covers removed.
- Check all engine inlets and cowling free of ice. Without exhaust duct plugs installed, ice may accumulate in the engine and seize the compressor/turbines. If de-icing fluid is used in the engine inlet, do not use bleed air for air conditioning until engine has been operated for five minutes.
- Check pitot heads clear of ice.

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COLD WEATHER OPERATION (CONT'D.)

NORMAL COLD WEATHER ENGINE START

To start **cold soaked** engines when the OAT is below 32°F (0°C). START ALL ENGINES AT THE GATE OR IN THE GATE AREA AND CONSIDER REPOSITIONING THE AIRCRAFT INTO THE WIND IF THE TAILWIND EXCEEDS 15 - 20 KNOTS.

First Engine To Be Started

Maximize APU air output by:

- Reducing electrical and pneumatic loads to as low as possible.
- Galley Power ..... OFF
- One (only) Fuel Boost Pump ..... ON
- AC Hydraulic Pumps ..... OFF
- All A/C Packs ..... OFF
  - If pneumatic pressure is below 20 PSI with START VALVE OPEN.

Select ignition to "both".

- If ignition selector is faulty, Windmill Start Switch - ON.

In addition to normal start procedures:

- **SELECT FUEL AND IGNITION SWITCH DIRECTLY TO ENRICH AT 25% N_3 OR MAXIMUM MOTORING SPEED.**
- RELEASE ENRICH when engine stabilizes.
- With extremely cold OAT's, any rise in TGT should be considered an indication of light off and the start attempt should be continued.
- ALLOW 60 SECONDS FROM FUEL FLOW INDICATION FOR LIGHT OFF TO OCCUR.

CAUTION

N_3 OVERRIDE TO BE USED ONLY FOR A FLUCTUATING N_3 INDICATOR. DO NOT USE N3 OVERRIDE ABOVE 53% N_3 BECAUSE OF POSSIBLE STARTER OVERSPEED AND/OR CRASH RE-ENGAGEMENT. (THE STARTER PAWLS PREVIOUSLY DISENGAGED RE-ENGAGE IF THE ENGINE ROLLS BACK INTO A STILL RUNNING STARTER.)

Observe the following:

- N_1/N_2 Rotation before moving FUEL AND IGNITION switch to ENRICH.
- Engine oil pressure may rise to full scale.
- The OIL FILTER PRESSURE and ENG VIB FLTR PRESS lights may illuminate.
- Oil quantity indication may drop to zero.
- A prolonged start cycle may also cause the OIL PRESS ENG light to illuminate.
- These indications are acceptable provided the indications return to normal when the engine stabilizes.
- Do not operate the engine above idle thrust until the oil quantity returns to normal and the oil temperature is above -10°C.

Let the engine stabilize at ground idle for at least 3 minutes before advancing the throttle.

If **Windmill Start** Switch was used, unlatch.

After first engine has stabilized, start remaining engines using crossbleed as follows:

- Unlatch APU Bleed Air S/O Switch.
- Latch both Crossbleed Valve Switches.
- After 3 minutes at ground idle:
  - Obtain ground clearance before advancing throttle on operating engine.
  - Advance throttle to approximately 70% N_3 to maintain 30 PSI minimum duct pressure or greater if possible.

  NOTE: Do not move throttle from this point until after the start valve is closed. Also avoid pneumatic duct pressure changes while the start valve is open. Damage to the starter can occur due to duct pressure surges.

- All engines should be stabilized at ground idle before leaving the gate area.

COLD WEATHER OPERATION (CONT'D.)

ALTERNATE COLD WEATHER ENGINE START

To be used only for cold weather starts **AFTER** first start attempt results in a hot start **AFTER STARTER CUTOUT.** Record in log book that this procedure was used. If engine hot start occurred **before starter cutout**, use NORMAL COLD WEATHER ENGINE START procedure EXCEPT DO NOT USE ENRICH.

- Other engine(s) should be operating.
- Unlatch APU Bleed Air S/O Switch.
- Latch both Crossbleed Valve Switches.
- Latch any one Pack Flow Control Switch.
  - If third attempt is required, latch two pack switches.
- Latch Hi Pressure Switch on problem engine.
  - This bleeds air to unload the compressor.
- Restart the problem engine using crossbleed air.

CAUTION

N_3 OVERRIDE TO BE USED ONLY FOR A FLUCTUATING N_3 INDICATOR. DO NOT USE N_3 OVERRIDE ABOVE 53% N_3 BECAUSE OF POSSIBLE STARTER OVERSPEED AND/OR CRASH RE-ENGAGEMENT. (THE STARTER PAWLS PREVIOUSLY DISENGAGED RE-ENGAGE IF THE ENGINE ROLLS BACK INTO A STILL RUNNING STARTER.)

- Use ENRICH.
- Maintain 30 PSI minimum duct pressure or greater, if possible.
- At 44% N_3, the following steps are taken simultaneously.
  - Push the Gnd Start Release Switch to provide a closing signal to the start valve.
  - Unlatch the **Eng Isln Valve** Switches on the **operating** engines. This action unloads the compressor by permitting bleed air from the **problem** engine to supply the air conditioning pack(s) without back pressure from the operating engine(s).
- Let engine stabilize at ground idle for at least 3 minutes before advancing throttle.
- Continue normal checklist with after initial start.
  - All engines should be stabilized at ground idle before leaving the gate area.

AFTER ENGINE START

Use minimum electrical equipment until generators have stabilized. Usually, less than one minute is required for the IDG to stabilize sufficiently.

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COLD WEATHER OPERATION (CONT'D)

ENGINE ANTI-ICE

Ground:
Use engine anti-ice when OAT is below +10°C (50°F) and visible moisture is present or wet runway exists.

If icing conditions are present, engine anti-ice should be turned ON for each engine as the engine stabilizes at ground idle at the completion of the engine start procedure.

With temperatures less than +1°C (34°F), it is recommended that engines be accelerated to 60% N_1 for one minute every 10 to 15 minutes of ground operations and before takeoff. Runup only one engine at a time. Engine indications must be stable before takeoff.

In Flight:
Use engine anti-ice when TAT is between 5°C and -15°C with visible moisture present.

- Activate engine anti-ice before penetration of icing conditions to prevent ice buildup. Turn CONTINUOUS IGNITION ON before activating engine anti-ice to protect against flameout. Continous ignition may be turned off when stable engine operation is assured.
- Ice may accumulate on the fan blades and cause high vibration indications (see Powerplant Abnormals). To prevent this:
  - Select engine anti-ice before entering any known or suspected icing conditions.
  - During descent, in icing conditions, maintain as high a thrust as practical.
  - During low thrust conditions, accelerate the engines to 90% N1 for 5 seconds at 10 minute intervals.

WING ANTI-ICE

Ground:
The wing anti-ice system is locked out (except for TEST) to prevent overheating the skin.

In Flight:
Use wing anti-ice when TAT is between +5°C and -15°C and visible moisture is present. The wing anti-ice system should not be turned ON during takeoff until the aircraft reaches 400' AGL or obstacle clearance height, whichever is greater.

CAUTION:
PRIOR TO USING WING ANTI-ICE ABOVE FL 200: SUDDEN CHANGES IN BLEED AIR DEMANDS AT HIGH ALTITUDE MAY CAUSE HI-PRESS BLEEDS TO OPEN TOO RAPIDLY AND CAUSE MULTIPLE OVERPRESSURE ~~OR HIGH FLOW~~ TRIPS WITH RESULTANT LOSS OF CABIN PRESSURE. THE FOLLOWING PROCEDURE WILL AVOID THIS CONDITION.

- Latch pneumatic CROSSBLEED switches.
- Unlatch any two HI PRESS switches.
- Latch WING ANTI-ICE switches ON .
- While observing DUCT pressure:
  - Latch HI PRESS switches one-at-a-time.
  - Allow duct pressure to stabilize prior to latching each HI PRESS switch.
  - If BLEED DUCT OV PRESS illuminates or a High Flow Trip occurs refer to Pneumatic Abnormal Procedures.

COLD WEATHER OPERATION (CONT'D)

TAXI

If taxiways are slippery, the Captain should consider starting all engines before leaving the gate. Symmetrical thrust will increase steering effectiveness, and safety should be considered before fuel conservation.

Maintain greater separation on ice, packed snow, or slush. Pieces of ice can damage airplane, ramp facilities, other airplanes, or injure personnel. Use minimum thrust necessary to initiate airplane movement. On slick taxiways, particularly in strong crosswind conditions, avoid using large nosewheel steering inputs.

Avoid taxi with the flaps extended when slush thrown up by the main gear may accumulate in the flap and slat areas. Damage could occur during retraction. If flaps are left up during taxi, completion of the Taxi and Before Takeoff checklists will be delayed until flaps are in takeoff position and the flight control checks are completed.

When operating the flaps monitor the flap position indicators for positive movement. If the flaps stop, immediately place flap lever in the indicated position.

CONTINUOUS IGNITION

Continuous ignition should be selected:

- For takeoff on runways covered by snow, dust or water.
- On climbout and approach in precipitation or turbulence.
- Before turning engine anti-ice ON.
- For all landings.

BEFORE TAKEOFF

Where startup of engine(s) has been delayed to conserve fuel, assure that the engine(s) are at stabilized idle with all parameters indicating normally before advancing throttles (see section on Cold Weather Engine Start).

If icing conditions are anticipated engine anti-ice should be ON . Check for stable engine indications before applying takeoff thrust. Do not turn wing anti-ice on until above 400 feet.

TAKEOFF

Wet snow, standing water, and ice affect takeoff performance. Slush and standing water increase drag on the landing gear. Precipitation in any form affects stopping capability.

Use NORMAL thrust on wet runways. Takeoff corrections for runways covered with slush, standing water, or wet snow are located in the ARM (SP 3922). Takeoff on runways with standing water/slush greater than $\frac{1}{2}$ inch deep is prohibited.

If a takeoff is aborted on a wet runway use maximum allowable symmetrical reverse thrust; check spoiler deployment, and apply maximum braking. Rudder is effective down to about 50 knots. With the brake pedals fully depressed and not modulated, the anti-skid system will provide the minimum distance stop for the existing condition of the runway.

CRUISE

Fuel tank temperature should remain at +3°C above the fuel freeze point. Jet A freeze point is –40°C. Jet A-1 is -55°C (available only in Europe). If fuel temperature approaches limit, decrease altitude or divert to warmer air. Increasing Mach also increases fuel temperature.

DESCENT AND APPROACH

In icing conditions, maintain highest practical RPM.

GO-AROUND/CLIMB PERFORMANCE

After flying in moderate to heavy icing conditions, and when the temperature is 46°F or less at the airport of intended landing, climb limit weight must be reduced by 30,000 lbs. to compensate for possible ice build-up on unheated surfaces.

COLD WEATHER OPERATION (CONT'D)

LANDING

Braking effectiveness is significantly reduced on wet, slush covered or icy runways.

- To obtain optimum braking.
  - Smoothly apply brake pressure.
  - Do not attempt to modulate.
  - Hold constant brake pressure until a safe taxi speed is reached.
  - Leave anti-skid ON until reaching a safe taxi speed.
- On initial brake application, the anti-skid system modulates brake pressure to determine the skid threshold. Upon detecting wheel deceleration, the anti-skid system releases sufficiently to avoid skid. Three or four releases occur in the process of determining existing runway conditions. If brake pedal pressure is changed during this period, the process will begin again. Braking effectivness during this period is reduced.
- To optimize stopping performance:
  - Avoid excessive approach speed.
  - Touchdown within 1500 feet of approach end of the runway.
  - Assure that spoilers deploy fully.
  - As soon as reverser lights indicate actuation, select maximum allowable symmetrical reverse thrust.
  - Counteract pitch-up tendency from spoilers and reversers, and lower nose-wheel to runway.
  - Apply brakes.
  - Reduce reverse thrust by 80 knots to achieve reverse idle by 70 knots. Select forward idle at normal taxi speed.

CAUTION

ENGINE DAMAGE MAY OCCUR IF THRUST IS NOT REDUCED TO REVERSE IDLE BY 60 KNOTS.

  - Avoid large or abrupt steering inputs. Be alert for any tendency toward loss of directional control.

AFTER LANDING

Carefully control taxi speed to avoid skidding, particularly when turning.

If icing conditions exist, or were encountered during approach, do not retract flaps for taxi. A visual inspection should be accomplished to determine that flaps and flap areas are clear of ice before retracting.

SHUTDOWN

In extremely cold conditions, leave side window heat on. Otherwise, observe normal shutdown procedures.

HOT WEATHER OPERATION - HUMIDITY CONTROL

GENERAL

The L-1011 Humidity Control System is designed to prevent excessive fog and condensation in the cabin. If condensation is allowed to form in the cabin overhead, there is no effective way to eliminate it. In a properly functioning air conditioning system, most condensation problems originate on the ground during too rapid cool down of a heat-soaked aircraft or when aircraft doors are open for ground servicing at high humidity stations. Overcooling the cabin can also cause fogging and condensation.

These problems can be minimized by planning ahead and paying careful attenton to humidity control procedures. If these procedures are observed and condensation problems persist, a system malfunction is indicated.

Humidity Control is generally associated with summer, but this procedure will apply most of the year in Florida and other southern stations. The Humidity Control Switch should always be ON if the airport ambient temperature is above 50°F. No special procedures are necessary as long as the air conditioning system is essentially in a heating mode. In hot weather and high humidity conditions with the system in a cooling mode, the cold duct temperatures produced can cause fog and condensation. Humidity control procedures for hot weather operation must be closely observed.

COOLING DOWN A HEAT-SOAKED AIRCRAFT ON THE GROUND

When reporting for duty in hot, high humidity situations, it is important for someone in the crew to check the aircraft cabin temperature as soon as possible after reporting. If nothing is being done to cool the aircraft, the Second Officer should check that cabin doors are closed (even L-1 until it is needed), start the APU, and begin to cool the cabin immediately. The main idea is to start the cooling process in time to get the cabin comfortable for passenger boarding, while maintaining high enough duct temperatures to prevent condensation forming. A gradual cooling process with the CABIN (FWD, MID and AFT) ZONE TEMPERATURE SELECTORS at the 12 O'CLOCK POSITION is desired.

Basic setup of the air conditioning system when cooling down a heat soaked aircraft is outlined below:

HUMIDITY CONTROL SW ..... LATCH ON

- With packs in AUTO and Humidity Control ON, ACM discharge temperatures should be approximately 2 to 3°C.

PACK AUTO/MANUAL SWITCHES ..... AUTO

PACK FLOW CONTROL SWITCHES (3) ..... LATCH (FLOWBAR)

- At least one pack flow control switch should be latched prior to opening the APU Bleed Air Shutoff Valve.

ZONE TRIM SWS ..... LATCH

ZONE TEMPERATURE SELS .... 12 O'CLOCK

- Ensure that the Cabin (FWD, MID, and AFT) ZONE TEMPERATURE SELECTORS are in the 12 o'clock (75°) positions.

APU BLEED AIR SHUTOFF VALVE ..... LATCH OPEN

APU COMPRESSOR MODE SEL ..... NORM

HOT AIR AND HOT AIR ISLN VALVE SWS LATCH (FLOWBAR)

ON THE GROUND WITH ONE CABIN DOOR OPEN FOR PASSENGER BOARDING

(Originating or through flight)

If the CABIN TEMPERATURE is too warm use the cool down procedure described above.

If the CABIN TEMPERATURE is stabilized in a comfortable range, use at least two packs when passengers are on board. The volume of air flowing through the cabin also affects passenger comfort. APU MIN MODE may be selected, but use APU NORM MODE anytime necessary. Set CABIN ZONE TEMPERATURE SELECTORS to 12 o'clock. If fog plumes are reported inthe cabin, turn the appropriate ZONE TEMP SELECTOR(S) to a slightly warmer setting.

AFTER ENGINE START (All doors closed)

After all cabin doors are closed, the probability of condensation is lessened. After initial engine start CABIN ZONE TEMPERATURE SELECTORS can be adjusted to a cooler range (72°F). Cool the cabin only as much as needed for passenger comfort.

IN FLIGHT

Delta policy is to use the Humidity Control System as necessary in flight up to 5000 feet. This would be appropriate when operating to/from airports with hot, humid conditions. During descent, it is not necessary to overcool the cabin so that it will remain comfortable on the ground. In fact, doing so may contribute to the formation of condensation. This is especially true when the aircraft doors are opened on the ground for servicing.

FLIGHT TERMINATION

(Passengers deplaned and cabin doors open for servicing)

On terminating flights (where doors will be open for servicing) it is vital that the CABIN ZONE TEMPERATURE SELECTORS be set at 12 o'clock (or warmer) positions and the APU placed in MIN mode. Many condensation problems are believed to originate during servicing, when an unlimited supply of hot, humid air enters the aircraft through doors opened for servicing the aircraft and encounters cold air at the air conditioning outlets.

MIN mode on the APU will minimize the volume of air entering the cabin. CABIN ZONE TEMP SELECTORS at 12 o'clock (or warmer) produces air with a lower relative humidity and higher temperature. If fog is observed, change the appropriate CABIN ZONE TEMP SELECTOR to a warmer setting. (Do not over-control; there is a delay in response).

The mechanic boarding a terminating flight also checks for APU MIN MODE and CABIN ZONE TEMP SELECTORS at 12 o'clock. Maintenance will be responsible for shutting down the APU on terminating flights, where Delta maintenance personnel are available.

SUMMARY

Observe the following guidelines for optimum Humidity Control System Operation:

- PLAN AHEAD to get the passenger cabin comfortable prior to boarding.
- ON THE GROUND SET CABIN ZONE TEMP SELECTORS AT 12 O'CLOCK (or warmer). For the Humidity Control System to function effectively a setting must be used that requires zone trim air to be added to the cold ACM discharge air.
- MINIMIZE OPEN TIME OF SERVICE DOORS. WHILE SERVICE DOORS ARE OPEN, USE APU MIN MODE.
- IF FOG PLUMES ARE REPORTED in the cabin, ADJUST the appropriate CABIN ZONE TEMP SELECTOR WARMER.
- MAKE DETAILED LOG BOOK WRITE-UPS of all system malfunctions and instances of condensation dripping on passengers so that appropriate maintenance action can be initiated.

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L-1011 ENGINE OPERATION IN HEAVY RAIN

Incidents in the industry have revealed that during descents in extremely heavy rain that Engine Runway/Flameout is possible. Problems have been experienced during engine deceleration in response to throttle closure.

Investigation of these incidents revealed that forward aircraft speed through heavy rain increases the concentration of water into the core engine. When the water concentration is high enough, the engine runs down and a subsequent loss of thrust occurs. The concentration of water can be significantly lowered by setting and maintaining a high enough fan speed to centrifuge water away from the core engine while passing through the area of extremely heavy rain.

During Flight Through Heavy Rain or Heavy Rain With Hail:

CONTINUOUS IGNITION . . . . . **ON**

N1 RPM . . . . . **MIN 45%**

RAPID THRUST CHANGES . . . . . **AVOID**

ENGINE PARAMETER . . . . . **MONITOR**

- It is possible that there may be fluctuations in engine parameters in particular a drop in TGT.

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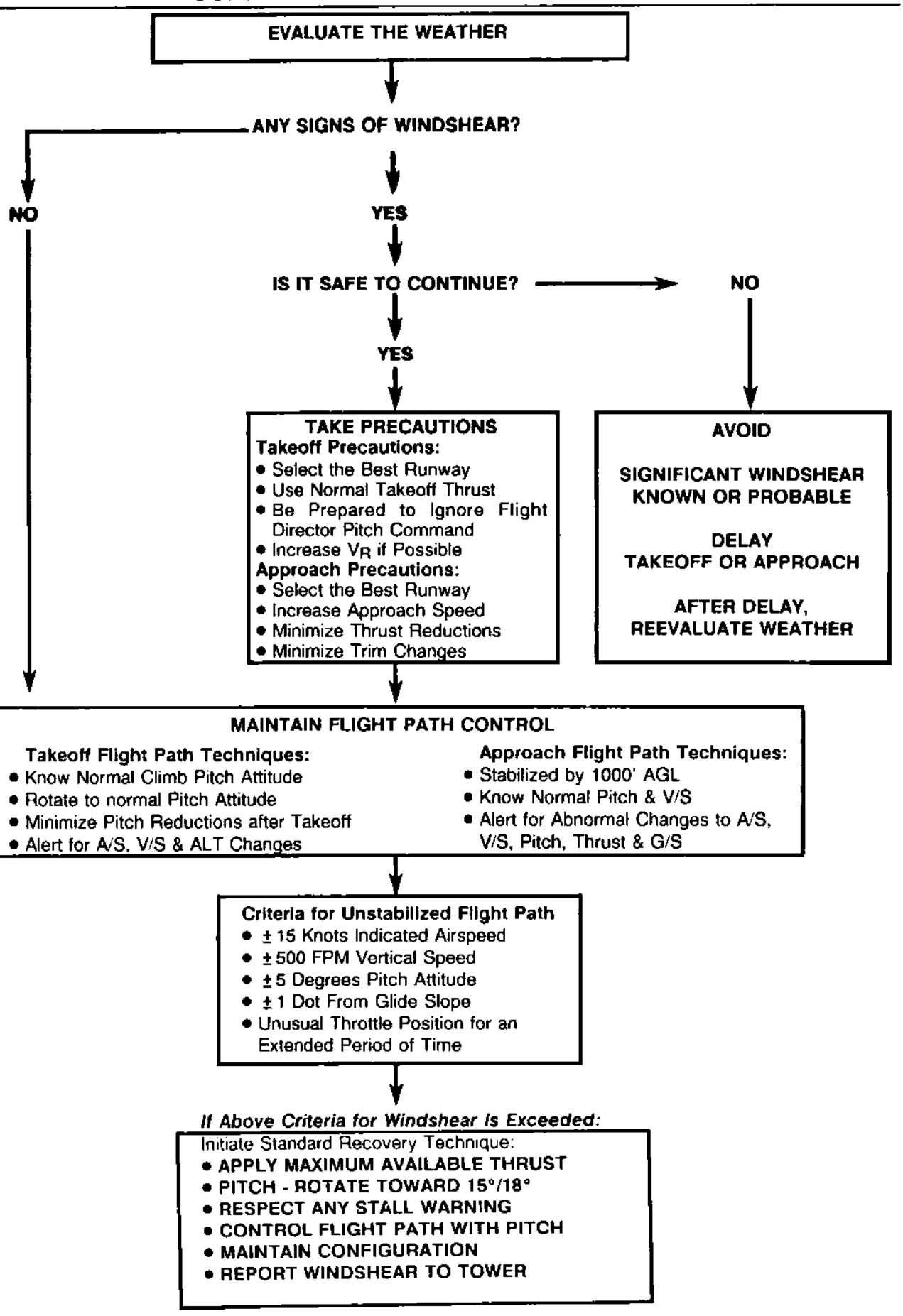
EVALUATE THE WEATHER
ANY SIGNS OF WINDSHEAR?
NO
YES
IS IT SAFE TO CONTINUE?
NO
YES
TAKE PRECAUTIONS
Takeoff Precautions:
• Select the Best Runway
• Use Normal Takeoff Thrust
• Be Prepared to Ignore Flight Director Pitch Command
• Increase V_R if Possible
Approach Precautions:
• Select the Best Runway
• Increase Approach Speed
• Minimize Thrust Reductions
• Minimize Trim Changes
AVOID
SIGNIFICANT WINDSHEAR KNOWN OR PROBABLE
DELAY TAKEOFF OR APPROACH
AFTER DELAY, REEVALUATE WEATHER
MAINTAIN FLIGHT PATH CONTROL
Takeoff Flight Path Techniques:
• Know Normal Climb Pitch Attitude
• Rotate to normal Pitch Attitude
• Minimize Pitch Reductions after Takeoff
• Alert for A/S, V/S & ALT Changes
Approach Flight Path Techniques:
• Stabilized by 1000' AGL
• Know Normal Pitch & V/S
• Alert for Abnormal Changes to A/S, V/S, Pitch, Thrust & G/S
Criteria for Unstabilized Flight Path
• ±15 Knots Indicated Airspeed
• ±500 FPM Vertical Speed
• ±5 Degrees Pitch Attitude
• ±1 Dot From Glide Slope
• Unusual Throttle Position for an Extended Period of Time
If Above Criteria for Windshear Is Exceeded:
Initiate Standard Recovery Technique:
• APPLY MAXIMUM AVAILABLE THRUST
• PITCH - ROTATE TOWARD 15°/18°
• RESPECT ANY STALL WARNING
• CONTROL FLIGHT PATH WITH PITCH
• MAINTAIN CONFIGURATION
• REPORT WINDSHEAR TO TOWER

WINDSHEAR AVOIDANCE GUIDELINES

GENERAL

Delta's guidelines in this area continue to be **AVOID SIGNIFICANT WINDSHEAR – KNOWN OR PROBABLE.**

The block diagram on the opposing page shows, in a very condensed format, how the various elements of proper windshear avoidance relate to each other.

The following discussion further explains the intent and the details of each element, however these guidelines should be viewed in their total context, not just each element separately.

EVALUATE THE WEATHER CONDITIONS

Flight crews must be aware of unfavorable weather phenomena that can precipitate windshear or indicate the presence of windshear. In order for the pilot to avoid significant windshear, it is necessary to develop a good understanding of the associated DANGER SIGNALS.

Detection is difficult if not impossible with today's technology. Except for a reliable PIREP or a LLWAS windshear alert from the tower, there is no single signal which is conclusive proof that windshear exists. Even LLWAS or a PIREP cannot accurately predict windshear for a following aircraft because in these dynamic conditions the windshear intensity can change so rapidly.

Several vastly different weather conditions are capable of producing significant windshear, but the microburst deserves the most respect. Dry microbursts are especially insidious since they are difficult to detect visually or with conventional ground or airborne radar.

DANGER SIGNALS OF WINDSHEAR

Here are some of the Danger Signals which may indicate the possibility of windshear.

- PIREP's
  - Potential windshear may be two or three times as severe as reported in the PIREP.
- LLWAS Windshear Alerts
  - LLWAS has limited accuracy in detecting the microburst.
  - LLWAS is limited to field boundary and ground level.
- Wet Thunderstorm Microburst
  - Heavy rain or lightning.
  - Any distinct rain shaft.
  - Evidence of a strong local outflow such as blowing dust, dust rings, dust devils, flailing trees, etc.
  - Clouds with a bowl-shaped underbelly appearance.
- Dry Microburst
  - Surface Temp above 75° F.
  - Dew point spread 30° to 50° F.
  - Convective activity in the area with high cloud bases.
  - Virga or scattered light rain.
  - Radar returns of weak cells between 5000' & 15,000' AGL.
- Frontal Activity with:
  - Movement of 30 knots or more.
  - Temp. Diff. 10°F or greater.
- Other Danger Signals:
  - Strong & gusty surface winds.
  - Strong sea breeze, mountain wave or temperature inversion conditions.
- Radar
  - Search above and along the takeoff and approach path to the extent possible.
  - Radar has functional and technical limitations at close range.

AVOID SIGNIFICANT WINDSHEAR – KNOWN OR PROBABLE

Some windshear cannot be flown through safely. Therefore, avoid areas with known or probable significant windshear, especially when that condition may be encountered during takeoff or approach.

Only one Danger Signal may not confirm that windshear exists, but two or more danger signals indicate an increased possibility of windshear that may affect your operation.

While not the only factor to consider, a thunderstorm or heavy rain shower normally indicates a probability of significant windshear.

Assess the weather conditions as early as possible. If significant windshear is known or probable for your planned flight path:

- Delay the takeoff until conditions improve.
- Delay the approach until conditions improve.
- If on an approach, initiate an immediate go-around.
- Enroute, detour around areas of significant windshear – known or probable.

MAINTAIN FLIGHT PATH CONTROL

The Flight Path Control Techniques, listed in the Standard Policies section of Normal Procedures, may prevent a dangerous situation from developing even if windshear is inadvertently encountered. These techniques are so important that each pilot should incorporate them into his personal operation and practice them on each takeoff and approach WHETHER OR NOT windshear is suspected.

TAKE PRECAUTIONS WHEN APPROPRIATE

When the weather conditions are unstable and there is the **possibility** of windshear but there is an **absence of evidence** that significant windshear actually does exist, the following precautions are recommended, in addition to Flight Path Control Techniques, to increase the margin of safety.

Approach Precautions During Unstable Weather Conditions

- Select the most favorable runway considering:
  - Runway length.
  - Availability of ILS or visual glide slope information.
  - Avoidance of potential windshear conditions.
  - Surface wind conditions.
- Fly the approach at Bug + 20 knots or the Speed Command, whichever is greater, down to near touchdown.
- Minimize Thrust reductions after stabilized on the approach.
- Minimize Trim changes after stabilized on the approach.
- The Autopilot may allow more monitoring during the approach but must be disengaged during a windshear recovery.
- Flight Directors can help to recognize windshear but they must be disengaged or ignored during a windshear recovery.

Takeoff Precautions During Unstable Weather Conditions

- Use Normal Takeoff Thrust
  - NOT Alternate Thrust
- Select the most favorable runway considering:
  - Takeoff performance margin
  - Avoidance of potential windshear conditions.
  - Surface wind conditions.
- Set V_1, V_R and V_2 based on Actual Takeoff Weight.
- Compute an Increased V_R based on the Runway Allowable Takeoff Weight for the runway.
  - Mentally note the Increased V_R and delay rotation.
  - Do not increase rotation speed more than 20 knots.
  - At the Increased Rotation speed make a continuous rotation at the normal rate to the normal initial climb pitch attitude.

Takeoff Go-No-Go Guidelines

Rapid airspeed changes during takeoff roll of ± 15 knots or more:

- Prior to V_1:
  - Abort unless runway remaining is clearly insufficient .
- At or after V_1:
  - Apply Max Available Thrust.
  - Begin rotation approximately 2000 ft from the end of the usable runway surface even if the airspeed is below V_R.
  - Then apply the Standard Recovery Technique below.

RECOVERY FROM AN INADVERTENT WINDSHEAR ENCOUNTER

The Standard Recovery Technique is designed to help achieve near optimal aircraft performance if the aircraft flight path becomes unstabilized in spite of good planning and proper precautions.

The following criteria for indications of an unstabilized flight path are published only as a guideline. These criteria are specifically **uncontrolled changes** (not pilot induced) from a normal takeoff, a normal climb-out or a normal stabilized approach, which could be caused by either an increasing performance windshear or a decreasing performance windshear. The pilot must evaluate all of the information available and apply his best judgment for the situation.

Criteria for Recognizing An Unstabilized Flight Path

- ± 15 kts indicated airspeed.
- ± 500 fpm vertical speed.
- ± 5 degrees pitch attitude.
- ± 1 dot from glideslope.
- Unusual throttle position for an extended period of time.

When to Initiate a Recovery

Initiate the Standard Recovery Technique when an unstabilized flight path or marginal aircraft performance is indicated by:

- Windshear below 1000' AGL.
  - Criteria exceeded for an Unstabilized Flight Path.
- Severe or Extreme Turbulence encountered below 1000' AGL.
- Stall Warning encountered:
  - Buffet or Stick Shaker.
- Ground Proximity Warning System
  - "Pull-up" Warning.

Standard Recovery Technique

When ground contact is a factor:

- APPLY MAXIMUM AVAILABLE THRUST
  - Aggressively push throttles full forward - "Firewall".
  - Disconnect Autothrottles, if engaged.
- PITCH - ROTATE TOWARD 15°/18°
  The target pitch attitude on the L-1011 is dependent upon configuration. Use 15° with Flaps 33, gear down. Use 18° for all other configurations.
  - Simultaneously with thrust application, rotate at a smooth gradual rate toward a target pitch attitude of 15°/18°.
  - Disengage Autopilot.
  - Read through Flight Director pitch commands.
- RESPECT ANY STALL WARNINGS
  - Stop rotation if stick shaker or buffet is encountered.
  - Use INTERMITTENT stick shaker as the upper control pressure limit and continue to try to move toward the target pitch.
- CONTROL FLIGHT PATH WITH PITCH
  - Use 15°/18° nose up as the target pitch attitude throughout the recovery unless ground contact becomes imminent.
  - If ground contact becomes imminent, increase pitch attitude gradually to stop the descent.
  - Continue to respect any stall warnings and retain positive control of the aircraft.
  - The pilot not flying should call out vertical speed and altitude and/or radio altitude as appropriate.
- MAINTAIN CONFIGURATION
  - Minimize gear and flap changes until ground contact is no longer a factor.
- REPORT WINDSHEAR TO TOWER
  - As soon as conditions permit, report encounter in detail.
  - Use the word PIREP to ensure that it is rebroadcast.

When ground contact is not a factor or is no longer a factor:

- Aggressive thrust application is still appropriate but;
  - Try to avoid exceeding engine limitations, if possible.
- Adjust target pitch attitude as appropriate for the conditions.
  - 5 to 10 degrees nose up is suitable at most altitudes.
  - Minimize altitude loss during acceleration.
- Appropriate configuration changes may be made as desired.
- Accelerate back to normal speed.

Recovery Considerations

If ground contact is a factor, use maximum available thrust as long as necessary to achieve a safe recovery. The crew can feel confident that the engine(s) will operate satisfactorily for what-ever reasonable time is required.

Disregard all Flight Director commands. The Flight Directors may be switched off as desired. The TO/GA mode of the Flight Directors on the L-1011 will provide a pitch command sufficient to achieve an airspeed equal to 1.25 Vs. Be aware that this pitch may be insufficient to provide a recovery.

Proper energy management is the key to a successful recovery. The 15°/18° target pitch is a calculated balance between consuming all available energy too early and a lower pitch attitude which may result in excessive altitude loss. In these dynamic and possibly violent air mass conditions the objectives are to keep the aircraft airborne and under positive control as long as possible, thus improving the chances of re-entering a more stable air mass.

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TURBULENCE

Avoid flight through severe turbulence whenever possible. When flying at 30,000 ft. or higher, it is not advisable to attempt to climb over the trubulent area unless it is obvious that it can be overflown well in the clear.

Before entering areas of known turbulence or upon encountering unexpected turbulence:

- Be prepared. Check autopilot, instruments, radar, lights pitot heat, ignition, anti-icing, seat belts and shoulder harness. Alert Flight Attendants and secure loose items in the cockpit.
- Determine the best penetration altitude, preferably below the 1.5G aerodynamic ceiling (see ODM). If possible, avoid altitudes greater than that value.
- Make an initial thrust setting of approximately 88% N1, depending upon gross weight and altitude (see Buffet Boundary Speeds, ODM). This should provide the proper target penetration speed as presented in the graph in Limitations Section, POM.
- If airspeed is greater than 300 knots, reduce to 300, regardless of Mach number.
- If airspeed is below 255 knots, do not reduce speed if Mach is within target range.
- If airspeed and Mach are less than the minimum target values, increase speed until the first target is attained.
- Turn on continuous ignition.
- Engage autopilot in any mode except altitude hold. If moderate to severe turbulence is encountered, use TURB mode to reduce autopilot response rate.
- If severe turbulence is encountered, make trurst changes only if necessary to maintain target attitude. Do not make large or rapid thrust chances.
- Maintain wings level and fly the attitude indicator.
  - Don't chase airspeed or altitude.
- If thunderstorm conditions are encountered, detour the area if possible. When early evasive action is not practical, apply the following suggested minimum clearance destances to avoid areas where sharp changes in rainfall intensity are indicated.
  - Below 10,000', avoid areas by at least five miles.
  - Between 10,000–20,000 ft., avoid areas by ten to fifteen miles.
  - Above 20,000 ft., avoid areas by at least twenty miles.

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NON-MAINTENANCE STATION OPERATIONS

A list of non-maintenance stations is on the Communications Card. If uncertain of a particular station's status, ask the agent meeting the flight.

OIL SERVICING

The Captain of an arriving flight at a nonmaintenance station will notify the Stations Agent meeting the flight and make an entry in the AIRCRAFT LOG BOOK if oil servicing is required. The minimum recommended oil quantity for dispatch of the L-1011 is 14 quarts for domestic flights and 21 quarts for international flights. The oil quantity gauge is valid if it is checked within 30 minutes of shutdown. If oil servicing is required, the following log book entry must be made:

"#_____engine needs_____quarts of oil."

The oil servicing will be performed by a trained Stations Agent and the required entry made in the log book that the oil servicing has been accomplished. If oil servicing is not required, no log book entry will be made. It is the responsibility of the Flight Crew to check the oil quantity gauges to determine that oil is serviced to the recommended quantity before dispatch. If the Flight Crew is uncertain as to the oil quantity because of oil draining to the sump after engine shutdown, the engine may be motored or operated to determine the oil quantity. Oil servicing instructions are contained in SP 3583 "L-1011 Fuel and Oil Servicing." This SP is in the ARMS onboard each aircraft.

AIRCRAFT CONFIGURATION

When an aircraft is to be on the ground for more than one hour at a non-maintenance station, configure the aircraft for Ground Service Bus operation. Complete the entire SHUTDOWN Checklist. Ensure that all drains on the aircraft battery are turned OFF – including the Emergency Lighting, Master Radio Switches, Battery Switch and APU Master Power Switch (unless Stations personnel desire to utilize the APU and are familiar with APU shutdown procedures. Place the GND SERVICE Switch in the EXT PWR (or APU) position. Pull the required color coded circuit breakers.

TOWING

When Flight Crew assistance is needed for towing, Stations will make every effort to accomplish this during the normal crew duty time of 30 minutes after arrival or one hour prior to departure. If a Flight Crew Member is required for towing operation, he must be qualified on the aircraft.

APPROACH TO STALL
(AIRCRAFT TRAINING AND TEST ONLY)

These maneuvers are performed to familiarize the pilot with stall warnings and desired recovery techniques. Approaches to stall are performed in the following configurations:

- Clean Configuration - gear and flaps up.
- Departure Configuration - gear up, flaps 10°, 15 to 20° bank.
- Landing Configuration - gear down, flaps 33.

General

- Altitude; not less than 10,000' AGL.
- Continuous Ignition - **ON**.
- Reduce thrust and decelerate in level flight or slight climb.
- At first recognition of approach to stall, but not later than 10 KIAS above charted stall speed in the ODM:
  - Advance the throttles and call for "Max Power" (for training use 90% N_1).
  - Smoothly reduce pitch to approximately 10° ANU.

    NOTE: Lowering the nose below 10° ANU will normally cause a greater loss of altitude and not effect as desirable a recovery.

  - Maintain wings level, or if in a bank, level wings. Maintain lateral control with ailerons **do not use rudder.**

    NOTE: A premature or abrupt increase in pitch can cause a secondary stall buffet which may be more severe than the original buffet.

INITIAL CONDITIONS					APPROACHING THE STALL	
FLAPS	GEAR	TRIM SPEED	BANK ANGLE	% N_1	ANTICIPATED STICK SHAKER	APPROXIMATE PITCH
0°	UP	BUG + 60	0°	60	BUG + 15	15°
10°	UP	BUG + 30	15/20°	60	BUG – 15	20°
33°	DOWN	BUG	0°	60	BUG – 25	20°

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APPROACH TO STALL (CONT'D)

Clean Configuration

- Entry:
  - Set Bugs at V_{REF}.
  - Final trim speed will be V_{REF} + 60 KIAS.
  - Set thrust at 60% N1.
  - Maintain level flight or a slight rate of climb. Do not allow the aircraft to sink.
- Recovery:
  - Advance throttles and call for "Max Power".
  - Smoothly reduce pitch to approximately 10° ANU.
  - Maintain wings level.
  - As airspeed increases through Bug + 40 (20 knots below final trim speed) smoothly increase pitch to begin slowing sink rate while allowing the airspeed to continue increasing to V_{REF} + 60 and level flight (See lasgt note under General).

Departure Configuration

- Entry:
  - Set bugs at V_{REF}.
  - Final trim speed will be Bug + 30.
  - Flaps 10°.
  - Establish a 20 degree bank.
  - Set thrust at 60% N_1.
  - Maintain level flight or a slight rate of climb. Do not allow the aircraft to sink.
- Recovery:
  - Advance throttles and call for "Max Power".
  - Smoothly reduce pitch to approximately 10° ANU while simultaneously leveling the wings.
  - Maintain wings level.
  - As the airspeed increases to V_{REF}, smoothly increase pitch to begin slowing sink rate while allowing the airspeed to continue increasing to V_{REF} + 30 and level flight (See last note under General).

Landing Configuration

- Entry:
  - Set Bugs at V_{REF}.
  - Final trim speed will be bug speed.
  - Gear DOWN - Flaps 33°.
  - Set thrust at 60% N_1.
  - Maintain level flight or a slight rate of climb. Do not allow the aircraft to sink.
- Recovery:
  - Advance throttles and call for "Max Power".
  - Smoothly reduce pitch to approximately 10° ANU.
  - Maintain wings level.
  - As the airspeed increases to Bug, smoothly increase pitch to stop sink rate and maintain level flight (see last note under General).

Stalls Above 20,000' (for information only)

The recovery for stalls encountered above 20,000' is slightly different.

- If a stall occurs above 20,000' MSL:
  - Advance throttles and call for "Max Power" while simultaneously lowering the nose to slightly below the horizon.
  - Maintain wings level.
  - As the airspeed increses through V_{REF} + 60 (minimum clean speed) begin to increase pitch to stop sink rate and return to normal flight regime.

NOTE: Be especially cautious not to be premature or abrupt in increasing pitch as this can cause a severe secondary stall buffet.

FLIGHT CREW BULLETIN

APPLICABLE TO: L-1011
NUMBER: 86-3
DATE: 3-12-86

SUBJECT: DOOR OPEN LIGHT DURING TAKEOFF

BACKGROUND

Should the Pilot's Annunciator Panel **DOOR OPEN** light illuminate during the takeoff roll, it is **not absolutely** necessary to reject the takeoff. Door light problems are most likely caused by misaligned proximity switches or no pack takeoffs when doors are not expanded to their outward limits (especially on a rough runway).

PROCEDURE

Check all door lights are extinguished following engine start, during taxi out and prior to takeoff.

Should the **DOOR OPEN** *light illuminate during the takeoff roll and . . . . . .*

a pack was on for takeoff, do not turn on additional packs. Follow the DOOR OPEN ABNORMAL Procedure. See AIRCRAFT GENERAL.

Or if packs were off for takeoff, turn on only one pack after takeoff. Check light extinguished. Should the door light remain illuminated with one pack operating, **do not** continue pressurizing the aircraft and land as soon as possible.

NOTE: In all cases of known company L-1011 rejected takeoffs for* DOOR OPEN *light illumination, the doors were actually found closed and locked.

Gene Vieh
L-1011 Program Manager

Published by Flight Operations Dept. - Delta Air Lines

FLIGHT CREW
BULLETIN

APPLICABLE TO: L-1011
NUMBER: 86-7
DATE: 9-2-86

SUBJECT: L-1011 TAXI & T/O RESTRICTIONS LGA

REMOVE & DESTROY FCB 86-5
DATED 5-6-86

NOTE: FCB was revised to update information under WEIGHT DATA RECORD.

GENERAL

Normal takeoff operations of the L-1011 at LaGuardia airport are conducted with 10° flaps. However, in addition to the normal runway allowable and climb limit weights, ALL TAXI AND TAKEOFF OPERATIONS USING FLAPS 10 MUST COMPLY WITH THE PAVEMENT LOADING LIMITATIONS depicted in the applicable Weight and Balance Standard Practice. This chart (based on New York Port Authority criteria) gives the maximum weight and center of gravity combinations allowed on runway and taxiway areas extending on piers over the water. The normal weight versus CG limitations depicted in the Weight and Balance Standard Practice must still be observed, since some portions of the pier loading chart lie outside of the normal weight / CG envelope.

FLAPS 18

Increased payloads can be accommodated if operations are conducted WITHOUT use of runway and taxiway areas extending over the piers. AN 18 DEGREE FLAP TAKEOFF ON RUNWAY 4 OR 31 PROVIDES THE PERFORMANCE NECESSARY TO TAKEOFF OR ABORT PRIOR TO REACHING THE PIER AREA.For these operations the pavement loading restrictions do not apply, because the aircraft will not use the pier area for taxi, takeoff, or an abort. The 18 degree flap performance figures incorporate an unbalanced field length analysis using clearway to accomplish this.

WEIGHT DATA RECORD

Effective the middle of September, a normal AWABS II Weight Data record will be provided for Flaps 10 or 18 takeoffs. The presence of Flaps 18 performance figures does not necessarily mean that a Flaps 18 takeoff is required. However, if the aircraft weight/CG falls outside the pier loading restrictions for Flaps 10, the AWABS II Weight Data Record will be transmitted without data under the middle third FLAPS 10 columns. Instead the term "OVERWEIGHT" will be displayed. Also, when this occurs the phrase "C.G. OUT OF RANGE" will appear just to the right of the THRUST/FLAP designator.

USE OF RWY 4 OR 31

In some instances runways 4 or 31 may not be available or desired (delays, wind, field conditions, etc.) when an 18 degree flap takeoff is anticipated. Then, either the aircraft gross weight must be reduced and/or the center of gravity shifted forward to comply with LGA pier loading restrictions contained in the Weight and Balance Standard Practice. It is recommended that you plan ahead. Consult with the load planner and Flight Control, if problems are anticipated.

FLAPS 18 PROCEDURES

A takeoff utilizing flaps 18 degrees on runways 4 or 31 may be conducted provided the following conditions are met:

GROUND

- Anti-skid system must be operative
- All three thrust reversers must be operative, if the runway is wet.
- Determine 18 degree flap V-speeds from the ODM or Airport Restrictions salmon colored LGA pages.
- If normal power "packs off" performance is required, adjust EPR and turn air conditioning packs "OFF" prior to takeoff.
- If the takeoff is aborted and the aircraft comes to a stop on the runway pier (beyond intersecting runway), THE AIRCRAFT MUST NOT TAXI FURTHER OUT ON THE PIER. Maintenance must be called to tow the aircraft off the pier, or a 180° turn made to return to the land portion of the runway. CAUTION: If a 180° turn is to be attempted, use a wing walker to assure landing gear clearance (L-1011-1/-100/-200 turn radius is 142', and the runway width is 150'!).

AFTER TAKEOFF

- After takeoff, retract flaps from 18 to 10 at V_2 + 10 (Minimum) and not lower than 400' AGL or clear of obstacles.
- Retract flaps from 10 to 4 at V2 + 20 (minimum) at 1000' AGL, and continue with climb schedule.

SECOND OFFICERS

- The following steps provide a guide for Second Officers, where confirmation of LGA taxi/takeoff performance is desired:

  - Check the actual takeoff weight and center of gravity for possible pier loading restrictions depicted in the Weight and Balance Standard Practice on board the aircraft.If the actual takeoff weight and center of gravity are within the limits depicted, operate the aircraft normally.

  - If the actual takeoff weight and center of gravity are outside the allowable LGA pavement loading restrictions, the PIER MUST NOT BE USED. Taxi on the pier is prohibited and a 10 degree takeoff may not be made.

  - While in the weight and balance section of the ARM, check the normal loading envelope to assure that the aircraft is within its normal limits.

  - If the pier cannot be used:
    (a) Conditions permitting, choose either runway 4 or 31 for an 18 degree flap departure (a 10 degree flap takeoff is not authorized)

    Using 18 degree flap numbers, confirm that the actual takeoff weight is less than the computed maximum allowable takeoff weight for that runway.

    Use 18 degree flap V-speeds.

    Remember that the anti-skid system must be operative and if the runway is wet all three thrust reversers must be operative.

    (b) If runway 4 or 31 is not acceptable, the aircraft weight and/or center of gravity must be adjusted to comply with the weight and center of gravity limits in the LGA pavement loading restrictions chart.

  - If the flight is dispatched with new numbers,repeat the above steps.

STANDARD PRACTICES

For your information the Pavement Loading Restrictions at LaGuardia are found in the following locations:

L-1011-1	Weight & Balance SP3921.11
L-1011-100	Weight & Balance SP3925.11
L-1011-200	Weight & Balance SP3930.11
L-1011-500	Weight & Balance SP3935.11

Only the applicable Weight and Balance Standard Practice should be on the aircraft.

Milton McKnight
L-1011 Program Manager

FLIGHT CREW
BULLETIN

APPLICABLE TO: L-1011
NUMBER: 86-9
DATE: 10-6-86

SUBJECT: LANDING GEAR OPERATION

BACKGROUND INFORMATION

The purpose of this bulletin is to emphasize the AFTER TAKEOFF checklist item.

GEAR . . . . . UP/NEUTRAL

Delta has experienced several cracked main gear shock strut cylinders at the retract actuator attach point. The cause has been determined as stress corrosion cracking. With the gear and gear handle up, the actuator attach points are subjected to very high tension stresses, since the total weight of the gear is being held by the actuator. Therefore, there is a need to limit the exposure to the stress by minimizing the time the gear handle is in the up position.

PROCEDURE

AFTER TAKEOFF and GEAR UP, place the gear handle to NEUTRAL as soon as practical.

BEFORE LANDING, **DO NO**T place gear handle to UP until ready to extend gear.

Milton McKnight
L-1011 Program Manager

FLIGHT CREW
BULLETIN

APPLICABLE TO: L-1011
NUMBER: 86-10
DATE: 10-23-86

SUBJECT: SHIP 724 - OPERATING AS L-1011-100 (WITH OR WITHOUT AN ENGINE INTERMIX CONDITION

REMOVE AND DESTROY FCB 86-6 DATED 9-4-86

Ship 724 can operate as an L-1011-100 aircraft with or without an engine intermix. For the engine intermix operation one or more RB211-22B engines will be installed. The exact engine position will be specified in the Flight Plan REMARKS section. This configuration makes Ship 724 a -100 airplane, requiring all performance data to be based on -22B thrust.

As long as the pink placard (identifying the airplane as a -100 is installed, the following applies:

- DO NOT USE the EPR computer unless all engines are RB211-22B.
- Use the pink TAKEOFF and LANDING chart dated 3-21-86. Use the L-1011-100 ODM for V speeds.
- Use 10 flaps and only NORMAL thrust for takeoff. ALLOWABLE takeoff weights are normally based on PACK ON. Reduce chart EPR by .010 for PACK ON operations.
- Use blue L-1011-100/-200/-500 Second Officer's and Pilot's Checklists.
- Throttle stagger will occur during intermix operation. Do not use the autothrottles.
- The REMARKS on each Flight Plan for Ship 724 will carry a text similar to the following whenever engine intermix is in effect:
  - RB211-22B engine in no. _____ position.
  - Asymmetric or symmetric inlets installed (as appropriate).
- LGA operations - When necessary to use 18 degrees flap for takeoff, refer to SP3926 ARM LGA pink pages for V speeds.
- Refer to blue or white pages in the L-1011 POM AS APPROPRIATE.
- L-1011 TAKEOFF and LANDING weight limitations are to be observed while in domestic operation. Use L-1011-1 Weight and Balance SP3921 found in onboard binder entitled, Ship 724 as L-1011-100 (Domestic). ***Do not*** use L-1011-1-- SP3925.
- Use allowable weights contained in SP3926 L-1011-100 Airport Restrictions.
- If actual takeoff weight is less than 280,000 lbs., make VMCG and VMCA corrections in SP481 (ARM'S manual).
- Ship 724 without INS or ONS will not be operated to BDA.

Milton McKnight
L-1011 Program Manager

FLIGHT CREW BULLETIN

DELTA

APPLICABLE TO: L-1011
NUMBER: 88-7
DATE: 4-15-88
PAGE: 1 of 1

SUBJECT: L-1011 HYDRAULIC SERVICE CENTER OVERHEAT INCIDENT – MODIFIED INTERIM ENGINE START PROCEDURES

REMOVE AND DESTROY FCB 88-6

One L-1011 operator has reported the following incident involving a fire in an aircraft's hydraulic service center.

The aircraft was at the gate undergoing normal preflight checks with the APU providing electrical power. Both AC hydraulic pumps were operating.

During a walk-around inspection, the Second Officer observed smoke coming from the left hand wheel well area. At about the same time, crew members in the flight station noted an intermittent wheel well fire warning on "B" loop. All electrical power was shut down. Hydraulic fluid was observed leaking from the Hydraulic Service Center.

During investigation, it was noted that the C system Hydraulic motor pump electrical connector shell was severely overheated and there was a hole burnt through the connector shell and the AC motor pump connector. Additionally, there was fire damage to the Lav waste duct. There was lesser overheat damage to the DLC servo, servo wiring and flap PDU right hand switch can.

It is suspected that a stream of pressured hydraulic fluid mist was emitted from the burn-through on the AC pump motor and subsequently ignited by an arcing power lead. The hydraulic fluid fire discontinued when the source of ignition was removed.

A modification is currently underway that involves the installation of a ground fault protection system on each AC hydraulic pump. Until corrective action is completed, Both AC pumps will be deactivated by collaring their circuit breakers (2L12,2L22). A placard will be affixed adjacent to the pump switches.

INTERIM OPERATING PROCEDURES – BOTH AC PUMPS DEACTIVATED

The MEL allows operation without either AC pump, if those components are properly placarded as inoperative. During the period of flight operations under this condition, utilize the following procedures.

ON THE GROUND

Preflight

In lieu of using the AC pumps during the Hydraulic system and Autoflight panel checks, use ATM's to pressurize systems B and C.

CAUTION:

OBTAIN CLEARANCE FROM GROUND PERSONNEL PRIOR TO STARTING ATM'S WHILE PARKED AT THE GATE.

If necessary, the checks can be delayed until just prior to pushback.

Pushback

In order to assure B system hydraulic pressure during aircraft movement, **INITIATE** the start of Engine No. 2 at pushback. Engine spin-up will assure B system pressure sufficient to provide positive braking, should the need arise.

In the event of an aborted start, the B system brake accumulator will provide pressure for emergency braking, if required.

INFLIGHT

The AC hydraulic pumps may be activated inflight only when, in the judgement of the crew, an abnormal situation exists that so warrants their use.

Milt McKnight
L-1011 Program Manager

CURRENT FLIGHT CREW BULLETINS (DOMESTIC)

84-4	86-7	86-10	88-1	88-3	88-5
86-3	86-9	87-1	88-2	88-4	

All other DOMESTIC FLIGHT CREW BULLETINS cancelled.

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FLIGHT CREW BULLETIN

DELTA

APPLICABLE TO: L-1011
NUMBER: 88-8
DATE: 5-27-88

SUBJECT: L-1011-500 SHIPS 759 - 762 (FORMER UAL) DIFFERENCES

The following list is a synopsis of the known cockpit differences of Ships 759 - 762 and are only briefly described on the first pages of this bulletin but will reference the page number(s) of the attached pages which address in detail the system differences and identify them by hashmarks in the margins. For that reason this bulletin will only address those differences which affect procedure or crew duties and provide a list of the differences in logical order of importance.

QUALIFICATION

No Captain or First Officer may perform duties as a crewmember on these aircraft without first having:

- Comprehensively read this bulletin
- Viewed the video on the Digital Autoflight system and
- Signed and returned the attached form to your Chief Pilot in verification of the aforegoing.

For the first few months of operation these aircraft are intended to support only the Pacific Operations and the ATL - PDX -ATL segments. Therefore, the exposure of these aircraft will be somewhat limited. However, this will not be the case always, necessitating that each L-1011 pilot qualify himself with the above noted steps.

DIFFERENCES

LIMITATIONS

- These aircraft are CAT IIIa, 700RVR, 50'AH limited.
- Max Gross Weight of these aircraft is 506,000 lbs. for TAXI, 504,000 lbs. for TAKEOFF. ***NOTE: Approval for 512,000 lbs. taxi and 510,000 lbs. T/O is pending; crews will be notified by TWX upon approval.***
- The accuracy of the Performance Management System (PMS) has not been demonstrated and therefore, airplane range calculations and fuel management cannot be predicated on its use.

AUTOFLIGHT SYSTEM
(Differences Pages 1 -20
Normal Operation pgs.17 - 20)

- All displays are digital
- MODE switchlights are arranged differently
- MODE selection of MACH Hold is functional but should not be used
- BC MODE selection is deactivated
- ILS switchlight corresponds to A/L selection on our aircraft. However, there is no "A/L ARM" annunciation. If ILS is selected and both Radio Altimeters have failed, the AFCS MODE Panel will annunciate APPROACH indicating Autoland is not available.
  NOTE: CAT I minimums apply when approach is annunciated.
- INS MODE selection couples INS #1 OR #2 to APFDS.
- VOR MODE selection arms APFDS for capture and tracking of VOR course.
- There is no SYNC position for the flight director switches.
- Both autopilots will remain engaged during an auto go-around until a new PITCH Mode is selected; then the last engage will drop off.

Autothrottle Modes (See Page 8)

- The basic autothrottle (AT) is not compatible with either autothrottle thrust management (TM) or the APFDS IAS mode. Engaging one will trip the other OFF.
- Selecting thrust management (TM) removes the ATS from the speed command system and places it under control of the Performance Management System (PMS).

Altitude Select (See Page 13)

- ALTITUDE select mode is in effect when either autopilot or or either flight director is in use **except when in TO/GA mode.**

  The system is armed whenever an altitude selection is made on the ALTITUDE Panel. An ALT ARM legend appears in the AFCS MODES Annunciator and will remain displayed until the selected altitude is captured. Should TO/GA be selected, the ALT ARM legend will be removed and automatic altitude capture will not occur.

AFCS WARNING Panel

- If the SPLIT legend is displayed at any time turning both flight director switches OFF, disengaging the autothrottles, and disengaging autopilot(s) may clear it.
- If the SPLIT annunciation cannot be cleared **the use of either autopilot is prohibited unless the faulty autopilot can be determined by other indications or FIDDS.**

APFDS FIRST FAIL Light Illuminated

- Disengage both autopilots and flight directors, turn ON both flight directors, then reengage autopilot(s). If the light remains illuminated - Dual Autoland is not available.

DELTA

FLIGHT INSTRUMENTS

HSI (See pgs 21 - 26)
- With the RADIO/INS switch in INS, the HSI will display only TRACK information. TRACK appears over the lubber line and INS in the COURSE POINTER WINDOW. See page 22.

Instrument Source Select
- There is no provision at this time for ALTN NAV selection. The first pilot to select FLT DIR, IAS/M, ALT/VSI or HDG, disarms the other pilot's switchlight.

ILS Cruise Monitor light
- Whenever this light illuminates on the VHF NAV panel, an ILS receiver has failed and Dual Autoland is not available.

Flight Recorder (See page 26)
This system requires a FIDDS (Fault Isolation Data Display System) computer. The flight recorder data; date, flight, etc., is entered into this computer before each flight.
- The DOCUMENTARY ENTRY mode is used by the S/O to enter the flight number and date information into FIDDS' computer memory. These data are used later for fault information displays in the FLIGHT DATA RECALL mode.

Clocks (See pgs 24 and 25)
- Electronic digital chronometer clocks are installed.

Performance Management System
(See Pages 27 - 39)
- Provides display of performance data for various phases of flight and inputs for coupling to the autopilot and autothrottle system.
- See Operating Guide on pages 39 and 40.

Ground Proximity Warning System
(See pgs 41 and 42)
- The warning consists of two flashing red lights and voice warnings. The system can only be deactivated by puling C/B's 1B1 and 1B2.

NAVIGATION

INS
- Three INS Units are installed. There is no FMS. Tripple Mix is available. Nav information from the #3 INS cannot be displayed on HSI's. Neither can it be coupled to the APFDS.
- The INS programs are not compatible with our other aircraft. This is because the Delta program would not drive the digital HSI's. Therefore when when checking the program you will see 25 11 instead of 25 04. The 25 11 program is only required for the #1 and #2 positions. The #3 can use either program.
- **Do not select a PI of 2 since this is requesting the unit to receive OMEGA updating. A flashing 2 will result.**
- A single panel dual head ADF is installed.

COMMUNICATIONS
- A third VHF COM radio is not installed.
- The HF radio is a single panel dual head type.
- The Cabin Interphone panel is arranged differently, yet functionally the same. So is the MIC SELECT panel.
- The Control Wheel Mic switch is located on the forward side of the yoke under the index finger.

MISCELLANEOUS
- The Rudder Pedal Steering switch is not installed.
- No Bulk Cargo Door.
- Potable Water Indicators installed on S/O panel.
- Weather Radar may be any combination of color and non-color.
- The standby altimeter can only be set in millibars.
- The CALSEL switch on the SELCAL panel is active.
- The S/O chair can be electrically operated.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS (GREEN)

84-4	86-7	86-10	88-1	88-3	88-5	88-7
86-3	86-9	87-1	88-2	88-4	88-6	

All other GREEN FLIGHT CREW BULLETINS cancelled.

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GENERAL

The autoflight system combines the autopilot and flight director functions into an integrated autopilot flight director system (APFDS). There are two APFDS systems, No. 1 and No.2. Each system has two independent computation channels for monitoring purposes. A single mode selector panel is used, therefore both autopilots and both flight directors are always in the same mode. Each autopilot and each flight director can be engaged separately. The No. 1 INS (INS-1) platform provides attitude information to APFDS-1; No. 2 INS (INS-2) platform provides attitude information to APFDS-2. *INS* -3 is used by both systems for pitch and roll comparison. The system also includes the:

- Autothrottle system (ATS).
- Thrust Management (TM) system, which is part of the performance management system (PMS).
- Stabilizer trim.
- Fault Isolation Data Display System (FIDDS).

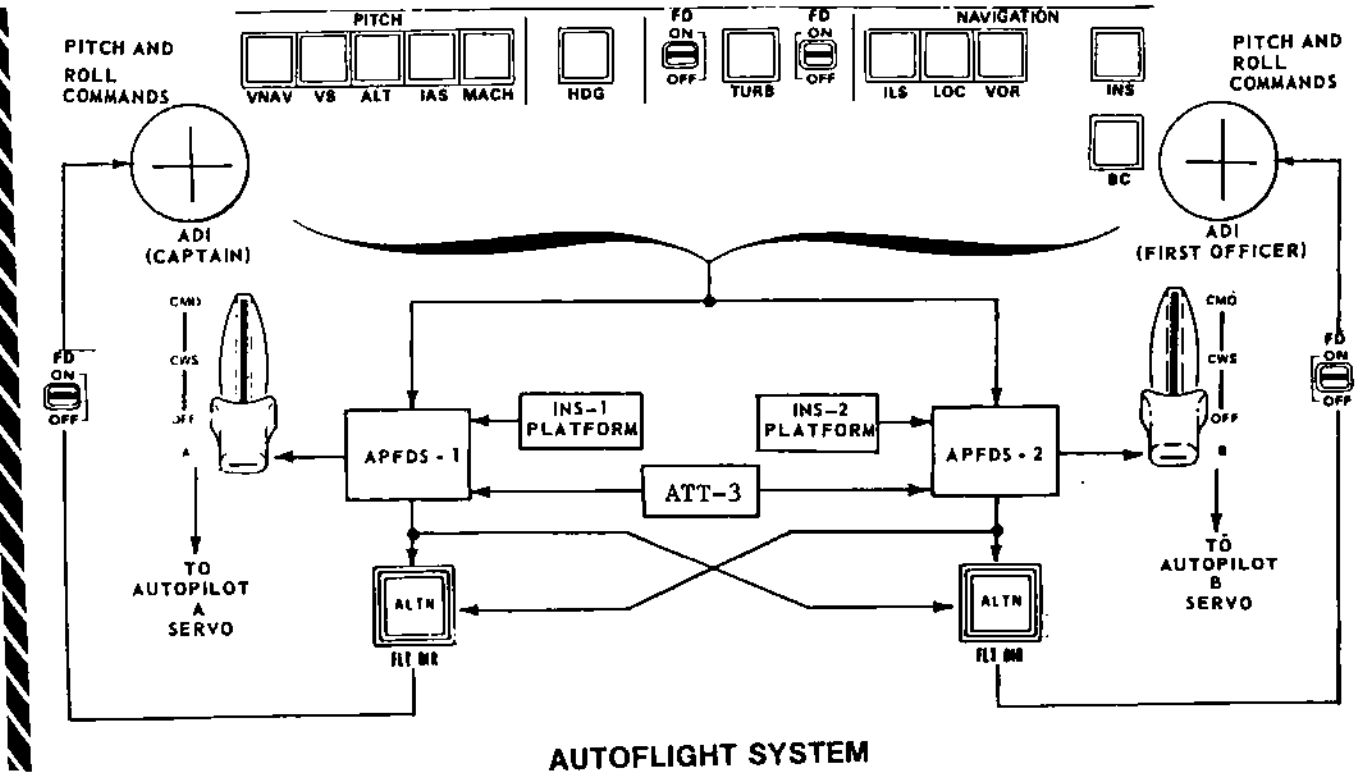
The autoflight system is approved for instrument approaches to Category II weather minima with one engine inoperative. On Category III approaches all engines must be operative to alert height.

AUTOPILOT

Two autopilots, A and B, provide automatic pitch and roll control. Yaw control is added during autoland and roll-out. Separate engage switches select control wheel steering (CWS) or command (CMD) modes of operation. Hydraulic power for autopilot A is provided by hydraulic system B and power for autopilot B is provided by hydraulic system A.

FLIGHT DIRECTOR

The flight director displays pitch and roll commands for the same modes as the autopilot. Separate flight director (FD) switches activate the ADI command bars with signals from the selected flight director.



AUTOFLIGHT SYSTEM

COMPUTERS

The autoflight system uses independent computers, which function in both autopilot and flight director systems. Each computer is divided into two identical channels for monitoring.

APFDS computer No. 1 provides signals for both autopilot A and flight director A. APFDS computer No. 2 provides signals for both autopilot B and flight director B.

The APFDS source used for displaying flight director command signals on the ADIs can be selected by using the ALTN FLT DIR switchlights on the captain's and first officer's respective INSTR SOURCE SELECT panels. The switchlights are normally unlatched, permitting the following:

- APFDS-1 supplies the captain's command signals.
- APFDS-2 supplies the first officer's command signals.

Input signals for autopilots A and B are supplied by APFDS-1 and APFDS-2 respectively.

Airspeed and Altitude Inputs

Two air data computers (ADCs) supply altitude and airspeed signals to the autoflight system. Inputs from ADC-1 supply APFDS-1 with:

- Calibrated airspeed.
- True airspeed.
- Altitude.
- Altitude rate of change.

The same information from ADC-2 is supplied to APFDS-2.

Radio Altimeter Inputs

Two low range radio altimeters (LRRA) provide altitude data to program the autoland functions of the APFDS as follows:

- At 1500 ft, and approximately 25 seconds after glideslope capture, the runway align and flare functions are armed, and the rudder system transfers from series to parallel operation.
- At 150 ft, the airplane aligns with the runway and wing-down crosswind corrections are provided.
- At 50 ft, autoflare is initiated. The ATS is signalled to move the throttles toward IDLE and the flare maneuver is initiated.
- At 5 ft, rollout guidance becomes effective and the throttles move to the IDLE stop.

LRRA-1 supplies APFDS-1; LRRA-2 supplies APFDS-2.

Navigation Inputs

Navigation reference information for APFDS-1 is supplied by:

- No. 1 VHF NAV/ILS receivers.
- Compass system No. 1.
- INS-1.

The same information from the respective No. 2 systems is supplied to APFDS-2.

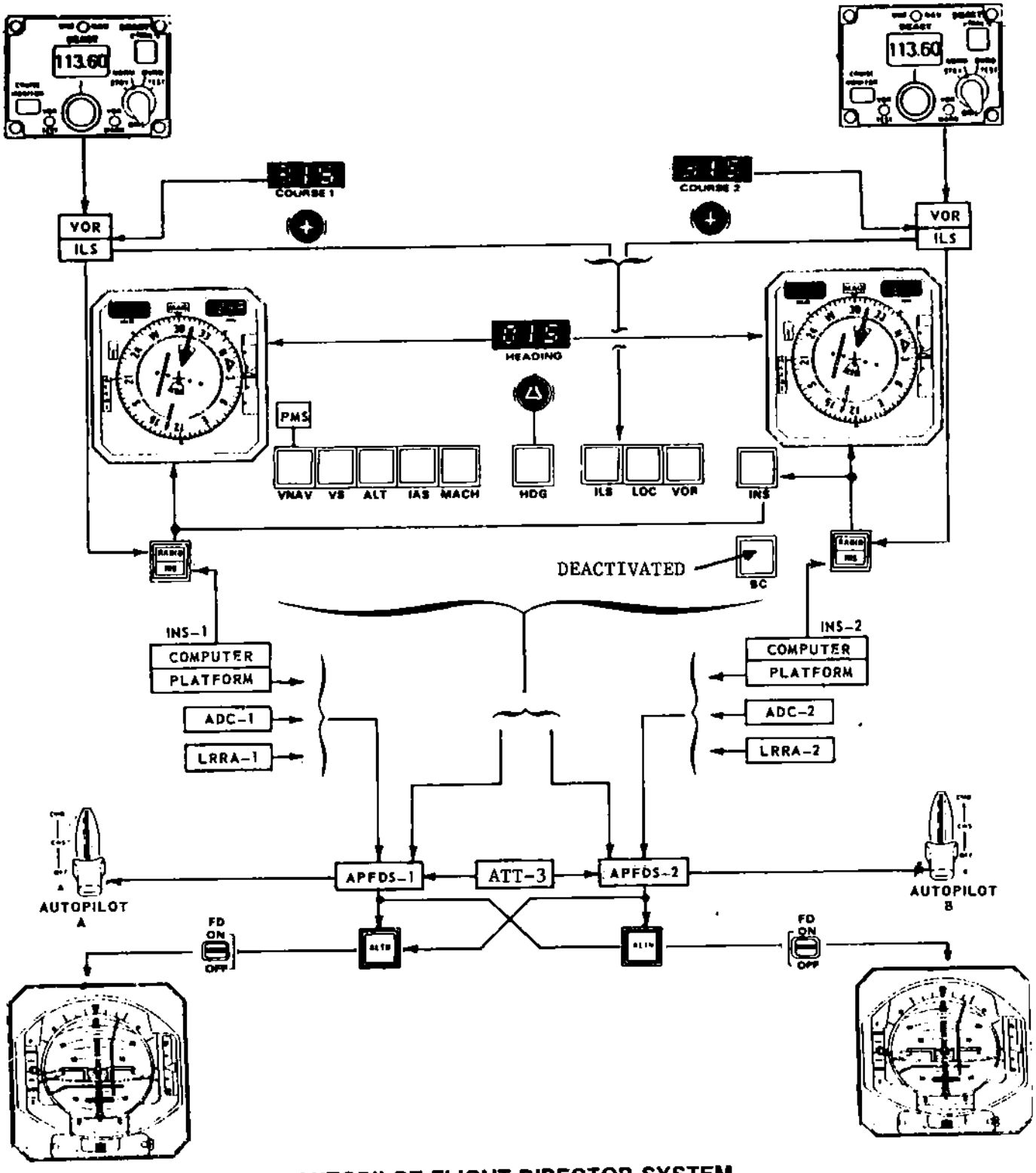
The NAVIGATION selector panel permits selection of the source of navigation information to be used by the APFDS computers:

- ILS commands to capture and track the localizer and glideslope. This mode provides for autoland with either or both autopilots engaged in CMD.
- LOC commands to capture and track the selected LOC. Glideslope capture is not provided.
- VOR commands to capture and track the selected VOR radial.
- HDG commands to turn to and maintain the selected heading.
- INS commands to capture and track the selected INS track.

APFDS MODES OF OPERATION

The following APFDS modes of operation are available, and each is individually annunciated on the AFCS MODES panels.

MODE	AUTOPILOT CWS	AUTOPILOT CMD	FLIGHT DIRECTOR
ALT	•	•	•
ALT SEL	•	•	•
TURB	•		
VNAV		•	•
VS		•	•
IAS		•	•
MACH		•	•
HDG		•	•
ILS		•	•
LOC		•	•
VOR		•	•
INS		•	•
TAKEOFF GO-AROUND		•	•



AUTOPILOT FLIGHT DIRECTOR SYSTEM

AUTOPILOT CWS MODES

ENGAGEMENT (CWS)

When an autopilot is engaged in CWS, it will automatically maintain the airplane pitch attitude and roll attitude (or heading if the bank angle is less than three degrees) existing at the moment the pilot releases the controls. The existing attitude can be modified by a normal pilot control input; when the pilot releases the control(s), the autopilot will maintain the new attitude.

Normal pitch limit is ±18 degrees; the bank angle limit is 35 degrees. If the controls are released with these limits exceeded, the autopilot will return the airplane to these limits.

ALTITUDE HOLD AND ALTITUDE SELECT

The altitude hold and altitude select modes may be used in CWS autopilot or flight director operation in the same manner as they are used in CMD operation.

TURBULENCE

Pressing the TURB switchlight on the APFDS engages the turbulence penetration mode. If the autopilot is in CMD (other than ILS or go-around) the autopilot switch will trip to CWS. The TURB mode can only be released .. the TURB switchlight is pressed a second time or the autopilot is disengaged.

When TURB is selected, the switchlight illuminates and a TURB legend appears in the AFCS MODES panels. The ADI command bars will be biased out of view. Pitch and roll gains will be reduced by 50 percent, but the yaw SAS is not affected and automatic stabilizer trim remains operative.

TURB may be selected anytime, except:

- When the autopilot is off.
- When go-around mode is established.
- When ILS is engaged and A/L is displayed.

AUTOPILOT COMMAND MODES

ENGAGEMENT (CMD)

Placing an autopilot switch to CMD with no pitch or navigation mode selected will cause the autopilot to function as if in the CWS mode. Selecting only a pitch mode will permit CWS roll control. Selecting only a navigation or heading mode will permit CWS pitch control.

PITCH MODES

ALTITUDE HOLD. Pressing the ALT switchlight on the PITCH panel causes the airplane to maintain the altitude existing at the time of selection. To engage altitude hold, at least one autopilot must be engaged (CWS or CMD), or at least one FD switch must be set to ON. The ALT switchlight will illuminate, and an ALT legend will appear in the AFCS MODES panels and in the PITCH mode display. In addition, the PITCH numeric display will indicate (to five digits) the altitude being maintained.

Altitude hold will disengage if the ALT switchlight is pressed again or if any of the following modes are engaged.

- Go-around.
- MACH hold.
- IAS hold.
- VS.
- VNAV.
- TURB.
- Glideslope capture when in the ILS mode.

It will also disengage automatically if the autopilot and flight directors are disengaged.

ALTITUDE SELECT. Altitude select provides for intercept and capture of a selected altitude. It is used for autopilot control and/or flight director guidance, and is compatible with any navigation mode.

The system is armed whenever an altitude selection is made on the ALTITUDE panel. An ALT ARM legend appears in the AFCS MODES panels and will remain displayed until the selected altitude is captured.

NOTE

If ALT hold is already engaged when altitude select is armed, ALT hold will remain engaged. The ALT switchlight will remain illuminated and the ALT and ALT ARM legends will be displayed on the AFCS MODES panels.

When the actual altitude change is to be initiated, one of two actions must take place:

- Another pitch mode, such as IAS, VS, VNAV or MACH must be selected (which will cause ALT hold to disengage if it was engaged), or
- The ALT switchlight must be pressed (disengaging ALT hold) and CWS pitch control used to initiate a climb or descent toward the selected altitude.

In either case, the selected pitch mode or CWS pitch control will remain active until the selected altitude is captured.

When the altitude capture maneuver is initiated, a CAP legend appears in the PITCH mode display. In addition, the numeric display will indicate the same altitude as in the SELECT ALTITUDE display. When capture of the selected altitude is complete:

- Altitude hold is automatically engaged.
- The CAP legend changes to ALT.
- The ALT switchlight is illuminated.
- The ALT ARM legend in the AFCS MODES panel changes to ALT.

Altitude select may be manually disengaged only by turning both flight directors off and disconnecting the autopilot.

Altitude select mode is in effect (always engaged) when either autopilot or either flight director is in use except when in TAKEOFF or GO-AROUND modes.

Indicated Airspeed (IAS)
The IAS mode provides the capability of holding the airspeed existing at the time of selection by changing pitch attitude as required. It is selectable for autopilot control and/or flight director guidance. The mode is activated by pressing the IAS switchlight on the PITCH modes panel. The switchlight will illuminate, M/IAS legend will appear in the AFCS MODES panels, IAS appears in the PITCH mode display, and the numeric display indicates the present indicated airspeed in knots.

