Super 80

DC-9-81 (MD-81)

Aircraft Operating Manual

By Coolsky, 2018
Version 2.0

Super 80 – Aircraft Operating Manual

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SECTION 1

DESCRIPTION

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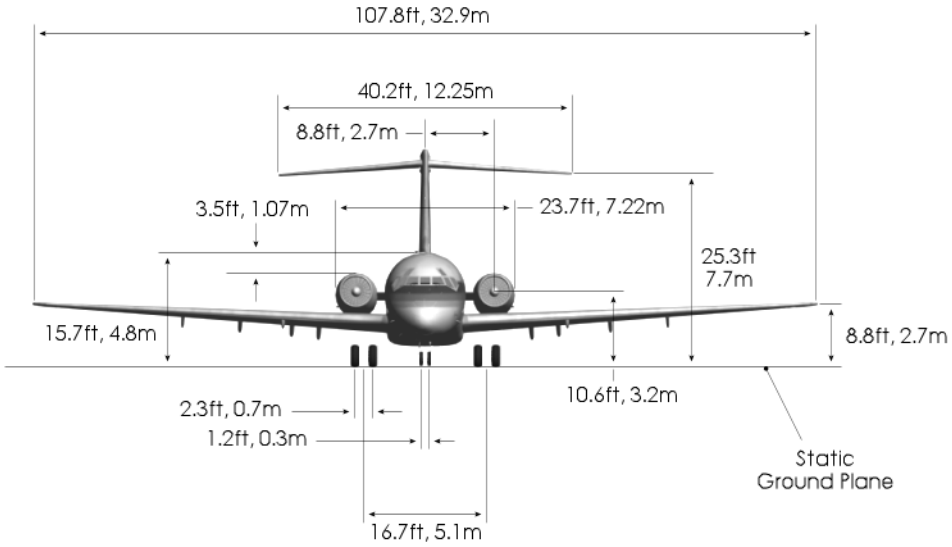
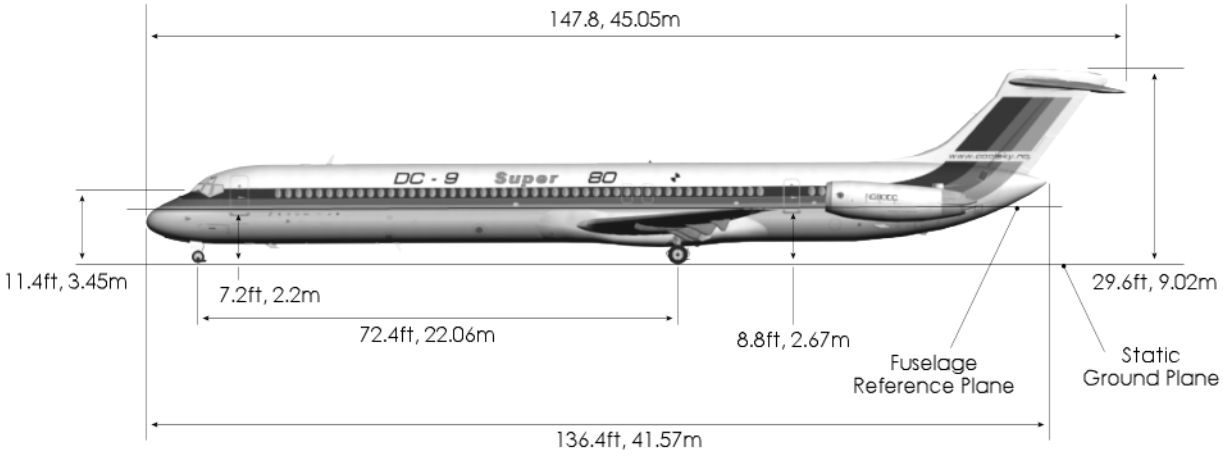
DIMENSIONS





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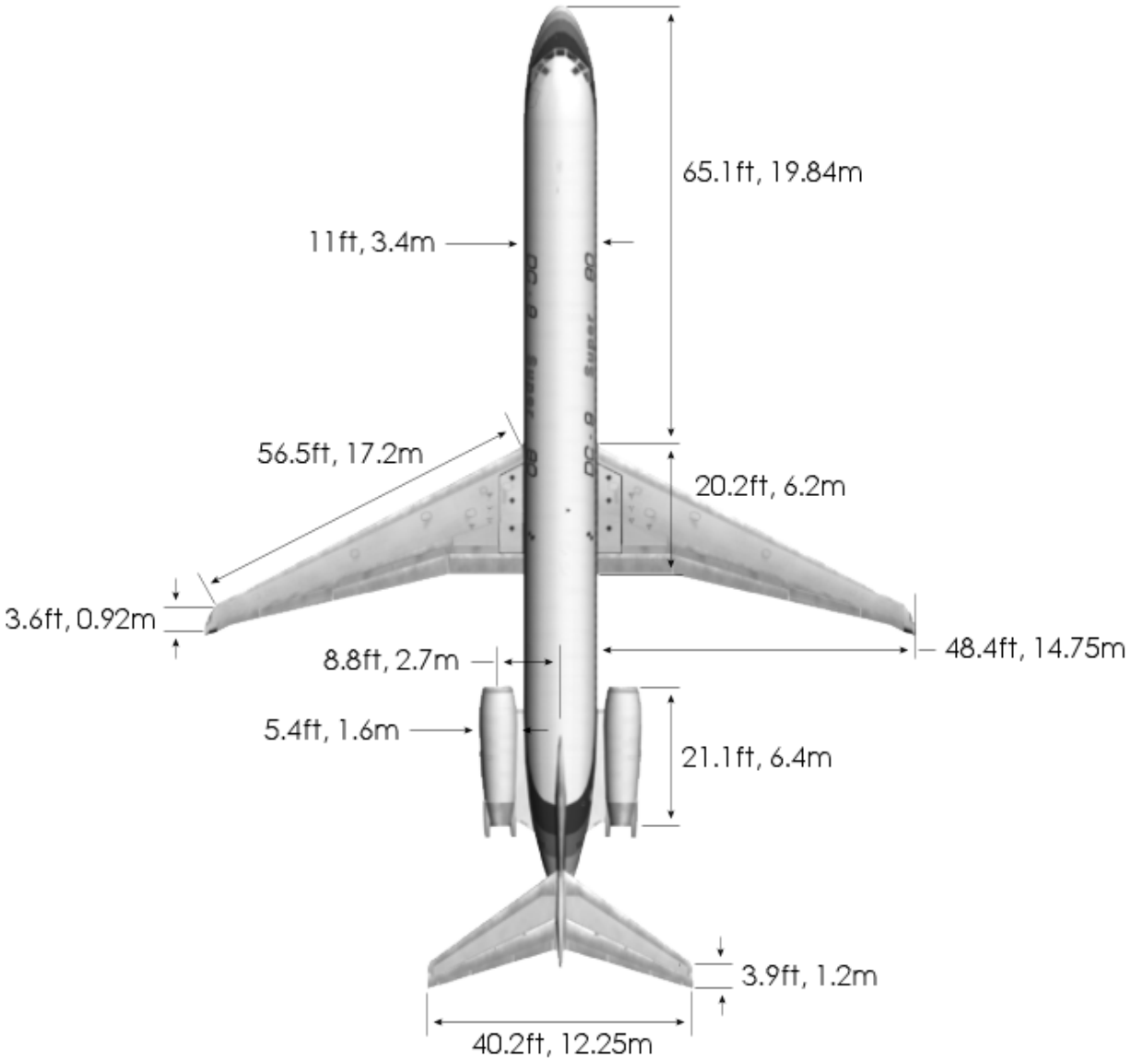

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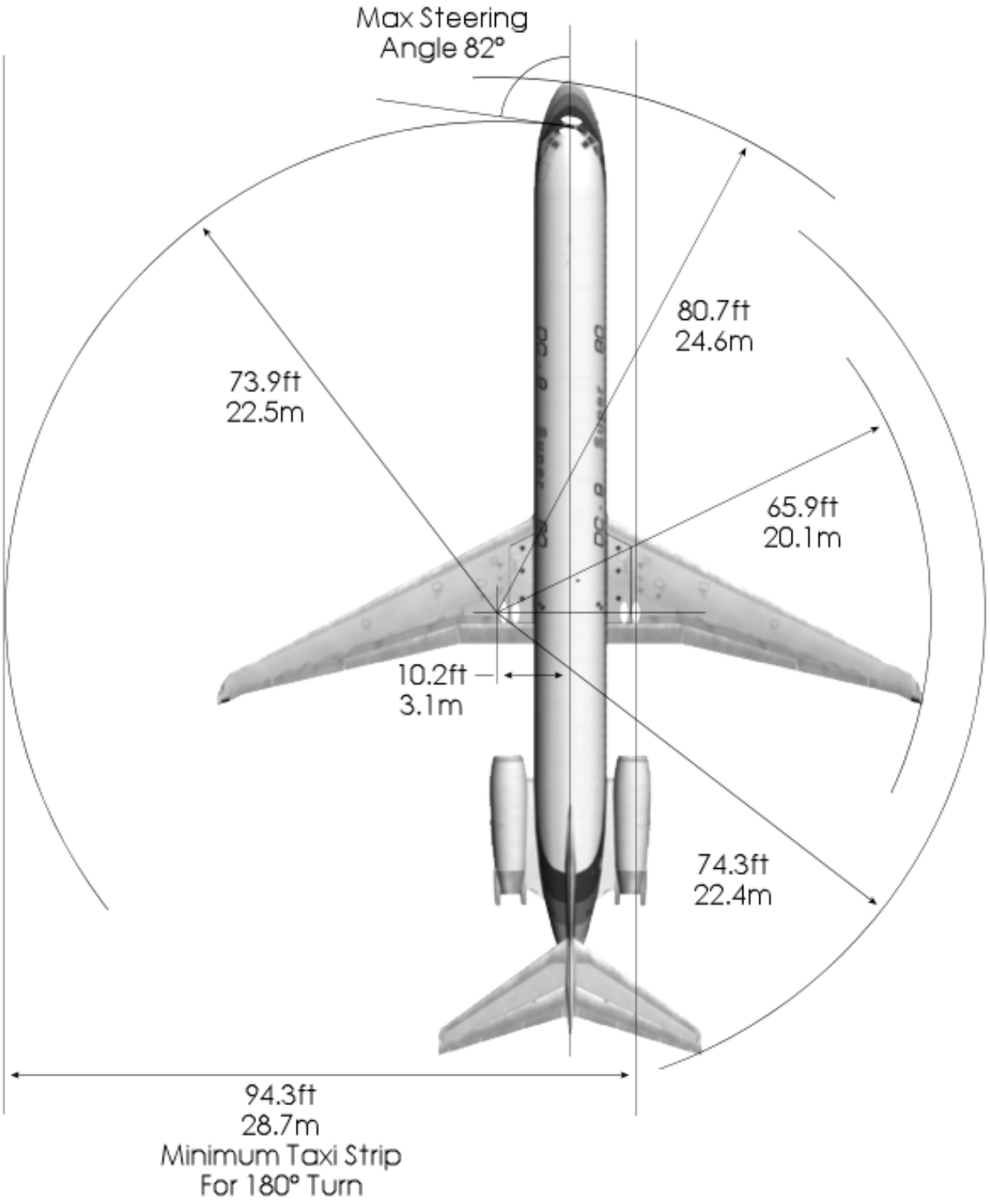
TURNING RADIUS



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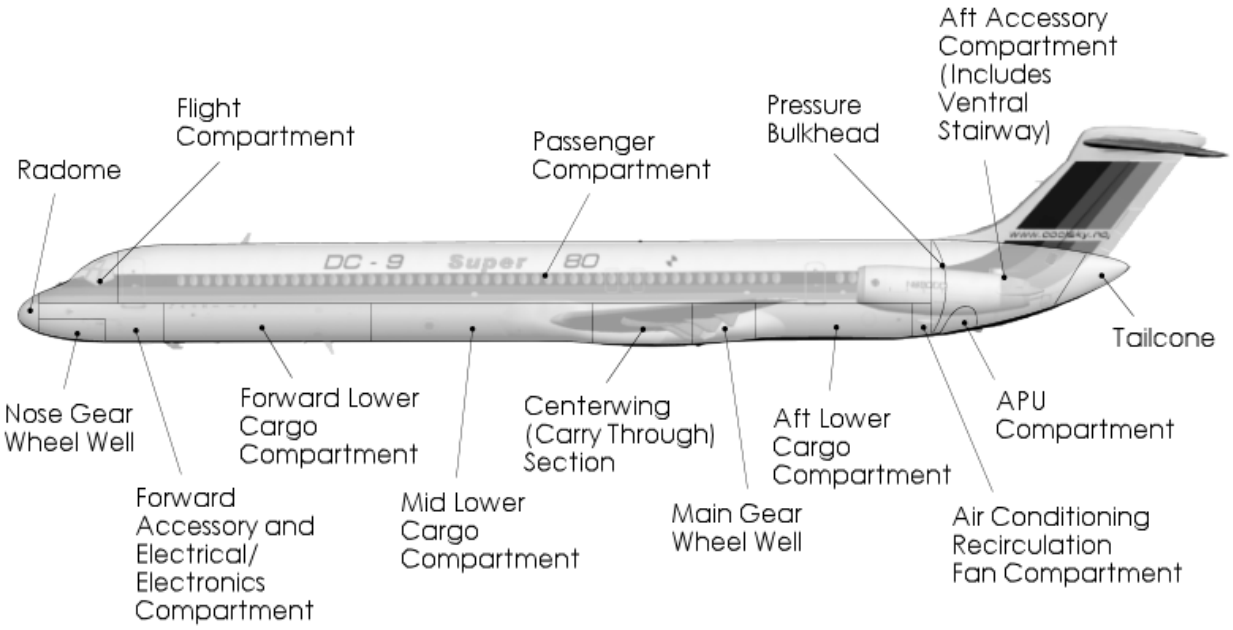
COMPARTMENTS



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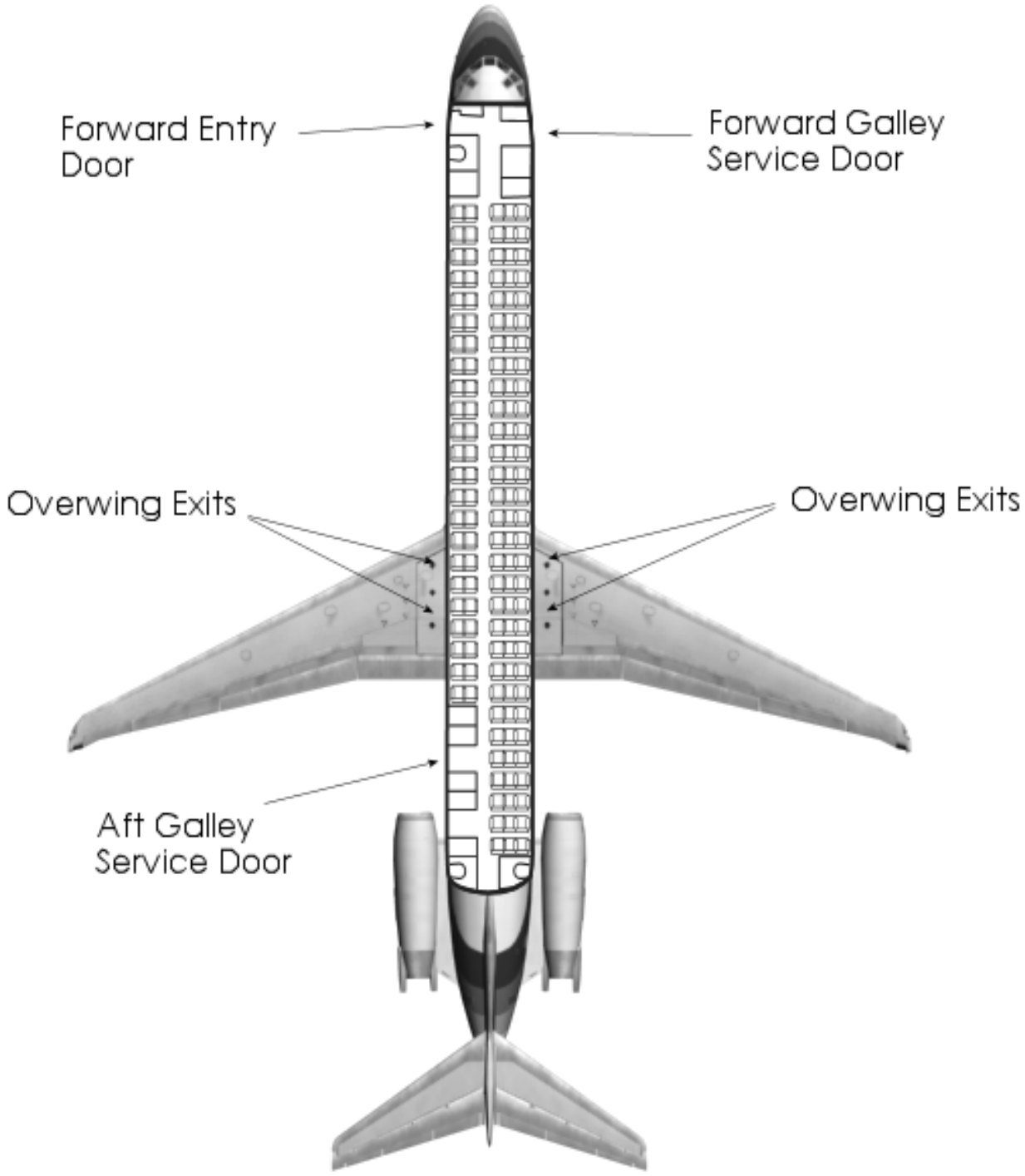
INTERIOR ARRANGEMENT



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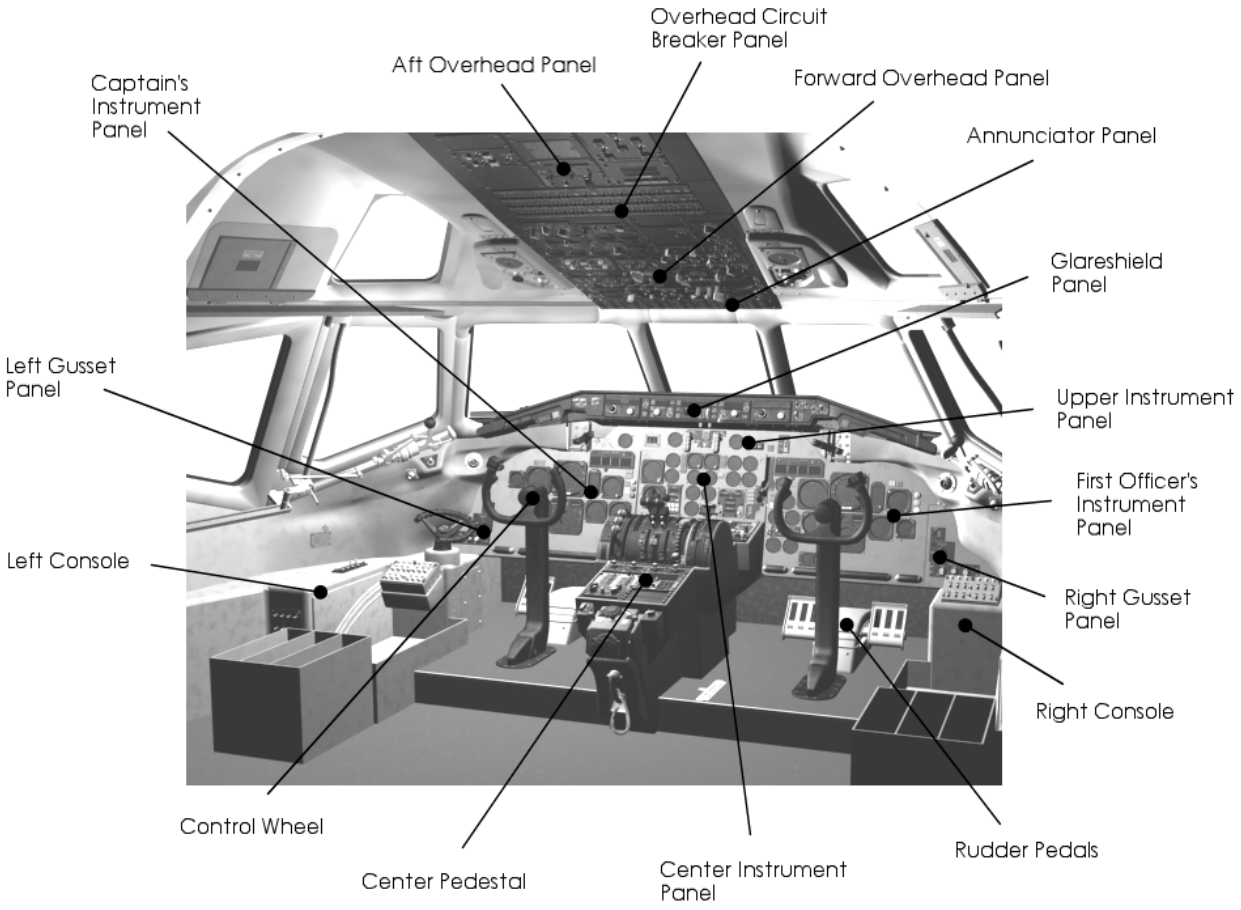
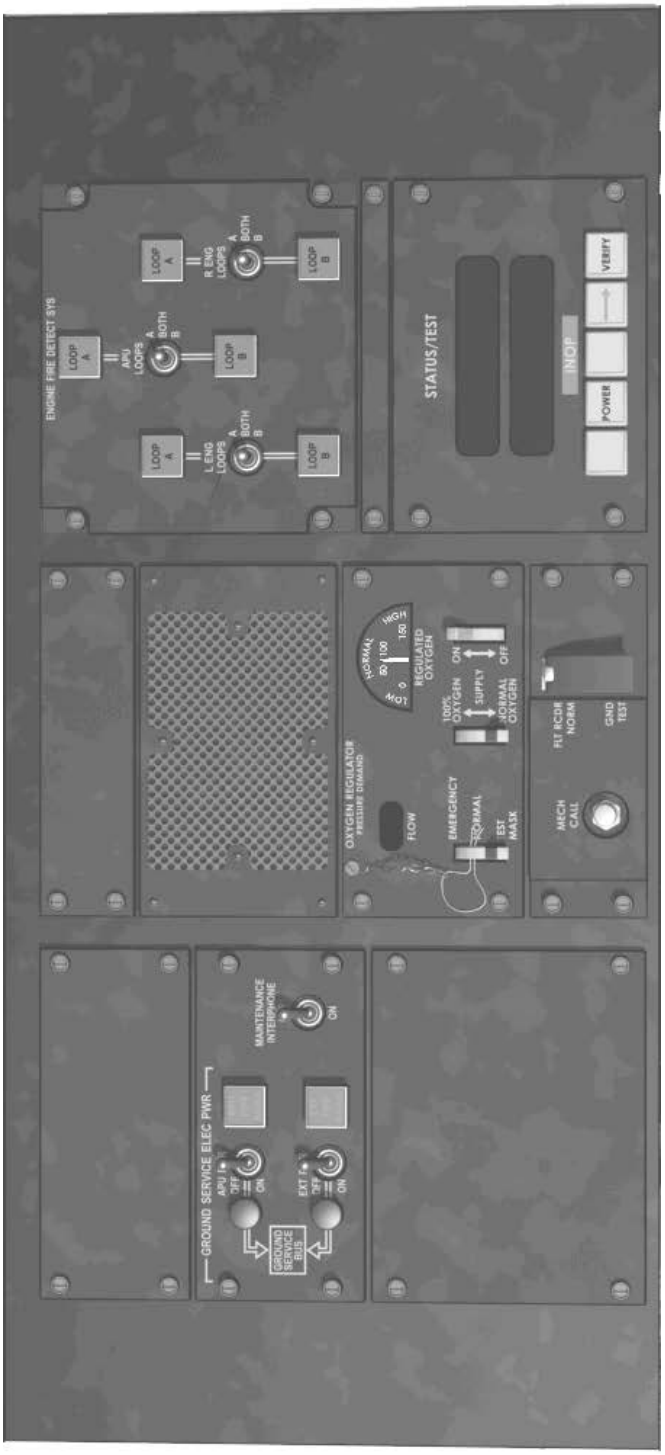
COCKPIT ARRANGEMENT



OVERHEAD PANEL (AFT)



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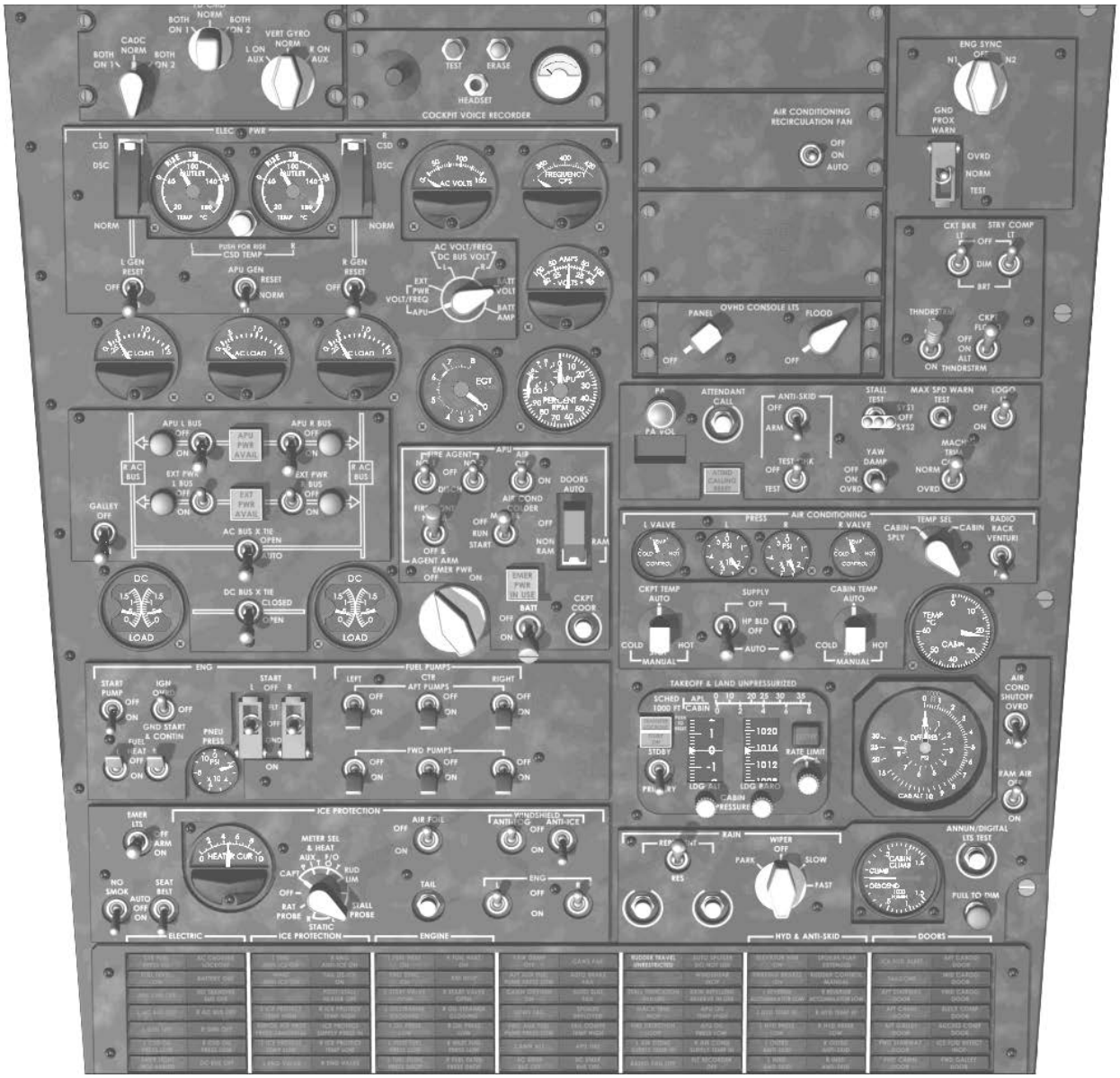
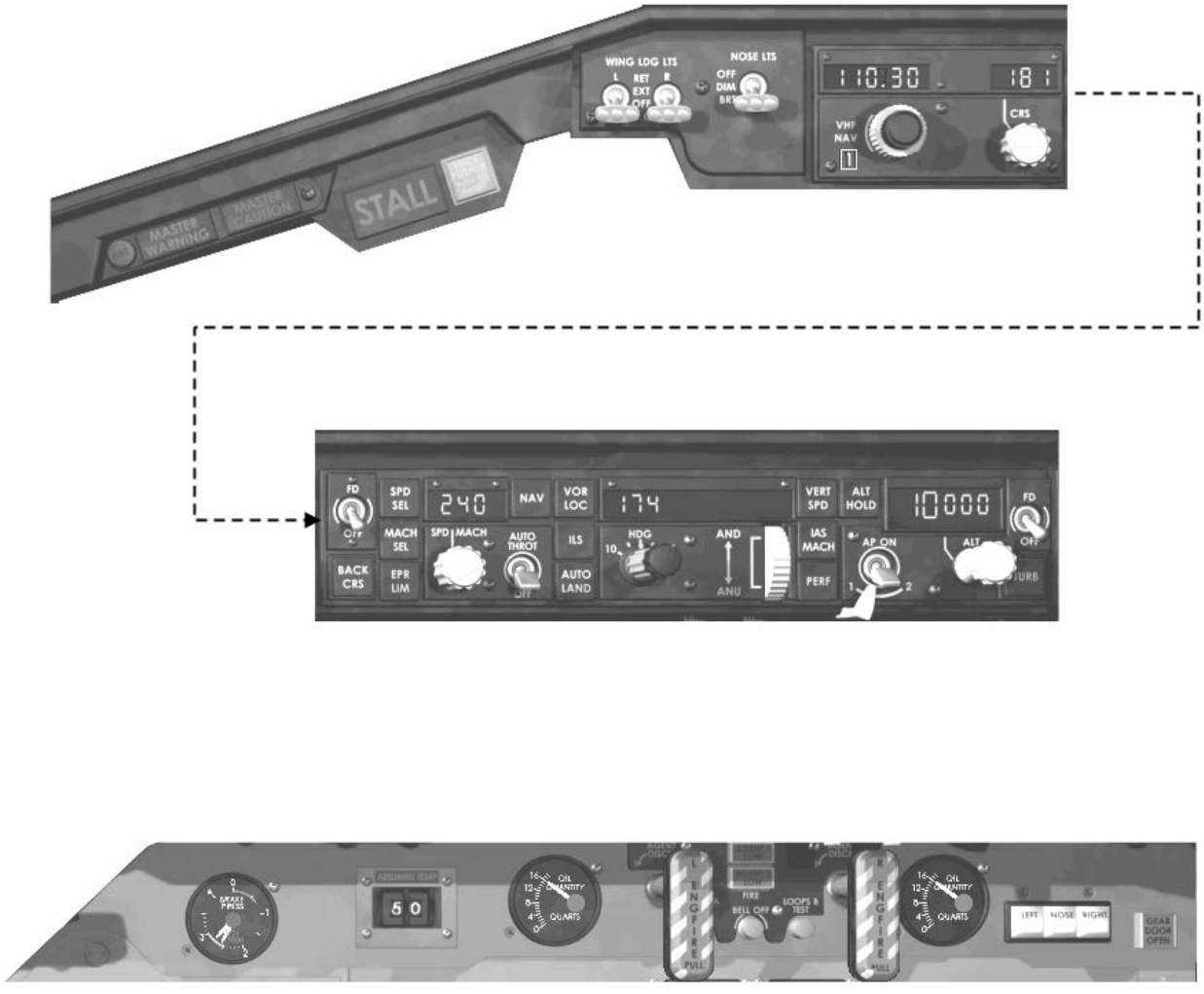
OVERHEAD PANEL (FORWARD)