The IAS mode is compatible with the autothrottle thrust management (TM) mode, but is not compatible with the basic autothrottle system (ATS) which holds a reference speed by means of thrust modulation. If the basic ATS is already engaged at the time IAS is selected, AT will be disengaged. Conversely, if the basic ATS is selected with IAS already engaged, IAS will be disengaged.

The IAS mode is not compatible with the ILS mode. If IAS is engaged, ILS cannot be selected.

Vertical Speed (VS)
The VS mode provides automatic control of vertical speed. The mode is activated by pressing the VS switchlight on the PITCH modes panel. The switchlight will illuminate, VS will appear on the AFCS MODES panels and in the PITCH mode display, and the numeric display indicates the present vertical speed in feet per minute. A + or − symbol at the left of the numeric display indicates climb or descent, respectively.

The VS mode can be engaged at any time without a transient pitch response, since the initial pitch command will coincide with existing conditions. When the mode is engaged, the synchronization stops and the display becomes the VS command indicator. Adjustments in command vertical speed are made by means of the vertical speed control wheel. The maximum climb command available is 4000 fpm; the maximum descent command is 8000 fpm.

Vertical Naviation (VNAV)
The VNAV mode couples the APFDS to pitch commands from the PMS during climb and descent. It is activated by pressing the VNAV switchlight on the PITCH modes panel. The switchlight will illuminate and VNAV is displayed on the AFCS MODES panels. Depending on PMS input, either IAS or M will appear in the PITCH mode display. PMS commanded speed, in knots or Mach number, will appear in the numeric display.

During climb and descent, the throttles may be controlled manually or through the autothrottle thrust management (TM) mode.

Mach
The MACH mode provides the capability of holding the Mach existing at the time of selection by changing pitch attitude as required. It is selectable for autopilot control and/or flight director guidance. The mode is activated by pressing the MACH switchlight on the PITCH modes panel. The switchlight will illuminate, a M/IAS legend will appear on the AFCS MODES panels, M appears in the PITCH mode display, and the numeric display indicates the present Mach number.

The MACH mode is compatible with the autothrottle TM mode, but is not compatible with the ATS. If the basic ATS is already engaged at the time MACH is selected, AT will be disengaged. Conversely, if the AT switchlight is selected with MACH already engaged, MACH will be disengaged.

TAKEOFF AND GO-AROUND MODES

Takeoff is a flight director mode only.

Go-around is an autopilot and/or flight director mode.

The takeoff and go-around modes are both selected by the same switch on either control wheel. Air/ground logic determines which mode will be activated.

When the airplane is on the ground, pressing the switch establishes the takeoff mode, and the TO/GA legend appears in the AFCS MODES panels.

When the airplane is airborne, pressing the switch establishes the go-around mode on the flight director and the TO/GA legend appears in the AFCS MODES panels. In the go-around mode, all heading, pitch and navigation modes are disengaged. If an autopilot is engaged, the go-around mode can be established only if the flaps are set to 33. The autothrottle system will disengage and an auto-go-around will commence. The spoilers will retract and DLC inputs will be canceled. If the rudder is not in parallel operation, it will shift to parallel. If both autopilots are engaged, they will ← both remain engaged until a pitch mode is selected. At that time, the second autopilot engaged for the approach will disengage. Thrust must be set manually ← in go-around mode.

NOTE

During a go-around initiated at a very low altitude, as long as the go-around mode is selected in the air, it will remain engaged even if the airplane touches down during the course of the go-around. However, the go-around mode cannot be initially selected when the airplane is on the ground.

In both the takeoff and go-around modes, roll guidance is wings-level, although HDG mode may also be selected, and a specific heading commanded with the heading bug.

Pitch guidance in both modes will command an angle of attack that corresponds to an airspeed of 1.25Vs for the existing flap setting, up to a maximum of 17.5 degrees of pitch.

WARNING

If the go-around mode is established on the flight director and an autopilot is then set to CMD, the autopilot will seek a 1.25Vs angle of attack for the existing flap setting.

NOTE

When in the takeoff or go-around mode, an altitude may be selected on the ALTITUDE panel, however the altitude select mode is not active and ALT ARM will not be annunciated as long as TO/GA is displayed.

NAVIGATION/HEADING MODES

Heading (HDG)

In the HDG mode, the APFDS is coupled to the magnetic heading set in the window of the HEADING selector. The heading bugs on both HSIs are also positioned by the same selector. Pressing the HDG switchlight engages the mode, the switchlight illuminates and a HDG legend appears in the AFCS MODES panels.

NOTE

When the HSI(s) is in the INS mode, the heading bugs are still controllable by the pilot, and indicate the true heading corresponding to the magnetic heading selected on the glareshield panel.

HDG mode may be used in conjunction with ILS, LOC, or VOR mode prior to course capture.

INS Mode

The INS mode is used to couple INS navigation to the APFDS. It is selectable for autopilot control and/or flight director guidance. The autopilot will fly the airplane to zero the INS XTK value.

When the INS switchlight is pressed, the switchlight illuminates, INS is displayed on the AFCS MODES panels, and both APFDS computers use INS data. If the airplane is not on an INS course when the autopilot is engaged, the autopilot will turn the airplane to an appropriate intercept angle.

NOTE

When the HSI(s) is in the INS mode, the heading bugs are still controllable by the pilot, and indicate the true heading corresponding to the magnetic heading selected on the glareshield panel.

VOR Mode

The VOR mode is used to track a selected VOR radial. The mode is selected by tuning at least one receiver to the desired VOR frequency, setting the course to be tracked on the NAVIGATION panel using the course selector(s), and then pressing the VOR switchlight.

When the VOR mode is armed, VOR ARM is displayed on the AFCS MODES panels and the VOR switchlight illuminates. At VOR capture, the VOR ARM legend goes out and VOR is displayed on the AFCS MODES panels.

When overhead a VOR station, VOR receiver validity is inhibited to prevent the autopilot from disconnecting and the roll command bars from biasing out of view. The AFCS MODES panels change from VOR to VOR ARM. At this time, the outbound course is set on the NAVIGATION panel, and CWS or the HDG mode may be used until outbound VOR course capture.

LOC Mode

The LOC mode should be used when making localizer only approaches. The ILS to be used is tuned and identified on the VHF NAV receivers, and the localizer course is set in the COURSE windows on the NAVIGATION panel. The LOC mode is selected by pressing the LOC switchlight on the NAVIGATION panel. A LOC ARM legend will appear in the AFCS MODES panels.

The localizer mode can be manually released by pressing the LOC switchlight a second time or by disengaging both flight directors and disconnecting the autopilot from the CMD mode.

ILS Mode

The ILS mode can be selected after tuning the ILS on the VHF NAV receivers. The localizer course must be set on the NAVIGATION panel. The ILS mode is engaged by pressing the ILS switchlight on the NAVIGATION panel. The switchlight illuminates and the LOC ARM and GS ARM annunciators appear in the AFCS MODES panels. The second autopilot can then be set to CMD to provide a dual autoland status. Altitude hold and the HDG select modes are normally used to maintain altitude and establish the localizer intercept angle.

At localizer capture, the AFCS MODES annunciators change from LOC ARM to LOC. After localizer capture, glideslope capture is initiated approximately ⅓-dot from beam center as indicated on the HSI. At the initiation of capture, the GS ARM annunciation changes to GS.

When the airplane reaches 1500 ft radio altitude, and approximately 25 seconds after glideslope capture, the autoland A/L annunciator appears. Two additional annunciators, ALN ARM and FLR ARM, also appear which indicate that the required interlocks are valid for the runway alignment and flare maneuvers. Also, the rudder shifts from series to parallel operation. This is indicated by rudder pedal movement when yaw SAS inputs are made.

WARNING

When the rudder is in parallel operation, erratic localizer signals caused by preceding airplanes or airplanes on the ground can cause large lateral offsets by the autopilot.

This situation may exist when coupled approaches are conducted in VMC at high density airports. Do not hesitate to disconnect the autopilot and either continue the approach manually or go-around.

When landing flaps are selected, DLC becomes active. This is indicated by speed brake handle movement and by indications of spoiler position on the surface position indicator. At this point, the autothrottle system changes from maintaining the selected IAS to maintaining an angle of attack corresponding to an airspeed of 1.3Vs. This is indicated by AOA appearing in the AUTOTHROTTLE mode display.

The align maneuver begins at 150 ft radio altitude. A sideslip is now used to remove or reduce the crab angle that was needed to correct for crosswinds up to this point. Initiation of the alignment maneuver is indicated by the ALN ARM annunciation changing to ALIGN.

At 50 ft radio altitude, the flare maneuver is initiated and the annunciation changes from FLR ARM to FLARE. If the autothrottle is engaged, thrust is reduced automatically by the autothrottle system.

The flight director command bars will bias out of view.

At 5 ft radio altitude, rollout computation is initiated, ROLLOUT is annunciated in the AFCS MODES panels, and a wings-level attitude is commanded. However, in strong crosswinds, a wing-low touchdown may be commanded by the APFDS.

At touchdown, the autoground-spoilers are deployed and the ATS system brings the throttles to idle. This automatically disengages the ATS. The ALERT lights on the AFCS WARNING annunciators do not flash and the ATS DISC legend does not appear since the computer recognizes this action to be a normal part of the automatic landing system.

After touchdown, rollout guidance is provided by localizer beam tracking, damped by yaw rate sensing. Steering control is supplied by yaw SAS input to the rudder controls.

FLIGHT DIRECTOR MODES

All modes except TURB are also available to the flight director system, which can be utilized without the autopilot by setting the FD switch ON and leaving the autopilot disengaged. The pitch and roll command bars provide guidance to maintain any of the modes. However, in ILS mode, the flight director will not provide ALIGN and FLARE commands, and the command bars will bias out of view at 50 ft radio altitude.

If only a navigation or heading mode is selected, and a pitch mode is not selected, only the roll command bar will be displayed; the pitch command bar will be biased out of view.

If a navigation or heading mode is not selected both the roll and pitch command bars will be biased out of view; it is not possible for only the pitch command bar to be displayed.

BACK COURSE

The back course (BC) mode is a flight director function only and provides roll commands on the back course of the localizer.

No back course glideslope flight director pitch guidance is available. No pitch command information is provided, unless a pitch mode is selected.

The BC mode is selected by tuning at least one ILS receiver to the desired frequency, setting the inbound front course in the COURSE windows using the course selectors on the NAVIGATION panel and pressing the BC switchlight. The switchlight illuminates and BCK CRS and LOC ARM appear in the AFCS MODES panels. The expanded localizer is biased out of view.

Prior to back course capture, the HDG mode may be used. When the back course is captured, the LOC ARM display will change to LOC and BCK CRS will continue to be displayed.

AUTOTHROTTLE MODES

BASIC AUTOTHROTTLE

The throttles are linked to the speed command system by pressing the autothrottle (AT) switchlight on the AUTOTHROTTLE panel. The ATS provides automatic control of airspeed or angle of attack (AOA) by means of thrust modulation. Both modes provide commands for throttle control, automatically moving the throttles in response to preselected airspeed commands. This allows the airplane to acquire and maintain the selected airspeed. The speed command system is independent of, but may be used with the autopilot.

The autothrottle system will reduce engine thrust at flare during an autoland sequence and will disconnect at touchdown.

The basic autothrottle (AT) is not compatible with either the autothrottle thrust management (TM) mode or the APFDS IAS mode. Engaging one will trip the other off.

FAST-SLOW INDICATOR

Inputs are provided for fast-slow indicators on the ADIs. The fast-slow indicators operate at all times when the respective ATS switchlights on the FCES panel are latched in. The AT switchlight on the AUTOTHROTTLE panel does not have to be latched in.

When both ATS switchlights, located on the overhead FCES panel are latched in, channel 1 provides inputs to:

- The captain's fast-slow indicator.
- Both pitch computers.
- The autothrottle servo.

Channel 2 operates as a standby channel for the autothrottle system and continually provides input to:

- The first officer's fast-slow indicator.
- Both pitch computers.

The fast-slow indicators will reference to the speed shown in the numeric display unless an AOA legend appears in the AUTOTHROTTLE mode display. In that event, the fast-slow indicators are referenced to the angle of attack.

THRUST MANAGEMENT

A thrust management (TM) switchlight on the AUTOTHROTTLE panel, when pressed, removes the ATS from the speed command system and places it under control of the performance management system (PMS). In climb and engine-out driftdown, TM maintains the EPR commanded by the PMS (the engine with the highest indicated EPR is the limiting engine). In level flight cruise, TM maintains the IAS or Mach commanded by the PMS and ensures that EPR limits are not exceeded.

The ATS TM mode is normally used in conjunction with the APFDS VNAV mode during climb and descent, but is also compatible with the APFDS MACH, and IAS modes.

AOA MODE

When the airplane is in any configuration other than landing flaps extended, an angle of attack (AOA) legend appears in the AUTOTHROTTLE mode display if speed is reduced to 1.3Vs for the existing flap setting. When the flaps are lowered to 33, the AOA function is automatically selected and CG and wind-gust compensation is provided. The AOA legend is also in view whenever either the takeoff or go-around mode is active.

With landing flaps selected, the AOA mode functions to control the airplane speed to Vth + 3 kt with the airplane loaded to its aft CG limit. The command speed will increase to:

- Vth + 6 kt with the CG in the normal loading mid location, and
- Vth + 10 kt with the CG at its forward limit.

Gust compensation speed increases are also added to the command airspeed in steps of 4 kt and 6 kt for short-period airspeed fluctuations of 6 kt and 16 kt respectively. Therefore, the commanded airspeed will never go below Vth, even in turbulent conditions.

The system provides commands to the APFDS computer for pitch guidance in both go-around and takeoff modes to maintain an angle of attack corresponding to a speed of 1.25 Vs. Go-around and takeoff mode pitch commands to control speed are displayed by the flight director pitch command bars.

AUTOTHROTTLE ANNUNCIATORS

Any failure within either ATS channel which results in a computed difference in speed commands illuminates both ATS FAIL lights.

The IAS inputs to the fast-slow indicators do not switch channels. Therefore, with either ATS FAIL light illuminated, the respective fast-slow indicators are biased out of view.

If a failure occurs while the autothrottle system is active:

- The throttles will remain in their last position.
- The AT switchlight extinguishes.
- ATS DISC is annunciated.
- The ALERT light flashes on the AFCS WARNING panel.

If the flight directors are in use in the takeoff or go-around mode, the command bars will bias out of view.

In a coupled go-around, if both ATS channels fail:

- The autopilot engage switch will trip to OFF.
- AP DISC is annunciated on the AFCS warning panel.
- The aural warning (wailer) is activated.

AUTOTHROTTLE MODE PANEL
(Glareshield)

THRUST MANAGEMENT SWITCHLIGHT
Momentary.

When pressed, switchlight illuminates and:

- Autothrottle system responds to PMS inputs.
- Displays THR MGT on AFCS MODES panels to confirm that TM mode has engaged.

AUTOTHROTTLE SWITCHLIGHT

Latched in:
Engages basic autothrottle. Disengages APFDS IAS mode, if engaged. Automatically disengages when:

- Go-around switch is pressed.
- IAS mode is engaged.
- TURB mode is engaged.
- The airplane lands.

Unlatched:
Disengages basic autothrottle.

NUMERIC DISPLAY

AT engaged or, neither AT nor TM engaged:

- Indicates selected IAS.

TM engaged:

- Indicates EPR (when in climb or descent) or Mach or IAS (when in cruise) as commanded by the PMS.

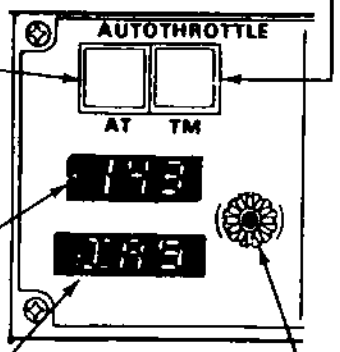
AUTOTHROTTLE MODE DISPLAY

AT engaged:

- Indicates IAS.
- Indicates AOA (angle of attack) when in AOA mode.

TM engaged:

- Indicates EPR when in climb or descent.
- Indicates M (Mach) or IAS when in cruise.



AUTOTHROTTLE AIRSPEED SELECTOR

Selects the IAS reference for the speed command system when TM mode is disengaged and AOA legend is not displayed.

PITCH MODE PANEL
(Glareshield)

PITCH SWITCHLIGHT(S) (5)
Momentary.
When pressed, switchlight illuminates. Selected mode must be displayed on AFCS MODES panels to confirm that mode has engaged. Disengaged by one of the following:

- Pressing switchlight a second time.
- Disengaging autopilot and FD.
- Engaging another pitch mode.

VNAV:
Couples the APFDS to pitch commands from the PMS for programmed climb and descent speeds.

- Automatically disarms and switchlight extinguishes when selected altitude is captured and APFDS goes into altitude hold.

VS:
Holds vertical speed existing at engagement.

- After engagement, vertical speed may be varied by rotating vertical speed selector.
- The VS mode may be used for glideslope capture.

ALT:
Holds altitude existing at engagement.

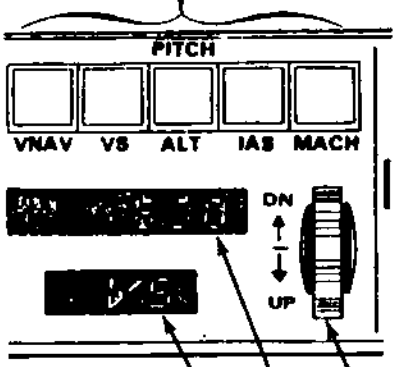
- May be engaged at any vertical speed with either autopilot in CWS or CMD, or at least one FD on, however, will overshoot initially and then return to the altitude existing at time of engagement.
- Also engages automatically when selected altitude is reached, if ALT SELECT is armed.
- The ALT mode may be used prior to glideslope capture.

IAS:
Holds indicated airspeed existing at engagement.

- Disengages AT.
- Inhibited after selection of ILS mode.

MACH:
Holds indicated Mach existing at engagement.

- Disengages AT.



PITCH MODE DISPLAY
Indicates selected PITCH mode:

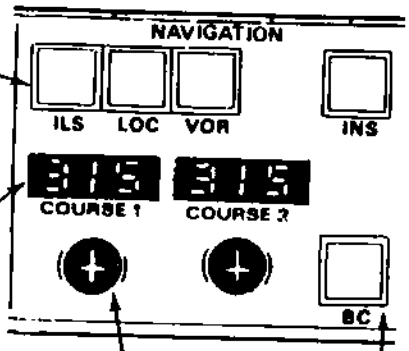
- VS.
- ALT.
- CAP (during altitude capture maneuver).
- IAS (during IAS mode or in VNAV mode when PMS is commanding an indicated airspeed).
- M (Mach) (during MACH mode or in VNAV mode when PMS is commanding a Mach number).

NUMERIC DISPLAY
Indicates:

- Altitude.
- Vertical speed.
- Indicated airspeed.
- Mach number.

VERTICAL SPEED SELECTOR
Provides control of vertical speed reference for the APFDS when VS mode is engaged. Inoperative in all other modes.

NAVIGATION MODE PANEL
(Glareshield)



NAVIGATION SWITCHLIGHT (4)
Momentary.

When pressed, switchlight illuminates.

- Selected mode must be displayed on AFCS MODES panels to confirm that mode has engaged.
- Disengaged by pressing switchlight a second time (except ILS with autopilot in CMD after track status is attained) or disengaging autopilots and flight directors.

ILS:
Arms APFDS for ILS approach (FD only) or for autoland (one or both autopilots engaged in CMD).

- LOC ARM and GS ARM are displayed initially on AFCS MODES panels.

LOC:
Arms APFDS for capture and tracking of localizer.

- Glideslope capture not available. LOC ARM is displayed initially on AFCS MODES panels.

VOR:
Arms APFDS for capture and tracking of VOR course.

- VOR ARM is displayed initially on AFCS MODES panels.

INS:
Couples INS to APFDS.

- INS is displayed on AFCS MODES panels.

COURSE DISPLAY (2)
Indicates selected VOR or ILS course.

- Repeated on respective HSI course pointer when HSI is in RADIO mode.

COURSE SELECTOR (2)
Selects desired VOR or ILS course, and positions course pointer on respective HSI when HSI is in RADIO mode.

- When set to ILS course, provides heading information to computer for wind integration, localizer capture and runway alignment.

BACK COURSE SWITCHLIGHT
References FD roll command bar to back course localizer.

- LOC ARM and BCK CRS are displayed initially on AFCS MODES panels.

(Each Pilots Instrument Panel)

ILS DEVIATION LIGHT (2)
Armed when flight director or autopilot is in the ILS mode.

- Flashes 4 seconds on, 2 seconds off, if both ILS receivers are not tuned to the same frequency.

After localizer capture, light comes on steady with 1 dot deviation down to 900 ft radio altitude, and then linearly decreases to ⅓ dot deviation from 900 ft to 125 ft radio altitude, and then less than ⅓ dot deviation from 125 ft to 5 ft radio altitude.

- After glideslope capture, light comes on steady with 1 dot deviation down to flare.
- On rollout, light comes on steady with ½ dot localizer deviation.

ALTITUDE SELECT PANEL
(Glareshield)

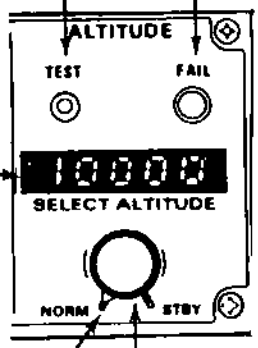
ALTITUDE ALERT SYSTEM TEST SWITCH
Momentary.

When pressed, bypasses inhibit circuits to permit system test on the ground. Varying the altimeter indications more than 250 ft from the selected altitude:

- Illuminates respective ALTITUDE light.
- Sounds C-chord tone.

SELECTED ALTITUDE DISPLAY

Displays altitude selected by altitude selector.



FAIL LIGHT
On:
Indicates failure of selected altitude source.

ALTITUDE SOURCE SELECTOR

NORM:
Altitude alert aural warning.

- APFDS altitude select mode and PMS are referenced to captain's altimeter.

STBY:
Altitude alert aural warning.

- APFDS altitude select mode and PMS are referenced to first officer's altimeter.

NOTE

The altitude alert ALTITUDE lights are controlled by their respective amplifiers and are not affected by the source selector.

ALTITUDE SELECTOR

Sets reference altitude for APFDS altitude select mode, for altitude alert warning systems, and for PMS.

AFCS WARNING PANEL

AP DISC

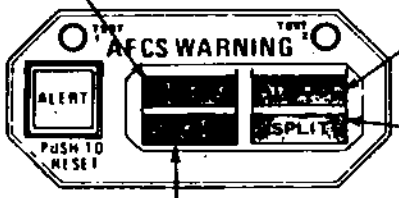
Autopilot engage switch(es) has dropped to OFF.

- Accompanied by aural warning (wailer).

ATS DISC

Light in AT switchlight is out, autothrottle system has been disconnected:

- Manually by ATS disconnect switch on throttles.
- Automatically by engaging APFDS IAS mode.
- Automatically by ATS computer failure.



SPLIT

Indicates that the APFDS computers are not in the same mode.

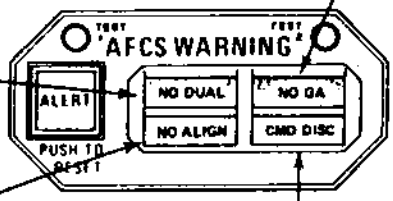
AP LIMIT

AP limit is displayed with:

- Stabilizer control system jam.
- Pitch trim runaway.
- Pilot inputs overriding the stabilizer servo.

NO GA

Appears after glideslope capture if a fault is detected in go-around computations.



NO DUAL

Autopilot failure after A/L annunciated and both autopilots engaged.

- Indicates that any additional failures can result in total autopilot disconnect and loss of flight director guidance.
- Cannot be reset by pressing ALERT switchlight. NO DUAL inhibited below 150 ft.

CMD DISC

Autopilot tripped from CMD to CWS.

NO ALIGN

Appears approximately 25 seconds after LOC annunciated with ILS selected and an autopilot in CMD:

- If there is an alignment/rollout mode failure.
- If inbound course selector settings differ by more than 1 degree, or the compasses disagree by more than 6 degrees. If problem is not cleared prior to annunciation of A/L, the NO ALIGN annunciation will be displayed and can only be cleared by disconnecting the autopilot and clearing the ILS mode.

(Forward Caution Panel)

APFDS FIRST FAIL LIGHT

On:
Indicates fail operational (dual) autoland may not be available.

AFCS MODES PANEL (2)

LOCALIZER ARM

System armed for localizer capture.

GLIDESLOPE ARM

System armed for glideslope capture.

APPROACH

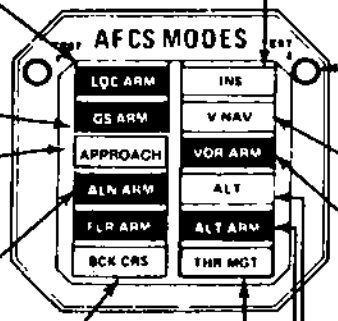
Autoland is not available due to both radio altimeters inoperative.

ALIGN ARM AND FLARE ARM

Indicates autopilot self-checks have been made, rudder is in parallel operation, and computers are armed for align and flare functions.

BACK COURSE

Indicates back course selected.



INS

INS mode is engaged.

TEST 2 SWITCH

When pressed, presents display as shown.

VERTICAL NAVIGATION

The VNAV mode is engaged.

VOR ARM

VOR mode engaged and armed for VOR capture.

ALTITUDE

Altitude hold is engaged.

- Automatically comes into view if altitude select mode is engaged and selected altitude is reached.

ALTITUDE ARM

Altitude select mode is engaged and armed to capture the selected altitude.

THRUST MANAGEMENT

Autothrottle TM mode is engaged and system is receiving inputs from the PMS system.

NOTE

Captain's AFCS MODES panel displays only APFDS A operation; first officer's panel displays only APFDS B operation.

- With A autopilot engaged, the captain's modes panel must be monitored.
- With B autopilot engaged, the first officer's modes panel must be monitored.
- When either pilot transfers his flight director, he must monitor the other pilot's modes panel for proper operation.

AFCS MODES PANEL (2)

TEST 1 SWITCH

When pressed, presents display as shown.

GLIDESLOPE

Glideslope captured.

AUTOLAND

One (or both) autopilots have made self-checks and dual computations are being used.

- Appears approximately 25 seconds after glideslope capture and below 1500 ft radio altitude. Automatic landing capability has been established.

ALIGN

In view at 150 ft radio altitude (if autopilot is being used in CMD).

- Indicates runway alignment has been initiated.

FLARE

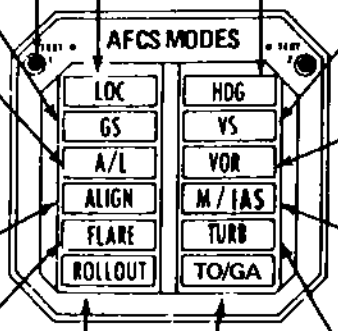
In view at 50 ft radio altitude (if autopilot is being used in CMD).

- Indicates the flare program has been initiated.
- If ATS engaged, throttles move to idle.

ROLLOUT

In view at 5 ft radio altitude (if autopilot is being used in CMD).

- Indicates rollout segment is initiated.



LOCALIZER

Localizer captured.

HEADING

Heading mode is engaged.

VERTICAL SPEED

Vertical speed mode is engaged.

VOR

VOR mode engaged and VOR radial captured.

M/IAS

IAS or MACH mode engaged. IAS or Mach is held by pitch attitude.

TURBULENCE

Turbulence mode engaged.

- Automatically disconnects ATS.
- Autopilot trips to CWS.
- No CMD modes available.
- Flight director command bars are biased out of view.

TAKEOFF/GO-AROUND

On the ground:

In view when the takeoff/go-around switch is pressed and a flight director is engaged. Flight director will display takeoff and climbout commands, with wings level in roll axis unless HDG is also engaged.

In flight:

In view when the takeoff/go-around switch is pressed, provided flaps have extended to landing position and autopilot is in CMD, or flight director is on with autopilot off or in CWS.

- When in go-around mode, ATS is disconnected (thrust must be set manually), DLC is inactive and wings-level and pitch attitude for an angle of attack corresponding to an airspeed of 1.25 Vs (max 17.5°) are commanded.
- HDG may be engaged if desired.

PREFLIGHT

Since all components of the automatic flight systems use roll or pitch information, a preflight check must be performed on the INS in accordance with Navigation section 1107.150 to ensure that both systems No. 1 and No. 2 are functional.

DEPARTURE RADIO CHECK

Check the following:
— Turn the flight directors on and select takeoff mode; then select heading mode. Check for SPLIT warning.

NOTE

If the SPLIT warning appears on the AFCS WARNING panel, notify Maintenance.

PRETAXI

During the Pretaxi check, ensure that A and B autopilot channels will engage.

NOTE

Turn both flight directors off to allow autopilot engagement if the flight directors are in the takeoff mode and to remove any computer stored transient faults.

If an autopilot will not engage, use the following procedure before takeoff:
— Check both flight director switches off.
— Pull the circuit breakers for the affected autopilot (autopilot A, CBs 1A3 and 1A4 or autopilot B, CBs 1A21 and 1A22), and CB 1H12.
— Wait five seconds then reset CBs.
— Check that the autopilot will engage.
— Turn on both flight directors.
— Reset all fail indications on the overhead panel and cycle both ACS switchlights to reset the ACS FIRST FAIL light.

If the APFDS FIRST FAIL annunciator is illuminated as the result of electrical power transfers,
— Turn FD switches to OFF then ON; cycle A/P disconnect buttons on control wheel.
— Do not clear the APFDS FIRST FAIL annunciator with the forward caution panel reset switch unless it cannot be cleared with the above procedure.

NOTE

If the APFDS FIRST FAIL annunciator is cleared with the forward caution panel reset switch, a NO DUAL annunciator will occur on a subsequent dual autoland attempt.

AUTOPILOT MONITORING

Whenever an autopilot or flight director mode is selected, confirm that the mode has engaged by reference to the respective AFCS MODES panels. Illumination of the mode switchlight is not sufficient confirmation of mode engagement. Either APFDS system accepting the mode will cause the mode switchlight to illuminate and it may not be the autopilot or flight director being used to control the airplane.

A APFDS operation is displayed on the captain's AFCS MODES panels; B APFDS operation is displayed on the first officer's AFCS MODES panels. When an autopilot is engaged, it must be monitored on the proper AFCS MODES panels.

When either pilot transfers his flight director, he must monitor the other pilot's AFCS MODES panel for proper operation.

AUTOPILOT CWS OPERATION

NOTE

Operation of autopilot A or B channels is identical. Use channel A to reference autopilot to No. 1 navigation systems and channel B to reference autopilot to No. 2 navigation systems. Alternate use of the two channels is desirable.

To engage the autopilot for CWS operation, proceed as follows:
— Set the autopilot engage switch to CWS.
— Use the control wheel to establish the desired pitch and roll attitudes.

ALTITUDE MODE

The altitude hold mode is available during CWS autopilot operation. The control wheel is still used to establish desired roll attitude.
— Press ALT switchlight; check that it illuminates.
— Check AFCS MODES panels for ALT.

Altitude Select
Engage the altitude select mode as follows:
— Set altitude selector to the desired altitude.
— Set at least one flight director to ON.
— Set the autopilot engage switch to CWS.
— Check the AFCS MODES panel for ALT ARM.

TURBULENCE (TURB) MODE

The TURB mode is available during CWS autopilot operation.
— Press TURB switchlight; check that it illuminates.
— Check AFCS MODES panels for TURB.

NOTE

If engaged, the ALT hold mode will trip off.

NAVIGATION/HEADING MODES

None of the navigation or heading modes are available during CWS autopilot operation.

AUTOPILOT COMMAND (CMD) OPERATION

To engage the autopilot for single channel command operation,
— Set the autopilot engage switch to CMD.
— Press the switchlight for the desired NAVIGATION or HDG mode.
— Press the switchlight for the desired PITCH mode.
— Check the AFCS MODES panels for proper annunciation.

NOTE

If a NAVIGATION or HDG mode is not selected, the autopilot will be in CWS mode in roll. If a PITCH mode is not selected, the autopilot will be in CWS mode in pitch.

PITCH MODES

Altitude Hold
Operation in ALT is the same as in the CWS mode of autopilot operation.

NOTE

Any other pitch mode will trip off when the ALT switchlight is engaged.

The ALT hold mode will trip off when any other pitch mode is engaged, or when the glideslope is captured in the ILS mode.

Altitude Select
Engage the altitude select mode as follows:
— Set the altitude selector to the desired altitude.
— Select CWS pitch control, or VS, IAS, MACH or VNAV mode to initiate a climb or descent.
— Check the AFCS MODES panels for ALT ARM and selected pitch mode annunciation.

The autopilot will initially maintain the pitch attitude existing at the time of selection if the airplane is not within the 900 ft (approximate) capture zone. Any other mode can be used to establish the desired climb or descent toward the selected altitude. When capture takes place the airplane pitches to capture and hold the selected altitude. At the selected altitude the ALT switchlight illuminates and the AFCS MODES panels change from ALT ARM to ALT. Any previously engaged pitch mode switchlight goes out and the related annunciators go blank.

VS Mode
The autopilot varies pitch attitude to maintain the selected vertical speed. Engage the VS mode as follows:
— Press the VS switchlight; check that it illuminates.
— Check the AFCS MODES panels for VS annunciation.
— Set the vertical speed selector to the desired rate of climb or descent.

IAS or Mach Modes
The autopilot varies pitch attitude to maintain the airspeed or Mach exisiting at the time IAS or MACH is selected. Engage these modes as follows:
— Press the IAS or MACH switchlight when at the desired speed; check that it illuminates.
— Check the AFCS MODES panels for M/IAS annunciation.

NOTE

The autothrottles can be used with the IAS or MACH modes only if TM is engaged. The autothrottle system will disengage if IAS or MACH is selected with AT engaged. ←

VNAV (Vertical Navigation
The autopilot varies pitch attitude to maintain the climb or descent Mach/IAS as commanded by the PMS. Engage this mode as follows:
— Set the altitude selector to the desired altitude.
— Press the VNAV switchlight; check that it illuminates.
— Press the TM switchlight; check that it illuminates.
— Check the AFCS MODES panels for VNAV, ALT ARM and THR MGT annunciations. ←

NOTE

VNAV should be used in conjunction with thrust management (TM). See Autothrottle Operation in this section.

NAVIGATION /HEADING MODES

HDG Mode
Engage the HDG mode as follows:
— Press the HDG switchlight; check that it illuminates.
— Check the AFCS MODES panels for HDG annunciation.
— Set the heading selector to the desired heading.

INS Mode
The autopilot is supplied with INS commands to capture and follow the desired INS track.

NOTE

Most ATC clearances permit flight from present position to the next waypoint. It is seldom necessary to capture the INS track except for course offsets of less than one mile.

To capture the INS track,
— Press the INS switchlight; check that it illuminates.
— Check the AFCS MODES panels for INS annunciation.

An intercept angle of up to 45 degrees will be programmed automatically. For other intercept angles, the heading mode may be used as follows with HSI in INS mode.

— Check that the INS switchlight is out.
— Set the HSI heading bug to the desired airplane track (ignore the magnetic heading display).
— Press the HDG switchlight; check that it illuminates.
— Check the AFCS MODES panels for HDG annunciation.
— When near the desired INS track, press the INS switchlight; check that it illuminates and that the HDG switchlight extinguishes.
— Check the AFCS MODES panels for INS annunciation.

Refer to INS Normal Operation in chapter 7, Navigation section.

VOR Mode

To capture the VOR course,

— Check at least one RADIO/INS switchlight in RADIO.
— Use the COURSE control to set the course to be tracked.
— Determine the desired intercept heading.
— Set the heading selector to the intercept heading and press the HDG switchlight; check that it illuminates.
— Press the VOR switchlight; check that it illuminates.
— Check the AFCS MODES panels for HDG and VOR ARM annunciation.

The autopilot will turn the airplane to and maintain the selected intercept heading. The heading can be changed at any time prior to course capture by using the HEADING selector.

At course capture, the VOR ARM annunciator will change to VOR and course tracking will begin. The HDG switchlight will go out and HDG will disappear from the AFCS MODES panels.

LOC Mode

Engage the LOC mode as follows:

— Set the desired LOC course.
— Set the HEADING selector to the desired intercept heading and press the HDG switchlight; check that it illuminates.
— Press the LOC switchlight; check that it illuminates.
— Check the AFCS MODES panels for HDG and LOC ARM annunciation.

The autopilot will turn the airplane to and maintain the selected intercept heading. The heading can be changed at any time prior to course capture by using the HEADING selector.

At localizer capture the LOC ARM annunciator will change to LOC and course tracking will begin. The HDG switchlight will go out and HDG will disappear from the AFCS MODES panels.

ILS Mode

Engage the ILS mode as follows:

— Set the desired localizer course.
— Set the HEADING selector to the desired intercept heading and press the HDG switchlight; check that it illuminates.
— Press the ILS switchlight; check that it illuminates.
— Check the AFCS MODES panels for HDG, LOC ARM and GS ARM annunciation.
— Engage the second autopilot.

NOTE

The ILS mode should not be selected until the airplane is at the procedure turn inbound or on final radar vector and cleared for the approach.

The autopilot will turn the airplane to and maintan the selected heading. The heading can be changed at any time prior to localizer capture by using the HEADING selector.

At localizer capture, the LOC ARM annunciator changes to LOC and course tracking will begin. The HDG switchlight extinguishes and HDG disappears from the AFCS MODES panels. After capture, set the HEADING selector to the inbound localizer course in the event a go-around is required.

Prior to glideslope capture, airplane pitch attitude can be controlled by utilizing an altitude or vertical speed mode. If no pitch mode is selected, pitch can be controlled by using the control wheel as in CWS mode.

At glideslope capture, the PITCH mode and numeric displays go blank, and the GS ARM annunciation will change to GS.

After Glideslope Capture. As the airplane descends through 1500 ft radio altitude and approximately 25 seconds after glideslope capture, A/L, ALN ARM and FLR ARM will be displayed on the AFCS MODES panels. Parallel rudder operation will begin. Also at this time, if the second autopilot has not been engaged in CMD, a NO DUAL indication will be displayed on the AFCS WARNING panels. Automatic gain-programming of localizer and glideslope deviation, which is a function of radio altitude, is used to provide stable glideslope control down to the flare point.

At 150 ft radio altitude, the ALN ARM annunciation will change to ALIGN and the align maneuver is initiated.

At 50 ft radio altitude, the FLR ARM annunciation will change to FLARE and the flare maneuver is initiated. The autothrottle, if engaged will also begin a smooth reduction toward idle.

At 5 ft radio altitude, ROLLOUT will be annunciated and the yaw SAS will be commanded to track the localizer beam to provide directional guidance via rudder and nose wheel steering during the rollout.

At touchdown the autothrottle system brings the throttles to idle and disengages automatically. The autoground spoilers will extend. Apply reverse thrust normally.

Disengage the autopilot when desired, near the end of rollout.

NOTE

The autopilot adds nose-up trim bias during approach. Expect a nose-up out-of-trim condition if the autopilot is disengaged.

FLIGHT DIRECTOR MODES

All modes available to the autopilot (in CMD), plus takeoff and back course are also provided for the flight director. To allow simultaneous operation of the flight director and autopilot, the same procedures are used. The flight director may be used when the autopilot is OFF, in CWS, or in CMD. Commands displayed on the ADIs and the AFCS MODES panels are activated on the side with the FD switch ON. Flight director commands may be followed using the normal flight controls, or with the autopilot in CWS. When the autopilot is in CMD, the corresponding flight director (being in the same mode) can be used to monitor autopilot operation.

NOTE

When either pilot transfers his flight director he must monitor the other pilot's AFCS MODES panel for proper operation.

AUTOTHROTTLE OPERATION

To engage basic autothrottle,
- Set the autothrottle airspeed selector to present indicated airspeed.
- Press the AT switchlight; check that it illuminates.
- Set the autothrottle airspeed selector to the desired airspeed.
- Manually align EPRs.

To engage thrust management autothrottle,
- Press the TM switchlight; check that it illuminates.
- Check the AFCS MODES panels for THR MGT annunciation.
- Manually align EPRs.

To disengage the autothrottle,
- Press the autothrottle disengage switch (on throttle 1 or 3); check AT switchlight out.
- Press the autothrottle disengage switch again to reset the ATS DISC warning on the AFCS WARNING panel.

GENERAL

The Horizontal Situation Indicator (HSI) displays airplane position relative to a selected VOR/ILS course or INS track. Each pilot has a RADIO/INS switchlight on the glareshield panel, to select a radio or INS display for his HSI. The HSI 1-2 windows always display 1 on the captain's side and 2 on the first officer's side, to indicate the source of the VOR or INS information displayed on that side. When an INS display is selected, the word TRACK appears over the lubber line and NAV appears in the radio/INS annunciator window. When a radio display is selected, MAG appears over the lubber line and VOR (for VOR) or blue-yellow background (for localizer) appears in the radio/INS annunciator.

The HSIs also display:

- DISTANCE (miles) and TIME (minutes) to the next INS waypoint. The DISTANCE and TIME displays are not affected by the RADIO/INS switchlight.
- an ALERT light that indicates an impending waypoint change, when in the INS mode.

HSI WITH INS SELECTED

These indications are automatically supplied from the INS.

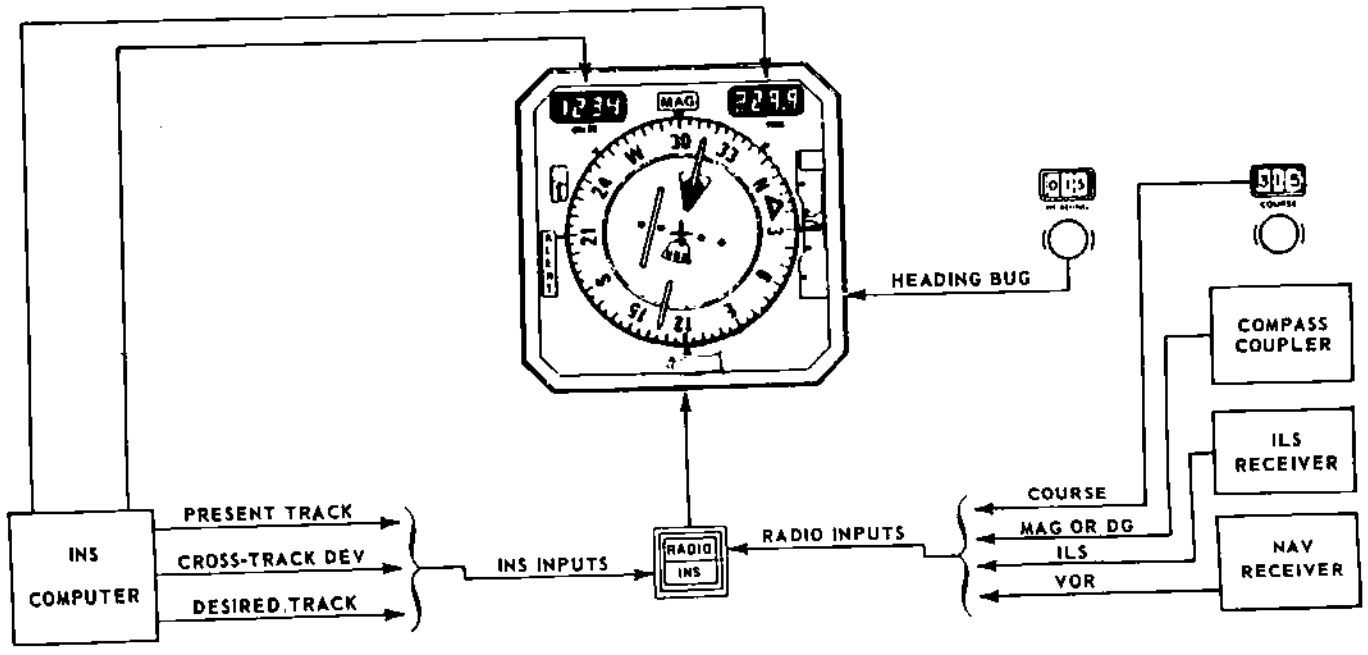
When INS is selected, the HSI indicates:

- Airplane present track, on the azimuth card at the lubber line.
- Desired track, by the course pointer on the azimuth card.
- Cross-track deviation, by the course deviation bar on the dot scale. When the course deviation bar is centered with the course pointer on the lubber line, the airplane is on the desired track.
- Direction to the waypoint, by the diamond-shaped flag used for VOR.
- Desired heading, by the heading bug on the azimuth card.

HSI INDICATIONS WITH RADIO SELECTED

When a RADIO display is selected, the HSI indicates:

- Airplane magnetic heading, on the azimuth card at the lubber line (if DG is selected on the compass controller, selected gyro heading is on the azimuth card).
- VOR/LOC deviation, by the course deviation bar.
- Glideslope deviation, on the glideslope deviation scale.
- Desired heading, by the heading bug on the azimuth card.
- Desired course, by the course pointer on the azimuth card.

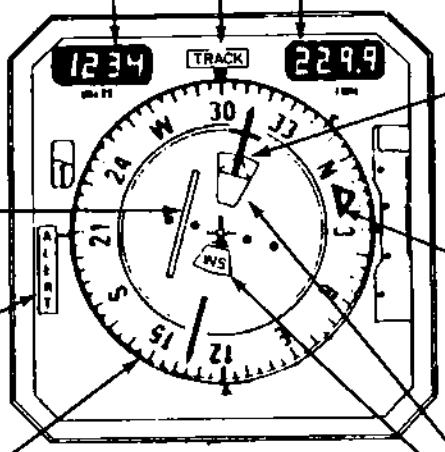


INS AND RADIO INPUTS TO HSI

MILES WINDOW
Displays distance in miles and tenths of miles from present position to next waypoint. Data is supplied by INS.

TRACK-MAG ANNUNCIATOR
Indicates data being displayed under lubber line.
TRACK: Present track being displayed.

TIME WINDOW
Displays time to go, in minutes and tenths of minutes, from present position to next waypoint. Data is supplied by INS.



COURSE POINTER
Points to desired track. Track angle error is shown by angle of course pointer relative to lubber line.

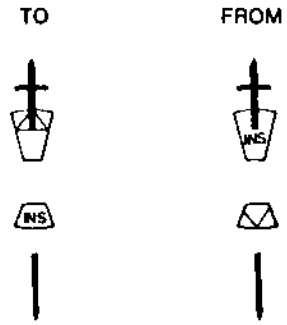
COURSE DEVIATION BAR
Indicates cross track deviation. Each dot equals 4 nm left or right.

HEADING BUG
- Controllable by heading knob on glareshield panel.
- Indicates true track corresponding to magnetic heading set in HEADING window on glareshield panel.

WAYPOINT ALERT ANNUNCIATOR
Flashes when within one minute of reaching a waypoint. Continues to flash after passing waypoint if next waypoint was not inserted, or INS is in manual mode.

AZIMUTH CARD
Displays present track under lubber line.

COURSE POINTER WINDOW CONDITIONS



COURSE POINTER WINDOWS

To Condition:
- Arrow in upper window indicates that next waypoint is available and that leg change has taken place.
- INS in lower window indicates that INS data is being displayed.

From Condition:
- INS in upper window indicates that INS data is being displayed.
- Arrow in lower window indicates next waypoint is not available, either because it was not inserted, or because INS is in manual mode.

HSI (INS MODE)

FLIGHT DIRECTOR SWITCH

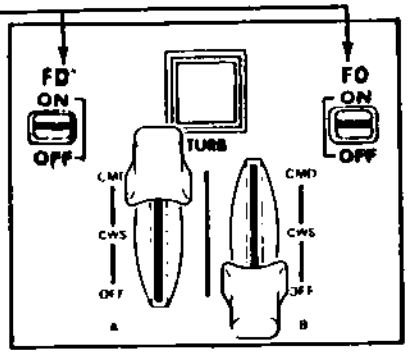
One for each pilot

ON:

Connects the selected normal or alternate flight director to the ADI.

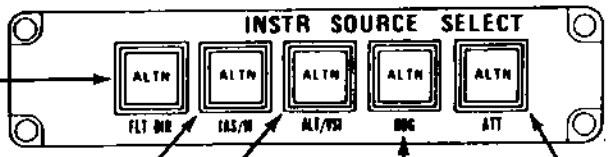
OFF:

The ADI pitch and roll command bars are biased out of view.



INSTRUMENT SOURCE SELECT PANEL (2)

The first pilot to select FLT DIR, IAS/M ALT/VSI or HDG, disarms the other pilot's respective switchlight.



FLT DIR Switchlight

Unlatched:

ADI pitch and roll command bars will be supplied from their normal sources.

The ALTN legend will be out.

Latched in:

Associated ADI pitch and roll command bars will be supplied by the other flight director.

The ALTN legend illuminates to indicate that the transfer circuits are energized.

IAS/M Switchlight

Unlatched:

Airspeed indicators are supplied from their normal source.

The ALTN legend will be out.

Latched in:

Associated airspeed indicator will reproduce the other airspeed indication.

Disarms the IAS/M switchlight on the other side.

The ALTN legend will be on to indicate the transfer circuits are energized.

ALT/VSI Switchlight

Unlatched:

Altimeter and vertical speed indicators are supplied from their normal source.

The ALTN legend will be out.

Latched in:

The associated altimeter and vertical speed indicator will reproduce the altimeter and vertical speed indication on the other side.

Disarms the ALT/VSI switchlight on the other side.

The ALTN legend will be on to indicate the transfer circuits are energized.

HDG Switchlight

Unlatched:

RMIs and HSIs are supplied from their normal source.

The ALTN legend will be out.

Latched in:

Transfers associated HSI to the same compass coupler supplying the other side. Also transfers FD source.

The ALTN legend will come on to indicate transfer circuits are energized.

ATT Switchlight

Unlatched:

ADIs are supplied from their normal source.

The ALTN legend will be out.

Latched in:

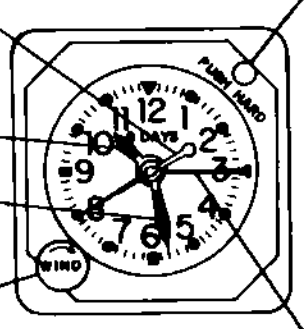
Respective ADI receives altitude information from VG3.

The ALTN legend will come on to indicate transfer circuits are energized.

DESCRIPTION

The GMT SET SELECTOR installed adjacent to the Second Officer's clock provides time-base information to the flight recorder by way of FIDDS.

S/O PANEL CLOCK



Sweep Second Hand
Controlled by PUSH HARD switch.

Hour Hand

Minute Hand

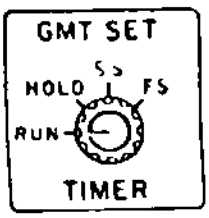
WIND Knob
Winds clock. Sets hour and minute hands when pulled.

PUSH HARD Switch
Controls sweep second hand and minute register hand.

- Pushing switch starts both hands.
- Pushing switch a second time stops both hands.
- Pushing switch a third time resets both hands to zero.

Minute Register Hand
Registers minutes for sweep second hand movement.

GMT SET SELECTOR



GMT SET Selector
Selector is used to install the correct UTC in the flight recorder system (FIDDS). Flight recorder time (UTC) is displayed when the flight recorder switchlight is latched in, the FIDDS Panel ON key is activated, and the documentary data line key is activated.

RUN - GMT display changes as function of time.

HOLD - GMT display holds at last indication.

SS - GMT display slow slews at rate of one minute per second.

FS - GMT display fast slews at rate of about 1.5 hours per second.

CONTROLS AND INDICATORS

CHRONOMETER (CHRO) CONTROL

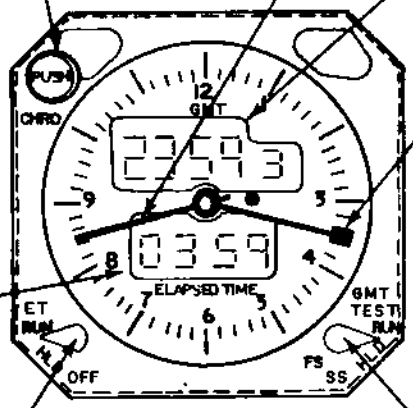
Pushbutton controls minute and second hands of short-term timer function. Performs same function as CLOCK SWP control on glareshield side panels.

First push: Initiates minute and second hand movement to display up to 12 minutes elapsed time.

Second push: Stops the timer and holds the hands at the current display.

Third push: Resets hands to zero out timer.

ELAPSED TIME WINDOW



(Pilots' Instrument Panels)

CHRONOMETER SECOND HAND

GMT DISPLAY WINDOW

Displays GMT up to 23 hours, 59.9 minutes.

CHRONOMETER MINUTE HAND

ELAPSED TIME (ET) CONTROL

When set to:

OFF:
Elapsed time is reset to zero and ELAPSED TIME display goes blank.

RUN:
Begins accumulation of time in hours and minutes.

HLD:
Stops and holds accumulated time.

GMT SELECTOR

Operates GMT display and selects GMT display function.

TEST:
8s appear in display windows.

RUN:
GMT display changes as a function of time.

HLD:
GMT display holds at last indication.

SS:
GMT display slow slews at the rate of one minute per second.

FS:
GMT display fast slews at the rate of one hour per second.

CLOCK SWEEP CONTROL

Controls minute and second hands of short-term timer function. Performs same function as CHRO control on clock face.

(Glareshield Side Panels)

FIDDS

INTRODUCTION

The Fault Isolation Data Display System (FIDDS) is an integral part of the Digital Autopilot and provides information for troubleshooting Autopilot and Active Control System (ACS) problems. ***This system is installed only on Digital Autopilot L-1011-500 airplanes*** and provides onboard flight station access to computer detected and analyzed fault data. This information is used for maintenance troubleshooting and results in quick correction of Autopilot and Active Control System problems.

The FIDDS' panel is conveniently located for troubleshooting on the flight engineer's lower console panels. As shown in Figure 1, the FIDDS' panel has four separate modes for airline operational use.

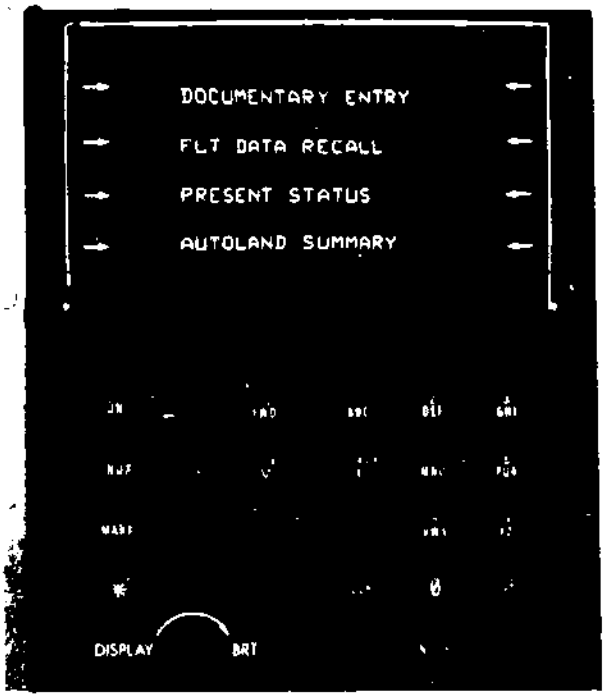


Figure 1 FIDDS Panel - Index Page

The *DOCUMENTARY ENTRY* mode is used by the Flight Engineer to enter the flight number and date information into FIDDS' computer memory. These data are used later for fault information displays in the *FLIGHT DATA RECALL* mode.

The *AUTOLAND SUMMARY* mode is designed to tabulate airline use of the Automatic Landing System. This mode automatically counts the number of automatic landings attempted and completed during a specified time period, as well as the number of automatic landings attempted with a NO DUAL indication. This mode also counts the number of automatic landings disconnected due to a system problem or pilot decision.

The *FLIGHT DATA RECALL* mode is designed to record in-flight Autopilot or ACS failure indications that occur during takeoff, cruise, and landings. These failure indications are automatically fault isolated and the data are conveniently stored in memory for later use at the next maintenance stop. The *FLIGHT DATA RECALL* mode is useful for troubleshooting intermittent or difficult problems that occur during flight. Some intermittent problems are difficult to duplicate by on-ground maintenance tests, and the fault data stored in the *FLIGHT DATA RECALL* memory can be useful for correcting these types of problems. The *FLIGHT DATA RECALL* mode stores (in the computer memory) the last 70 in-flight failure indications that occurred with Autopilot type problems, as well as the last 30 in-flight failure indications that occurred with the Active Control System (ACS). In the *FLIGHT DATA RECALL* mode, one fault display is stored for each in-flight detected failure. If the in-flight problem is reset by the flight crew and the failure repeats, a new FIDDS' display is generated and stored for the same problem. Thus, the *FLIGHT DATA RECALL* information is an actual record of failure indications and associated fault data that occurred on the last flight or the last series of flights. During maintenance troubleshooting, the *FLIGHT DATA RECALL* data should be analyzed and compared to problems noted by the flight crew in the Airplane Log Book before replacing system components.

The *PRESENT STATUS* mode is designed for troubleshooting problems that occur during on-ground operations. This mode is specially useful for troubleshooting problems that occur during pre-flight crew checks or maintenance checks of the Autopilot or ACS systems. The *PRESENT STATUS* mode is operational at all times and can also be used for in-flight troubleshooting. *PRESENT STATUS* data, however, are displayed only as long as the flight station failure indication is present. In other words, *PRESENT STATUS* fault data are not stored in memory and can be lost if the failure indication is reset by the flight or maintenance crew. **The *PRESENT STATUS* mode should be used only to troubleshoot problems that can be duplicated by flight station procedures.**

GENERAL

The performance management system (PMS) provides:

- a means of computing various operating parameters for controlling flight as economically as possible,
- a display of performance data for various phases of flight, and
- inputs for coupling to the autopilot and autothrottle systems.

All PMS input, computation, and data display functions are controlled by a Control Display Unit (CDU) on the forward pedestal.

The PMS has the following primary modes of operation, some of which are data displays only; others are coupled to the APFDS and ATS.

- Takeoff
- Climb
- Cruise (includes Holding)
- Descent to BOD (Bottom of Descent)
- Enroute descent
- Engine-out driftdown
- Landing

Takeoff and landing are display modes only. The remaining modes can be coupled to the APFDS and ATS.

Supporting CDU page data can be selected to display alternate climb, cruise or descent schedules to accomodate ATC and allow an evaluation of a step climb. A maintenance function display is also available, but on the ground only.

The primary purpose of the Performance Management System is to conserve fuel. All airplane performance data and engine EPR tables are stored in the PMS computer. To obtain the full benefit of PMS, it is coupled to the autopilot, flight director and autothrottle.

The PMS is normally engaged during climb, cruise, and descent as well as engine-out driftdown modes. In climb, descent and driftdown, the autopilot holds the commanded PMS speed by adjusting pitch. In cruise or holding, the autopilot reverts to the normal altitude hold mode.

The PMS uses the autothrottle to maintain a commanded EPR during climb, descent and engine-out driftdown, and to hold the commanded PMS speed in cruise and holding. When controlling airspeed during cruise and holding, the system biases the autopilot altitude hold channel to permit an altitude drift of ±100 ft to help dampen throttle activity.

The system contains an optimized climb, cruise and descent schedule. An additional two schedules are available for each flight phase, primarily to accomodate ATC. The optimum climb schedule includes a variable climb speed and a variable EPR derate.

CONTROL DISPLAY UNIT (CDU)

The CDU provides the means of controlling and monitoring the PMS. The CDU consists of keyboard controls, illuminated status annunciators, and a data page display. The page display presents seven lines of alphanumeric text. Six of the lines can be individually changed. Line keys are provided to reference each line for text changes. A numerical keyboard permits data insertion onto the selected line. When a line is selected for data entry, any existing information on the line is cleared, an arrow appears at the right end of the line, and an INSERT key is illuminated. When the desired data is entered on the selected line, pressing the INSERT key enters the data into the PMS, extinguishes the INSERT key and removes the arrow from the selected line. Previous data can be recovered prior to pressing the INSERT key by re-indexing the line or selecting another page.

PRIMARY MODES OF OPERATION

TAKEOFF

The takeoff mode is a display mode only. It computes and displays takeoff EPR based on inserted temperature. The page display is titled TAKEOFF.

CLIMB

During climb, the PMS uses pitch to control airspeed according to the IAS/Mach climb schedule commanded. In addition, it controls the engines through the ATS, to the selected climb EPR schedule. An interim altitude may be captured by using normal APFDS altitude select procedures. The system switches to a cruise control mode when an interim altitude hold is engaged, and holds the selected cruise IAS or mach in level flight. On subsequent climb, PMS automatically reverts to optimum climb mode with the proper EPR derate for the existing gross weight.

The selected cruise altitude is captured by using the normal APFDS procedure for selecting ALT ARM. At cruise altitude capture, the PMS automatically switches to the cruise mode.

STEP-CLIMB. The PMS displays advisory information to assist the flight crew in the choice of cruise altitude. The advisories consist of the optimum altitude advisory and the step-climb advisory. Optimum altitude is the altitude for optimum specific range. The step-climb advisory consists of an estimated time to begin the step-climb and wind-trade information, and it is based on an assumed step-climb of 4000 ft, unless a different altitude increment is manually entered. The wind-trade provides a means of deciding if a step-climb is worthwhile on the basis of expected winds at the new altitude. Upon reaching the new altitude new step climb advisories are initiated for the next 4000 ft step-climb.

CRUISE

In cruise mode, normal APFDS altitude hold is used in pitch and the ATS controls speed according to either a selected IAS or mach, or to a computed optimum mach, depending on the cruise option used. To minimize throttle hunt, small pitch commands are introduced to the APFDS altitude hold function, and altitude is allowed to vary up to 100 ft. The commands are a function of mach rate and are used to dampen short term mach variations without affecting throttle setting.

A turbulent air feature is also provided in the cruise mode. The PMS senses mach rate-of-change. When an index level is exceeded for a given period of time, the PMS turbulence mode is automatically actuated. The PMS then positions the throttles to the required EPR for the commanded flight condition and maintains this throttle setting until the turbulence decreases below the threshold level.

DESCENT

The PMS provides a descent mode which is programmed to control the airplane descent to arrive at any predetermined geographical position defined by distance, altitude and speed. This is accomplished by back-computing from the bottom of descent (BOD) point to determine the optimum top of descent, based on cruise altitude, computer-stored airplane performance, the existing winds at cruise, and a wind model during descent.

The descent maneuver consists of a gradual push-over to capture the mach/IAS schedule, using APFDS pitch commands and ATS fixed EPR commands. Normal APFDS altitude select and capture procedures are used to capture the final descent altitude.

ENGINE OUT

Automatic control of two-engine driftdown, level-flight cruise, and climb is provided.

HOLDING

Holding mode is similar to cruise and is available with flaps zero and flaps 4.

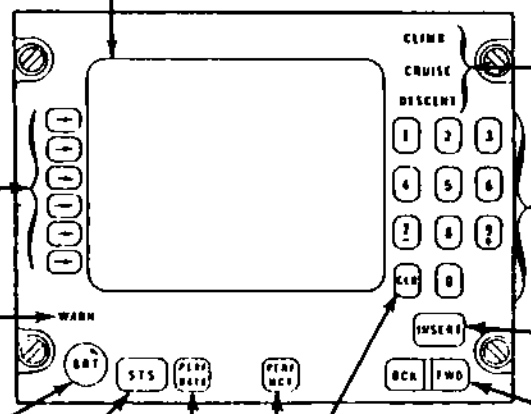
LANDING

The landing mode is a display mode only. It computes and displays the Vth and go-around EPR.

SEMI-AUTOMATIC MODE

PMS can be used with the autopilot off or in CWS provided a flight director is on.

CONTROL DISPLAY UNIT



LINE KEYS (6)
(Momentary press-type)
When pressed once,
- Clears present data from line.
- Displays an arrow at the right end of the line.
- Illuminates INSERT key.

When pressed a second time, restores original data if new data was not inserted.

PAGE DISPLAY

MODE ANNUNCIATORS
Illuminate to indicate the PMS mode currently engaged. DESCENT annunciator flashes two minutes prior to TOD.

KEYBOARD
10 keys used to load data before insertion (includes + and – for loading temperature).

WARNING ANNUNCIATOR
On:
PMS has failed.

INSERT KEY
When pressed, inserts loaded data into the PMS computer.

BRIGHTNESS CONTROL
Controls intensity of page display.

BACK/FORWARD KEY
Permits paging BCK (backward) or FWD (forward) to display desired page.

STATUS LIGHT/KEY
Malfunction indicator.
Flashing:
- Moderate PMS malfunction.

Steady:
- Serious PMS malfunction.

Pressing key calls up malfunction page and resets warning.

CLEAR KEY
When pressed, erases the last digit loaded; when pressed a second time, erases the next-to-last digit, etc.

PERFORMANCE DATA KEY
When pressed, selects LANDING DATA page display.

PERFORMANCE MANAGEMENT KEY
When pressed, displays page that is presently engaged, or is relevant to the phase of flight (takeoff, climb, cruise, descent).

PMS, Normal Operation

GENERAL

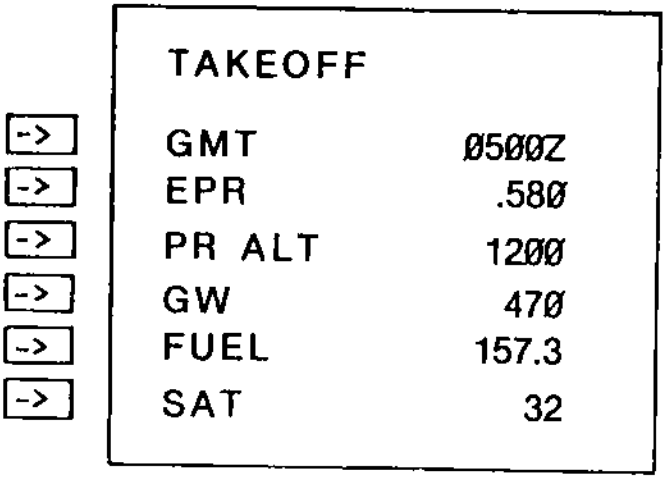
Normal operating procedures for the PMS are covered in detail in this section. A PMS Operating Guide is included at the end of this section (and is also available in laminated form on the airplane) to summarize PMS procedures.

PREFLIGHT

PMS INITIALIZATION

PMS initialization begins by displaying and entering data on the Takeoff page.

— Press the PERF MGT key to display the Takeoff page. On initial display, the page indicates entries from the previous flight. The following is a sample of the initial Takeoff page that will be displayed.



— Press the GMT line key. If page GMT is accurate, press INSERT key.
— If page GMT is not accurate, enter the correct GMT, using the keyboard, and press the INSERT key.

NOTE

When entering the GMT, enter the time slightly ahead of the actual time. Press the INSERT key when the selected time is the same as the actual time.

The PMS is now initialized, and the EPR, GW, FUEL and SAT lines go to zero. The pressure altitude (PR ALT) line will display the pressure altitude sensed by the ADCs. This provides a confidence check that takeoff EPR will be calculated for the proper pressure altitude.

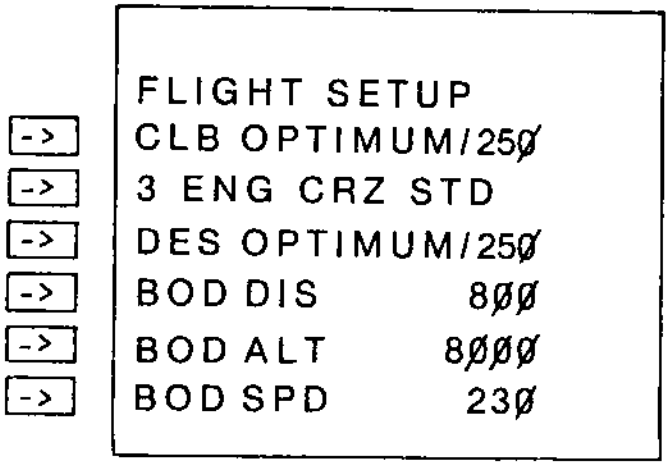
— Press the GW line key.
— Enter the airplane gross weight in pounds x 1000. The gross weight should be entered (to the nearest 1000 lb) using a 3-digit number. For example, 470,600 lb will be entered as 471.
— Press the INSERT key.
— Press the FUEL line key.
— Enter the total fuel weight in pounds x 1000 to the nearest 100 lb. For example, 157,320 lb will be entered as 1573; a decimal will automatically appear after the 7 (157.3).
— Press the INSERT key.
— Press the SAT line key.
— Enter the SAT. Press the + or – key, then enter the tower temperature in degrees Centigrade. For a reduced thrust takeoff, enter assumed temperature. (Only the – sign is displayed; no sign, indicates a temperature above zero.)

After SAT has been entered, computed packs-on takeoff EPR will be displayed.

FLIGHT SETUP

This page provides the capability of selecting flight performance schedules other than Pan Am standards, when required by ATC. The selections can be made at any time, on the ground or inflight.

— Press the PERF MGT key.
— Press the FWD key. The following is a sample of the page that will be displayed.



The first three lines were automatically pre-programmed when GMT was inserted. These lines may be indexed and the data changed at any time, on the ground or inflight. Normally, optimum climb, standard cruise and optimum descent should be used to maximize fuel savings. The remaining three lines are used to enter distance to BOD (Bottom of Descent), BOD altitude, and speed at BOD.

For a short flight, enter total trip distance as BOD DIS, and enter BOD ALT and BOD SPD. This permits the PMS to compute an optimum cruise altitude. For long flights, the three lines of BOD data should be entered enroute when distance to BOD can be accurately established from INS data. BOD DIS is required for the PMS to compute optimum TOD.

NOTE

The PMS reduces distance to BOD as a function of INS-2 groundspeed and cannot recognize off-track deviation. Distance to BOD should be updated if track deviations occur. If INS-2 is inoperative, the PMS will use true airspeed as ground speed.

TAXI AND TAKEOFF

FINAL GROSS WEIGHT INSERTION

— Press the BCK key to display the Takeoff page.
— Press the GW line key.
— Reduce the blocks GW finals by the amount of taxi fuel burned, and enter the present calculated gross weight using the keyboard, then press the INSERT key.

Leave the Takeoff page displayed for takeoff.

CLIMB

PMS ENGAGEMENT

— Set either autopilot to CMD.
— Press the VNAV switchlight (light illuminates and VNAV is displayed on AFCS MODES panels).
— Press the TM switchlight and set ATS switch to ON (light illuminates and THR MGT is displayed on AFCS MODES panels).
— Check that PMS target EPR is not exceeded; adjust throttles manually to balance all EPRs.
— Check that PMS target IAS or mach is being maintained.

The PMS will use the selected climb mode to climb the airplane to the cruise altitude entered on the glareshield panel altitude selector. PMS will automatically transition to the selected cruise mode after leveloff.

INTERMEDIATE LEVELOFF

If a level off at an intermediate altitude (as selected on the glareshield panel altitude selector) is required, the PMS will maintain the selected cruise IAS or mach after leveloff.

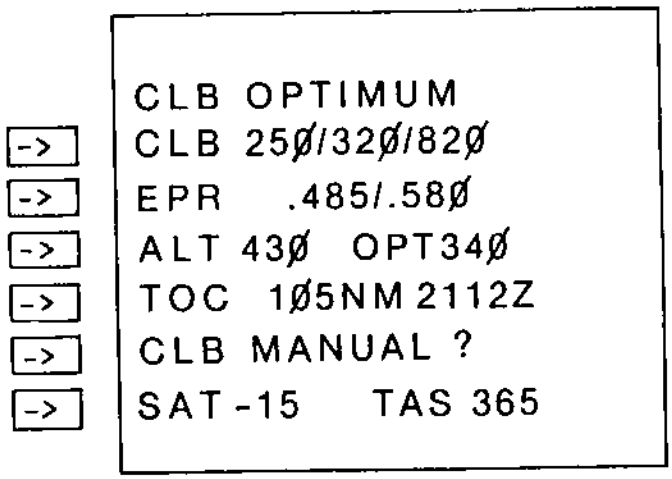
To resume climb to a higher altitude (it is assumed that the autopilot is still engaged and that TM is still selected),

— Select the new altitude on the glareshield panel altitude selector and the CDU Cruise page. Arm ALT SELECT.
— Press the VNAV switchlight (light illuminates and VNAV is displayed on AFCS MODES panels).

The PMS will now climb the airplane to the new cruise altitude, and transition to the selected cruise mode after level off.

CLIMB DISPLAY

The Climb page is automatically displayed at liftoff. The following is a sample of the page that will be displayed.



CLB:
Indicates sequentially,

- Commanded IAS below 10,000 ft,
- Intermediate altitude IAS,
- High altitude mach.

EPR:
Indicates sequentially,

- Derated EPR for optimum climb schedule,
- Limit climb EPR,

ALT:
Desired cruise altitude. Initial cruise altitude must be inserted by the crew to enable the PMS to compute distance and time to TOC. The inserted altitude must be higher than the existing altitude or the PMS climb mode will not engage. An altitude of 430 is automatically selected after inserting GMT.

PMS, Normal Operation

OPT: Optimum cruise altitude.

TOC: Indicates sequentially, distance to TOC, and ETA at TOC to ALT selected above.

CLB MANUAL: Provides the capability of reverting to a manual climb speed, if requested by ATC, without selecting the Climb Setup page.

SAT-TAS: Actual SAT and TAS provided by the ADCs.

To insert desired cruise altitude,
— Press the ALT line key.
— Enter the initial cruise altitude, then press INSERT key.

OPTIONAL CLIMB MODES

PMS always reverts to climb optimum mode after level off.

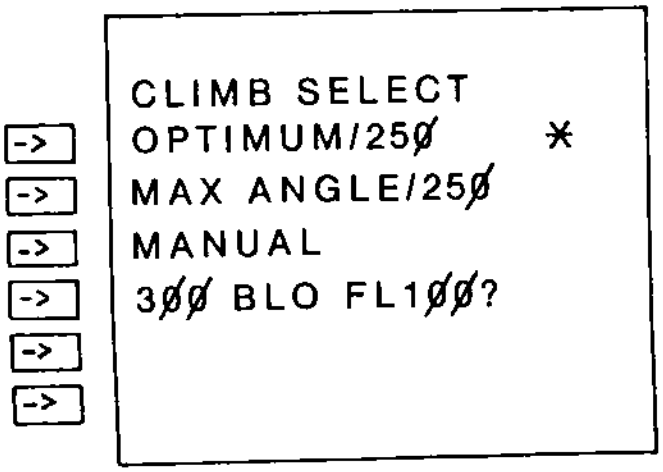
If a manual climb mode is required,
— Press the CLB MANUAL ? line key:
- The page title changes to CLB MANUAL,
- the speed portion of the CLB line is erased,
- an arrow is displayed.

— Enter the desired IAS or mach, then press the INSERT key. The PMS uses the CLB OPTIMUM EPR derate.

NOTE

The PMS accepts IAS speeds only in the 240 to 340 kt range. If other speeds are inserted, the line will display IAS TOO HI (or LO).

If a climb mode other than CLB OPTIMUM or CLB MANUAL is required by ATC, or a climb speed of 300 kt is desired below 10,000 ft to conserve additional fuel, press the CLB (IAS/mach) line key. The following is a sample of the page that will be displayed (the asterisk indicates the climb mode that is currently selected):


CLIMB SELECT
-> OPTIMUM/25Ø *
-> MAX ANGLE/25Ø
-> MANUAL
-> 3ØØ BLO FL1ØØ?
->
->
->

CRZ: Indicates commanded cruise mach and the corresponding IAS. (Standard cruise is .830M).

FUEL REM: Fuel remaining based on the fuel weight inserted, less fuel used.

ALT:
Desired cruise altitude. A higher altitude must be inserted to initiate a climb, and a lower altitude must be inserted to initiate a descent. These altitude changes may be inserted at any time without affecting cruise operation, since the autopilot altitude hold mode is controlling altitude.

OPT: Optimum cruise altitude.

STEP: Time at which a 4000 ft step-climb may be started to reach OPT altitude at the proper GW. Other than a 4000 ft step-climb may be entered on the Step Data page.

TOD: Distance and GMT to the top of descent. (The crew must insert distance to BOD on the Flight Set-up or Descent page using INS/ONS distance from present position to BOD waypoint.)

SAT-TAS: Actual SAT and TAS provided by the ADCs.