GLARESHIELD AND UPPER INSTRUMENT PANEL



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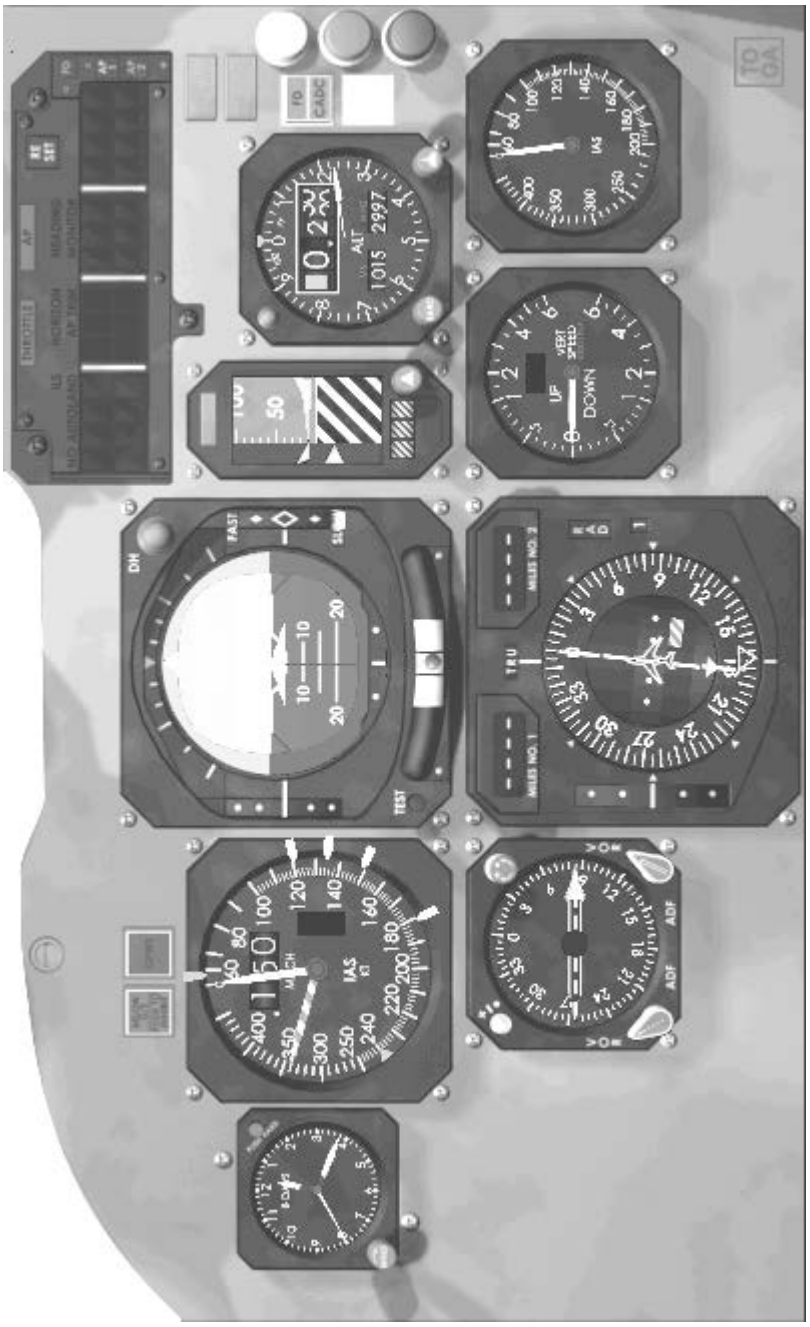
CAPTAIN'S INSTRUMENT PANEL



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CENTER INSTRUMENT PANEL

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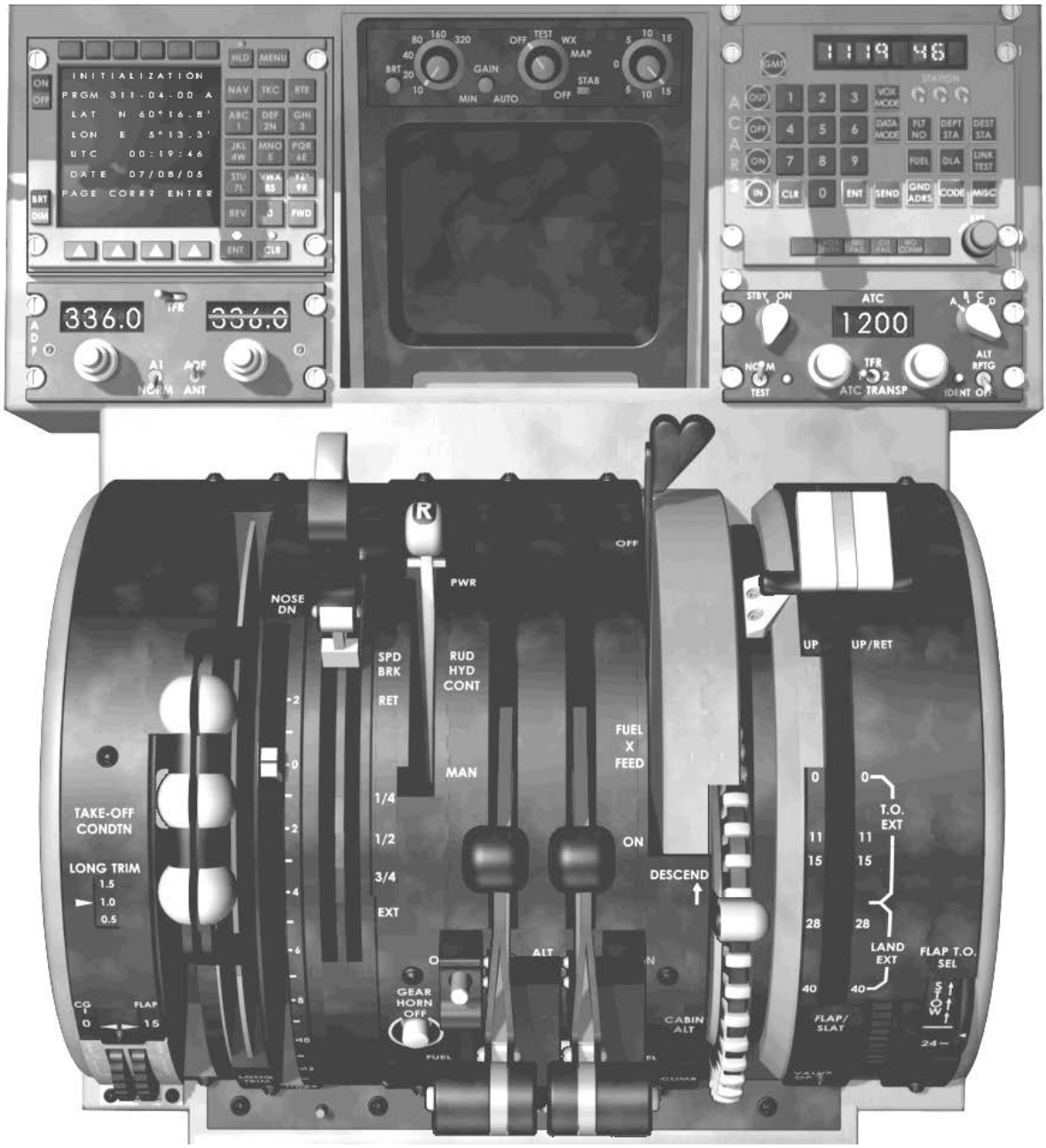
PEDESTAL (FORWARD)



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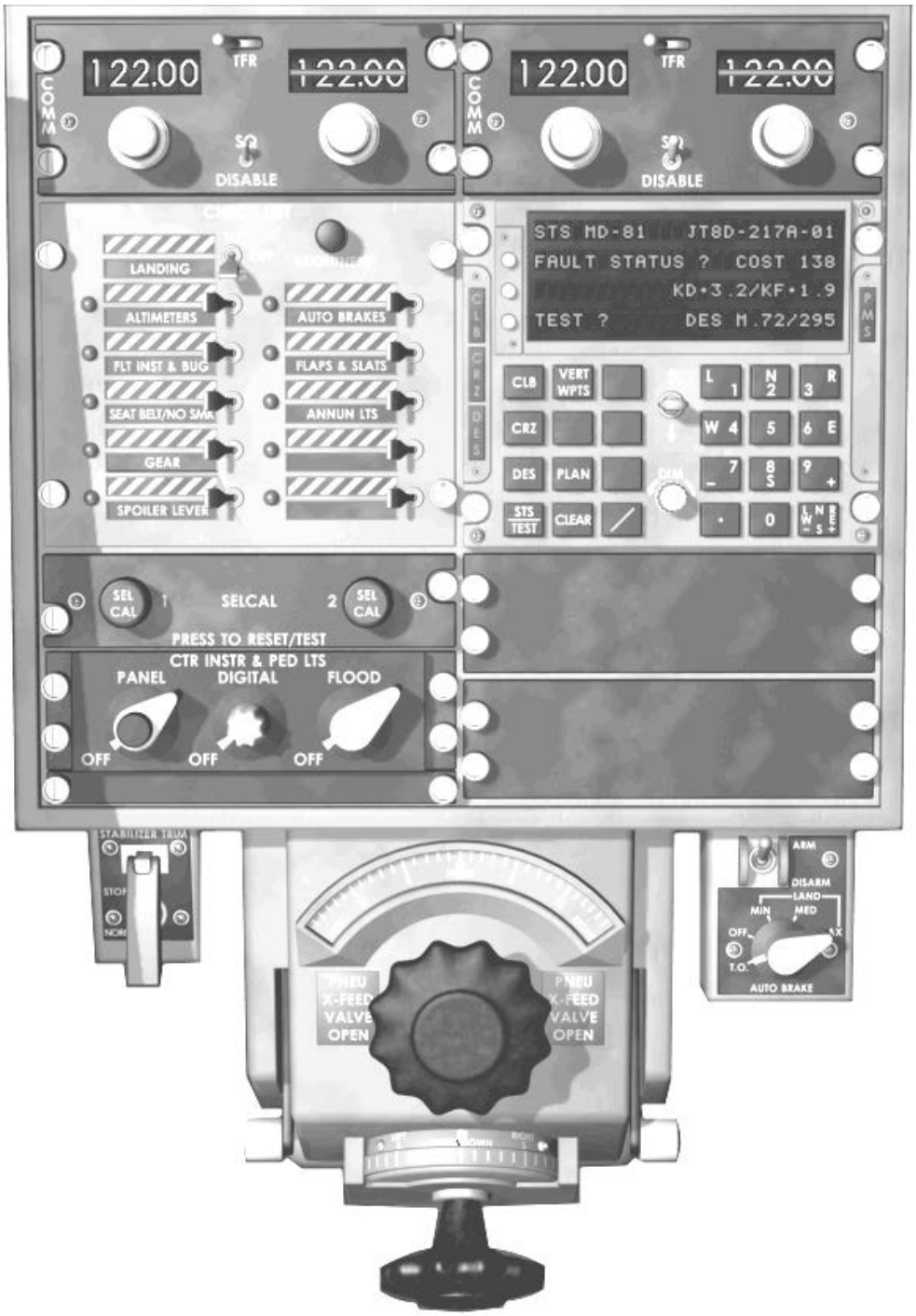
PEDESTAL (AFT)



SECTION 2

LIMITATIONS

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GENERAL

Flight Maneuvering Load Acceleration Limits +2.5g to -1.0g

Operational Limits

Runway Slope	+1.7% to -2.0%
Limiting Tailwind Component	10 knots

Crosswind Values (Take-Off and Landing)

Maximum demonstrated crosswind component is 30kts. This is not a limitation. However, components at or near 30 knots with higher gusts should be considered operationally unacceptable.

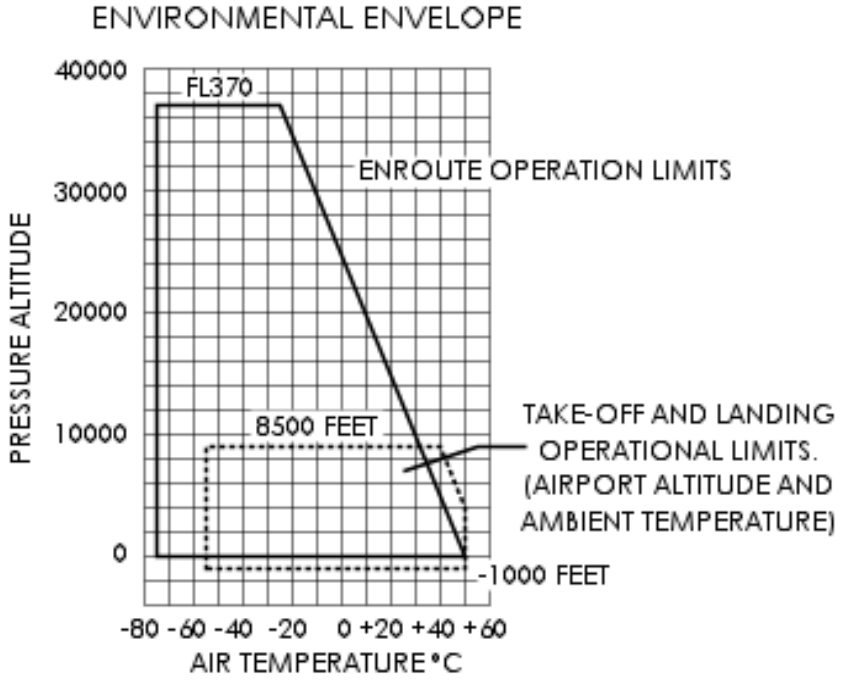
Minimum Take-Off and Landing Altitude -1,000 ft

Maximum Take-Off and Landing Altitude 8,500 ft

Take-Off and Landing Temperature Limitations

Minimum	-65°F/-54°C
Maximum	+122°F/+50°C

Environmental Envelope



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AIRSPEEDS

Maximum Operating Airspeed (V_{MO}/M_{MO})

V_{MO} – 340kts
M_{MO} – .84M (above Mach/IAS crossover altitude)

Landing Gear Operation (V_{LO}/M_{LO})

Extension – 300kts/.70M
Retraction – 250kts/.70M

Landing Gear Extended (V_{LE}/M_{LE})

300kts/.70M

Flap Placard Speeds (V_{FE}/M_{FE})

FLAP POSITION	LIMITING SPEED
0°-13°	280kts/.57M
14°-20°	240kts/.57M
21°-25°	220kts/.57M
26°-30°	200kts/.57M
31°-40°	195kts/.57M

Slats Extended

SLATS POSITION	LIMITING SPEED
Mid position	280kts/.57M
Full extended	240kts/.57M

Turbulence Penetration Speed

275-285kts or .75-.79M, whichever is lower

WEIGHTS

Maximum Ramp Weight

150,500 lbs

Maximum Take-Off Weight

149,500 lbs

This is maximum allowable gross weight for the aircraft at brake release, just prior to commencing take-off roll.

Maximum Landing Weight

130,000 lbs

Landings at weights exceeding the Maximum Landing Weight are authorized. Special procedures apply for overweight landings. Maintenance reports and inspections are required following an overweight landing.

Maximum Zero Fuel Weight

122,000 lbs

SECTION 3

NORMAL PROCEDURES

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SECTION 3: NORMAL PROCEDURES

GENERAL

Normal Procedures Checklist

The Normal Procedure Checklists are used to insure that all important safety items have been accomplished.

The items in the Checklist cannot be considered accomplished until all of the expanded procedures associated with that item have been accomplished.

Crew Duties

Normally crew duties are divided between the Captain and First Officer during ground operations and between pilot-flying and pilot-not-flying during flight. The Captain is responsible for ensuring that all normal procedure checklists are accomplished at the proper time.

Normally the pilot-not-flying will accomplish the appropriate checklist and notify the pilot-flying when the checklist has been completed.

Auto-Flight/Altitude Clearance Procedures

Normally when the autopilot is engaged, the pilot-flying will control the Flight Guidance panel. When the autopilot is not engaged, the pilot-flying will normally call for changes to be made to the Flight Guidance panel by the pilot-not-flying.

Both pilots should be aware of all communications traffic and clearances.

Traffic Watch

Both crew members shall maintain traffic watch during all phases of flight.

Cabin Door Operation

The cabin door(s) shall be closed for departure and opened on arrival by the Gate Agent, using the cabin door exterior control. Except for emergencies, do not request the Flight Attendant to open or close the door(s). Call the Gate Agent.

Note: It is perfectly normal to have a gap between the cabin door and aircraft when the door is closed and the aircraft is unpressurized. This allows for negative pressure relief. The doors will become flush with the airframe when the aircraft pressurizes during the take-off roll.

Anti-Collision Lights

The Anti-Collision lights shall be ON when the engines are about to best started or are running, and anytime the airplane is in motion, taxi or tow.

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NORMAL PROCEDURE CHECKLIST

BEFORE STARTING ENGINES

LOGBOOK.....CHECKED
RUDDER PEDALS AND
SEATS ..... ADJUSTED AND LOCKED
WINDOWS .....CLOSED AND LOCKED
O2 PANELS/INTERPHONE/
O2 PRESSURE ..... SET AND CHECKED
EMERGENCY LIGHTS ..... ARMED
PROBE HEAT ..... CHECKED AND CAPT
WINDSHIELD ANTI-ICE ..... ON
ANTI-SKID ..... OFF
PRESSURIZATION ..... AUTO (UP) AND SET
AIR COND SHUTOFF..... AUTO
FLIGHT GUIDANCE PANEL..... SET AND CHECKED
FLT INSTR/SWITCHES/BUGS ..... SET AND CROSSCHECKED
FUEL PANEL/QUANTITY AND
DISTRIBUTION ..... SET AND CROSSCHECKED
GEAR HANDLE AND LIGHTS.....DOWN AND GREEN
TRANSPONDER .....SET
STABILIZER TRIM .....SET
SPOILER LEVER ..... RET
THROTTLES .....CLOSED
TAKE-OFF WARNING .....CHECKED
FUEL LEVERS ..... OFF
FLAPS/SLATS .....UP/RETRACTED
AILERON/RUDDER TRIM ..... ZERO/ZERO
PARKING BRAKE/PRESSURE.....PARKED/NORMAL
SHOULDER HARNESSES ..... ON
FLIGHT FORMS.....CHECKED
NO SMOKING SIGNS..... ON

FIVE MINUTES PRIOR TO DEPARTURE
SEAT BELT SIGNS..... ON

PRIOR TO ENGINE START OR PUSH OUT

GALLEY POWER..... OFF
ENGINE IGNITION ..... CONTIN
FUEL PUMPS..... ON
AUX HYDRAULIC PUMP..... ON
ANTI-COLLITION/EXTERIOR LIGHTS..... ON/AS REQUIRED
DOOR ANNUNCIATOR ..... OUT
AIR CONDITIONING SUPPLY SWITCHES ..... OFF

TAXI

BEFORE TAXI OR POWERBACK

GALLEY POWER.....ON
ENGINE ANTI-ICE..... AS REQUIRED
HYDRAULIC PUMPS.....CHECKED AND HI/ON

TAXI
APU ..... AS REQUIRED
PNEU X-FEED (One engine taxi)..... L CLOSED/R OPEN
ANTI-SKID (After leaving ramp area)..... ARM
R ENG (One engine taxi).....SHUTDOWN
FLIGHT CONTROLS ..... CHECKED
FGS.....T/O MODE

BEFORE TAKE-OFF (Mechanical Checklist)

FLT INST & BUGS..... SET AND CHECKED
ANTI-ICE..... AS REQUIRED
FLAPS AND SLATS .....TAKE-OFF
STAB TRIM .....SET
APU/PNEU X-FD'S..... AS REQUIRED/CLOSED
ANTI-SKID/ABS .....ARMED/TAKE-OFF AND ARMED
SPOILER LEVER..... ARMED
TO PA/PACKS ..... COMPLETE/AS REQUIRED
ANNUNCIATOR LIGHTS..... CHECKED
NOSE LIGHTS.....BRIGHT

AFTER TAKE-OFF – CLIMB

GEAR .....UP AND NO LIGHTS
SPOILER LEVER.....DISARMED
AUTO BRAKES .....OFF AND DISARMED
FLAPS AND SLATS .....UP/NO LIGHTS
PRESSURIZATION AND AIR COND ..... CHECKED

10,000FT MSL
ENGINE IGNITION..... AS REQUIRED
FUEL SYSTEM..... CHECKED
STERILE COCKPIT ..... CABIN CHIME
ALTIMETERS.....RESET AND CROSSCHECKED
HYDRAULIC PUMPS.....LOW/OFF

18,000FT MSL
EXTERIOR LIGHTS ..... AS REQUIRED
ALTIMETERS.....RESET AND CROSSCHECKED

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CRUISE

ENG SYNC ..... ON
FIRST FLIGHT OF DAY ITEMS ..... CHECKED
DELAY CODES IN ACARS ..... AS REQUIRED

DESCENT

LANDING DATA ..... PREPARED
PRESSURIZATION ..... SET AND CHECKED
ENG SYNC ..... OFF
ENGINE IGNITION ..... CONTIN
ENGINE AND AIRFOIL ANTI-ICE ..... AS REQUIRED
WINDSHIELD ANTI-FOG ..... AS REQUIRED
SHOULDER HARNESSES ..... ON

DESCENDING THRU FL180 OR LEAVING CRUISE ALTITUDE, WHICHEVER IS LOWER
EXTERIOR LIGHTS ..... AS REQUIRED
ALTIMETERS ..... RESET AND CROSSCHECKED
HYDRAULIC PANEL ..... HI/ON/CHECKED

10,000FT MSL
STERILE COCKPIT ..... CABIN CHIME

BEFORE LANDING (Mechanical Checklist)

ALTIMETERS ..... RESET AND CROSSCHECKED
FLT INST & BUGS ..... SET AND CROSSCHECKED
SEAT BELT/NO SMK ..... ON
GEAR ..... DOWN, THREE GREEN
SPOILER LEVER ..... ARMED
AUTO BRAKES ..... AS REQUIRED
FLAPS & SLATS ..... LAND
ANNUNCIATOR LIGHTS ..... CHECKED

AFTER LANDING – TAXI

AUTOPILOT AND AUTOTHROTTLE SWITCHES ..... OFF
LANDING LIGHTS ..... OFF
SPOILER LEVER ..... RET
AUTO BRAKES ..... OFF/DISARM
PNEU XFEED (One engine taxi) ..... R OPEN/L CLOSED
FLAPS/SLATS ..... UP/RETRACTED
RADAR ..... OFF
TRANSPONDER ..... STBY
ANTI-SKID ..... OFF
BRAKE PRESSURE ..... MONITOR
APU ..... AS REQUIRED
R ENG (One engine taxi) ..... SHUTDOWN

PARKING

BRAKES ..... PARKED
SEAT BELT SIGN ..... OFF
PNEU XFEED VALVES ..... OPEN
APU OR EXTERNAL POWER ..... ESTABLISHED
FUEL LEVERS ..... OFF
ANTI-COLLISION/EXTERIOR LIGHTS ..... OFF/AS REQUIRED
ENGINE IGNITION ..... OFF
FUEL PUMPS ..... OFF
EMERGENCY LIGHTS ..... OFF
PROBE HEAT ..... OFF
ANTI-ICE ..... OFF
AIR CONDITIONING ..... AS REQUIRED
OIL/HYD/O2 QUANTITIES ..... CHECKED
ARRIVAL REPORT ..... AS REQUIRED
LOGBOOK ..... COMPLETED
FD SWITCHES OFF ..... OFF
O2 PANEL SUPPLY LEVERS ..... OFF
COCKPIT LIGHTS ..... AS REQUIRED

ALL PASSENGERS HAVE DEPLANED
GALLEY POWER ..... OFF
AIR CONDITIONING ..... OFF
APU ..... AS REQUIRED
BATTERY SWITCH ..... ON/OFF
POST FLIGHT INSPECTION ..... AS REQUIRED

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ORIGINATION PRE-FLIGHT INSPECTION

ORIGINATION PRE-FLIGHT INSPECTION (Procedure)

The Origination Pre-Flight Inspection is accomplished on the first origination flight of the day for the aircraft and anytime the condition of the aircraft is in doubt.

WALK-AROUND INSPECTION..... COMPLETE

1. Not simulated.

COCKPIT SAFETY INSPECTION

BATTERY SWITCH.....ON

2. Set the battery switch to the ON position.

COCKPIT LIGHTS..... AS REQUIRED

3. Set the Cockpit Flood light switch to OFF, or as required.
4. Turn on the Center Instrument & Pedestal Digital lights.
5. Turn on the Instrument Panel Digital lights.
6. Turn on the Flight Guidance Control Panel Digital lights.

HYDRAULIC PANEL ..... CHECK

7. Set the Transfer Pump switch to OFF.
8. Set both Engine Pump switches to HI.
9. Set the Auxiliary Pump switch to OFF.

GEAR HANDLE .....DOWN

10. Confirm that the gear handle is down and that all the three green gear lights are on.

CIRCUIT BREAKERS ..... CHECK

11. Not simulated.

COCKPIT INITIAL PREPARATION

APU (When required) .....START

12. Please refer to STARTING APU Procedure guide on how to start the APU.

APU PWR and EXT PWR ..... OFF

13. Set the APU PWR switch to OFF.
14. Set the EXT PWR switch to OFF.
15. Note: The APU PWR and EXT PWR switches on the Ground Service Elec Pwr Panel must be OFF before connecting APU or External Power to main AC buses.

EMERGENCY LIGHTS..... ARM

16. Set the EMER LTS switch to ARM.

GALLEY POWER .....ON

17. Set the Galley Power switch to ON.

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CABIN ALT CONTROL LEVER/POSITION INDICATOR..... AUTO/VALVE OPEN

18. Check that the CABIN ALT Control Lever is in the AUTO (up) position (Yellow handle, not the wheel).
19. Check that the outflow valve indicator indicates VALVE OPEN. Full forward indicates valve closed, full aft indicates valve fully open. Note: If the valve is only partially open, that is ok.

PNEUMATICS AND AIR CONDITIONING ..... ESTABLISHED

20. Set both Pneumatic X-Feed handles to the OPEN (up) position.
21. Check that the APU AIR switch is set to ON or COLDER.
22. Set both Air Conditioning Supply switches to AUTO.
23. Set the Air Conditioning Recirculation Fan to AUTO.
24. Set the CKPT TEMP selector to AUTO.
25. Set the CABIN TEMP selector to AUTO.
26. Set the AIR COND SHUTOFF switch to AUTO.
27. Set the RAM AIR switch to OFF.

EXTERIOR LIGHTS ..... CHECK LIGHTS

28. Check the exterior lights of the aircraft. (Not simulated in the panel)

FLAP HANDLE/INDICATOR ..... AGREE

29. Make sure the flaps/slats handle is in the UP/RET position.
30. Check that the flap/slat handle and indicator agree.

ANTI-SKID ..... TEST AND OFF

31. Set the ANTI-SKID switch to ARM.
32. Hold the ANTI-SKID TEST CHK switch to TEST. Check that all four anti-skid lights come on.
33. Set the ANTI-SKID switch back to OFF.

PARKING BRAKE ..... PARKED

34. The parking brake should be on. (Raised position)
35. Check that the Parking Brake light is on.
36. Check that the Brake Pressure gauge reads above the red band.

SHOULDER HARNESSES..... CHECK

37. Check the condition of the shoulder harnesses. (Not simulated)

LOGBOOK..... CHECK

38. Check the aircraft papers. (Not simulated)

CHECKLISTS..... CHECK ABOARD

39. Make sure you have all applicable checklists onboard with you.

COCKPIT AREA INSPECTION

CREW LIFE VESTS, O2 MASKS, SMOKE GOOGLES..... CHECK ABOARD

40. Not simulated.

FLIGHT CREW OXYGEN SUPPLY CYLINDER ..... CHECK

41. Not simulated.

PASS OXY MASK..... NORM (GUARDED)

42. Not simulated.

PROTECTIVE BREATING EQUIPMENT ..... CHECK

43. Not simulated.

COCKPIT EMERGENCY EQUIPMENT ..... CHECK ABOARD

44. Not simulated.

SPARE BULB KIT ..... CHECK

45. Not simulated.

FINAL COCKPIT PREPARATION

MAINTENANCE INTERPHONE..... OFF

46. Set the Maintenance Interphone switch to OFF.

FLIGHT RECORDER .....TEST/NORM

47. Open the guard and set the Flight Recorder Test switch to TEST.
48. If the FLIGHT RECORDER OFF light stays off, the Flight Recorder operates properly.
49. Set the Flight Recorder Test switch back to NORM and put the guard back on.

FD CMD..... NORMAL

50. Set the FD CMD switch to NORM.

CADC ..... NORMAL

51. Set the CADC switch to NORM.

VERT GYRO ..... NORMAL

52. Set the VERT GYRO switch to NORM.

COCKPIT VOICE RECORDER..... CHECK

53. Press the Cockpit Voice Recorder Test switch.
54. Observe the TEST MONITOR METER as a test signal is being sent to the Voice Recorder. No reading on the meter indicates a failure.

ELECTRICAL SYSTEM ..... CHECK

55. Check that both CSD switches are guarded.
56. Set the L GEN and R GEN switches to RESET and then back to ON.
57. Set the AC BUS X TIE switch to AUTO.
58. Set the DC BUS X TIE switch to OPEN.

EMERGENCY POWER.....CHECK AND OFF

59. Set the Emergency Power switch to ON.
60. Check that EMER PWR IN USE light comes on.
61. Set the Emergency Power switch back to OFF.

WING TANK FUEL PUMPS.....OFF

62. Turn off all, left and right, wing tank fuel pumps. If a pump is being used for APU operation, leave it on.

CENTER TANK FUEL PUMPS..... CHECK

63. Turn off fuel pump used for APU operation.
64. Check each of the center tank fuel pumps individually, checking that both the L and R INLET FUEL PRESS LOW lights go out when each pump is turned on and comes back on when the pump is turned off. Note: The Start Pump should be off.
65. Turn back on fuel pump used for APU operation.

IGNITION.....OFF

66. Set the Ignition switch to OFF.

FUEL HEAT.....OFF

67. Set both FUEL HEAT switches to OFF.

START SWITCHES (L & R) .....OFF

68. Set both engine start switches to OFF. (Guarded position)

NO SMOKING.....ON

69. Set the NO SMOK switch to ON.

SEAT BELT.....OFF

70. Set the SEAT BELT switch to OFF.

PROBE HEAT..... CHECK AND CAPT

71. Rotate the METER SEL & HEAT switch to all positions and check for a reading on the HEATER CUR gauge (except for RAT PROBE position) and that the PITOT/STALL HEATER OFF light remains out.

AIR FOIL ANTI-ICE.....OFF

72. Set the Air Foil Anti-ice switch to OFF.

WINDSHIELD ANTI-FOG.....OFF

73. Set the Windshield Anti-Fog switch to OFF.

WINDSHIELD ANTI-ICE.....ON

74. Set the Windshield Anti-Ice switch to ON. Note: If the windshield have been cold soaked over night, they may require up to 30 minutes to warm up thoroughly.

ENGINE ANTI-ICE.....OFF

75. Set both Engine Anti-Ice switches to OFF.

ENGINE SYNC.....OFF

76. Set the ENG SYNC switch to OFF.

GROUND PROXIMITY WARNING SYSTEM.....TEST AND NORM

77. Set the GPWS switch to TEST (the switch is spring loaded back to NORM).
78. You should hear the aural alert "Whoop Whoop" followed by "Pull up" and "Glideslope". The GPWS FAIL light should also come on, together with...
79. ...the GPWS and BELOW G/S lights during the test.

CIRCUIT BREAKER AND STANDBY COMPASS LIGHTS.....AS REQUIRED

80. Set the CKT BKR LT switch to OFF, or as required.
81. Set the STBY COMP LT switch to OFF, or as required.

THUNDERSTORM LIGHT.....OFF

82. Set the THNDRSRM LT switch to OFF.

COCKPIT FLOOD LIGHT.....AS REQUIRED

83. Set the CKPT FLOOD switch to OFF, or as required.

OVERHEAD CONSOLE LIGHTS.....AS REQUIRED

84. Set the OVHD CONSOLE LTS knobs to OFF, or as required.

STALL WARNING.....TEST

85. Set the STALL TEST switch to SYS 1 (Momentary). This will test Stall Warning system 1. The stall warning horn should sound, followed by the vocal alert "Stall".
86. The STALL warning light should come on (flashing), together with the PUSH TO INHIBIT light (steady).
87. Repeat test for system 2.

MAX SPEED WARNING.....TEST

88. Set the MAX SPD WARN TEST switch to SYS 1. Check that audio clacker sounds followed by the vocal warning "Overspeed" is heard.
89. Repeat test for system 2.

YAW DAMPER.....ON

90. Set the YAW DAMP switch to ON.
91. Check that the YAW DAMP OFF light is out.

MACH TRIM COMPENSATION.....NORM

92. Set the MACH TRIM COMP switch to NORM.
93. Check that the MACH TRIM INOP light is out.

AIR CONDITIONING.....CHECKED

94. Check cabin and cockpit temperature and adjust as necessary.

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RADIO RACK..... FAN

95. Set the RADIO RACK switch to FAN.

CABIN PRESSURIZATION..... SET

96. Set the System Selector switch to PRIMARY.
97. Check that the STDBY ON and TRANSFER LOCKOUT lights are out.
98. Set the LDG ALT to Departure Field Elevation.
99. Set the LDG BARO to Current Altimeter Setting (press "B" on your keyboard).
100. Set the RATE LIMIT knob to the center index.
101. Push the FLOW light to test it.

RAIN REPELLENT ..... REPELLENT

102. Set the RAIN REPELLENT switch to REPELLENT.

WINDSHIELD WIPER..... OFF

103. Set the Windshield Wiper switch to PARK, to make sure the wiper is properly parked, and then back to OFF.

ANNUNCIATOR/DIGITAL LIGHTS .....TEST

104. Push the ANNUN/DIGITAL LTS TEST switch to test all Annunciator and digital lights in the cockpit. Carefully check all the lights on the overhead panel, main panel and pedestal for malfunction.

AUTOLAND PRE-FLIGHT TEST .....ACCOMPLISH

105. Set both VHF radios to the same ILS frequency (any ILS frequency will do). (Click the lower left number to switch between the two VHF radios)
106. Set both course readouts to the same course (any course will do).
107. Set the FD switch to FD.
108. Check that the NO AUTOLAND light on the FMA is out.
109. Press the AUTO LAND button.
110. Check that the NO AUTOLAND light flashes for a short while. If the light comes on steady, the test has failed. If the light goes out, the test has completed successfully.