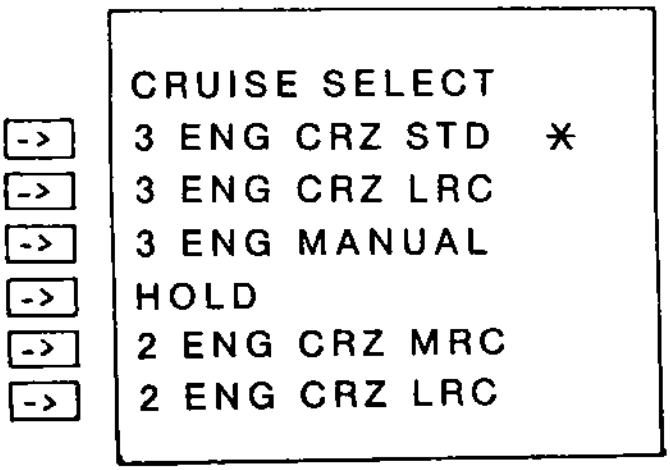
OPTIONAL CRUISE MODES

In addition to 3 Eng Cruise Std, the following cruise modes are available,

- 3 Eng Crz LRC. This is used if optimum altitude is not available (Standard cruise of .830M is equivalent to LRC at optimum altitude).
- 3 Eng Manual. This is used if ATC required a special cruise speed.

The optional cruise modes may be selected by pressing CRZ (IAS/mach) line key to display the Cruise Select page.

The following is an example of the page that will be displayed (the asterisk indicates the cruise mode that is currently selected):



If 3 Eng Crz LRC is desired,

— Press the 3 ENG CRZ LRC line key. The display will revert to the Cruise page which will now be titled 3 Eng Cruise LRC. The data display will be in the same format as the 3 Eng Cruise Std page. The PMS will now command the displayed LRC mach/IAS.

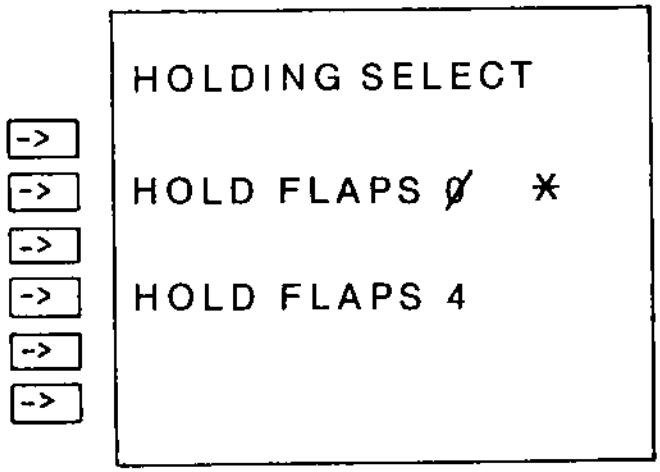
If 3 ENG MANUAL cruise is desired,

— Press the 3 ENG MANUAL line key. The display will revert to the Cruise page which will now be titled 3 Eng Manual. The CRZ line will be blank.

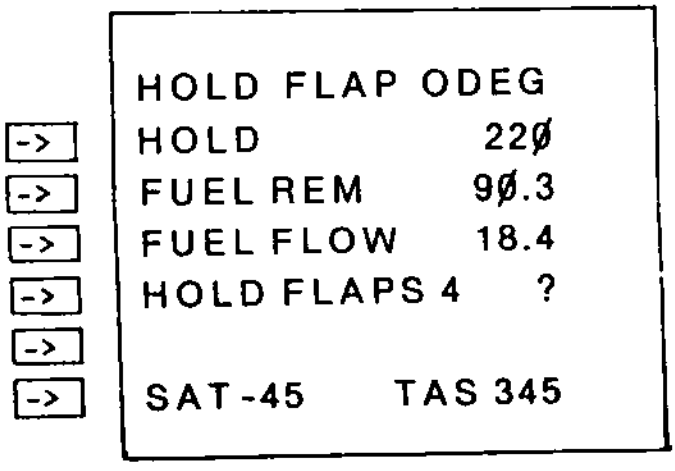
— Enter the desired IAS (366 kt or less) or desired mach (.800 to .860), then press INSERT key. PMS will now command the displayed CRZ IAS or mach.

If holding is desired,

— Press the HOLD line key. The following will be displayed:



Pressing either HOLD line key changes the page to the option selected. If HOLD FLAPS 0 line key is pressed, the following is a sample of the page that will be displayed (PMS will now command the indicated HOLD speed):



PMS, Normal Operation

HOLD: Holding speed for the selected option.

FUEL REM: Fuel remaining based on fuel weight inserted, less fuel used.

FUEL FLOW: Present total fuel flow in 1000 lb/hr, displayed to the nearest 100 lb/hr.

HOLD FLAPS 4 ?: Denotes the capability of making an immediate selection to holding at 4 degrees flap. If selected, the line goes to HOLD FLAPS 0 ?, the page title changes to Hold Flap 4 Deg, and the PMS then displays and commands the 4-degree flap speeds.

SAT-TAS: Actual SAT and TAS provided by the ADCs.

ENGINE OUT

Two options are available with engine-out operation:

- 2 ENG CRUISE MRC, which is a maximum range driftdown (shallowest possible descent angle). At level off altitude, the PMS reverts to LRC.
- 2 ENG CRUISE LRC, which is a more rapid driftdown and transition to LRC.

If 2 ENG CRUISE MRC is desired,

— Press CRZ (IAS/mach) line key on the Cruise page to display the Cruise Select page.
— Press 2 ENG CRZ MRC line key. The following is a sample of the page that will be displayed:

```
2ENG CRUISE MRC
-> IAS/EPR    32Ø/524
-> RES FUEL 22.Ø
-> ALT 19Ø OPT 193
-> RNGE 2415/23Ø5Z
-> 2 ENG CRZ LRC?
-> SAT -45 TAS 345
```

IAS/EPR: Driftdown speed for the present gross weight and altitude, followed by the max continuous EPR.

RES FUEL: Desired reserve fuel quantity in pounds. Must be inserted by the crew. This value is used by PMS to calculate the RNGE value displayed below.

ALT: Desired 2-engine cruise altitude. Must be inserted by the crew and be lower than existing altitude to initiate driftdown.

OPT: Cruise altitude at which the airplane can maintain long range cruise at max continuous thrust.

RNGE: Distance in nautical miles and the GMT to the reserve fuel value displayed above.

2 ENG CRZ LRC?: Permits direct selection of LRC mode if more rapid driftdown is required.

SAT-TAS: Actual SAT and TAS provided by the ADCs.

If 2 ENG CRUISE LRC is desired, it may be selected in two ways:

— Press the 2 ENG CRZ LRC line key on the Cruise Select page, or
— Press the 2 ENG CRZ LRC? line key on the 2 ENG CRUISE MRC page.

The following is a sample of the page that will be displayed when either line key is pressed:

```
2ENG CRUISE LRC
-> IAS/EPR    3Ø5/418
-> RES FUEL 22.Ø
-> ALT 19Ø OPT 193
-> DD 210NM Ø:37
-> DD FUEL 11.2
-> SAT -45 TAS 345
```

IAS/EPR: Driftdown speed for the present gross weight and altitude, followed by the LRC EPR minus 0.120 EPR.

RES FUEL: Desired reserve fuel quantity, in pounds. Must be inserted by crew.

ALT: Desired 2-engine cruise altitude. Must be inserted by the crew, and be lower than existing altitude to initiate driftdown.

OPT: Same as 2 ENG CRUISE MRC. Cruise altitude at which the airplane can maintain long range cruise at max continuous thrust.

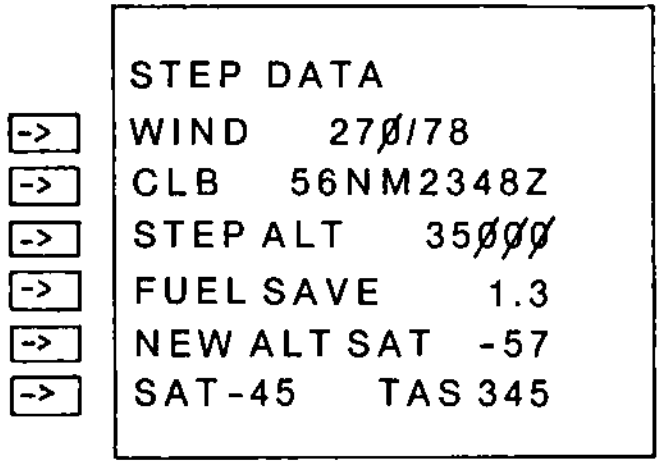
DD: Drift down data; distance in nautical miles and time in hours and minutes for the airplane to drift down to the OPT altitude (or selected ALT provided it is within + 1000/ – 3000 ft of OPT altitude).

DD FUEL: Estimate of fuel burn during driftdown to the OPT altitude (or selected ALT provided it is within + 1000/ – 3000 ft of OPT altitude).

SAT-TAS: Actual SAT and TAS provided by the ADCs.

To engage either 2 ENG CRUISE mode, (it is assumed that the autopilot is still engaged and that TM is still selected),
— Press ALT line key.
— Enter an altitude below OPT and press INSERT.
— Set the altitude selector on the glareshield panel to the clearance altitude and arm ALT SELECT.
— Press the VNAV switchlight.
— Check AFCS MODES panels for VNAV, ALT ARM, THR MGT.
— Check CDU CRUISE light on.

STEP-DATA
— Press PERF MGT key to display the Cruise page.
— Press the STEP line key. The following is a sample of the page that will be displayed:



WIND: Present wind velocity and direction can be manually entered if wind at STEP ALT is known.

CLB: Distance to and GMT at the beginning of the step-climb, to the STEP ALT.

STEP ALT: Automatically displays step climb altitude in 4000 ft increments. Can be manually entered to a desired step altitude.

FUEL SAVE: Total fuel SAVE or LOST by climbing to the STEP ALT compared to the present altitude.

NEW ALT SAT:Assumed SAT at STEP ALT, computed by using present SAT and standard lapse rate.
Can be manually inserted if SAT at STEP ALT is known.

SAT/TAS: Actual SAT and TAS provided by the ADCs.

If a climb to a higher altitude is desired, refer to Climb, PMS Engagement.

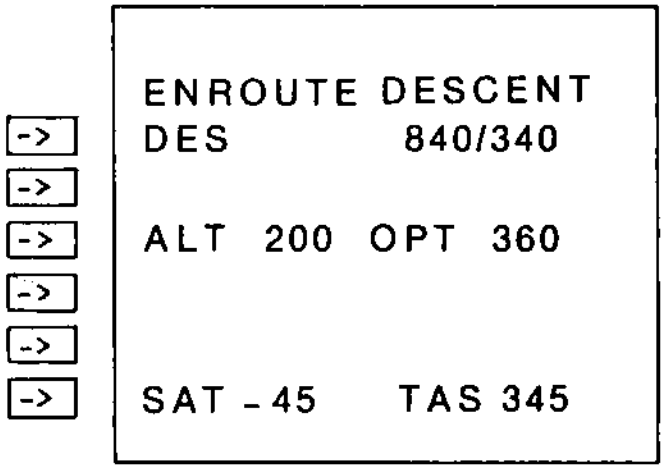
DESCENT

ENROUTE DESCENT

An enroute descent to an altitude, other than the BOD altitude, can be made if the airplane is not within 10 minutes of TOD. Proceed as follows:
— Select the new altitude on the glareshield panel and arm ALT SELECT.
— Press PERF MGT key to display the Cruise page.
— Press the ALT line key; enter new altitude and press INSERT key.
— Press the VNAV switchlight (light illuminates and VNAV is displayed on AFCS MODES panels). Check TM and ATS still on; TM will reduce thrust automatically.

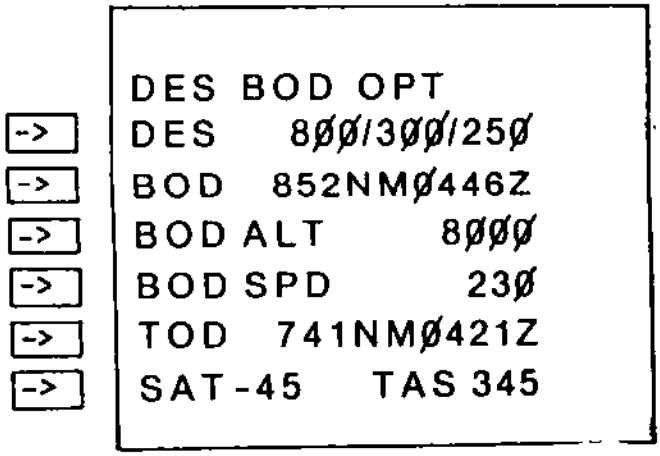
The PMS will now descend the airplane to the newly selected altitude at the existing speed. Above .80M, a constant mach will be held until transition to constant IAS, which occurs as follows: .83/330, .82/320, .81/310, etc. At cruise altitude capture, speed will be maintained at the selected cruise option.

The following is a sample of the page that will be displayed:



DES: Commanded descent schedule.
ALT. Altitude inserted by crew.
OPT: Optimum cruise altitude.
SAT-TAS: Actual SAT and TAS provided by the ADCs.

DESCENT TO BOD
— Press PERF MGT key to display the Cruise page.
— Press the TOD line key; the following is a sample of the page that will be displayed during cruise:



PMS, Normal Operation

DES: Optimum descent speed schedule.

BOD: Distance to and time of arrival at BOD waypoint. Crew must enter distance to BOD waypoint from INS data.

BOD ALT. Desired altitude to cross BOD waypoint. Must be entered by crew.

BOD SPD: Desired speed to cross BOD waypoint. Must be entered by crew.

TOD: Distance to and time of arrival at optimum TOD point as computed by PMS using BOD distance, BOD ALT, and BOD SPD entered by crew.

SAT/TAS: Actual SAT and TAS provided by the ADCs.

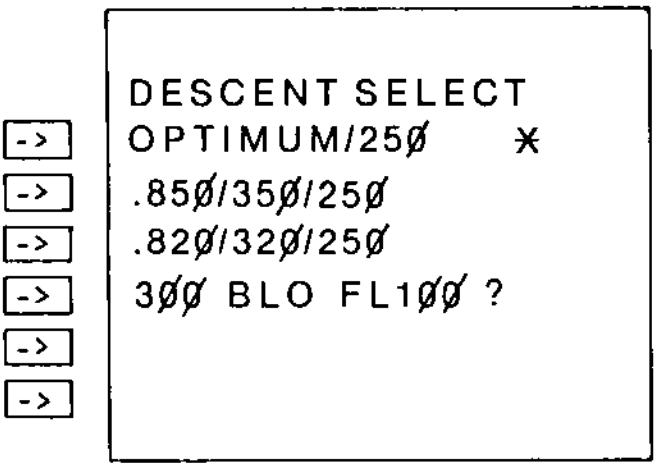
OPTIONAL DESCENT MODES

In addition to OPTIMUM descent, the following descent modes are available if required by ATC:

- .850/350/250
- .820/320/250
- 300 kt below 10,000 ft.

— Press the PERF MGT and FWD keys. The Flight Setup page will be displayed.
— Press the DES line key; the Descent Select page will be displayed.

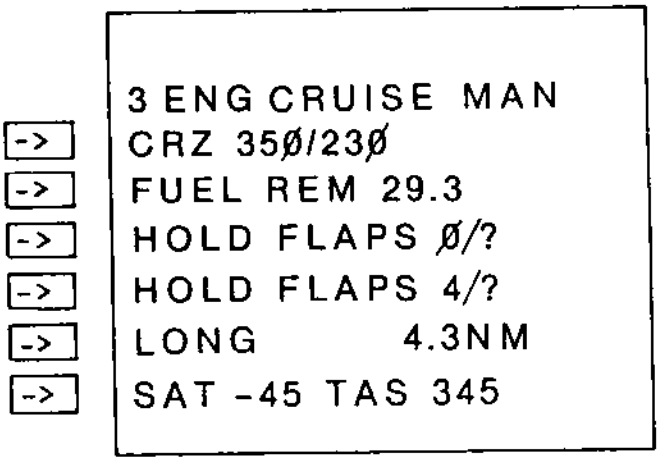
The following is an example of the page that will be displayed:


DESCENT SELECT
->
OPTIMUM/25Ø *
->
.85Ø/35Ø/25Ø
->
.82Ø/32Ø/25Ø
->
3ØØ BLO FL1ØØ ?
->
->
->

PMS Description

CRUISE AT BOD

After level off at BOD altitude and reduction to BOD speed, the PMS automatically transitions to a cruise mode. The following is a sample of the page that will be displayed:



CRZ: Mach and IAS as selected for BOD speed on the Flight Setup page.

FUEL REM: Based on the fuel weight inserted, less fuel used.

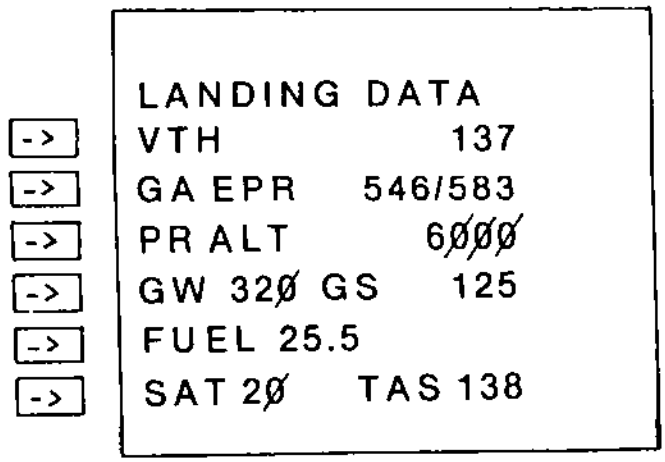
HOLD FLAPS 0/?:
HOLD FLAPS 4/?: } Permits direct selection of holding modes.

LONG: Indicates the distance short of (– sign) or beyond (no sign) BOD waypoint. The line is erased when more than 10 minutes beyond BOD.

SAT/TAS: Actual SAT and TAS provided by the ADCs.

APPROACH/LANDING

— Press the PERF DATA key to display the Landing Data page. The following is a sample of the page that will be displayed:



NOTE

The Landing Data page is a display page only; it is not coupled to the APFDS or ATS.

VTH: Vth for the displayed gross weight.

GA EPR: EPR based on measured pressure altitude, IAS and TAT. Display indicates both standard and the two-engine-inop go-around EPR.

PR ALT: Present pressure altitude.

GW: Computed gross weight.

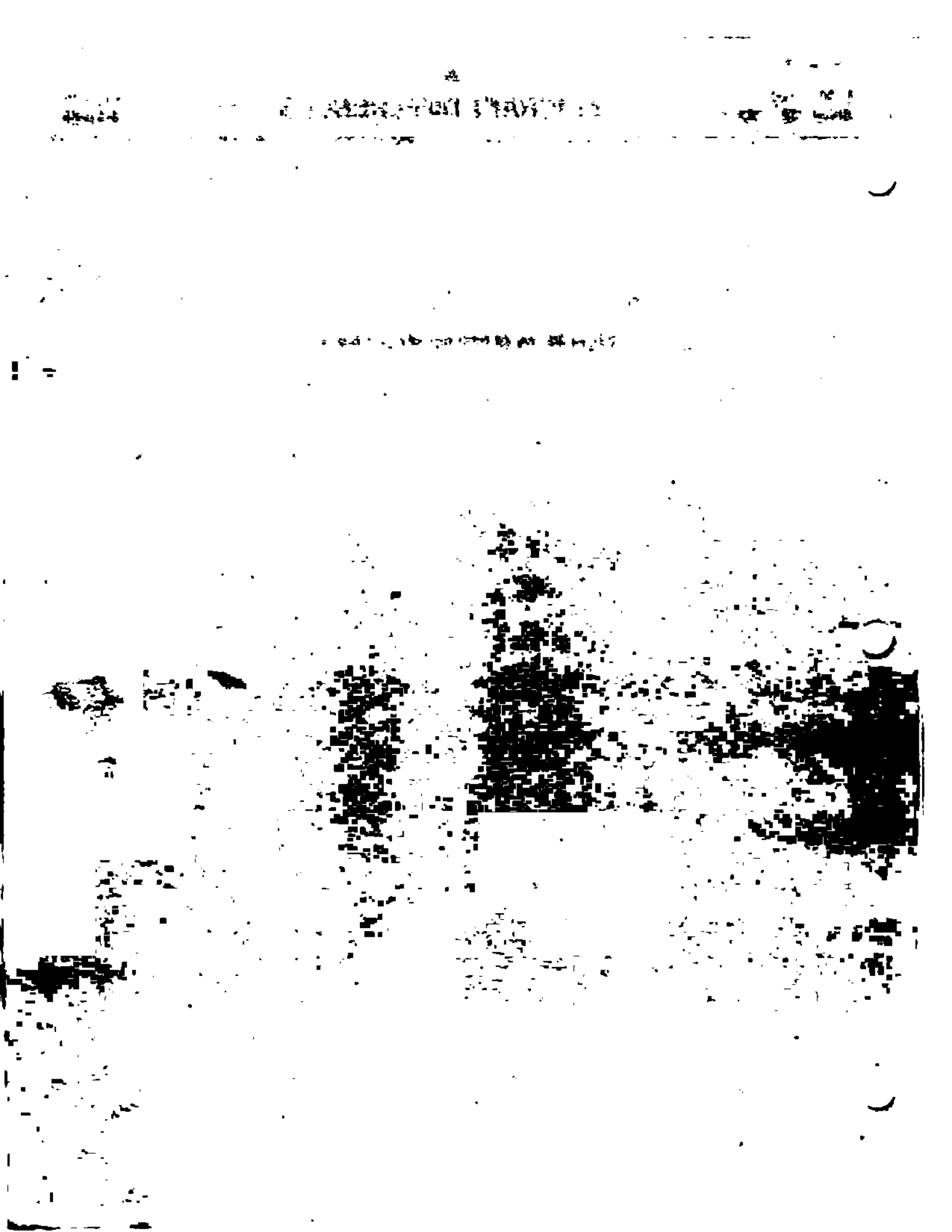
GS: INS-2 groundspeed (erased if INS-2 is inoperative).

FUEL: Computed fuel remaining.

SAT-TAS: Actual SAT and TAS provided by the ADCs.

OPPOSITE SIDE BLANK

Pages 39 and 40 Intentionally Left Blank



Ground Proximity Warning System

DESCRIPTION

The ground proximity warning system (GPWS) warns the flightcrew of a potentially dangerous flightpath relative to the ground. The warning consists of two flashing red lights labeled GPWS and voice warnings of

- "Sink rate".
- "Terrain".
- "Don't Sink".
- "Too Low, Terrain".
- "Too Low, Gear".
- "Too Low, Flap".
- "Whoop, Whoop, Pull Up."
- "Glideslope" (no flashing red lights).

GPWS MODES

Warning is provided for the following flight modes

Mode 1: Excessive rate of descent below 2500 ft AGL.

Mode 2: Excessive rate of closure with rising terrain.

Mode 3: Descent during takeoff regime.

Mode 4: Not in landing configuration
A. Gear up below 500 ft AGL (1000 ft with Mach greater than 0.45)
B. Flaps up below 200 ft AGL (1000 ft with Mach greater than 0.45)

Mode 5: Excessively low on glideslope.

The system is not designed to warn for

- landing short of the runway if the airplane is in landing configuration with a nominal rate of descent and no ILS glideslope, and
- a flight profile approaching very steep terrain such as a sheer cliff.

Warning occurs when operating in the shaded areas of the graphs shown in this section for each of the modes. It is possible for two or more modes to give warning simultaneously; mode 1 through 4 warnings take precedence over mode 5.

All modes are deactivated below 50 ft radio altitude to prevent false warnings caused by a malfunctioning radio altimeter running down to zero feet.

SYSTEM INPUTS

The following are the inputs to the GPWS computer

SOURCE	INFORMATION
No. 1 radio altimeter.	Altitude above ground level and closure rate with rising terrain.
No. 1 air data computer.	Barometric rate of descent and mach.
No. 1 glideslope receiver.	Deviation below glideslope.
Gear handle switch.	Not in landing configuration.
Flap drive unit position switch.	Not in landing configuration.

MALFUNCTION AFFECTS

The GPWS is affected as follows, after loss of the specified signal to the GPWS computer

SIGNAL	GPWS EFFECT
Radio altimeter (captain's radio altimeter flag showing).	Full shutdown.
Air data computer (captain's barometric altimeter flag shows).	Warnings for excessive rate of descent and descent during takeoff regime are inop.
Ac power.	Full shutdown.
Dc power.	GPWS lights are inoperative.
Glideslope receiver.	Glideslope warning is inop.
Gear handle switch.	Not in landing configuration warning for gear may be inop, or cause a nuisance warning, depending on type of failure.
Flap drive unit position switch.	Not in landing configuration warning for flaps may be inop, or cause a nuisance warning, depending on type of failure.

Ground Proximity Warning System

CONTROLS AND INDICATORS

GPWS SWITCHLIGHT (2)

Momentary

When pressed between 1000 ft and 50 ft AGL,

- Disarms "Glideslope" voice warning. Disarm can be initiated either before a warning occurs or during a warning.
- System stays disarmed until the airplane is again flown above 1000 ft AGL (or below 50 ft).

GPWS Light

- Illuminates for all voice warnings except "Glideslope".
- Automatically extinguishes when potentially dangerous condition is corrected (cannot be manually extinguished).

(Each Pilot's Glareshield)

GPWS VOICE WARNING SPEAKER

- Volume is not adjustable.

GPWS TEST SWITCH

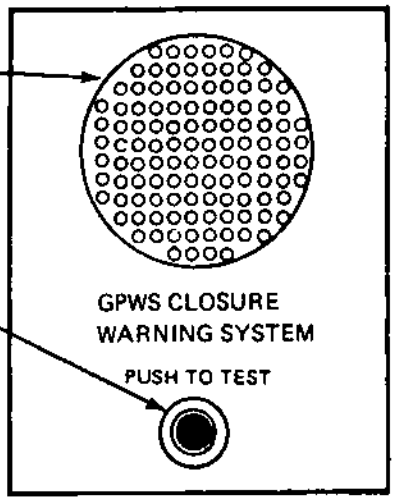
Momentary

With less than flaps 33, pressing the switch will

- Sound the "Glideslope" warning once (GPWS lights remain out) then,
- Sound the "Whoop, Whoop, Pull Up." warning, and illuminates both GPWS lights.

NOTE

Test switch is disarmed inflight below 1000 ft radio altitude.



(Flight Station Ceiling, Left of CB Panel 1)

(FOR INTRACOMPANY CORRESPONDENCE ONLY)

DELTA
AIR LINES

1. I hereby certify that I have received and read the Flight Crew Bulletin covering L-1011-500 ships 759-762 (former UAL) differences.

and

2. I have viewed the video entitled "L-1011-500 DIGITAL AUTOFLIGHT SYSTEM (Former UAL Aircraft)"

I understand that both items 1 & 2 must be accomplished prior to my first trip as a crewmember on Ship 759, 760, 761 or 762.

_____/_____
Signature Date

_____
Printed Name

FOLD FOLD FOLD

TO: CHIEF PILOT _____
DEPT. 062

FOLD FOLD FOLD

FLIGHT CREW BULLETIN

APPLICABLE TO: L-1011
NUMBER: 88-9
DATE: 5-31-88
PAGE: 1 of 1

SUBJECT: INS COOLING SYSTEM

All INS-installed L-1011's are equipped with an INS cooling system consisting of a normal and auxiliary (backup) system. Herein is a brief description along with procedures governing its use.

PRIMARY COOLING SYSTEM

Normally, the INS(s) are supplied cooling air by the Forward Electronic Service Center (FESC) cooling system. An auxiliary cooling system is available in case the FESC system fails, to insure that the INS's continue to receive adequate cooling.

The FESC cooling system is activated by latching the FWD Avionic Air switch on the FECS Monitor Panel. Normal ground operation is conducted with the FWD Avionic Air OVBD light illuminated and the **LO FLO** light extinguished. When airborne, both legends will be extinguished.

In flight, the **OVBD** light remains extinguished unless the FESC cooling fan has failed. In that event, the exhaust outflow valve automatically opens and cooling air remains available to all avionic units and the INS's.

AUXILIARY COOLING SYSTEM (INS COOLING SWITCH)

The INS Cooling switch controls the auxiliary cooling system, which connects with the FESC cooling system, but operates independently. The system consists of two operating modes: Automatic (unlatched) and Manual (latched).

Automatic Mode

Automatic mode is selected when the INS Cooling switch on the S/O panel is unlatched. The **ON** light and **LO FLO** lights are extinguished and the INS cooling fan is not operating.

Manual Mode

When the INS Cooling switch is latched, the manual mode is selected. The ON legend illuminates, the INS cooling fan operates and **LOW FLO** is extinguished.

NORMAL OPERATING PROCEDURE (EXCEPT SHIP 724)

For all INS equipped L-1011's, the INS auxiliary cooling system normally should be operated in the automatic mode (unlatched) since it is the backup system. Automatic operation will occur if airflow is lost to the INS units or if an overtemp is detected (ships 732 – 741, 751 – 762 only).

NOTE: Ship 724 has a limited cooling system which requires that the INS Cooling switch remain latched when three INS's are installed.

If airflow from the FESC cooling system is lost, the following sequence will occur:

- FWD Avionic Air – LOW FLO light illuminates. (712 – 731)
- INS Cooling LOW FLO light illuminates.
- INS Cooling ON legend illuminates when INS cooling fan begins to operate.
- INS Cooling **LO FLO** legend extinguishes.

NOTE: On ships 751–753, the LO FLO light will not extinguish, even though air flow is regained.

OVERTEMP DETECTION (EXCEPT 712 – 731)

If an overtemp condition is detected in the area near the INS units, the INS Cooling ON light illuminates, indicating the INS cooling fan has begun operating. The INS fan will operate until the temperature is reduced to a safe level. This sometimes occurs during extended ground operation on a hot day.

SYSTEM RESET

To reset the INS cooling system (turn fan off), latch/unlatch the INS COOLING switch. On ships 751–753, power must be removed by opening the appropriate circuit breaker.

CIRCUIT BREAKERS

Ships 712–731: WINDSHIELD WASHER & INS CONT, 2C19; WINDSHIELD WASHER PUMP & INS FAN, 2C21.

Ships 732–762: INS COOLING FAN – CONT, 3H6 and INS COOLING FAN–PWR, 3H8.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS (GREEN)

84–4	86–9	87–1	88–2	88–4	88–7
86–3	86–10	88–1	88–3	88–5	88–8
86–7					

All other GREEN FLIGHT CREW BULLETINS cancelled.

FLIGHT CREW BULLETIN

APPLICABLE TO: L-1011
NUMBER: 88-11
DATE: 6-22-88

SUBJECT: ADDITIONAL AMPLIFICATION SHIPS 759-762 DIFFERENCES (FORMER UAL)

ATTACHED TO THIS FLIGHT CREW BULLETIN ARE REPLACEMENT ERRATA PAGES FOR THE DIFFERENCES' PACKAGE ATTACHED TO FLIGHT CREW BULLETIN 88-8

STALL MARGIN

- 1.45 V_S CLEAN. A.O.A. (alpha) will appear in IAS window if airspeed drops below 1.45 V_S in the clean configuration only. This is approximately 10 kts. above V_{REF} +60. A.O.A. will appear at 1.3V_S for all other configurations.

INS 25-11 PROGRAM (31N-FONS-2)

- Turn on.
  - FROM-TO display initialized at 0-1.
- HOLD
  - **DSRTK/STS**
    3IN FONS-2 program will display 25-11 in left window. If 31N FMS program, 25-04 is displayed instead. The 31N FMS program cannot be used in the number 1 and number 2 INS positions.
- Ability to display loaded ramp coordinates **NOT** available in 31 FONS-2 (25-11).
- Triple mixing same as Delta aircraft.
- "Wind On Nose" same as Delta aircraft.
- Auto leg switching occurs **only** if LAT/LONG of next waypoint is loaded. If no waypoint is loaded, current leg will continue to be flown with ALERT light flashing.
- If track change from present position to a waypoint is initiated, a "double go direct" program is initiated to prevent a "button hook" maneuver that would normally be expected.
- Malfunction code 56/02 (difference between displayed present position and inertial position greater than 3 + 3T) is clearable **WARN** but INS data to A/P and HSI's remain valid and autopilot **will not** disconnect.
- INS(s) should be loaded with present position and initialized in order to get ground speed information to PMS.

FIDDS

- To load:
  - Turn system on.
  - Index documentary entry.
  - Press clear.
  - Enter (flashing digits in sequence).
    - Date
    - Flight Number
    - Leg Number
    - GMT Time (by use of the HOLD, RUN, FAST SLEW, SLOW SLEW switch adjacent to S/O clock).
  - Press insert.

NOSE WHEEL STEERING

- Since no rudder pedal steering switch is installed, C/B 2F19 may be pulled for ground operations, but **must be IN for all takeoffs and landings.**

FLIGHT DIRECTOR

- A lateral steering mode must be selected prior to selecting pitch mode.
- For takeoff, V_2 +70 must be set in IAS window prior to selecting TO/GA.

AUTOFLIGHT

- The dim switch on the Captain's side glareshield will black out all digital lighting on the autoflight system when turned full counterclockwise.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS (GREEN)

84-4	86-7	86-10	88-1	88-3	88-5	88-7	88-9
86-3	86-9	87-1	88-2	88-4	88-6	88-8	88-10

All other GREEN FLIGHT CREW BULLETINS cancelled.

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FLIGHT CREW BULLETIN

SUBJECT: CHANGE TO DIFFERENCES TRAINING SHIPS 759 - 762 (PUD'S)

The requirement to sign the certification document is deleted. Viewing of the video is now optional. A cockpit checkout will be given by a pilot approved by the base Chief Pilot and he will fill out a Delta form 0412-20143 "Attendance Record and Certificate of Training" with the following remark "The above crewmember has been given a cockpit checkout covering those items listed in L-1011 FCB 88-8, dated May 21, 1988 and L-1011 FCB 88-11, dated June 22, 1988".

The differences bulletin will be incorporated into the L-1011 POM/PRM blue pages as soon as possible. In addition these differences will be incorporated into recurrent systems training.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS (GREEN)

84-4	86-9	88-1	88-4	88-8	88-11
86-3	86-10	88-2	88-5	88-9	88-12
86-7	87-1	88-3	88-7	88-10	88-13

All other GREEN FLIGHT CREW BULLETINS cancelled.

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FLIGHT CREW BULLETIN

SUBJECT: INCREASE IN MAXIMUM WEIGHTS - SHIPS 759 - 762 (PUD'S)

Approval is pending for an increase in maximum taxi and takeoff weight for the four formal UAL -500's.

The new weights will be the same as all other -500's in the Delta fleet, i. e.,

MAX TAXI WEIGHT	512,000 LBS
MAX T/O WEIGHT	510,000 LBS

Unfortunately a corresponding change to the PMS program to accommodate these weight increases will lag behind the initial approval. What this means to the crew is that the PMS cannot be used unless the gross weight is below 506,000 pounds. Procedurally, after sufficient fuel has been burned to reduce the gross weight to 506,000 pounds or below,

- Index Performance Management
  Press Page Fwd 2 times
- Update GMT if necessary
- Verify Pressure Altitude
- Update Gross Weight
- Update Fuel Remaining
- Verify SAT

Once these parameters are inserted and verified, VNAV and thrust management can be used.

The PMS can be initialized on the ground as normal, but the max gross weight it can accept is 506,000 pounds. If this is done, the only inflight change required is an updating of the gross weight when the actual GW is 506,000 pounds or less and a verification of the other parameters.

Flight crews will be notified via teletype and message on the flight plans when this approval is received from the FAA.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS (GREEN)

84-4	86-9	88-1	88-4	88-8	88-11	88-14
86-3	86-10	88-2	88-5	88-9	88-12	
86-7	87-1	88-3	88-7	88-10	88-13	

All other GREEN FLIGHT CREW BULLETINS cancelled.

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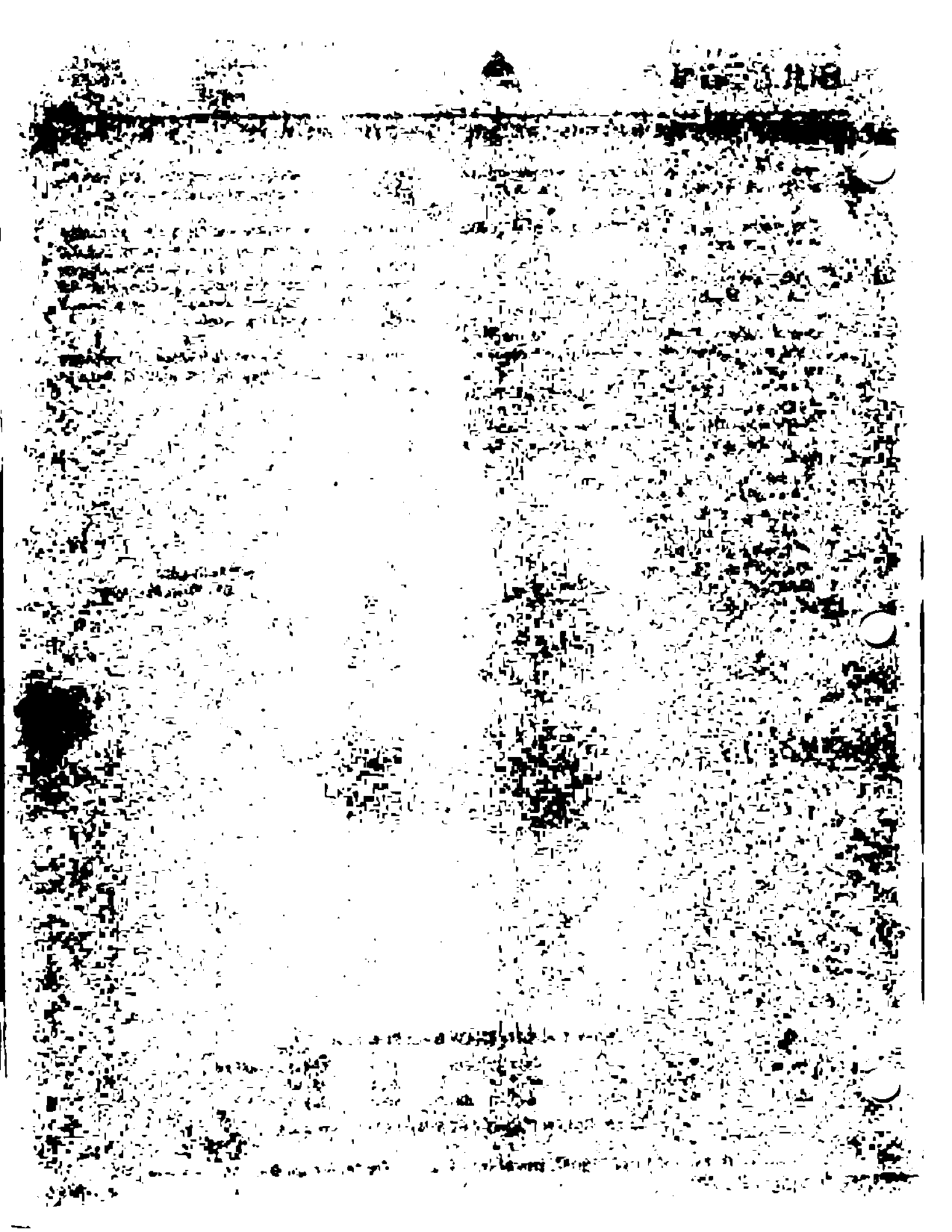

FLIGHT CREW BULLETIN

DELTA

APPLICABLE TO: L-1011
NUMBER: 88-17
DATE: 8-19-88
PAGE: 1 of 1

SUBJECT: NEW THRUST RATING FOR L-1011 RB 211-22B ENGINES

A new thrust rating for -22B engines has been approved. This rating is known as Maximum Takeoff Thrust and can be used only under certain conditions when payload is limited with Normal Takeoff Thrust. The increased thrust is approximately 1900 pounds at sea level elevation and below 75°F temperature. This new thrust rating has no bearing on the application of the reduced rating known as Alternate Thrust.

We now have three T/O ratings:
MAXIMUM TAKEOFF THRUST
NORMAL TAKEOFF THRUST
ALTERNATE TAKEOFF THRUST

At the current time, only the airports at SAN and OGG would benefit from the use of the new Max Power. Therefore only those two cities will have runway data published in the ARM and in AWABS.

If the crew receives an AWABS WDR with a takeoff predicated on MAX power, it will be necessary for them to obtain V speeds from the ODM.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS (GREEN)

86-3	88-3	88-9	88-14
86-7	88-5	88-11	88-15
86-9	88-7	88-12	88-16
86-10	88-8		

All other GREEN FLIGHT CREW BULLETINS cancelled.

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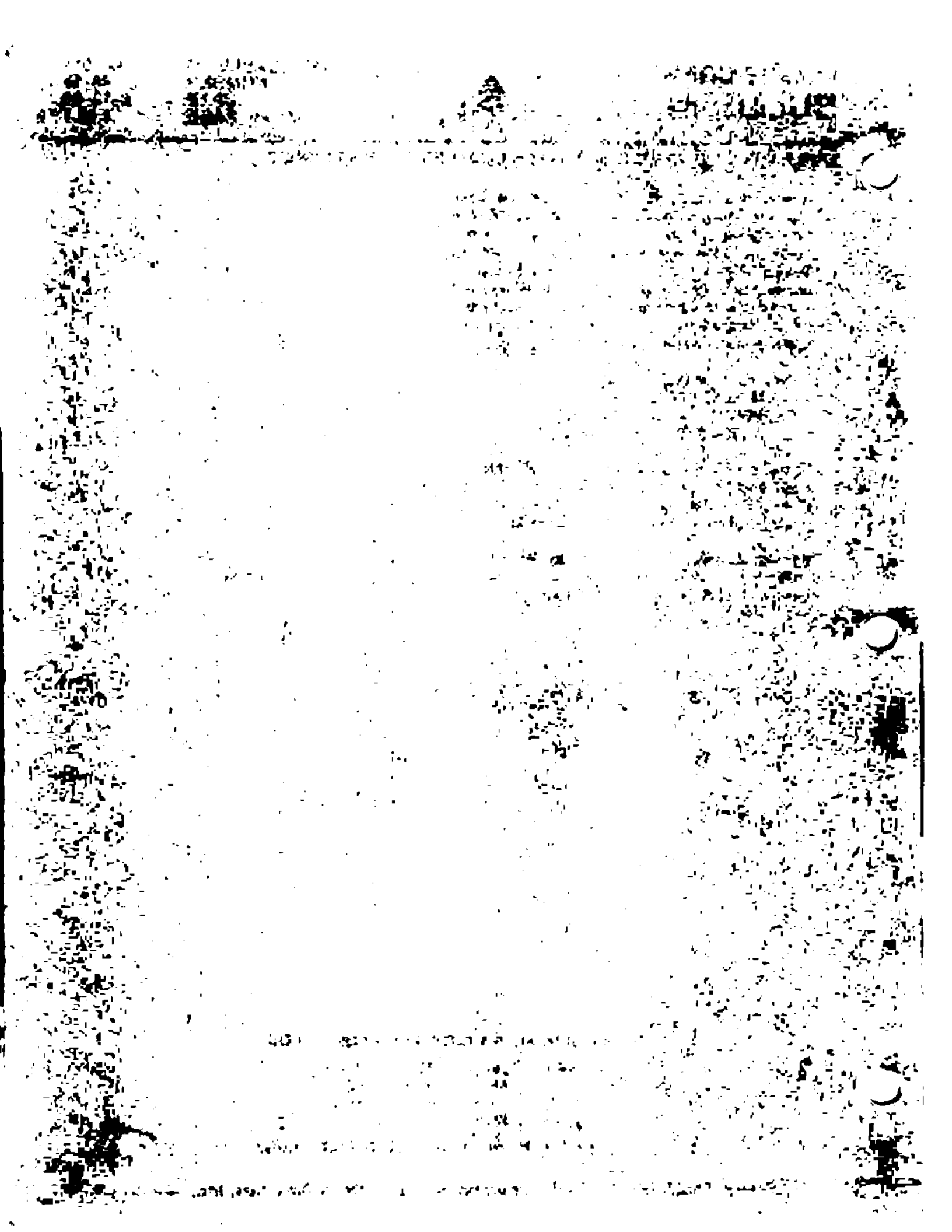

FLIGHT CREW BULLETIN

DELTA

APPLICABLE TO: L-1011
NUMBER: 88-18
DATE: 8-25-88
PAGE: 1 of 1

SUBJECT: INS QUICK REFERENCE CARD
(NOT FOR USE ON MID-PACIFIC OR TRANSOCEANIC OPERATIONS)

REMOVE AND DESTROY FCB'S 88-3 AND 88-5

Attached is an INS Quick Reference Card that will provide ample information for domestic crews to initialize the INS(s) on any aircraft flown on which INS(s) are installed and take appropriate action should a malfunction occur.

With the receipt of this bulletin, all crews are authorized to use INS(s) over all domestic routes under the following restrictions:

- INS is NOT to be used as a primary means of navigation.
- All warnings and associated action codes must be strictly adhered to.
- All action/malfunction codes that cannot be cleared must be noted in the aircraft log book.
- Ensure that cooling air is available to navigation units before turning INS on (See L-1011 FCB 88-9).

SETUP: DUAL ONS/FMS/SINGLE INS EQUIPPED -1 AIRCRAFT

The FMS FIX page and ONS initial position coordinates should be loaded with identical coordinates used to load the INS. However, if different coordinates are loaded inadvertently, the INS will give no warning indication as there is no interface with the FMS or APFDS.

SETUP: FMS-EQUIPPED -500 AND -250 AIRCRAFT

The crew can now initialize and program the FMS in the usual manner. It is imperative that the exact same coordinates previously loaded into the INS(s) are loaded into the FMS on the FIX page. If coordinates are not loaded, or if they differ from those loaded into the INS(s), a red WARN light on INS-1 and -2 will illuminate when NAV is selected.

It is not necessary to load waypoint data into the INS's. FMS lateral and vertical navigation will be available for interface with the APFDS. FMS performance management can be used in the usual manner in conjunction with Autothrottles.

SETUP: PMS-EQUIPPED -500 AIRCRAFT (SHIPS 759-762)

As the PMS has no lateral navigation capability, it is to be loaded in the usual manner. The INS units will provide a ground speed input to the PMS, providing more accurate ETA's to step climbs and BOD.

EN ROUTE NAVIGATION: DUAL ONS/FMS/ SINGLE INS EQUIPPED -1 AIRCRAFT

As the INS is not interfaced with the FMS or APFDS, there is no change in normal FMS/ONS navigation procedures.

EN ROUTE NAVIGATION: FMS-EQUIPPED -500 AND -250 AIRCRAFT

The FMS can be used for navigation with both Auto Tune switches in AUTO and the RADIO/NAV switches in NAV. The FMS course data will be displayed on both CDI's. Both pilots will keep the current VOR frequency dialed into their respective VOR navigation receiver and periodically confirm airway tracking by selecting MAN. The HSI RADIO/NAV switch should be in RADIO for this to be a viable cross check.

With both Auto Tune switches in AUTO, the navigation mode will be DME/DME or VOR/DME, as in the -1 aircraft. However, there will be an additional INS mode when out of VOR reception range. The FMS will display these navigation mode choices as IDD, IDV or INS. DR is the same as on the -1 aircraft.

NOTE: If the FMS degrades to an INS or DR mode continuously with AUTO selected; if a red WARN light illuminates on any INS CDU, or if for any reason you suspect erroneous course information, FMS navigation should be immediately discontinued. Select and tune an appropriate VOR station for airway tracking and, if necessary, notify ATC. Place all three INS Mode Selector switches to ATT and remove power from the FMS CDU's by pulling their circuit breakers. Further use of the INS's will be in the ATT Mode only.

EN ROUTE NAVIGATION: PMS-EQUIPPED -500 AIRCRAFT (SHIPS 759-762)

VOR/DME Airway navigation is the only authorized mode for domestic operations. The INS units will provide wind data and a ground speed input to the PMS.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS (GREEN)

86-3	86-9	88-7	88-9	88-14	88-17
86-7	86-10	88-8	88-11	88-15	

All other GREEN FLIGHT CREW BULLETINS cancelled.

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FLIGHT CREW BULLETIN

DELTA

APPLICABLE TO: L-1011
NUMBER: 88-20
DATE: 9-14-88
PAGE: 1 of 1

SUBJECT: RESTRICTION ON USE OF FMS FOR LATERAL NAVIGATION IN DESCENT

REMOVE AND DESTROY FCB 88-19

The use of the FMS for lateral navigation during descent on -1, -250 and non-PUD-500 aircraft has created some confusion among the ranks of L-1011 pilots. To gain a clearer understanding of when you can or **can't** use the FMS LNAV mode for descent, we will iterate the limitations for FMS operation.

-250 and -500 Aircraft
"FMS lateral steering must not be used beyond the Top of Descent."

For -250 and -500 aircraft, the limitation is stated in unequivocal terms. Under **no circumstance** can FMS LNAV be used beyond Top of Descent.

For -1, -100 and -200 Aircraft
"FMS steering must not be used beyond the Top of Descent if at any time during the ground set up or the flight a route change has been made affecting the route beyond the Top of Descent."

The wording of the limitation allows some exceptions if interpreted literally. To understand what the limitation truly means, you need to know how it evolved.

The FMS has not been able to meet FAA certification criteria for operation in the Lateral Steering mode during that portion of flight between Top-of-Descent (T*D) and End-of-Descent (E*D); specifically, when there has been a change to a lateral waypoint position beyond the FMS computed T*D fix, after initial waypoint loading. For example, **ATC has amended your route of flight beyond the fix computed by the FMS as T*D.** Your subsequent **reprogramming of the new route into the FMS requires that you abandon use of FMS lateral navigation beyond T*D.**

The reason for this is an undefined memory in the current FMS program. This undefined memory may be holding one or more of the original waypoints programmed beyond the expected T*D. It is possible for a waypoint from the undefined memory to become the exact fix for lateral steering without warning before or after engagement.

T*D is a FMS computed position based on what the pilot has specified as the E*D, cruise wind and aircraft performance parameters stored in the FMS. It is a floating point along a flight plan route and may not coincide with the initial position at which ATC clears the aircraft for descent. In the absence of a T*D (i. e., no E*D programmed), it cannot be assumed the aforementioned anomaly does not exist. In fact, the FAA's position is that it has not been proven not to exist. Therefore, the limitation remains applicable.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS (GREEN)

86-3	86-9	88-7	88-9	88-14	88-17
86-7	86-10	88-8	88-11	88-15	88-18

All other GREEN FLIGHT CREW BULLETINS cancelled.

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SUBJECT: CONTAMINATED RUNWAYS - COMPUTATION OF RUNWAY ALLOWABLE WEIGHT AND REDUCED V_1

BACKGROUND INFORMATION

Contaminated runways affect takeoff performance by reducing the acceleration and/or deceleration capability of the aircraft for both the all engine and engine out conditions.

There have been several studies by NASA and the aircraft manufacturers to determine the effects of runway contaminants on takeoff performance. These studies showed that reducing the Runway Allowable Weight combined with a reduction in V_1 (where data is available) will provide increased margins for both the accelerate-stop case (abort) and the accelerate-go case, the latter assuming the loss of an engine at V_1.

DURING SEPTEMBER 1988, WE WILL IMPLEMENT ON L-1011-1, -250 AND -500 MODELS A REVISED PROCEDURE FOR COMPUTING TAKEOFF PERFORMANCE ON CONTAMINATED RUNWAYS USING WEIGHT CORRECTIONS FOR ALL CONTAMINANTS AND V_1 REDUCTIONS FOR ICY AND SLIPPERY-WET RUNWAYS. Initially, data will be provided in AWABS I format and on or about November 15, 1988 converted to AWABS II format.

NOTE: Wet runway data will be provided as soon as available.

To implement the new procedure the following data is being added:

- ODM, TAKEOFF SECTION - Contaminated V_1 speed tables/procedures added.
- ARM, AIRPORT RESTRICTIONS, ON LINE CITIES Standard Practice - Definitions and table to compute the Contaminated Runway Allowable Weight. This data is used whenever Manual Weight Data Record must be used.

DEFINITIONS

The following definitions are used to determine the type of contamination on the affected runway.

CONTAMINATED RUNWAY: A runway which is CLUTTERED, SLIPPERY-WET, or ICY. All other runways are considered DRY.

CLUTTERED RUNWAY (CTR): A runway on which all or any portion is covered by slush, standing water, or wet snow. Performance corrections are provided for both 1/4 inch (25 CTR) and 1/2 inch (50 CTR). Under the cluttered condition, both acceleration and deceleration capability of the aircraft are reduced. Weight penalties are automatically applied to the AWABS generated weight data record if CTR is shown on the field condition report.

NOTE: Dry snow performance correction equivalencies to Clutter (wet snow) corrections are given in the ARM Standard Practice.

SLIPPERY-WET RUNWAY (SLP-WET): A runway on which all or any portion is wet and the FLIGHT CREW CONSIDERS the aircraft stopping capability to be degraded. See Flight Operations Procedures Manual, Section 5, beginning at page 46.2 for guidance on this determination. Under these conditions, the FLIGHT CREW must request a Weight Data Record based on SLP-WET from the gate agent. V_1 corrections are provided for Slippery-Wet conditions.

ICY RUNWAY (ICY): A runway on which all or any portion is covered by ICE. Weight penalties are automatically applied to the AWABS-generated Weight Data Record if ICE is shown on the Field Condition Report. In many cases, the weight penalty associated with ICY is extremely large and will preclude operation. V_1 corrections are provided for ICY runway conditions.

AWABS will be automated for contaminated runway weight corrections. If a field condition report has been issued, it should NOT be necessary for the Captain to request a message be sent to CLP (Central Load Planning) except for "SLP-WET" conditions. However, if the Captain is not certain a field condition report has been issued, it is recommended the Captain send a message to CLP via the gate agent requesting the type runway contaminant (if not DRY) he desires.

The Captain should not arbitrarily request ICY or 25/50 CTR unless runway conditions indicate they are needed since payload could be restricted. Do not request multiple WDRs for each type of contaminant. Also, if a preliminary WDR is available, verify the proper contaminated runway data was printed.

(Continued on next page.)

DETERMINING WEIGHT CORRECTIONS

Reduced runway allowable weights are provided for all contaminated runway conditions on the L-1011. For AWABS dispatched flights, the runway allowable weight for the applicable runway condition will be automatically provided on the Weight Data Record. This can also be done for the SLP-WET condition which requires a Flight Crew request to the gate agent; the request should be made in a timely manner to minimize any delay.

In some cases, penalties to the DRY runway allowable weight must be manually computed as in the case of a failure of the mainframe computer. Stations personnel who will produce your manual Weight Data Record are NOT charged with applying corrections for contaminated runways; therefore, the crew will have to apply needed corrections prior to takeoff.

The more common situation for a manually-computed WDR is where the aircraft has departed the gate with an AWABS-generated WDR and corrections must be applied to the runway allowable weight because runway conditions other than DRY exist, The crew can elect to:

- Manually compute the runway allowable weight for the existing contaminant by using charts in the Airport Restrictions SPs. These charts are direct look-up for each type of contaminant. Enter with the DRY runway allowable weight and read across to find the corresponding contaminated runway allowable weight for the airport elevation.
- Return to the gate and request a WDR reflecting the current runway conditions.

The second situation can be minimized if the Flight Crew checks the AWABS-generated WDR before the pushback to assure the runway conditions upon which it was based match the field condition report or current conditions.

***** SPECIAL SITUATION *****

A supplemental allowable weight chart has been added to the -250 and -500 ARM Standard Practices. This chart should be used when payload is being restricted prematurely by the AWABS program. The following conditions have to be present to use this chart:

- ICY Runway
- Flaps 18
- Dry Runway Allowable = 540,000 lbs.
- Airport Elevation $\leq$ 2,000 ft.
- Runway Length (-250) $\geq$ 10400 ft.
  (-500) $\geq$ 11200 ft.

To use this chart, enter with runway length, temperature, and airport elevation and read the corresponding ICY runway allowable weight. Initiate a manual dispatch using this value as the runway allowable weight.

***** DETERMINING V_1 SPEEDS *****

Once the WDR is received with the applicable runway contaminant, the **FLIGHT CREW** must compute the corresponding V_1 speeds. Lockheed has provided data to derive V_1 corrections only for the ICY and SLP-WET runway cases. V_1 speeds for the other type contaminants do not change.

V_1 UNDER ICY CONDITIONS IS THE SPEED ABOVE WHICH A STOP MAY NOT BE SAFELY ACCOMPLISHED

Use the following steps to compute ICY and SLP-WET runway V_1 speeds:

- From the AWABS-generated WDR obtain the ICY or SLP-WET runway allowable weight for the specific runway being used.
- Determine the ICY or SLP-WET V_1 speed from the appropriate ICY or SLP-WET Speed Table in the ODM, Takeoff Section. Enter the table using the current OAT, pressure altitude and Runway Allowable Weight obtained in the first step. DO NOT INTERPOLATE. Use the closest Runway Allowable Weight, OAT and pressure altitude shown in the table.
- Obtain the DRY runway V_1 for the actual weight from the Takeoff Decision Speed Chart.
- Compare the V_1 obtained in the third step with the V_1 obtained in the second step. Use the LOWER of the two V_1s for takeoff.

NOTE: V_R and V_2 for ICY and SLP-WET runways are obtained from the Takeoff Section of the ODM and do NOT change.

EXAMPLE 1

A CLUTTERED RUNWAY

Assume that we're flying an L-1011-1 out of Cincinnati on Runway 18 and the conditions are as follows:

Actual Takeoff Weight	327965 lbs
Outside Air Temperature	80°F (26.7°C)
Airport Elevation	891 ft.
Field Condition	25 CTR (Standing Water)
Runway Length	9501 Feet
Flap Setting	10°, Packs On

STEP 1 Obtain the RWY ALLOW weight from the WDR.

CVG RUNWAY 18 LENGTH 9501
BASED ON 1 / 4 INCH CLUTTER WIND 2TW 6XW
ALTERNATE POWER NOT AUTHORIZED

		RWY ALLOW
370015	ALTN 10	370015
395196	NORM 10	→ 395196
401421	NORM 10 – PACKS OFF	401421

For this case, the Runway Allowable Weight is 395196.

STEP 2 For CTR conditions, no V_1 correction is used. Determine V_1, V_R, and V_2 as you would for DRY conditions.

EXAMPLE 2

AN ICY RUNWAY WHERE PAYLOAD RESTRICTION IS DISCUSSED

Assume that we're flying an L-1011-250 out of Dallas on Runway 35R and the conditions are as follows:

Actual Takeoff Weight	432400 lbs
Outside Air Temperature	36°F (2.2°C)
Airport Elevation	603 ft.
Field Condition	ICY
Runway Length	11388 Feet
Flap Setting	18°, Packs On

STEP 1 Obtain the RWY ALLOW weight from the WDR.

DFW RUNWAY 35R LENGTH 11388
BASED ON ICY WIND 4HW 0XW
ALTERNATE POWER NOT AUTHORIZED

		RWY ALLOW
432588	NORM 18	→ 432588
440663	NORM 18 – PACKS OFF	440663
OVERWT	NORM 22 – PACKS OFF	

For this case, the ICY Runway Allowable Weight is 432,588.

(Continued on next page.)

STEP 2 Determine the contaminated runway V_1 speed from the ICY table in the ODM using 440.0 Runway Allowable Weight. The V_1 is: 128 knots.

NOTE: 440.0, 0°C, and sea level airport elevation are used because they are the closest figures shown on the table.

Contaminated Runway V_1 Speeds - L-1011-250 Flaps 18

Corrected Runway Allowable Weight (1000 lbs)	ICY			
	Airport Elev. (feet)	Ambient Temp deg C (deg F)		* Min Rwy Length
		0 (32)	10 (50)	
440.0	6000	*118	*118	12350
	4000	*122	*122	11850
	2000	*125	*125	11300
	S.L.	→ *128	*128	→ 10900

NOTE: The contaminated V_1 speed has an asterisk (*) next to it. This means that the aircraft is V_{MCG} limited and that the runway length needs to be checked against the minimum runway length. For this case, the minimum runway length is 10,900 ft which is less than our available runway length in DFW.

If the available runway length were less than the "minimum", OPERATION FROM THAT RUNWAY UNDER ICY CONDITIONS IS PROHIBITED!

STEP 3 Determine the dry runway V_1 speed from the TAKEOFF DECISION SPEED chart. V_1 for 432400 lbs. (actual weight) NORMAL thrust is: 143 knots.

TAKEOFF DECISION SPEED - V_1 (KIAS)

FLAPS 18 - NORMAL THRUST

TAKEOFF WEIGHT (1000 LB)	AIRPORT ELEVATION (FEET)	AMBIENT TEMPERATURE - C					
		0	10	20	30	40	50
440	6000	143	142	142	142	- - -	- - -
	4000	143	143	142	142	142	- - -
	2000	143	143	143	143	143	142
	S.L. →	143	143	143	143	143	143

STEP 4 Use the lower of the V_1 speeds that were determined in STEPS 2 and 3. In this case 128 knots.

(Continued on next page.)

STEP 5 With the present conditions, we are NOT PAYLOAD RESTRICTED since the RUNWAY ALLOWABLE WEIGHT is greater than our ACTUAL TAKEOFF WEIGHT. However, if we were payload restricted we could check to see if the SUPPLEMENTAL CHART, found in the appropriate ARM page 10.3, was applicable. The necessary conditions to use this chart are:

L-1011-250 or L-1011-500 only (no chart for -1)
Flap Position 18
Airport Elevation 2000 ft or less
Minimum Rwy Length of 10400 ft (-250) or 11200 ft (-500)
ICY Runway
DRY Runway Allowable Weight of 540,000 lbs.

Now, obtain the DRY Runway Allowable Weight and see if it is 540,000 lbs.

DFW RUNWAY 35R

THRUST / FLAPS	RUNWAY ALLOW	CLIMB LIMIT
NORM 18	→ 533932	511156
NORM 18 - PACKS OFF	539554	519913
NORM 22 - PACKS OFF	540000	508495

This value is 533932 lbs. Therefore, for this example, the Supplemental chart cannot be used.

If all necessary conditions are met, then proceed to the appropriate ARM Standard Practice and use the Flaps 18 Supplemental chart which is on Page 10.3. Enter this chart with the closest runway length and temperature and determine the supplemental ICY Runway Allowable weight. Then repeat STEPS 2, 3, and 4 to determine the final contaminated V_1 speed. Note that if using the supplemental chart, minimum runway lengths from the ODM V_1 tables do not apply.

STEP 6 Determine the V_R speed from the TAKEOFF ROTATION SPEED chart and the V_2 speed from the TAKEOFF SAFETY SPEED chart from the ODM.

TAKEOFF SAFETY SPEED - V_2 (KIAS)

FLAPS 18 - NORMAL THRUST

TAKEOFF WEIGHT (1000 LB)	AIRPORT ELEVATION (FEET)	AMBIENT TEMPERATURE - C					
		0	10	20	30	40	50
440	6000	158	158	157	156	- - -	- - -
	4000	159	159	159	158	156	155
	2000	160	160	160	159	158	156
	S.L. →	160	160	160	160	159	158

TAKEOFF ROTATION SPEED - V_R (KIAS)

FLAPS 18 - NORMAL THRUST

TAKEOFF WEIGHT (1000 LB)	AIRPORT ELEVATION (FEET)	AMBIENT TEMPERATURE - C					
		0	10	20	30	40	50
440	6000	150	150	150	- - -	- - -	- - -
	4000	149	149	149	150	151	- - -
	2000	148	148	148	149	150	151
	S.L. →	148	148	148	148	149	150

V_1 for 432400 lbs. is 128 knots, V_R is 148 knots, and V_2 is 160 knots.

DELTA

EXAMPLE 3

AN ICY RUNWAY WHERE THE RUNWAY LENGTH IS LESS THAN THE MINIMUM

Assume that we're flying an L-1011-500 out of Atlanta on Runway 9R and the conditions are as follows:

Actual Takeoff Weight	429470 lbs
Outside Air Temperature	37°F (2.8°C)
Airport Elevation	1026 ft.
Field Condition	ICY
Runway Length	9000 Feet
Flap Setting	10°, Packs On

STEP 1 Obtain the RWY ALLOW weight from the WDR.

ATL RUNWAY 9R LENGTH 9000
BASED ON ICY WIND 6HW 0XW
ALTERNATE POWER NOT AUTHORIZED RWY ALLOW
OVERWT ALTN 10
OVERWT NORM 10
OVERWT NORM 10 - PACKS OFF

For this runway, the aircraft is overweight.

Let's try runway 9L which has a length of 11889 ft.

ATL RUNWAY 9L LENGTH 11889
BASED ON ICY WIND 6HW 0XW
ALTERNATE POWER NOT AUTHORIZED RWY ALLOW
OVERWT ALTN 10
490532 NORM 10 → 490532
499059 NORM 10 - PACKS OFF 499059

For this case, the the RWY ALLOW weight is 490532 lbs.

(Continued on next page.)

STEP 2 Determine the contaminated runway V_1 speed. Enter the Contaminated Runway V1 Speed Chart in the ODM with 500.0, 0°C, and 2000 Ft. airport elevation.

Contaminated Runway V_1 Speeds – L-1011-500 Flaps 10

Corrected Runway Allowable Weight (1000 lbs)	ICY			
	Airport Elev. (feet)	Ambient Temp deg C (deg F)		* Min Rwy Length
		0 (32)	10 (50)	
500.0	6000	132	133	
	4000	130	131	
	2000	*131 →	*131 →	12750
	S.L.	*134	*134	12350

STEP 3 The contaminated runway V1 speed from the chart is 131 knots which is VMCG limited. Now, we need to check our runway length against the minimum required. This minimum is 12750 ft and our runway has only 11889 ft. Since this is the longest runway at ATL, OPERATION FROM THIS AIRPORT AT THIS FLAP SETTING IS PROHIBITED FOR THESE CONDITIONS.

SUGGESTION: Try Flaps 18 following the procedure in Example 2.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS (GREEN)

86-3	86-9	88-7	88-9	88-14	88-17	88-20
86-7	86-10	88-8	88-11	88-15	88-18	

All other GREEN FLIGHT CREW BULLETINS cancelled.

FLIGHT CREW BULLETIN

APPLICABLE TO: L-1011
NUMBER: 88-22
DATE: 9-28-88

SUBJECT: No. 2 Engine Fuel Shutoff Valve

The Number 2 Engine Primary Emergency Fuel Shutoff Valve has been modified to remain closed when the associated fuel-and-ignition switch is in the OFF position. When accomplishing the S/O's fuel panel check, the No. 2 engine FUEL PRESSURE light will remain illuminated with a tank pump latched.

Revised procedure: POM Normal Procedures, Page 14.

TANK PUMPS CHECK/LTS OUT

- Latch TANK PUMP switch; check:
  - FLOWBAR
  - Check LO remains extinguished.
  - FUEL PRESSURE will normally extinguish except on No. 2 engine.
- Unlatch TANK PUMP switch.
- Check each pump.
- Leave one pump latched to supply the APU.
- If fuel migration exists in 2L or 2R (also 1A or 3A Ship 724) leave respective switches latched.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS

86-3	86-10	88-9	88-15	88-20
86-7	88-7	88-11	88-17	88-21
86-9	88-8	88-14	88-18	

All other GREEN FLIGHT CREW BULLETINS cancelled.

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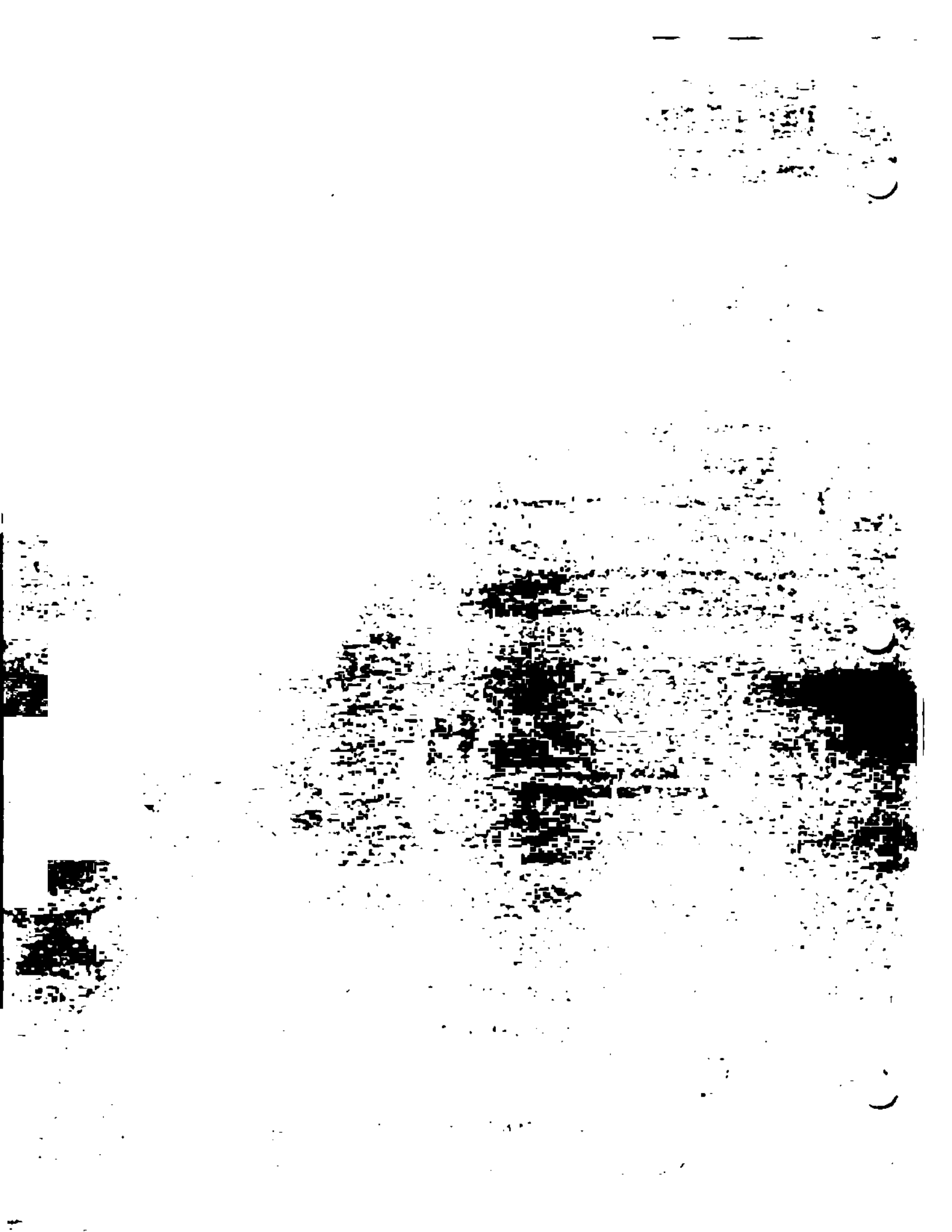

FLIGHT CREW BULLETIN

APPLICABLE TO: L-1011
NUMBER: 88-23
DATE: 12-10-88

SUBJECT: Clarification and Re-emphasis of Hydraulic System Check and FMS Limitation

Remove and Destroy FCB L-1011 88-4 and FCB L-1011 T88-3

There has been no deletion of the requirement to pressurize all hydraulic systems and to do an autopilot check. As the AC pump circuit breakers remain clamped, the ATM's provide this source of pressure. Clearance should be obtained from ground personnel prior to ATM activation. The autopilot check should be accomplished while the hydraulic systems are pressurized.

These checks must be done prior to pushback to avoid any lengthy delays, should a malfunction be found.

Perform the hydraulic system check in the following manner:

Prior to Pushback, After Obtaining Clearance From Ground Personnel:

B and C ATM's ..... ON

B-A and C-D PTU's ..... LATCH/FB's

ABCD HYDRAULIC SYS's QTY & PRESS CK

CHAN 1 and 2 YAW SAS "FAIL", ABCD STABILIZER "INOP" and HYD RUD LIMITER "PUSH" ..... EXT

A and B AUTOPILOTS ..... CK

B-A and C-D PTU's ..... OFF

B and C ATM's ..... OFF

This check may be delayed until just prior to pushback if desired.

Normally, clearance for engine start will be obtained prior to pushback. In order to assure B system pressure during aircraft movement, **initiate** the start of No. 2 engine at pushback.

Engine spin-up will assure B system pressure sufficient to provide positive braking, should the need arise. If local ramp operations prohibit starting an engine during pushback, B system ATM may be used to provide pressure during pushback and any subsequent towing. Do not attempt an engine start with APU as the air source while an ATM is in operation. There is an insufficient supply of pneumatic air to adequately supply both ATM(s) and the starter motor.

IN FLIGHT

The AC pumps may be activated in flight only when, in the judgement of the crew, an abnormal situation exists that warrants their use.

IN OTHER MATTERS

Reference L-1011 FCB 88-20 dated 9-14-88:

Lateral Steering, FMS -250/500 Aircraft:

- May not be used after departing cruise altitude descending with the intention of landing. It does not matter if E*D has been programmed or not – Do not use in descent !

Lateral Steering, FMS -1 Aircraft:

- Can be used in descent **only if** flight plan is flown as initially programmed. Changes effecting the flight plan are permitted if the changes do not effect any waypoint beyond T*D. Not programming E*D does not circumvent this limitation.

This is not a change, just a reiteration.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS

86-3	86-10	88-9	88-15	88-20
86-7	88-7	88-11	88-17	88-21
86-9	88-8	88-14	88-18	88-22

All other GREEN FLIGHT CREW BULLETINS cancelled.

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FLIGHT CREW BULLETIN

APPLICABLE TO: L-1011
NUMBER: 89-1
DATE: 1-13-89

SUBJECT: New Delta Supplements Section Issue

The Delta Supplements section to the International Jeppesen Manual has been completely revised with a new format. This material, containing special information formerly used only by International crews, is generic to all Transoceanic Operations including Mid Pacific.

To simplify distribution, the Delta Supplements section and any future revisions will now be printed and distributed by Jeppesen. All L-1011 Captains and First Officers, **including domestic pilots**, will receive the revised section by means of a standard Jeppesen L-1011 Domestic revision in the white envelope with blue lettering. Pilots who have been issued International Jeppesen manuals will be instructed to remove and destroy the old section from those books and insert the new section into their Domestic manual. Although the material in this revision does not apply to them, domestic pilots who are not qualified in Mid Pacific operations are nevertheless encouraged to retain this section for future reference.

A new tab will be included in the revision package. Some duplication is expected in the case of former International pilots. However, this is necessary to ensure that everyone has been issued the complete revision.

It is realized that this new method of distribution and filing will overfill the Domestic binder if the pilot chooses to keep everything in one book. Since each pilot has been issued an extra binder, it is suggested that this be used to split the text in order to accomodate this revision. International pilots may wish to keep this material stored in it's former location in the International Jeppesen book if they so desire.

The revised subject matter will include such items as Universal Ten Degree Navigation Tables, ICAO Flight Plan explanation, Reclearance Flight Plan procedures, etc. It will also contain excerpts from the L-1011 POM in order to provide a handy reference to such items as the Transoceanic Procedures Checklist or INS and Omega setup procedures.

We anticipate that this revision will be distributed early next month.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS

86-3	86-10	88-9	88-15	88-20	88-23
86-7	88-7	88-11	88-17	88-21	
86-9	88-8	88-14	88-18	88-22	

All other GREEN FLIGHT CREW BULLETINS cancelled.

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FLIGHT CREW BULLETIN

APPLICABLE TO: L-1011
NUMBER: 89-2
DATE: 1-25-89

SUBJECT: FMS Manual Update of Magnetic Variation

When operating outside VOR/DME range the FMS will not automatically update Mag Variation (MVR). On flights to and from BDA, HNL, OGG and SJU when beyond VOR/DME reception range, the FMS uses ONS for position information. The current procedure requiring that the FMS course be displayed on the PNF's HSI, and the Omega course on the PF's HSI (and for autopilot nav) may reveal a significant difference between the desired tracks on the FMS HSI versus the ONS HSI if the MVR is not manually updated relative to the aircraft's estimated position. Flight Crews are required to update Mag Variation manually when operating on the aforementioned routes outside VOR/DME reception range.