STATIC AIR SELECTOR..... NORM

111. Set the Static Air Selector switch to the NORM position.

FLIGHT INSTRUMENTS..... CHECK

112. On the main instrument panel, check that all gyros are erect and no flags are visible on any of the flight instruments.

OIL QUANTITIES..... CHECK

113. Check the quantity on the Oil Quantity gauges.

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FIRE WARNINGS.....TEST

114. Press and hold the LOOPS TEST button to test the Engine Fire Warning system. Check that the fire bell sounds, followed by vocal warning "Fire left engine" and "Fire right engine".
115. Check that the red light in both ENG FIRE handles come on, both AGENT LOW lights come on, and both MASTER CAUTION and MASTER WARNING lights come on.
116. Also, check that all the FIRE DETECTOR LOOP lights on the ENGINE FIRE DETECT SYS panel come on during the test. (All switches should be in the BOTH position)

REVERSE THRUST AND UNLOCK LIGHTS.....OUT

117. Check that Engine Reverse Thrust lights and Engine Reverse Unlock lights for both engines are out.

ENGINE INSTRUMENTS..... CHECK

118. Check that all engine instruments read normal (zero).

THRUST RATING SYSTEM .....TEST

119. Push and hold the TEST button on the TRI. RAT should indicate +12°C. EPR LIM should indicate 2.04. Mode Selector lights and NO MODE light should be out.
120. Release the test button. RAT should indicate ambient temperature. EPR LIM should indicate 2.00 with failure flag in view. NO MODE light should come on. All Mode Selector lights should be out.
121. Press TO to turn the NO MODE light off.

FUEL QUANTITY .....TEST

122. Push the Fuel Quantity Test button to test the Fuel Quantity Indication System. Each individual tank quantity indicator should indicate 3000 LBS. The total fuel quantity should read 9000 LBS, and Zero Fuel Weight should indicate current ZFW plus 9000 LBS.

FUEL PANEL, QUANTITY AND DISTRIBUTION..... CHECK

123. Check that total fuel on board is sufficient for the planned flight.
124. Check the current fuel distribution against the Fuel Distribution Guide. (The Fuel Distribution Guide can be found in the Aircraft Operating Manual, Section 15)

FUEL USED RESET ..... RESET

125. Set the FUEL USED RESET switch to RESET (Momentary) to reset the fuel used counters.

HYDRAULIC SYSTEMS..... CHECK

126. Set the Aux Hydraulic Pump switch to OVRD and then to ON.
127. Check that the right hydraulics pressure gauge indicates within the top green band for both positions with R HYD PRESS LOW light out.
128. Set the Transfer Pump switch to ON (Aux Hydraulic Pump still in OVRD or ON)
129. Check that the left hydraulics pressure gauge indicates within green band with the L HYD PRESS LOW light out.
130. Check hydraulic quantities. Both gauges should read well above the red band.
131. Set the Transfer Pump switch back to OFF.
132. Set the Aux Hydraulic Pump switch back to OFF.

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BRAKE TEMPERATURE.....TEST

133. Press and hold the Brake Temperature Test button. The Brake Temperature Gauge should slowly rise to indicate about 450°C and the Overheat light should come on.

RADAR.....TEST AND OFF

134. Set the Mode Selector switch to TEST. The radar screen should display a green, yellow and red test pattern. Set the Mode Selector switch back to OFF.

ACARS.....DATA/SET

135. Insert the flight number for the current flight. Press FLT NO.
136. Set the flight number by clicking on the ACARS keyboard...
137. ...and press ENT when done.
138. Insert the Departure station. Press DEPT STA
139. Click the display to set the station name...
140. ...and press ENT when done.
141. Insert the Destination station. Press DEST STA, click the display to set the station name, and press ENT when done.

142. TRANSPONDER STBY
143. Set the Function Selector to STBY.

STABILIZER TRIM .....CHECK

144. Move the LONG TRIM handle in both directions and check that the LONG TRIM indicator moves in the appropriate direction.

SPOILER LEVER .....RET

145. The spoiler lever should be in the RET position (forward down position).

RUDDER HYDRAULIC CONTROL.....PWR

146. The RUD HYD CONT lever should be in the PWR position (forward).

REVERSE LEVERS/THROTTLES..... DOWN/CLOSED

147. Advance both throttles, checking for freedom of movement. Check that the Take-off Configuration warning sounds are heard. Then close the throttles.

FUEL CROSSFEED VALVE .....OFF

148. Set the FUEL X FEED lever to OFF (forward).

FUEL LEVERS .....OFF

149. Both Fuel Levers should be in the down and OFF position. (Under the throttles handles)

PMS.....PREFLIGHT ACCOMPLISHED

150. Please refer to the PMS guide on how to preflight the PMS.

AILERON AND RUDDER TRIM.....CHECK AND SET

151. Check travel or both aileron and rudder trim in all directions. Then set both to zero.

AUTO BRAKE .....OFF AND DISARM

152. Set the AUTO BRAKE Selector to OFF.
153. Set the AUTO BRAKE ARM/DISARM switch to DISARM.

COCKPIT CLEAN-UP INSPECTION

COCKPIT CLEAN-UP INSPECTION

For flights other than the first origination flight of the day for the aircraft, only the Cockpit Clean-Up Inspection needs to be accomplished.

WALK-AROUND INSPECTION.....COMPLETED

1. Not simulated.

PROTECTIVE BREATING EQUIPMENT..... CHECK

2. Not simulated.

SHOULDER HARNESSES..... CHECK

3. Check the condition of the shoulder harnesses. (Not simulated)

FLIGHT CREW OXYGEN SUPPLY CYLINDER..... CHECK

4. Not simulated

LOGBOOK..... CHECK

5. Check the aircraft papers. (Not simulated)

CIRCUIT BREAKERS ..... CHECK

6. Not simulated.

BATTERY SWITCH.....ON

7. Set the battery switch to the ON position.

EMERGENCY POWER.....OFF

8. Set the Emergency Power switch to OFF.

APU PWR and EXT PWR Switches .....OFF

9. Set the APU PWR switch to OFF.
10. Set the EXT PWR switch to OFF.

APU (When required) .....START

11. Please refer to STARTING APU Procedure guide on how to start the APU.

EMERGENCY LIGHTS..... ARM

12. Set the EMER LTS switch to ARM.

FLIGHT RECORDER.....TEST/NORM

13. Open the guard and set the Flight Recorder Test switch to TEST.
14. If the FLIGHT RECORDER OFF light stays off, the Flight Recorder operates properly.
15. Set the Flight Recorder Test switch back to NORM and the guard back on.

GALLEY POWER .....ON

16. Set the Galley Power switch to ON.

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CENTER TANK FUEL PUMPS..... CHECK

17. Turn off all fuel pumps.
18. Check each of the center tank fuel pumps individually, checking that both the L and R INLET FUEL PRESS LOW lights go out when each pump is turned on and comes back on when the pump is turned off.
19. Turn back on fuel pump used for APU operation.

PROBE HEAT..... CHECK AND CAPT

20. Rotate the METER SEL & HEAT switch to all positions and check for a reading on the HEATER CUR gauge (except for RAT PROBE position) and that the PITOT/STALL HEATER OFF light remains out.

WINDSHIELD ANTI-ICE.....ON

21. Set the Windshield Anti-Ice switch to ON. Note: If the windshield have been cold soaked over night, they may require up to 30 minutes to warm up thoroughly.

CABIN ALT CONTROL LEVER/POSITION INDICATOR..... AUTO/VALVE OPEN

22. Check that the CABIN ALT Control Lever is in the AUTO (up) position (Yellow handle, not the wheel).
23. Check that the outflow valve indicator indicates VALVE OPEN.

PNEUMATICS AND AIR CONDITIONING.....ESTABLISHED

24. Set Pneumatic X-Feed handles to the OPEN (up) position.
25. Check that the APU AIR switch is set to ON or COLDER.
26. Set both Air Conditioning Supply switches to AUTO.
27. Set the Air Conditioning Recirculation Fan to AUTO.
28. Set CKPT TEMP selector to AUTO.
29. Set CABIN TEMP selector to AUTO.
30. Set AIR COND SHUTOFF switch to AUTO.
31. Set RAM AIR switch to OFF.

CABIN PRESSURIZATION..... SET

32. Set the System Selector switch to PRIMARY.
33. Check that the STDBY ON and TRANSFER LOCKOUT lights are out.
34. Set the LDG ALT to Departure Field Elevation.
35. Set the LDG BARO to Current Altimeter Setting (press “B” on your keyboard).
36. Set the RATE LIMIT knob to the center index.

AUTOLAND PRE-FLIGHT TEST.....ACCOMPLISH

37. Set both VHF radio to the same ILS frequency (any ILS frequency will do). (Click the lower left number to switch between the two VHF radios)
38. Set both course readouts to the same course (any course will do).
39. Set the FD switch to FD.
40. Check that the NO AUTOLAND light on the FMA is out.
41. Press the AUTO LAND button.
42. Check that the NO AUTOLAND light flashes for a short while. If the light comes on steady, the test has failed. If the light goes out, the test has completed successfully.

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FUEL PANEL, QUANTITY AND DISTRIBUTION..... CHECK

43. Check that total fuel on board is sufficient for the planned flight.
44. Check the current fuel distribution against the Fuel Distribution Guide. (The Fuel Distribution Guide can be found in the Aircraft Operating Manual, Section 15)

FUEL USED RESET ..... RESET

45. Set the FUEL USED RESET switch to RESET (Momentary) to reset the fuel used counters.

GEAR HANDLE ..... DOWN

46. Confirm that the gear handle is down and that all the three green gear lights are on.

FLAP HANDLE/INDICATOR..... AGREE

47. Make sure the flaps/slats handle is in the UP/RET position.
48. Check that the flap/slat handle and indicator agree.

HYDRAULIC QUANTITIES..... CHECK

49. Check hydraulic quantities. Both gauges should read well above the red band.

TAKE-OFF WARNING SYSTEM ..... CHECK

50. Advance both throttles, and check that the Take-off Configuration warning sounds are heard. Then close the throttles.

ACARS..... DATA/SET

51. Insert the flight number for the current flight. Press FLT NO.
52. Set the flight number by clicking on the display...
53. ...and press ENT when done.
54. Insert the Departure station. Press DEPT STA, click the display to set the station name, and press ENT when done.
55. Insert the Destination station. Press DEST STA, click the display to set the station name, and press ENT when done.

PMS..... PREFLIGHT ACCOMPLISHED

56. Please refer to the PMS guide on how to preflight the PMS.

BEFORE STARTING ENGINES

BEFORE STARTING ENGINES (Checklist)

Please note that if you start with a cold aircraft (all systems off), you should go through the Cockpit Clean-up Procedure first in order to setup the aircraft before flight.

LOGBOOK.....CHECKED

1. Check aircraft and pilot logbooks.

RUDDER PEDALS AND SEATS..... ADJUSTED AND LOCKED

2. Make sure the seats are properly adjusted and locked in the tracks. Use the Pilot Eye Locator to adjust your position. (Not simulated)

WINDOWS .....CLOSED AND LOCKED

3. All windows in the cockpit should be closed and locked.

O2 PANELS/INTERPHONE/O2 PRESSURE .....SET AND CHECKED

4. Set the oxygen SUPPLY lever to ON.
5. Set the DILUTER DEMAND CONTROL lever to NORMAL OXYGEN.
6. Check the pressure on the oxygen pressure gauge.
7. Check and set the levers on the Audio Panel. For normal operation set VHF 1 and 2, and the MKR lever to ON (up). Leave the rest in the OFF (off) position.

EMERGENCY LIGHTS..... ARMED

8. Set the emergency lights switch to ARM.

PROBE HEAT .....CHECKED AND CAPT

9. Rotate the METER SELECTOR AND HEAT switch to the captain's pitot tube (CAPT). This will turn on heating on all pitot tubes.
10. Check for a reading of the current flow to the captain's pitot tube on the HEATER CURRENT gauge.
11. Also, check that the PITOT/STALL HEATER OFF light is out.

WINDSHIELD ANTI-ICE.....ON

12. Turn on the windshield anti-icing system. A "hand-feel" test is required to verify the operation of the windshield anti-icing system.

ANTI-SKID..... OFF

13. Set the AUTO BRAKE Selector to OFF
14. Set the AUTO BRAKE ARM/DISARM switch to DISARM.

PRESSURIZATION.....AUTO (UP) AND SET

15. Make sure the CABIN ALTITUDE CONTROL LEVER is in the up and auto position (Yellow handle, not the wheel).
16. Set the RATE LIMIT CONTROL KNOB to the center position, or as required.
17. Also, set the departure barometric pressure by pressing the "B" key on your keyboard.

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AIR COND SHUTOFF ..... AUTO

18. Set the AIR CONDITION SHUTOFF switch to auto. This makes sure the air conditioning packs are automatically shut-off in the event of an engine failure.

FLIGHT GUIDANCE PANEL..... SET AND CHECKED

19. The Flight Guidance Panel is located on the glareshield.
20. Set the navigation radios as desired for the flight.
21. Set the course as desired for the flight.
22. Set the Flight Director switches to FD.
23. Set Auto-throttle switch to OFF, and speed readout to 250 knots.
24. Set the heading to runway heading.
25. Set the Autopilot master switch to OFF.
26. Set the Digital Flight Guidance Computer 1-2 switch as desired.
27. Use the Altitude Selector to set the first level off altitude in the Altitude Preselect Readout.

FLT INSTR/SWITCHES/BUGS ..... SET AND CROSSCHECKED

28. First, set the clock to correct Zulu time. (Use the P3D menu to set time)
29. Check the Mach/Airspeed indicator. The needle should read 0 knots. The Mach readout should read .150 Mach. The bugs should be set to V_1, V_2, flap and slat retract, and clean minimum maneuvering speed. All these speeds can be found in the speed booklet.
30. Test the ADI by pressing the TEST button. Check for 20 degree right bank and 10 degree nose up attitude. The ATT flag should appear, and then disappear when the test button is released.
31. Check and set the altimeter using the BARO knob. You can also reset the barometric pressure setting by pressing the "B" key on your keyboard.
32. Also set and check the Standby Altimeter.
33. Check the Radio Magnetic Indicator. No flags should be visible. Set the VOR/ADF Selectors as desired. Compare the heading to the HSI.
34. The HSI should have no flags visible.
35. The Vertical Speed Indicator should read zero.
36. The Standby Airspeed Indicator should read zero.
37. The Standby Attitude Indicator should have no flags visible, the gyro should be erect – level horizon, and the airplane symbol should be properly positioned.
38. On the Thrust Rating Indicator, select TO Mode for a standard thrust take-off.
39. On the Engine Pressure Ratio gages, check that the bugs are set according to the EPR LIM Readout on the TRI. (You may need to push in the EPR knob)

FUEL PANEL/QUANTITY AND DISTRIBUTION ..... SET AND CROSSCHECKED

40. All Tank Pump switches should be in the OFF position. However, a pump being used for APU operation should be left on.
41. Set the Zero Fuel Weight according to the Weight & Balance sheet. You will find Weight & Balance data in the Super 80 Dispatch Center.
42. The Fuel Crossfeed Valve should be closed (forward down position).
43. Now, check the fuel quantity and distribution. Confirm that the total fuel onboard is sufficient for the planned flight.
44. Also, check the fuel distribution according to the Fuel Distribution Guide. (The Fuel Distribution Guide can be found in the manual)

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GEAR HANDLE AND LIGHTS..... DOWN AND GREEN

45. Confirm that the gear handle is down and that all the three green gear lights are on.

TRANSPONDER..... SET

46. Set the Function Selector to ON.
47. Set the Mode Selector to A.
48. Set the Altitude Reporting switch to ALT RPTG.
49. Set the Transfer switch to 1.
50. And finally, set the transponder code in the Code Readout as instructed by ATC.

STABILIZER TRIM ..... SET

51. To set the stabilizer trim we need to input CG and FLAP setting to the Take-off Condition Computer. First, set the CG according to the Weight & Balance sheet. (See Super 80 Dispatch Center)
52. Second, set the FLAP setting according to the Weight & Balance sheet, or as desired.
53. And finally, align the LONG TRIM indicator (white) with the LONG TRIM TAKE-OFF Position Indicator (green) using the LONG TRIM handle.

SPOILER LEVER ..... RET

54. The spoiler lever should be in the RET position (forward position).

THROTTLES ..... CLOSED

55. Both throttles should be closed and the reverse levers down.

TAKE-OFF WARNING ..... CHECKED

56. Verify that the Take-off Warning system is operating properly. With the flaps and slats up and retracted, advance the throttles. The take-off warning horn sounds and the vocal annunciations of "Fulaps" and "Slat" are heard.