Reference: Jeppesen Yellow Pages for BDA, Navigation Procedures; the procedure described below will be used in lieu of the MVR update procedure described on page 4 dated 9-29-88, and is also applicable to Mid Pac operations. Flight Crews should note that the procedure to update MVR as described in the BDA yellow pages can occassionally be performed successfully; however, the procedure described in this FCB has been demonstrated to be more reliable.

To manually update FMS MVR:

- Set Nav Control panel to MAN.
- Press Nav and index NAV MODE.
- Index OMEGA Valid/In and observe OMEGA Valid/Out.
- Index EXECUTE, and FMS is now in DR.
- Press NAV and index STA SEL.
- Note top line reads AUTO VOR/DME DR.
- Index MAN VOR/DME.
- Press INSERT; note top line now reads MAN VOR/DME DR.
- Index EXECUTE and **note no station frequencies exist.**
- Press NAV and index NAV DATA; ? should appear after MVR.
- Index MVR and manually change as required.

After Manual Update:

- Press NAV then index STA SEL.
- Index AUTO; the top line of the stations page should read AUTO VOR/DME DR.
- Index OMEGA Valid/Out and observe OMEGA Valid/In.
- Index EXECUTE, and FMS is now in AUTO.

Milt McKnight
L-1011 Fleet Manager

CURRENT FLIGHT CREW BULLETINS

86-3	86-10	88-9	88-15	88-20	88-23
86-7	88-7	88-11	88-17	88-21	89-1
86-9	88-8	88-14	88-18	88-22	

All other GREEN FLIGHT CREW BULLETINS cancelled.

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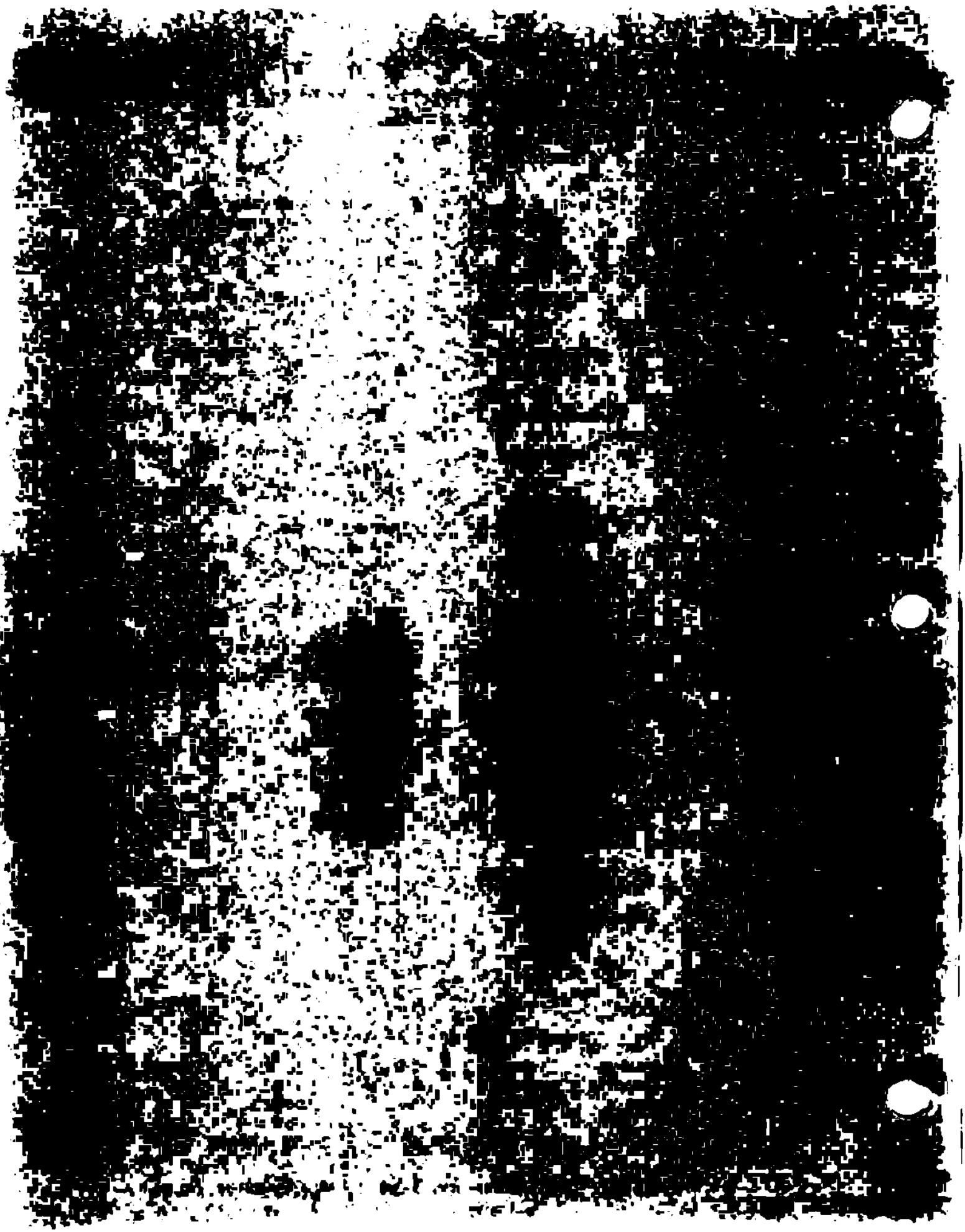

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GENERAL

The Mid-Pacific procedures and company policies contained in this section are to be used in conjuncton with other appropriate operating procedures set forth in the following documents:

- Pilots Operating Manual (POM), supported and/or supplemented by:
  - Flight Crew Bulletins
  - Flight Operations Procedures Manual (FOPM)
  - Delta Special Pages (DSP)
  - Federal Air Regulations
  - The provisions of FAR 121 apply to all Delta Airlines operations, International and Domestic.
  - Jeppesen Route Manuals.

These procedures have been arranged in the order that the pilot would expect to use them, beginning from the time that he reports to the operations area until he turns in the papers at the completion of the flight. Note that a checklist of things to be accomplished has been included at the first part of this section for ready crewmember access. A Table of Contents has also been added to enable easy reference to various procedural sections.

TRANSOCEANIC PROCEDURES CHECKLIST

For your convenience a checklist appears on the following page to serve as a review of the normal crew duties which have been outlined in this text. Unless there is an overriding and unusual operational consideration, the crew duties as described in the Transoceanic Procedures Checklist will normally be performed by the indicated crew member.

TRANSOCEANIC PROCEDURES CHECKLIST

PREFLIGHT

CONFIRM DELTA FLT PLAN AGREES WITH ICAO FLIGHT PLAN C

CONFIRM DELTA FLIGHT PLAN AGREES WITH FIX LIST AND THAT COORDINATES AGREE WITH NAV CHARTS ..... C, F

NUMBER EACH WAYPOINT ON MASTER AND S/O FLIGHT PLANS ..... C, F, S

FILL OUT PLOTTING CHART ..... PF

FILL OUT FUEL LOG ..... S

FILL OUT PASSENGER BRIEFING MAPS ..... S

CHECK FOLDER CONTENTS COMPLETE .... C, S

COCKPIT PREPARATION

TEST, ALIGN, AND INPUT GATE COORDINATES ..... C, F, S

CHECK GATE COORDINATES - ONS & INS (FOR INS, USE WPT 0 & HOLD) C

LOAD ONS WAYPOINTS & CROSSFILL (USE MASTER FLIGHT PLAN) ..... PF

LOAD INS WAYPOINTS ..... P, F, S

LOAD FMS ..... PF

INDEPENDENTLY CONFIRM ONS, INS & FMS WPTS/SETUP (CIRCLE WPT #'S) ..... PNF

CHECK INS WPTS & ONS/FMS AGREE ..... S

SELECT "NAV" BEFORE PUSHBACK & INS STATUS 1-55 ..... C or F

CHECK FMS/ONS FIX = 0 ..... C or F

CONFIRM FINAL WX RLS # IS SAME AS FLT PLAN RLS # ..... C, F, S

BEFORE TAKEOFF

CHECK INS GS, ONS POSITION ..... C, F
(A/C Stopped)

USE HEADSETS BELOW 10M ..... C, F, S

IN FLIGHT

AFTER LEVEL OFF, PERFORM COMPASS DEVIATION CHECK (CAPT VERIFY) ..... PNF

CONFIRM AIRWAY TRACKING AND COURSE DISTANCE USING VOR/DME WITH AUTO TUNE IN MANUAL ..... C, F

PRIOR TO OCEANIC OPERATION, MAKE FMS/ONS/INS ACCURACY CHECK - OVERFLY GATEWAY IF NECESSARY ..... C, F

HSI TRUE/MAG SWITCH ..... TRUE

MONITOR AND CONFIRM ALL CLEARANCES ..... C, F, S

MAINTAIN "HOWGOZIT" ON THE MASTER FLIGHT PLAN & FUEL LOG ..... PNF, S

COMPLETE AIREP LOG DATA AND MAKE POSITION REPORTS ..... PNF

MAKE POST POSITION PLOT & USE CHART TO CONFIRM POSITION RPT ..... PF

CROSS-CHECK INS #3 XTK ..... S

UPDATE FUEL LOG AT FUEL CHECKPOINTS ..... S

COMPARE INS NEXT WAYPOINT COORDINATES DIST, & TIME WITH ONS & FMS ..... C, F, S

CHECK COAST-IN ACCURACY - INS, ONS, FMS vs VOR/DME ..... C, F, S

ENSURE ALL COMPANY REPORTS SENT ..... S

BEFORE SHUTDOWN

LOG INS/ONS RESIDUAL READOUTS .... C, F, S

AFTER PARKING

COMPLETE & PLACE FOLLOWING ITEMS INTO TRANSOCEANIC FLIGHT FOLDER:

- MASTER/SECOND OFFICER FLIGHT PLANS
- AIREP LOG
- PLOTTING CHART
- FUEL LOG
- FUEL SLIP
- T/O & LANDING DATA CARDS
- USWB WIND & WEATHER CHARTS, FINAL WX BRIEFING
- WEIGHT & BALANCE DATA
- ICAO FLIGHT PLAN

FLIGHT FOLDER

The TRANSOCEANIC FLIGHT FOLDER will be used for all extended overwater operations.

The following is a listing of the **minimum data** which must be contained in the Transoceanic (Int'l) Flight Folder. Additional copies will be furnished at the Captain's discretion for qualified observers.

- ICAO Flight Plan; one (1) copy.
- Delta Flight Plan; Two (2) copies.
- Preliminary Weather Briefing Message; one (1) copy.
- National Weather Service Briefing Material – Significant Weather Chart for FL 250 thru 600 plus Upper Wind and Temperature Chart for FL 340 are mandatory items.
- Transoceanic Plotting Chart; one (1) copy.
- AIREP log; one (1) copy.
- S/O Fuel Log; one (1) copy.

The **Captain will** confirm receipt of the above information and ensure that the Flight No./Date and Crew Names are entered on the front of the folder.

The Captain will ensure that all of the required items listed above have been inserted into the folder prior to leaving operations or delivered to the crew prior to pushback. Prior to pushback, he will again check to ensure that **all** required documents are aboard, including the **final** wx briefing and **final** weight and balance..

- Required maps, charts, and forms are located in the briefing rooms or in the operations area for departures from all U.S. Stations.

Upon completion of a flight, all required Transoceanic Flight Folder data as described above, **plus Takeoff and Landing data cards**, the **Fuel Slip**, and the **Aircraft Weight and Balance Data**,must be inserted into the folder and returned to your Base Operations for file retention. The folder contents are subject to periodic review by the FAA and DAL Flight Operations for accuracy and compliance with procedures. Do not include other non specified documents or extraneous paperwork.

Passenger Enroute/Progress Briefing Maps

The S/O will prepare the passenger Briefing Map as part of his preflight duties.

- The maps will be posted in the cabin prior to gate departure if possible.
- If unable to post the maps prior to gate departure, the S/O **will not** leave his station for this purpose until the flight is above 18,000' on climb out.

FLIGHT PLANNING PROCEDURES

The flight planning process is a **Crew** function requiring joint participation by each crew member as specified. **On an exception basis, the Captain may find it necessary to alter the crew member functions in order to accommodate a unique operational contingency.** The Captain should conduct a crew briefing to review such pertinent items as Metro Alerts, the Remarks section, the weather and NOTAMS for destination, alternate, and ETP airports, next best route or flight levels, or other items unique to Mid-Pacific Flight Plans.

The **Captain confirms** that the ICAO Flight Plan is valid, noting the Date/Time, Flight #, A/C #, and other pertinent data. Check that date of ICAO matches the Delta Flight Plan date. The Delta Flight Plan routing, the ICAO routing, the Fix List routing, and the routing as described in the body of the Flight Plan must be compared and confirmed as being identical.

Write in any omitted mandatory reporting fix and any required dog leg fix along the planned route of flight. **Contact Flight Control, if necessary, to resolve any discrepancy.**

The Captain and F/O, **working together**, will confirm that the Delta Flight Plan coordinates from the Fix List match the fix coordinates along the prescribed route of flight as depicted on the Navigation Charts.

The Fix List identifiers will also be confirmed (using the FMS Data book as necessary), and these ID's will be used to insert fixes into the FMS.

One copy of the Delta Flight Plan will be identified as the "MASTER FLIGHT PLAN" by inscribing the word **MASTER** in the top margin of the flight plan message along with the **Captain's initials.**

- No other copy of the Delta Flight Plan will be so identified.
- The **MASTER** Flight Plan will be used to load ONS #1 and #2, the INS, and the FMS computer, and for logging flight progress ("howgozit") data.

A second copy of the Delta Flight Plan will be used by the S/O for fuel computations, flight following, cross referencing, etc.

- In the event of any problem with one ONS system, the pilot position effected will assume responsibility for the INS and will complete all checks and loading of that NAV computer.

Waypoint Numbering

Waypoint numbering on the MASTER Flight Plan and the S/O Copy will be identical. The MASTER Flight Plan will be used and each waypoint sequentially numbered as follows: The airport fix should be numbered as WPT 000 (for the FMS) and the first en route waypoint fix beyond the airport should be WPT 001, etc. ONS 1 & 2 and the INS will use the identical waypoint coordinates, and will be numbered 1 thru 9 with the #1 waypoint corresponding to the FMS #1.

Waypoint numbering in the FMS will not match that of the ONS or INS after the first nine waypoints have been loaded. On Mid-Pac routes, nine waypoints will usually suffice for the entire route. However, if it is necessary to load more than nine in the FMS, continue to load the FMS sequentially past #9, i.e., 10, 11, 12, etc. Should this be necessary, the ONS & INS waypoint numbering would be continued from #9 beginning again with #1, 2, 3, etc.

Non-compulsory waypoints on the six (6) Composite Routes (Charted as R 463 thru R 578) between the Mainland and the Hawaiian Islands need not be loaded in navigation computers or the FMS unless you are specifically cleared to one of these fixes by ATC for navigation purposes such as route changes, crossing restrictions, etc. These waypoints are situated directly on the great circle track and will be automatically overflown by any of our navigation systems, so it is not necessary to load them in order to remain on track. It is required that as you pass these positions you record the midpoint weather data (Temp, Wind, Turbulence, Icing, etc.) for inclusion in the next AIREP.

These midpoints are easily identifiable by the miles to go (distance) readout on any navigation computer. This exemption in no way affects the requirement that all waypoints will be loaded on other Track/Routes, such as Random routes or transoceanic routes in the North Atlantic or the North Pacific.

The S/O will confirm that the waypoint coordinates and numbering sequence on the S/O copy of the flight plan match with the identical waypoints as those recorded on the **MASTER** flight plan by the Captain and/or F/O. Any alteration of the numbering sequence must receive the Captain's concurrence, providing him the opportunity to make appropriate notations on the **MASTER** flight plan.

Plotting Chart

A Plotting Chart is required for all extended overwater operations.

All crew members should be familiar with plotting chart procedures. The plotting chart is normally prepared in a briefing room during preflight preparations. However, on through flights with minimal ground time (less than 1 hour) such as the en route stop in SAN prior to the oceanic crossing on the SLC – HNL trip, the plotting chart may be prepared en route at the Captain's discretion. **On an exception basis**, the Captain may delegate this function to the S/O, other duties permitting, provided that the PF confirms the data recorded on the plotting chart.

The following items must be entered on the Plotting Chart, using the Delta Flight Plan or the 10 degree tables as a basic reference:

- Identify and plot each waypoint.
- For the segment between each waypoint, enter the following data:
  - Zone time between waypoints.
  - Zone distance between waypoints.
  - True Course (Mid point).
  - Average Midpoint Magnetic Heading.
  - Plot the Two engine out (2EO) ETP. Any decision to turn back or go ahead must be based on this point.

COCKPIT PREPARATION

Use of Headsets – Mandatory Below 10,000 Ft.
Flight Crew Members will continuously use headsets during all taxi and flight operations below 10,000 feet. It is strongly recommended that headsets be used in all foreign airspace regardless of altitudes.

NOTE: It is important to note the program number displayed on ONS/INS/FMS during initial start up.

The Captain will normally test and initialize the #1 Omega, and the F/O the #2 unit.

The S/O will normally test and align the #3 INS. **DO NOT ACCEPT A PREVIOUS ALIGNMENT MADE BY MAINTENANCE OR ANOTHER CREW.** After landing at the west coast gateway airports, it may be more desirable to cycle the INS MSU (mode select unit) switch to STDBY (rather than to OFF) and then back to ALIGN for a faster alignment. By using this procedure, any previously loaded waypoint coordinates will be retained in the INS memory bank. **However, if these waypoints are retained for navigation on the transoceanic leg, it is imperative that their accuracy be confirmed, as per procedure, by the PNF.**

COCKPIT PREPARATION (CONT'D.)

The Captain will then check both ONS units and the INS for proper present position and System Status Code countdown in progress. (For INS position verification, select WPT zero, and press HOLD).

Waypoint Loading and Verification
Cockpit preparation time is short because it is necessary to load three separate navigation systems before departure. Therefore, the recommended sequence is to load the ONS and the INS units first, and then program the FMS. This priority is desirable since the FMS is dependent upon the ONS for accurate overwater navigation. Testing, initializing, loading, and confirming waypoints on the 3 primary navigation systems takes priority over programming the FMS. The FMS is not required for dispatch. If cockpit preparation time is short, the FMS may remain unpowered with the circuit breakers pulled. If desired, the CB's may be engaged to start the FMS later in flight. To remove all doubt, the **minimum** navigation requirements prior to departing the gate are:

For Extended Overwater Navigation:
- Both ONS units initialized and the first enroute waypoint loaded and verified. (If one ONS is inop, the INS must be operational).
- INS (if installed and operational) aligned, switched to NAV, and the first enroute waypoint loaded and verified.

For Domestic Operations:
- FMS & ONS are not required and may be inoperative.
- INS is not required for domestic navigation and may be operated in ATT for route segments not involving extended overwater navigation. The INS MSU may also be placed in OFF, with appropriate reference to M.E.L. limitations.
- Normal VOR & ADF Minimum Equipment List applies.

NOTE: During the following loading and checking procedures, the MASTER Flight Plan Fix List will be used. Since these coordinates have already been verified from another source during Preflight Planning, this procedure will eliminate any chance of confusion over the actual route to be loaded.

It is recommended that SID or STAR waypoints **NOT** be loaded in any of these units which are intended for use in long range navigation unless they serve a **realistic navigation purpose**, as opposed to a maneuvering convenience. Excess waypoints are a source of distraction while flying in high density traffic areas.

During preflight planning, the MASTER Flight Plan has been marked so that the numbers opposite the waypoints in the body of the Flight Plan correspond to those which appear on the FIX List. (On Mid-Pac Composite Routes, the Non-Compulsory waypoints are skipped in this numbering process and not loaded. Therefore there will be gaps in the numbering sequence on those specific routes.) The PF will load the numbered waypoints into all navigation computers. (At the Captain's discretion, the S/O may load the INS waypoint coordinates.)

The PF will also program the FMS and load the waypoints into the FMS in the identical sequence previously entered into the ONS.

The PNF will use the MASTER Flight Plan to confirm that the data has been properly loaded into the ONS, INS, & the FMS, in that order. The PNF draws a circle around each of these numbers as he independently verifies them.

The first waypoint to be overflown is then marked with a diagonal thru the circle to both designate and verify this as the "TO" waypoint, or the waypoint that ONS/INS/FMS navigation would proceed towards after takeoff. If it becomes necessary to load additional waypoints after the original cockpit preflight setup, waypoint verification will be accomplished using this identical procedure. **The S/O will confirm that the coordinates on his flight plan match those on the MASTER Flight Plan.**

NOTE: All waypoint loading and checking will be done independently. Do not read coordinates to each other. It is imperative that one pilot load a unit and the other one check it. If collaboration is allowed during this procedure, it is easy for both pilots to confirm the same mistake.

PRIOR TO PUSHBACK

All three crew members will verify that the final paperwork is on board. When the final weather is delivered to the cockpit, the release number on the weather briefing should be the same as that on the Delta Flight Plan. (Example: If the Final Weather Briefing shows Release #2, the Delta Flight Plan should also read Release #2.) If the final release differs from the one prepared during preflight, the more recent release will be used as the MASTER Flight Plan.

PRIOR TO PUSH BACK

The INS Mode Selector should be placed in the NAV position approximately 10 minutes prior to push back, and **must** be in NAV before any aircraft movement. The MSU may be moved to NAV any time after the green ready light has illuminated (PI of 5). If refined alignment (measurable only in yards) is desired, this may be obtained by waiting until the PI Index has reached four (4) before switching to NAV. However, under no circumstances is it necessary to delay a departure or to risk a pushback without completing the checklist simply to obtain this refined alignment. After placing the INS MSU switch to NAV, the INS Desired Track and the distance to the first waypoint **will be checked** to verify that the course and the distance are reasonable and that they match with those displayed on the ONS units and the FMS.

The INS CDU selector will then be placed to TK/GS in order to provide ground speed readout during taxi, takeoff, and initial climb. The groundspeed should read zero with the A/C stopped. With the aircraft parked, a ground speed of 2 or 3 knots may be an indication of a faulty unit and consideration should be given to realigning the INS.

The ONS CDU selectors will be placed to POS. (The only useful ONS data displayed before takeoff is the present position. As an indication of ONS accuracy, it is recommended that a check of position coordinates be made shortly before takeoff.)

It is common for discrepancies of a mile to exist in areas of poor signal propagation where a long taxi distance is involved. (i.e., HNL Int'll) However, any unreasonable errors, warning lights, etc, should be investigated. If merely poor signal reception is suspected, takeoff is recommended. However, if the problem is not resolved before passing the gateway and that ONS is required under the MEL, it will be necessary to resolve the difficulty prior to proceeding on track/route outside of radar contact.

The transponder code is normally set to code 2000 while flying outside of domestic airspace on track/route. Unless otherwise directed by ATC, this is usually done after gateway passage outbound when cleared to en route frequency by the Air Traffic Controller.

It is not uncommon to receive a last minute route change in Mid-Pacific operations. If a change is issued during taxi, climb or other periods of high workload, there is less chance of error if only the first one or two waypoints are loaded with the rest being inserted and confirmed later on when cockpit workload permits.

A Compass Deviation Check will be accomplished after level off at initial cruise altitude prior to track entry or as soon as possible thereafter with the HSI switch in MAG.

EN ROUTE OPERATING PROCEDURES

The PNF should accomplish this check. The Compass Deviation Check will be completed using the following procedure: (It is desirable to perform the Compass Deviation Check and navigation accuracy checks prior to reaching the Gateway. However, on some Mainland – HNL flights, this is not always possible due to the short distance between the Gateway and the coast.)

- Read True Heading on INS CDU and record.
- Read and record Mag Variation from the appropriate Jeppesen chart (Do NOT read from the FMS).
- Read and record the following data on the AIREP Deviation Log: (Record the data as quickly as possible, then do the computations later to eliminate possible heading change while making computations.)
  - #1 HSI heading
  - #1 RDDMI heading
  - #2 HSI heading
  - #2 RDDMI heading
  - Standby Compass Heading
- Compute **INS** Mag Heading (By subtracting east or adding west variation and record.)
- Perform Deviation Computations for each compass and enter on the AIREP log.

NOTE: The compass deviation information can be useful for two reasons: (1) for dead-reckoning should both INS and ONS fail, and (2) when a divergence between Omega and INS occurs. A divergence may be discovered while computing INS MAG heading. This should check within +/- one degree. A difference of 2 or 3 degrees, for example, would indicate a faulty INS. This check can therefore also be considered as an INS confidence check.

After level off and prior to track entry, it is recommended that the top white airspeed bug be reset to the two engine FMS critical/PMS Maximum Range Cruise driftdown speed. If the FMS/PMS is not available, consult the ODM abnormals for the Driftdown Speed schedule. DO NOT USE THE FMS THRUST COMPUTATIONS FOR DRIFTDOWN BELOW 15,000 FEET ON THE L-1011-1 AIRCRAFT. (Reference the L-1011-1 ODM.)

It is standard and required procedure to monitor emergency or "Guard" frequency, 121.5 MHZ, while operating in Track/Non radar areas, with the volume adjusted so as to enable reception of any emergency message.

The HSI TRUE/MAG switch will be in the TRUE position during flight in a non-radar/track environment. (Gateway – Gateway)

EN ROUTE OPERATING PROCEDURES (CONT'D.)

Nav Mode Selection on Track/Route

For all Track/Route navigation and whenever out of VOR range, and for departures from coastal airports (LAX, HNL, etc.), the Autotune Auto/Manual switch will be in Manual. The PF will couple his autopilot directly to his ONS for lateral navigation by selecting his HSI Radio/Nav Switch to NAV, FMS/ONS Switch to ONS, & NAV Select Source Switch to ONS. The PNF will display the opposite ONS data on his HSI by selecting NAV on his HSI Radio/Nav Switch and ONS on his FMS/ONS Switch. Do **NOT** couple the autopilot to the FMS. Since Autopilot A or B will be using the present position derived from the selected ONS unit, any deviations between ONS #1, #2, or the INS must be detected by a crewmember. The FMS Source Switch will be selected to display the ONS (1 or 2) that is coupled to the autopilot.

The #1 & #2 ONS data selectors may be in any desired position since good navigation technique would specify systematically evaluating various displays as opposed to one fixed position throughout the flight. Nonetheless, we strongly encourage that the CDU on the ONS coupled to the autopilot be set to display the Present Position, and the Opposite ONS selected to show the "TO" waypoint, except for use as necessary to derive other data.

The INS CDU selector will be carried in the XTK/TKE position at all times except for temporary use when deriving other required data.

The current FROM – TO waypoints will be maintained in the INS at all times except for temporary use, with the Captain's concurrence, to derive other data. The XTK/TKE should be continuously monitored by all three crew members.

Prior to entering the oceanic area, the accuracy of the ONS, INS, and FMS systems will be periodically monitored and checked against published radial and DME information **with Autotune switch In MANUAL**.

This may seem to be superfluous information when applied to a trip which proceeds from a coastal airport directly to a gateway. However, it is not unusual to fly routes which may be utilizing VOR/DME navigation for as much as an hour prior to commencing the transoceanic flight segment. (i.e., LAX – HNL, on Delta Route PGW via OAK – ALCOA, etc.) In such a case, it might be desirable to use FMS with Autotune VOR DME updating for the first part of the flight.

If previously operating in Domestic Airspace, during Coast-out the autopilot should be coupled to the ONS as described above.

The Auto/Manual switch should be placed in Manual before 50 DME during coast out to prevent erroneous FMS updating due to a weak VOR/DME signal. Prior to track entry the FMS FIX POS BY Page should be checked and the FIX POS BY ONS should be indexed to flush any erroneous update. The ONS Fix line should now read zero.

NAVIGATION EQUIPMENT ACCURACY CHECKS

An aircraft position check, by means of external navaids, should be made prior to gateway crossing. This check is required in order to ascertain the preferred navigation system to be used for the ocean crossing and bring attention to any "gross error". This record may be used to determine the NAV system to rely upon in the event of any disparity between systems.

The Long Range Navigation Systems used by Delta Air Lines and approved by the FAA are Omega (ONS), Inertial (INS), and the Flight Management System (FMS). These systems are referenced in the North Atlantic MNPS Airspace Operations Manuals and the NOPAC Operations Manual.

The Navigation System Accuracy Check should be accomplished prior to the Oceanic Gateway. Preplanning is essential as the gateway may, in some cases, be reached soon after departure. If time allows, however, delaying the check to note a trend is desirable. If unable to accomplish a System Accuracy check prior to the Gateway, it will be necessary to overfly the gateway in order to accomplish a system check. DO NOT ACCEPT CLEARANCE DIRECT TO A TRACK/ROUTE WAYPOINT WITHOUT A NAVIGATION SYSTEM CHECK. At the Gateway, a system check could be accomplished by VOR, Radial/DME or DME/DME.

A Gateway is defined as a fix where a flight transitions from a short range airways nav igation system to an oceanic (long range) navigation system.

The methods of determining the accuracy of a navigation system are outlined in the Pilot's Operating Manual, NAV Operating Procedures.

Omega Confidence Checks

The navigational performance of the ONS systems may be evaluated by [illegible]ching the following two checks. **These checks will be performed either prior to or shortly after passing the gateway, and any time thereafter should there be a discrepancy between the two ONS units or between the INS and Omega systems.** It is suggested that the results of these checks be recorded on the AIREP as indicated in the illustration below.

EN ROUTE OPERATING PROCEDURES (CONT'D.)

Station Frequency Check: Select Waypoint 3 and set the CDU selector to AUX. Note the number of stations indicating a #7. The number seven is a computer code denoting that all three frequencies of a transmitting station are being utilized by the ONS computer. Record the number of "7's" being received.

Geometric Dilution of Precision (GDOP) and System Quality Index Checks: Select Waypoint 4 with the CDU selector set to AUX. This will display two computer evaluations of overall ONS accuracy. The **left** window displays a code for GDOP on a scale from 0 to 99.9, with 2.4 or less denoting a normal operation. (A reading of 2.5 or more inhibits relaning.) The **right** window displays a code for System Quality Index on a scale from 00 to 24 with 00 being the highest quality. Any number above 05 indicates degraded performance.

Example of ONS Confidence Check Recording:

ONS#1 AUX 3__ AUX 4 GDOP__ AUX 4 QUAL __
ONS#2 AUX 3__ AUX 4 GDOP__ AUX 4 QUAL __

Waypoint confirmation will be accomplished in the following manner:

Just prior to passing a waypoint, check the **coordinates** and the **distance** to the next "TO" waypoint, and then compare navigation computer time with the flight plan estimated **time**. Time, distance, and coordinate verifications will be taken from ONS/INS computers, **NOT** the FMS. Use the FMS data to corroborate ONS/INS readouts. To signify verification of the next waypoint, a diagonal will be drawn thru the circled number of the "TO" waypoint.

After passing a waypoint, draw a second diagonal thru the circle around that waypoint number to signify that this waypoint has been passed.

To summarize the enroute waypoint confirmation procedure, the following example applies:

8 = Waypoint 8 un-verified.

(8) = Waypoint 8 coordinates & distance loaded and verified.

(8) = Waypoint 8 coordinates rechecked **enroute**, with time and distance to this fix also verified.

(8) = After Waypoint passage.

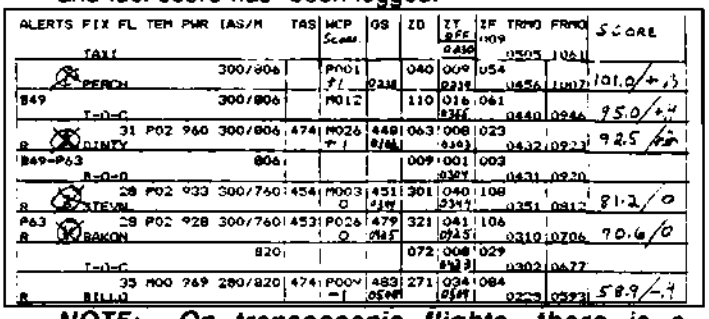
When flying within the Continental route structure or when VHF NAV facilities are available, the above confirmation procedures are unnecessary <u>provided</u> that the Pilot Flying periodically checks the radio navigation or direct route tracking by deselecting Auto Tune, dialing in the **<u>Inbound</u>** VOR frequency and radial, and then verifies the on course indication to the station.

"Howgozit"

A time and fuel score ("Howgozit") will be kept by the PNF and the S/O. This record compares Actual Times of Arrival (ATA) with Estimated Times of Arrival (ETA), and Actual Fuel on Arrival (AFA) with Estimated Fuel on Arrival (EFA).

The PNF will mark his score on the MASTER Flight Plan. The S/O keeps a comprehensive time and fuel score related to "K" factor on the L-1011 Fuel Record Form. It is also recommended for the PF to keep score on the plotting chart.

This illustration shows an example of how a scorekeeping procedure might appear on a flight plan. the ETA, EFA, ATA, AFA and Score Data is logged on the body of the flight plan opposite each waypoint fix. The waypoint numbering is in the same sequence as those on the fix list. Notice that waypoint BILLO (Non-Compulsory on Rt. 464) has not been numbered for waypoint loading but that time and fuel score has been logged.



NOTE: On transoceanic flights, there is a noticeable tendency for all three crew members to start working on the Howgozit" or other required paperwork at the same time. The psychology seems to be that when one pilot begins his paperwork, the others think that this is a good idea! This is especially true during climb. Remember that aircraft control, traffic surveillance, and navigation are the prime priorities while flying in high density traffic areas.

AIREP Reporting Procedures

An AIREP report will be given over all compulsory reporting points, normally by the PNF. **<u>Both the transmission and the readback</u>** should be monitored by the PF to ensure that information, clearances, etc., are understood by both the flight crew and the controlling agency. The PF should refer to the plotting chart to verify the accuracy of position reports.

EN ROUTE OPERATING PROCEDURES (CONT'D.)

(Delta Metro requests that wind direction and velocity be reported to the nearest degree and the nearest knot, i.e., 271/64, etc.) Midpoint position, wind, temperature, and weather data should be reported as an addendum to the required compulsory position reports. The identifier of the Control Facility (SFO, HNL, etc), the time of the report, and the initials of the sender are required on the AIREP log.

Use of Plotting Chart

The plotting chart is used for flight following, verification of position, and confirmation of AIREP position reporting accuracy. Normal position verification is accomplished using a Post Position Plot procedure. The chart also serves as a backup tool in case of total navigation system failure.

After passing each waypoint on Transoceanic routes, a Post Position Plot (PPP) will be made on the plotting chart approximately two degrees or ten minutes after waypoint passage. A simple method of doing this is to press the HOLD key on the INS when passing a point which is two degrees past the last waypoint. (Do not use ONS for this purpose unless the INS is unreliable or inoperative. In this event, plot the coordinates from the ONS which is NOT coupled to the autopilot.) This technique simplifies plotting the longitude on East – West flights. Record the PPP using the following procedures:

- Select POS on the INS CDU.
- Press the HOLD key to freeze readout of present position.
- Record LAT/LON of position at initiation of plot.
- Plot LON position first, then LAT on the chart.
- Mark the Zulu time on the chart near the plot.

Any plot not coinciding with the track/route must be resolved immediately.

Summary of Waypoint Passage Procedures.

- Just prior to waypoint passage, confirm coords, dist, & time to next wpt on both ONS units, the INS, & the FMS.
- Overhead the waypoint, the crew must observe that the aircraft turns toward the correct heading to the next "TO" waypoint.
- After passing, cross out old wpt & mark diagonal thru next "TO" wpt.
- Log "Howgozit" info on MASTER Flight Plan, Plotting Chart, & Fuel log.
- Log AIREP data and make report. Record Receiving Agency ID, Time of report, and initials of pilot sending position report.
- Prepare INS (or ONS, if INS unreliable/inop) for position HOLD at Post Position Plot Point.

Resolution of Disagreement Between Systems

In the event that a disagreement of ten (10) miles or more occurs between the two ONS units, or between the ONS units and the INS, perform the following checks:

- Check Autopilot engaged & AFCS Mode Annunciators correct.
- Check correct coordinates in the "TO" waypoint.
- Compare all 3 CDU readouts for reasonableness, with special attention to status, heading, groundspeed, track, and wind data. If malfunction status annunciated, perform recommended action.
- Check Desired Track and Distance display. (If in doubt, wait until passing a known waypoint, then check map to verify True Course)
- Check CDU's for Malfunction Codes.
- Check Engine Performance Log remarks for history of accuracy information.
- Perform INS Confidence Check (Compass Deviation Check).
- Perform ONS Confidence Check.

If the divergence is identified to be an Omega problem with no malfunction codes displayed, try the following recommendations:

- Check GMT/DAT for correctness.
- Check MH/TAS. Update if required.
- Check HF Station WWV (Frequency 5000, 10000, or 15000 KH) at 16 or 47 minutes after the hour, for broadcast of Omega outages or anomaly information.
- Precision update to INS position..
- Deselect stations showing poor station quality index.
- Retaning.
- Momentarily pull and reset Circuit Breakers–**Less than 7 sec**
  - Omega #1 CB 1–C–9
  - Omega #2 CB 1–E–23
- Turn ONS off, allow to cool down, then re–initialize.

If a discrepancy exists between the FMS position and that shown on the ONS/INS units, consider the possibility that an FMS update may have occurred utilizing a weak DME signal. This anomaly has been identified as a known cause of differences between FMS and actual position. Should this occur, the following procedure will clear the discrepancy from the FMS:

- Press NAV FUNCTIC
- Key PAGE FORWARD and index FIX POSITION.
- Index FIX POSITION BY ONS.

EN ROUTE OPERATING PROCEDURES (CONT'D.)

Bear in mind that ONS/INS units are your primary long range navigation systems, with the FMS acting only as a slave.

If unable to resolve a position disagreement problem, the following actions are recommended:

If the discrepancy is more than 10 miles but less than 20 miles, it is recommended that the aircraft be flown in a position which is midway between the crosstrack difference. If the disagreement is in long-track miles to go, adjust ETA.

Attempt to contact other nearby aircraft for wind, groundspeed, drift information, or other assistance desired.

IF CONFIDENCE IN POSITION IS STILL IN DOUBT, CONTACT ATC AND DECLARE UNRELIABLE NAVIGATION, BROADCASTING ON ASSIGNED ENROUTE FREQUENCIES AND 121.5 MHZ

Use DR navigation by referring to the True Course, Magnetic Heading, Zone Distance, and Zone Time data on the Delta Flight Plan and the plotting chart.

Use ADF, VOR, or HF/DF steer if available.

NOTE: The Jeppesen En Route and Orientation Charts for both the Pacific and Atlantic Routes contain important procedures which pertain to loss of navigation systems, engine failure, etc. Pilots are encouraged to review these notes periodically.

Declaration of Unreliable Navigation

Any deviation from assigned track/route of twenty (20) or more miles on Pacific Routes **must be reported immediately**. The flight crew, when detecting such navigation deviations, will broadcast their estimated position to both the controlling agency and other aircraft on the appropriate assigned frequency and on 121.5 MHZ.

Coast-In Accuracy

ONS accuracy will be logged as soon as position accuracy can be verified by VOR/DME reception after the oceanic crossing. This data, along with the INS drift data, is logged in the Remarks Section of the Engine Performance Log. Since it is not uncommon for an ONS to drift out of tolerance during approach maneuvering, it is wise to note this information just prior to commencing a letdown.

POST FLIGHT

After parking at the gate, and before shutting off the INS MSU's, note INS platform drift and residual ground speed in the REMARKS section of **Engine Performance Report Log**. INS drift will now be recorded in both distance (miles to go) **and** circular error. Circular error is determined by dividing the distance by the block time. For example, if the **raw** platform present position (update removed) shows a distance of 5 miles to the actual gate position and the block time is ten hours, the circular error would be one half (.5) NMPH (nautical miles per hour). The following tolerances will apply:

- A circular error in excess of two (2) miles requires a **Maintenance Log entry. A circular error of two and one half (2.5) NMPH or greater will require that the INS be replaced.**
- A residual ground speed of 5 or more knots will also require an entry in the **Maintenance Log.**
- Maintenance Manual Procedures will apply.

ONS distance errors (if any) are also recorded. This information is useful by providing a recorded reference which may reveal a degradation of accuracy in the INS or ONS units.

NOTE: It is common to see an ONS perform perfectly up to the point where approach maneuvering begins, and then subsequently show an excessive MTG readout at the gate. This is especially true while approaching HNL, were radio interference abounds. Any combination of quick maneuvers, speed changes, etc., may also affect Omega accuracy during the last few minutes of flight. Therefore, do not write up an ONS if the above factors apply.

The outbound and inbound Flight Folder will be retained by the S/O at layover points and turned in to Scheduling/Chief Pilot Office upon return to home base. The folders will be periodically reviewed for accuracy and completion, and retained for a minimum of 90 days, subject to FAA review in regard to any inquiry with respect to that flight or series of flights.

SUMMARY

We direct your attention to the first paragraph under FLIGHT PLANNING PROCEDURES, which states, "On an exception basis, the Captain may find it necessary to alter the crew member functions in order to accommodate a unique operational contingency." This philosophy applies to the total operation, not just the flight planning. The Captain's Command Authority **must** provide the latitude to address **special contingency considerations.** "Standard Operating Procedures" will work smoothly and should be applied without deviation in the vast majority of our operations - - the rule takes precedence over the exception. Nonetheless, the Captain must be equipped and prepared to exercise appropriate operational decisions as dictated by the particular operational situation.

SUPPLEMENTAL INFORMATION

The following information is included as a reference for those pilots who are new to extended overwater navigation procedures, or for those who desire a quick review.

ICAO FLIGHT PLAN MESSAGE EXPLANATION

```
20MAY1203MF 070222
QU  ATLFPFPXA  ATLDDDL
TRAINDL 03480A

.ATLDDDL 201203
FF  KZLAZQZX  PHNLXAAX
PHZHQZX PHNLYGYX

201203 KATLDALW

(FPL-DL1569-IS

- L101/H-SR/C

- KLAX1535

- N0481310      PRCH6
  DINTY/M082F330  R576
  DIALO/M082F350 R576

DENNS/N0478F350 MAGGI2

- PHNL0501 PHNA

- EET/KZOA0033 PHZ0408

REG/N1734D SEL/EMDJ)

CAPTAIN MCLELLAN
END COPY
```

The crew is required to possess a copy of the ICAO Filed Flight Plan Message. **Pertinent flight plan information lies within open parentheses ( ).** Everything prior to the first open bracket constitutes a computer code for the priority of the message over the teletypewriter network and the computer address of various ATC and DAL agencies requiring the message.

Within the parentheses, each section of the message is divided by hyphens. Everything between hyphens constitutes a message field whether it is all on one line or not. Within message fields, items are divided by an oblique stroke / (slash) or a space.

The first message beginning after the open parenthesis is (FPL -. This means "Filed Flight Plan Message". In the field -DL1569, the DL is the registration marking for Delta Airlines, followed by the flight number.

The field -IS is a code representing the rules under which the flight will be operated. I = IFR and the type of flight ,S = scheduled air carrier.

The field -L101/H is the type of aircraft and wake turbulence category (H = heavy).

The next field -SR/C designates the radio communication, navigation, and transponder code equipment. "S" means standard equipment for the route of flight. The "R" stands for "RNAV" capability. The "C" represents that both A and C transponder modes are available.

-KLAX1535 represents the departure airport and the scheduled departure time.

The next field is the route of flight. The first subdivision -N0481F310 PRCH6 DINTY/ refers to the segment of the flight which is operated under domestic ATC. Domestic segments must be filed in the format TAS followed by flight level. The "N" stands for knots, 0481 is the filed TAS. FL310 and PRCH6 is the flight level 310 and the code for the departure. DINTY is the point where the domestic portion of the route terminates.

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ICAO FLIGHT PLAN MESSAGE
EXPLANATION (CONT'D.)

The subdivision M82F350 R576 DENNS/ is the beginning of the oceanic portion of the route which must be filed with Mach number and flight level. R576 is the approved ICAO coding for the route. The /, in this case, represents a point on the route where a change in speed or altitude is **planned**. NOTE: An ATC clearance "Cleared as filed" **does not** constitute authority to step climb at DENNS. This / mark merely alerts ATC that a change may be requested. NO478F350 MAGGI is the Mach number, altitude, and STAR for the arrival segment of the flight.

The field -PHNL0501 PHNA represents destination airport and the elapsed time of flight. PHNA (ICAO designator for Barber's Point NAS) stands for the farthest alternate if alternates are specified. NOTE: The FMS code for PHNA is NAX, and the Delta Flight Plan message uses this terminology.

The field -EET/KZOA0033 PHZH0408 denotes enroute estimates to the domestic FIR (Flight Information Region) boundary and the Hawaiian FIR boundary. In this example, the flight is estimated to cross KZOA 33 minutes after takeoff, and arrive at PHZH 4 hours and 8 minutes after takeoff.

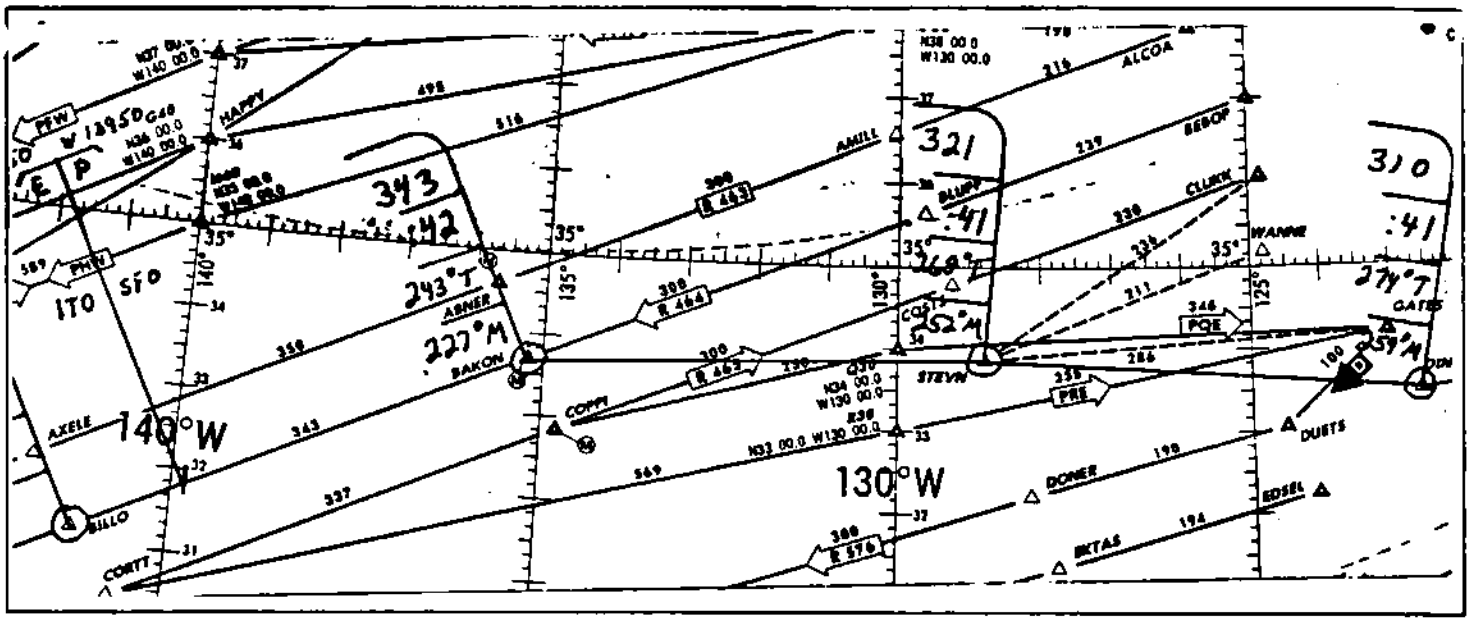
REG/N1734D SEL/EMDJ) translates to Registration Number N1734D, Selcal EMDJ. Note the parenthesis ")" denotes the end of the ICAO message. The items MCLELLAN & END COPY are convenience items added by Delta, denoting the Captain's name (not a required item) and the end of the message.

Use of Plotting Chart

The following illustrations are intended to serve as helpful aids in plotting the positions and other required data. It is required that this be prepared prior to entering the track/route, preferably during preflight planning. Figure 1 illustrates how a chart would appear after preflight plotting of the data taken from the REMARKS, FIX LIST, and ZONE DIST/TIME Sections of the Delta Flight Plan. Note that the following items have been marked on the chart:

- Course line between waypoints.
- Zone distance between each waypoint.
- Zone time between waypoints.
- True Course between waypoints.
- Average Midpoint Magnetic Heading between waypoints.
- Two Engine Out (2EO) ETP between SFO – ITO.

NOTE: Magnetic Headings are published as an aid to DR navigation in the event that all ONS and INS systems have failed. If actual winds aloft differ from the forecast, the MH on the Fix List will differ from actual aircraft heading until forecast winds are realized. In this case, apply the actual drift correction to True Course (TC), corrected for variation. (TC is printed on or measured from the Jepp charts, 10 degree tables, etc.)



ALERTS	FIX	FL	TEN	PWR	IAS/M	TAS	WCP	OS	ZD	ZT	ZF	TRMO	FRMO
											009		
	TAXI											0505	1061
					300/804		P001		040	009	054		
	PERCH											0454	1007
B49					300/804		M012		110	016	041		
	T-O-C											0440	0946
		31	P02	960	300/804	474	M026	448	063	008	023		
R	DINTY											0432	0923
B49-P63					804				009	001	003		
	B-O-D											0431	0920
		28	P02	933	300/760	454	M003	451	301	040	108		
R	STEVN											0351	0812
P63		29	P02	928	300/760	453	P026	479	321	041	106		
R	BAKON											0310	0706
					820				072	008	029		
	T-O-C											0302	0677
		35	M00	969	280/820	474	P009	483	271	034	064		
R	BILLO											0229	0593
		35	P03	971	280/820	478	M003	475	257	033	060		
R	BEATS											0155	0513

FIX LIST DATA FIX	FMS	LAT	LONG	T/C	VAR	D/C	M/H
KLAX	LOS	N33 56.5	W118 24.4	263	E14		
PERCH		N33 52.1	W119 09.4	262	E14		
DINTY	DRY	N33 29.0	W122 38.0	274	E15		
STEVN		N33 52.0	W126 47.0	268	E15		252
BAKON	BKN	N33 41.9	W135 13.3	243	E16		
BILLO	BLO	N31 10.7	W141 17.6	241	E15	R02	228
BEATS	BTS	N29 06.8	W145 37.3	239	E14		
SANDY	SDY	N26 31.8	W150 27.4	237	E13	R07	231
MRADR	SRR	N24 32.4	W153 50.7	235	E12	R09	232
BLITA	BTA	N23 31.9	W155 28.9	213	E12	R10	211
[illegible]	T33	N22 19.6	W156 20.6	230	E12	R10	228
MAGGL	MAG	N21 50.7	W156 58.1	229	E12		
OAH		N21 16.1	W157 42.3	284	E12		
KHNL	HLU	N21 19.3	W157 55.5		E12		

If MH is not printed, it has been dropped by the Flight Planning computer because a climb or descent is recommended on that leg.

FIGURE 1

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Figure 2 illustrates how a map might appear after enroute plotting has been accomplished. Note the inclusion of the following additional data which has been plotted since preflight:

- Post Position Plot (PPP) at 2 degrees after each waypoint
- LAT/LON of PPP plus Actual Time of Arrival (ATA) at plot.
- Optional; time & fuel score.

Note that the PPP plot at 147 degrees West shows an off-course position. This could identify a navigational error which should be investigated immediately. (The plot at 149W verifies an on-course correction.)

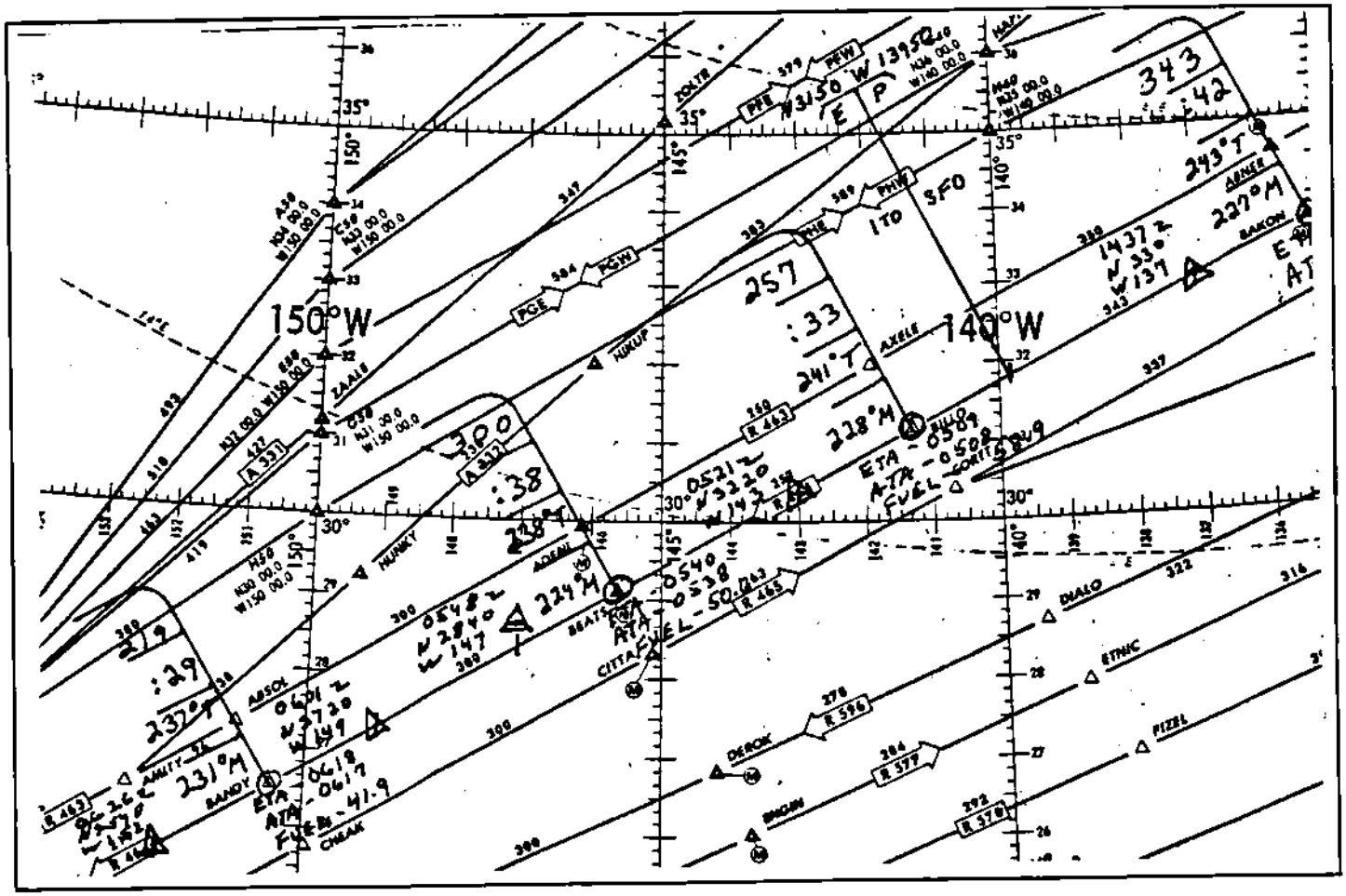

FIGURE 2

NOTE: Post Position Plots (PPP) opposite the Non-Compulsory reporting points (BILLO & BANDY) are shown for illustration purposes only. On the six Mid-Pacific Composite Routes (R463 thru R578), the PPP is not necessary following a non-compulsory waypoint. On all other routes, the PPP is required after <u>each</u> waypoint.

SCORING AND COURSE PLOTTING
AFTER CHANGE OF ROUTING

It is not unusual to be assigned another route of flight by ATC after departure, especially on the West Coast – Hawaii routes. The question now arises as to how to keep the time and fuel score on the new route. The answer is to simply draw a line perpendicular to the original course and then reference your "howgozit" score to those points where the extension of the perpendicular crosses the new course.

Figure 3 illustrates this situation. In this example, the routing has been changed from the original (R–578) to Route PVW. We have used dashed lines to highlight the perpendicular lines which form new crossing points.

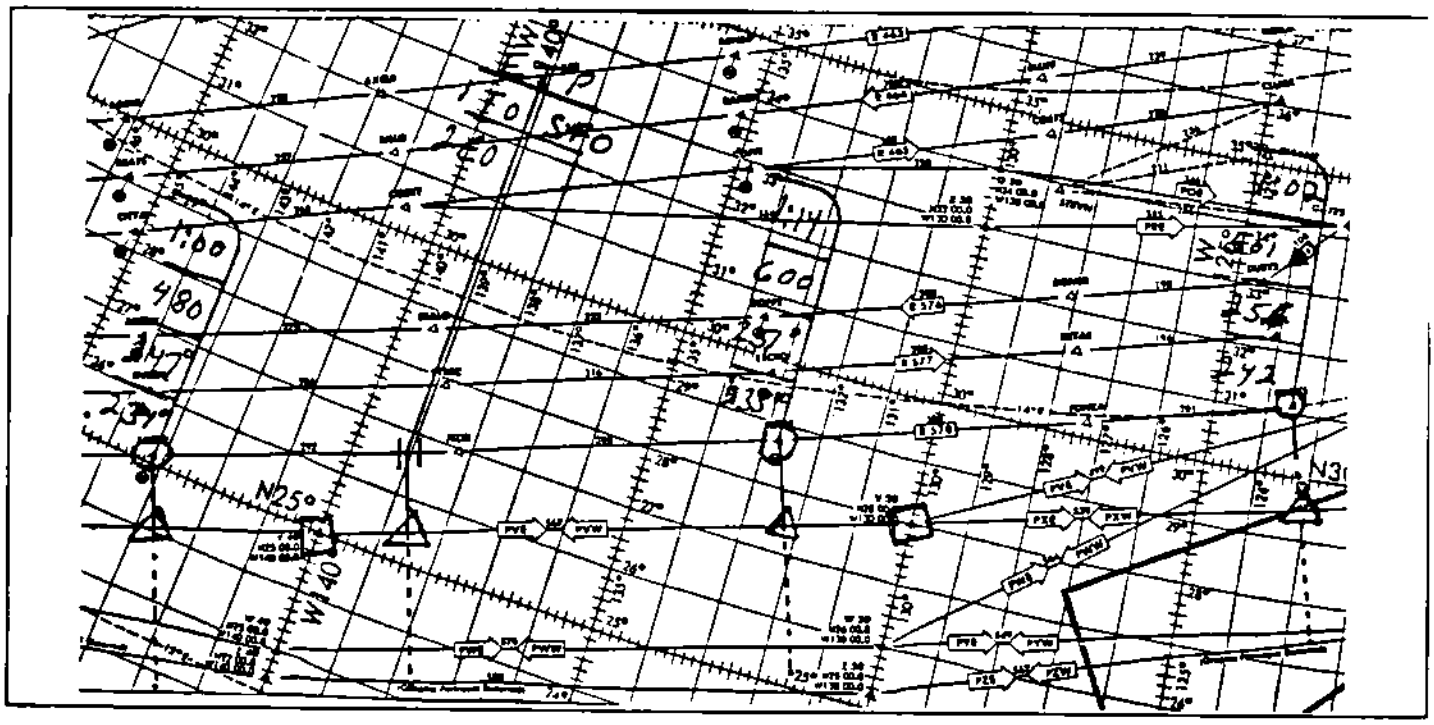

FIGURE 3

The methods or techniques of marking plotted information will vary with an individual pilot's artistic or mechanical drawing abilities. However, the finished product must meet the criterion of being neat enough to stand close scrutiny as a professional document which may serve as the best source of corroboration of your compliance with procedures in any post flight critique or inquiry.

To highlight the scorekeeping points and the projected new ETP, Triangles have been drawn around each point where the perpendiculars cross the new course line. Also, note that boxes have been drawn around waypoints V30, V40, etc., to denote the new waypoints which require an AIREP. Bear in mind that the AIREPs in this example will be given over V30, V40, etc, but that time and fuel score is referenced to the perpendicular crossing points below FOOTS, FEARS, etc.

The first few times that a route change has been experienced will serve to show how easy it is to make a mess out of the map! If you have any problem with the above procedure, you should plot the revised route on a clean plotting chart and always carry an extra copy or two for this contingency.

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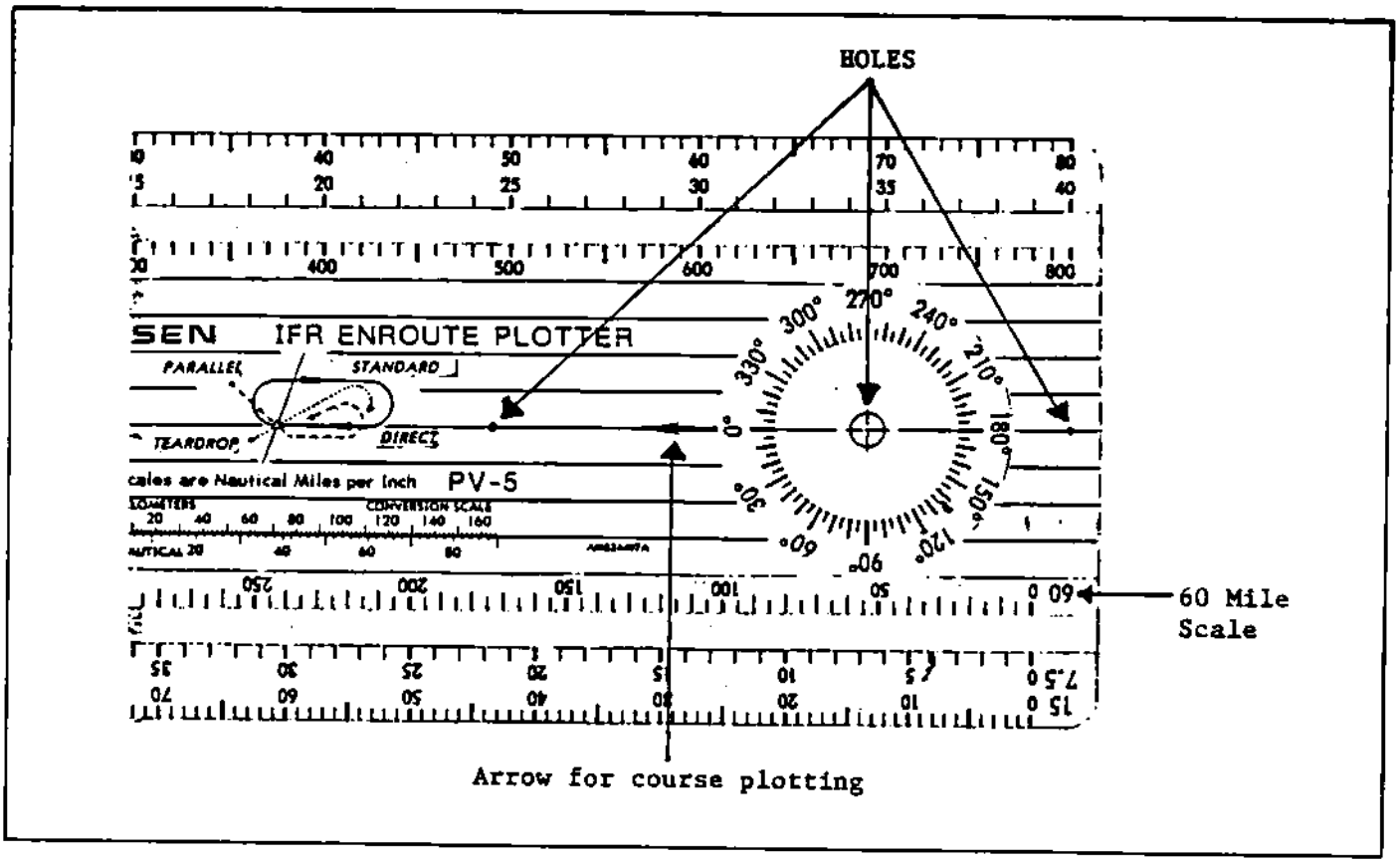

FIGURE 4

It is recommended that the Jeppeson plotter be used to draw these new lines, since it is very easy to strike a perpendicular by using the small holes drilled in the center of the compass rose or other places along the centerline of the plotter as a reference point from which to draw the line. (See Figure 4) This plotter is also easy to use for measuring distances on the plotting chart. On the standard Jeppeson chart, the scale is 1" = 120 Miles. By using the 60 mile scale on the plotter and then doubling the figure, the Miles – To – Go or other references to the "howgozit" point can be measured. (See Figures 3 & 4, but don't try to take a measurement from it because the reproduction has been reduced!)

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COURSE PLOTTING

Having solved the score keeping question, the next problem is how to find the new course, for the one on the flight plan is no longer valid. Once again, the answer lies in the use of the plotter. Lay the plotter along the new course with the arrow pointing towards the direction of flight, and read the new TRUE COURSE at the top of the compass rose. (See Figures 4 and 5) For best accuracy, the course should be measured at the midpoint between waypoints. By applying the variation and drift angle, a new MAGNETIC HEADING may be calculated.

Read True Course From
V30 to V40 = 252°

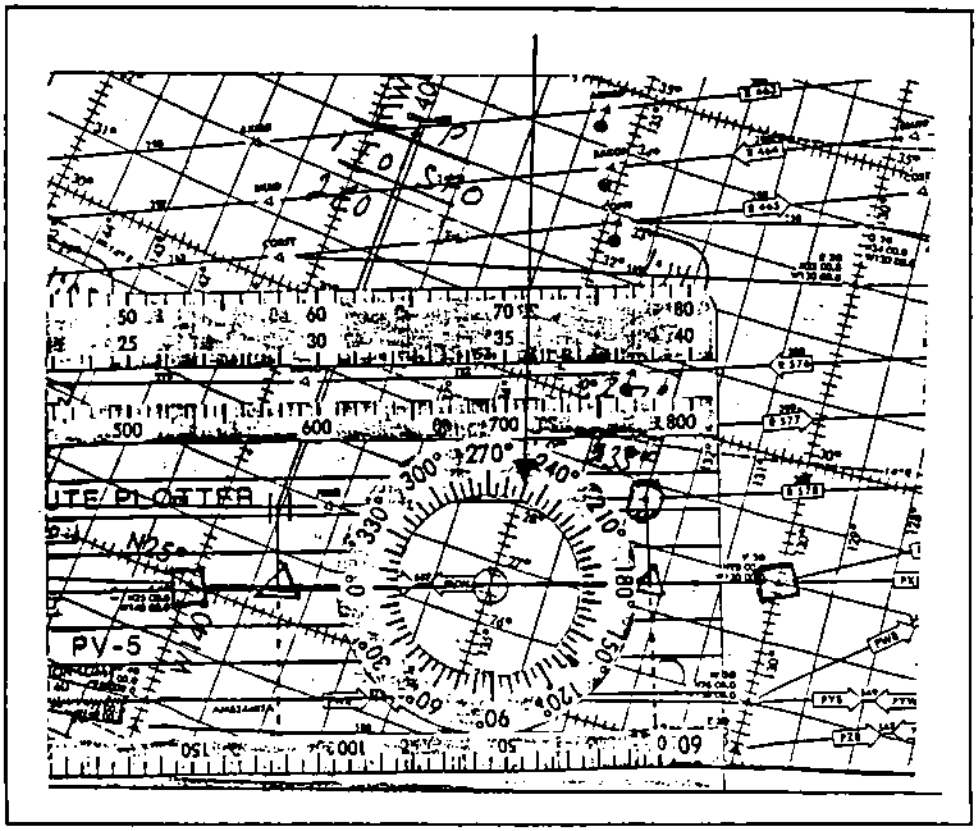


FIGURE 5

SUBJECT: NAVIGATION EQUIPMENT ACCURACY CHECK AND LOGGING INS ERROR

FILE IN POM AFTER MID PACIFIC OPERATIONS TAB

BACKGROUND

In order to comply with recommendations described in FAA AC 90-79 and the MNPS manual, an aircraft position check, by means of external navigation aids, should be made prior to gateway crossing. This navigation accuracy check is required in order to ascertain the preferred navigation system to be used for the ocean crossing and bring attention to any "gross error" prior to entering oceanic airspace. The record of this check may also be used to determine the navigation system to rely upon in the event of any disparity between systems while en route.

The Long Range Navigation Systems used by Delta Air Lines and approved by the FAA are Omega (ONS), Inertial(INS), and The Flight Management System(FMS). These systems are referenced in the North Atlantic MNPS Airspace Operations Manuals and the NOPAC Operations Manual.

The Navigation System Accuracy Check should be accomplished prior to the Oceanic Gateway. Pre planning is essential as the gateway may, in some cases, be reached soon after departure. If time allows, however, delaying the check to note a trend is desireable. If **unable** to accomplish a System Accuracy check prior to the Gateway, it will be necessary to overfly the gateway in order to accomplish a system check. DO NOT ACCEPT CLEARANCE DIRECT TO TRACK/ROUTE WAYPOINT WITHOUT A NAVIGATION SYSTEM CHECK. At the Gateway, a system check could be accomplished by VOR, Radial/DME or DME/DME.

A Gateway is defined as a fix where a flight transitions from a short range airways navigation system to an oceanic (long range) navigation system.

The methods of determining the accuracy of a navigation system are as follows:

FMS/INS NAV ACCURACY CHECK (3 INS with FMS)

The reliability and accuracy of the FMS system is continually monitored while in range of reliable VOR/DME signals. With the autotune switch in manual, confirm FMS position against VOR/DME. After position confirmation, **return** to autotune. Then:

FMS "NAV FUNCTION" KEY . . . . . PRESS

FMS "NAV MODE" page . . . . . INDEX
- Insure that all 3 INS units are IN and that IDD or IDV is indicated at top of page (IDD preferred)

FMS "NAV FUNCTION" KEY . . . . . PRESS

PAGE FWD KEY . . . . . PRESS

FIX PAGE . . . . . INDEX
- ("Fix Pos by" page appears)

DME/DME or DME/VOR LINE READS . . "0-3"
- (Indicates FMS Accuracy).

INS Data Selectors (All Units) . . . . . WAY PT

INS WAYPOINT SELECTOR . . . . . 1 thru 9
- (Any waypoint other than zero – all units)

"HOLD" BUTTON (All Units Simultaneously) . . . . . PRESS
- (DO NOT USE REMOTE)

NOTE: The data selector must be kept in either POS or WAY PT to retain the displayed position coordinates. The INS raw platform and the updated coordinates displayed on the CDU are "frozen" the moment the "HOLD" key is depressed (illuminated) with the data selector in either POS or WAY PT.

LAT and LONG (All Units) . . . . . RECORD
- (Raw Platform Position.)

DATA SELECTORS INS #1 or #2 . . . . . POS
- (FMS DME/DME or DME/VOR updated position.)

LAT and LONG INS #1 or #2 . . . . . RECORD

"HOLD" BUTTON (All Units) PRESS/RELEASE

FMS/INS NAV ACCURACY CHECK
(3 INS with FMS) (CONT'D.)

"HOLD" LIGHT . . . . . EXTINGUISHED

NOTE: If the "Hold" button is left depressed for an excessive period of time expect a red warning light on the affected INS. Do not be alarmed. Simply release the HOLD, select DSRTK/STS on the Data Selector Switch and press/release the TEST switch alternately until the warning light extinguishes and all action/malfunction codes disappear.

Using INS Raw platform position coordinates and FMS DME/DME or DME/VOR updated position coordinates, subtract smaller from larger and **record.**

INS UNITS (All Units) . . . . . RANK
- (Smallest difference is most accurate.)

INS NAV ACCURACY CHECK (NO FMS)

NOTE: Ensure that aircraft is tracking to a selected and identifiable navigation fix. If necessary, engage HDG Mode (APFDS) and overfly the fix in HDG mode. Turn to the outbound heading after passing over the fix.

NAV FIX COORDINATES (Selected Fix) . . . . . RECORD

INS DATA SELECTORS (All Units) . WAY PT

INS WPT SELECTOR (Any Wpt Other Than 0, All Units) . . . . . 1 THRU 9

"HOLD" BUTTON (All Units Simultaneously Over Known Fix) . . . . . PRESS

NOTE: The INS raw platform and the updated coordinates dispayed on the CDU are "frozen" the moment the "HOLD" key is depressed (Illuminated) with the Data Selector in either POS or WAY PT. (1 thru 9) The data selector must be kept in either POS or WAY PT to retain the selected position coordinates and, until update is complete, to prevent erroneous updates.

LAT and LONG (All units) . . . . . RECORD
- (Raw platform position.)

DATA SELECTOR –
(INS #1 or #2 If installed) . . . . . POS
- (Triple mix position.)

LAT & LONG – (INS #1 or #2) . . . . . RECORD
- (For 3 INS installation only.)

NOTE: If INS #3 has been previously updated, select POS on INS #3 Data Selector Switch to determine if another update is warranted.

Using the INS Raw Platform Coordinates And The Selected NAV FIX Coordinates, subtract smaller from larger and **record.**

NOTE: If any INS unit is in error by more than 2 NMPH of operation, a manual update should be carefully considered. However, if the accumulative error is less than 6NM, an update is not recommended.

LAT – One Minute = One NM
LONG – One Minute = One NM or less
25N – One Minute = approx .9 NM
35N – One Minute = approx .8 NM
45N – One Minute = approx .7 NM
55N – One Minute = approx .6 NM
65N – One Minute = approx .4 NM

If INS Unit is To Be Updated Manually:
- Select POS on unit to be updated ("HOLD" ulluminated)
- Type in Lat/Long of known fix
- Press INSERT — "HOLD" extinguishes if update accepted

HOLD Key (All units) . . . . . PRESS/RELEASE

HOLD LIGHT (All units) . . . . EXTINGUISHED

NOTE: If the HOLD key is left depressed for an excessive period of time, expect a red warning light on the affected INS. Do not be alarmed. Simply release the HOLD and select DSRTK/STS on the Data Selector Switch and press/release the TEST switch alternately until the warning light extinguishes and all action/malfunction codes dissappear.

NAV UNITS . . . . . RANK/RECORD

ONS NAV ACCURACY CHECK

At any time while in flight or on the ground, the present position (POS) can be compared with an accurate position fix and updated in latitude and/or longitude.

When the HOLD key is pressed and illuminated, present position and GMT displays are frozen. (The system continues computing position changes resulting from the aircraft movement during the display freeze). The display freeze allows for a comparison of the fix position obtained by other means, while the GMT provides a time reference for recording the position check.

To Accomplish ONS Position Check:

Ensure that the aircraft is tracking to a selected and identifiable navigation fix. If necessary, engage HDG mode (APFDS) and overfly the fix in HDG mode. (If this procedure is used, predetermine and turn to the outbound heading after passing over the fix.)

NAV FIX COORDS (Selected fix) . . . . RECORD

ONS DATA SELECTORS (All units) . . . . POS

WPT SWITCH (Any Position Other Than Zero) . . . . SELECT

"HOLD" KEY (All Keys Simultaneously Over Known Fix) . . . . PRESS

LAT & LONG (All Units) . . . . RECORD

Using ONS Position Coords And Selected Known Fix Coords, subtract smaller from larger and **record**.

NOTE: If any ONS unit is in error by greater than 3 to 4 miles, refer to the POM NAV operating procedures for a Precision Update.

LAT – One Minute = One NM
LONG – One Minute = One NM or less
25N – One Minute = approx .9 NM
35N – One Minute = approx .8 NM
45N – One Minute = approx .7 NM
55N – One Minute = approx .6 NM
65N – One Minute = approx .4 NM

"HOLD" KEY (All Units) . . . . PRESS/RELEASE

HOLD KEY ILLUMINATION . . EXTINGUISHED

ONS UNITS . . . . . RANK/RECORD

LOGGING INS ERROR

The procedure for logging INS drift error is being changed to comply with the requirement to record circular error as well as distance error. Circular error is determined by dividing the distance displayed after parking at the gate by the total block time. This provides a more technically correct history of INS accuracy, similar to the "3 + 3T" limitation with which you are already familiar. A Maintenance Log Entry is required to alert both maintenance and the subsequent crew members to the fact that a particular INS unit is approaching limitations. A Maintenance Log Book write-up will be required whenever the circular error exceeds two (2) NMPH. Maintenance action taken to sign off a write-up of between 2 and 2.4 NMPH is to simply test and satisfactorily relign the unit. However, when a unit reaches or exceeds the circular error limit of 2.5 NMPH, it is performing out of limits and it **must** be replaced.