FUEL LEVERS ..... OFF

57. Both Fuel Levers should be in the down and OFF position. (Under the throttles handles)

FLAPS/SLATS..... UP/RETRACTED

58. Make sure the flaps/slats are up and retracted.
59. Check that the flap/slat handle and indicator agree.
60. Check that the Slat lights are off.

AILERON/RUDDER TRIM..... ZERO/ZERO

61. Set both aileron trim and rudder trim to the centered position.

PARKING BRAKE/PRESSURE ..... PARKED/NORMAL

62. The parking brake should be on. (Raised position)
63. Check that the Brake Pressure gauge reads above the red band.

SHOULDER HARNESSES..... ON

64. Make sure you are securely strapped in.

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FLIGHT FORMS .....CHECKED

65. Have you done your paperwork?

NO SMOKING SIGNS .....ON

66. Set the No Smoking switch to ON.

FIVE MINUTES PRIOR TO DEPARTURE

SEAT BELT SIGNS .....ON

67. Set the Seat Belt switch to ON about 5 minutes before departure.

PRIOR TO ENGINE START OR PUSHOUT

PRIOR TO ENGINE START OR PUSH OUT (Checklist)

GALLEY POWER ..... OFF

1. Set the Galley Power switch to OFF.

ENGINE IGNITION..... CONTIN

2. Set the Engine Ignition switch to CONTIN.

FUEL PUMPS..... ON

3. Normally you would turn on all the fuel pumps. However, if the center tanks do not have any usable fuel, leave them OFF.

AUX HYDRAULIC PUMP..... ON

4. Set the Auxiliary Hydraulic Pump switch to ON. Also check that both engine hydraulic pumps are in the LOW position.

ANTI-COLLITION/EXTERIOR LIGHTS..... ON/AS REQUIRED

5. Turn on the anti-collision light to alert ground personnel that the engines are about to be started.
6. Set the POS/STROBE light switch to BOTH.

DOOR ANNUNCIATOR..... OUT

7. Verify that all door annunciator lights are out.

AIR CONDITIONING SUPPLY SWITCHES ..... OFF

8. Set the Air Conditioning switches to OFF. These switches may, at the Captain's discretion be left in the AUTO position until just prior to positioning the first engine start switch to GND.

APU START

APU START (Procedure)

Use this procedure to start the APU both on the ground and in-flight.

BATTERY SWITCH.....ON

1. Set the battery switch to the ON position.

APU DOORS.....AUTO

2. Open the guard and set the APU Doors switch to AUTO.

APU AIR.....OFF

3. Set the APU Air switch to OFF.

APU FIRE CONT.....NORM

4. Set the APU FIRE CONT switch to the NORM position.

START PUMP.....AS REQUIRED

5. If AC electric power is not available (no ground power connected and no engine running), set the START PUMP switch to ON. Otherwise, leave the switch in the OFF position.

FUEL BOOST PUMPS.....AS REQUIRED

6. If AC electric power is available (ground power connected and/or engine(s) running), set the RH Aft Fuel Boost Pump switch to ON. Note that you do not need to have both the Start Pump and a Fuel Boost Pump running, only one of them is required.

APU MASTER.....START/RELEASE

7. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
8. Check that the APU RPM and APU EGT start rising.
9. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.

APU RUNNING AND ELECTRICAL POWER ESTABLISHED

10. When APU RPM and APU EGT has stabilized…
11. …and APU power has been connected to the AC buses, continue the APU Start procedure. (Both switches on and both lights on)

FUEL BOOST PUMPS.....AS REQUIRED

12. Normally, the RH Aft Fuel Boost Pump is used for APU operation. However, the center tanks may also be used for APU operation at the Captain's discretion. Set the RH Aft Fuel Boost Pump switch to ON.

START PUMP.....AS REQUIRED

13. If the Start Pump was used to start the APU, set the Start Pump switch to OFF.

APU AIR.....AS REQUIRED

14. Set the APU Air switch to ON.

PNEUMATIC PRESSURE..... NORMAL

15. The Pneumatic Pressure Gauge should indicate about 35 PSI.

PNEUMATIC X-FEED VALVES ..... OPEN

16. Open both Pneumatic X-Feed handles (up position).

ENGINE START

ENGINE START (Procedure)

1. Before starting an engine you need a pneumatic pressure source. This can be bleed air from either the APU or bleed air from the other engine if that has already been started.

2. For a Crossbleed Start (bleed air from running engine) make sure both Pneumatic X-Feed handles are open (up position).

3. For APU bleed air start, the APU must be running and… (Please refer to the APU START procedure guide on how to start the APU)

4. …the APU Air switch must be set to ON…

5. …and the Pneumatic X-Feed handle for the engine you are about to start must be set to OPEN. Set the left Pneumatic X-Feed handle to OPEN (up).

6. Check the Pneumatic Pressure Gauge. Optimum starting pressure is about 30-38 PSI.

7. Open the guard to the Left Engine Starter switch and set the switch to GND.

8. Check that the L START VALVE OPEN light comes on.

9. Check that the pneumatic pressure remains above 25 PSI. If the pneumatic pressure drops below 25 PSI, be alert for a hung or hot start.

10. Check for increasing oil pressure.

11. Check for increasing N_2.

12. Check for increasing N_1.

13. Check for increasing hydraulic pressure.

14. At maximum motoring (minimum 20% N_2)…

15. …set the left Fuel Lever to ON. (Under the throttle handle)

16. Monitor N_1, EGT, N_2 and Fuel Flow.

17. At 40% N2…

18. …set the Left Engine Starter switch back to OFF and put the guard back on.

19. Check that N_2 stabilizes at about 50-60%.

20. When the engine has stabilized at idle RPM, check the following: APU PWR (L) Power In Use Light should be out.

21. EXT PWR (L) Power In Use Light should be out.

22. L CSD OIL PRESS LOW light should be out.

23. L OIL PRESS LOW light should be out.

24. L HYD PRESS LOW light should be out.

25. EGT should indicate 300-480°C.

26. Fuel Flow should indicate 800-1100 LBS/hour.

27. If outside temperatures are below freezing, turn on left Engine Anti-Ice.

28. To start right engine, repeat the engine start procedure for the right engine.

POWER BACK FROM GATE

POWER BACK FROM GATE (Procedure)

1. Power back gate departure is only authorized when both crew members have received proper training. A minimum of two ground crew is required, one Guideman and one Wingwalker. The Guideman should be position in front of the aircraft, in clear view of both pilots. The Wingwalker should be positioned aft of the right wing. Depending on the situation and gate location, a second Wingwalker for the left wing might be required.

2. Both engines should be running before commencing with the procedure. See the Engine Start procedure on how to start the engines.
3. Complete the BEFORE TAXI items on the Taxi checklist.
4. Flash nose wheel landing and taxi light once, to indicate to the Guideman that you are ready to begin power back. To re-establish cockpit to ground communication, flash the nose light three times (not simulated).
5. At the direction of the Guideman (come forward signal), taxi the aircraft two or three feet forward, before going into reverse thrust. This is done as a safety precaution against blocked wheels.
6. Once the Guideman sees the aircraft moving forward, he will give the power back signal by rotating the wands horizontally in a circular motion.
7. Apply and hold the brakes to stop the forward motion and simultaneously set both engines to reverse idle thrust.
8. When both blue ENG REVERSE THRUST lights come on, release the brakes and drop both feet to the floor.
9. Monitor Guideman and establish reverse thrust for rearward movement. Do not exceed 1.3 EPR. Rearward speed should not exceed that of a normal walk.
10. If rearward speed is excessive, place one engine in forward thrust.
11. Turns during power back must be commanded by the Guideman. Upon the Guideman's signal, turn the steering wheel tiller in the direction of the Guideman's lowered wand. Turns are made with reference to the Guideman's left or right.
12. When the aircraft has reached the desired position, the Guideman will give the come forward signal.
13. Sharply come out of reverse, and apply forward thrust.
14. CAUTION: DO NOT USE BRAKES TO STOP REARWARD MOVEMENT.
15. Check that all reverse lights are out.
16. On the Guideman's signal, establish forward movement or come to a full stop.
17. Flash nose wheel landing and taxi light once, to signal to the Guideman that you are ready to taxi.
18. When the area is clear, the Guideman will give the standard departure salute.

SPECIAL CAUTIONS:

- The Guideman should never give the stop signal when the aircraft is in rearward movement. The come forward signal should be used to stop the aircraft.
- Do not use the brakes when the airplane is in rearward movement.
- If the brakes are inadvertently applied during rearward movement and the aircraft starts to tail tip, immediately move both throttles into forward thrust.

TAXI

TAXI (Checklist)

BEFORE TAXI OR POWERBACK

The first part of the TAXI checklist is normally performed before the aircraft starts moving.

GALLEY POWER .....ON

1. Set the Galley Power switch to ON. (...keeps the coffee warm...)

ENGINE ANTI-ICE.....AS REQUIRED

2. In snowy or cold weather you should turn on the Engine Anti-Ice switches. Otherwise you may leave them in the OFF position.

HYDRAULIC PUMPS.....CHECKED AND HI/ON

3. Set the Aux Pump switch to OFF. Check that L and R HYD PRESS LOW lights remain off with both engine hydraulic pump switches in the LOW position.
4. Set both Engine Pump switches to HI.
5. Set the Auxiliary Pump switch back to ON.
6. Set the Transfer Pump switch to ON in order to power both hydraulic systems in the event of an engine or pump failure.

TAXI

The second part of the TAXI checklist is normally performed while the aircraft is taxiing. Note that one engine taxi is only necessary when extended taxi is expected. Otherwise, taxi with both engines running and skip the one engine taxi items.

APU.....AS REQUIRED

7. Shut down the APU, by moving the APU MASTER switch to OFF. Leave the APU on if one engine taxi is planned or supplemental bleed air for cabin cooling is required.
8. Set the APU AIR switch to OFF.
9. Set the APU DOORS switch to OFF and put the guard back on.

PNEU X-FEED (One engine taxi).....L CLOSED/R OPEN

10. Prior to shutting down the right engine for one engine taxi, close the left Pneumatic X-feed Valve handle. Leave the Pneumatic X-feed Valve handles in the OPEN (up) position if both engines are to be used for taxi.

ANTI-SKID (After leaving ramp area)..... ARM

11. Turn on the anti-skid system after leaving the ramp area. Set the ANTI-SKID switch to ARM.

R ENG (One engine taxi).....SHUTDOWN

12. Move the right Fuel Lever to the OFF position to shutdown the right engine for one engine taxi.

FLIGHT CONTROLS.....CHECKED

13. Slowly move the rudder pedals, control wheel and control column to their extreme positions checking for freedom of movement and normal control forces.
14. Check that the SPOILER DEPLOYED light comes on during aileron check.
15. Check that the ELEVATOR POWER ON light comes on when the control column is moved full forward.

FGS ..... T/O MODE

16. Press the TO/GA button.
17. The pitch and roll FMA windows should annunciate TAK OFF.
18. The V-command bars should be wings level at or near the horizon line.

BEFORE TAKE-OFF

BEFORE TAKE-OFF (Mechanical Checklist)(Checklist)

Use the mechanical checklist on the pedestal to accomplish the items in the Before Takeoff checklist.

FLT INST & BUGS .....SET AND CHECKED

1. Make sure the bugs are set correctly on the Mach/Airspeed indicator. Use the Speed Cards to set the bugs for take-off.
2. The ADI should have no flags visible.
3. The Radio Altimeter should read zero.
4. The altimeters should read field altitude.
5. The Altimeter Reference Index should be set to Obstacle Clearance Altitude. (You will need a map for the airfield you are departing from for this. Set zero if you don't know OCA).
6. The RMI should have no visible flags.
7. The HSI should have no visible flags.
8. Cross check the Standby Altimeter with the Captain's Altimeter.
9. The Standby Attitude Indicator should be erect and have no flags visible.
10. Make sure the ART switch is in the AUTO position (guarded position).

ANTI-ICE..... AS REQUIRED

11. Set the Air Foil Anti-Ice switch to OFF. Turn the Air Foil Anti-ice switch back to ON after reaching 1000 feet if icing conditions exist or are anticipated.

FLAPS AND SLATS ..... TAKE-OFF

12. Set flaps for takeoff according to the Weight & Balance sheet, or as desired.
13. Verify slats are in the take-off position by observing the TAKEOFF light.

STAB TRIM ..... SET

14. Check position of LONG TRIM Indicator (white) against LONG TRIM TAKEOFF Position Indicator (green). These should be aligned.

APU/PNEU X-FD'S .....AS REQUIRED/CLOSED

15. If the APU is still running (after one engine taxi), shut down the APU by moving the APU Master switch to OFF.
16. Set the APU AIR switch to OFF.
17. Set the APU DOORS switch to OFF and put the guard back on.
18. Close both Pneumatic X-Feed handles (down position).

ANTI-SKID/ABS .....ARMED/TAKE-OFF AND ARMED

19. Set the Anti-Skid switch to ARM.
20. Set the AUTO BRAKE Selector to TO.
21. Set the AUTO BRAKE ARM/DISARM switch to ARM.

SPOILER LEVER ..... ARMED

22. Arm the Spoiler lever (forward raised position).

TO PA/PACKS ..... COMPLETE/AS REQUIRED

23. The Captain should give the Take-off PA no less than 1 minute prior to departure.
24. When take-off is imminent, chime the cabin by pressing the ATTENDANT CALL button once. Press the Attendant Call Reset light below to extinguish the light.
25. Set the Air Conditioning Supply switches to AUTO.

ANNUNCIATOR LIGHTS ..... CHECKED

26. Check that the RUDDER TRAVEL UNRESTRICTED light is on.
27. Check that no other amber warning lights are on.

NOSE LIGHTS ..... BRIGHT

28. Turn on the nose lights just prior to take-off to indicate the airplane is about to start the take-off roll. Leave the lights on until reaching 10,000 feet.

TAKE-OFF

TAKE-OFF (Procedure guide)

1. Align the airplane with the runway and check compass heading against the published runway heading.
2. Activate TO/GA mode.
3. Advance the throttles to 1.4 EPR or 80% N_2.
4. Monitor the engine instruments.
5. If Auto throttles are to be used for take-off, set the ATS switch to AUTO THROT.
6. Check that the Auto throttles go into Clamp Mode at 60 knots (when using ATS)
7. Crosscheck all engine instruments for reasonableness during the take-off roll. This is especially important in icing conditions. All needles should be within normal range.
8. Callouts for "80 knots", "V_1", "rotate", "V_2" and "V_2 + 10" should be made.
9. When the aircraft has reached a positive rate of climb…
10. …select gear up and verify that the gear has been properly retracted by observing that all three gear lights are out.
11. Disarm the spoilers.
12. Set the AUTO BRAKE Selector to OFF.
13. Set the AUTO BRAKE ARM/DISARM switch to DISARM.

BELOW 800 FEET

14. Maintain take-off power.
15. Airspeed V_2 + 10 knots.
16. Max pitch up angle 20 degrees.

800 – 3000 FEET

17. Reduce the pitch angle to achieve approximately one half existing rate of climb.
18. Retract flaps on schedule.
19. Select CL mode on TRI for climb power.
20. Retract slats on schedule.
21. Airspeed V_{CLEAN} to 3000 feet.

ABOVE 3000 FEET

22. Accelerate to 250 knots by reducing pitch angle a bit more.
23. Maintain a rate of climb of approximately 500 – 1000 FPM during acceleration.
24. Procedure complete.

AFTER TAKE-OFF – CLIMB

AFTER TAKE-OFF – CLIMB (Checklist)

The After Take-off checklist should be performed after the aircraft has been cleaned up (gear, flaps and slats up/retracted) and when workload permits.

GEAR ..... UP AND NO LIGHTS

1. Verify that the gear has been properly retracted by observing that all three gear lights are out.

SPOILER LEVER ..... DISARMED

2. Set the Spoiler Lever to RET (forward down position).

AUTO BRAKES ..... OFF AND DISARMED

3. Set the AUTO BRAKE Selector to OFF.
4. Set the AUTO BRAKE ARM/DISARM switch to DISARM.

FLAPS AND SLATS ..... UP/NO LIGHTS

5. Check that the Flaps Lever is in the UP/RET position.
6. Check that the Flaps Indicator indicates flaps up.
7. Check that all lights are out on the Slats Advisory Lights panel.

PRESSURIZATION AND AIR COND ..... CHECKED

8. Check that the Cabin Altitude indicator is indicating normally. (rising altitude)
9. Check that the Differential Pressure indicator is indicating normal values. Beware of excessive cabin differential pressure. Maximum allowed cabin differential pressure is 8.32 PSI.
10. Check the Cabin Vertical Speed indicator. It should indicate a climb of less than 500 FPM. Higher climb rates may cause passengers to feel uncomfortable.
11. If necessary, adjust the cabin climb rate with the Rate Limit Control knob.
12. Check the Air Conditioning gauges. Check pressure and temperature.