A residual ground speed of 5 or more knots will also require an entry in the Maintenance Log.

Regarding crew action for inoperative or out of tolerance navigation units, the following guidelines apply. While every effort will be made to dispatch aircraft with three good INS units, the MEL requires only two operative units for dispatch. It is preferable to have these units installed in the #1 and #2 positions, but not a specific requirement. A delay is acceptable if it becomes necessary to move a good INS from the #3 position to the #1 or #2 position. It is not desirable to delay a flight simply to replace a #3 INS, especially at our overseas airports where spares are in short supply. The same philosophy applies to the FMS. Reasonable efforts will be made to provide an operational FMS for all departures. However, remember that the FMS is merely a useful tool and is not required for our operation. In the event that the FMS cannot be provided or will require extensive delays, you should proceed using INS only.

LOGGING INS ERROR (CONT'D.)

Effective upon receipt of this Flight Crew Bulletin, INS platform drift will be logged using the following procedure:

- After parking at the gate and before shutdown, record the INS platform drift and residual ground speed in the REMARKS section of **Engine Performance Report Log**. INS drift will now be recorded in both distance (miles to go) **and** circular error. Circular error is determined by dividing the distance by the block time. For example, if the **raw** platform position (update removed) shows a distance of 5 miles to the actual gate position and the block time is ten hours, the circular error would be one half (.5) NMPH. The following tolerances will apply:
  - A circular error in excess of two (2) NMPH requires a **Maintenance** Log Book entry. A circular error of two and one half (2.5) NMPH or greater will require that the INS be replaced.
  - A residual ground speed of 5 or more knots will also require an entry in the Maintenance Log.

Milt McKnight
L-1011 Fleet Manager

EXAMPLE
ENGINE PERFORMANCE REPORT LOG

CREW REMARKS:

CREW PLEASE DO NOT MARK IN THIS AREA

BLOCK TIME	8:00	#1	#2	#3
	Dist	2	20	4
	NMPH	.25	2.5	.5
	G/S	0	6K	0

EXAMPLE
AIRCRAFT MAINTENANCE LOG

Item No.	FRM Code	IRREG./
N	**R**	
1. #2 INS Circular Error 2.5 NMPH – G/S (Ground Speed) = 6K		

CURRENT TRANSOCEANIC FLIGHT CREW BULLETINS

None

MID PACIFIC
FLIGHT CREW
BULLETIN

APPLICABLE TO: L-1011
NUMBER: M-P 89-1
DATE: 1-10-89

SUBJECT: Omega Confidence Check

FILE IN POM AFTER MID PACIFIC OPERATIONS TAB

BACKGROUND

The Litton Omega Program 211-34-05 includes a new computer software modification which measures triangulation effectiveness and annunciates the results on the window display in Auxiliary Function #4. (System Quality Index continues to be displayed in the window with AUX 4 selected) This new display is called Geometric Dilution of Precision (GDOP). This feature has been added as an additional means of determining the reliability of Omega navigation during periods of signal degradation, station outages, or other anomalies which may affect the geometric triangulation of signals.

The Omega computer must receive valid "speed" and "course" lines in order to fix it's position properly. It utilizes signals from various locations and evaluates them as to their relation either ahead/behind, or off to one side of the aircraft, in effect plotting lines of position (LOP) to form a triangle. If the lines coincide to form a well defined triangle, the GDOP readout will be low. However, as the LOP's approach a flat triangle or a series of lines coming to or from only one relative direction, the GDOP display numerical index increases.

The GDOP scale ranges from 0.0 to 99.9, with 0.0 being best. To illustrate a practical example, Litton states that the GDOP at LAX when using signals from Hawaii, North Dakota, Australia, and Japan would be 2.4 -- not a very well defined triangle. However, if an additional signal of good quality were to be received from Argentina, the GDOP index number would improve. Litton also states that if the GDOP is 2.5 or larger, a relane is inhibited.

PROCEDURE

Current procedures for performing Omega Confidence Checks include logging the System Quality Index numbers displayed in the right window of AUX Function 4. The GDOP numbers will provide additional insight as to the true value of the signals being received. Therefore, effective this date, the GDOP numbers will also be logged when the AUX 4 display is selected.The Omega Confidence Check Recording is currently logged in spaces provided on the back of the Delta Air Lines AIREP - L-1011 Form. This form will continue to be used, but it will not be revised until the decision is made as to whether to continue it's use or to include the AIREP and Confidence Check log as part of the new Flight Plan format. Pending that decision, the AUX 4 numbers will be recorded on the back of the AIREP in the following format:

ONS 1	AUX 3...	AUX 4 GDOP...
		AUX 4 GDOP...
ONS 2	AUX 3...	AUX 4 QUAL...
		AUX 4 QUAL...

Milt McKnight
L-1011 Fleet Manager

CURRENT MID PACIFIC FLIGHT CREW BULLETINS

M-P 88-5

MID-PACIFIC
FLIGHT CREW
BULLETIN

APPLICABLE TO: L-1011
NUMBER: M-P 89-2
DATE: 2-17-89

SUBJECT: New Normal Procedures

The new L-1011 Pilot's and Second Officer's Checklist and normal procedures (dated February 20, 1989) may have procedures that conflict with current Transoceanic (or Mid Pacific as appropriate) procedures. If a conflict arises, the current Mid Pacific or Transoceanic procedures take precedence.

Please forward any written comments regarding any procedural conflicts to L-1011 Fleet Manager, Dept. 027 - ATL.

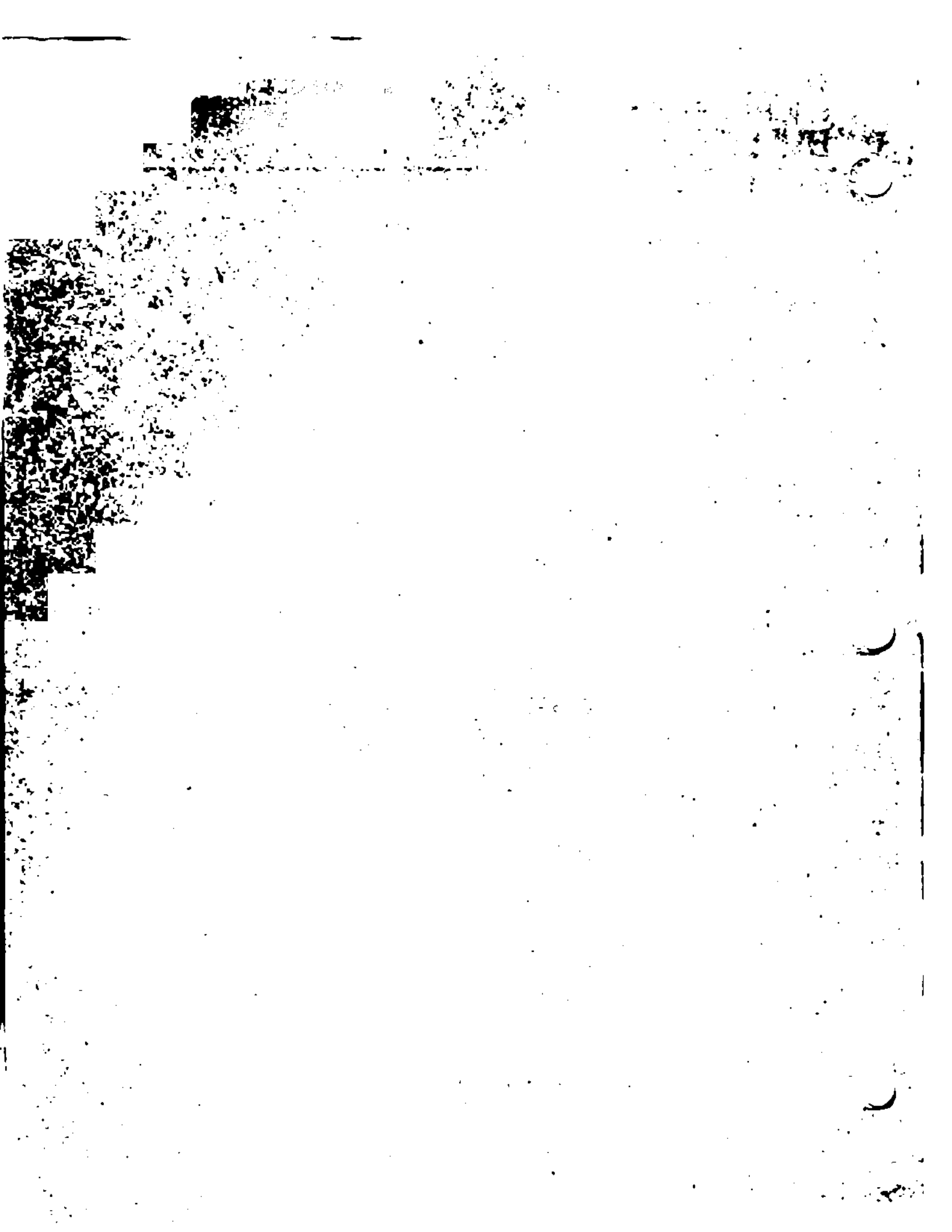
Milt McKnight
L-1011 Fleet Manager

Current Mid-Pacific Flight Crew Bulletins

M-P 88-5 M-P 89-1

All other Mid-Pacific Flight Crew Bulletins cancelled.

Published by Flight Operations Dept. - Delta Air Lines, Inc.



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GENERAL

The Transoceanic/International procedures and company policies contained in this section are to be used in conjunction with other appropriate operating procedures set forth in the following documents:

- Pilots Operating Manual (POM), supported and/or supplemented by
- Flight Crew Bulletins.
- Flight Operations Procedures Manual (FOPM)
- Delta Special Pages (DSP).
- Federal Air Regulations
  - The provisions of FAR 121 apply to all Delta Airlines operations, International and Domestic.
- Jeppesen International Route Manuals.

These procedures have been arranged in the order that the pilot would expect to use them, beginning from the time that he reports to the operations area until he turns in the papers at the completion of the flight. Note that a checklist of things to be accomplished has been included at the first part of this section for ready crewmember access. A Table of contents has also been added to enable easy reference to various procedural sections.

PREFLIGHT

CONFIRM DELTA FLIGHT PLAN AGREES WITH ICAO FLIGHT PLAN C

CONFIRM TRACK MESSAGE AGREES WITH DELTA FLT PLAN & ICAO FLT PLAN C

CONFIRM DELTA FLIGHT PLAN AGREES WITH FIX LIST & THAT COORDS AGREE WITH NAV CHARTS ... C,F

NUMBER EACH WPT ON MASTER & S/O COPIES OF FLIGHT PLAN ..... C,F,S

FILL OUT PLOTTING CHART ..... PF

FILL OUT FUEL LOG ..... S

FILL OUT PASSENGER BRIEFING MAPS ... S

CHECK FOLDER CONTENTS ..... C & S

COCKPIT PREPARATION

TEST, ALIGN, AND INPUT GATE COORDINATES ..... C,F,S

CHECK ALL 3 INS GATE COORDS USE WPT 0 & HOLD C

LOAD FMS GROUND SET UP OR INS WAYPOINTS FROM MASTER FLIGHT PLAN (INS 1 & 2 ONLY) ..... PF

CHECK FMS SET UP AND CONFIRM WPT SEQUENCE AND COORDINATES INDEPENDENTLY (CIRCLE WPT #'s) .... PNF

LOAD #3 INS USING COORDINATES CONFIRMED FROM MASTER FLT PLAN .... S

SELECT "NAV" BEFORE PUSHBACK & SELECT INS STATUS 1-55/54 ..... C or F

CHECK REQUIRED FOLDER DOCUMENTS ABOARD PRIOR TO PUSHBACK ..... S

USE A IGN E-BOUND,B IGN W-BOUND C,F

BEFORE TAKEOFF

CHECK FMS/INS FIX = 0, THEN

CHECK GROUND SPEED READOUTS .. C,F,S

USE HEADSETS BELOW 10M ..... C,F,S

ENROUTE

AFTER LEVEL OFF, PERFORM COMPASS DEVIATION CHECK ..... PNF

CONFIRM AIRWAY TRACKING AND COURSE DISTANCE USING VOR/DME WITH AUTO TUNE IN MANUAL ..... C,F

PRIOR TO OCEANIC OPERATION MAKE FMS/INS ACCURACY CHECK - OVERFLY GATEWAY IF NECESSARY ..... C,F

MONITOR AND CONFIRM ALL CLEARANCES ..... C,F

MAINTAIN "HOWGOZIT" ON THE MASTER FLIGHT PLAN & FUEL LOG .. PNF,S

COMPLETE AIREP LOG DATA AND MAKE POSITION REPORTS ..... PNF

USE PLOTTING CHART FOR POSITION REPORT CONFIRMATION & POST POSITION PLOT ..... PF

ON INS #3 CHECK COURSE CHANGE AFTER EACH WAYPOINT ..... S

UPDATE FUEL LOG AT EACH WAYPOINT .. S

COMPARE DISTANCE, TIME, AND NEXT WAYPOINT COORDINATES ..... C,F,S

CHECK COAST-IN ACCURACY OF INS/FMS USING VOR/DME ..... C,F,S

ENSURE ALL COMPANY REPORTS SENT .. S

BEFORE INS SHUTDOWN

LOG INS RESIDUAL READOUTS AT GATE

AFTER PARKING

PUT FOLLOWING ITEMS INTO TRANSOCEANIC FLIGHT FOLDER:

- MASTER FLIGHT PLAN
- S/O FLIGHT PLAN
- AIREP LOG
- PLOTTING CHART
- FUEL LOG
- FUEL SLIP
- TO & LANDING DATA CARDS
- USWB WIND & WEATHER CHART; FINAL WX BRIEF MSG
- WEIGHT & BALANCE DATA
- ICAO
- TRACK MESSAGE

FLIGHT FOLDER

The TRANSOCEANIC FLIGHT FOLDER will be used for all extended overwater operations.

The following is a listing of the **minimum data** which must be contained in the Transoceanic (Int'l) Flight Folder. Additional copies will be furnished at the Captain's discretion for qualified observers.

- ICAO Flight Plan; one (1) copy.
- Delta Flight Plan; Two (2) copies.
- Preliminary Weather Briefing Message; one (1) copy.
- National Weather Service Briefing Material - Significant Weather Chart for FL 250 thru 600 plus Upper Wind and Temperature Chart for FL 340 are mandatory items. If this data is not otherwise obtainable, a **direct** briefing from Flight Control Metro via telephone, ARINC, etc., is required.
- Transoceanic Plotting Chart; one (1) copy.
- AIREP log; one (1) copy.
- S/O Fuel Log; one (1) copy.
- Track Message - one (1) copy.

The **Captain** will confirm receipt of the above information and ensure that the Flight No./Date and Crew Names are entered on the front of the folder.

The S/O will ensure that all of the required items listed above have been inserted into the folder prior to leaving operations. Prior to pushback, he will again check to ensure that all required documents are aboard, including the Final Weather Briefing and the Final Weight and Balance.

- Required maps, charts, and forms are located in the briefing rooms or in the Operations area.

It is recommended that each Captain and First Officer carry a spare Plotting Chart and AIREP, and that each Second Officer carry an extra set of Passenger Briefing Maps and a spare Fuel Log.

Upon completion of a flight, all required Transoceanic Flight Folder data as described above, **plus Takeoff and Landing data cards, the Fuel Slip, and the final Weight & Balance data,** must be inserted into the folder and returned to your Base Operations for file retention. The folder contents are subject to periodic FAA or Company review for accuracy and compliance with procedures. Do not include other non specified documents or extraneous paperwork.

Passenger Enroute/Progress Briefing Maps - Oceanic Crossings.

- The S/O will prepare the passenger Briefing Map as part of his preflight duties.
- The maps will be posted in the cabin prior to gate departure if possible.
- If unable to post the maps prior to gate departure, the S/O will not leave his station for this purpose until the flight is above 18,000' on climb out.

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FLIGHT PLANNING PROCEDURES

The Flight Planning process is a **Crew** function requiring joint participation by each crewmember as specified. **On an exception basis**, the Captain may find it necessary to alter the crewmember functions in order to accommodate a unique operational contingency. The Captain should conduct a crew briefing to review such pertinent items as Metro Alerts, the Remarks section, the weather and NOTAMS for destination, alternate, and ETP airports, next best route or flight levels, or other items unique to Transoceanic Flight Plans.

The **Captain confirms** that the ICAO Flight Plan is valid, noting the Date/Time, Flight #, A/C #, and Captain's name. Check that date of ICAO matches the Delta Flight Plan. The Delta Flight Plan Release **routing** and the ICAO **routing** must be compared to the Fix List. (Altitudes or Mach speeds need not match.) Should a discrepancy exist, contact Flight Control and resolve.

For Atlantic crossings, the Captain will also confirm that the Delta Flight Plan Track Routing matches the North Atlantic Track (NAT) message. (Date/time of the NAT message must be checked in relation to the planned time to cross 30 West)

The **Captain and First Officer**, working together, **confirm** the Delta and ICAO Flight Plan waypoints listed in the body of the Flight Plan and Fix List against all required/desired fixes along the described route of flight and as depicted on the Navigation Charts.

- **Confirm** the fix identifier.
- **Confirm** the LAT/LON shown on the chart against that shown on the Delta Flight Plan.
- **Confirm** that the Track Fixes from the Track message match those in the body of the Delta Flight Plan & the Fix List.
- Write in any omitted mandatory reporting fix and any required "dogleg" fix along the planned route of flight; **Confirm** LAT/LON of all inserted fixes against chart data.
- FMS DATA Book Codes (from the Flight Plan **FIX LIST**) will be used when inserting fixes during an FMS operation.

One copy of the Delta Flight Plan will be identified as the "MASTER FLIGHT PLAN" by inscribing the word **MASTER** in the top margin of the flight plan message, along with the **Captain's initials.**

- No other copy of the Delta Flight Plan will be so identified. (The **MASTER** Flight Plan will be used later to load the FMS and/or the #1 & #2 INS computers.)

NOTE: The following procedure applies only to the Mid Pacific routes between the Mainland and Hawaii.

Non compulsory waypoints on the Composite Route System (R463 thru R578) between the Mainland and the Hawaiian Islands need not be loaded in navigation computers or the FMS unless you are specifically cleared to one of these fixes by ATC for navigation purposes such as route changes, crossing restrictions, etc. These waypoints are situated directly on the great circle track and will be automatically overflown by any of our navigation systems, so it is not necessary to load them in order to remain on track. It is necessary to check passing these positions for the purpose of AIREP midpoint wind and meteorological data reporting, and they are easily identifiable by the miles to go (distance) readout on any navigation computer. This exemption in no way effects the requirement that **all waypoints will be loaded** on all other Transoceanic Track/Routes, such as on the North Atlantic or the North Pacific.

Waypoint Numbering

Waypoint numbering on the MASTER flight plan will differ, depending upon whether the operation will be conducted using FMS/INS or INS only.

- The MASTER Flight Plan Fix List, when using **FMS/INS**, will be used to sequentially number each waypoint as follows: The airport fix should be numbered as WPT 000 and the first navigational waypoint fix beyond the airport on the route of flight should be numbered as WPT 001, etc. INS #3 waypoints selected to be loaded by the S/O will be numbered sequentially as 3 thru 9 on the Master Flight Plan, with #3 corresponding to the FMS/INS #1 waypoint.
- Numbers associated with FIX LIST waypoints will be transcribed adjacent to appropriate fixes in the Flight Plan body. Non-compulsory waypoints on Mainland - Hawaii composite routes may be eliminated from this numbering sequence.
- The MASTER Flight Plan Fix List, when using **INS ONLY**, will be numbered sequentially #1 thru #9 for use in loading all three INS units identically. WPT 001 will be the first navigational waypoint fix beyond the airport on the route of flight. (The S/O will use identical numbers.) Subsequent waypoints will be again numbered as #1 thru #9, etc.
- When it is necessary en route to load more than nine INS waypoints on aircraft with FMS inoperative, INS numbering will be continued from #9 beginning again with #1, 2, 3, etc. **Identical loading and confirmation procedures will be used for en route waypoint loading as those which are utilized during preflight.**

FLIGHT PLANNING PROCEDURES (CONT'D.)

The S/O will confirm that the waypoint coordinates and numbering sequence on the S/O copy of the flight plan match those recorded on the **MASTER** flight plan by the Captain and/or F/O. **Any alteration of the numbering sequence must receive the Captain's concurrence, providing him the opportunity to make appropriate notations on the MASTER flight plan.** (The second copy of the Delta Flight Plan will be used later by the S/O for use in loading INS #3 and for flight following, fuel computations cross referencing, etc.)

Plotting Chart

The Plotting Chart is required for extended overwater operations. All crew members should be familiar with plotting chart procedures. This chart should normally be completed in the briefing room by the pilot who will fly the oceanic leg. There may be times when this is not possible, such as a case when a clearance on an alternate track (other than that filed) is received. In this event, the plotting chart will be completed as soon as is practical. At the Captain's discretion, this may be delegated to the S/O dependent on crew duties.

The following items must be entered on the Plotting Chart, using the Delta Flight Plan or the 10 degree tables as a basic reference:

- Identify and plot each waypoint.
- For the segment between each waypoint, enter the following data:
  - Zone time between waypoints.
  - Zone distance between waypoints.
  - True Course (Measured at the Midpoint)
  - Average Midpoint Magnetic Heading
- Plot the Two engine out (2EO) ETP. Any decision to turn back or go ahead must be based on this point.

On routes between the south eastern U.S. or between PDX and NRT/SEL, it may not be possible to plot the entire course on one side of the plotting chart. It is a requirement to use plotting procedures over the entire course between oceanic gateways. This may necessitate using the reverse side of the plotting chart to complete this requirement.

COCKPIT PREPARATION

Headsets - Mandatory Below 10,000

Transoceanic Flight Crew Members will continuously use headsets during all taxi and flight operations in foreign airspace below 10,000'. It is recommended that headsets be used in all foreign airspace regardless of altitudes.

Each crew member, Captain, F/O, & S/O, will normally test and align INS #1, #2, & #3 respectively. **The Captain will then check ALL three INS units for proper present position and System Status Code countdown in progress.**

NOTE: DO NOT ACCEPT A PREVIOUS ALIGNMENT MADE BY MAINTENANCE OR ANOTHER CREW UNLESS ON TIME DEPARTURE IS A CRITICAL FACTOR. In this case, the Captain will confirm the correct alignment coordinates by selecting WPT zero, and HOLD.

NOTE: During the following loading and checking procedures, the MASTER Flight Plan Fix List will be used. Since these coordinates have already been verified from another source during Preflight Planning, this procedure will eliminate any chance of confusion over the actual route to be loaded. The S/O will confirm that the coordinates on his flight plan match those on the MASTER Flight Plan before loading the #3 INS.

It is recommended that SID or STAR waypoints **NOT** be loaded in any of the units (which are intended for use in long range navigation) unless they serve a **navigation purpose**, as opposed to a maneuvering convenience. Excess waypoints are a source of distraction while flying in high density traffic areas.

COCKPIT PREPARATION (CONT'D.)

- **The PF will program the FMS and load the confirmed waypoint coordinates from the MASTER flight plan.** For INS only operations, remote load INS #1 and #2.
- The S/O will load the #3 INS with the confirmed waypoint coordinates from the S/O copy of the Flight Plan. **DO NOT REMOTE LOAD INS #3.**
- For **FMS/INS** operations, waypoints should be loaded in the #3 INS in coordination with the Captain. This will allow the S/O to load those waypoints needed for fuel checks. However, with no exceptions, the S/O will continue to load all track and non radar environment waypoints in INS #3 with the same numerical sequence as reflected on the MASTER Flight Plan to ensure navigational cross reference with #1 & #2 INS's and to provide back up navigation should either #1 or #2 INS fail.
- For **INS ONLY** operations, the S/O will load the #3 INS with the identical waypoint coordinates in the same sequence (1 thru 9) as they have been loaded into the INS #1 and #2 units.
- The PNF will use the MASTER Flight Plan to confirm that the data has been properly loaded. After checking each waypoint, the PNF will draw a circle around the fix number to indicate that it has been verified. A diagonal will be drawn thru the first fix circle to designate that this is the "TO" waypoint and to signify that the distance and coordinates have been verified to the first waypoint.

NOTE: All waypoint loading and checking will be done independently. Do not read coordinates to each other. It is imperative that one pilot load a unit and the other pilot check it. If collaboration is allowed during this process, it is very possible that both pilots may confirm an error.

PRIOR TO PUSH BACK

All three crew members will verify that the final paperwork is on board and that the Delta Flight Plan and the Final Weather Briefing have the same release number. (Example: If the Delta Flight Plan shows Release #2, the Final Weather Briefing should also read Release #2.) If the data on the Final Release differs from that which is on the MASTER Flight Plan (prepared during preflight), the Final Release will be used as the MASTER.

The INS Mode Selectors should be placed in the NAV position approximately 10 minutes prior to push back, and **must** be in NAV before **any** aircraft movement. The MSU may be moved to NAV any time after the green ready light has illuminated. If refined alignment (measurable only in yards) is desired, this may be obtained by waiting until the Performance Index (PI) has reached four (4) before switching to NAV. However, under no circumstances is it necessary to delay a departure or to risk a pushback in the ALIGN mode simply to obtain this refined alignment.

After selecting NAV, position all INS CDU's to DSRTK/STS and check that each displays status 1-55. Then press the FMS NAV function key, Page FWD to FIX POS BY page to check that FIX POS BY INS is "0".

NOTE: For INS ONLY operations, select DSRTK/STS and press key #4 and INSERT on INS units 1 & 2 to enter triple mix. Display status in this case will show 1-54 (INS #3 will remain in status 1-55, Stand Alone.) The CDU's on each INS will be cross checked to verify that the Desired Track and the Distance to the first waypoint are reasonable and that they match with each other.

To evenly distribute ignition system usage and reduce the potential failure rate, use the "A" system on Eastbound flights, and the "B" system Westbound.

Prior to taxi the INS CDU selectors will be placed to TK/GS in order to provide ground speed readout during taxi, takeoff, and initial climb. Any ground speed reading with the aircraft stopped may be an indication of a deteriorating INS unit.

ENROUTE OPERATING PROCEDURES

It is standard ICAO procedure to monitor emergency or "Guard" frequency,121.5 MHZ, while operating in Track/Non radar areas.

Compass Deviation Check

The Compass Deviation Check will be accomplished after level off at initial cruise altitude and/or prior to track entry, if possible, with the HSI switch in MAG.

- Read True Heading on INS CDU and record.
- Read and record Mag Variation from the appropriate Jeppesen chart (Do NOT read from the FMS).

Read and record the following data on the AIREP Deviation Log: (Record the data quickly, then do the computations later to eliminate possible heading change while making computations.)

- #1 HSI heading
- #1 RDDMI heading
- #2 HSI heading
- #2 RDDMI heading
- Standby Compass Heading

Compute **INS** Mag Heading (Add or subtract variation and record.)

Perform Deviation Computations for each compass and enter on the AIREP log.

NOTE: If the compass system headings differ by more than one degree from the computed INS heading AND there is a crosstrack disagreement of over 10 miles between the INS units, there is a strong possibility that the accuracy of one of the INS units is degrading due to mechanical or electronic malfunction. Should this occur and the crosstrack divergence continues to increase, do not rely on the suspect INS for tracking information.

Transponder Operation

- North Atlantic
  - Except in cases of emergency or radio failure, pilots of aircraft flying in the NAT Region shall operate transponder on:
    - Code 2000 all directions.
    - Code 2100 prior to entering Bermuda TCA.

NOTE: Last assigned code to be retained for 30 minutes after entering NAT airspace.

- **North Pacific**
  - On NOPAC routes, it is standard procedure to set Code 2000 when operating between 170E and 150E. When **east** of 170E, a discrete code may be assigned which should be maintained unless otherwise advised by ATC. (Usually when flying near Alaskan airspace.) If no discrete code is assigned, maintain Code 2000 while flying on track/route.

After level off and prior to track entry, it is recommended that the top white airspeed bug be reset to the two engine FMS Critical/PMS Maximum Range Cruise driftdown speed. If the FMS/PMS is not available, consult the ODM abnormals for the Driftdown Speed schedule.

Positioning of INS Data Selector - Track/Non Radar Environment

The #3 INS Data selector will be carried in the XTK/TKE position at all times except for temporary use when deriving other required data. The current FROM - TO waypoints will be maintained in the INS at all times except for temporary use, with the Captain's concurrence, to derive other data .

The #1 & #2 INS data selectors may be in any desired position since good navigation technique would specify systematically evaluating various displays as opposed to one fixed position throughout the flight. Nonetheless, we strongly encourage that the FMS display the next waypoint to be overflown on the WAYPOINTS page and that the next waypoint to be overflown will be indexed to reflect coordinates and nav data. The INS data selector on the INS driving the A/P should be periodically switched to POS, and the opposite INS to WPT #2 to monitor progression of position coordinates as they count down towards waypoint coordinates.

NOTE: For INS ONLY navigation, the data selector for the INS driving the auto pilot should be carried in POS, with the opposite INS displaying the next WPT to be overflown, except when the selectors are being used to derive other data. (The #3 INS Data Selector will be used as described above.)

TRACK/ROUTE MACH RESTRICTIONS

When a Mach restriction has been issued as part of an oceanic clearance (such as in the North Atlantic when you are normally cleared to maintain Mach .83 on the assigned track), the flight will be flown at that speed while on the Track/Route. This speed will also be maintained beyond the Track/Route until the aircraft is in radar contact with ATC or has otherwise received clearance to change speeds. Set the required Mach in the FMS. If no Mach assignmnent or restriction applies, continue to use the FMS MIN COST CRUISE mode.

EN ROUTE OPERATING PROCEDURES (CONT'D.)

Navigation Equipment Accuracy Checks.
In order to comply with recommendations described in FAA AC 90-79 and the MNPS manual, an aircraft position check, by means of external navigation aids, should be made prior to gateway crossing. This navigation accuracy check is required in order to ascertain the preferred navigation system to be used for the ocean crossing and bring attention to any "gross error" prior to entering oceanic airspace. The record of the check may also be used to determine the navigation system to rely upon in the event of any disparity between systems while en route.

The Long Range Navigation Systems used by Delta Air Lines and approved by the FAA are Omega (ONS), Inertial (INS), and the Flight Management System (FMS). These systems are referenced in the North Atlantic MNPS Airspace Operations Manuals and the NOPAC Operations Manual.

The Navigation System Accuracy Check should be accomplished prior to the Oceanic Gateway. Preplanning is essential as the gateway may, in some cases, be reached soon after departure. If time allows, however, delaying the check to note a trend is desirable. If unable to accomplish a System Accuracy check prior to the Gateway, it will be necessary to overfly the gateway in order to accomplish a system check. DO NOT ACCEPT CLEARANCE DIRECT TO A TRACK/ROUTE WAYPOINT WITHOUT A NAVIGATION SYSTEM CHECK. At the Gateway, a system check could be accomplished by VOR, Radial/DME or DME/DME.

A Gateway is defined as a fix where a flight transitions from a short range airways navigation system to an oceanic (long range) navigation system.

The methods of determining the accuracy of a navigation system are outlined in the Pilot's Operating Manual, NAV Operating Procedures.

Enroute Waypoint Confirmation.
Waypoint confirmation in Track/Non radar environment will be accomplished as follows:

Just prior to passing a waypoint, check the **coordinates** and the **distance** to the next "TO" waypoint, and then compare navigation computer time with the flight plan estimated **time**. To signify verification of the next waypoint, a diagonal line will be drawn thru the circled number of the "TO" waypoint.

After passing a waypoint, draw a second diagonal thru the circle around that waypoint number to signify that this waypoint has been passed.

To summarize the enroute waypoint confirmation procedure, the following example applies:

8 = Waypoint 8 unverified.

(8) = Waypoint 8 coordinates & distance loaded and verified.

(8) = Waypoint 8 coordinates rechecked enroute, with time and distance to this fix also verified.

(8) = After waypoint passage.

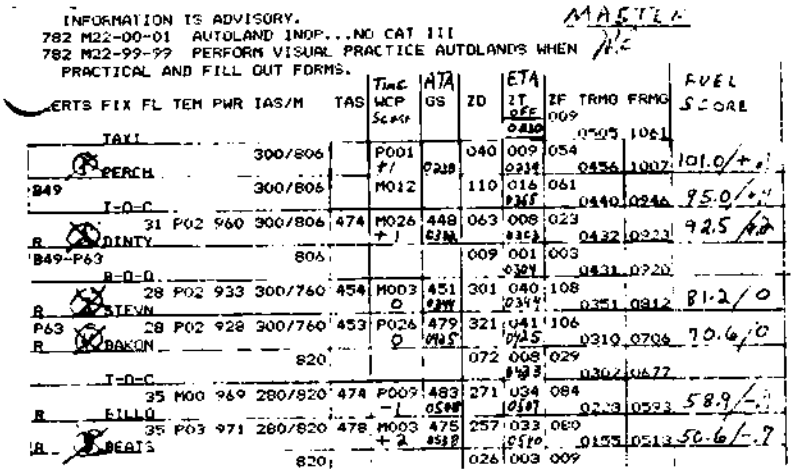
NOTE: When flying within the Continental route structure or when VHF NAV facilities are available, the above confirmation procedures are not necessary provided that the Pilot Flying periodically checks the radio navigation or direct route tracking by deselecting Auto Tune, setting the inbound VOR frequency and radial, and verifying the on course indication to the station.

EN ROUTE OPERATING PROCEDURES (CONT'D.)

"Howgozit"

A time and fuel score ("Howgozit") will be kept by the PNF and the S/O. This record compares Actual Times of Arrival (ATA) with Estimated Times of Arrival (ETA), and Actual Fuel on Arrival (AFA) with Estimated Fuel on Arrival (EFA). The PNF will mark his score on the MASTER Flight Plan. The S/O keeps a comprehensive time and fuel score related to "K" factor on the L-1011 Fuel Record Form. It is good operating practice for the PF keep score on the oceanic plotting chart.

This illustration shows an example of how a scorekeeping procedure might appear on a flight plan. The ETA, EFA, ATA, AFA and Score data is logged on the body of the flight plan opposite each waypoint fix. The waypoint numbering is in the same sequence as those on the fix list. Notice that waypoint BILLO (Non-Compulsory on Rt. 464) has not been numbered for waypoint loading, but that time and fuel score has been logged.



NOTE: On transoceanic flights, there is a noticeable tendency for all three crewmembers to start working on the "howgozit" data or other required paperwork at the same time. The psychology seems to be that when one pilot begins his paperwork, the others think that this is a good idea! This is especially true during climb. Remember that aircraft control, traffic surveillance, and navigation are the prime priorities while flying in high density traffic areas.

AIREP Log/Position Reporting

An AIREP report will be given over all Track/Non radar compulsory reporting points, normally by the PNF. **Both the transmission and the readback** should be monitored by the PF to ensure that information, clearances, etc., are understood by both the flight crew and the controlling agency. Log the call letters (GAN, SNN, HNL, etc.), the time of transmission and the initials of the sender in the spaces provided on the AIREP Log. The PF should refer to the plotting chart to verify the accuracy of position reports. (Delta Metro requests that wind direction and velocity be reported to the nearest degree and the nearest knot, i.e., 271/64, etc.) Midpoint position, wind, temperature, and weather data should be reported as an addendum to the required compulsory position reports.

Use of Plotting Chart

The plotting chart is used for flight following, verification of position, and confirmation of AIREP position reporting accuracy. Normal verification of position is accomplished using a Post Position Plot procedure. The chart also serves as a backup tool in case of total navigation system failure.

Post Position Plot (PPP)

After passing each compulsory navigation waypoint on Transoceanic routes, a Post Position Plot will be made on the plotting chart approximately two degrees or ten minutes after waypoint passage. A simple method of doing this is to press the HOLD key on the INS when passing a point which is two degrees past the last waypoint. This technique simplifies plotting the longitude on East - West flights. Record the PPP using the following procedures:

- Select POS on the #3 INS CDU. (If #3 INS is unreliable or inop, use POS on CDU of INS not coupled to the autopilot. Failure to release the HOLD on INS #1 or #2 may cause a red warning light to illuminate.)
- Press the HOLD key to freeze readout of present position.
- Record LAT/LON of position at initiation of plot.
- Plot LON position first, then LAT on the chart.
- Mark the Zulu time on the chart near the plot.
- Release HOLD

Any plot not coinciding with the track/route must be resolved immediately.

EN ROUTE OPERATING PROCEDURES (CONT'D.)

Summary of Waypoint Passage Procedures

- Just prior to wpt passage, confirm coords, dist, & time to next wpt.
- Mark diagonal thru the next "TO" wpt.
- Overhead the waypoint, the crew must observe that the aircraft turns to the correct heading to the next "TO" wpt.
- After passing, cross out old wpt.
- Log "Howgozit" info on MASTER Flight Plan, Plotting Chart, & Fuel log.
- Log AIREP data and make report. Record Receiving Agency ID, Time of report, and initials of sender.
- Prepare INS for position HOLD at Post Position Plot.

Resolution of Disagreement between INS Units - Track/Non Radar Environment

In the event that there is a disagreement of ten (10) miles or more between the two INS systems, perform the following checks:

- Check Autopilot engaged & AFCS Mode Annunciators correct.
- Check correct coordinates in the "TO" waypoint.
- Compare all 3 CDU readouts for reasonableness, with special attention to status, heading, groundspeed, track, and wind data. If malfunction status annunciated, perform recommended action.
- Check Desired Track and Distance display. (If in doubt, wait until passing a known waypoint, then check map or the 10 degree tables to verify True Course)
- Check CDU's for Malfunction Codes.
- Check Engine Performance Log remarks for history of accuracy information.

Perform INS Confidence Check (Compass Deviation Check). **Bear in mind that the INS units are your primary long range navigation systems, with the FMS acting only as a slave.**

If Unable to Resolve a Position Disagreement Problem, the Following Actions Are Recommended:

- If the discrepancy is more than 10 miles but less than 20 miles, it is recommended that the aircraft be flown in a position which is midway between the crosstrack difference. If the disagreement is in long-track miles to go, adjust ETA.
- Attempt to contact other nearby aircraft for wind, groundspeed, drift information, or other assistance desired. If a turnaround is advisable, use wind info from the AIREP to figure return headings.

IF CONFIDENCE IN POSITION IS STILL IN DOUBT, CONTACT ATC AND DECLARE UNRELIABLE NAVIGATION, BROADCASTING ON ASSIGNED ENROUTE FREQUENCIES AND 121.5 MHZ.

- Use DR navigation by referring to the True Course, Magnetic Heading, Zone Distance, and Zone Time data on the Delta Flight Plan and the plotting chart.
- Use ADF, VOR, or HF/DF steer if available.

NOTE: The Jeppesen En Route and Orientation Charts for both the Pacific and Atlantic Routes contain important notes which pertain to loss of navigation, engine failure, etc. Pilots are encouraged to review these periodically.

Declaration of Unreliable Navigation

Any deviation from assigned track/route of twenty miles on Pacific routes or twenty five miles on Atlantic routes **must be reported immediately**. The flight crew, when detecting such navigation deviations, will broadcast their estimated position to both the controlling agency and other aircraft on the appropriate assigned frequency and on 121.5 MHZ.

Coast-In Accuracy

When in range of reliable VOR/DME signals, check the accuracy of the FMS and INS units by comparison of VOR radials and DME distances against the individual displays on each INS CDU or that which is displayed in the FMS.

POST FLIGHT

The INS readouts of miles to go and residual ground speed are recorded before INS shutdown for the dual purpose of giving both maintenance and the flight crew a history of the accuracy of each individual INS unit. This is useful for maintenance in trouble shooting and it gives the flight crew a recorded reference which may reveal an indication of degradation of accuracy. After parking at the gate, and before shutting off the INS MSU's, note INS platform drift and residual ground speed in the REMARKS section of **Engine Performance Report Log**. INS drift will now be recorded in both distance (miles to go) **and** circular error. Circular error is determined by dividing the distance by the block time. For example, if the **raw** platform present position (update removed) shows a distance of 5 miles to the actual gate position and the block time is ten hours, the circular error would be one half (.5) NMPH (nautical miles per hour). The following tolerances will apply:

- A circular error in excess of two (2) NMPH requires a **Maintenance Log entry. A circular error of two and one half (2.5) NMPH or greater will require that the INS be replaced.**
- A residual ground speed of 5 or more knots will also require an entry in the **Maintenance Log.**
- Maintenance Manual Procedures will apply.

The outbound and inbound Flight Folder will be retained by the S/O at layover points and turned in to Scheduling/Chief Pilot Office upon return to home base. The folders will be periodically reviewed for accuracy and completion, and retained for a minimum of 90 days, subject to FAA review in regard to any inquiry with respect to that flight or series of flights.

SUPPLEMENTAL INFORMATION

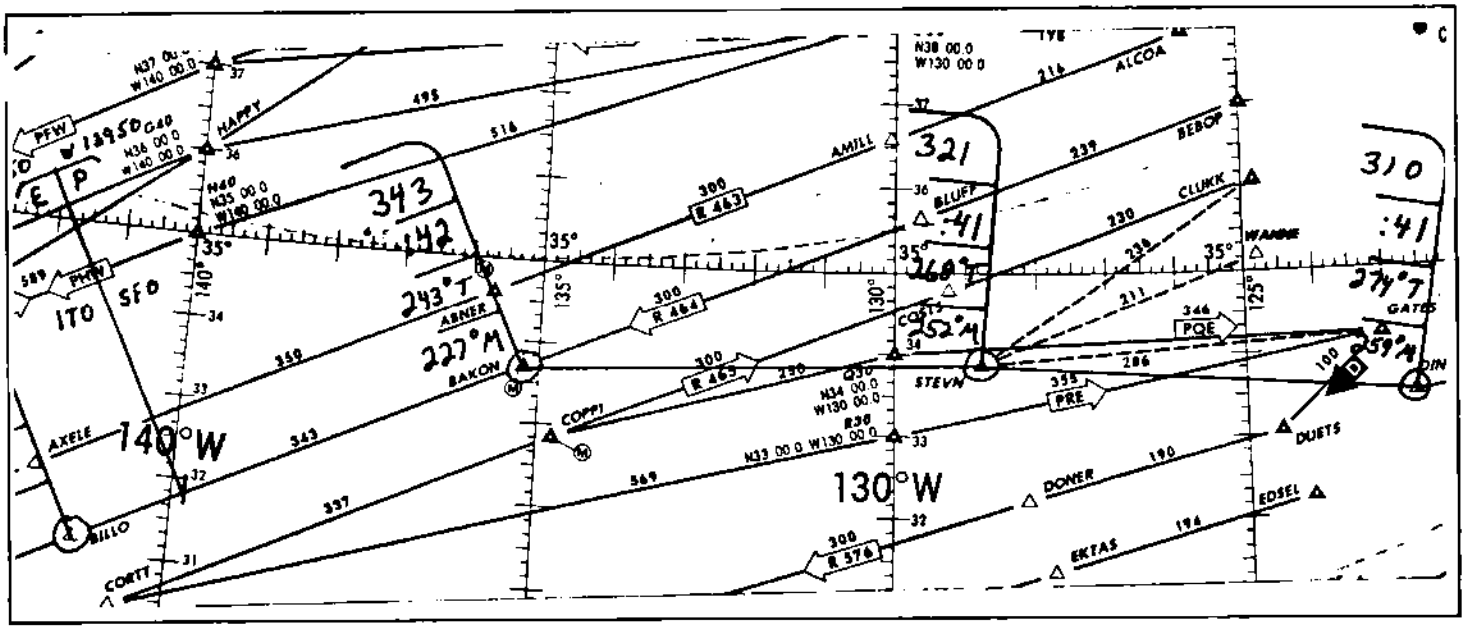
The following information is included as a reference for those pilots who are new to extended overwater navigation procedures, or for those who desire a quick review.

Use of Plotting Chart

The following illustrations are intended to serve as helpful aids in plotting the positions and other required data. It is required that this be prepared prior to entering the track/route, preferably during preflight planning. Figure 1 illustrates how a chart would appear after preflight plotting of the data taken from the REMARKS, FIX LIST, and ZONE DIST/TIME Sections of the Delta Flight Plan. Note that the following items have been marked on the chart:

- Course line between waypoints.
- Zone distance between each waypoint.
- Zone time between waypoints.
- True Course between waypoints.
- Average Midpoint Magnetic Heading between waypoints.
- Two Engine Out (2EO) ETP between SFO – ITO.

NOTE: Magnetic Headings are published as an aid to DR navigation in the event that all ONS and INS systems have failed. If actual winds aloft differ from the forecast, the MH on the Fix List will differ from actual aircraft heading until forecast winds are realized. In this case, apply the actual drift correction to True Course (TC), corrected for variation. (TC is printed on or measured from the Jepp charts, 10 degree tables, etc.)



ALERTS	FIX	FL	TEM	PWR	IAS/M	TAS	WCP	GS	ZD	ZT	ZF	TRMG	FRMG
											009		
	TAXI											0505	1061
					300/806		P001		040	009	054		
	PERCH											0456	1007
B49					300/806		M012		110	016	061		
	T-O-C											0440	0946
		31	P02	960	300/806	474	M026	448	063	008	023		
R	DINTY											0432	0923
B49-P63					806				009	001	003		
	B-O-O											0431	0920
		28	P02	933	300/760	454	M003	451	301	040	108		
R	STEVN											0351	0812
P63		29	P02	928	300/760	453	P026	479	321	041	106		
R	BAKON											0310	0706
					820				072	009	029		
	T-O-C											0302	0677
		35	M00	969	280/820	474	P009	483	271	034	084		
R	BILLO											0228	0593
		35	P03	971	280/820	478	M003	475	257	033	080		
R	BEATS											0155	0513

FIX LIST DATA FIX	FMS	LAT	LONG	T/C	VAR	D/C	M/H
KLAX	LOS	N33 56.5	W118 24.4	263	E14		
PERCH		N33 52.1	W119 09.4	262	E14		
DINTY	DNY	N33 29.0	W122 35.0	274	E15		
STEVN		N33 52.0	W126 47.0	268	E15		252
BAKON	BKN	N33 41.9	W135 13.3	243	E16		
BILLO	BLO	N31 10.7	W141 17.6	241	E15	R02	226
BEATS	BTS	N29 06.6	W145 37.3	238	E14		
BANDY	BDY	N26 31.8	W150 27.4	237	E13	R07	231
BRADN	BRR	N24 32.6	W153 50.9	235	E12	R09	232
BITTA	BTA	N23 31.9	W155 28.9	213	E12	R10	211
CHMPS	TSB	N22 19.6	W156 20.6	230	E12	R10	228
MAGG1	MAG	N21 50.7	W156 58.1	229	E12		
CHM		N21 16.1	W157 42.3	284	E12		
KHNL	HLU	N21 19.3	W157 55.9		E12		

If MH is not printed, it has been dropped by the Flight Planning computer because a climb or descent is recommended on that leg.

FIGURE 1

Figure 2 illustrates how a map might appear after enroute plotting has been accomplished. Note the inclusion of the following additional data which has been plotted since preflight:

- Post Position Plot (PPP) at 2 degrees after each waypoint
- LAT/LON of PPP plus Actual Time of Arrival (ATA) at plot.
- Optional; time & fuel score.

Note that the PPP plot at 147 degrees West shows an off-course position. This could identify a navigational error which should be investigated immediately. (The plot at 149W verifies an on-course correction.)

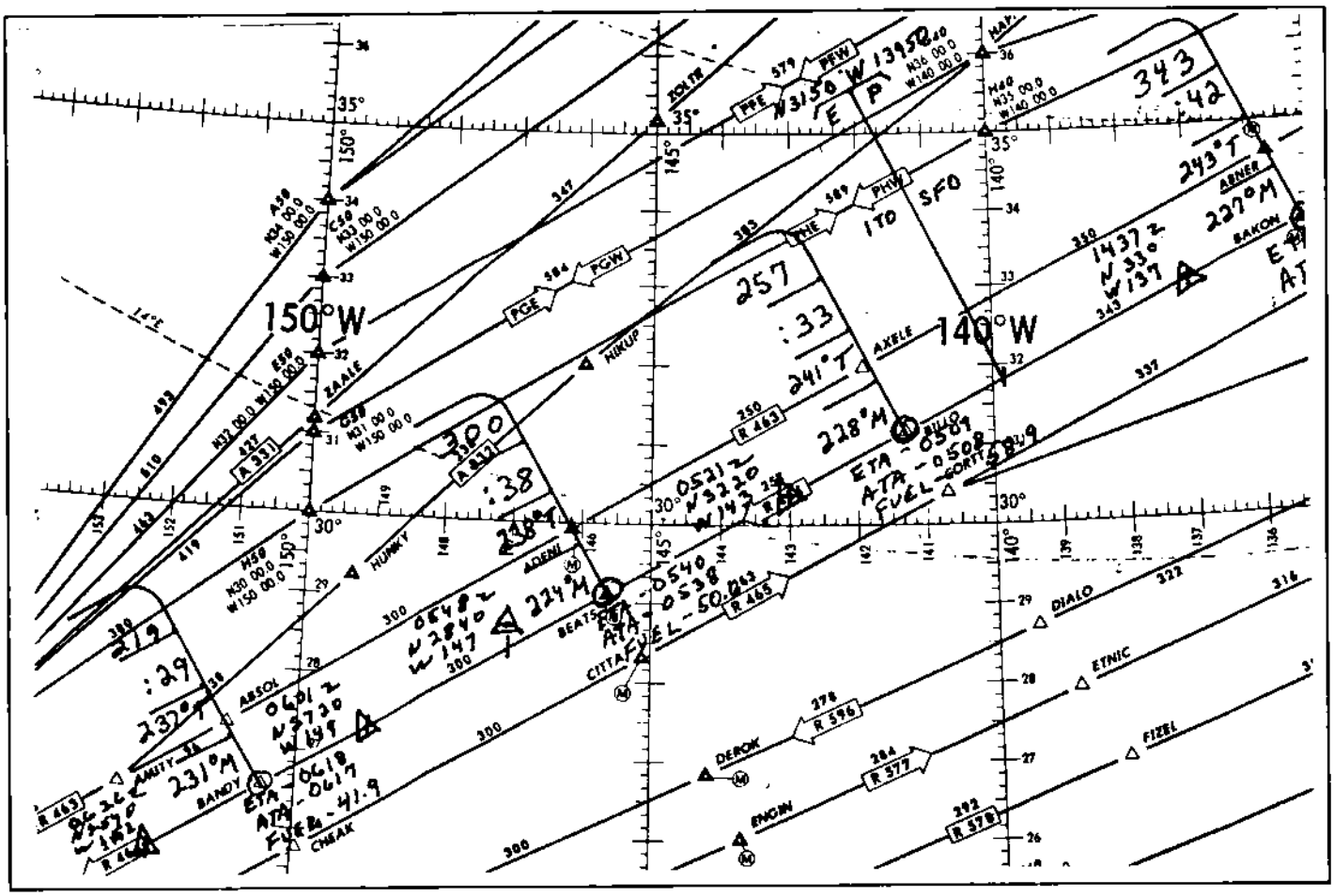


FIGURE 2

NOTE: Post Position Plots (PPP) opposite the Non-Compulsory reporting points (BILLO & BANDY) are shown for illustration purposes only. On the six Mid Pacific Composite Routes (R463 thru R578), the PPP is not necessarily following a non-compulsory waypoint. On all other routes, the PPP is required after <u>each</u> waypoint.

a

SCORING AND COURSE PLOTTING AFTER CHANGE OF ROUTING

It is not unusual to be assigned another route of flight by ATC after departure, especially on the West Coast - Hawaii routes. The question now arises as to how to keep the time and fuel score on the new route. The answer is to simply draw a line perpendicular to the original course and then reference your "howgozit" score to those points where the extension of the perpendicular crosses the new course.

Figure 3 illustrates this situation. In this example, the routing has been changed from the original (R-578) to Route PVW. We have used dashed lines to highlight the perpendicular lines which form new crossing points.

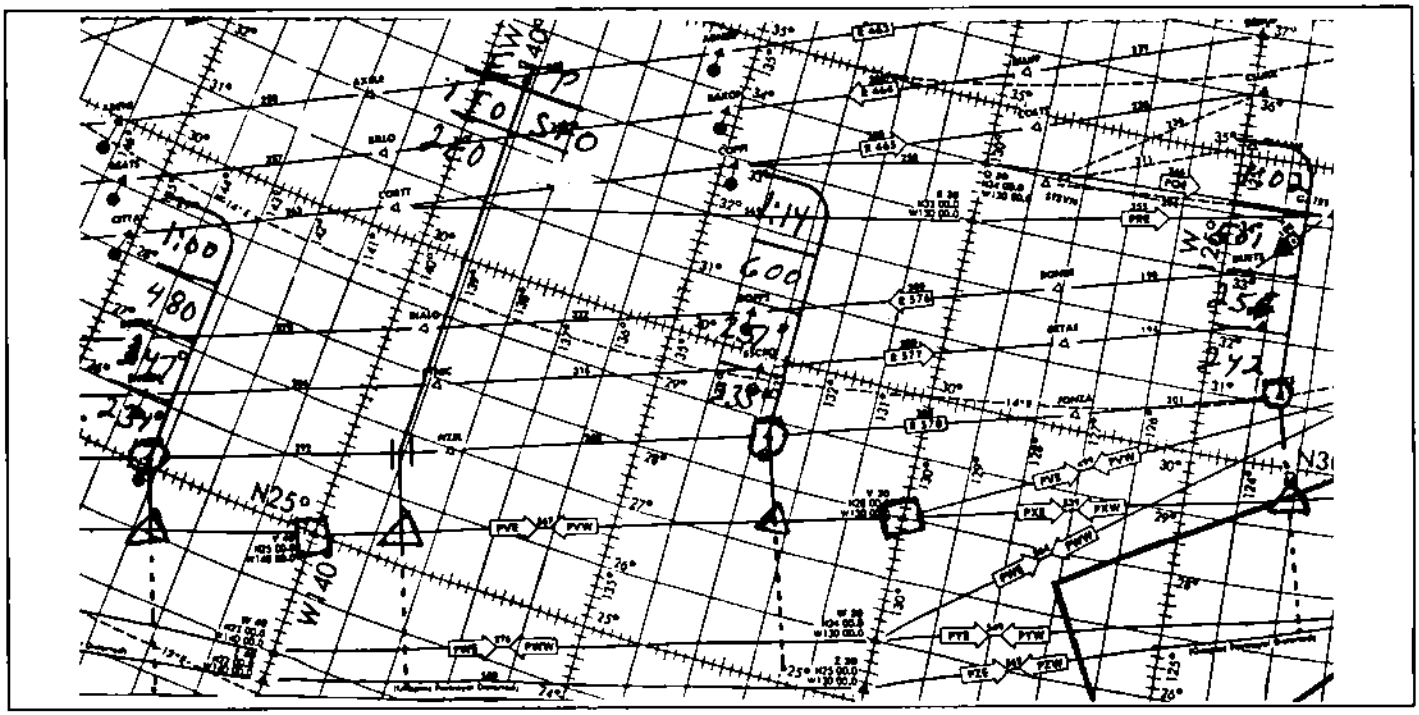


FIGURE 3

The methods or techniques of marking plotted information will vary with an individual pilot's artistic or mechanical drawing abilities. However, the finished product must meet the criterion of being neat enough to stand close scrutiny as a professional document which may serve as the best source of corroboration of your compliance with procedures in any post flight critique or inquiry.

To highlight the scorekeeping points and the projected new ETP, Triangles have been drawn around each point where the perpendiculars cross the new course line. Also, note that boxes have been drawn around waypoints V30, V40, etc., to denote the new waypoints which require an AIREP. Bear in mind that the AIREPs in this example will be given over V30, V40, etc, but that time and fuel score is referenced to the perpendicular crossing points below FOOTS, FEARS, etc.

The first few times that a route change has been experienced will serve to show how easy it is to make a mess out of the map! If you have any problem with the above procedure, you should plot the revised route on a clean plotting chart and always carry an extra copy or two for this contingency.

a

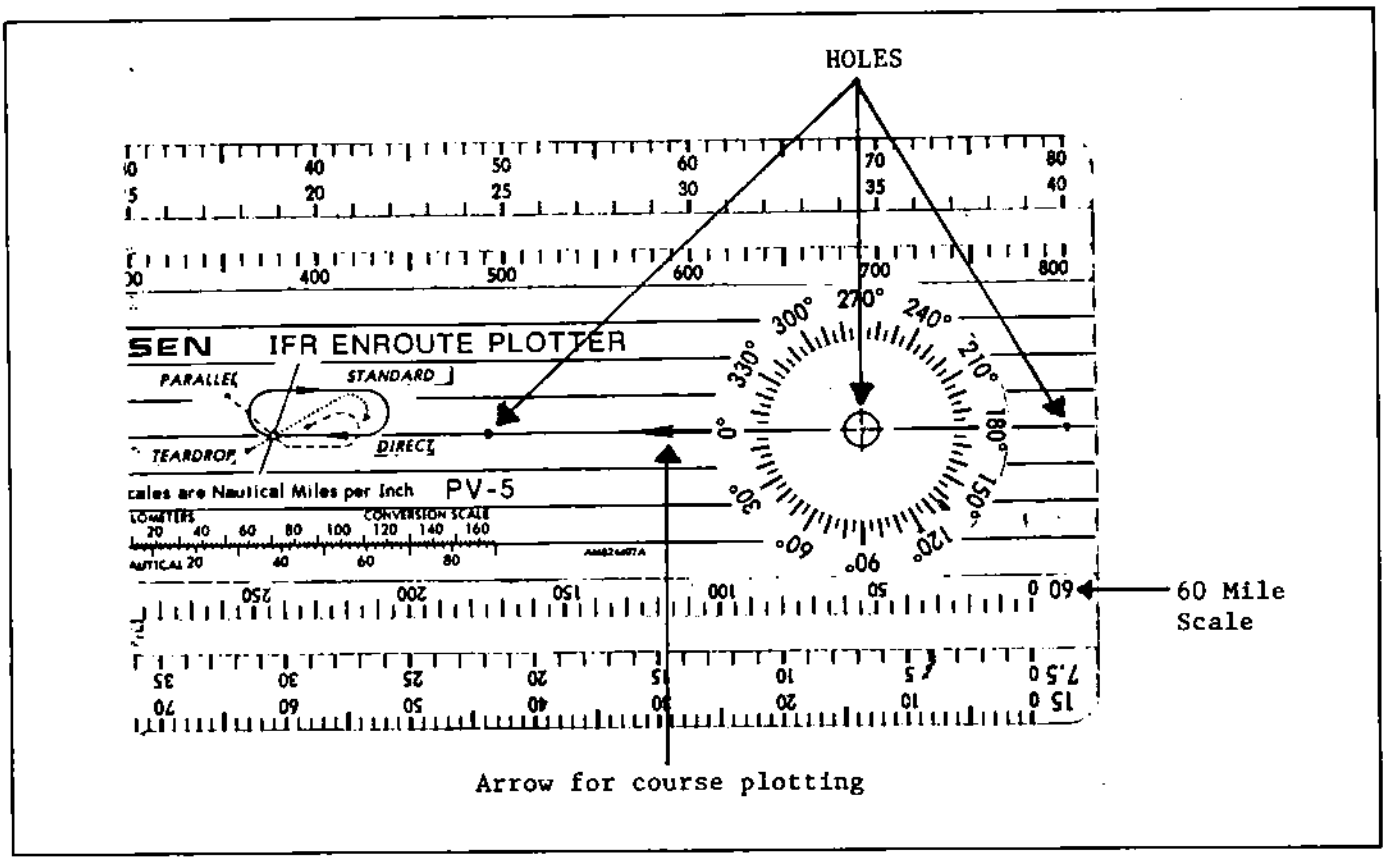


FIGURE 4

It is recommended that the Jeppeson plotter be used to draw these new lines, since it is very easy to strike a perpendicular by using the small holes drilled in the center of the compass rose or other places along the centerline of the plotter as a reference point from which to draw the line. (See Figure 4) This plotter is also easy to use for measuring distances on the plotting chart. On the standard Jeppeson chart, the scale is 1" = 120 Miles. By using the 60 mile scale on the plotter and then doubling the figure, the Miles – To – Go or other references to the "howgozit" point can be measured. (See Figure 4, but don't try to take a measurement from it because the reproduction has been reduced!)

a

COURSE PLOTTING

Having solved the score keeping question, the next problem is how to find the new course, for the one shown on the flight plan is no longer valid. Once again, the answer lies in the use of the plotter. Lay the plotter along the new course with the arrow pointing towards the direction of flight, and read the new TRUE COURSE at the top of the compass rose. (See Figures 4 and 5) For best accuracy, the course should be measured at the midpoint between waypoints. By applying the variation and drift angle, a new MAGNETIC HEADING may be calculated

Read True Course From
V30 to V40 = 252°

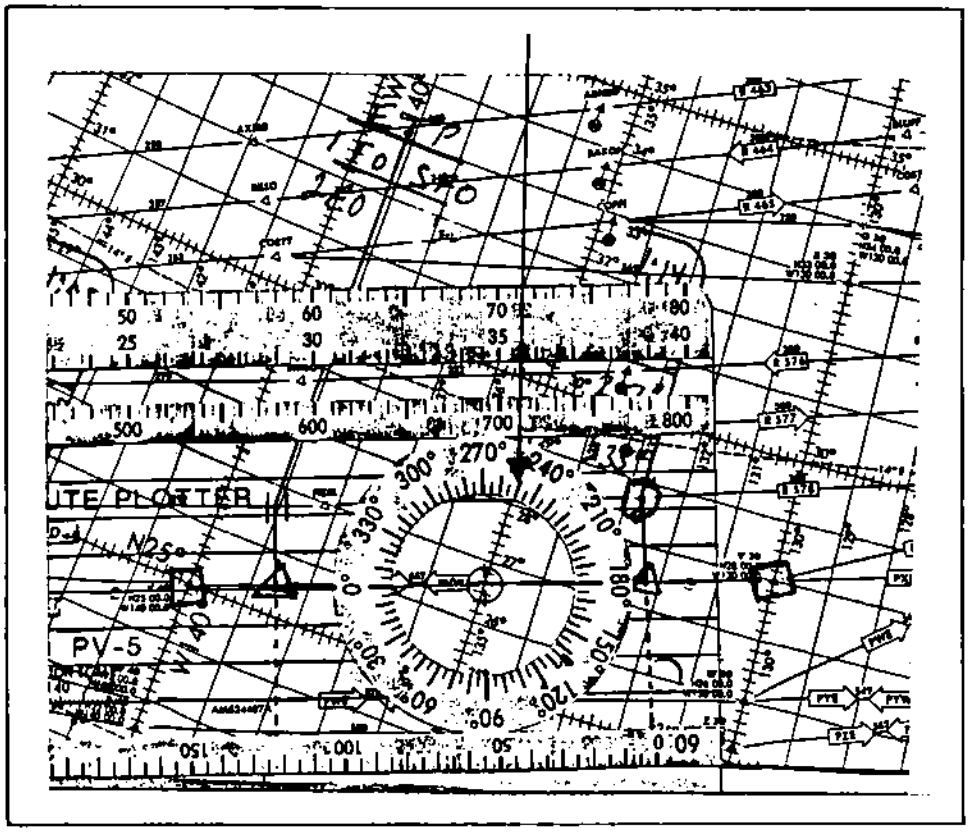


FIGURE 5

SUBJECT: LOG BOOK WRITE-UPS AND MAINTENANCE RADIO CALL-INS

FILE IN POM AFTER TRANSOCEANIC OPERATIONS TAB

In recent meetings with Maintenance personnel, it was brought to our attention that we could further reduce flight delays and make our Maintenance staff's job easier by reemphasizing certain key points. **FIRST**, Maintenance wants and needs our careful, concise and accurate log book entries. This applies to all operations, International as well as Domestic. Your good judgment still prevails. At all stations the Captain and Second Officer should make an effort to meet with Maintenance on deplaning for a short briefing on the aircraft's status. Remember, the log book entry is very important for tracking trends in systems reliability. **SECOND**, please make a radio call-in to the Maintenance Coordinator when significant write-ups are to be placed in the log book. The more time Maintenance has to prepare for corrective action the more likely a delay or cancellation can be avoided. On the International flights, it takes two to three hours to substitute equipment and swap over the cabin servicing so at least a three hour ahead call-in is desired if the problem is known at that time.

Even though the Maintenance man who meets your flight may not be aware of your radio call-in, be assured that a large number of people have received notification of your circumstances and are preparing to do whatever is necessary to properly correct and redispatch the outbound flight with as little inconvenience as possible to our passengers.

Thank you again for all your cooperation in this area. It helps make our airline more efficient.

Milt McKnight
L-1011 Fleet Manager

TRANSOCEANIC FLIGHT CREW BULLETIN

DELTA

APPLICABLE TO: L-1011
NUMBER: T 88-2
DATE: 8-22-88

SUBJECT: FMS NAVIGATION

FILE IN POM AFTER TRANSOCEANIC OPERATIONS TAB

BACKGROUND

Automatic navigation is normally controlled by the FMS which provides **position updating** and Flight Plan Waypoints to INS 1 and INS 2. The INS units provide lateral steering commands to their respective APFDS. The **FMS position**, used for INS updating, is derived from the average INS "raw" position, updated by VOR/DME or DME/DME radio inputs and is continually displayed on the INS 1 and 2 CDU's when the Data Selector is in POS. The APFD flies this updated position.

The difference between the updated position and the average INS platform position can be seen by pressing the NAV Function Key, Paging Forward and Indexing FIX. The DME/DME line (or DME/VOR if only one DME is available) will indicate 0 and the INS line will display any deviation in miles between the average "raw" INS position and the FMS updated position. If the INS line displays 5 and the DME/DME 0, the aircraft is proceeding on a course 5 miles away from the average "raw" INS position. This 5 mile difference is normally referred to as an "updated position vector" and is maintained in the FMS memory for the remainder of flight when DME/DME updates are no longer received. It is not changed or updated again until the FMS is once more receiving valid radio signals. Therefore, the only flight path deviation which should occur is that additional platform drift while overwater. However, certain FMS functions, if initiated, or a glitch in the FMS software can remove the updates as the following paragraph explains.

Indexing INS units IN/OUT is a procedure by which some crews compare "raw" platform position deviation in nautical miles between the remaining two units. It has been determined that as units are alternately selected OUT, any prior DME/DME position refinement update from the FMS may be removed. Consequently, if this procedure is followed when the aircraft is not in acceptable DME or VOR reception range (allowing for an immediate update refinement), the FMS will begin to average the "raw" platform INS positions.

For example, the aircraft is at 30W, the FIX POS BY page of the FMS displays on the INS line the number 3 . This means the FMS updated position is 3 nautical miles from the averaged "raw" position of the INS units. Now, should a crewmember go through the deselection steps described above, the airplane will steer slowly and progressively to the averaged "raw" INS platform position if the autopilot is in CMD.

PROCEDURE

Until a software change is installed in the FMS to prevent the automatic removal of updates:

- **DESELECTING INS UNITS WHILE OUT OF NAV RADIO RANGE SHOULD BE DISCONTINUED.**

Milt McKnight
L-1011 Fleet Manager

CURRENT TRANSOCEANIC FLIGHT CREW BULLETINS

T 88-1

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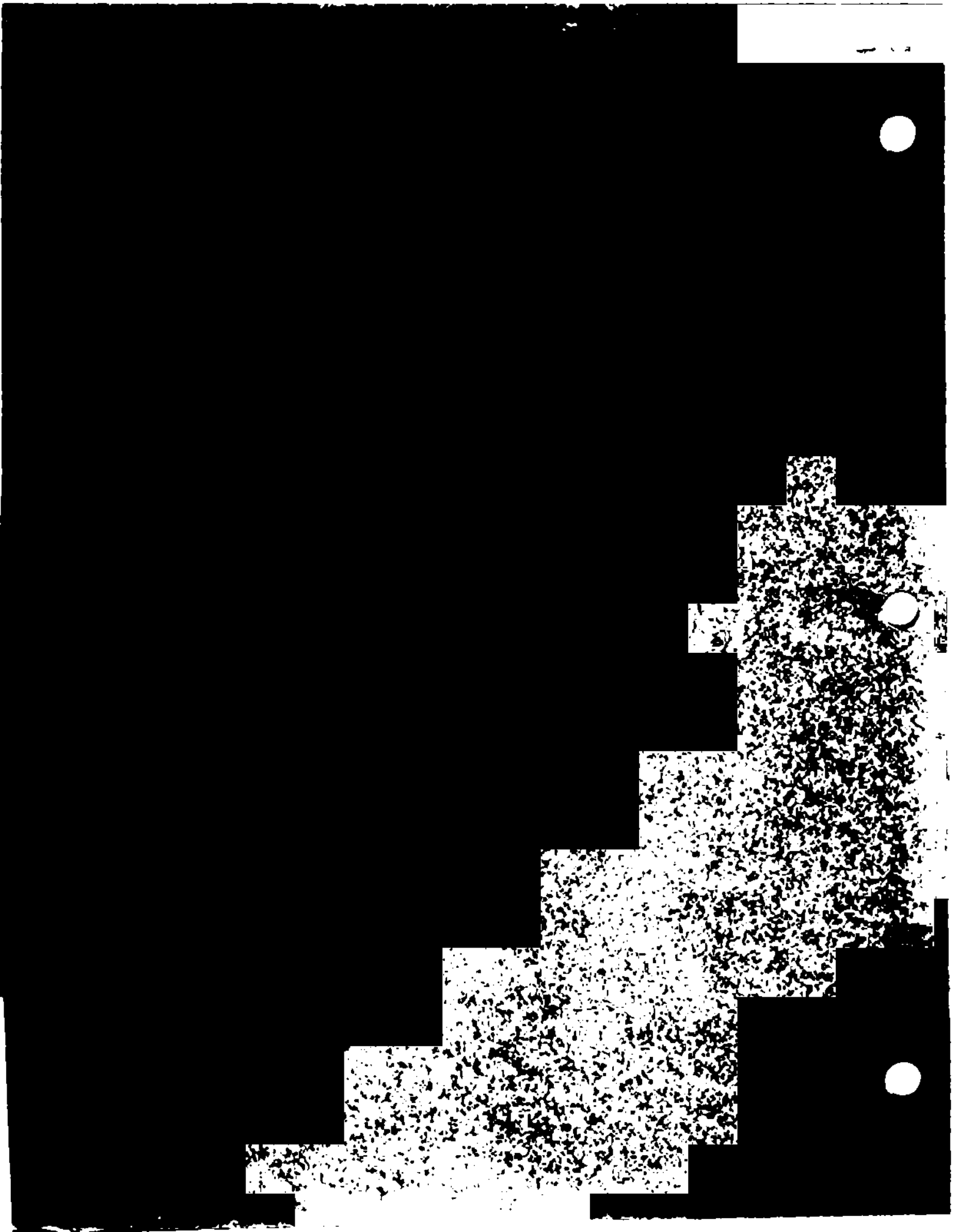

TRANSOCEANIC
FLIGHT CREW
BULLETIN

APPLICABLE TO: L-1011
NUMBER: T 88-3
DATE: 5-25-88
Page 1 of 1

SUBJECT: L-1011 INTERIM ENGINE START PROCEDURES - TRANSOCEANIC

FILE IN POM AFTER TRANSOCEANIC OPERATIONS TAB

Reference: L-1011 Domestic Flight Crew Bulletin 88-7 dated 4-15-88 - Modified Interim Engine Start Procedures.

INTERIM OPERATING PROCEDURES - BOTH AC PUMPS DEACTIVATED

The MEL allows operation without either AC pump if those components are properly placarded as inoperative. During the period of flight operations under this condition, utilize the following procedures:

ON THE GROUND

At Stations where it may be operationally unfeasible or undesirable to start an engine at the gate or during pushback, the following procedure is another option to the one outlined in the referenced Bulletin.

In lieu of using the AC pumps during the Hydraulic System and Autoflight panel checks, delay the checks until just prior to pushback.

CAUTION:
OBTAIN CLEARANCE FROM GROUND PERSONNEL TO START ATM'S TO PRESSURIZE SYSTEMS B AND C AND ACCOMPLISH THE REQUIRED SYSTEM CHECKS.

When cleared for pushback, continue to operate "B" system ATM until brakes have been set. With the "B" system brake accumulator pressure available, the "B" ATM may then be turned OFF and number 2 engine started.

IN FLIGHT

The AC hydraulic pumps may be activated in flight only when, in the judgement of the crew, an abnormal situation exists that so warrants their use.

Milt McKnight
L-1011 Fleet Manager

CURRENT TRANSOCEANIC FLIGHT CREW BULLETINS

T 88-1 T 88-2

Published by Flight Operations Dept. - Delta Air Lines, Inc.

TRANSOCEANIC FLIGHT CREW BULLETIN

DELTA

APPLICABLE TO: L-1011
NUMBER: T 88-4
DATE: 8-22-88

SUBJECT: L-1011-100/-200/-250/-500 INTERNATIONAL PERFORMANCE

FILE IN POM AFTER TRANSOCEANIC OPERATIONS TAB

BACKGROUND

The purpose of this Flight Crew Bulletin is to describe the takeoff performance options you may encounter for L-1011-100/-200/-250/-500 aircraft.

WEIGHT DATA RECORDS

L-1011-100
On L-1011-100 Weight Data Records the following basic performance options will be displayed. ***(NOTE: all takeoff options are presented in the normal order of selection.)***

NORM 10
NORM 10 – PACKS OFF
NORM 14 – PACKS OFF

For the L-1011-100 maximum zero fuel weight is the lesser of:

- The maximum zero fuel weight according to aircraft gross weight (see POM Limitations).

or

- The maximum zero fuel weight indicated in the remarks section of the flight plan. On transoceanic flights the Flight Control dispatcher determines maximum zero fuel weight which will provide required engine(s) out performance along the route (provided driftdown procedures are properly executed).

L-1011-200/-250/-500
For the L-1011-200/-250-500, the basic takeoff performance options will be:

NORM 18
NORM 18 – PACKS OFF
NORM 22 – PACKS OFF

CAUTION:
FLAPS 22 TAKEOFFS ARE NOT AUTHORIZED FOR -250 AIRCRAFT ABOVE 496 K LBS. TOW.

Alternate Thrust
At this time ALTERNATE THRUST is **not authorized** for -250 aircraft.

For non-transoceanic operations ALTERNATE takeoff thrust may be used **(L-1011-200/-500 only).** Where AWABS II is available, the normal domestic options may be displayed:

ALTN 10
NORM 10
NORM 10 – PACKS OFF

IMPROVED PERFORMANCE

In addition to the basic takeoff performance, "Improved Performance" options were developed using IMPROVED CLIMB and/or CLEARWAY takeoff analysis.

IMPROVED CLIMB takeoffs (used only on L-1011-100) utilize slightly higher V-speeds to increase kinetic energy at liftoff and improve the climb limit weight (at the expense of the runway allowable weight). The FAA Approved Flight Manual prohibits use of the Flight Director "TAKEOFF" Mode for "IMPROVED CLIMB" takeoffs.

CLEARWAY takeoff analysis permits the use of a clear area free of obstacles past the runway end over which first segment climb can be completed. (Not all airport runways have CLEARWAY available for use). In the event of engine loss at V1 during takeoff, CLEARWAY analysis is supposed to ensure a minimum height of 17.5 feet above the runway end (compared with a minimum height of 35 feet normally without use of clearway).

DELTA

IMPROVED PERFORMANCE (CONT'D.)

L-1011-100

On the L-1011-100 when additional or "Improved Performance" is necessary, the following options may be shown on the weight data record in place of the basic takeoff performance options (only two of these should be presented at one time):

IMPRVD 10 - PACKS OFF
OR
IMPRVD 14 - PACKS OFF
AND/OR
CLWY 04 - PACKS OFF

"IMPRVD" stands for IMPROVED CLIMB. IMPROVED CLIMB takeoffs may also involve use of CLEARWAY (Refer to ARM). "CLWY" means the takeoff performance analysis utilizes CLEARWAY. The number indicates flap setting.

When L-1011-100 takeoff calculations use CLEARWAY performance data (labeled IMPR PERF - CLWY in SP 3926), and headwind component will be omitted from maximum allowable takeoff weight computations.

L-1011-200/-250/-500

For the L-100-200/-250 and -500 when "Improved Performance" is necessary, the following option is substituted for the basic takeoff performance options on the weight data record:

CLWY 14 - PACKS OFF

"CLWY 14" means the takeoff analysis utilizes 14° flaps and CLEARWAY.

The improved performance options are only used at designated airport runways shown on salmon colored pages in the applicable Airport Restrictions Standard Practice. V-speeds should be found on salmon colored pages in the ODM (listed by airport and runway) and on the Airport Restrictions SP salmon colored page.

TAILWIND TAKEOFFS

Company policy prohibits TAILWIND takeoffs when improved performance - IMPROVED CLIMB and/or CLEARWAY - is being utilized for the L-1011-100.

Limitations on V1 due to maximum brake energy (V1 cannot be more than the certificated maximum brake energy speed for the aircraft weight/conditions) have been incorporated into the runway allowable weights for zero wind and headwind takeoffs. For TAILWIND takeoffs with actual takeoff gross weight IN EXCESS OF 460,000 lbs. (L-1011-100/-200/-250 or -500), check the ODM Takeoff section for possible VMBE corrections.

TAKEOFF DATA CARDS

Second Officers should indicate above "V1" on the Takeoff Data Card the configuration on which takeoff performance is based, e.g. "IMPRVD 14 - PACKS OFF". V-speeds must be derived from the appropriate white page of the ODM, or from the ODM or ARM salmon colored pages.

SUMMARY

ANY TIME THE ACTUAL AIRCRAFT GROSS WEIGHT APPROACHES THE MAXIMUM ALLOWABLE TAKEOFF WEIGHT FOR TRANSOCEANIC OPERATIONS, PERFORMANCE IS CRITICAL. The Weight Data Record information should be carefully compared with known conditions of:

- Temperature.
- Wind.
- Runway in Use.
- Fuel on Board.
- Pressure Altitude

ANY QUESTIONS CONCERNING THE VALIDITY OF THE WEIGHT DATA RECORD (AWABS II OR OTHER) MUST BE RESOLVED PRIOR TO TAKEOFF.

If problems are encountered, forward them with a copy of the Weight Data Record to the L-1011 Fleet Manager, Dept. 052, ATL.

Milt McKnight
L-1011 Fleet Manager

TRANSOCEANIC FLIGHT CREW BULLETIN

APPLICABLE TO: L-1011
NUMBER: T 88-5
DATE: 11-12-88

SUBJECT: NAVIGATION EQUIPMENT ACCURACY CHECK AND LOGGING INS ERROR

FILE IN POM AFTER TRANSOCEANIC OPERATIONS TAB

BACKGROUND

In order to comply with recommendations described in FAA AC 90-79 and the MNPS manual, an aircraft position check, by means of external navigation aids, should be made prior to gateway crossing. This navigation accuracy check is required in order to ascertain the preferred navigation system to be used for the ocean crossing and bring attention to any "gross error" prior to entering oceanic airspace. The record of this check may also be used to determine the navigation system to rely upon in the event of any disparity between systems while en route.

The Long Range Navigation Systems used by Delta Air Lines and approved by the FAA are Omega (ONS), Inertial(INS), and The Flight Management System(FMS). These systems are referenced in the North Atlantic MNPS Airspace Operations Manuals and the NOPAC Operations Manual.

The Navigation System Accuracy Check should be accomplished prior to the Oceanic Gateway. Pre planning is essential as the gateway may, in some cases, be reached soon after departure. If time allows, however, delaying the check to note a trend is desireable. If **unable** to accomplish a System Accuracy check prior to the Gateway, it will be necessary to overfly the gateway in order to accomplish a system check. DO NOT ACCEPT CLEARANCE DIRECT TO TRACK/ROUTE WAYPOINT WITHOUT A NAVIGATION SYSTEM CHECK. At the Gateway, a system check could be accomplished by VOR, Radial/DME or DME DME.

A Gateway is defined as a fix where a flight transitions from a short range airways navigation system to an oceanic (long range) navigation system.

The methods of determining the accuracy of a navigation system are as follows:

FMS/INS NAV ACCURACY CHECK (3 INS with FMS)

The reliability and accuracy of the FMS system is continually monitored while in range of reliable VOR/DME signals. With the autotune switch in manual, confirm FMS position against VOR/DME. After position confirmation, return to autotune. Then:

FMS "NAV FUNCTION" KEY ..... PRESS

FMS "NAV MODE" page ..... INDEX
- Insure that all 3 INS units are IN and that IDD or IDV is indicated at top of page (IDD preferred)

FMS "NAV FUNCTION" KEY ..... PRESS

PAGE FWD KEY ..... PRESS

FIX PAGE ..... INDEX
- ("Fix Pos by" page appears)

DME/DME or DME/VOR LINE READS .. "0-3"
- (Indicates FMS Accuracy).

INS Data Selectors (All Units) ..... WAY PT

INS WAYPOINT SELECTOR ..... 1 thru 9
- (Any waypoint other than zero – all units)

"HOLD" BUTTON (All Units Simultaneously) . ..... PRESS
- (DO NOT USE REMOTE)

NOTE: The data selector must be kept in either POS or WAY PT to retain the displayed position coordinates. The INS raw platform and the updated coordinates displayed on the CDU are "frozen" the moment the "HOLD" key is depressed (illuminated) with the data selector in either POS or WAY PT.

LAT and LONG (All Units) ..... RECORD
- (Raw Platform Position.)

DATA SELECTORS INS #1 or #2 ..... POS
- (FMS DME/DME or DME/VOR updated position.)

LAT and LONG INS #1 or #2 ..... RECORD

"HOLD" BUTTON (All Units) PRESS/RELEASE

FMS/INS NAV ACCURACY CHECK
(3 INS with FMS) (CONT'D.)

"HOLD" LIGHT . . . . . EXTINGUISHED

NOTE: If the "Hold" button is left depressed for an excessive period of time expect a red warning light on the affected INS. Do not be alarmed. Simply release the HOLD, select DSRTK/STS on the Data Selector Switch and press/release the TEST switch alternately until the warning light extinguishes and all action/malfunction codes disappear.

Using INS Raw platform position coordinates and FMS DME/DME or DME/VOR updated position coordinates, subtract smaller from larger and **record.**

INS UNITS (All Units) . . . . . RANK
- (Smallest difference is most accurate.)

INS NAV ACCURACY CHECK (NO FMS)

NOTE: Ensure that aircraft is tracking to a selected and identifiable navigation fix. If necessary, engage HDG Mode (APFDS) and overfly the fix in HDG mode. Turn to the outbound heading after passing over the fix.

NAV FIX COORDINATES (Selected Fix) . . . . . RECORD

INS DATA SELECTORS (All Units) . WAY PT

INS WPT SELECTOR (Any Wpt Other Than 0, All Units) . . . . . 1 THRU 9

"HOLD" BUTTON (All Units Simultaneously Over Known Fix) . . . . . PRESS

NOTE: The INS raw platform and the updated coordinates dispayed on the CDU are "frozen" the moment the "HOLD" key is depressed (Illuminated) with the Data Selector in either POS or WAY PT. (1 thru 9) The data selector must be kept in either POS or WAY PT to retain the selected position coordinates and, until update is complete, to prevent erroneous updates.

LAT and LONG (All units) . . . . . RECORD
- (Raw platform position.)

DATA SELECTOR –
(INS #1 or #2 if installed) . . . . . POS
- (Triple mix position.)

LAT & LONG – (INS #1 or #2) . . . . . RECORD
- (For 3 INS installation only.)

NOTE: If INS #3 has been previously updated, select POS on INS #3 Data Selector Switch to determine if another update is warranted.

Using the INS Raw Platform Coordinates And The Selected NAV FIX Coordinates, subtract smaller from larger and **record.**

NOTE: If any INS unit is in error by more than 2 NMPH of operation, a manual update should be carefully considered. However, if the accumulative error is less than 6NM, an update is not recommended.

LAT – One Minute = One NM
LONG – One Minute = One NM or less
25N – One Minute = approx .9 NM
35N – One Minute = approx .8 NM
45N – One Minute = approx .7 NM
55N – One Minute = approx .6 NM
65N – One Minute = approx .4 NM

If INS Unit is To Be Updated Manually:
- Select POS on unit to be updated ("HOLD" ulluminated)
- Type in Lat/Long of known fix
- Press INSERT — "HOLD" extinguishes if update accepted

HOLD Key (All units) . . . . . PRESS/RELEASE

HOLD LIGHT (All units) . . . . EXTINGUISHED

NOTE: If the HOLD key is left depressed for an excessive period of time, expect a red warning light on the affected INS. Do not be alarmed. Simply release the HOLD and select DSRTK/STS on the Data Selector Switch and press/release the TEST switch alternately until the warning light extinguishes and all action/malfunction codes dissappear.

NAV UNITS . . . . . RANK/RECORD

ONS NAV ACCURACY CHECK

At any time while in flight or on the ground, the present position (POS) can be compared with an accurate position fix and updated in latitude and/or longitude.

When the HOLD key is pressed and illuminated, present position and GMT displays are frozen. (The system continues computing position changes resulting from the aircraft movement during the display freeze). The display freeze allows for a comparison of the fix position obtained by other means, while the GMT provides a time reference for recording the position check.

To Accomplish ONS Position Check:

Ensure that the aircraft is tracking to a selected and identifiable navigation fix. If necessary, engage HDG mode (APFDS) and overfly the fix in HDG mode. (If this procedure is used, predetermine and turn to the outbound heading after passing over the fix.)

NAV FIX COORDS (Selected fix) . . . . RECORD

ONS DATA SELECTORS (All units) . . . . POS

WPT SWITCH (Any Position Other Than Zero) . . . . . SELECT

"HOLD" KEY (All Keys Simultaneously Over Known Fix) . . . . . PRESS

LAT & LONG (All Units) . . . . . RECORD

Using ONS Position Coords And Selected Known Fix Coords, subtract smaller from larger and **record**.

NOTE: If any ONS unit is in error by greater than 3 to 4 miles, refer to the POM NAV operating procedures for a Precision Update.

LAT – One Minute = One NM
LONG – One Minute = One NM or less
25N – One Minute = approx .9 NM
35N – One Minute = approx .8 NM
45N – One Minute = approx .7 NM
55N – One Minute = approx .6 NM
65N – One Minute = approx .4 NM

"HOLD" KEY (All Units) . . . . PRESS/RELEASE

HOLD KEY ILLUMINATION . . EXTINGUISHED

ONS UNITS . . . . . RANK/RECORD

LOGGING INS ERROR

The procedure for logging INS drift error is being changed to comply with the requirement to record circular error as well as distance error. Circular error is determined by dividing the distance displayed after parking at the gate by the total block time. This provides a more technically correct history of INS accuracy, similar to the "3 + 3T" limitation with which you are already familiar. A Maintenance Log Entry is required to alert both maintenance and the subsequent crew members to the fact that a particular INS unit is approaching limitations. A Maintenance Log Book write-up will be required whenever the circular error exceeds two (2) NMPH. Maintenance action taken to sign off a write-up of between 2 and 2.4 NMPH is to simply test and satisfactorily relign the unit. However, when a unit reaches or exceeds the circular error limit of 2.5 NMPH, it is performing out of limits and it **must** be replaced.

A residual ground speed of 5 or more knots will also require an entry in the Maintenance Log.

Regarding crew action for inoperative or out of tolerance navigation units, the following guidelines apply. While every effort will be made to dispatch aircraft with three good INS units, the MEL requires only two operative units for dispatch. It is preferable to have these units installed in the #1 and #2 positions, but not a specific requirement. A delay is acceptable if it becomes necessary to move a good INS from the #3 position to the #1 or #2 position. It is not desirable to delay a flight simply to replace a #3 INS, especially at our overseas airports where spares are in short supply. The same philosophy applies to the FMS. Reasonable efforts will be made to provide an operational FMS for all departures. However, remember that the FMS is merely a useful tool and is not required for our operation. In the event that the FMS cannot be provided or will require extensive delays, you should proceed using INS only.

LOGGING INS ERROR (CONT'D.)

Effective upon receipt of this Flight Crew Bulletin, INS platform drift will be logged using the following procedure:

- After parking at the gate and before shutdown, record the INS platform drift and residual ground speed in the REMARKS section of **Engine Performance Report Log**. INS drift will now be recorded in both distance (miles to go) **and** circular error. Circular error is determined by dividing the distance by the block time. For example, if the raw platform position (update removed) shows a distance of 5 miles to the actual gate position and the block time is ten hours, the circular error would be one half (.5) NMPH. The following tolerances will apply:
  - A circular error in excess of two (2) NMPH requires a **Maintenance** Log Book entry. A circular error of two and one half (2.5) NMPH or greater will require that the INS be replaced.
  - A residual ground speed of 5 or more knots will also require an entry in the Maintenance Log.

Milt McKnight
L-1011 Fleet Manager

EXAMPLE
ENGINE PERFORMANCE REPORT LOG

CREW REMARKS:				
BLOCK TIME	8:00	#1	#2	#3
	Dist	2	20	4
	NMPH	.25	2.5	.5
	G/S	0	6K	0

CREW PLEASE DO NOT MARK IN THIS AREA

EXAMPLE
AIRCRAFT MAINTENANCE LOG

Item No. **N**	FRM Code **R**	IRREG./
1. #2 INS Circular Error 2.5 NMPH – G/S (Ground Speed) = 6K		

CURRENT TRANSOCEANIC FLIGHT CREW BULLETINS

T 88-1 T 88-2 T 88-3 T 88-4

Published by Flight Operations Dept. - Delta Air Lines, Inc.

TRANSOCEANIC FLIGHT CREW BULLETIN

APPLICABLE TO: L-1011
NUMBER: T 89-1
DATE: 1-9-89

SUBJECT: Redispatch Flight Plan

FILE IN POM AFTER TRANSOCEANIC OPERATIONS TAB
RETAIN UNTIL PUBLICATION OF REVISED DELTA SUPPLEMENTAL PAGES TO JEEPPESEN MANUAL.

BACKGROUND

In compliance with the new "Automated Operations Specifications" which are now in effect, there are some important changes to be observed when a Redispatch Flight Plan is to be utilized.

Under the previous rules, it was permissible for the flight to continue past the redispatch point without specifically receiving any new information. Under the new Operations Specifications, it is now required that within two hours prior to the flight's arrival at the designated redispatch or rerelease point and prior to executing the redispatch or release, the pilot in command must be provided with "additional information." (This concerns weather conditions, ground facilities, etc.; i.e., all the routine items considered for original dispatch or release and was included in our flight plan as issued.) In short, you must receive a briefing update before proceeding beyond the redispatch point or divert to your alternate.

PROCEDURE

Effective immediately, Flight Control will initiate contact with any flight operating with a redispatch flight plan in order to provide the required information prior to reaching the redispatch point. In the event that you are not alerted to contact Flight Control by SELCAL or other means, please attempt to arrange a phone patch with Dispatch via Company radio or ARINC. Should this not be possible, it is recommended that you request the Air Traffic Controller to contact company and relay the information.

Be advised that upon reaching the redispatch point, the Captain, having received the "additional information" for redispatch must forward to Flight Control by appropriate communications service a message that specifically states his concurrence with the redispatch release. This may be given as a remark on the AIREP, it could be relayed by ATC, or it can be given on Company VHF.

Milt McKnight
L-1011 Fleet Manager

Current Transoceanic Flight Crew Bulletins

T88-1 T88-2 T88-3 T88-4 T88-5

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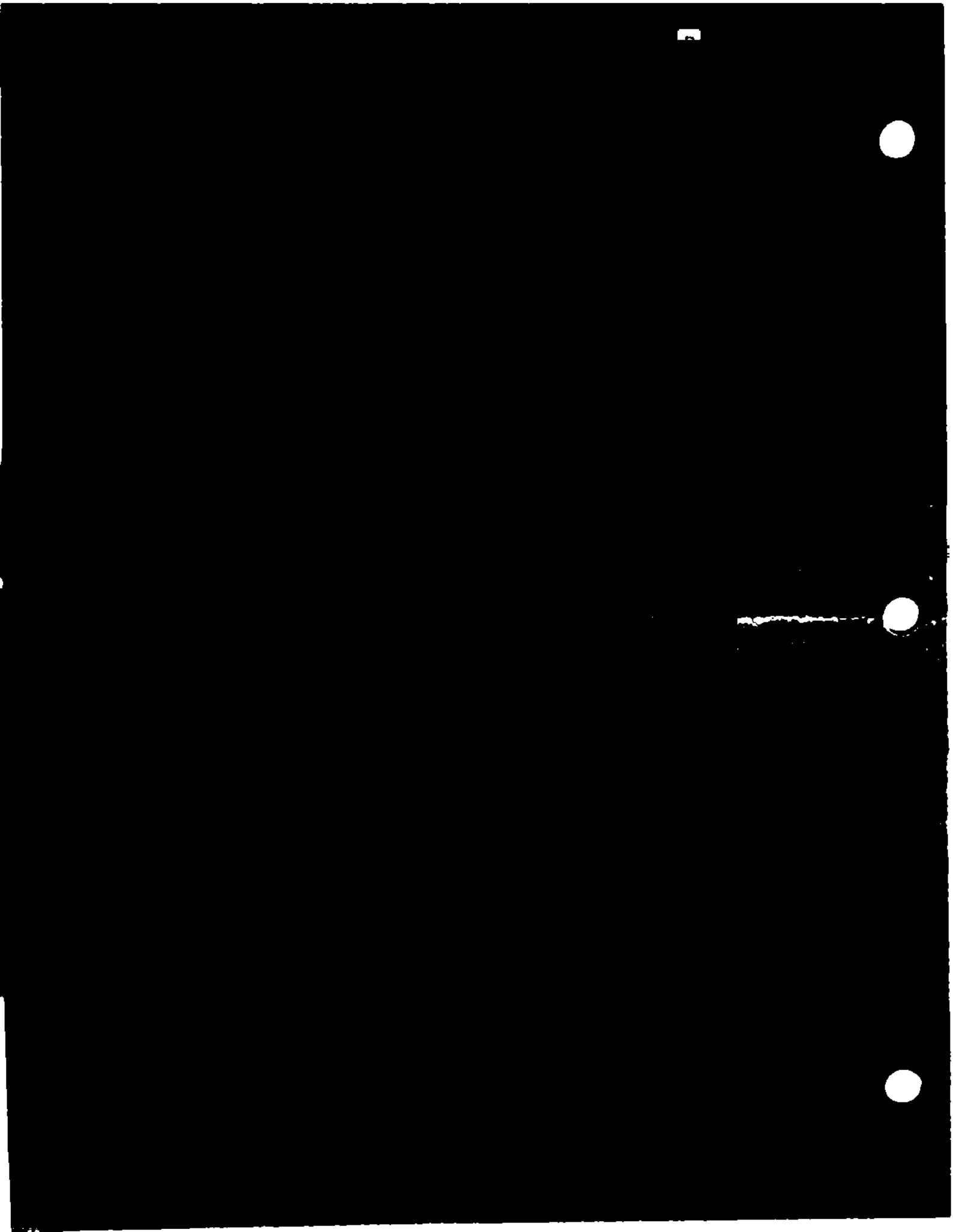

TRANSOCEANIC FLIGHT CREW BULLETIN

APPLICABLE TO: L-1011
NUMBER: T 89-2
DATE: 2-24-89

SUBJECT: Computing Fuel Remaining In-Flight

Because of the need to be certain the fuel required to continue on a Reclearence Flight Plan is available, it is recommended that the following method for determining **Fuel Remaining** be used until such time as the S/O fuel log can be revised:

Fuel On Board after refueling will be determined by two means:

- The sum of the Fuel Quantity Indicators. (Due to differences in the fuel density, the total fuel in pounds will sometimes exceed the advertised full capability of the system)
- The total Fuel quantity in tanks as recorded on the fuel service record.(This fuel quanity is the amount to be **inserted into the FMS/PMS**)

Both quantity totals are used to determine Fuel Remaining.

To determine the fuel remaining inflight:

- Find the Sum of the Fuel Used Gauges at the appropriate enroute fix.(**Total Burnoff**)
- Subtract the sum of the Fuel Used Gauges (**Total Burnoff**) from the **Fueling Slip Total** and record the fuel remaining in any conveinent place on the S/O's Fuel Record.
- Find the sum of the fuel remaining in each tank (TOTAL RMG all tanks).
- Compare the two recorded fuel quanity remaining amounts from steps 2 and 3.
- **The lessor of the two will be the Fuel Remaining used for flight planning purposes.**

Example: Determining fuel remaining inflight:

(A) Fuel Slip Total 213.6 Lbs (Total fuel inserted into FMS/PMS)
(B) Total Remaining (Quantity Indicator Total) 560 Lbs (total at Re-clearance Fix of all quanity indicators to be logged on the S/O's fuel record)
(C) Fuel Used Gauge Total 161.4 Lbs (Total burnoff)
(D) Total Remaining (fuel slip minus fuel used) 52.2 Lbs

Fuel Slip total (A) 213.6 Lbs

Fuel Used Gauge Total(C) 161.4 Lbs

Total remaining (fuel slip minus fuel used) (D) 52.2 Lbs

Total remaining(quanity indicator total) (B) 560 Lbs

Fuel Remaining for flight planning purposes = Lessor of (B) or (D) = 52.2 Lbs.

Crews should use this method for computing Fuel Remaining in deciding to continue to a destination or to divert.

The Limitations Section of the POM also prohibits the use of the FMS and PMS for airplane range and fuel calculations for in-flight planning purposes (e.g., Re-clearance Flight Plan Fuel Requirements.)

The fuel inserted into the FMS/PMS for maintaining the "HOWGOZIT" should be derived from the Fuel boarded as indicated on the Fuel Service Record. (Do not insert a fuel weight in excess of max capacity as listed in the Fuel Section of the PRM.

Engineering is making a continuing effort to improve the accuracy and reliability of the L-1011 fuel quanity system by investigating new calibration points other than full and empty.

The Alternate Fuel Monitoring System is not installed on Ships 759 through 762. Therefore, at each enroute fuel check point, the S/O must verify that no fuel has migrated back into Tanks 1A and 3A after they have been burned empty. (Should indicate no more than 400 lbs. each when empty.) This verification should be accomplished on all extended range L-1011's regardless of whether the monitoring system is installed.

Milt McKnight
L-1011 Fleet Manager

Current Transoceanic Flight Crew Bulletins

T88-1 T88-2 T88-4 T88-5 T89-1

All other Transoceanic Flight Crew Bulletins cancelled.

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TRANSOCEANIC FLIGHT CREW BULLETIN

APPLICABLE TO: L-1011
NUMBER: T 89-3
DATE: 2-24-89

SUBJECT: New Normal Procedures

The new L-1011 Pilot's and Second Officer's Checklist and normal procedures (dated February 20, 1989) may have procedures that conflict with current Transoceanic (or Mid Pacific as appropriate) procedures. If a conflict arises, the current Mid Pacific or Transoceanic procedures take precedence.

Please forward any written comments regarding any procedural conflicts to L-1011 Fleet Manager, Dept. 027 - ATL.

Milt McKnight
L-1011 Fleet Manager

Current Transoceanic Flight Crew Bulletins

T88-1 T88-2 T88-4 T88-5 T89-1 89-2

All other Transoceanic Flight Crew Bulletins cancelled.

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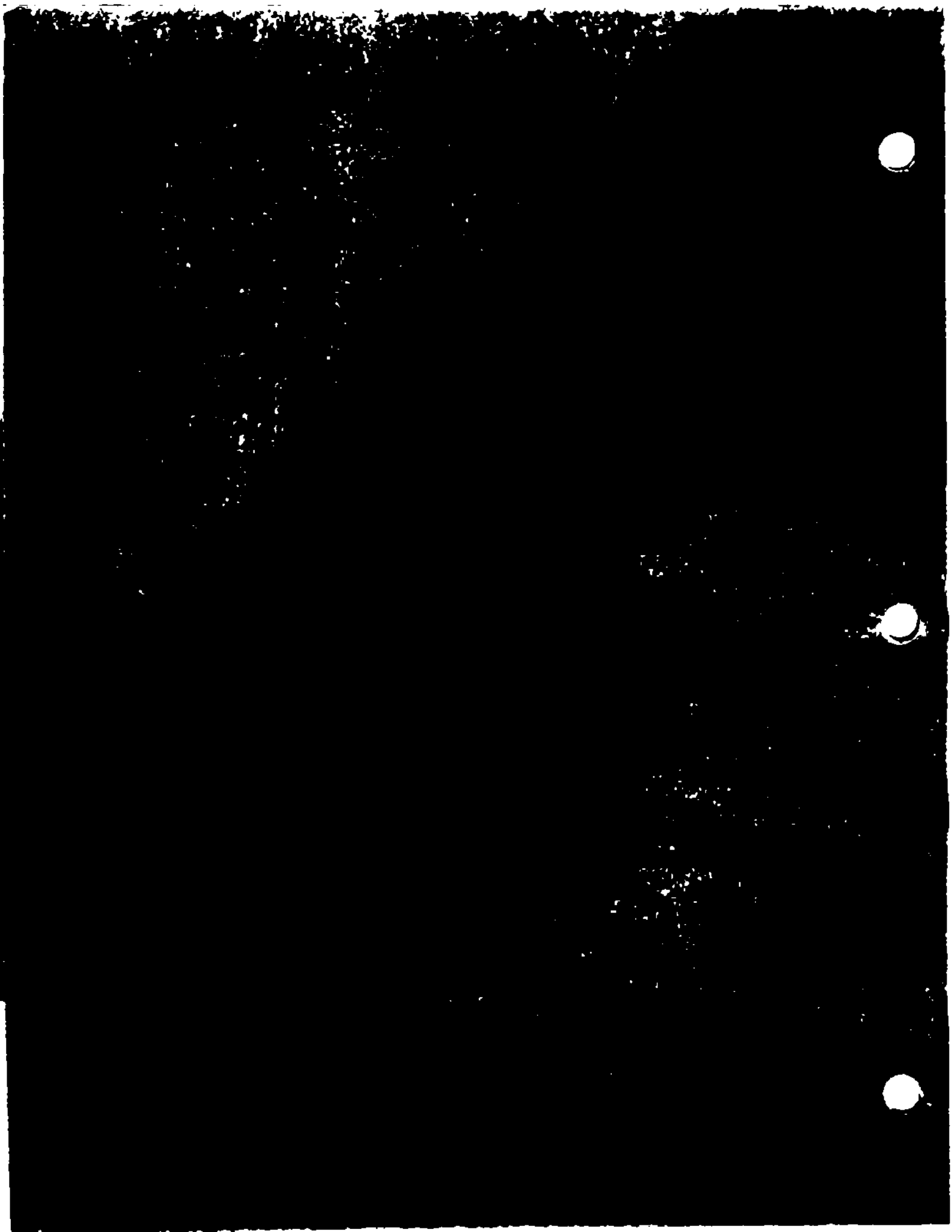

North Atlantic MNPS Airspace Operations Manual – Fourth Edition

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North Atlantic MNPS Airspace Operations

(issued with the Fourth Edition of the Manual)

GUARDING AGAINST COMPLACENCY

Especially since 1977, when the MNPS rules were introduced, careful monitoring procedures have enabled the NAT Provider States to obtain a good indication, both of the frequency with which navigation errors occur, and their causes. Their frequency is low, and only one aircraft in many thousands is found to have a serious navigation error. Navigation systems are now so reliable that a typical crew member could theoretically spend his complete career flying across the Atlantic without ever being more than five miles from cleared track. Not surprisingly, this may eventually lead in some cases to over-confidence.

RARE CAUSES OF ERRORS

To begin with, and to illustrate the surprising nature of things which can go wrong, here are examples of some extremely rare faults which have occurred:

- The lat/long co-ordinates displayed near the gate position at one international airport were wrong.
- Because of a defective chip in one of the INS systems on an aircraft, although the correct forward latitude was inserted by the crew (51°) it subsequently 'jumped' by one degree to (52°).
- The aircraft was equipped with an advanced system with all the co-ordinates of the waypoints of the intended route already on tape; the crew assumed that these co-ordinates were correct, but one was not.
- When crossing 40°W westbound the Captain asked what co-ordinates he should insert for the 50°W waypoint and was told '48 50'. He wrongly assumed this to mean 48°50'N at 50°00W and as a result deviated 50' from track.
- The flight crew had available to them the correct co-ordinates for their cleared track, but unfortunately the data which they inserted into the navigation computer was from the company flight plan, in which an error had been made.

COMMONER CAUSES OF ERRORS

However, the most common causes of gross errors, in approximate order of frequency, have been as follows:

- A mistake of one degree of latitude has been made in inserting a forward waypoint. There seems to be a greater tendency for this error to be made when a track, after locating through the same latitude at several waypoints (eg 57°N 50°W 57°N 40°W 57°N 30°W) changes by one degree (eg 56°N 20°W). Other circumstances which can lead to this mistake being made include getting a reclearance in flight.
- The crew have been recleared by ATC, or have asked for and obtained a reclearance. But they have forgotten to re-programme the INS or ONS.
- The auto-pilot has been inadvertently left in the heading or de-coupled position after avoiding clouds, or left in the VOR position after leaving the last domestic airspace VOR. In some cases the mistake has arisen during distraction caused by SELCAL or by some flight deck warning indication.
- An error has arisen in the ATC-loop, so that the controller and the crew have had different understandings of the clearance. In some cases the pilot has heard not what was said, but what he wanted to hear said.

LESSONS TO BE LEARNT

- **Never relax** or be casual in respect of the cross-check procedure, this is especially important towards the end of a long night flight.

- **Avoid casual RT procedures.** A number of gross errors have been the result of a misunderstanding between pilot and controller as to the cleared route. Adhere strictly to proper phraseology and do not be tempted to clip or abbreviate details of waypoint co-ordinates.

- **Make an independent check on the gate position.** Do not assume that the gate co-ordinates are correct without cross-checking with an authoritative source. Normally, of course, you expect co-ordinates to be to the nearest tenth of a minute, so make sure that the display is not to the nearest hundredth, or in minutes and seconds. And if you are near to the prime meridian, remember the risk of confusing east and west.

- **Before entering Oceanic Airspace** make a careful check of INS/ONS position at or near to the last radio facility – or perhaps the last but one.

- **Do not assume** that you are at a waypoint merely because the alert annunciator indicates; cross-check by reading present position.

- **Flight deck drills.** There are some tasks on the flight deck which can safely be delegated to one member of the crew, but navigation using automated systems is emphatically not one of them, and the Captain should participate in all navigation cross-check procedures.

- **Initialisation errors:** *Always* return to the ramp and re-initialise INS if the aircraft is moved before the INS NAV mode is selected. If after getting airborne it is found that during initialisation a longitude insertion error has been made, unless you thoroughly understand what you are doing, and have also either had recent training on the method or carry written drills on how to achieve the objective, you should not proceed into MNPS airspace, but should turn back or make an en-route stop.

- **Waypoint loading.** Before departure, make a check that the following agree: computer flight plan, ICAO flight plan, track plotted on chart, and if appropriate, track message. In flight, involve two different sources in the cross-checking, if possible. Do not be so hurried in loading waypoints that mistakes become likely, and always check waypoints against the current ATC clearance.

- **Use a Pilot-Chart on the flight deck.** It has been found that making periodic plots of position on a suitable chart and comparing with current cleared track, greatly helps to pick up errors before getting too far from track.

- **Consider making a simple use of basic DR Navigation as a back-up.** Outside Polar Regions, provided that the magnetic course (track) is available on the flight log, a check against the magnetic heading being flown, plus or minus drift, is likely to indicate any gross tracking error.

- **Always remember** that something absurd may have happened in the last half-hour. There are often ways in which an overall awareness of directional progress can be maintained: the position of the sun or stars; disposition of contrails; islands or coast-lines which can be seen directly or by using radar; radio nav-aids, and so forth. This is obvious stuff, but some of the errors which have occurred could have been prevented if the crew had shown more of this type of alertness.

- **If you suspect** that equipment failure may be leading to divergence from cleared track, it is better to advise ATC early rather than late.

- **In conclusion,** navigation fits vary greatly between operators. If any of the above does not apply in your case, remember that it may help to prevent someone else making a mistake, and may stimulate you to avoid mistakes of a similar nature.

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October 1984

SECTION 1 – THE ORGANISED TRACK SYSTEM

GENERAL

As a result of passenger demands, time zone differences and airport noise restrictions, much of the North Atlantic air traffic contributes to one of two flows; a westbound flow departing Europe in the morning, and an eastbound flow departing North America in the evening. The effect of these flows is to concentrate most of the traffic unidirectionally, peak westbound traffic operating between 1130Z and 1900Z, peak eastbound traffic between 0100Z and 0800Z at 30° west.

Because of the constraints of large horizontal separation criteria and a limited economical height band (FL 310–390) the airspace is very congested at peak hours. In order to provide the best service to the bulk of the traffic, a system of organised tracks is constructed every 12 hours to accommodate as many aircraft as possible on or close to their minimum cost paths.

At jet levels, all the NAT Region is controlled airspace in which the IFR apply at all times, however in many areas airspace utilisation can be and is improved by the strategic use of so-called 'opposite direction' flight levels, ie FL 310, 350, 390 eastbound and FL 330, 370 westbound during peak flow periods. The application of Mach Number Technique permits further improvement of utilisation in the longitudinal plane and helps to facilitate en route step-climbs. (See Section 7.)

The variability of the weather system would in any case necessitate reconstruction of the organised track system at frequent intervals. Furthermore, because of the energetic nature of weather systems, including jet streams, eastbound and westbound minimum time paths are seldom identical. The creation of a different organised track system is therefore necessary every 12 hours.

CONSTRUCTION OF THE ORGANISED TRACK SYSTEM (OTS)

After determination of basic minimum time tracks, with due consideration of airlines' preferred tracks (see Section 4) and taking into account airspace restrictions such as Danger Areas and military airspace reservations, the organised track system is constructed by the appropriate Oceanic Area Control Centre (OAC), the night-time OTS by Gander OAC and the daytime by Shanwick OAC (Prestwick), each taking into account tracks which New York, Reykjavik and/or Santa Maria OACs may require in their Oceanic Control Areas (OCAs). In each case OAC planners consult each other, co-ordinate as necessary with adjacent OACs and domestic ATC agencies and ensure that the proposed system is viable for lateral and vertical separation criteria. They also take into account the anticipated requirements of opposite direction traffic and ensure that sufficient track/flight level profiles are provided to satisfy anticipated traffic demand. The impact on domestic route structures and the serviceability of transition area radar and navaids are checked before the system is finalised.

The agreed organised track system is then promulgated as the NAT Track Message via the AFTN to all interested addressees. A typical time of publication of the daytime OTS is 0100Z and the night-time OTS 1300Z. Examples of both systems showing track and flight level availability are at the Appendix to this Section.

THE NAT TRACK MESSAGE

This message gives full details of the co-ordinates of the organised tracks as well as the flight levels that are expected to be in use on each track. In most cases there are also details of

domestic entry and exit routeings associated with individual tracks and the portion of airspace within which the Datum Line Technique is applicable. In the day-time system the track most northerly at its point of origin is designated Track 'A' (Alpha) and the next most northerly Track 'B' (Bravo) etc; whilst in the night-time system the most southerly track at point of origin is designated Track 'Z' (Zulu) and the next most southerly 'Y' etc. The hours of validity of the two Organised Track Systems (OTS) are *normally* as follows:

Day-time OTS	1130Z–1900Z at 30°W
Night-time OTS	0100Z–0800Z at 30°W

Changes to these times can be negotiated between Gander and Shanwick OACs, however in all cases the hours of validity are specified in the NAT Track Message for each system.

Correct interpretation of the track message by airline dispatchers and aircrews is essential to both economy of operation and in minimising the possibility of misunderstanding leading to the use of incorrect track co-ordinates (see Section 5). Oceanic airspace outside the published OTS is available, subject to separation criteria and NOTAM restrictions, for use by random operations. It is usually possible for ATC to clear aircraft to join or leave an outer track of the OTS without difficulty. If an operator wishes to file partly or wholly outside the OTS, knowledge of separation criteria, the forecast upper wind situation and correct interpretation of the NAT Track Message will assist in judging the feasibility of the planned route. When anticipated volume of traffic does not warrant publication of all available flight levels on a particular track ATC will publish only those levels required to meet traffic demand. The fact that a specific flight level is not published for a particular track does not necessarily mean that it cannot be made available if requested. (Examples of NAT Track messages are contained in the Appendix.)

OTS CHANGEOVER PERIODS

In order to ensure a smooth transition from night to day track system and vice-versa a period of several hours is interposed between the termination of one system and the commencement of the next. It is recommended that random flights, planning to cross 30°W eastbound within the hour preceding the onset of the day track system or planning to cross 30°W westbound within the hour preceding the onset of the night track system, flight plan to join a track of the OTS at or beyond 30°W in accordance with the flight levels published in the NAT Track Message, or flight plan to remain clear of the OTS.

Outside the hours of validity of the OTS and the above transition periods operators are encouraged to flight plan a random route at flight levels appropriate to the direction of flight. If necessary and in all cases of doubt, dispatchers should seek the advice of the appropriate Oceanic centre on the best procedure to adopt.

On many occasions tracks on two successive systems may appear to have the same co-ordinates, *but special care should be taken to ensure that this is really the case for the whole track and also to check to what extent the associated landfall/termination points and domestic routeings are also identical.*

APPENDIX: EXAMPLES OF DAY-TIME WESTBOUND AND NIGHT-TIME EASTBOUND TRACK MESSAGES AND ASSOCIATED TRACK SYSTEMS

EXAMPLE OF WESTBOUND NAT TRACK MESSAGE ASSOCIATED WITH SYSTEM ILLUSTRATED

NAT TRACKS FL 310/370 INCLUSIVE (DATE) 1130Z-1900Z

A 57/10 56/20 59/30 58/40 56/50 SCROD CYYR
WEST LVLS 310 330 350 370
EAST LVLS NIL
EUR RTS WEST 2
EUR RTS EAST NIL
NAR NA222 NA230

B 56/10 57/20 58/30 57/40 55/50 CYSTR KLAMM
WEST LVLS 310 330 350 370
EAST LVLS NIL
EUR RTS WEST 2
EUR RTS EAST NIL
NAR NA202 NA204

C 55/10 56/20 57/30 56/40 54/50 CARPE REDRY
WEST LVLS 310 330 350 370
EAST LVLS NIL
EUR RTS WEST 2
EUR RTS EAST NIL
NAR NA180 NA182

D 54/15 55/20 56/30 55/40 53/50 CYAY
WEST LVLS 310 330 350 370
EAST LVLS NIL
EUR RTS WEST 2 VIA EGL
EUR RTS EAST NIL
NAR NA160 NA166

E 53/15 54/20 55/30 54/40 52/50 DOTTY
WEST LVLS 310 330 350 370
EAST LVLS NIL
EUR RTS WEST 2 VIA SNN
EUR RTS EAST NIL
NAR NA152 NA154