10,000FT MSL

The next part of the checklist should be completed when the aircraft has climbed past 10,000 feet MSL.

ENGINE IGNITION ..... AS REQUIRED

13. Set the Ignition switch to OFF.

FUEL SYSTEM ..... CHECKED

14. Check the Fuel Quantity gauges, Fuel Flow gauges and fuel pump switches to verify proper engine fuel feed.

STERILE COCKPIT ..... CABIN CHIME

15. Cycle the No Smoking switch (set to OFF then back to ON) as a signal to the Flight Attendants that they may leave their seats. If this is a no smoking flight, leave the No Smoking switch ON, otherwise set it to AUTO.

ALTIMETERS.....RESET AND CROSSCHECKED

16. Reset and crosscheck all altimeters. Set the barometric pressure as advised by ATC (press B on the keyboard).

HYDRAULIC PUMPS..... LOW/OFF

17. Set both Engine Pump switches to LOW.
18. Set the Auxiliary Pump switch to OFF.
19. Set the TRANS Pump switch to OFF if on.

20. Not on the checklist: On the Annunciator Panel, check that the RUDDER TRAVEL UNRESTRICTED light is out.

18,000FT MSL

The next part of the checklist should be completed when the aircraft has climbed past 18,000 feet MSL.

EXTERIOR LIGHTS .....AS REQUIRED

21. Make sure the wing landing lights and nose landing lights switches are OFF.

ALTIMETERS.....RESET AND CROSSCHECKED

22. Inside Continental U.S. the altimeters should be set to 29.92 IN HG above FL180. Outside Continental U.S. altimeters should be reset at the specified Transition Altitude obtained from charts or ATC.

CRUISE

CRUISE (Checklist)

ENG SYNC.....ON

1. Set the ENG SYNC selector to N_1.
2. Engine instruments should be monitored and checked regularly.
3. Monitor the Fuel Panel. After the center tank is empty, as indicated by the quantity gauge…
4. …set the center tank Fuel Pump switches to OFF.

FIRST FLIGHT OF DAY ITEMS .....CHECKED

5. During the airplane's first flight of the day various checks must be made in-flight. These checks include checking the weather radar (range, tilt, and display), engine and wing anti-ice systems.

DELAY CODES IN ACARS.....AS REQUIRED

6. If the flight is delayed, the flight crew should notify the Dispatch Center via ACARS. (Currently not simulated)

DESCENT

DESCENT (Checklist)

LANDING DATA ..... PREPARED

7. Make sure the bugs are set correctly on the Mach/Airspeed indicator. Use the Speed Cards to set the bugs for landing.

PRESSURIZATION ..... SET AND CHECKED

8. Set the cabin landing altitude to destination field elevation.
9. Set the destination field barometric pressure as advised by ATC.
10. Check that the Cabin Vertical Speed indicator indicates a descent. Descent speed should be less than -500 FPM for passenger comfort.
11. Check that the Cabin Differential Pressure is decreasing.

ENG SYNC ..... OFF

12. Set the ENG SYNC selector to OFF.

ENGINE IGNITION ..... CONTIN

13. Set the Engine Ignition switch to CONTIN.

ENGINE AND AIRFOIL ANTI-ICE ..... AS REQUIRED

14. If icing conditions are anticipated, turn on engine and airfoil anti-ice.

WINDSHIELD ANTI-FOG ..... AS REQUIRED

15. If you expect to descend into an area with high humidity or rain, turn on windshield anti-fog. Note that this system should be used for anti-fogging rather than defogging.

SHOULDER HARNESSES ..... ON

16. Make sure you are securely strapped in.

DESCENDING THRU FL180 OR LEAVING CRUISE ALTITUDE, WHICHEVER IS LOWER

The next part of the checklist should be completed when the aircraft has descended through FL180, or when leaving a cruising altitude lower than FL180.

EXTERIOR LIGHTS ..... AS REQUIRED

17. At the Captain's discretion, the wing landing lights and/or ground flood lights may be turned on for recognition purposes. Note that extending the wing landing lights above 200 knots may cause a slight buffet.

ALTIMETERS ..... RESET AND CROSSCHECKED

18. Inside Continental U.S. the altimeters should be set to the local barometric pressure setting as advised by ATC. Outside Continental U.S. altimeters should be reset when descending to an altitude…
19. …below the Transition Level obtained from charts or ATC. After resetting the altimeters, crosscheck indicated altitude. (QNH)

HYDRAULIC PANEL ..... HI/ON/CHECKED

20. Set both Engine Pump switches to HI.
21. When the hydraulic pressure has stabilized at approximately 3000 PSI, set the TRANS pump to ON.
22. Also, set the Auxiliary Pump switch to ON.
23. Check the Hydraulic Quantity gauges. Both gauges should read above the red band.
24. Check the Brake Pressure gauge. Both needles should indicate minimum above the red band, but normally within the green band.

10,000FT MSL

The next part of the checklist should be completed after the aircraft has descended through 10,000 feet MSL.

STERILE COCKPIT .....CABIN CHIME

25. When descending through 10,000 feet, advise the Flight Attendants of the beginning of sterile cockpit period by pressing the ATTENDANT CALL button once.

BEFORE LANDING

BEFORE LANDING (Mechanical Checklist) (Checklist)

Use the mechanical checklist on the pedestal to accomplish the items in the Before Takeoff checklist.

The Before Landing checklist should be performed and completed before passing over the outer marker or final approach fix. Final flap extension may occur past the outer marker as per schedule.

ALTIMETERS.....RESET AND CROSSCHECKED

1. Reset and crosscheck all altimeters. Set the barometric pressure as advised by ATC (press B on the keyboard).
2. Set the Decision Height reference on the Radio Altimeter as required. DH may be found on the approach plate for the instrument approach procedure you are flying.

FLT INST & BUGS .....SET AND CROSSCHECKED

3. Check that none of the flight instruments have any flags visible. Crosscheck all standby flight instruments against the primary flight instruments.

SEAT BELT/NO SMK .....ON

4. Set the Seat Belt Sign switch to ON.
5. Set the No Smoking sign switch to ON.
6. Make a PA to advice the Flight Attendants to prepare for landing. (Not simulated)

GEAR ..... DOWN, THREE GREEN

7. Select gear down with the Gear Handle and verify that the gear is down and locked by observing three green gear lights.

SPOILER LEVER .....ARMED

8. Arm the Spoiler lever (forward raised position).

AUTO BRAKES .....AS REQUIRED

9. Set the AUTO BRAKE Selector to MIN for normal braking.
10. Set the AUTO BRAKE ARM/DISARM switch to ARM.

FLAPS & SLATS.....LAND

11. Extend the flaps and slats on schedule. Avoid extension and operation near the maximum airspeeds in order to minimize air loads on the flaps/slats. Extend flaps/slats near the minimum airspeed for the current configuration.

ANNUNCIATOR LIGHTS .....CHECKED

12. Check that no amber warning lights are on.

LANDING

LANDING (Procedure guide)

1. Upon touchdown, verify that the Auto-Spoiler function has moved the Spoiler Lever full aft to deploy the spoilers for aerodynamic braking.

2. Check that both the blue Engine Reverse Thrust lights come on when applying reverse thrust. If only one reverser deploys, use caution when applying reverse power on remaining engine.

3. Since reversing is more effective at higher airspeeds, reversing should be initiated as soon as practicable.

4. The Auto Brakes must be used when braking action is reported less than good. Otherwise, ABS is not required and may be used at the Captain's discretion. Monitor the ABS Disarm light. The ABS should be disengaged when reaching taxi speed.

AFTER LANDING

AFTER LANDING – TAXI (Checklist)

With the exception of Autopilot, Autothrottle and Automatic Brake system which are normally performed on the runway after rollout, none of the items in the After Landing checklist should be accomplished until the aircraft is clear of the runway.

AUTOPILOT AND AUTOTHROTTLE SWITCHES ..... OFF

1. Set the Autothrottle switch to OFF.
2. Set the Master Autopilot switch to OFF.

LANDING LIGHTS ..... OFF

3. Turn OFF the Wing Landing lights and Nose Landing lights.

SPOILER LEVER ..... RET

4. Set the Spoiler Lever to RET.

AUTO BRAKES ..... OFF/DISARM

5. Set the AUTO BRAKE Selector to OFF.
6. Set the AUTO BRAKE ARM/DISARM switch to DISARM.

PNEU XFEED (One engine taxi) ..... R OPEN/L CLOSED

7. For one engine taxi, open the right Pneumatic X-feed Valve handle (up) and leave the left Pneumatic X-feed Valve handle closed (down).

FLAPS/SLATS ..... UP/RETRACTED

8. Verify that the Flaps Handle is in the UP/RET position.
9. Verify that the flaps are retracted.
10. Verify that the slats are retracted (all lights out).

RADAR ..... OFF

11. Set the Mode Selector switch to OFF.

TRANSPONDER ..... STBY

12. Set the Transponder Function Selector to STBY.

ANTI-SKID ..... OFF

13. The Anti-skid switch must be set to OFF before entering the ramp area.

BRAKE PRESSURE ..... MONITOR

14. Check the Brake Pressure gauge. Both needles should indicate minimum above the red band, but normally within the green band.

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APU..... AS REQUIRED

15. The APU must be started prior to initiating one engine taxi. If one engine taxi will not be initiated, start the APU approximately 2 minutes prior to gate arrival. Please refer to the STARTING APU procedure guide on how to start the APU.
16. Before shutting down the right engine, set the APU Air switch to ON...
17. ...and set the right Pneumatic X-Feed Valve Lever to OPEN (up).

R ENG (One engine taxi) .....SHUTDOWN

18. For one engine taxi, the right engine is normally shutdown leaving the left engine running for taxi operations.
19. Set the right Fuel Lever to OFF. (located under the throttle handle, down position)
20. Verify right engine shutdown by observing the right engine instruments dropping.

PARKING

PARKING (Checklist)

BRAKES ..... PARKED

1. Set the parking brake by lifting the Parking Brake Control knob.

SEAT BELT SIGN ..... OFF

2. Set the Seat Belt Sign switch to OFF.

PNEU XFEED VALVES ..... OPEN

3. Make sure that both Pneumatic X-Feed Valve levers are in the OPEN (up) position.

APU OR EXTERNAL POWER ..... ESTABLISHED

4. If the ground crew has plugged in the external electric power, the EXT PWR AVAIL light will come on (blue). Note: In the panel, click the EXT PWR AVAIL light to simulate the ground crew plugging in the external electric power.
5. Connect the external electric power to the busses by setting the left and right EXT PWR BUS switches to ON.
6. If external electric power is connected, the APU should be turned off. Set the APU Master switch to OFF.
7. Set the APU AIR switch to OFF.
8. Set the APU DOORS switch to OFF and put the guard back on.

FUEL LEVERS ..... OFF

9. Check that External power or APU power is properly connected to the busses by observing at least one Power In Use lights before turning off the second Fuel Lever. Note: The Power In Use lights will come on after you have shut down an engine.
10. Set both Fuel Levers to OFF, one at a time.
11. Verify both engines shutting down by observing the engine instruments dropping.

ANTI-COLLISION/EXTERIOR LIGHTS ..... OFF/AS REQUIRED

12. Set the Anti-collision switch to OFF.
13. Set the POS/STROBE light switch to OFF during daytime. Leave the Position Lights on at night (POS position).

ENGINE IGNITION ..... OFF

14. Set the ENG IGN switch to OFF.

FUEL PUMPS ..... OFF

15. Set all Fuel Boost Pump switches to OFF. If the APU is operating, leave the RH AFT pump on.

EMERGENCY LIGHTS ..... OFF

16. Set the Emergency Lights switch to OFF.

PROBE HEAT ..... OFF

17. Rotate the METER SELECTOR AND HEAT switch to OFF.

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ANTI-ICE.....OFF

18. Set the Air Foil Anti-ice switch to OFF.
19. Set the Windshield Anti-fog switch to OFF.
20. Set the Windshield Anti-ice switch OFF.
21. Set the Engine Anti-ice switches to OFF.

AIR CONDITIONING.....AS REQUIRED

22. Adjust cabin temperature and cockpit temperature as necessary.

OIL/HYD/O2 QUANTITIES.....CHECKED

23. Check Oil quantity...
24. Check Hydraulic quantity...
25. Check O_2 quantity (currently not simulated), and make a note about low quantities for maintenance.

ARRIVAL REPORT.....AS REQUIRED

26. Send an Arrival Report via ACARS to the Dispatch Center. (Currently not simulated)

LOGBOOK.....COMPLETED

27. Make appropriate entries in the Flight Crew and aircraft logbooks.

FD SWITCHES OFF.....OFF

28. Set the Flight Director switch to OFF.

O2 PANEL SUPPLY LEVERS.....OFF

29. Set the DILUTER DEMAND CONTROL switch to NORMAL OXYGEN.
30. Set the SUPPLY TOGGLE switch to OFF.

COCKPIT LIGHTS.....AS REQUIRED

31. All cockpit lights should be turned off, except for dome lights if required, to minimize heat build up in the cockpit. Turn off both Overhead Console Lights switches.
32. Turn off all four cockpit lights switches.
33. Turn off all three center instruments and pedestal switches.
34. Turn off all three main instrument panel lights.

ALL PASSENGERS HAVE DEPLANED

The next part of the checklist should be completed after all the passengers have left the aircraft.

GALLEY POWER.....OFF

35. Set the Galley Power switch to OFF.

AIR CONDITIONING.....OFF

36. After the last flight of the day, the Air Conditioning system should be turned off. Set both Air-conditioning supply switches to OFF.

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APU.....AS REQUIRED

37. If the APU is running (aircraft does not have ground power), leave the APU running unless advised by ground crew to shut it down.

BATTERY SWITCH.....ON/OFF

38. If the aircraft has ground power connected or the APU is running, leave the battery switch in the ON position. If the aircraft is being completely shut down for the night (last flight of the day), set the battery switch to the OFF position.

POST FLIGHT INSPECTION .....AS REQUIRED

39. After the final flight of the day an accelerated walk-around inspection is carried out to check the aircraft for obvious discrepancies affecting the fuselage, wing, empennage, engines, landing gear and tires.

SECTION 4

OPERATING TECHNIQUES

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SECTION 4: OPERATING TECHNIQUES

PREFACE

A procedure may be described as an orderly plan for accomplishing a specific task, and usually involves several steps. Technique may be described as the expert manner of performing these steps.

Proper operating technique results in a higher degree of safety, better passenger comfort, less wear and tear on equipment, and increased fuel economy.

At all times, the pilot should perform his/hers duties with awareness, intelligence and in anticipation of what will happen next, to ensure the safety and success of the flight.

TAXI

Taxi Thrust

To begin the taxi roll and break away from the ramp, release the brakes and smoothly increase thrust. On the ramp area, limit thrust to 1.2 EPR to minimize jet blast and avoid damaging equipment on the ramp area.

When adding power to break away, set the power and wait for the engines and aircraft to respond. Do not continually increase thrust until the aircraft starts moving. Roll straight forward at first before turning to avoid the need for excessive thrust.

Taxiing

The MD-81 has a very responsive nosewheel steering and light nosewheel footprint. Special caution is therefore required when taxiing on wet or slippery surfaces. Turning to rapidly at a high taxi speed may cause the nosewheel to loose traction and skid. Heading control will not be regained until the speed has been reduced and the nosewheel deflection is reduced.

The limit deflection angle for the nosewheel is 82 degrees left and right.

The main gear is approximately 70ft behind the pilots. When entering turns, the pilot should therefore overshoot the centerline to compensate for the aft position of the main gear.

Avoid riding the brakes. Intermittent, positive application of the brakes will ensure cool brakes and less wear.

Normal Idle Thrust

With idle thrust and a loaded aircraft, greater use of the brakes may be required. Note that reverse thrust to assist slowing the aircraft during normal taxiing is not authorized. However, during conditions of reduced brake effect, reverse thrust may be used in an emergency to assist slowing the aircraft. Do not use asymmetrical thrust for directional control.