NOTES: 1 DATUM TRACK ALPHA
2 R99 IN EFFECT FOR EUR/CAR TRAFFIC

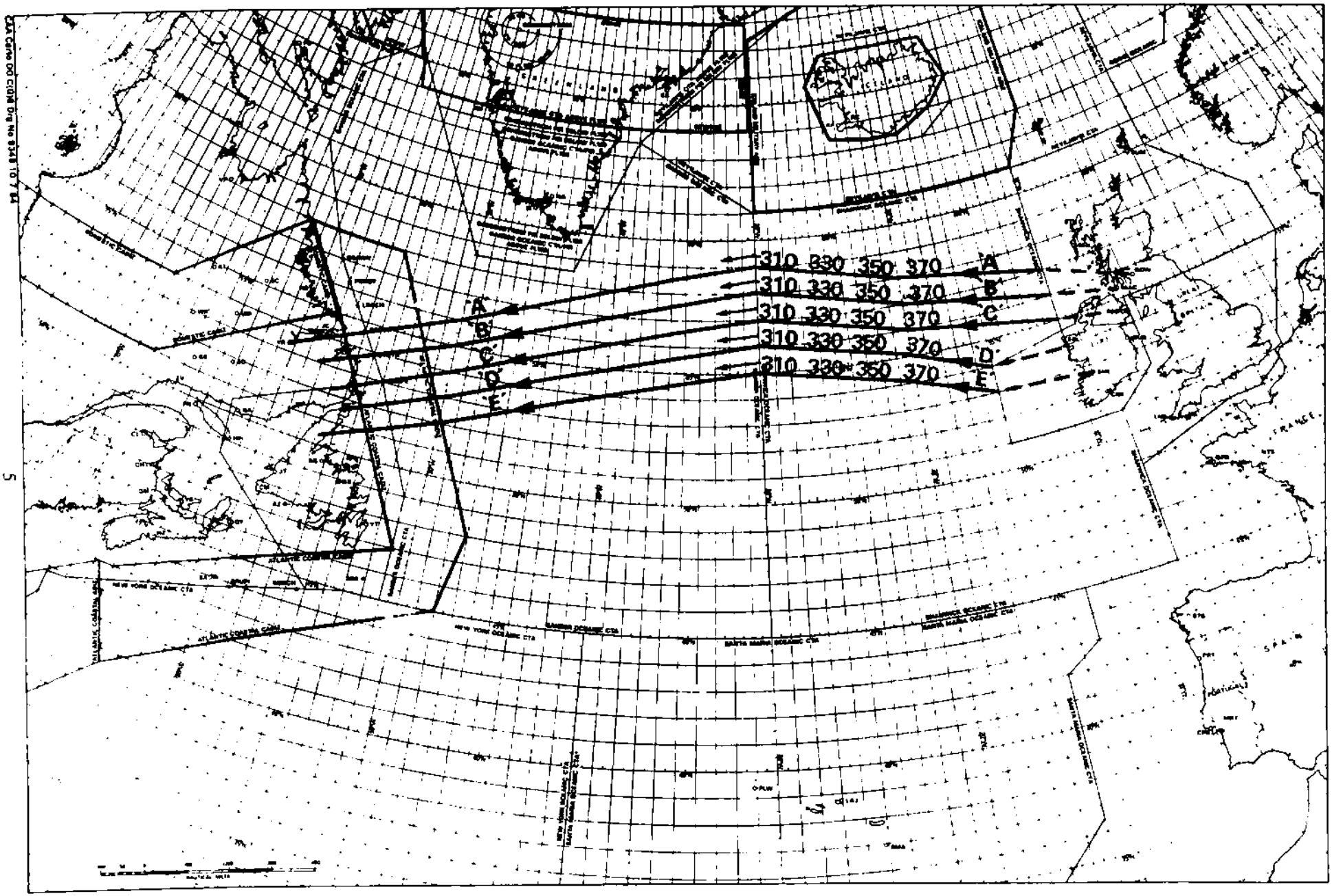

Fig 1 Example of Day-time Westbound Organised Track System

EXAMPLE OF EASTBOUND NAT TRACK MESSAGE ASSOCIATED WITH SYSTEM ILLUSTRATED

```
NAT TRACKS FL 330/390 INCLUSIVE (DATE) 0100Z ON 07

V   CYSG  51/50  52/40  53/30  54/20  55/10  BEL
    LVLS EAST 330  350  370  390
    LVLS WEST  NIL
    NAR  NA141  NA149

W   CYQX  50/50  51/40  52/30  53/20  53/15  GL
    LVLS  EAST  330  350  370  390
    LVLS  WEST  NIL
    NAR  NA125  NA127  NA131

X   VYSTA 49/50  50/40  51/30  52/20  52/15  SAN
    LVLS EAST 330  350  370  390
    LVLS WEST  NIL
    NAR NA105  NA107  NA111

Y   CYYT  48/50  49/40  50/30  51/20  51/15  CRK
    LVLS EAST 330  350  370  390
    LVLS WEST  NIL
    NAR NA83  NA89  NA93

Z   COLOR 47/50  48/40  49/30  50/20  50/08  LND
    LVLS EAST 330  350  370  390
    LVLS WEST  NIL
    NAR NA41  NA51  NA53

NOTE:  1  DATUM LINE TRACK VECTOR
       2  R99 IN EFFECT FOR CAR/EUR TRAFFIC
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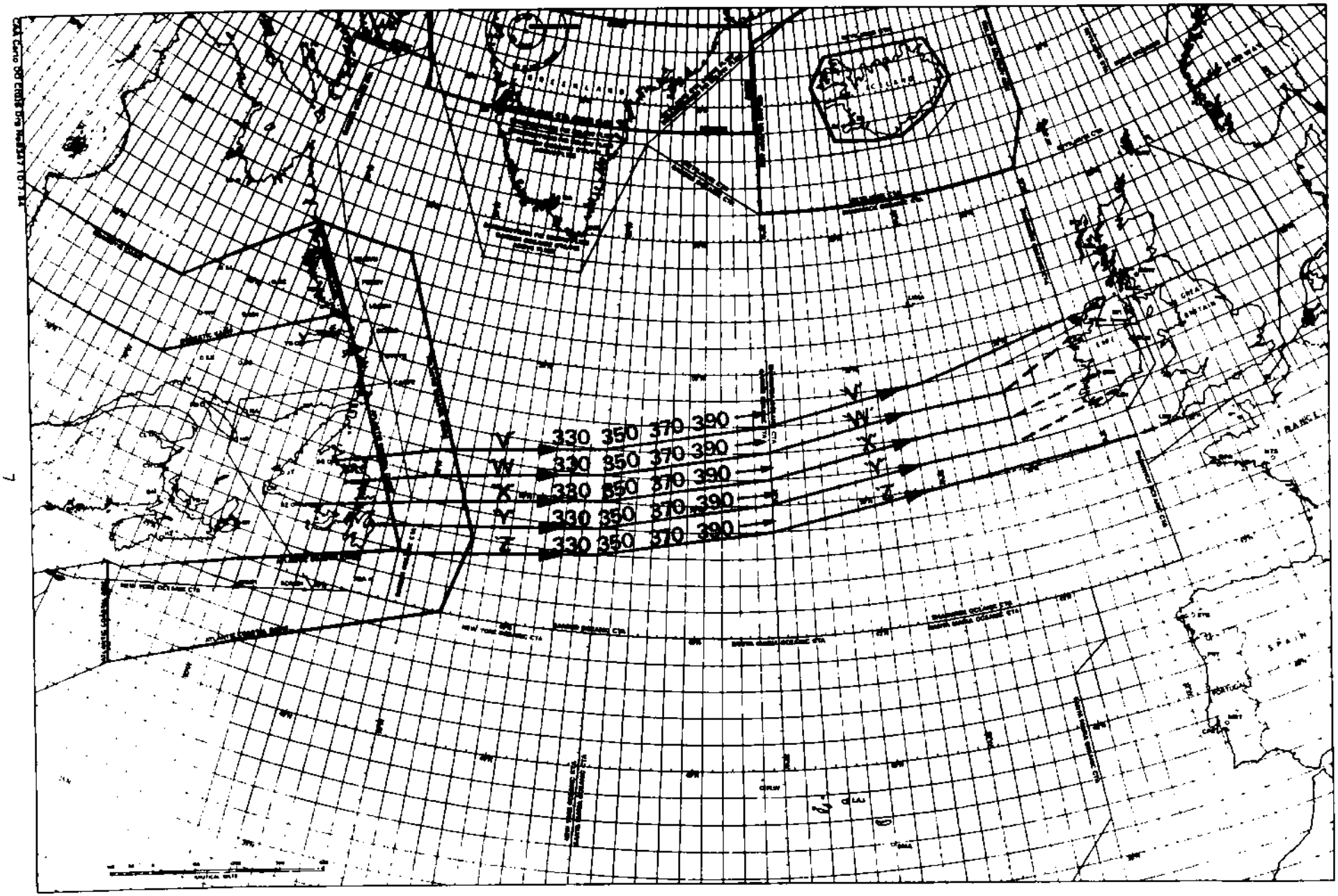


Fig 2 Example of Night-time Eastbound Organised Track System

SECTION 2 – THE POLAR TRACK STRUCTURE (PTS)

GENERAL

Like most other NAT traffic flows, traffic on the Europe–Alaska axis is predominantly unidirectional; in the Reykjavik CTA the westbound peak is between 1200–1800Z and the eastbound peak is between 0001–0600Z. In order to facilitate the flow of this traffic during peak periods and avoid a multiplicity of random routes a Polar Track Structure (PTS) consisting of 20 fixed tracks has been established for use during these periods (see Fig 3).

Although not mandatory, flights planning operations on the Europe–Alaska axis at FL 310–390 inclusive during peak periods are strongly recommended to submit flight plans in accordance with one of the promulgated PTS tracks.

ABBREVIATED CLEARANCES

An abbreviated clearance may be used when clearing an aircraft to follow one of the polar tracks throughout its flight within the Reykjavik CTA. When an abbreviated clearance is issued it shall include:

(1) the cleared track specified by the track code number;

(2) the cleared flight level(s);

(3) the cleared Mach Number.

On receipt of an abbreviated clearance the pilot shall read back the contents of the clearance message and in addition the full details of the track specified by the code number.

ABBREVIATED POSITION REPORTS

When operating on the PTS within the Reykjavik CTA position reports may be abbreviated by replacing the normal latitude co-ordinate with the word 'Polar' followed by the track code number.

eg: 'Position Japanair 422 Polar 3 20W/1537 estimating Polar 3 40W/1620 next Polar 3 LT'.

Unless otherwise required by air traffic services a position report shall be made at the significant points listed for the relevant PTS track.

ADDITIONAL INFORMATION ON THE PTS

Flight planning procedures for the PTS are covered in Section 4 of this document. Further information on PTS procedures, track co-ordinates etc, is contained in AIP Iceland and/or Icelandic NOTAMs.

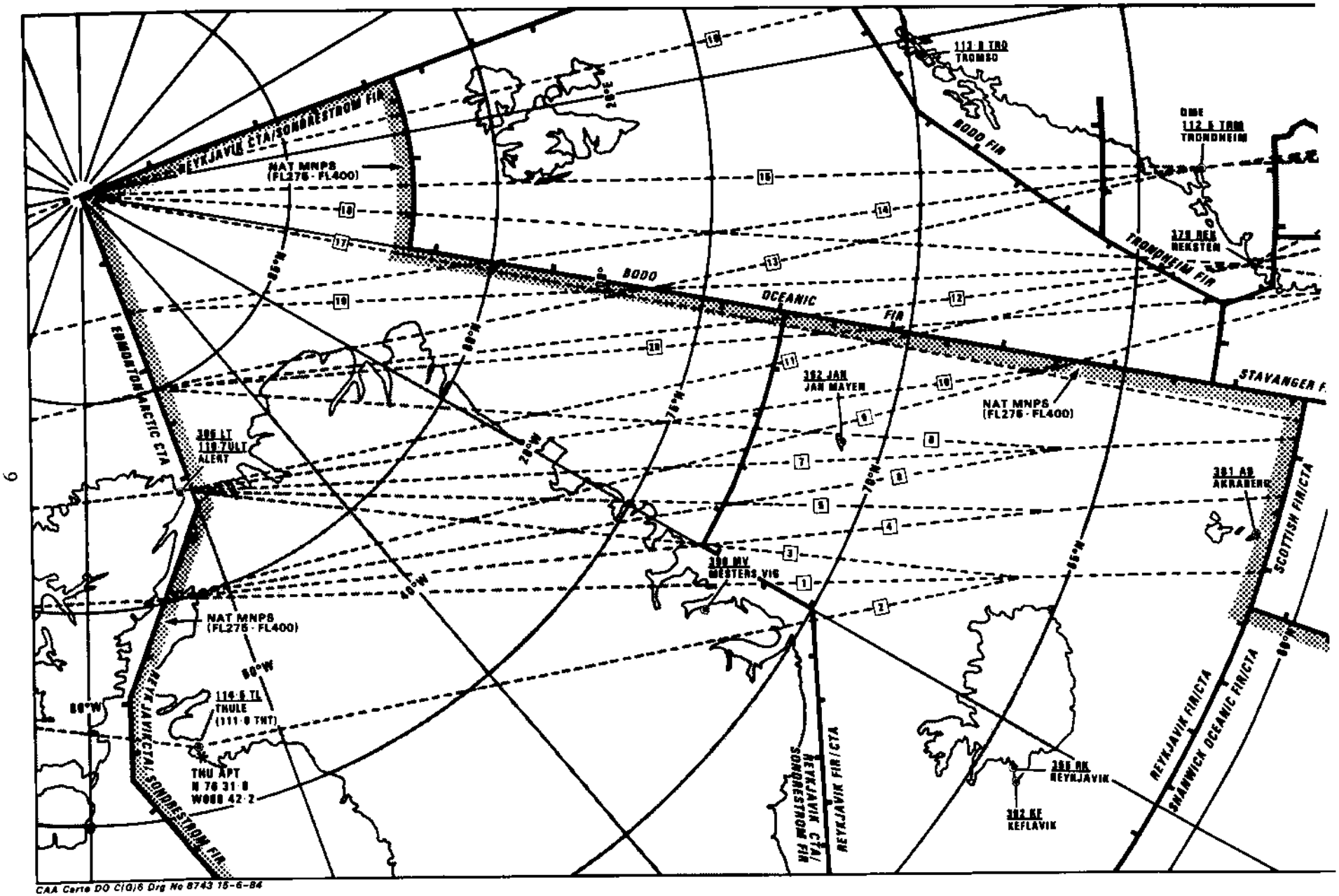


Fig 3 Polar Track Structure (PTS)

SECTION 3 – OTHER ROUTES AND ROUTE STRUCTURES WITHIN OR ADJACENT TO NAT MNPS AIRSPACE

GENERAL

The Organised Track System and the Polar Route Structure are the most significant route structures within the NAT MNPS airspace but there are other routes and route structures within and adjacent to the MNPS airspace knowledge of which completes the picture of upper airspace organisation in the NAT Region and immediately adjacent areas.

OTHER ROUTES WITHIN NAT MNPS AIRSPACE

Other routes within NAT MNPS airspace which are illustrated in Fig 4 are as follows:

(1) upper air routes established to facilitate the traffic flow between Europe and the Caribbean area (R99, G61, UB47);

(2) special routes between North Eastern Canada and Europe via Greenland and Iceland, and between the Azores and the Portuguese mainland for aircraft equipped with normal short-range navigation equipment (VOR, DME, ADF) and *at least one* approved fully operational long-range navigation equipment;

(3) special routes of short stage lengths where aircraft equipped with normal short-range navigation equipment can meet the MNPS track-keeping criteria. (G3 and G11.)

ROUTE STRUCTURES ADJACENT TO NAT MNPS AIRSPACE

SST Route Structure

The SST Route structure (also illustrated in Fig 4) comprises three fixed tracks: 'SM' – westbound, 'SN' and 'SO' – eastbound. SST flights on these tracks normally operate well above MNPS airspace (FL 500 +), the exception is in the event of a delayed supersonic acceleration or emergency descent. Standard separation is applied in the first case and emergency descent contingency procedures take into account the possible existence of organised track system traffic operating below the SST tracks.

UK Westbound Domestic Recommended Route Structure (RRS)

The RRS consists of recommended routes through the UK FIR from European departure areas to oceanic entry points. The routes are listed in the UK AIP grouped into three structures numbered 1, 2 and 3. The structure of routes to be used is dependent on the alignment of the Organised Track System and anticipated traffic density and is published as part of the westbound North Atlantic Track Message for each track under the heading 'EUR RTS WEST'. For example 'EUR RTS WEST 3' under Track 'E' means that Structure 3 is in operation for traffic planning on that track.

North American Routeings (NARs)

The North American routeings consist of a numbered series of predetermined routes which form a link between oceanic track exit and entry points and the North American domestic airspace route structure in both directions. The specific route numbers related to each track exit/entry point are published in the North Atlantic Track Message under the heading 'NAR'.

For example 'NAR NA 20, NA 24' under Track 'B' means that after the exit point of Track 'B' flights may flight plan on NA 20 or NA 24 depending on their destination. Full details of the routeings, procedures etc can be found in United States and Canadian AIPs.

Canadian Northern and Arctic Track Systems

North of the North American Routes are two track systems; the Northern Track System which links with NAT random route traffic operating between Europe and the Western North America (Los Angeles, San Francisco etc) and an Arctic Route System that interfaces with the Polar Track Structure for traffic between Europe and Alaska. Both systems are established within Canadian MNPS airspace, procedures for which, together with full details of the track systems can be found in the appropriate Canadian AIP. (Some of the rules for Canadian MNPS airspace such as vertical dimensions differ from those in NAT MNPS airspace.)

Routes between North America and the Caribbean area

In the New York Oceanic Control Area to the west of 60° West there is an extensive network of routes linking points in the United States and Canada with Bermuda, the Bahamas and the Caribbean area. Details of these routes and associated procedures are contained in the United States AIPs.

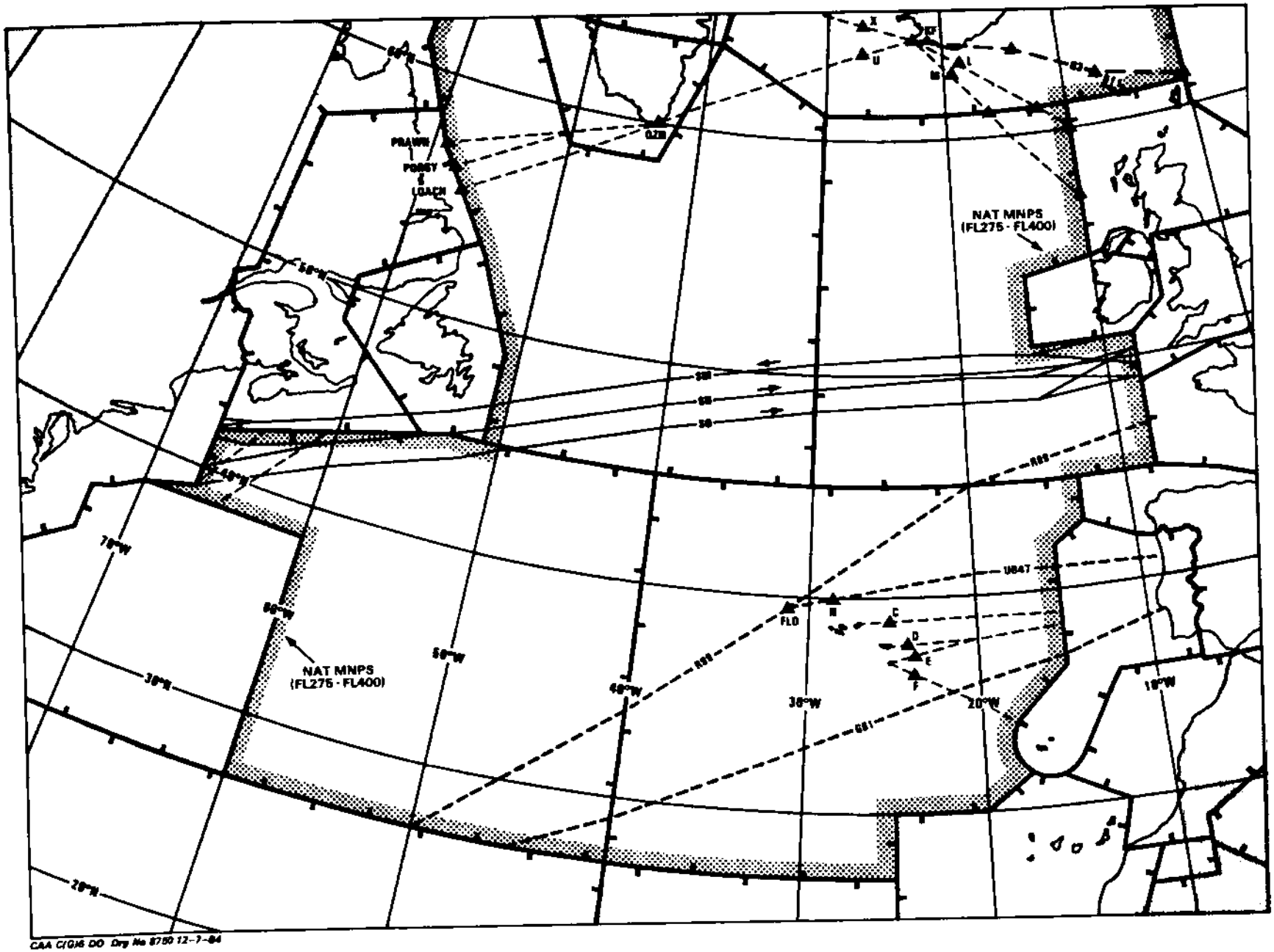


Fig 4 Other routes and route structures within and above NAT MNPS airspace

PREFERRED TRACK MESSAGES

In order to enable oceanic planners to take into consideration operators' preferred tracks in the construction of the organised track system, all NAT operators (both scheduled and non-scheduled) should provide information by AFTN message to the appropriate OACs regarding the number of turbojet flights and tracks likely to be requested during the peak traffic periods. Such information should be provided as far in advance as possible, but not later than 2300 GMT for the day-time OTS and 1030 GMT for the night-time OTS.

ATC FLIGHT PLANS

GENERAL REQUIREMENTS

Airline staff preparing flight plans will be aware that they must co-operate in seeking to prevent the flight subsequently diverging from its intended track. Thus, care should be taken when feeding track information into the computer and the information should be cross-checked before it is given to the operating crew. Where applicable, the crew shall be given both the organised track message and relevant amendments to it.

The correct completion of the flight plan is extremely important as errors can lead to delay in data processing and subsequent clearance of the flights concerned.

Flight plans for flights departing from points in other Regions and entering the NAT Region without intermediate stops should be submitted as far in advance of departure as possible.

All generally eastbound and westbound flights should normally flight plan so that specified ten degrees of longitude (20°W, 30°W, 40°W etc) are crossed at whole degrees of latitude; and generally northbound and southbound flights should normally flight plan so that specified parallels of latitude spaced at five degree intervals (65°N, 60°N, 55°N etc) are crossed at whole degrees of longitude.

For all flights intending to operate within NAT MNPS airspace for *any* portion of their flight the letter 'X' should be inserted after the letter 'S' in Item 10 of the flight plan indicating that the flight is certified as being in compliance with the MNPS.

For turbojet aircraft the Mach Number planned to be used for each portion of the flight in the NAT Region should be specified in Item 15 of the flight plan.

FLIGHT PLANNING REQUIREMENTS ON SPECIFIC ROUTES

Flights planning on the Organised Track System at/or South of 70°N

If (and only if) the flight is planned to operate *along the whole length* of one of the organised tracks as detailed in the North Atlantic Track Message, the intended organised track should be defined in Item 15 of the flight plan using the abbreviation 'NAT' followed by the code letter assigned to the track.

Flights wishing to join or leave an organised track at some intermediate point are considered to be random route aircraft and *full* track details must be specified in the flight plan. The track letter should *not* be used to abbreviate any portion of the route in these circumstances.

The requested Mach Number and flight level at the commencement point of the organised track should be specified at either the last domestic reporting point prior to ocean entry or the organised track commencement point.

Each point at which a change of Mach Number or flight level is requested must be specified as geographical co-ordinates in latitude or longitude, followed in each case by the abbreviation 'NAT' and the code letter assigned to the track.

For flights operating along the whole length of one of the organised tracks, estimates are only required for the commencement point of the track.

Flights planning on random route segments at/or South of 70°N

The requested Mach Number and flight level should be specified at either the last domestic reporting point prior to ocean entry or the oceanic control area boundary.

The route of the flight should be specified in terms of the following significant points:

(1) the last domestic reporting point prior to oceanic entry point;

(2) the oceanic control area boundary entry point, *when required by the OACs concerned* (see Note 1 below);

(3) significant points formed from the intersection of half or whole degrees of latitude with meridians spaced at intervals of ten degrees of longitude from the Greenwich Meridian to 70°W;

(4) the oceanic control area boundary exit point, *when required by the OACs concerned* (see Note 1 below);

(5) the first domestic reporting point after ocean exit.

Each point at which a change of Mach Number or flight level is requested must be specified and followed in each case by the next route segment expressed as geographical co-ordinates in latitude and longitude.

Estimates are required for all significant points listed in (1), (3) and (5) above.

Flights planning on random route segments North of 70°N

Flight planning requirements for flights in the above category are identical to those listed above (for flights on random route segments at/or south of 70°N) except that the route should be specified in terms of significant points formed by the intersection of parallels of latitude expressed in degrees and minutes with meridians normally spaced at intervals of 20° from the Greenwich Meridian to 60°W.

NOTE: 1 FIR boundary estimates are only required in flight plans for flights operating through Shanwick, Santa Maria and New York FIRs as follows:

Shanwick FIR:	All random flight plans must contain FIR boundary estimates for the eastern, northern and southern boundaries of the Shanwick Oceanic Control Area and 30° West boundary estimates for eastbound random flights in transit through the Gander/Shanwick FIRs.
New York/ Santa Maria FIRs:	All flight plans must contain New York/Santa Maria FIR boundary estimates.

Flights planning on random routes in North/South direction

Flight planning requirements for flights in the above category are identical to those listed for flights operating on random route segments at/or south of 70°N except that the route should be specified in terms of significant points formed by the intersection of whole degrees of longitude with specified parallels of latitude which are spaced at 5° intervals from 20°N to 90°N.

Flights planning on the Polar Route Structure (PTS)

If (and only if) the flight is planned to operate *along the whole length* of one of the Polar tracks, the intended track should be defined in Item 15 of the flight plan using the abbreviation 'PTS' followed by the code number assigned to the track.

Flights wishing to join or leave a Polar track at some intermediate point are considered to be random route aircraft and *full track details* must be specified in the flight plan. The track number must not be used to abbreviate any portion of the route in these circumstances.

Estimated times over significant points shall be specified in Item 18 of the flight plan.

The requested Mach Number and flight level should be specified at the commencement point of the PTS at the NAT Oceanic boundary.

Each point at which a Mach Number or flight level change is requested must be specified as geographical co-ordinates in latitude and longitude followed in each case by the abbreviation 'PTS' and the code number assigned to the track.

Flights planned on R99, G61 and UB47 in the Santa Maria and New York OCAs

The requested Mach Number and flight level should be specified at the commencement point of the route.

The route of the flight should be described in terms of the appropriate route identifiers.

Each point at which a change in Mach Number or flight level is requested must be specified and followed in each case by the next route segment expressed in terms of the appropriate route identifier.

Estimates are required for each significant point on R99, G61 and UB47 in the Santa Maria and New York OCAs.

NOTE: When ATS Route R99 has been specified as the eastbound route on the CAR/EUR axis, operators should file flight plans along that route at least up to 45°N 20°W. Thereafter they may state in their flight plans a route of their choice to the most convenient landfall point in the EUR Region. New York and San Juan ACCs when issuing initial oceanic clearance for such flights will clear them along R99 to its landfall point at Nantes. If the pilot wishes to proceed along the route specified in the flight plan onwards from 45°N 20°W he *must* when approaching this point request a reclearance from Shanwick OAC. This request (or another suitable reclearance) will be granted subject to traffic conditions as they exist at the time. In cases where such a reclearance cannot be requested and obtained in time the aircraft concerned *must* follow the initial ATC clearance and proceed along ATS Route R99 to Nantes.

SECTION 5 – OCEANIC ATC CLEARANCES

GENERAL

Pilots should request oceanic clearances from the ATS unit responsible for the first oceanic area within which they wish to operate as early as possible, following the procedures and the time-frame laid down in appropriate AIPs. Such clearances, although in most cases obtained some time before reaching the oceanic boundary/entry point, are applicable only from that boundary/entry point.

Methods of obtaining oceanic clearances include:

- use of VHF clearance delivery frequencies when in coverage;
- use of HF to the OAC through the appropriate aeradio station (if possible at least 30 min before boundary/entry estimate);
- request via domestic or other ATC agencies.

NOTE: At some airports situated close to oceanic boundaries the oceanic clearance can be obtained before departure (eg Prestwick, Shannon, Gander, Goose Bay).

For westbound flights intending to operate in the Reykjavik, Santa Maria and Shanwick OCAs, after obtaining and reading back the clearance, the pilot should monitor the forward estimate for oceanic entry and if this changes should pass a revised estimate to ATC. As planned longitudinal spacing by these OACs is based solely on boundary estimates, failure to adhere to this ETA amendment procedure may result in a reclearance to a less economical track/flight level for the complete crossing. In other OACs planned longitudinal spacing is established by reference to short range navaids or radar, making accuracy of estimates less critical.

If the oceanic clearance which the pilot is given in flight differs from the route originally requested it then becomes his responsibility to obtain the necessary domestic route clearance in order to ensure that he is in compliance with his oceanic clearance when he enters oceanic airspace.

The pilot should appreciate that, irrespective of the flight plan filed, the great majority of oceanic clearances given to individual aircraft are at a specific flight level and cruise Mach Number and that in such cases no level or Mach Number changes should be made without prior ATC clearance.

CONTENTS OF CLEARANCES

An abbreviated clearance is only issued by air traffic services when clearing an aircraft to fly along the whole length of an organised track or along a Polar track within Reykjavik OCA. In all other circumstances *full* details of the cleared track are specified in the clearance message. When an abbreviated clearance is issued it includes:

- cleared track specified by Track and code letter or Polar track and number;
- cleared flight level;
- cleared Mach Number;
- if the aircraft is designated to report Met information en route, the phrase 'SEND MET REPORTS'.

On receipt of an abbreviated clearance the pilot should read back the contents of the clearance message and *full* details of the track specified by the code letter. If in any doubt the pilot should request a detailed description of the route from the ATC unit.

For selected operators proceeding Westbound through the UK FIRs there are special arrangements designed to relieve the load on clearance delivery frequencies.

OCEANIC CLEARANCES FOR FLIGHTS INTENDING TO OPERATE WITHIN THE NAT REGION AND SUBSEQUENTLY ENTER THE EUR OR NAM REGIONS

Oceanic clearances issued to flights in the above category are strategic clearances intended to provide a safe separation for each flight from oceanic entry to track termination point. Should a pilot receive a clearance on a track other than originally flight planned, *special caution should be exercised to ensure that the co-ordinates of the assigned track and the associated landfall and domestic routeings are fully understood and correctly inserted into the automated navigation system with appropriate cross checks.* In all cases where an en-route reclearance is requested by a pilot he should ensure that *the revised ATC clearance includes the new routeing from the exit from oceanic airspace to the first landfall point or coastal fix.* If at the time of being given a clearance or reclearance, the pilot has any doubt about it he should check the details with the ATC unit relaying the clearance/reclearance to him.

OCEANIC CLEARANCES FOR RANDOM FLIGHTS INTENDING TO OPERATE WITHIN THE NAT REGION AND SUBSEQUENTLY ENTER REGIONS OTHER THAN NAM OR EUR

Oceanic clearances issued to flights in this category are similar to domestic ATC clearances in that clearances are to destination on the assumption that co-ordination will be effected ahead of the aircraft's passage. In this case the flight profile is subject to change en-route prior to hand over from one centre to another dependent on traffic conditions in the adjacent area. As such centre/centre co-ordination is sometimes carried out well in advance, there is a possibility that on entry into the next FIR a more economical profile may be available than was envisaged at the time of co-ordination.

ERRORS ASSOCIATED WITH OCEANIC CLEARANCES

Navigation errors associated with Oceanic clearances fall into various categories, of which the most important are ATC System Loop and Waypoint Insertion errors.

ATC SYSTEM LOOP ERRORS

By definition an ATC system loop error is any error caused by a misunderstanding between the pilot and the controller regarding the assigned flight level, Mach Number or route to be followed. Such errors can arise by incorrect interpretation of the NAT Track Message by dispatchers, errors in co-ordination between ATC centres or misinterpretation of Oceanic clearances or reclearances by pilots. Errors of this nature which are detected by ATC from forward estimates will normally be corrected. However timely ATC intervention cannot always be guaranteed, especially as it may depend on HF communications.

WAYPOINT INSERTION ERRORS

Experience has shown that many of the INS/ONS tracking errors which occur result from failure to observe the principles of checking waypoints to be inserted against the ATC assigned track and of careful loading and cross-checking of on-board navigation systems. More detailed guidance on this subject is contained in Section 11 of this document.

Many of the navigation error occurrences detected by ATC Oceanic exit radars are the product of one or both of these causes. *It is therefore imperative that pilots double check each element of the Oceanic clearance on receipt, and at each waypoint, since failure to do so may result in inadvertent deviation from assigned track, resulting in possible collision hazard.*

SECTION 6 – AIR/GROUND COMMUNICATIONS AND POSITION REPORTING PROCEDURES

HF COMMUNICATIONS

Most NAT air/ground communications are conducted on single side-band HF frequencies. Pilots communicate with OACs via aeradio stations manned by communicators who have *no executive ATC authority*. Messages are relayed usually by radio-teletype from the ground station to the relevant OAC for action. Aeradio stations and OACs are not necessarily co-located, for example in the case of Shanwick operations, the OAC is located at Prestwick in Scotland, the associated aeradio station at Ballygirreen in the Republic of Ireland. The allocation of the four families of SSB frequencies (A, B, C, D) is by State of Registry of the aircraft and the route to be flown as follows:

DESIGNATED FOR	ROUTE		
	SOUTHERN	CENTRAL	NORTHERN
Aircraft registered in the hemisphere W of 30°W	A	B	B
Aircraft registered in the hemisphere E of 30°W	A	C	C
Aircraft flying Northern routes outside OTS tracks	–	–	D

NOTE: 1 Southern routes are those which enter the New York Oceanic or Santa Maria Oceanic flight information regions. The Central and Northern routes comprise all the others.

2 Aircraft registered in Australia will use families designated for aircraft registered East of 30°W.

SELCAL

During the time that they depend on HF communications pilots should maintain a listening watch on the assigned frequency. This is not necessary however if SELCAL is fitted and used correctly. Correct use includes:

(1) the provision of the SELCAL code in Flight Plan;

(2) the issue of a correction to the SELCAL code if subsequently altered due to a change of aircraft or equipment;

(3) a check on the operation of the SELCAL equipment at or prior to entry into Oceanic airspace with the appropriate aeradio station. (This SELCAL check *must* be completed prior to commencing SELCAL watch.);

(4) maintenance of a SELCAL watch.

HF COMMUNICATIONS FAILURE

In general, each Aeradio station continuously listens out on its appropriate family/families of NAT HF frequencies. In the event of failure of HF communications en-route every effort should be made by the pilot to relay position reports through other aircraft. At least until an air-to-air VHF frequency for the Region has been agreed, initial contact, and only initial contact for such relays can be established on 121.5 MHz (the frequency guarded by all aircraft operating in the NAT Region) and continued as necessary on another frequency. In all cases of communications failure the pilot should follow the Oceanic Clearance last received and *not* revert to his original flight plan.

GENERAL PURPOSE VHF COMMUNICATIONS (GP/VHF)

Aeradio stations are also responsible for the operation of GP/VHF outlets. These are especially valuable in the vicinity of Iceland and Greenland, VHF not being as subject to sunspot activity as HF. (One of these outlets is situated at Prinz Christiansund on the southern tip of Greenland and is remotely controlled from Gander Aeradio station.) When using these frequencies in fringe cover areas however, care should be taken to maintain a SELCAL watch on HF thus ensuring that if VHF contact is lost the aeradio station is still able to contact the aircraft. It is important for the pilot to appreciate that when using GP/VHF he is communicating with an aeradio station and therefore not in direct contact with ATC.

POSITION REPORTING PROCEDURES

Time and Place of Position Reports

Unless otherwise required by air traffic services, position reports from flights on routes which are not defined by designated reporting points should be made at the significant points listed in the flight plan.

Air Traffic Services may require any flight operating in a North–South direction to report its position at any intermediate parallel of latitude when deemed necessary.

In requiring aircraft to report their position at intermediate points ATS are guided by the requirement to have positional information at approximately hourly intervals and also by the need to cater for varying types of aircraft and varying traffic and MET conditions. Position information should be based on the best obtainable navigational fix.

Position Report Prefix

The prefix 'POSITION' should be used when passing NAT position reports to ground aeradio stations either on the initial call, or prior to the text of the message.

Contents of Position Reports

Position should, for flying outside the Polar Track Structure and domestic ATS route network, be expressed in terms of latitude and longitude except when flying over oceanic 'fish points' or other named reporting points. For flights whose tracks are predominantly east or west, latitude should be expressed in degrees and minutes, longitude in degrees only. For flights whose tracks are predominantly north or south, latitude should be expressed in degrees only, longitude in degrees and minutes. All times should be expressed in four digits giving both the hour and the minutes when making position reports in the NAT region.

Next Position and Time Over

'Next position' should normally be expressed as the significant point at which the aircraft is next required to report position.

If the estimated time for the next position is found to be in error by 3 minutes or more a revised estimate should be transmitted to the ATC unit concerned as soon as possible.

Next Subsequent Position

The name or co-ordinates of the ensuing significant point following 'the next position and estimated time over' should be given when making position reports in the NAT Region, and when reporting over the last domestic reporting point prior to entry into oceanic airspace.

This requirement allows ATC to closely monitor the progress of flights related to their assigned track and domestic routeing and more time to correct possible deviations.

Examples: 'POSITION SWISSAIR 110 52 NORTH 20 WEST 1020 FL 350 EST 52 NORTH 30 WEST 1102 NEXT 51 NORTH 40 WEST

'POSITION LUFTHANSA 440 SPRINGDALE 0342 FL 370 EST 51 NORTH 50 WEST 0410 NEXT 52 NORTH 40 WEST

Transmission of Position Reports

Position reports made by aircraft operating within an oceanic control area at a distance of 60 nm or less from the common boundary with an adjacent oceanic control area, including aircraft operating on tracks through successive points on each boundary, should also be made to the area control centre serving the adjacent control area. (In practice this only requires an addition to the address eg Shanwick copy Santa Maria.)

Meteorological Reports

From among the aircraft intending to operate on the organised track system OACs designate those which will be required to report routine meteorological observations at each prescribed reporting point. The designation is made by the OAC when issuing the oceanic clearance using the phrase 'SEND MET REPORTS', and is normally made so as to designate one aircraft per track at approximately hourly intervals, unless otherwise requested by the associated MET Office. Pilots flying tracks partly or wholly off the OTS should include routine Met Observations with every prescribed position report.

OPERATION OF TRANSPONDERS

Unless otherwise directed by ATC, pilots of aircraft equipped with SSR flying in NAT flight information regions shall operate transponders continuously in Mode A Code 2000, except that the last assigned code shall be retained for a period of 30 min after entry into NAT airspace.

NOTE: This procedure does not affect the use of the special purpose codes (7500, 7600 and 7700) in cases of unlawful interference, radio failure, interception or emergency.

SECTION 7 – APPLICATION OF MACH NUMBER TECHNIQUE (PANS/RAC)

DESCRIPTION OF TERMS

The term Mach Number Technique is used to describe a technique whereby subsonic turbojet aircraft operating successively along suitable routes are cleared by ATC to maintain appropriate Mach Numbers for a relevant portion of the en-route phase of their flight.

OBJECTIVE

The principal objective of the use of Mach Number Technique is to achieve improved utilisation of the airspace on long route segments where ATC has no means other than position reports of ensuring that the longitudinal separation between successive aircraft is not reduced below the established minimum. Practical experience has shown that when two or more turbojet aircraft operating along the same route at the same flight level maintain the same Mach Number they are more likely to maintain a constant time interval between each other than when using other methods. This is due to the fact that the aircraft concerned are normally subject to approximately the same wind and air temperature conditions and minor variations in speed which might increase or decrease the spacing between them tend to be neutralised over long periods of flight.

APPLICATION PROCEDURES IN NAT OCEANIC AIRSPACE

The Mach Number Technique is based on the True Mach Number. The ATC clearance must include the assigned Mach Number which is to be maintained. It is therefore necessary that information on the desired Mach Number be included in the flight plan by pilots intending to operate turbojet aircraft in NAT oceanic airspace. The normal requirement for ATC to calculate estimated times for the passage of significant points by the aircraft along its track still remains. This is necessary for both the provision of longitudinal separation between aircraft and for co-ordination with adjacent ATC units.

The prescribed longitudinal separation between successive aircraft flying at the same flight level must be provided over the entry point for a particular track or tracks. Intervention by ATC thereafter should normally only be necessary if an aircraft is required to change its Mach Number due to conflicting traffic or change in flight level.

In the application of Mach Number Technique, particularly in the 10 minute longitudinal separation environment, *it is imperative that pilots adhere strictly to their assigned Mach Numbers unless a specific re-clearance is obtained from the appropriate ATC unit.* If an immediate temporary change in the Mach Number is essential eg due to turbulence, ATC must be notified as soon as possible.

PROCEDURE AFTER LEAVING OCEANIC AIRSPACE

After leaving oceanic airspace pilots must maintain their assigned Mach Number in domestic controlled airspace until the appropriate ATC unit authorises a change.

SECTION 8 – MISCELLANEOUS PROCEDURES

PROVISION OF STEP-CLIMBS

Although the main flow of traffic operates on 'strategic' clearances there is scope for en-route tactical reclearances which afford the possibility of step-climbs. Controllers are aware of the need for fuel conservation and will accommodate requests for step-climbs whenever possible. In this context, forward planning can be enhanced by pilots complying with current recommended procedures (NOTAMs). Pilots should remember to maintain their last assigned Mach Number during step-climbs in oceanic airspace. If due to aircraft performance this is not feasible ATC should be advised at the time of the request.

EN-ROUTE CHANGES OF MACH NUMBER

The initial oceanic clearance will specify a Mach Number which pilots must adhere to. However as the aircraft weight reduces it may be more fuel efficient to adjust the Mach Number. ATC approval of requests for change in cruise Mach Number will be given if traffic conditions permit.

SPECIAL PROCEDURES – GANDER OCA

Eastbound flights intending to operate in the Gander OCA should notify the OAC of the optimum acceptable flight level, taking into account that the climb to the assigned oceanic flight level must normally be achieved whilst the aircraft is within radar coverage. Such flights should also notify the OAC of any required change to their oceanic flight planned level, track or Mach Number as soon as possible after departure to assist the OAC in preplanning optimum airspace utilisation.

APPLICATION OF DATUM LINE TECHNIQUE

Datum Line Technique is a method used in the NAT Region to assist, at the flight planning stage, by delineating in advance a block of airspace in which flight level(s) not appropriate to the direction of flight can be used. Normally this is done to accommodate a peak flow of aircraft operating on random routes. Within the confines of the Gander and Shanwick OCAs the Datum Line, as specified in the appropriate NAT Track Message, defines the southern limit of the airspace within which the following procedures apply:

(a) Normally an additional flight level laterally clear of the OTS as defined by a Datum Line would be made available:

during hours of night OTS – Eastbound FL 350

during hours of day OTS – Westbound FL 330

(b) Operators are encouraged to flight plan as follows:

(i) in accordance with the OTS; or

(ii) a route to join or leave an outer track of the OTS; or

(iii) a random route to remain clear of the OTS.

NOTE: Nothing in the paragraph (b) above prevents operators from flight planning across the OTS. However they should be aware that whilst ATC will make every effort to clear random traffic across the OTS at published levels, re-routes or changes in flight level may be necessary during peak OTS traffic periods.

SPECIAL ARRANGEMENTS FOR THE PENETRATION OF MNPS AIRSPACE BY AIRCRAFT INTENDING TO OPERATE ABOVE MNPS AIRSPACE

Aircraft not approved for operation in MNPS airspace may be cleared by the responsible ATC unit to climb or descend through MNPS airspace provided:

(a) the climb or descent can be completed within the useable coverage of selected VOR/ DME's and/or within radar coverage of the ATC unit issuing such clearance and the aircraft is able to maintain direct pilot-controller communications on VHF;

(b) MNPS aircraft operating in that part of the MNPS airspace affected by such climbs or descents are not penalised.

SECTION 9 – PARTIAL OR COMPLETE LOSS OF NAVIGATION CAPABILITY PRIOR TO ENTERING OR WHILST WITHIN MNPS AIRSPACE

GENERAL

There are two navigational requirements for aircraft planning to fly through MNPS airspace.

– one refers to the navigation performance which should be achieved (MNPS);

– the other refers to the need to carry standby equipment with comparable performance characteristics (as stipulated in Annex 6 Part 1 Chapter 7).

Some aircraft carry triplex equipment (eg 3 INS) and if one system fails even before take-off, the two basic requirements may still be satisfied and the flight can proceed normally. For aircraft with only two operational systems the following guidance is offered in respect of these general areas of failure.

1 **One System Fails Before Take-Off**

The pilot should consider:

(i) – delaying departure if timely repair is possible;

(ii) – planning on the special routes which have been recommended for use by aircraft suffering partial loss of navigation capability namely:

- STN/BEN – 60°N 10°W – 61°N 12° 35'W – LIMA – KF
- SNN/MAC/BEL/GOW – 57°N 10°W – 60°N 15°W – 61°N 16° 30'W – MIKE –KF
- KF – UNIFORM – 63°N 30°W – 61°N 40°W – OZN
- KF – XRAY – KK – SF – FB
- OZN – 59°N 50°W – PRAWN – KL
- OZN – 59°N 50°W – PORGY – HO
- OZN – 58°N 50°W – LOACH – YR

Subject to the following conditions:

- sufficient navigation capability remains to meet the MNPS and the requirements in Annex 6 Part 1 Chapter 7 can be met by relying on short range navaids;
- a revised flight plan is filed with the appropriate ATS unit;
- an appropriate ATC clearance is obtained;

(iii) – obtaining a clearance above or below MNPS airspace.

2 **One System Fails Before the Oceanic Boundary is Reached**

The pilot will have to consider:

(i) – Landing at a suitable aerodrome before the boundary or returning to the aerodrome of departure.

(ii) – Diverting by the special routes indicated in 1(ii) above subject to the same conditions.

(iii) – Obtaining a reclearance above or below MNPS airspace.

3 **One System Fails After the OCA Boundary is Crossed**

Once the aircraft has entered oceanic airspace the pilot should normally continue to operate the aircraft in accordance with the oceanic clearance already received, appreciating that the reliability of his total navigation system has been significantly reduced.

He should however,

- Assess the prevailing circumstances (eg performance of the second system, remaining portion of the flight in MNPS airspace etc).
- Prepare a proposal to ATC with respect of the prevailing circumstances (eg request clearance above or below MNPS airspace, turnback, obtain clearance to the special routes etc).
- Advise and consult with ATC as to the most suitable action.
- Obtain appropriate clearance prior to any deviation from oceanic clearance.

When the flight continues in accordance with its original clearance (especially if the distance ahead within MNPS airspace is considerable), the pilot should begin a special monitoring programme:

- To take special care in the operation of his remaining system taking account of the fact that his routine method of error checking is no longer available.
- To check the main and standby compass system against the information which he has available.
- To check the performance record of the remaining equipment and if doubt arises regarding the performance and/or reliability he should consider:
  - attempting visual sighting of other aircraft or their contrails which may provide a track indication;
  - calling the appropriate OAC to obtain information on aircraft adjacent to his estimated position and/or calling on VHF to establish contact with such aircraft (preferably same track/level) obtaining from them information which could be useful (drift, magnetic heading, wind details).

The Remaining System Fails After Entering MNPS Airspace

(Or the remaining system gives an indication of degradation of performance, or neither system fails completely but the system indications diverge widely and the defective system cannot be determined.)

The pilot should:

- notify ATC;
- make best use of procedures specified above relating to attempting visual sightings and establishing contact on VHF with adjacent aircraft for useful information;
- keep a special look-out for possible conflicting aircraft, and make maximum possible use of exterior lights;

- if no instructions are received from ATC within a reasonable period consider:
  - climbing or descending 500 feet if at or below FL 290 or 1000 feet if above FL 290;
  - broadcasting action on 121.5 MHz;

  and advising ATC as soon as possible.

SECTION 10 – SPECIAL PROCEDURES FOR IN-FLIGHT CONTINGENCIES

INTRODUCTION

The following procedures are intended for guidance only. Although all possible contingencies cannot be covered, they provide for such cases as inability to maintain assigned level due to weather, aircraft performance or pressurisation failure. They are applicable primarily when rapid descent, turnback, or both are required. The pilot's judgement shall determine the sequence of actions taken, having regard to the specific circumstances.

GENERAL PROCEDURES

If an aircraft is unable to continue flight in accordance with its air traffic control clearance, a revised clearance shall, whenever possible, be obtained prior to initiating any action, using the radio telephony distress or urgent signal as appropriate.

If prior clearance cannot be obtained, an air traffic control clearance shall be obtained at the earliest possible time and, in the meantime, the aircraft shall broadcast its position (including the ATS Route designator or the Track Code as appropriate) and intentions on 121.5 MHz at frequent intervals until air traffic control clearance is received.

SPECIAL PROCEDURES

Initial Action

If unable to comply with the above provisions, the aircraft should leave its assigned route or track by turning 90° to the right or left whenever this is possible. The direction of the turn should be determined by the position of the aircraft relative to any organised route or track system (eg whether the aircraft is outside, at the edge of, or within the system), the levels allocated to adjacent routes or tracks and if appropriate terrain clearance.

Subsequent Action

An aircraft able to maintain its assigned level should:

(a) if above FL 290, climb or descend 1000 ft (300 m);

(b) if below FL 290, climb or descend 500 ft (150 m);

(c) if at FL 290, climb 1000 ft (300 m) or descend 500 ft (150 m),

while acquiring and maintaining in either direction a track laterally separated by 30 nm from its assigned route or track.

An aircraft not able to maintain its assigned level should start its descent while turning to acquire in either direction a track laterally separated by 30 nm from its assigned route or track. For subsequent level flight a level should be selected which differs from those normally used by 1000 ft if above FL 290 or by 500 ft if below FL 290.

SECTION 11 – MNPS CROSS-CHECK PROCEDURES

INTRODUCTION

The aircraft navigation systems necessary for flying in the NAT MNPS Airspace are capable of a high standard of performance; in order to complement these, it is essential to have stringent routines of navigational cross-checking procedures. The following material offers guidance on the use of INS and Omega navigation systems which should assist in maintaining an overall high standard of performance, and thus of safety. Although there are several references in this material to 'two pilots' bear in mind that to the extent practical a third crew member should be involved in all cross-check procedures.

THE USE OF A MASTER DOCUMENT

The navigation procedures must include the establishment of some form of master working document to be used on the flight deck. This document may be based upon the flight plan, navigation log, or other suitable document which lists sequentially the waypoints defining the routes, the tracks and distances between each waypoint, and other information relevant to navigation along the cleared track. When mentioned subsequently in this guidance material, this document will be referred to as the 'master document'.

Misuse of the master document can result in gross navigation errors being made and for this reason strict procedures regarding its use should be established. These procedures should include the following:

Only one copy of the master document should be used in the cockpit. (If more than one copy is provided, one may be altered to reflect reclearance and/or other relevant amendments but the other may not. Subsequently the unaltered copy may be used to extract navigational data which results in an unintentional deviation from the current cleared track.)

A waypoint numbering sequence should be established from the outset of the flight and entered on the master document. The identical numbering sequence should be used in storing waypoints in the navigation computers.

An appropriate symbology should be adopted to indicate the status of each waypoint listed on the master document. Following is a typical example routine:

(i) The waypoint number is entered against the relevant waypoint co-ordinates to indicate that the waypoint has been inserted in the navigation computers.

(ii) The waypoint number is circled, to signify that insertion of the correct co-ordinates in the navigation computers have been double-checked independently by another crew member.

(iii) The circled waypoint number is ticked, to signify that the relevant track and distance information has been double-checked.

(iv) The circled waypoint number is crossed out, to signify that the aircraft has overflown the waypoint concerned.

All navigational information appearing on the master document must be checked against the best available prime source data. When an ATC track change is received or the ATC clearance is otherwise updated, the master document must be updated accordingly. Old waypoints should be clearly crossed out and the updated ones entered in their place.

When ATC clearances or reclearances are being obtained headsets should be worn, because the inferior clarity of loud-speakers has been known to result in mistakes. Two qualified crew members should monitor such clearances, one of them recording the clearance on the master document as it is received, the other checking the receipt and read-back. All waypoint co-ordinates should be read back in detail (except where approved local procedures make this unnecessary under the circumstances that the cleared track coincides with the filed ATC track, in which case each detail of this must be cross-checked with the master document and, if appropriate, the track message).

POSITION PLOTTING

It is very helpful for crews to use a simple plotting chart to provide themselves with a visual presentation of the intended route which, otherwise, is defined only in terms of navigational co-ordinates. Merely plotting the intended route on such a chart may reveal errors and discrepancies in the navigational co-ordinates which can then be corrected immediately, before they reveal themselves in terms of a deviation from the ATC-cleared route. As the flight progresses, plotting the aircraft's position on this chart approximately 10 min after passing each waypoint will also serve the purpose of navigation cross check, provided that the graticule is legible.

As the flight progresses in Oceanic airspace, plotting the aircraft's position on this chart will help to confirm (when it falls precisely on track) that the flight is proceeding in accordance with its clearance. But if the plotted position is laterally offset, the flight may be deviating unintentionally, and this possibility should be investigated at once.

RELIEF CREW MEMBERS

Flight crews conducting very long range operations may include an extra relief pilot. In such cases it is necessary to ensure that the navigational procedures are such that the continuity of the operation is not interrupted, particularly in respect of the handling and treatment of the navigational information.

SYSTEM ALIGNMENT

The alignment of INS must be completed and the equipment switched to the NAV mode prior to releasing the parking brake at the ramp for push-back, this takes approximately 15 minutes, but can be longer. There are various ways of ensuring that there is adequate time for this including, for example, the following:

(i) have the first crew member on the flight deck (often the crew member responsible for aircraft fuelling) place the system(s) in the align mode as soon as practicable;

(ii) at short transit stops leave the equipment in NAV provided that system (radial) errors are not so large as to require INS re-alignment. The decision to re-align may depend on the size of the error as well as the length and nature of the next leg;

(iii) note that INS batteries usually have a limited life (15 minutes in typical cases) and cannot be recharged on board if allowed to run down. Therefore, if the INS is left in NAV during a transit stop, or if the INS has been switched on for alignment, it is imperative that an individual be responsible for monitoring ground power interruptions. Note also that some INS provide overheat protection in STBY and ALIGN but not in other modes, so that during transits at tropical terminals with this equipment, the mode selector should be put directly (ie not through STBY because that would initiate re-alignment) to ALIGN.

In the absence of abnormally high radio noise levels, the synchronisation of Omega usually takes only a minute or so after switch on. At certain ramp or gate positions, however, particularly those where metal structures interfere with Omega signals, synchronisation may take longer or the inserted ramp co-ordinates may drift after insertion. Interference from ground vehicles, such as baggage trucks, can have a similar effect. Synchronisation or DR Warning lights usually indicate this situation. If the Omega equipment is serviceable the problem normally disappears shortly after the equipment is switched to aircraft power or the aircraft is moved, but it is good practice to check POS co-ordinates immediately before take-off and if necessary make a correction.

THE INITIAL INSERTION OF LATITUDE AND LONGITUDE

Early in the course of the pre-flight checking procedures, the aircraft's present position (POS) should be loaded into the INS. This position must be checked against an authoritative reference source before insertion. Any latitude error in the initial position will introduce a systematic error into the calculations and cannot be removed in flight by updating the resulting erroneous indications of POS. Correct insertion of POS must therefore be checked before the ALIGN mode is selected, and the inserted POS recorded in the Flight Log or master document. Subsequently, silent checks of POS should be carried out independently by both pilots during an early stage of their pre-flight checks.

With regard to the insertion whilst on the ramp of the initial co-ordinates, the following points should be taken into account:

(i) in the case of some INS systems, insertion errors exceeding about one degree of latitude will illuminate a malfunction light. It should be noted that very few systems provide protection against longitude insertion errors;

(ii) at all times but particularly in the vicinity of the equator or the prime meridian, care should be taken to ensure that the co-ordinates previously inserted are correct.

LOADING OF INITIAL WAYPOINTS

The entry of waypoint data into the navigation systems must be a co-ordinated operation by two persons, working in sequence and independently: one should key in and insert the data and subsequently, the other should recall it and confirm it against source information. It is not sufficient for one crew member just to observe another crew member inserting the data.

Waypoint 1 should be used for the ramp position of the aircraft. At least two additional waypoints, and if possible all the waypoints relevant to the flight, should be loaded while the aircraft is at the ramp. However, it is most important to ensure that the second waypoint is inserted accurately, rather than to endeavour to load the maximum number of waypoints. In this regard, the second waypoint should be associated with the first significant position along the route (approximately 100 nm from the departure point) and positions associated with ATC SIDs should not normally be used for this purpose.

During flight, at least two current waypoints beyond the sector being navigated should be maintained in the CDU until the destination ramp co-ordinates are loaded. The two pilots should be responsible for loading, recalling and checking the accuracy of the inserted waypoints, one loading and the other recalling and checking them independently. Where remote loading of the units is possible, this permits one pilot to cross-check additionally that the data inserted by the other is accurate. In neither case should this process be permitted to engage the attention of both pilots simultaneously during the flight.

An alternative and acceptable procedure is for the two pilots silently and independently to load their own initial waypoints and then cross-check them. The pilot responsible for carrying out the verification should work from the CDU display to the master document rather than in the opposite direction. This may lessen the risk of his 'seeing what he expects to see' rather than what is actually displayed.

After the initial waypoints have been loaded the initial track (between waypoints 1 and 2) and AUTO track change should be selected.

FLIGHT PLAN CHECK

The purpose of this check is to ensure complete compatibility between the master document and the programming of the self-contained navigation systems.

(i) DIS/TIME should be selected to check that the correct distance from the ramp position to waypoint 2 is indicated. An appropriate allowance may have to be considered at this point since the great circle distance shown on the CDUs may be less than the flight plan as a consequence of the additional mileage involved in ATC SIDs. However, if there is significant disagreement, POS and waypoint 2 co-ordinates should be re-checked.

(ii) Select REMOTE and track change 1–2 and check the accuracy of the indicated distance against that listed in the master document.

(iii) Select DSRTK and check that the desired track indicated on the CDU is as listed in the master document. This track check will reveal any errors made in the latitude or longitude designators (ie north/south or east/west) of the aircraft's ramp position.

(iv) Similar track and distance checks should be carried out for subsequent pairs of waypoints and any discrepancies between the master document and the CDU indications checked for possible waypoint insertion errors. These checks can be co-ordinated between the two pilots against the information in the master document.

(v) When each leg of the flight has been checked in this manner it should be annotated on the master document by means of a suitable symbology as previously suggested.

LEAVING THE RAMP

If the aircraft is moved prior to the NAV mode being initiated, inertial navigation systems must be realigned. In this event, the aircraft should be relocated where it will not block the gate position or otherwise interfere with airport traffic while the realignment is being carried out.

After leaving the ramp, INS groundspeeds should be checked (a significantly erroneous reading may indicate a faulty or less reliable unit). A check should be made on the malfunction codes whilst the aircraft is stopped but after it has taxied at least part of the way to the take-off position; any significant ground-speed indication whilst stationary may indicate a faulty unit such as a tilted platform. This check does not normally apply in the case of Omega because generally speaking such equipment is inhibited from providing a speed indication until the aircraft is airborne. Omega present position co-ordinates should be checked before take-off if there has been any possibility of error induced by signal interference.

IN-FLIGHT

If the initial part of the flight is conducted along airways, the airways facilities should be used as the primary navigational aids and the aircraft navigation systems monitored, in order to ascertain which system is giving the most accurate performance.

ATC OCEANIC CLEARANCE

As a general rule, two flight crew members, preferably the two pilots, should listen to and record every ATC clearance and both agree that the recording is correct. Any doubt should be resolved by requesting clarification from ATC.

If the ATC clearance is identical to the flight-planned track, it should be depicted on the plotting chart, as previously mentioned. If the aircraft is cleared by ATC on a different track from that flight planned, then:

(i) it is necessary to prepare an updated master document. For this purpose, one flight crew member should provide the other with track and distance data between the revised waypoints for insertion in the master document. An INS cruise data card or form may be used, the required data being extracted from the route manual;

(ii) the initial track information should be rendered unusable both on the master document and on the plotting chart in order to prevent inadvertent misuse at a later stage.

APPROACHING THE OCEAN

In the event of significant impairment of navigational capability, it should be understood by all concerned that the aircraft should not enter the MNPSA if it is no longer able to meet the navigational requirements.

Prior to entering the oceanic area, the aircraft's position should be checked as accurately as possible by means of external navigational aids, in order to ascertain the preferred aircraft navigation system to be used for the ocean crossing. This may perhaps necessitate DME/DME, DME/VOR checks at which stage navigation system errors can be determined by comparison of displayed and actual position. There are other means of carrying out such a check eg flying directly over a VOR or NDB. In the event of a significant discrepancy (eg greater than 6 nm) the question of whether the affected navigation system should be updated may be given cautious consideration. Updating is not normally recommended where the discrepancy is less than 6 nm. If it is decided to update the system, the proper procedures should be carried out in accordance with a prepared checklist. The duration of the flight prior to the oceanic boundary and the accuracy of the external navigational facility should be taken into consideration when determining the advisability of updating the aircraft's navigation system. For example, an NDB would not be considered satisfactory for the purpose, unless care is taken to track directly overhead the facility.

The navigation system which has performed most accurately since departure should be selected for autocoupling.

In view of the importance of following the correct track in Oceanic airspace, some operators advise that at this stage of the flight the third pilot or equivalent crew member should check the clearance waypoints which have been inserted into the CDU, using source information such as the track message when applicable.

OCEANIC BOUNDARY POSITION REPORT

Just prior to the oceanic boundary and, indeed, just before any waypoint, the present position co-ordinates should be monitored, recorded and verified, and the co-ordinates for the next waypoint monitored and verified. Thus, when the CDU alert light indicates, the crew should get ready to note and record the aircraft's present position on the master document. This should be verified against the current effective clearance on the master document. The waypoint number on the master document should be annotated with the appropriate symbol to indicate that it has in fact been verified.

If the oceanic boundary position report is made over a VOR facility, the appropriate radial to the first oceanic waypoint should be selected as a further check that the aircraft navigation system is tracking in accordance with the current effective clearance. If DME is also available, a distance check can be carried out as well.

AT AN OCEANIC WAYPOINT

Co-ordinates of the next two waypoints should be verified against the master document, as suggested earlier. When sending the ATC position report, the co-ordinates should be copied from the master document or alternatively the present position and the next two forward positions can be read from the CDU.

As soon as the waypoint alert light illuminates, the present position co-ordinates of each navigation system should be checked against the current clearance, to ensure that the intended aircraft position report to ATC coincides with the actual position of the aircraft and the ATC clearance. Overhead the waypoint, the pilots should observe that the aircraft turns in the correct direction and takes up a new heading appropriate to the leg to the next waypoint. The co-ordinates of the next waypoint should be verified against the master document as previously described. After the ATC position report has been sent, the present position of the aircraft should be plotted on the pilot chart to ensure that it is tracking as intended. At this stage also, the crew should be particularly alert in maintaining SELCAL watch, in view of possible ATC follow-up of the position report.

ROUTINE MONITORING

It is important to remember that there are a number of ways in which the autopilot may unobtrusively become disconnected from the command mode, therefore regular checks of correct engagement should be made.

Although it is common practice to display DIS/TIME, it is recommended that the navigation system coupled to the autopilot should display the present position co-ordinates throughout the flight. If these are then plotted on the pilot chart at approximately 20 min intervals, they will provide confirmation at regular intervals that the aircraft is tracking in accordance with its ATC clearance. Distance-to-go information should be available on the instrument panel as previously mentioned, while the waypoint alert light provides a reminder of the imminence of the waypoint.

If, as an alternative, position check and verification is being made both at each waypoint and 10 minutes after each waypoint, then an additional plot 20 minutes later may perhaps be considered counter-productive as a normal routine. Even so there may be circumstances (eg when the flight is down to one system only) justifying the procedure.

The navigation system not being used to steer the aircraft should display cross-track distance (XTK) and track angle error (TKE). These should be monitored, with XTK being displayed on the HSI where feasible.

Where there is a discrepancy between the information provided by two navigation systems the procedures detailed on page 38 under the heading 'Method of determining which system is faulty' should be applied.

APPROACHING LANDFALL

When the aircraft is approaching the first landfall navaid, it should acquire the appropriate inbound radial as soon as the flight crew is confident that the landfall navaid is providing reliable navigation information. The aircraft should then be flown to track, by means of radio navigation, overhead the facility which thus becomes the primary navigational guidance after leaving the oceanic area (eg for 'direct' clearance overland). Consideration should be given to updating the navigation system overhead the landfall fix, utilising the appropriate procedures from a checklist.

NAVIGATION SYSTEM ACCURACY CHECK

At the end of each flight, an evaluation of accuracy of the aircraft's navigation systems should be carried out, in order to facilitate correction of out-of-tolerance performance. One such accuracy check, carried out when the aircraft has reached its parking position, is to remove any updates which may have been made during the flight, and then to determine the radial error at the ramp position. Radial errors in excess of 2 nm per hour are generally considered excessive.

Records should be kept of aircraft navigation systems performance.

SOME SPECIAL CASES

Monitoring during distractions from routine

Training and drills should ensure that minor emergencies or interruptions to normal routine are not allowed to distract the crew to the extent that the navigation system is mishandled.

If during flight the auto pilot is disconnected (eg because of turbulence), care must be taken when the A/P is re-engaged to ensure that the correct procedure is followed (if the system in use sets a specific value on the boundary of automatic capture, the across-track indications should be monitored to ensure recapture of the programmed flight path). It is important to remember that there are a number of ways in which the autopilot may unobtrusively become disconnected from the command mode.

Avoiding confusion between magnetic and true

To cover all navigation requirements, some airlines now produce flight plans giving both magnetic and/or true tracks (courses). However, especially if crews are changing to a new system, there is a risk that at some stage (eg partial system failure, reclearances, etc), confusion may arise in selecting the correct values. Operators should therefore devise drills which will reduce this risk, as well as ensuring that the subject is covered during training.

Crews who decide to check or up-date their long-range navigation systems by reference to VORs should remember that in the Canadian Northern Control Area these are not aligned with reference to magnetic north.

Navigation in the area of compass unreliability

NOTE: Full coverage of this subject, including for instance the possible provision of runway headings in grid is beyond the scope of this document. The following should therefore be considered as general guidance only.

In the above area basic INS operation requires no special procedures, but most operators feel it is desirable to retain an independent heading reference in case INS failure occurs. There are various possible ways of doing this, dependent on the instrumentation fit.

Omega requires heading input from an external source. Different manufacturers may offer their own solutions to the special problems existing in the areas of compass unreliability. Such solutions should not however involve the use of charts or manual measurement of direction.

Deliberate deviation from track

Deliberate temporary deviations from track are sometimes necessary, usually to avoid severe weather; under normal circumstances, *ATC approval should be obtained.* Such deviations have often been the source of gross errors as a consequence of failing to re-engage the autopilot with the navigation system. It should also be noted that selection of the 'turbulence' mode of the autopilot will also have the effect of disengaging it from the aircraft navigation system. Therefore, after use of the turbulence mode, the aircraft must be flown back to the desired track before re-engaging the autopilot with the navigation system.

The following procedures have been found effective in ensuring that gross navigational errors do not result from diversions around severe weather:

(i) the autopilot turn control knob is used to turn the aircraft in the desired direction;

(ii) the 'autopilot engage' switch will automatically move from 'command' to 'manual'. (The altitude mode switch will either remain in 'altitude hold' or if in the 'altitude select' mode will trip to 'off'.);

(iii) the steering CDU display selector is set to XTK TKE, in order to provide a continuous display of crosstrack data;

(iv) if turbulence is encountered, the 'TURB' setting on the speed mode selector may be used in which case the altitude mode switch will automatically position to 'off';

(v) both RADIO INS switches remain in the INS position. This provides another visual display of the navigation situation on the HSI. Even when more than 8 nm off track the pegged needle on the HSI is a reminder of that fact, in addition to which it will confirm whether the aircraft is tracking towards, away from, or parallel to the desired track;

(vi) the turn control knob should be used to manoeuvre the aircraft as necessary;

(vii) when clear of the severe weather, the aircraft should be steered back to the desired track, guidance being obtained from the steering CDU to zero the XTK indication;

(viii) when the aircraft has been returned to the desired track, the autopilot engage switch is selected to 'command' and the altitude mode switch to 'altitude hold'. (The navigation mode selector should still be in the INS position.);

(ix) it is desirable that the entire crew, but at least the Captain and First Officer, monitor the diversion manoeuvre, to ensure that the aircraft has been returned to the desired track and the autopilot properly re-engaged for command INS operation;

(x) after return to track has been completed check assigned Mach Number *and advise ATC.*

ATC Reclearance

Experience suggests that when ATC issues a reclearance involving re-routeing and new waypoints, there is resultant considerable increase in the risk of errors being made. Therefore, this situation should be treated virtually as the start of a new flight, and the procedures employed with respect of copying the ATC reclearance, amending the master document, loading and checking waypoints, extracting and verifying flight plan information, tracks and distances, etc, and the preparation of a new pilot chart should be identical to the procedures employed at the beginning of a flight. However, when an in-flight reclearance is involved, the procedures should be such that one pilot is designated at all times to be responsible for flying the aircraft while the reprogramming of all navigation systems and other amendments to the cockpit documentation are being carried out.

In the event that the reclearance involves a direct routeing, it may be advisable to retain data relevant to the original route in case, as has occurred, the aircraft is required by ATC to revert to its original route.

ADVANCE PLANNING FOR THE DETECTION OF SYSTEM DEGRADATION, AND SUBSEQUENT ACTIONS

The detection of failures

INS and Omega installations normally include comparator and/or warning devices, but it is still necessary for the crew to make frequent comparison checks. With three systems on board the identification of a defective system should be straightforward, although it should be noted that during the acceleration phases of flight Omega groundspeed indications (unless overridden by some form of rate-aiding) are likely to be less accurate than INS and should not be used in comparison checks.

With only two systems on board experience indicates that if nothing is done by the crew until significant divergent indications become apparent, the possibility of identifying the defective unit will be very much reduced. If such a situation does in fact arise in Oceanic airspace it may be possible to contact nearby aircraft on VHF and obtain the read-out of spot wind (or if aircraft are going in the same direction, drift and ground speed) making use of this information to identify the defective system.

However, in many cases the above may be impractical. For that reason it is recommended that a regular record of INS and Omega performance should be maintained and kept available on board for operating crews, in line with the following suggestions:

(i) before take-off and while stationary, note the INS ground speed and POS or the Omega POS indications. These may give some indication of relative system accuracy;

(ii) the accuracy of each unit (INS or Omega) should be noted before reaching Oceanic airspace, preferably when passing some convenient short-range facility. A further record should be made at destination (in the case of INS) in terms of terminal error, first taking care to cancel any in-flight update which may have been made;

(iii) compass deviation check (with INS only). The intent is to obtain deviation values for the magnetic compass systems, so that, if necessary later in the flight, the relative accuracy of INS heading outputs (and navigation data) can be checked. Though slightly

complex to write up, the method is simple and potentially valuable in practice, and it has the additional advantage of reminding crews of some basic elements of navigation. Prior to entering Oceanic airspace simultaneously read both INS true heading and both magnetic compass indications. To the mean of the INS readings apply the local variation value to give magnetic heading. Compare this value with the magnetic heading compass readings to obtain the deviation on each and retain for possible use in the 'heading method' of determining which system is faulty. (See last paragraph below.)

Method of determining which system is faulty

Check malfunction codes for indications of unserviceability.

By referring to the records suggested above (under subparagraphs (i) and (ii)). These give a fairly positive clue as to which system is faulty.

By obtaining a fix. It may be possible to use the weather radar (range marks and relative bearing lines) to determine the position relative to an identifiable landmark such as an island; or the ADF to obtain bearings from a suitable NDB, in which case the variation at the position of the aircraft should be used to convert the RMI bearings to true; or if within range, the VOR, in which case the variation of the VOR location should be used to convert the radial to a true heading (except when flying in the Canadian Northern Control area).

By calling some nearby aircraft on VHF, and comparing information on spot wind, or ground speed and drift. If such assistance is not available, the wind speed and direction for the DR position of the aircraft may be extracted from the prognostic chart for comparison with the readout of INS or Omega. However, it is emphasised that the latter comparison should only be used as a last resort and preferably in conjunction with another method to confirm the result.

By the heading method (INS only). Simultaneously read both INS and both magnetic compass indications. Apply the respective deviation and the local variation value to each compass reading and obtain the mean (to the nearest degree). This should give an acceptably accurate true heading value to compare with the INS readings and to establish whether one of the IN units is defective. The following pro-forma, with typical values inserted, may assist flight crews with limited navigation experience:

Before entering Oceanic Airspace

	**1 INS*	**2 INS*	**1 Comp*	**2 Comp*
Heading	285.7°	286.1°	290°	293°
Mean True Heading (nearest degree)	286°			
Variation (E−) (W+)	6°			
	292°		Dev'n 2°E	1°W

If INS performance check required later in flight

	**1 INS*	**2 INS*	**1 Comp*	**2 Comp*
Heading	254°	259°	265°	266°
Deviation (E+) (W−)			2°E	1°W
			267	265
Variation (E+) (W−)			12°W	12°W
			255°	253°
Mean TH			254°	

(The above indicates that the navigation information provided by *1 INS is likely to be more accurate.)

What to do if the faulty system cannot be identified

Despite the above methods, the occasion may still arise when distance or across track differences develop between two INS or Omega systems, but the crew cannot determine which system is at fault. The majority of airlines feel that the procedure most likely to limit gross tracking errors under such circumstances is to fly the aircraft half way between the cross track differences as long as the uncertainty exists. In such instance ATC should be advised that the flight is experiencing navigation difficulties so that appropriate airspace clearance can be effected if necessary.

Guidance on what constitutes a failed system

Crews also require some guide lines on how to decide when an INS or Omega should be considered to have failed, eg failure of INS may be indicated by the red warning light, or by self diagnosis indications, or by an error over a known position exceeding the value agreed between an operator and its certifying authority. As a generalisation, if there is a difference greater than 15 nm between the two aircraft navigation systems (or between the three systems if it is not possible to detect which are the more reliable) it is advisable to split the difference between the readings when determining the aircraft's position. However, if the disparity exceeds 25 nm one or more of the navigation systems should be regarded as having failed, in which case *ATC should be notified.*

In the case of ONS, estimates of position error are easier to determine since it is probable that the system using the greater number of ground stations will be more reliable. Omega failure may also be shown by a red warning light or by BITE (Build in Test Equipment) indications.

SECTION 12 – A CHECK LIST FOR PILOTS NOT FAMILIAR WITH OPERATIONS IN NAT MNPS AIRSPACE

For the attention of pilots flying jet aircraft across the North Atlantic

Between FL 275 and FL 400 a considerable area of the North Atlantic is designated as Minimum Navigation Performance Specification Airspace. Unless the operation has been certificated by your State of Registry, you should not fly in the MNPSA which at present extends from 27°N to the Geographic North Pole.

To assist those pilots who are less familiar with operating in the area, the following short check list has been prepared:

1 Are you sure that your State of Registry has granted MNPS approval to this flight?

2 Assuming that it has, have you put capital X in Item 10 of your flight plan?

3 If you are intending to follow an organised track, and bearing in mind that the OTS changes every 12 hours, have you got a copy of the valid track message?

4 Are you familiar with the Mach Number technique?

5 Have you had an accurate time check, and do you have a reliable timepiece on the flight deck?

6 If using OMEGA, have you checked the latest NOTAMs regarding the serviceability of OMEGA (and VLF Stations if appropriate)?

7 If flying via the special Greenland/Iceland routes, have you checked the serviceability both of your one long range navigation facility and of the short range navigation facilities which you will use?

8 If flying other than on the special routes, are you sure of the serviceability of both your long range navigational systems?

9 Have you planned ahead for your action should you suffer a failure of one system?

If as a pilot you have any doubt about your answers to these questions, it may be necessary for you to consult with the Civil Aviation Department of your State of Registry. However, much advice is offered in the ICAO 'Guidance and Information Material Concerning Air Navigation in the NAT Region' (Fourth Edition October 1984).

L-1011

Long Range Aircraft

Differences

DELTA
AIR LINES

1/87

L-1011 AIRCRAFT DIFFERENCES

THIS BOOKLET CONTAINS

SECTION 1 DAL - 500 Differences

SECTION 2 PAA - 500 Differences

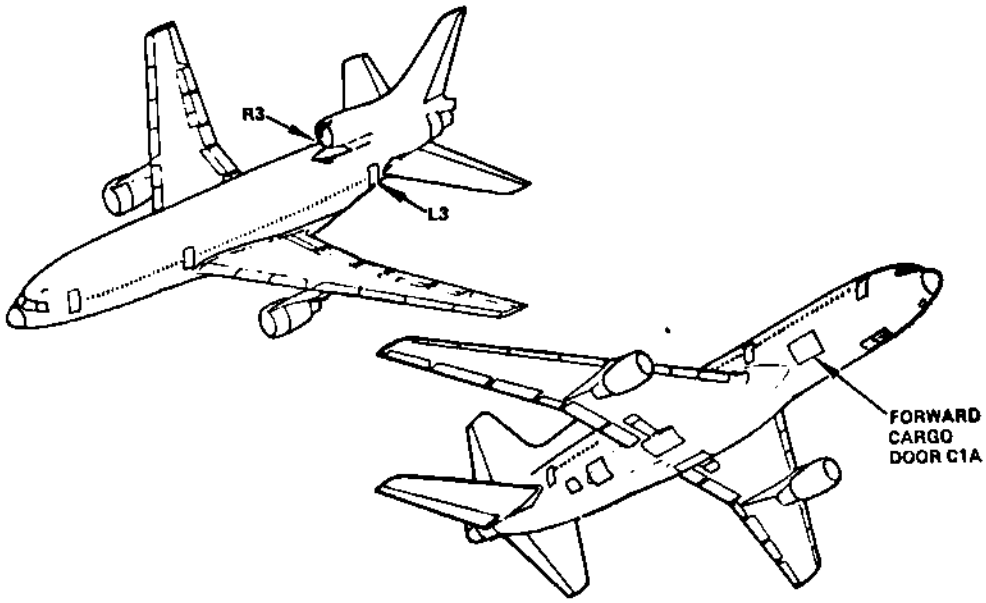
SECTION 3 Ship 724 Differences

SECTION 4 -250 Differences

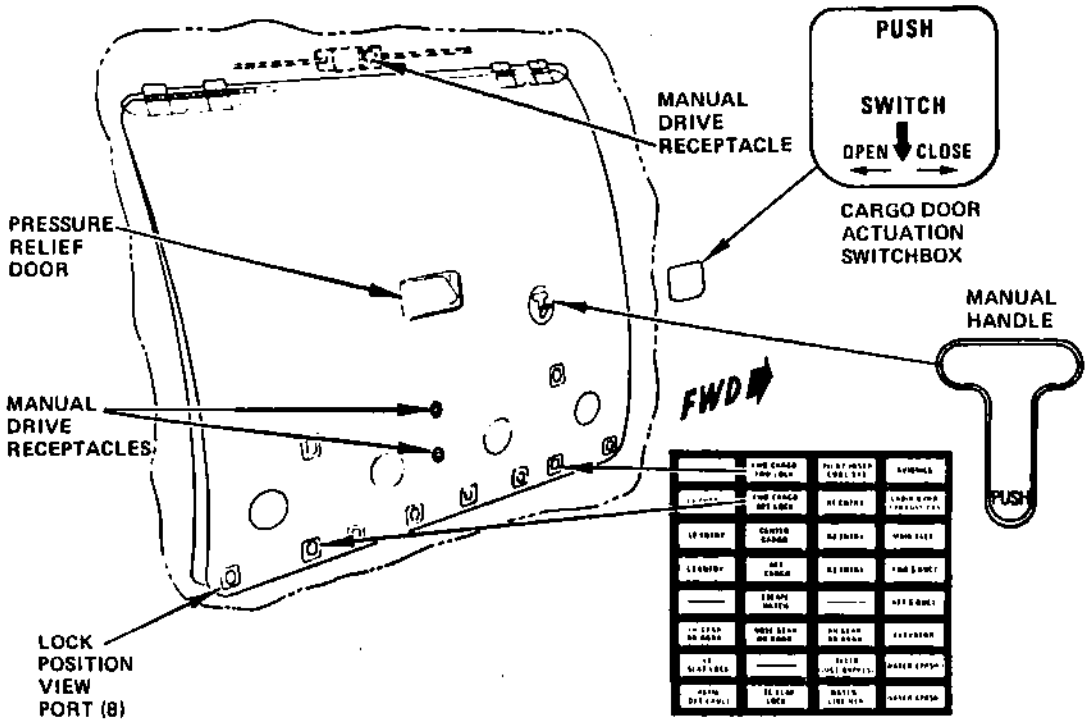
DAL

-500 Differences

DOOR LOCATIONS



C1A CARGO DOOR



DELTA -500 DIFFERENCES

AIRPLANE GENERAL

AIRCRAFT WEIGHTS - See Limitations (Blue Pages POM).

AIRCRAFT LENGTH - Shorter.

ENTRY DOORS - (3) sets instead of (4). Same operation as the forward doors on the 1- aircraft.

CARGO DOORS - Forward cargo door larger. See Limitations (Blue Pages POM).

GALLEY COMPLEXES - (3) one at each door cross-aisle. Has no lower galley or lifts.

FLIGHT ATTENDANT JUMPSEATS - (10) total, (4) single seats at the No. 1 doors, (4) single seats at the No. 2 doors, and (2) single seats at the No. 3 doors.

LAVATORIES - (8) Total, (5) in the rear, (2) in the front almost the same locations as on the -1 aircraft, and (1) aft of the No. 2 left door.

WATER TANK QUANTITY AND PRESSURE GAUGES - Located on the outside water service panel. Seen on S/O walkaround.

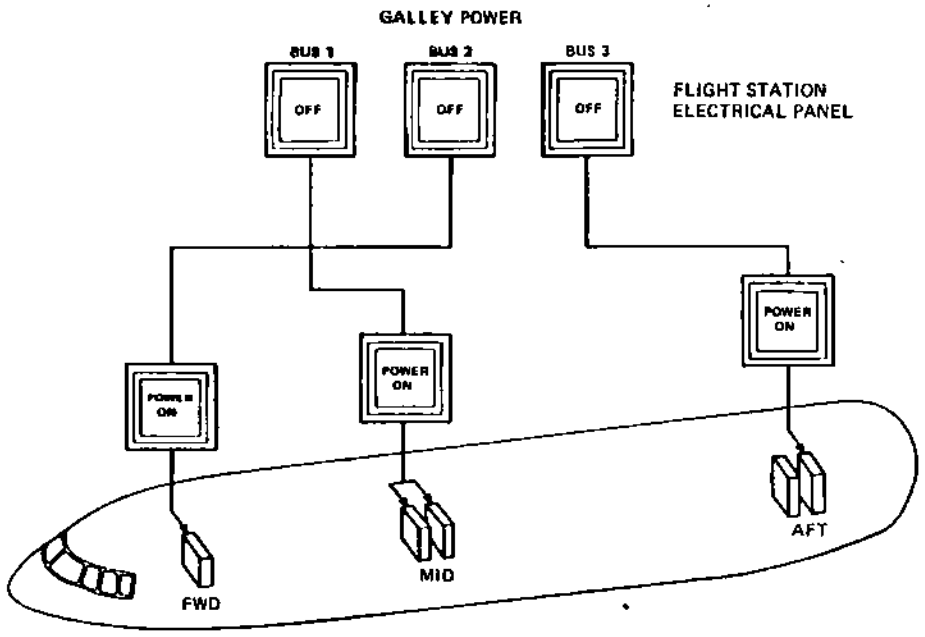
OXYGEN

Same as the -1 aircraft.

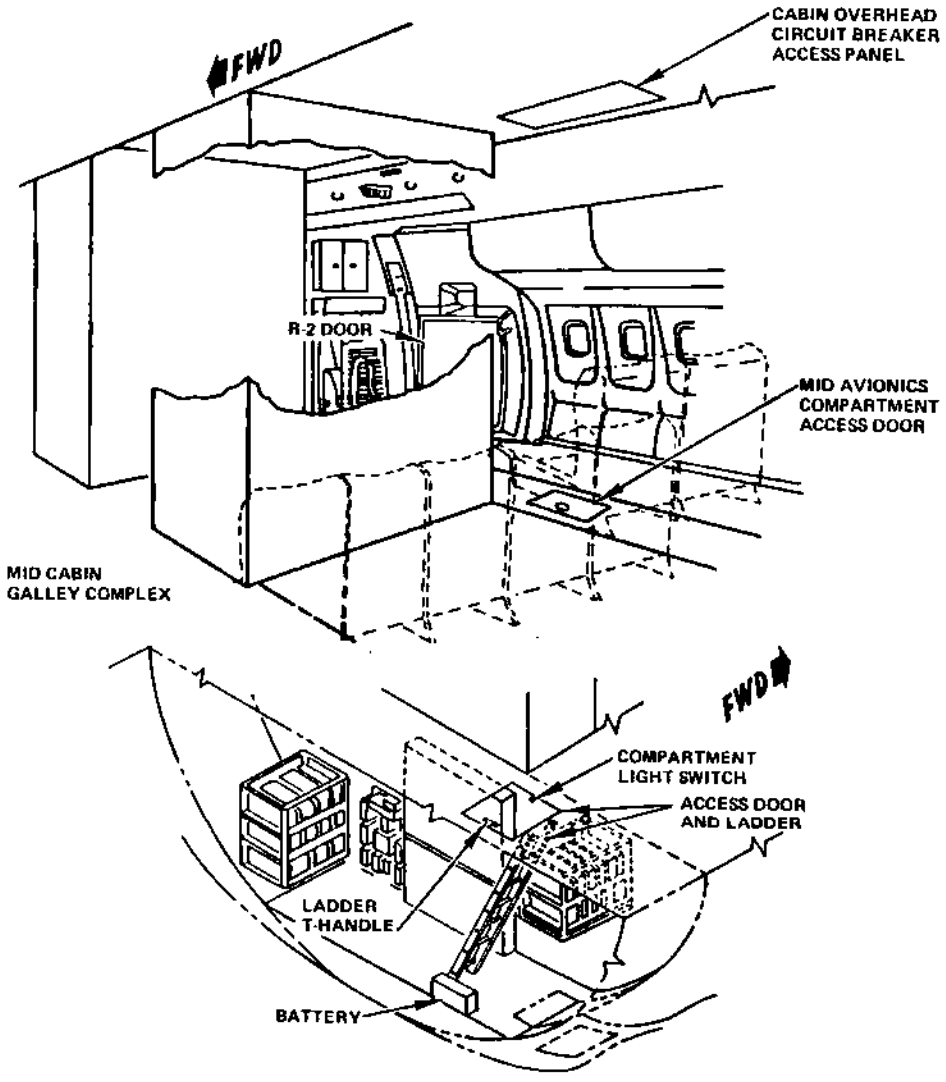
EMERGENCY EQUIPMENT

NO. 3 LEFT AND RIGHT DOOR SLIDE/RAFTS - Have 56 man slide/rafts (longer) instead of 51 man found on the -1 aircraft.

CREW PORTABLE OXYGEN BOTTLE WITH SMOKE MASK - (1) in the cockpit.



MID ELECTRICAL SERVICE CENTER



PASSENGER PORTABLE OXYGEN BOTTLES - All are the conventional O_2 type.

APU

APU air inlet duct automatically heated to reduce possibility of ice formation in inlet duct (inlet flow light).

ELECTRICAL

GALLEY POWER SWITCHES - Flight attendants have (3) switches, (1) for each galley instead of (1) for all galleys as on the -1 aircraft.

MID AVIONICS COMPARTMENT ACCESS - Is thru a hatch in the floor aft of the No. 2 right door. Open the hatch, a "T" handle on the aft bulkhead releases a ladder for compartment access. A light switch on the forward bulkhead turns on the compartment light.

NO. 4 AND 5 CIRCUIT BREAKER PANELS - Are combined into one panel in the ceiling above the mid avionics compartment access (aft of the No. 2 right door).

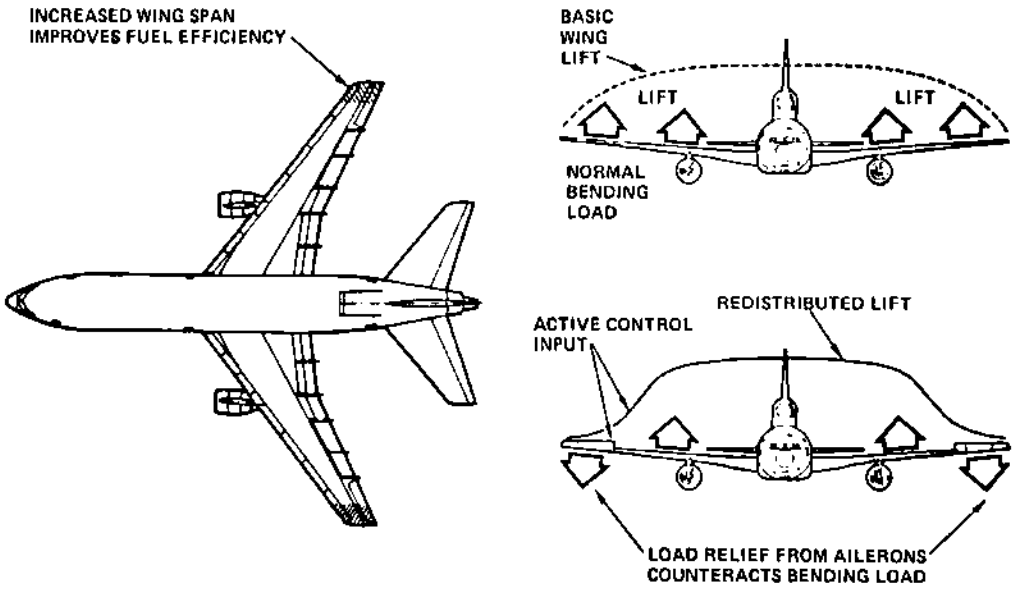
HYDRAULICS

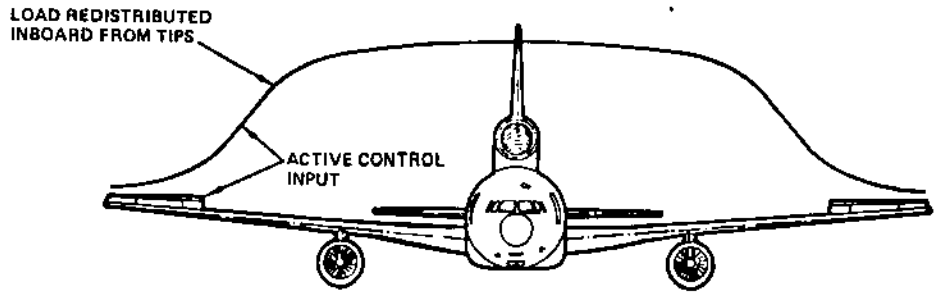
The low pressure disconnect feature of No. 2 pack is inter-locked with the "C" ATM and the "B" ATM.

LANDING GEAR

There is no tail skid on the -500.

ACTIVE CONTROL SYSTEM





FLIGHT CONTROLS

AILERONS

An Active Control System (ACS) - Is installed to reduce wing tip flexing. This is done by symmetrical up deflection and down deflection of both outbound ailerons. During normal flaps extended operations and when on the ground, both outboard ailerons are deflected up. The ailerons resume their normal position when the wing flaps are retracted in flight.

An ACS First Fail light indicates the loss of any single channel of the two dual-channel computers that has not affected channel engagement. Loss of any dual-channel computer will illuminate its fail light and the First Fail light.

See Active Control System - Limitations (Blue Pages)

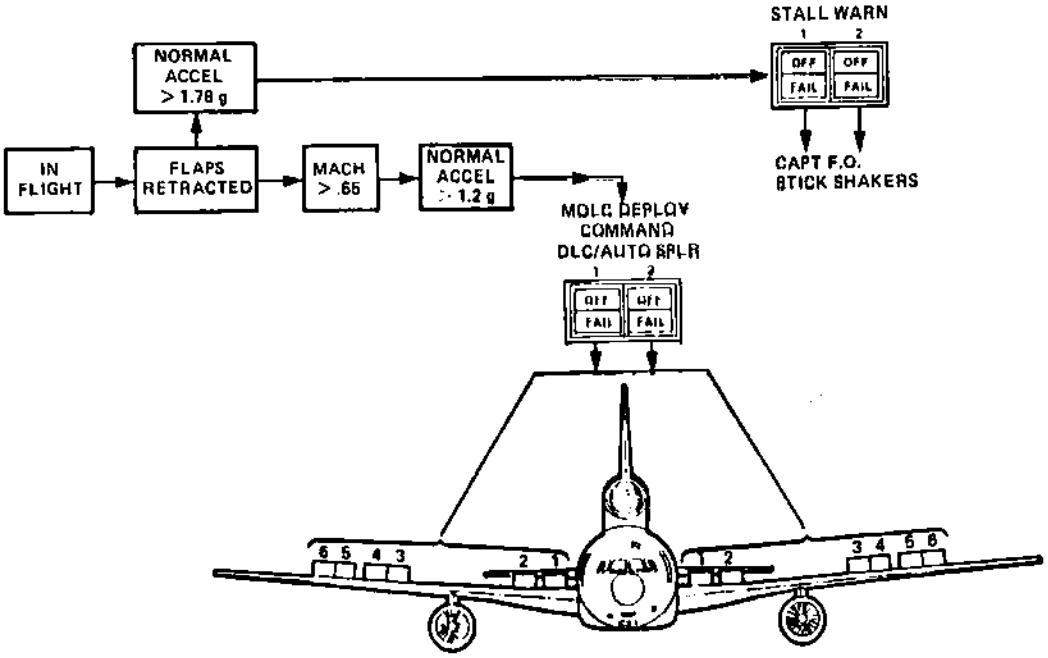
SPOILERS

SPEEDBRAKE SPOILERS - Panels 1 thru 6 provide speedbrake operation with the No. 1 panel extension stroke limited. The No. 2 & 3 panels are also stroke limited.

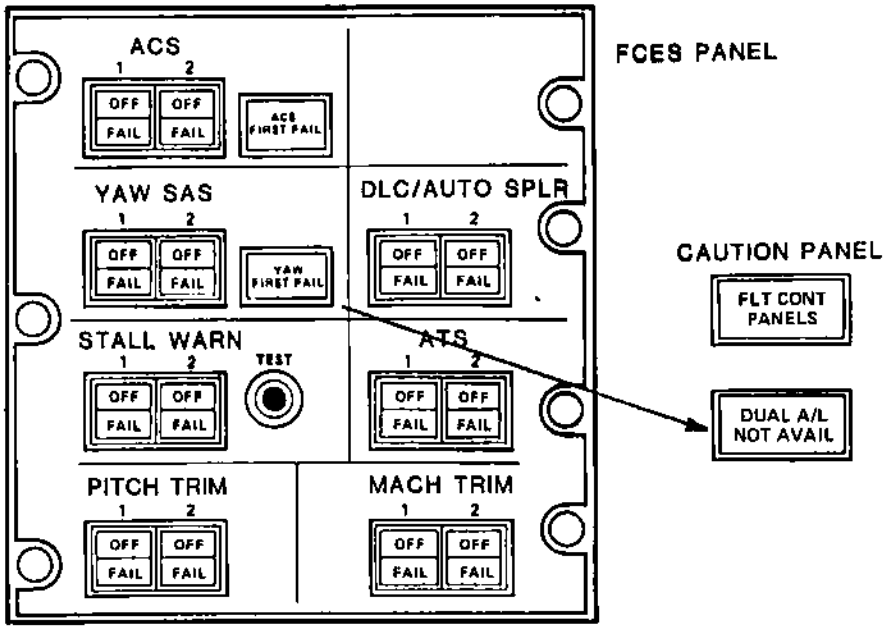
ROLL AUGMENTATION - Same as the -1 aircraft.

DLC/AGS/RTO - Same as the -1 aircraft, except, no flap operations
Panels 1 thru 6 can be deployed.

MANEUVERING DLC SPOILERS



YAW FIRST FAIL LIGHT



MANEUVERING DIRECT LIFT CONTROL - MDLC SPOILERS

PURPOSE - Is to unload wing due to G-loads.

OPERATION - With flaps retracted and speed greater than .65M, and then experience more than 1.2G's positive, spoiler panels 1 thru 6 will extend. If the G-loads increase, the spoilers will extend further. By approximately 1.78G's, spoiler panels 1 thru 6 will be extended to the maximum DLC limit. The G-sensitive stick shaker will also come on to alert the pilot that spoiler wing unloading is at its maximum limit. Any further increases in G-loads must be relieved by the pilot. As the G-loads decrease, the spoilers will automatically retract.

NOTE: The MDLC operation must be checked prior to each flight - See Limitations (Blue Pages) and Normal Procedures (Blue Pages).

NOTE: The G-Sensitive Stick Shaker must be checked piror to each flight - See Limitations (Blue Pages) and Normal Procedures (Blue Pages).

RUDDER

Hydraulic Limiting Scheduling - Is different from the -1 aircraft and Ship 724. However, the RUDDER HYDR LMTR light (on the pilot's annunciator panel) and the rudder hydraulic limiter PUSH light (on the overhead panel) function the same as on the -1 aircraft.

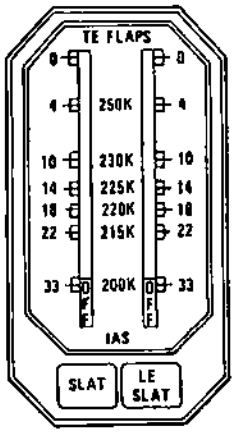
HORIZONTAL STABILIZER

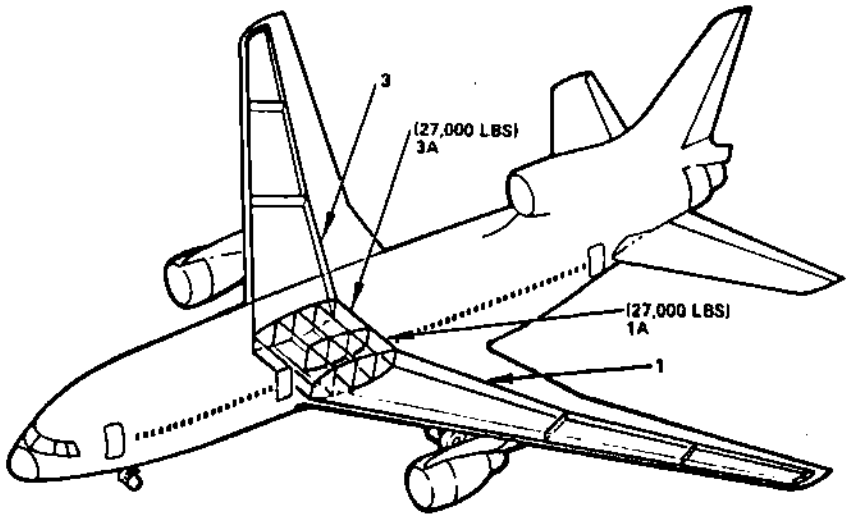
Same as the -1 aircraft.

YAW SAS

The YAW FIRST FAIL Light will illuminate the DANA light on the Pilots Annunciator Panel.

FLAP INDICATOR





--600 FUEL SYSTEM

FLAPS AND SLATS

The flap detented positions are slightly different. The flap maximum extension speeds are also different. The L.E. slat light (green) serves the dual purpose of transit (flashing), extended (steady), and retracted (dark). The Red SLAT light illuminates if the slats have not assumed the desired position (extended or retracted) within approximately 20 seconds. Normal extension-retraction takes approximately 10 to 12 seconds.

FUEL SYSTEM

GENERAL - Total fuel capacity is approximately 212,000 lbs. The center tanks will contain fuel if the total fuel load exceeds 159,600 lbs. Fuel loads less than 159,600 lbs. should not have fuel in the center tanks. If fuel is found in the center tanks with fuel loads less than 159,600 lbs., that fuel must be transferred out before takeoff or the maximum zero fuel weight reduced by the amount of unneeded fuel found in the center tanks. (See the Blue Pages Normal Procedures expanded checklist.)

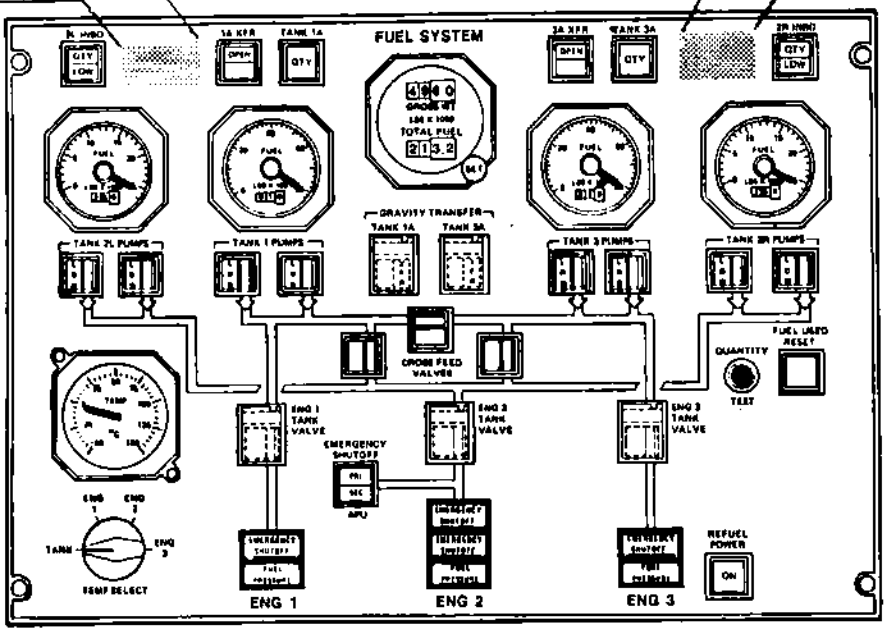
FUEL TRANSFER POLICY -500

BEGINNING AT AFTER START, LATCH THE TRANSFER SWITCHES AND LEAVE LATCHED FOR THE DURATION OF THE FLIGHT. ALSO, LEAVE AT LEAST ONE TANK BOOST PUMP SWITCH LATCHED IN THE NO. 1 AND 3 MAIN TANKS FOR THE DURATION OF THE FLIGHT. (The -500 aircraft do not have a built-in scavenge system.)

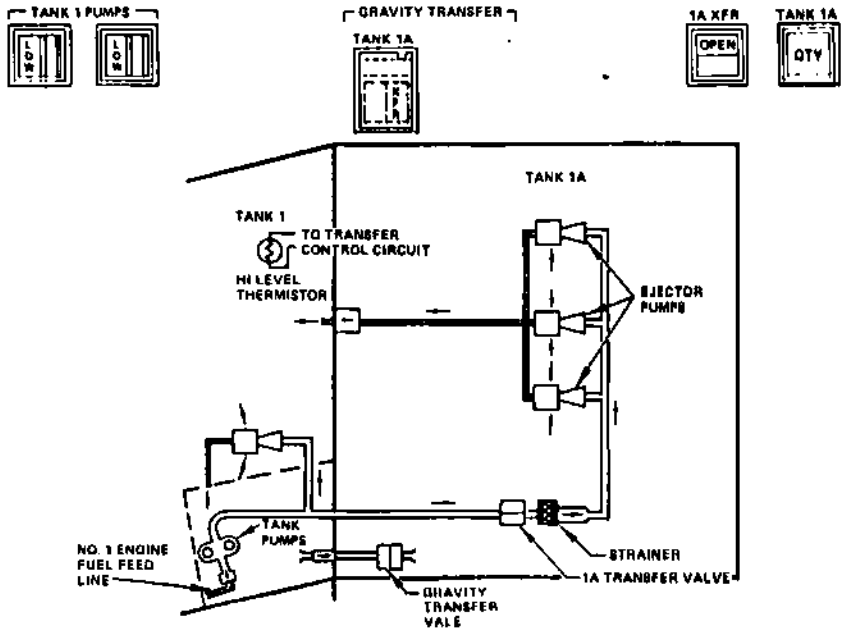
-250 / -500 AC LATCH XFR SWITCHES AFTER ENG. START AND FOR DURATION OF FLIGHT

FOR XFR SYSTEM FAILURE -- UNLATCH XFR SWITCHES AND MONITOR TANK QTY'S FOR PROPER LEVELS TO INITIATE GRAVITY XFR -- SEE PON FUEL ABNORMAL

-500 FUEL SYSTEM PANEL



-500



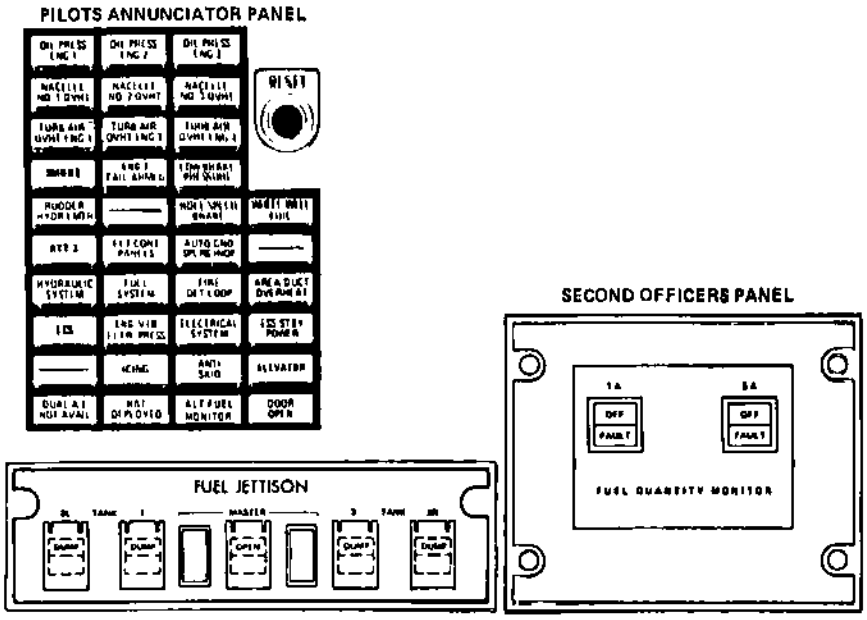
ALTERNATE (CENTER) TANK FUEL SYSTEM - The transfer switch(es) control a transfer valve that directs main tank boost pump pressure to ejector pumps (venturi devices) that moves fuel via jet pump action from the center tank into its adjacent main tank. The main tank is prevented from overfilling by a high-level thermistor that automatically closes and reopens the transfer valve. A blue disagreement light indicates the transfer valve is in transit.

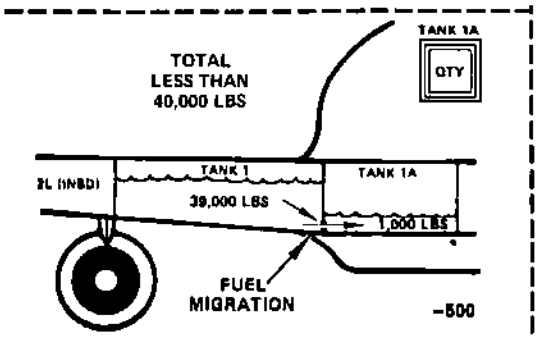
The tank 1A/3A quantity switch(es), when unlatched, will display the total fuel contained in both the center tank and its adjacent main tank on that main tank quantity gauge. Latched, the same quantity gauge will display only what is contained in the center tank.

The gravity transfer switch(es) controls a valve in the bottom low corner of the center tank. When open, fuel will flow one-way from the center tank into the adjacent main tank only if the fuel level in the main tank is equal to or lower than the level of fuel contained in the center tank. Gravity flow can equal engine demands.

The gravity transfer system is installed for use when the regular transfer system is unable to transfer fuel from the center tank into its main tank due to possible transfer valve failure, boost pump failure, ice accumulation in the transfer system plumbing, etc. The gravity transfer switch blue lights will cycle (valves open) when the master fuel jettison switch is latched for dumping fuel. This will allow the center tank to gravity flow into its respective main tank. (The main tanks dump as previously described for the -1 aircraft.)

ALTERNATE TANK FUEL MONITOR SYSTEM





CENTER FUEL TANK SCAVENGE - The -500 aircraft does not have a built-in scavenge system as is installed on Ship 724. Therefore, it is most important that the tank 1A and 3A transfer switches be latched and at least one main tank boost pump operated for the duration of the flight. This will supply the necessary fuel movement through the transfer system to prevent ice accumulation.

ALTERNATE TANK FUEL QUANTITY MONITOR SYSTEM - The fuel quantity monitoring system is to assist in early recognition of an inoperative alternate fuel transfer system, or fuel migration into a previously emptied alternate tank.

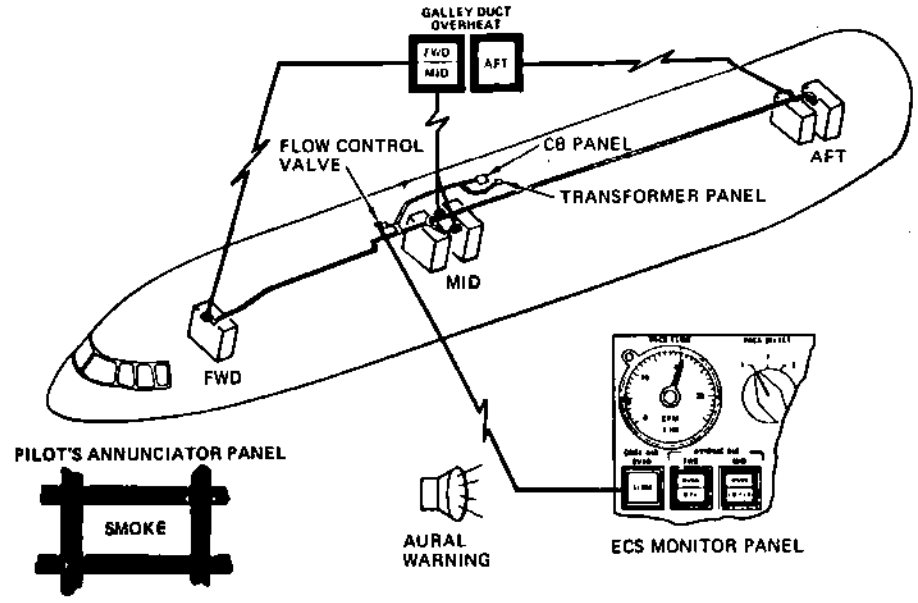
The monitor system uses fuel quantity signals to monitor the amount of fuel in the alternate (center) tank in relation to the total amount of fuel in both the main and alternate tanks. During fuel consumption, there is a point when all the fuel displayed in the No. 1 or No. 3 quantity indicators should be contained in the main tank and the alternate tank should be empty. If more than 1,000 lbs. of this total is in the alternate tank or if the alternate tank quantity increases to more than 1,000 lbs. after it has been emptied, the FAULT light(s) on the S/O's panel will illuminate. The ALT FUEL MONITOR light on the pilot's annunciator panel will also illuminate.

The fuel quantity setting to illuminate these lights is, if the main/alternate quantity is any total less than 40,000 lbs. with the respective alternate quantity more than 1,000 lbs., the lights will illuminate.
This monitor system is disabled by two actions:

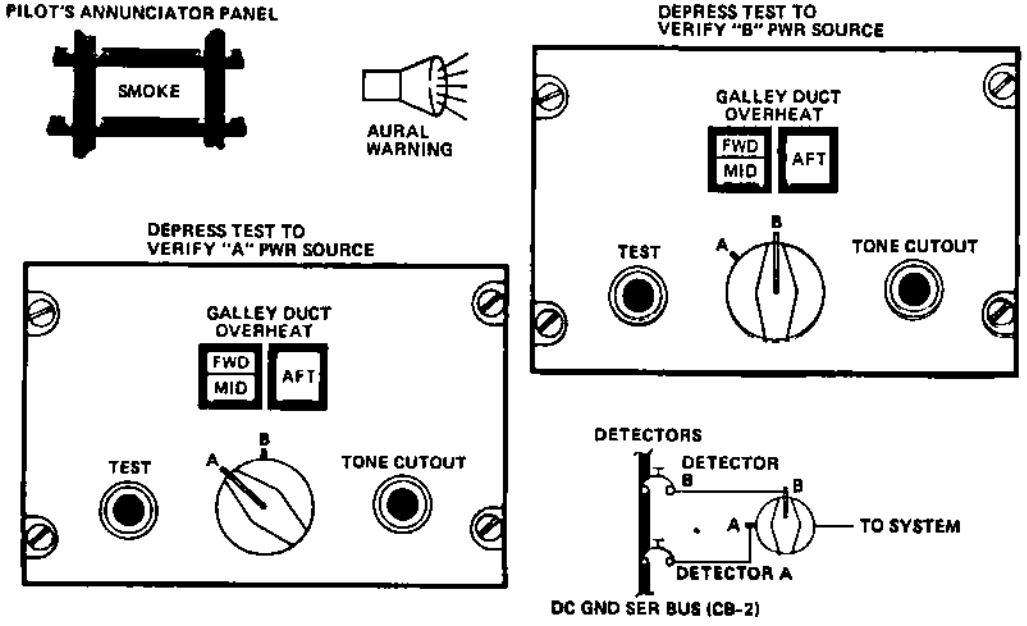
1. Unlatching the 1A or 3A fuel quantity monitor switchlight will disable the applicable fault light.
2. Latching the 1A or 3A quantity switchlight (to check the quantity in the 1A or 3A tanks) will also disable the applicable fault light.

If the alternate tank transfer system becomes inoperative, see the POM FUEL Abnormal Procedures (Blue Pages). Also see the placard on the top right of the fuel panel.

GALLEY EXHAUST DUCT OVERHEAT DETECTION SYSTEM



DETECTION TEST



POWERPLANT

The -500 aircraft does not intermix the RB211-22B (the little engine) with the RB211-524B4 (the big engine).

RB211-524B4 DIFFERENCES

Same as for Ship 724.

FUEL CONTROL AMPLIFIER SENSING

Same as for Ship 724.

LIMITATIONS

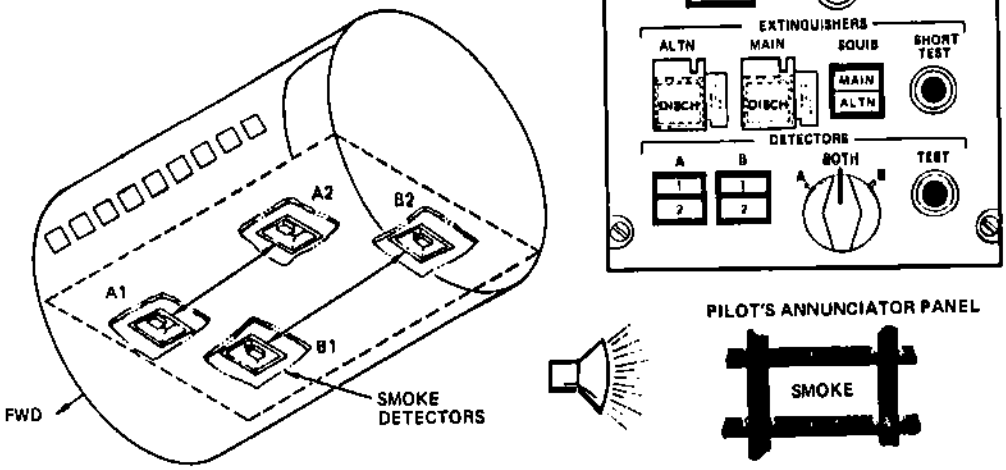
Same as for Ship 724 - POM Blue Pages.

FIRE PROTECTION

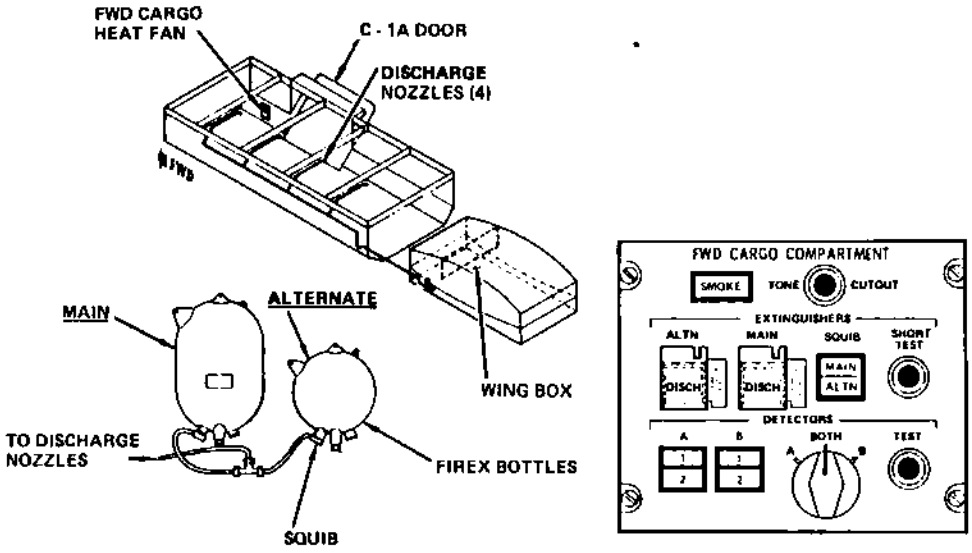
ENGINE FIRE PROTECTION - There are no pressure gauges installed for checking fire extinguisher bottle pressure.

GALLEY DUCT OVERHEAT DETECTION SYSTEM - There are three galley complexes; one installed at each door crossaisle. All three galley areas are vented together via a common vent manifold that exhausts air overboard through a galley vent valve located on the right side of the fuselage. This valve is controlled by the cool air overboard switch. Temperature sensors in the duct at each galley senses the temperature of the air flowing into the vent system from each galley area. Applicable FWD, MID, or AFT galley overheat lights will illuminate if this air is too hot. A SMOKE light on the pilot's annunciator panel will also illuminate. An alternating tone (the same as for a galley smoke/fire on the -1 aircraft) will sound. The tone can be silenced by the S/O. See the Normal Procedures, Blue Pages, for additional test information.

SMOKE DETECTORS
FORWARD CARGO COMPARTMENT



FWD CARGO CMPT. FIRE EXTINGUISHER SYSTEM



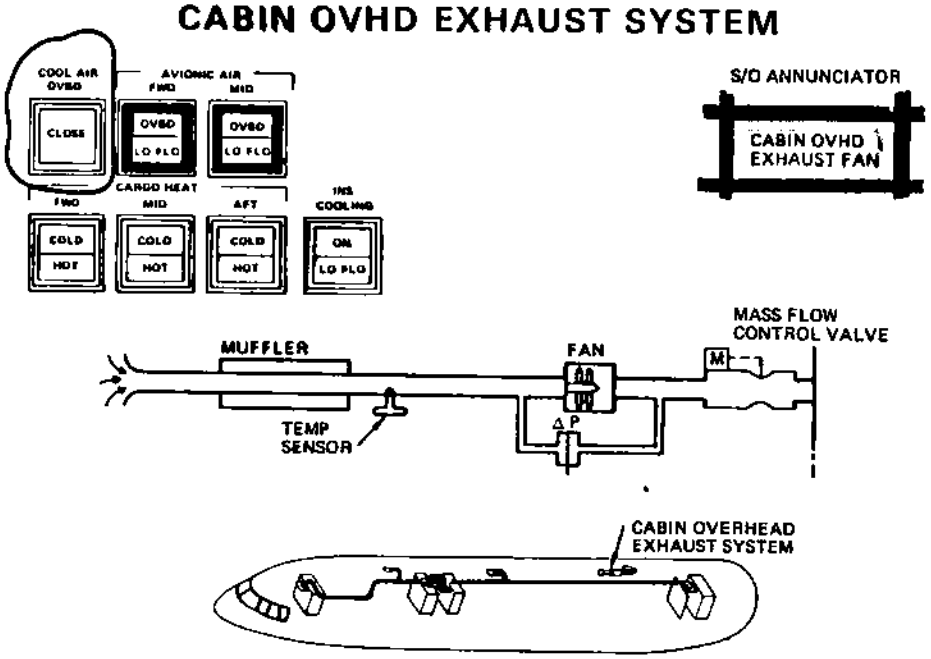
FORWARD CARGO COMPARTMENT SMOKE DETECTION AND FIRE EXTINGUISHING SYSTEM

Four smoke detectors are installed in the ceiling of the forward cargo compartment. Any one of these detectors sensing smoke will illuminate the SMOKE light on the pilot's annunciator panel. Any combination of two detectors sensing smoke will also illuminate the SMOKE light on the S/O's panel and sound an alternating tone. (The same tone as for galley smoke/fire on the -1 aircraft)

Either of two fire extinguishers (a large one or a small one) may be discharged into the forward cargo compartment.

See the Normal Procedures, Blue Pages, for additional test information.

CABIN OVHD EXHAUST SYSTEM



PNEUMATICS

Same as the -1 aircraft.

AIR CONDITIONING & PRESSURIZATION

Same as the -1 aircraft.

CABIN TEMPERATURE CONTROL - Due to no lower galley, the -500 has only 4 cabin temperature controls instead of 5.

INS COOLING - An INS cooling fan switch is installed behind the cargo heat switches on the ECS monitor panel. This cooling fan will automatically start, switch unlatched, if the INS boxes become too hot. The fan will run continuously if the switch is latched. The fan will not stop when the switch is unlatched if the INS boxes are still hot. The switch would have to be cycled after the boxes have cooled.

CABIN OVERHEAD EXHAUST SYSTEM - If the cabin overhead (the attic) gets too hot, a cabin overhead exhaust fan will start running and an overboard vent valve will open to cool the cabin overhead (the attic). When the attic cools, the fan stops and the vent valve closes.

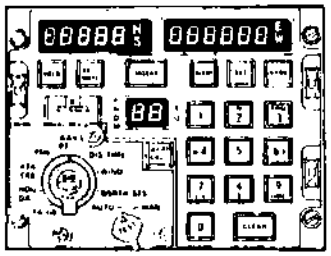
The cool air overboard switch will also close this valve if it is open. (It also closes the galley vent valve.)

ICE & RAIN PROTECTION

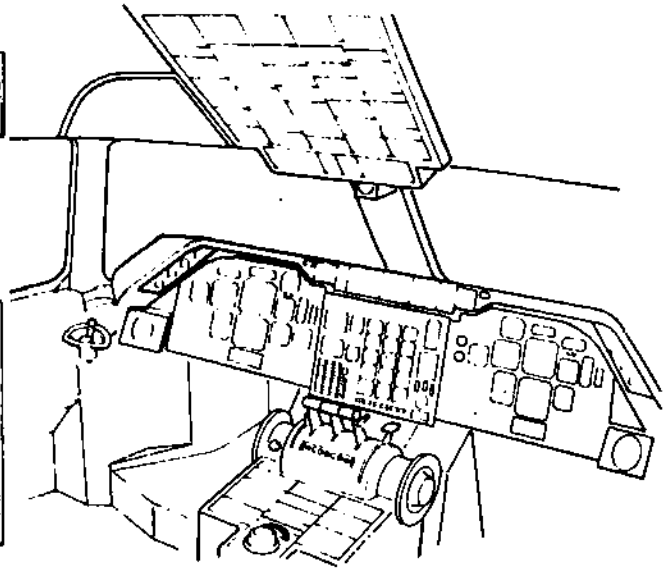
Same as the -1 aircraft.

INERTIAL NAVIGATION SYSTEMS

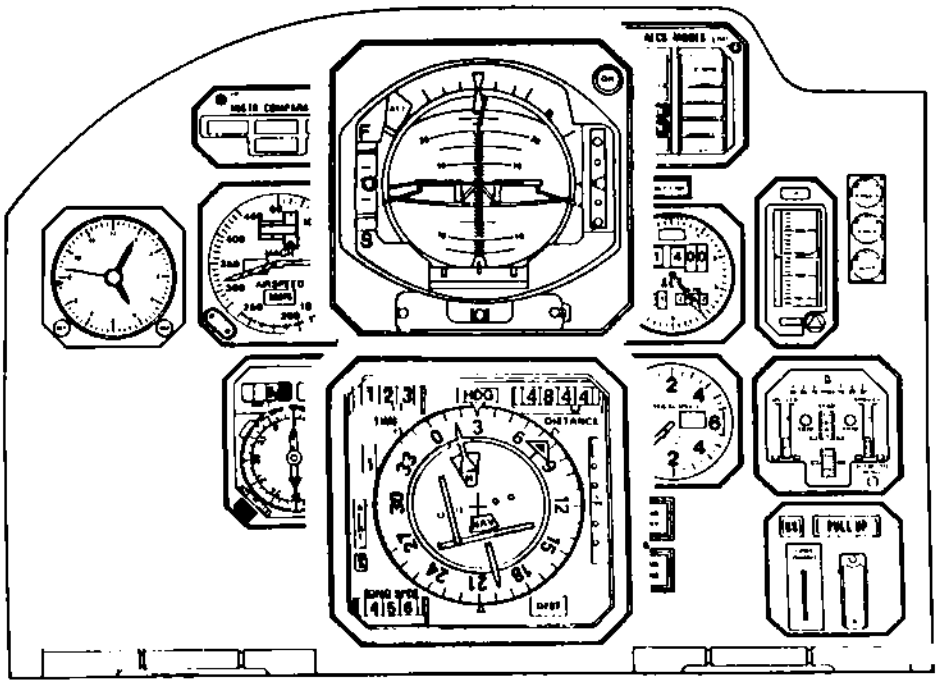
MODE SELECTOR
UNITS (3)



CONTROL/DISPLAY UNITS (3)



HSI CONTROLS-RADIO/NAV & MAG/TRUE



FLIGHT INSTRUMENTS & NAVIGATION

INS - FMS - Three INS mode selector panels and three INS control display panels are located as shown on the overhead panel and center pedestal. Two FMS control display panels are also located on the center pedestal.

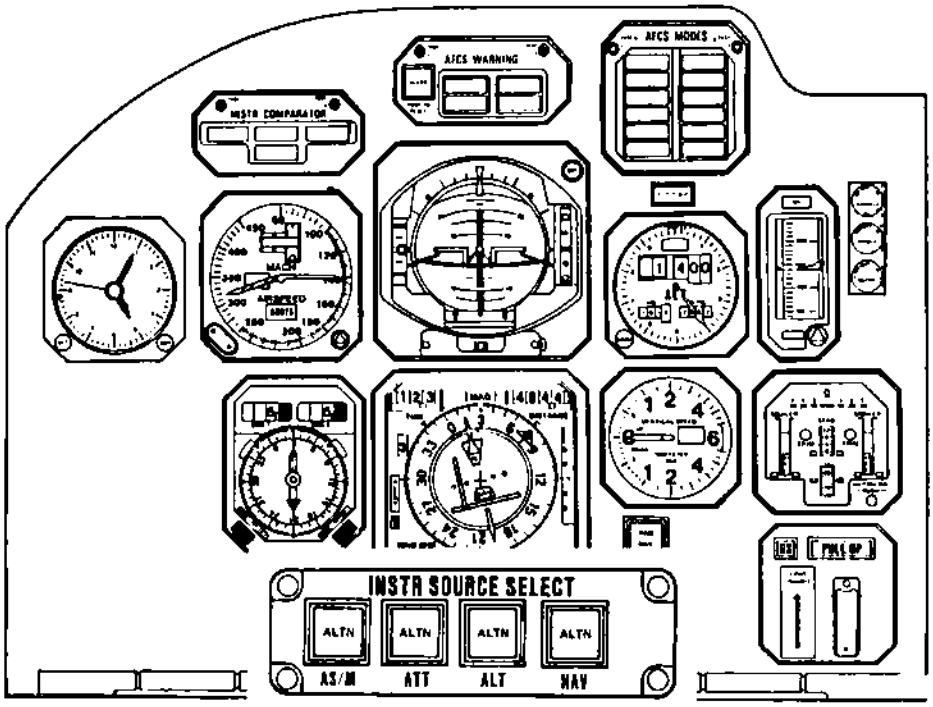
RADIO - NAV SWITCHING

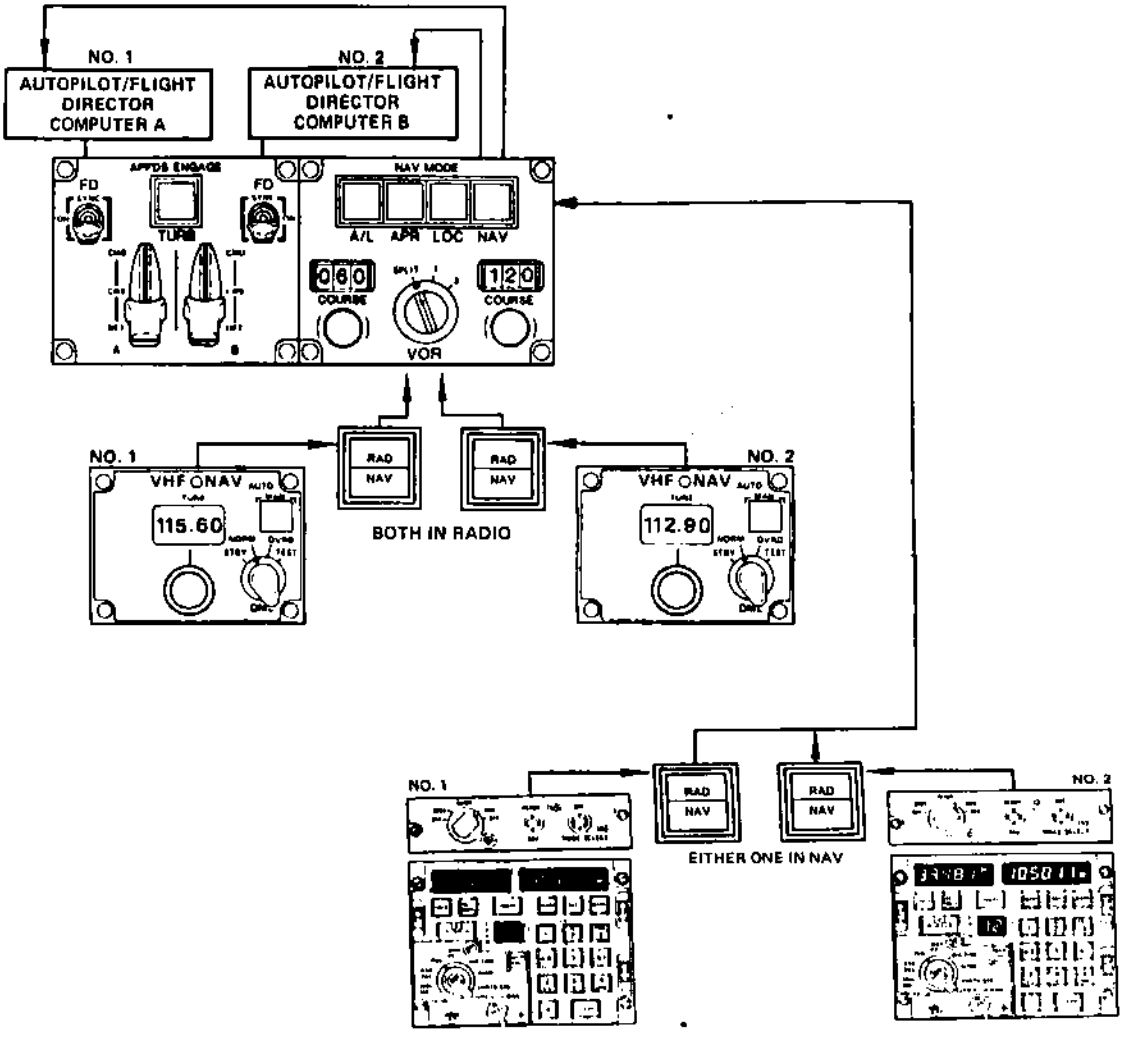
Two Radio-Nav switches are installed on the glareshield; one at each end below the master fire warning lights. These switches provide a means of selecting Radio or INS navigation data for display on each respective HSI. They are also used to supply either Radio or INS data for use by the Autopilot/Flight Director system.

HSI DISPLAY - SWITCHES IN RADIO - The Captain's switch provides MAG compass information to the Capt HSI and the F/O RMI. The course pointer displays VOR/ILS data. The First Officer's switch provides MAG compass information to the F/O HSI and the Capt RMI. The course pointer will display VOR/ILS data.

HSI DISPLAY - SWITCHES IN NAV - The Captain's switch provides TRUE heading information to the Capt HSI only if the TRUE-MAG switch is in the TRUE position. If the TRUE-MAG switch is in MAG, the HSI will display MAG heading. The course pointer will display No. 1 INS data. The F/O RMI will always display MAG heading and VOR/ADF information. The First Officer's switch provides TRUE heading information to the F/O HSI only if the TRUE-MAG switch is in the TRUE position. If the TRUE-MAG switch is in MAG, the HSI will display MAG information. The course pointer will display No. 2 INS data. The Capt RMI will always display MAG heading and VOR/ADF information.

Each respective HSI will remain in MAG heading if an ILS frequency is tuned on that VHF NAV panel.


AFCS WARNING
AFCS MODES
INSTR SOURCE SELECT
ALTN
ALTN
ALTN
ALTN
A/S/M
ATT
ALT
NAV


NO. 1
AUTOPILOT/FLIGHT DIRECTOR COMPUTER A
NO. 2
AUTOPILOT/FLIGHT DIRECTOR COMPUTER B
FD
FD
TURB
NAV MODE
A/L
APR
LOC
NAV
060
COURSE
120
COURSE
VOR
NO. 1
VHF ONAV
115.60
RAD NAV
RAD NAV
BOTH IN RADIO
NO. 2
VHF ONAV
112.90
NO. 1
RAD NAV
RAD NAV
NO. 2
EITHER ONE IN NAV

ALTERNATE NAV SWITCHING

Both instrument source select panels have an extra switch identified as ALTN NAV. Normally, with the Radio-Nav switch in NAV, the No. 1 INS supplies data to the Capt HSI. The No. 2 INS supplies the F/O HSI. In the event of a loss of either INS, the No. 3 INS can be selected to resupply that affected HSI. Both pilots can select ALTN NAV at the same time. The No. 3 INS can only supply the HSI's and not the Autopilot/Flight Director system.

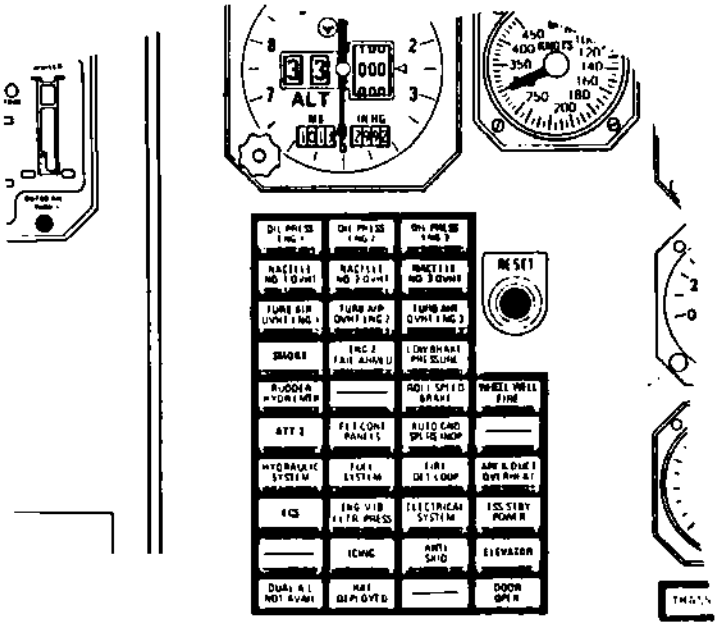
RADIO-NAV SWITCHING

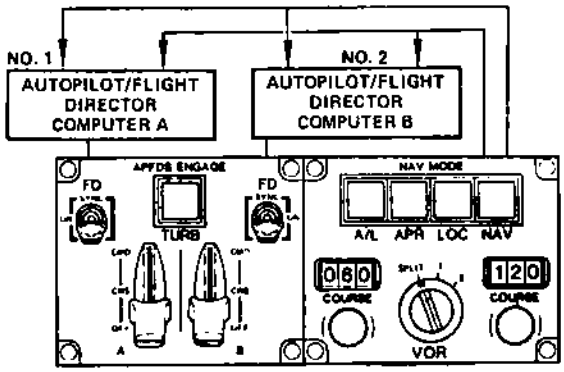
AUTOPILOT/FLIGHT DIRECTOR OPERATION - SWITCHES IN RADIO

BOTH SWITCHES IN RADIO - The Autopilot/Flight Director NAV mode is supplied VOR/ILS information. If the NAV mode is already engaged and operating in the INS mode (L-NAV annunciated) at the time the Radio-Nav switches are placed in RADIO, L-NAV will remain annunciated. The Autopilot/Flight Director will continue to use INS information until the NAV mode is disengaged and re-engaged and VOR appears in both annunciators.

ONE OR BOTH SWITCHES IN NAV - If either RADIO-NAV switch is placed in NAV and the Autopilot/Flight Director NAV mode is selected (L-NAV annunciated), the No. 1 INS is made available to the "A" Autopilot/Flight Director. The No. 2 INS is also made available to the "B" Autopilot/Flight Director. If the NAV mode is already engaged and operating in the Radio mode (VOR annunciated) at the time the Radio-Nav switch is placed in NAV, VOR will remain annunciated and the engaged Autopilot/Flight Director will continue to use Radio information until the Nav mode is disengaged and re-engaged. NOTE: If an ILS frequency is selected on a VHF NAV panel, the Autopilots will not engage while the Radio-Nav switches are in NAV. The affected HSI reverts to ILS display.

ATTITUDE 3 WARNING





If the Heading Select mode is selected with L-NAV annunciated, the L-NAV mode will be overridden. HDG SEL will appear in both mode annunciator panels. In summary, Heading Select overrides L-NAV and L-NAV overrides Heading Select.

VERTICAL GYRO 3 LIGHT - Is placarded ATT 3 on the -500 aircraft. It functions and is tested in the same manner as the vertical gyro 3 light on the -1 aircraft.

COMMUNICATIONS & RADAR

The cabin interphone reset panel is located in the forward avionics compartment, on the floor near the nose gear downlock viewer.

Same as the -1 aircraft.

AUTOPILOT/FLIGHT DIRECTOR

VOR SELECT SWITCH - The -500 autoflight panel has a VOR select switch that is labeled SPLIT, 1, 2. The SPLIT position will allow the No. 1 VOR to be used by the "A" Autoflight computer, and the No. 2 VOR to be used by the "B" Autoflight computer. The "1" position will allow the No. 1 VOR to be used by either the "A" or the "B" Autoflight computer. The "2" position will allow the No. 2 VOR to be used by either the "A" or the "B" Autoflight computer.

-500

ENGINE PERFORMANCE CRITERIA	DOMESTIC—NON-TRANSOCEANIC T/O FLAPS	T/O PACK	TRANSOCEANIC T/O FLAPS	T/O PACK
NORMAL THRUST	10°	ON	18°	ON
AT -524B4 RATING	10°	OFF	18°	OFF
	*18°	ON/OFF	22°	OFF
	*LGA ONLY-DOMESTIC AND OTHER NON-TRANSOCEANIC		*14 °	OFF
			*CLEARWAY PERFORMANCE CRITERIA	
			**14°	SPECIAL
			**FOUND IN AWABS ONLY	
A.R.M. SERIES 555-9 SP# 3937 ODM: -500	T/O WT 430,000# LDG WT 348,000#		T/O WT 510,000# LDG WT 368,000#	
ALTERNATE THRUST	10°	ON		
AT -22B RATING	10°	OFF	NOT AUTHORIZED	
A.R.M. SERIES 555-9 SP# 3937 ODM: -500	T/O WT 430,000# LDG WT 348,000#			

PERFORMANCE

The accompanying chart identifies the takeoff normal thurst vs alternate thrust flap/pack options currently in use for -500 domestic/non-transoceanic and transoceanic operations.

It also identifies:

- the Aircraft Restrictions Manual series that is tailored for the -500 aircraft.

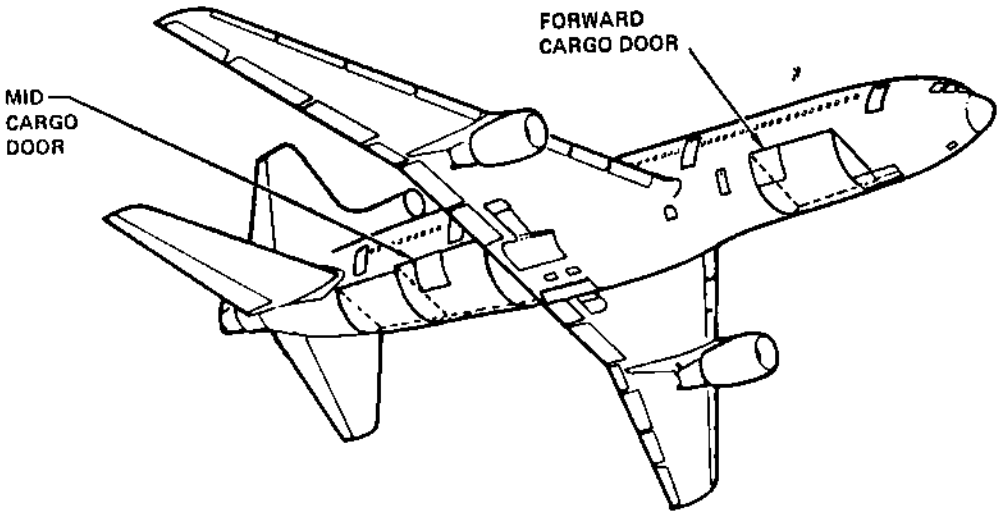
- the Standard Practice to be used for determining the Airport Restrictions - on line cities tailored for the -500.

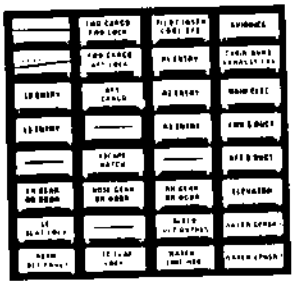
- the Operational Data Manual tailored for the -500.

- the maximum takeoff and landing weights to be used for both domestic/ non-transoceanic and transoceanic operations.

PAA

-500 Differences


FORWARD
CARGO DOOR
MID
CARGO
DOOR



PAA -500 DIFFERENCES

AIRPLANE GENERAL

AIRCRAFT WEIGHTS - Same as the DAL -500 aircraft.

AIRCRAFT LENGTH - Same as the DAL -500 aircraft.

ENTRY DOORS - Same as the DAL -500 aircraft.

CARGO COMPARTMENT DOORS - The forward and mid cargo compartment doors are the same as the DAL -500 aircraft. The PAA airplane has no aft cargo compartment door. The aft cargo (bulk) compartment is accessible through what would be the mid cargo compartment door. The door warning light identifies this door as the AFT CARGO door.

GALLEY COMPLEXES - Same as the DAL -500 aircraft.

FLIGHT ATTENDANT JUMP SEATS - (12) total, (4) single seats at the No. 1 doors, (2) double seats at the No. 2 doors, and (2) double seats at the No. 3 doors.

LAVATORIES - (8) total, (5) in the rear, (2) in the front, and (1) aft of the No. 2 right door.

WATER QUANTITY GAUGE - located on S/O panel below the APU panel.

4TH POD PROVISIONS - Are installed on the under side of the wing inboard of the No. 3 engine for ferrying a spare engine.

SECOND OFFICER'S SEAT - Is electrically powered.

OXYGEN

Same as the DAL -500 aircraft.

APU

Same as the DAL -500 aircraft.

ELECTRICAL

ESSENTIAL AND STANDBY BUS FAIL LIGHTS - Are amber instead of red.

HYDRAULICS

Has no hydraulic temperature gauge.

Same at the DAL -500 aircraft.

LANDING GEAR

Same as the DAL -500 aircraft.

FLIGHT CONTROLS

AILERONS AND ACTIVE CONTROL SYSTEM - Same as the DAL -500 aircraft.

SPOILERS AND MDLC - Same as the DAL -500 aircraft.

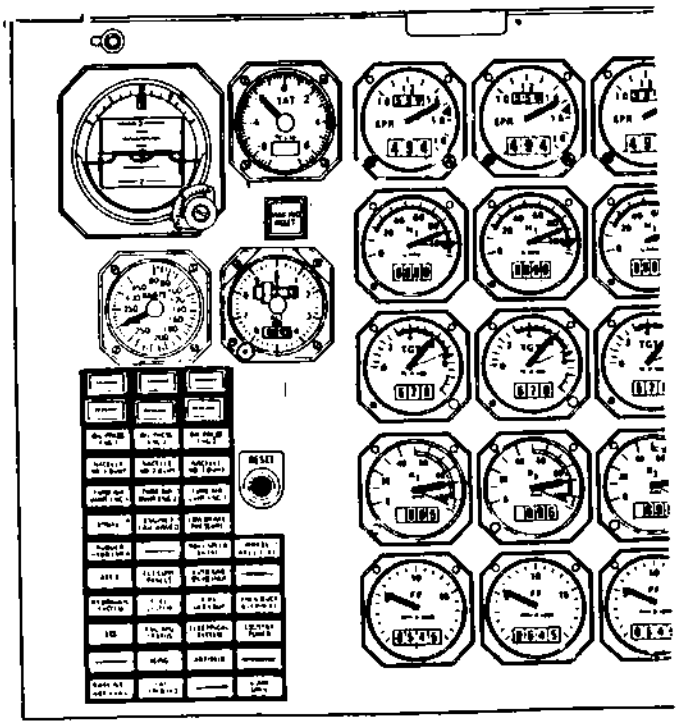
RUDDER - Same as the DAL -500 aircraft.

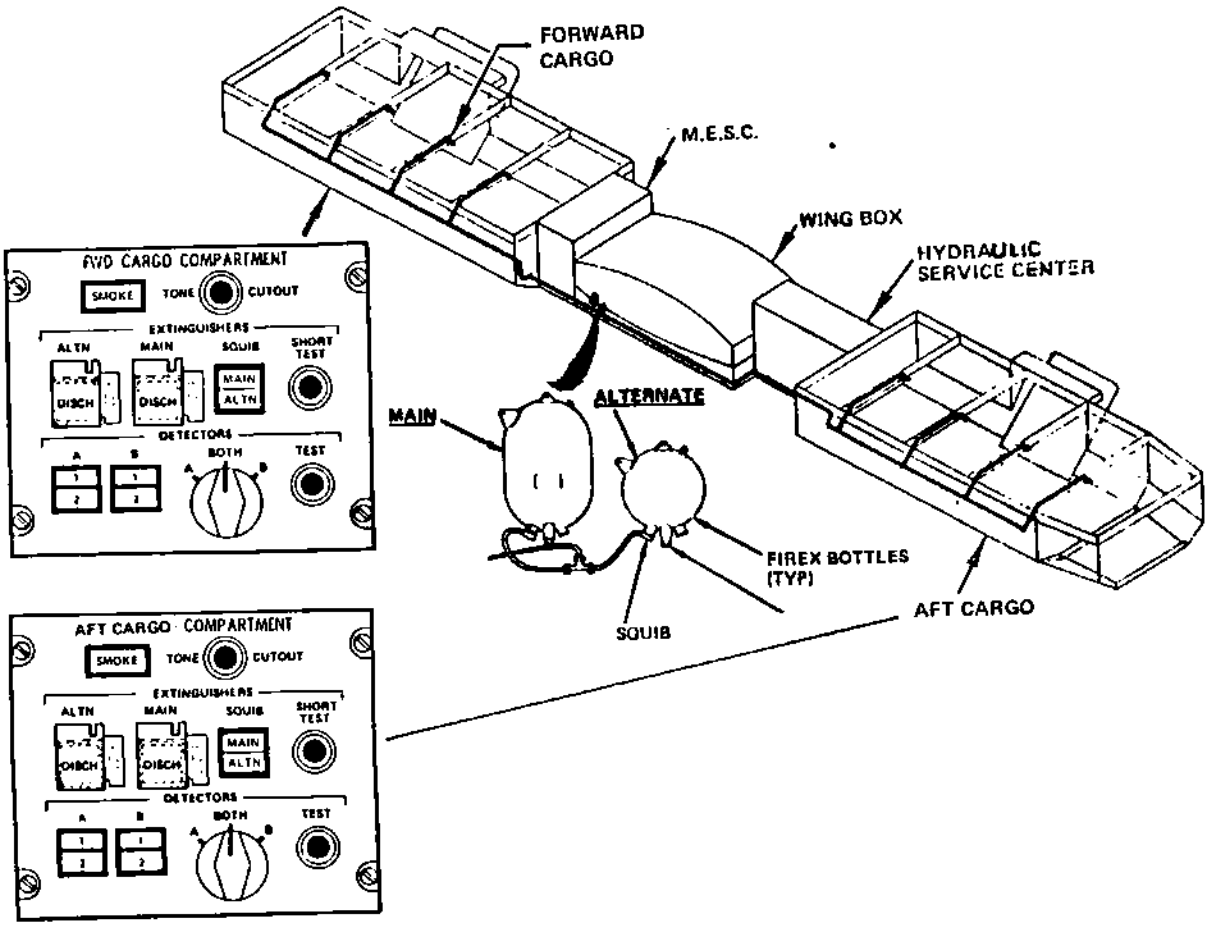
HORIZONTAL STABILIZER - Same as the -1 aircraft.

FLAPS AND SLATS - Same as the DAL -500 aircraft.

FUEL SYSTEM

Same as the DAL -500 aircraft.




FORWARD CARGO
M.E.S.C.
WING BOX
HYDRAULIC SERVICE CENTER
FWD CARGO COMPARTMENT
SMOKE
TONE
CUTOUT
EXTINGUISHERS
ALTN
MAIN
SQUIB
SHORT TEST
DISCH
MAIN ALTN
DETECTORS
A
B
BOTH
TEST
MAIN
ALTERNATE
FIREX BOTTLES (TYP)
SQUIB
AFT CARGO
AFT CARGO COMPARTMENT
SMOKE
TONE
CUTOUT
EXTINGUISHERS
ALTN
MAIN
SQUIB
SHORT TEST
DISCH
MAIN ALTN
DETECTORS
A
B
BOTH
TEST

POWERPLANT

The reverse TRANSIT and REVERSE lights are located on two additional top rows of the pilot's annunciator panel. The standby altimeter and airspeed indicators are smaller than they are on the Delta aircraft.

FIRE PROTECTION

ENGINE FIRE PROTECTION - Same as the DAL -500 aircraft.

GALLEY DUCT OVERHEAT DETECTION SYSTEM - Same as the DAL -500 aircraft.

FORWARD CARGO COMPARTMENT SMOKE DETECTION AND FIRE EXTINGUISHING SYSTEM - Same as the DAL -500 aircraft.

AFT CARGO COMPARTMENT SMOKE DETECTION AND FIRE EXTINGUISHING SYSTEM - Is the same operation as for the forward cargo compartment, with the exception that the forward cargo compartment and the aft cargo compartment share the same two fire extinguisher bottles.

LAVATORY FIRE EXTINGUISHING SYSTEM - Each lavatory has an automatic fire extinguishing system that will automatically discharge in the event a fire occurs in a lavatory waste container.

PNEUMATICS

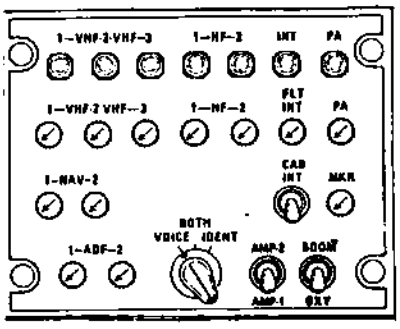
Same as the -1 aircraft.

AIR CONDITIONING AND PRESSURIZATION

Same as the DAL -500 aircraft.

ICE AND RAIN PROTECTION

Same as the DAL -500 aircraft.


1—VHF-1 VHF—3
1—HF—2
INT
PA
1—VHF-2 VHF—3
1—HF—2
FLT INT
PA
1—NAV—2
CAB INT
MKR
1—ADF—2
BOTH
VOICE IDENT
AMP-2
BOOM
AMP-1
OXY

FLIGHT INSTRUMENTS AND NAVIGATION

STANDBY ALTIMETER AND AIRSPEED INDICATORS - Are smaller in size than the DAL instruments.

CLOCKS - The Capt and F/O panels have digital clock rather than the standard clock found at the S/O panel.

INS - Same as the DAL -500 aircraft.

RADIO - NAV SWITCHING - Same as the DAL -500 aircraft.

ALTERNATE NAV SWITCHING - Same as the DAL -500 aircraft.

COMMUNICATIONS AND RADAR

VHF COMMUNICATION PANELS - Have small red flags that cover the frequency numbers of the side not being used.

ADF PANEL - The dual ADF's are located on a single panel on the center pedestal.

AUDIO PANELS - The audio panels at all pilot stations look different from the DAL L-1011 audio panels but the operation is the same as the -1 and -500 aircraft.

PTT SWITCHES - For the Capt and F/O are located under the index finger on the back of each control column. It is squeezed to transmit.

FLIGHT RECORDER SWITCH - The PAA flight recorder does not have a trip number and date encoding panel.

PA MONITOR PANEL - The PAA airplane does not have a PA monitor panel. PA's are monitored via a PA audio switch on the audio panel.

AUTOPILOT/FLIGHT DIRECTOR

Same as the Dal -500 aircraft.

PERFORMANCE

Same as the Dal -500 aircraft.

Ship 724

Differences

DELTA
AIR LINES

SHIP 724 DIFFERENCES

GENERAL INFORMATION

Ship 724 is an airplane that can be operated as either a -200 or a -100 aircraft. Its primary use is as the back-up airplane for the international operation. It can also be used domestically as needed.

Externally, Ship 724 looks like a -1 airplane. Cockpit-wise there are two main differences. Ship 724 has two additional fuel tanks located in the center section that have a capacity of approximately 9500 lbs. each. They are identified as tanks 1A and 3A, and are extensions of tanks 1 and 3.

If operated internationally, 724 will have (3) INS units installed. If operated domestically the INS units can be replaced with conventional vertical and directional gyros.

Cabin-wise, 724 has a lower galley and the entry door configuration is the same as the -1 aircraft. The following are the configuration differences that will cause Ship 724 to be operated as a -200 or a -100 aircraft.
A COLOR-CODED PLACARD WILL BE INSTALLED ON THE FIRST OFFICER'S INSTRUMENT PANEL TO IDENTIFY THE CURRENT OPERATING CONFIGURATION.

724 AS A -200 AIRCRAFT

- Will have a YELLOW placard installed on the F/O's instrument panel.
- Will have (3) RB211-524B4 Engines installed.
- The center fuel tanks can contain fuel if the total fuel load exceeds 159,600 lbs.

724 AS A -100 AIRCRAFT

- Will have a PINK placard installed on the F/O's instrument panel.
- Can have any combination of RB211-22B and RB211-524B4 engine inter-mix. It could have (3) RB211-22B engines installed.
- The center fuel tanks can contain fuel if the total fuel load exceeds 159,600 lbs.

If an engine inter-mix does occur on Ship 724, refer to the Aircraft Restrictions Manual for Standard Practice 481 entitled L-1011 -200 ENGINE INTER-MIX AT RB211-22B RATING for additional Procedural and Limitation information.

724 AS A -1 AIRCRAFT

- Will not have a Placard installed on the F/O's instrument panel.
- Will have there RB211-22B engines installed.
- Will have empty center fuel tanks
- Will not have FMS installed.
- The WHITE -1 power charts will be used.
- The WHITE -1 second officer's and pilot's check lists will be used.
- All -1 Aircraft Limitations will apply.
- Will use -1 Operational Data Manual.
- Will use -1 Aircraft Restrictions Manual, series 555-11.

AIRPLANE GENERAL

AIRCRAFT WEIGHTS - see limitations (blue pages POM).

AIRCRAFT LENGTH - same as the -1 aircraft.

ENTRY DOORS - same as the -1 aircraft.

CARGO DOORS - same as the -1 aircraft.

GALLEY COMPLEXES - same as the -1 aircraft.

FLIGHT ATTENDANT JUMPSEATS - (12) total, same locations as the -1 aircraft.

LAVATORIES - (7) total, same locations as the -1 aircraft.

OXYGEN

Same as the -1 aircraft.

EMERGENCY EQUIPMENT

Same as the -1 aircraft.

APU

Same as the -1 aircraft.

ELECTRICAL

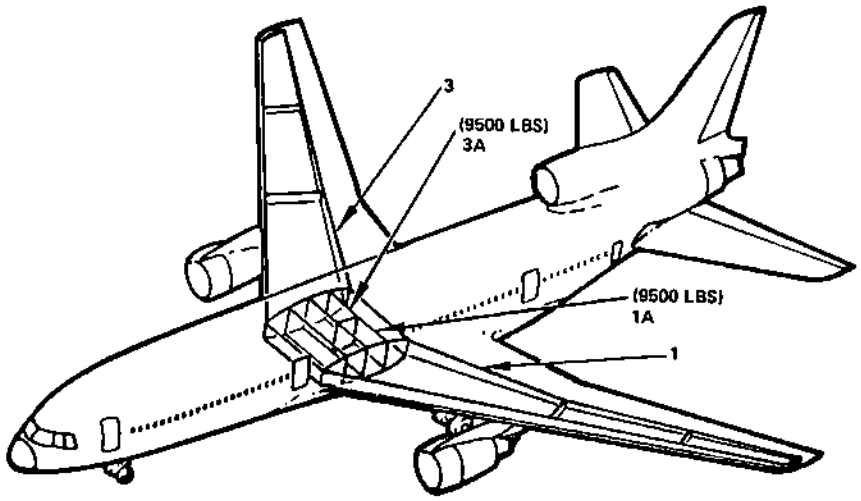
Same as the -1 aircraft.

HYDRAULICS

Same as the -1 aircraft.

LANDING GEAR

Same as the -1 aircraft.


3
(9500 LBS)
3A
(9500 LBS)
1A
1

FLIGHT CONTROLS

AILERONS - same as the -1 aircraft.

SPOILERS - same as the -1 aircraft.

RUDDER - rudder hydraulic pressure scheduling is different from the -1 aircraft. However, the RUDDER HYDR LMTR light (on the pilot's annunciator panel) and the rudder hydraulic limiter PUSH light (on the overhead panel) function the same as on the -1 aircraft.

HORIZONTAL STABILIZER - same as the -1 aircraft.

FLAPS AND SLATS - same as the -1 aircraft.

FUEL SYSTEM

GENERAL - total fuel capacity is approximately 179,000 lbs. If Ship 724 is operated either as a -200 or a -100, the center tanks will contain fuel if the total fuel load exceeds 159,600 lbs. Fuel loads less than 159,600 lbs. should not have fuel in the center tanks. If fuel is found in the center tanks with fuel loads less than 159,600 lbs., that fuel must be transferred out before takeoff, or, the maximum zero fuel weight reduced by the amount of unneeded fuel found in the center tanks. (See the blue pages normal procedures expanded checklist).

TRANSFER POLICY - SHIP 724

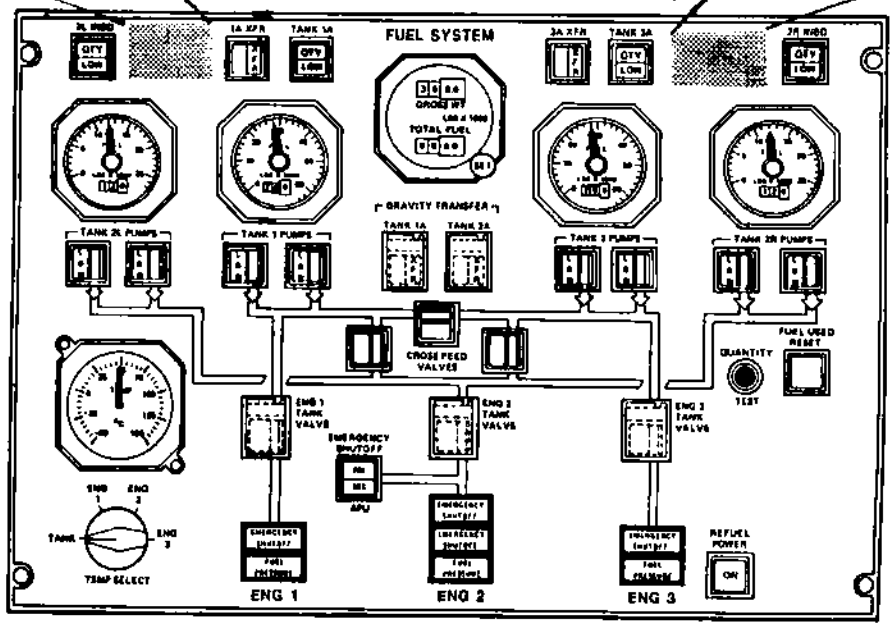
BEGINNING AT AFTER START, TRANSFER FUEL OUT OF THE CENTER TANKS UNTIL THE QTY LOW LIGHTS HAVE ILLUMINATED AND THE TANKS ARE EMPTY. TRANSFERRING CAN THEN BE STOPPED.

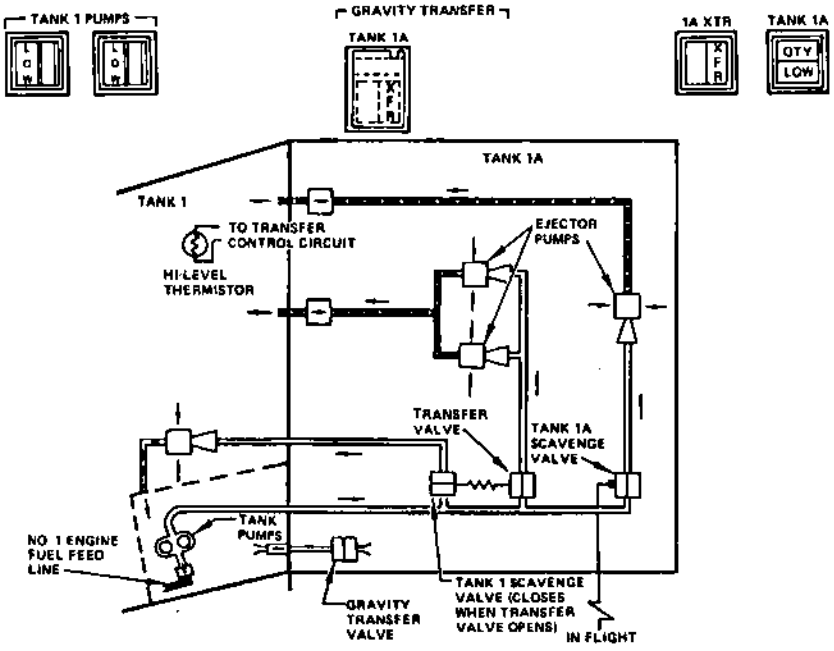
If Ship 724 is operated as a -1 aircraft, the center tanks must remain empty. If tanks 1A or 3A contain fuel the fuel must be transferred out before takeoff. (See the Blue Pages Normal Procedures expanded checklist).

LATCH XFR SWITCHES AFTER ENGINE START UNLATCH AFTER 1A/3A QTY LOW LIGHTS ON AND TANKS EMPTY.

FOR XFR SYSTEM FAILURE -- UNLATCH XFR SWITCHES AND MONITOR TANK QTY'S FOR PROPER LEVELS TO INITIATE GRAVITY TRANSFER - SEE POH ABNORMAL

FUEL PANEL (SHIP 724)





ALTERNATE (CENTER) TANK FUEL SYSTEM - The transfer switch/s control a transfer valve that directs main tank boost pump pressure to ejector pumps (venturi devices) that moves fuel via jet pump action from the center tank into its adjacent main tank. The main tank is prevented from overfilling by a high-level thermistor that automatically closes and re-opens the transfer valve. A blue disagreement light indicates the transfer valve is in transit.

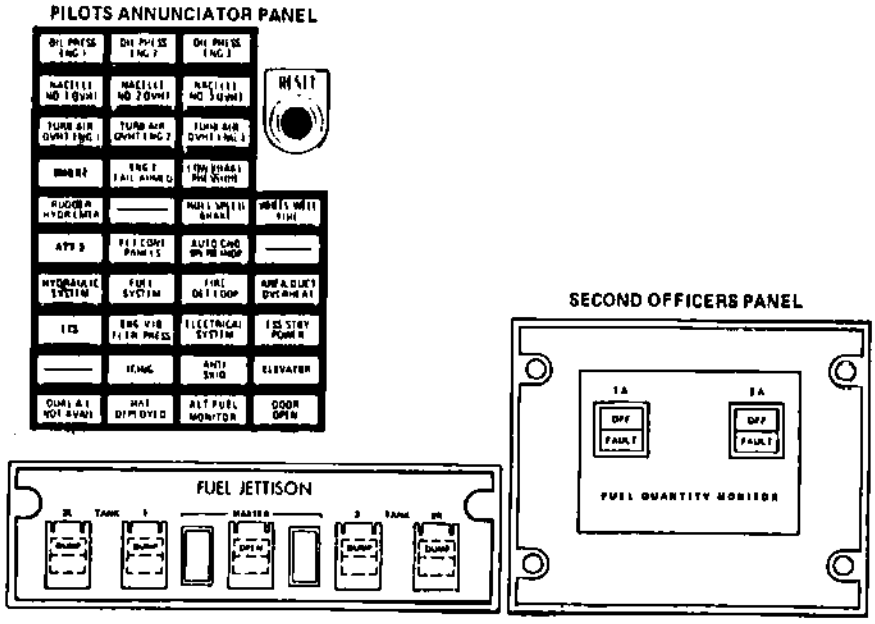
The tank 1A/3A quantity switch/s when unlatched, will display the total fuel contained in both the center tank and its adjacent main tank on that main tank quantity cause. Latched, the same quantity gauge will display only what is contained in the center tank.

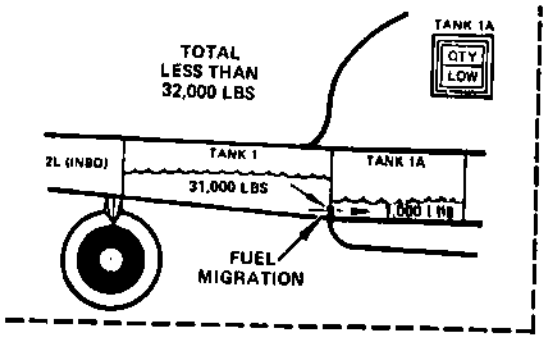
The low light is armed by its respective transfer switch to illuminate anytime the center tank fuel quantity is less than approximately 150 lbs.

The gravity transfer switch/s controls a valve in the bottom low corner of the center tank. When open, fuel will flow one-way from the center tank into the adjacent main tank only if the fuel level in the main tank is equal to or lower than the level of fuel contained in the center tank. Gravity transfer can equal engine demands.

The gravity transfer system is installed for use when the regular transfer system is unable to transfer fuel from the center tank into its main tank due to possible transfer valve failure, boost pump failure, ice accumulation in the transfer system plumbing, etc.

ALTERNATE TANK FUEL MONITOR SYSTEM





The gravity transfer switch blue lights will cycle (valves open) when the master fuel jettison switch is latched for dumping fuel. This will allow the center tank to gravity flow into its respective main tank. (The main tanks dump as previously described for the -1 aircraft).

CENTER FUEL TANK SCAVANGE SYSTEM - Ship 724 has a center tank scavange system that continually operates while in flight (controlled by gear switches) to circulate fuel through the center fuel tank using main tank boost pump pressure, preventing ice formation in the plumbing.

ALTERNATE TANK FUEL QUANTITY MONITOR SYSTEM - The fuel quantity monitoring system is to assist in early recognition of an inoperative alternate fuel transfer system, or fuel migration into a previously emptied alternate tank.

The monitor system uses fuel quantity signals to monitor the amount of fuel in the alternate (center) tank in relation to the total amount of fuel in both the main and alternate tanks. During fuel consumption, there is a point when all the fuel displayed in the #1 or #3 quantity indicators should be contained in the main tank and the alternate tank should be empty. If more than 1,000 lbs. of this total is in the alternate tank, or if the alternate tank quantity increases to more than 1,000 lbs. after it has been emptied, the FAULT light/s on the S/O's panel will illuminate. The ALT FUEL MONITOR light on the pilot's annunciator panel will also illuminate.

The fuel quantity setting to illuminate three lights is, if the main/alternate quantity is any total less than 32,000 lbs. with the respective alternate quantity more than 1,000 lbs., the lights will illuminate.

This monitor system is disabled by two actions:

1. Unlatching the 1A or 3A fuel quantity monitor switchlight will disable the applicable fault light.

2. Latching the 1A or 3A quantity switchlight (to check the quantity in the 1A or 3A tanks) will also disable the applicable fault light. If the alternate tank transfer system becomes inoperative, see the POM fuel Abnormal Procedures (Blue Pages). Also see the placard on the top right of the fuel panel.

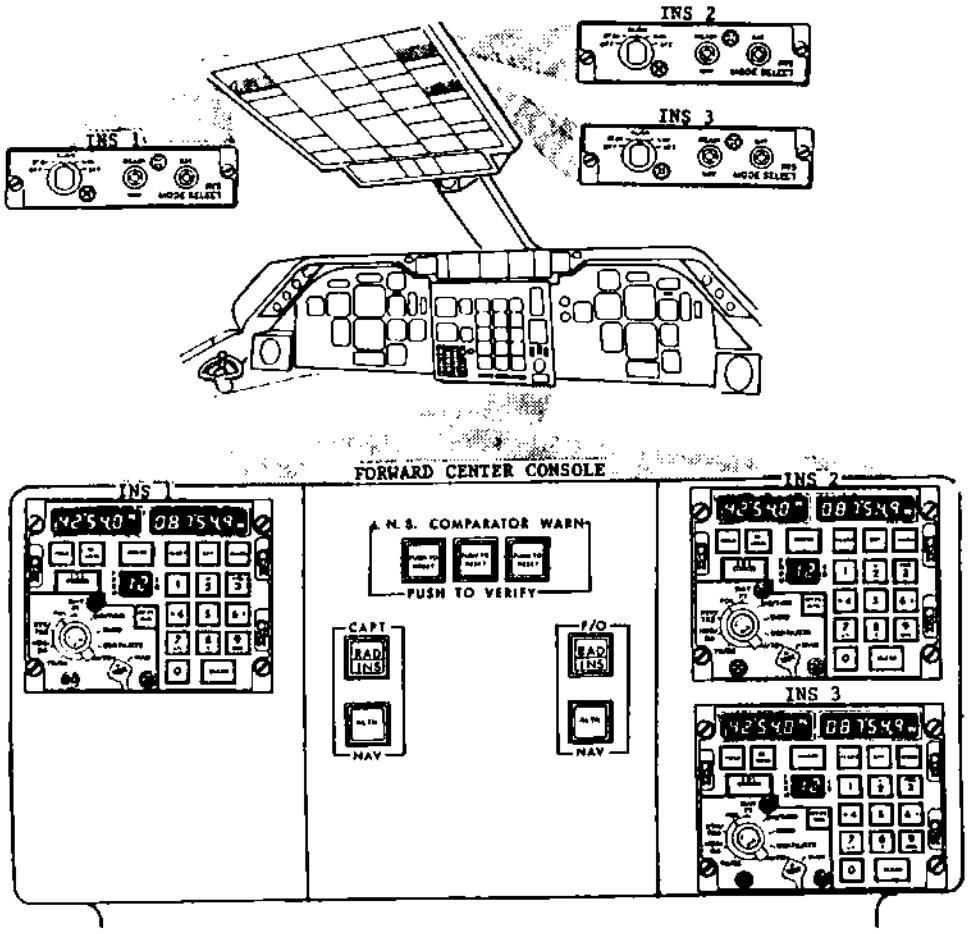
POWERPLANT

Ship 724 when operated as a -200 will have (3) RB211-524B4 engines installed. These are 50,000 lb. thrust engines. Standard practice 481, engine inter-mix standard practice, allows the use of an RB211-22B engine in any combination if an RB211-524B4 engine is not available. If a -22B engine is installed, 724 will be operated as a -100 aircraft.

RB211-524B4 DIFFERENCES - The oil temperature runs hotter than the -22B due to the location of the oil temperature sensor. The -524B4 engines have fuel flow regulator slugger valves installed to improve engine surge margin above 25,000 feet. This dampens the engine response to throttle movement. A malfunctioning slugger valve, above 25,000 feet, may result in a power loss that appears similar to a fuel control amplifier malfunction.

FUEL CONTROL AMPLIFIER SENSING - The fuel control amplifier on RB211-524B4 engine senses and reacts to overspeed conditions only and not overtemperature.

LIMITATIONS - See the POM Limitations section, Blue Pages.


INS 2
INS 3
INS 1
FORWARD CENTER CONSOLE
INS 1
N.S. COMPARATOR WARN
PUSH TO VERIFY
CAPT
F/O
RAD INS
NAV
INS 2
INS 3

FIRE PROTECTION

ENGINE FIRE PROTECTION - There are no pressure gauges installed for checking fire extinguisher pressure.

PNEUMATICS

Same as the -1 aircraft, Except Floor Heat Installed.

AIR CONDITIONING & PRESSURIZATION

Same as the -1 aircraft.

INS COOLING - An INS cooling fan switch is installed behind the cargo heat switches on the ECS monitor panel. A placard installed on the right side of the S/O panel states:

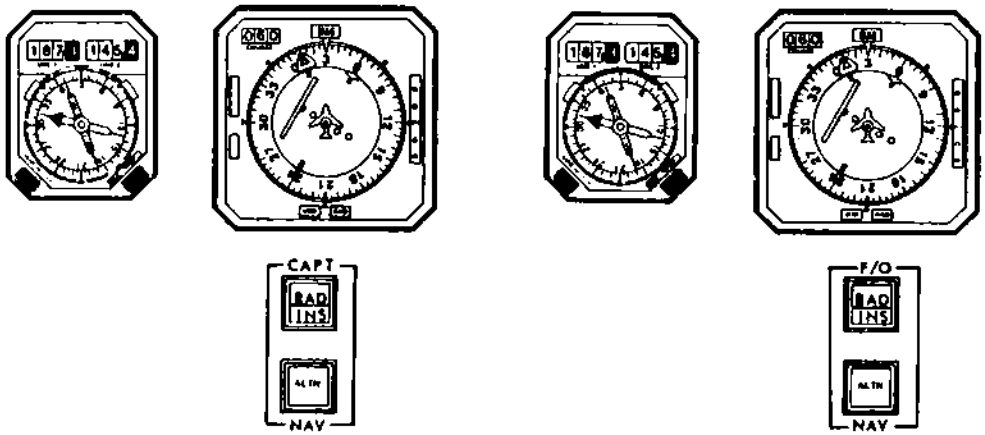
INS COOLING FAN
MUST BE "ON"
WHEN INS ATT/NAV
IS USED

ICE AND RAIN PROTECTION

Same as the -1 aircraft.

FLIGHT INSTRUMENT AND NAVIGATION

INSTRUMENTATION - GENERAL - Ship 724 is unique in that it can have either conventional gyros installed, or INS units installed. Domestically, all (3) INS units are usually removed and conventional vertical and directional gyros are installed. If INS units are left on board for domestic operations, all INS units are to be operated in the ATTITUDE mode, (see Normal Procedures Blue Pages).


CAPT
RAD
INS
ALTN
NAV
F/O
RAD
INS
ALTN
NAV

When INS units are installed, (3) mode selector panels are located on the overhead panel as shown. (3) control display panels are also located on the forward pedestal. Additionally, (3) INS comparator warning lights, (2) Radio - INS switches, and (2) alternate NAV switches are located on forward center pedestal.

RADIO - INS SWITCHING

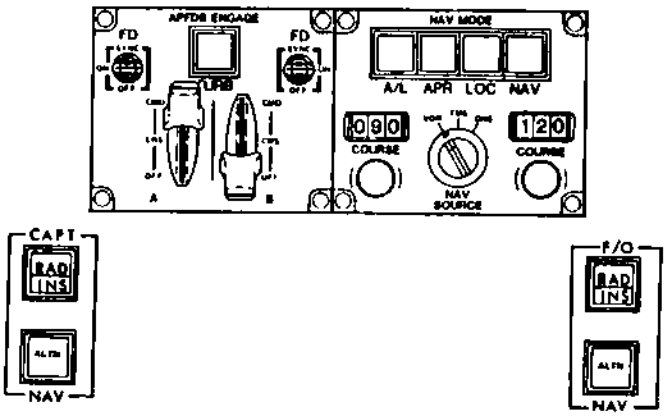
(2) Radio - INS switches are installed on the forward center pedestal. These provide a means of selecting either Radio or INS navigation data for display on each respective HSI. They are also used to supply either Radio or INS data for use by the autopilot - flight director system.

HSI DISPLAY SWITCHES IN RADIO - The captain's switch provides magnetic compass information to the CAPT HSI and the F/O RMI. The course pointer displays VOR/ILS data. The first officer's switch provides magnetic compass information to the F/O HSI and the CAPT RMI. The course pointer displays VOR/ILS data.

HSI DISPLAY SWITCHES IN INS - The captain's switch provides true heading information to the CAPT HSI. The course pointer will display No. 1 INS data. The HSI heading BUG will not respond to the heading select knob. The F/O RMI still displays magnetic heading and VOR/ADF information.

NOTE: Each respective HSI will remain in MAG heading if an ILS frequency is tuned on that VHF NAV panel.

CAPT
RAD INS
ALTN
NAV
F/O
RAD INS
ALTN
NAV


APPCH ENGAGE
FD
FD
LOC
NAV MODE
A/L
APR
LOC
NAV
090
COURSE
120
COURSE
NAV SOURCE
A
B
CAPT
RAD INS
ALTN
NAV
F/O
RAD INS
ALTN
NAV

ALTERNATE NAV SWITCHING

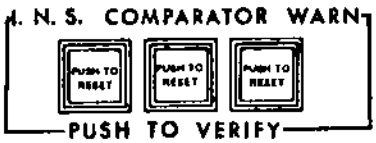
(2) alternate navigation switches are located under the Radio - INS switches on the forward center pedestal. Normally, with the Radio - INS switches in INS, the No. 1 INS supplies navigation data to the CAPT HSI. The No. 2 INS supplies the F/O HSI. In the event of a loss of either INS, the No. 3 INS can be selected to resupply that affected HSI. Only one pilot can select ALTN NAV at a time. The No. 3 INS can only supply that affected HSI and not the autopilot/flight director system.

RADIO - INS SWITCHING

AUTOPILOT/FLIGHT DIRECTOR OPERATION-SWITCHES IN RADIO

BOTH SWITCHES IN RADIO - The autopilot/flight director NAV mode is supplied VOR/ILS information. The Heading Select mode and both bugs operate normally. If the NAV mode is already engaged and operating in the INS mode (L-NAV annunciated) at the time the Radio - INS switches are placed in RADIO, L-NAV will remain annunciated. The autopilot/freight director will continue to use INS information until the NAV mode is disengaged and reengaged, and VOR appears in both mode annunciators.

ONE SWITCH IN INS - If either Radio - INS switch is placed in INS and the autopilot/flight director NAV mode is selected (L-NAV annunciated), the No. 1 INS is made available to the "A" autopilot/flight director. The No. 2 INS is also made available to the "B" autopilot/flight director. If the NAV mode is already engaged and operating in the RADIO mode (VOR annunciated) at the time the Radio - INS swtich is placed in INS, VOR will remain annunciated and the engaged autopilot/flight director will continue to use Radio


I. N. S. COMPARATOR WARN
PUSH TO RESET
PUSH TO RESET
PUSH TO RESET
PUSH TO VERIFY

information until the NAV mode is disengaged and reengaged. NOTE: If an ILS frequency is selected on a VHF NAV panel, the autopilot will not engage while the Radio - INS switches are in INS. The course pointer on the side selected to INS responds to INS navigation data only.

If either Radio - INS switch is in INS (L-NAV annunciated), the heading select bug on the side selected to INS does not respond to movement of the heading select knob. If the heading select mode is selected with L-NAV annunciated, the L-NAV mode will be overridden. HDG SEL will appear in both mode annunciator panels. Both flight director bars will respond to movement of the heading select knob. The heading bug/s in the HSI's do not respond. In summary, heading select will override L-NAV, and L-NAV will override Heading Select.

BOTH SWITCHES IN INS - Autopilot/flight director operation is the same as discussed for one Radio - INS switch in INS. With the NAV mode selected (L-NAV annunciated) both course pointers respond to INS information only. Both heading bugs do not respond to the heading knob. Heading Select will override L-NAV and L-NAV will override Heading Select.

INS COMPARATOR WARNING SYSTEM

(3) INS comparator warning lights are installed on the forward center pedestal that function only when all (3) INS's are operated in the ALIGN or NAV modes. These lights do not operate in the ATTITUDE mode.

This system is used to alert the crew to check the INS for navigation accuracy. The respective warning light will illuminate when any INS Inertial Position disagrees with the Inertial Position of the other two INS's by more than three miles plus three miles for every hour of operation in the NAV mode (3 + 3T)

for a maximum of eighteen nautical miles. The illumination of a comparator warning light does not necessarily indicate a computer failure. It does, however, indicate an accuracy check of that INS system is needed. An update of the affected INS will probably be required.

The Push-To-Reset is used to extinguish the affected light. The Push-To-Verify means the light will illuminate again whenever it is pressed, if the Inertial Position of the affected INS still disagrees with the other two INS's by more than the 3 + 3T value.

COMMUNICATIONS AND RADAR

Same as the -1 aircraft.

AUTOPILOT/FLIGHT DIRECTOR

NAV SOURCE SWITCH - VOR FMS ONS

Same as the -1 aircraft if the FMS or ONS is installed.

SHIP 724

	COCKPIT PLACARD	POWER CHARTS	CHECK LISTS	TOTAL FUEL	ENGINES INSTALLED
-200	YELLOW	YELLOW	BLUE	178,400#	3 -524B4
-100	PINK	PINK	BLUE	178,400#	-22B/-524B4

ENGINE PERFORMANCE CRITERIA	DOMESTIC — NON-TRANSOCEANIC T/O FLAPS	T/O PACK	TRANSOCEANIC T/O FLAPS	T/O PACK
-200 NORMAL THRUST 3 -524B4 ENGINES AT -524B4 RATING	10° 10° 18° (LGA-ONLY)	ON OFF ON/OFF	18° 18° 22° *14° * FOUND IN AWABS ONLY	ON OFF OFF SPECIAL
A.R.M. SERIES 555-10 S.P. # 3931 ODM: -200	T/O WT 430,000# LDG WT 348,000#		T/O WT 474,000# LDG WT 368,000#	
-200 ALTERNATE THRUST 3 -524B4 ENGINES AT -22B RATING	10° 10°	ON OFF	NOT AUTHORIZED	
A.R.M. SERIES 555-10 S.P. # 3931 ODM: -200	T/O WT 430,000# LDG WT 348,000#			
-100 NORMAL THRUST 3 -22B ENGINES OR -22B/-524B4 MIX AT -22B RATING	10° 10° 18° (LGA ONLY) *4° * DEN - OTHER HIGH ALTITUDE AIRPORTS	ON OFF ON/OFF OFF	10° 10° 14° *4° *10° *14° * IMPROVED PERFORMANCE CRITERIA	ON OFF OFF OFF OFF OFF
A.R.M. SERIES 555-14 SP # 3926 ODM: -100	T/O WT 430,000# LDG WT 348,000#		T/O WT 466,000# LDG WT 368,000#	

SHIP 724

PERFORMANCE

The accompanying chart identifies the takeoff normal thrust vs alternate thrust flap/pack options currently in use for ship 724 when it is used as a -200. Also shown are the flap/pack options available when ship 724 is operated as a -100.

It also identifies:

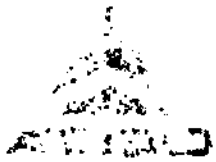
- The Aircraft Restrictions Manual series that is tailored for operation as a -200, and another, Aircraft Restrictions Manual series that is tailored for operation as a -100.

- The Standard Practice to be used for determining the Airport Restrictions-on line cities tailored for operation as a -200, and another, Standard Practice tailored for the Airport Restrictions - on line cities for operation as a -100.

- The Operational Data Manuals tailored for operation as a -200 and operation as a -100.

- The maximum takeoff and landing weights to be used for both domestic/non-transoceanic and transoceanic operation for operation as -200 and as a -100.

-250 Differences



-250 Differences

Ships 736 - 737 - 738 - 739 - 740 - 741

AIRPLANE GENERAL

AIRCRAFT WEIGHTS - Same as -500 aircraft.

AIRCRAFT LENGTH - Same as -1 aircraft.

ENTRY DOORS - Same as -1 aircraft.

LOWER GALLEY - Same as -1 aircraft with extra cart storage in forward cabin and No. 2 door areas.

LAVATORIES - Two additional, (1) in forward cabin area, and (1) aft of 2R door.

EMERGENCY EQUIPMENT - Same as -1 aircraft.

APU - Same as -1 aircraft.

ELECTRICAL - Same as -1 aircraft

HYDRAULICS - Low pneumatic pressure disconnect of No. 2 pack inter-locked with the "C" ATM and the "B" ATM. Same as -500 aircraft.

LANDING GEAR - Heavy duty landing gear, tires, wheels, and brakes. Brake pedal pressure same as -500 aircraft.

FLIGHT CONTROLS - Same as -1 aircraft.

FLAPS - Same flap detented position as -500 aircraft.

FUEL SYSTEM - Same as -500 aircraft.

POWER PLANT - Has RB211 - 524B4I engines installed - maintenance reliability and fuel economy improved.

FIRE PROTECTION - Same as -1 aircraft

PNEUMATICS - Same as -1 aircraft.

AIR CONDITIONING AND PRESSURIZATION - Same as -1 aircraft

ICE AND RAIN - Same as -1 aircraft.

FLIGHT INSTRUMENTS - Same as -500 aircraft.

NAVIGATION - Same as -500 aircraft - 3 INS and FMS.

COMMUNICATIONS AND RADAR - Same as -1 aircraft.

AUTO FLIGHT - Same as -500 aircraft - has split - 1 - 2 switch on Nav Mode Panel.

(SHIPS 736 THRU 741 DURING -250 MODIFICATION)

	COCKPIT PLACARD	POWER CHARTS	CHECK LISTS	TOTAL FUEL	ENGINES INSTALLED
-200	YELLOW	YELLOW	BLUE	213,600#	3 -524B4
-100	PINK	PINK	BLUE	213,600#	-22B/-524B4

ENGINE PERFORMANCE CRITERIA	DOMESTIC — NON-TRANSOCEANIC T/O FLAPS	T/O PACK	TRANSOCEANIC T/O FLAPS	T/O PACK
-200 NORMAL THRUST 3 -524B4 ENGINES AT -524B4 RATING	10° 10° 18° (LGA-ONLY)	ON OFF ON/OFF	18° 18° 22° *14° * FOUND IN AWABS ONLY	ON OFF OFF SPECIAL
A.R.M. SERIES 555-10 S.P. # 3931 ODM: -200	T/O WT 430,000# LDG WT 348,000#		T/O WT 474,000# LDG WT 368,000#	
-200 ALTERNATE THRUST 3 -524B4 ENGINES AT -22B RATING	10° 10°	ON OFF	NOT AUTHORIZED	
A.R.M. SERIES 555-10 S.P. # 3931 ODM: -200	T/O WT 430,000# LDG WT 348,000#			
-100 NORMAL THRUST 3 -22B ENGINES OR -22B/-524B4 MIX AT -22B RATING	10° 10° 18°(LGA ONLY) *4° *DEN - OTHER HIGH ALTITUDE AIRPORTS	ON OFF ON/OFF OFF	10° 10° 14° *4° *10° *14° * IMPROVED PERFORMANCE CRITERIA	ON OFF OFF OFF OFF OFF
A.R.M. SERIES 555-14 SP # 3926 ODM: -100	T/O WT 430,000# LDG WT 348,000#		T/O WT 466,000# LDG WT 368,000#	

SHIPS 736 THRU 741

PERFORMANCE

These aircraft during the -250 modification program will be operated as either a -200 or a -100. The takeoff thrust levels and flap/pack options available are the same options available for ship 724 when it is being used as either a -200 or a -100. The only difference between these aircraft and ship 724 is the total fuel capacity. Ships 736 thru 741 will have a much larger fuel capacity. The accompanying chart is repeated for use as needed.

When these aircraft (736 thru 741) are modified to -250 aircraft new data will be prepared and found in:

- A new Aircraft Restrictions Manual series 555-13 will be tailored for the -250 operation

- A new Standard Practice for Airport Restrictions - on line cities SP# 3941 will be tailored for the -250 operation.

- A new Operational Data Manual tailored for a -250.
  A new set of maximum takeoff and landing weights will be used for domestic/non-transoceanic and transoceanic operation as a -250.