Anti-Skid

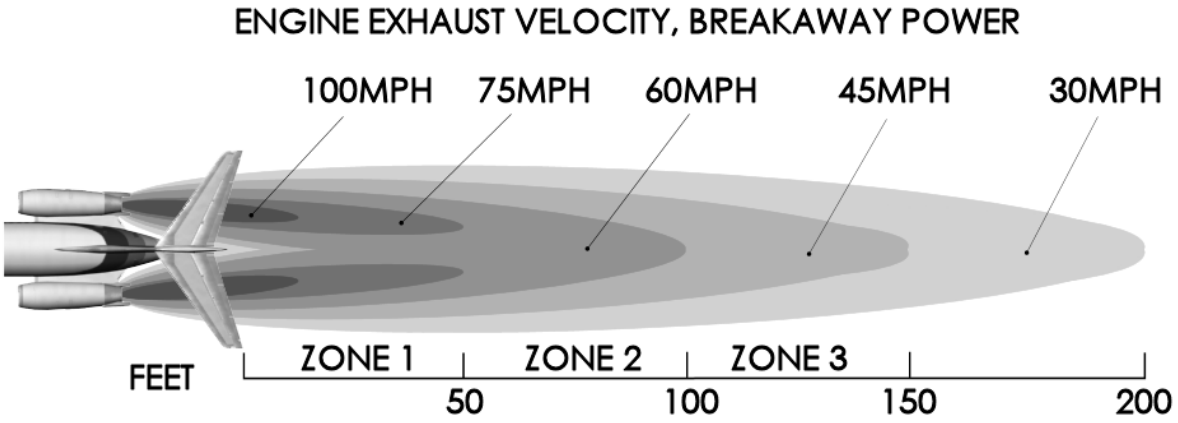
The anti-skid system should not be used while taxiing on the ramp area. Turn the anti-skid system on after leaving the ramp area, and off before entering the ramp area.

JET BLAST

When maneuvering on the ramp area special caution must be taken to avoid jet blast damage.

Use the following technique when maneuvering on the ramp area:

- Apply thrust to a maximum of 1.2 EPR.
- Retard both throttles as soon as the aircraft starts rolling.
- If a tight turn is required, leave the power on at 1.2 EPR until the point where jet blast could cause damage, then close both throttles. This should give the aircraft sufficient momentum to sustain taxi out of the congested area.
- If 1.2 EPR is not sufficient to move the aircraft out of a gate area where there is danger of jet blast damage to ground equipment, the Captain should request a tow-out.



Zone 1:

During breakaway power, the jet blast in zone 1 is powerful enough to up-root trees, cause structural damage to other aircraft, tip over and move heavy objects and break windows.

Zone 2:

During breakaway power, the jet blast in zone 2 is strong enough to weathercock unbraked aircraft, sway lift trucks, damage roofing and move unsecured objects.

Zone 3:

During breakaway power, the jet blast in zone 3 can move unbraked carts and small objects.

TAKE-OFF

Before Take-off

Normally, the Before Take-off checklist is performed while taxiing out to the take-off position. This checklist must be completed before commencing the take-off roll.

Runway Alignment

On the runway, line up slightly left or right of the center line to avoid the centerline lights. These lights, which are embedded into the runway surface, can cause nosewheel thump during the take-off wheel.

When the aircraft is lined up with the runway, check that the heading indication is about the same as the runway number.

If a braked take-off is being made, make sure the nosewheel is aligned with the runway prior to releasing the brakes.

Rejected Take-off

The braking action provided by the autobrake system in a rejected take-off situation is very sudden and abrupt. Consider using manual braking during a rejected take-off situation if runway length is not critical and immediate maximum braking is not required.

Rotation and Initial Climb

The take-off and initial climb performance depends on executing the rotation at the correct speed and proper rate. Rotation at V_R should be smooth and continuous. Rotating late, slow or under rotating causes the take-off ground run to increase.

Wings level should be maintained all the way through rotation and initial climb. Lift off should occur at about 8° deck angle.

Note that with the main gear on the ground, the tail cone will strike the runway at a body angle of 10.5°.

CLIMB

General

On the climbout, make shallow turns and smooth changes in attitude for passenger comfort.

Leveling Off

When the autopilot is engaged, closely monitor the FMA to ensure a smooth transition and level-off. Note that adjusting the pitch or vertical speed with the pitch control wheel may disengage the ALT CAP mode and engage VERT SPD mode.

CRUISE

Climbing to a Higher Altitude

Start a climb to a higher altitude by using the VERT SPD mode or by slowly increasing pitch if hand flying. When the aircraft has reached the desired climb speed, engage IAS/MACH HLD.

Cruise Speed

The cruise speed commanded by the PMS CRZ-OPT mode is the recommended cruise speed. This speed ensures efficient and economical fuel burn.

DESCENT

Descent Speed

Above the Mach crossover altitude, descend at the cruise Mach speed. Below the Mach crossover altitude, descend at 280KIAS.

Standard Descent Procedure

The standard procedure for descent is to descend with a clean aircraft at idle power. If the pilot needs to expedite the descent for traffic reasons, speedbrakes should be used to increase the rate of descent.

Descents with flaps/slats extended and/or gear down should be avoided as they are airspeed limited, noisy and expensive.

The PMS will present an optimum descent profile with Top of Descent (TOD) and Bottom of Descent (BOD). ATC and traffic allowing, the pilot should follow the optimized descent plan provided by the PMS.

If it becomes necessary to manually calculate the BOD/TOD, use the following method:

- Determine the altitude difference (total altitude you need to descend)
- 22,000ft
- Drop the last three digits
- 22,000 → 22
- Multiply by three
- 22 x 3 = 66
- For an unrestricted descent to a landing, add 10 NM.
- 66 + 10 = 76
- For a descent to an intermediate lower altitude, no additive is required.
- Add 2 NM for every 10 knots of tailwind and subtract 2 NM for every 10 knots of headwind.
- 30 knots tailwind
- 76 + (3 x 2) = 82
- Our TOD is approximately 82NM away from our landing destination or BOD.

Cabin Pressurization During Descent

A 3° descent profile will help maintain a 300fpm cabin rate of descent. Multiply the ground speed by six to find the required vertical speed required to maintain a 3° descent profile.

HOLDING

Fuel Economy

When ordered to enter a holding pattern by ATC, maintain the highest possible altitude to lower fuel consumption.

If prolonged holding is expected, request ATC to increase the size of the holding pattern. This will reduce the number of turns required. Turns require increased power and increased fuel burn.

All holding should be flown with a clean configuration. For best fuel economy, use the speeds in the holding pattern speed chart. However, the pilot should always comply with the ATC minimum holding speed.

APPROACH AND LANDING

Visual Approach

Be alert for the following visual illusions when executing a visual approach:

Runway Slope
An up-sloping runway creates an illusion of being high on the approach. A down-sloping runway creates the illusion of being low on the approach.

Visibility
Rain, haze, dust, smoke, glare or darkness may cause the illusion of being to high on the approach.

Runway Lighting
Strong, bright runway lights appear to be closer while dim runway lights appear to be farther away.

Runway Dimensions
The width versus length ratio of the runway will also affect visual perspective.

Glide Path

The normal approach path is based on a 3° descent flight path. Once established on the approach, make small adjustments to the glideslope, approach speed and trim. The approach style is essentially the same for VFR and IFR.

Use the 1000 foot point on the runway as aim for the approach. This will ensure that the approach will not be short or unnecessarily long.

The landing distance is affected by the glide path as well as the height above the runway threshold. For example, crossing the threshold at 100 feet instead of 50 can increase the landing distance by up to 950 feet on a 3° glide slope. A glide slope of 1° can increase the landing distance by up to 1500 feet.

Use the ILS or VASI to help you establish the correct glide path on the approach.

Thrust on Approach

Use the throttles as a primary flight control on approach. Use the throttles in coordination with the elevators to control airspeed, rate of descent and position on glide path. Always keep one hand on the throttles, even when using the autothrottle system.

Note that in the event of a go-around, the JT8D engines need about 8 seconds to accelerate from approach idle to go-around power.

Final Approach

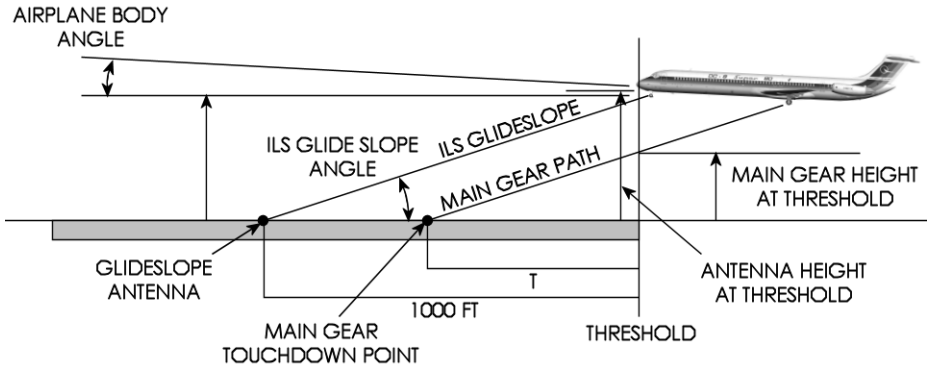
A good rule of thumb on final approach to give a 3° glide path: One-half the ground speed (knots) times ten will give the required rate of descent.

For example GS= 100, (100 / 2) x 10 = 500fpm

Another good rule of thumb: For a 3° glide path maintain 300 feet of altitude for each mile from the touchdown.

For example: If you are 5 miles from touchdown, 5 x 300 = 1500 feet. You should be at 1500 feet altitude when 5 miles from touchdown.

Estimated ILS Approach
Estimated touchdown point (no flare) assuming G/S transmitter at 1000 feet.



Flaps 28

Glide Path Angle (Degrees)	Estimated Body Angle (Degrees)	Pilot Eye Height At Threshold (Feet)	Main Gear Height At Threshold (Feet)	Main Gear Touchdown Point T (Feet)
2.5	4.9	44	29	664
2.75	4.65	48	34	708
3.0	4.4	52	39	744

Flaps 40

Glide Path Angle (Degrees)	Estimated Body Angle (Degrees)	Pilot Eye Height At Threshold (Feet)	Main Gear Height At Threshold (Feet)	Main Gear Touchdown Point T (Feet)
2.5	3.2	44	28	649
2.75	2.95	48	33	681
3.0	2.7	52	37	708

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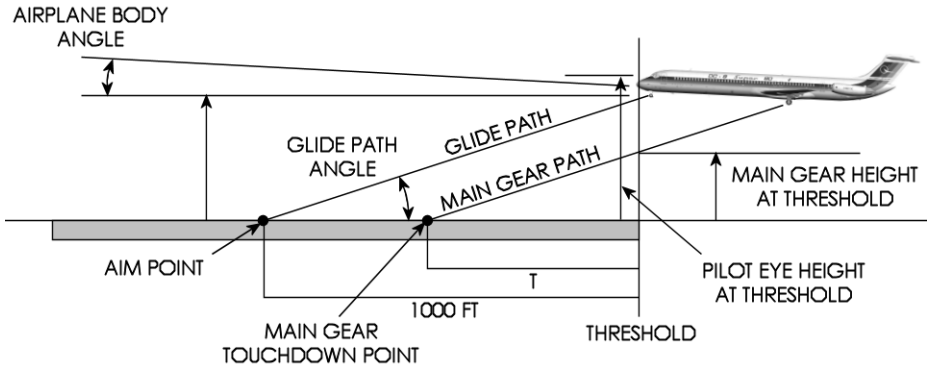
Estimated Visual Approach
Estimated touchdown point (no flare) assuming an aim point at 1000 feet.



Flaps 28

Glide Path Angle (Degrees)	Estimated Body Angle (Degrees)	Pilot Eye Height At Threshold (Feet)	Main Gear Height At Threshold (Feet)	Main Gear Touchdown Point T (Feet)
2.5	4.9	44	24	550
2.75	4.65	48	28	583
3.0	4.4	52	32	610

Flaps 40

Glide Path Angle (Degrees)	Estimated Body Angle (Degrees)	Pilot Eye Height At Threshold (Feet)	Main Gear Height At Threshold (Feet)	Main Gear Touchdown Point T (Feet)
2.5	3.2	43	22	503
2.75	2.95	48	27	562
3.0	2.7	52	31	591

Touchdown

The descent rate for a normal landing configuration is about 650 to 850 fpm.

Recommended landing technique is to reduce the sink rate at approximately 50 feet radio altitude. Smoothly lift the nose 2-3 degrees up to reduce the rate of descent. Simultaneously, slowly reduce power to idle.

Do not attempt to hold the aircraft off the runway by further increase in pitch.

Thrust should reach idle power at touchdown. With proper airspeed and thrust management, touchdown should occur at V_{REF}, but never below V_{REF}.

The aircraft tends to float in ground effect if the flare and thrust are excessive. Floating before touchdown "eats up" a lot of runway. It is better to put the aircraft down on the runway if you are coming in to fast, than trying to bleed the speed off in the air. The aircraft decelerates three times faster on the runway than in the air.

It is important to lower the nose on touchdown and hold a positive forward pressure on the control column. This decreases the wing angle of attack, reduces the lift, and puts more weight on the main gear. This increases rolling friction, as well as braking effectiveness. This procedure is five times more effective than holding the nose off for aerodynamic braking.

Directional Control

Differential braking may be used to aid in directional control after touchdown. Nosewheel steering should not be used until the aircraft is ready to turn off the runway.

Reverse Thrust

Reverse thrust should be applied immediately upon touchdown, as reverse thrust is most efficient at higher airspeeds.

Early application of reverse thrust greatly reduces runway required for rollout, and greatly reduces brake temperature and wear.

The application of reverse thrust tends to reduce and blank out the effect of the rudder. At 90 knots and 1.6 EPR, the rudder is almost completely ineffective.

Immediately reduce reverse thrust to idle reverse if the aircraft starts drifting across the runway. This will restore rudder effectiveness and help regain directional control.

Use of asymmetrical forward thrust to regain directional control is allowed. Use of asymmetrical reverse thrust is not allowed.

Speed Brakes

The automatic brake system is inhibited until the spoilers are deployed (manually or automatically). Monitor the automatic deployment of the spoilers at touchdown. Manually apply the spoilers if they fail to deploy automatically.

Autobrakes

The autobrake system senses deceleration and modulates the brake pressure required accordingly. Early and effective application of spoilers and reverse thrust is therefore very important to minimize brake temperature and wear.

If only minimum reverse thrust is used, the brake energy required to stop the aircraft almost doubles.

Brakes

The brakes slow down the aircraft by absorbing the motion energy of the aircraft. The brakes convert this motion energy into heat, which is dissipated through cooling.

The brakes are required to absorb vast amounts of energy. The higher the speed is at the time the brakes are applied, the higher the amount of energy they have to absorb.

While reverse thrust is more effective at higher airspeeds, the brakes are more effective at lower airspeeds.

During a normal landing, as speed is being reduced, the brakes should be applied just prior to the termination of reverse thrust operation. This practice will result in the most economical landing performance.

SECTION 5

EMERGENCY PROCEDURES

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Emergency techniques are currently not described.

SECTION 6

AIR CONDITIONING AND PRESSURIZATION

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SECTION 6: AIR CONDITIONING AND PRESSURIZATION

GENERAL

Pneumatics

The pneumatic system provides pressurized air for cabin pressurization. Air conditioning, ice protection, engine starting, and potable water tank pressurization. For ground operation and engine starting, pneumatic pressure is supplied by the APU, by ground power equipment, or by an operating engine.

In flight pneumatic pressure is supplied by the low and/or high stage compressors of both engines. Normally, bleed air from the left and right engines is supplied to the respective air conditioning units. Bleed air from both engines is supplied to the ice protection systems simultaneously. Pneumatic crossfeed valves permit operation of the air conditioning system and lee protection systems from either engine.

APU bleed air is normally used only for engine starting and for ground air conditioning when the engines are not operating.

Air Conditioning

Pressurized air from the pneumatic system is used for air conditioning and for pressurizing the airplane. During ground operation, pneumatic air to operate the air conditioning systems can be obtained from a ground source connected to the airplane, by the auxiliary power unit (APU), or by the engines. During flight, only the engines supply bleed air for operating the air condition.

The airplane has two identical air conditioning systems, designed for independent or parallel operation. Normally the right system operates from the right engine bleed air and supplies the passenger compartment temperature requirements. The left system operates from the left engine bleed air and supplies the flight compartment temperature requirements.

Pressurization

Pressurization is provided by a controlled flow of bleed air from the pneumatic supply, which passes through the air conditioning systems and is then ducted to the pressurized areas. Desired pressurization levels are maintained by regulating escape of the compressed air through the cabin air outflow valve. Normally, the outflow valve is automatically positioned by a dual automatic pressurization system to control cabin pressure rates from take-off to landing.

Dual pressure relief valves are installed to protect the airplane structure from maximum input pressure. The relief valves prevent the cabin differential pressure from exceeding the maximum limit of 8.32 PSI. Negative pressure is relieved by the inward movement of the galley service and passenger entrance door seals, and one negative pressure relief valve installed in the aft pressure bulkhead.

When operating on the pressure schedule, the cabin rate of climb will be proportional to the airplane rate of climb, with maximum limits as set by the rate limit knob. When climbing or descending toward a selected altitude above schedule, the cabin rate of change will be as selected on the rate limit knob. With the knob at the index mark, the rate limit is normally 700 fpm climb and 300 fpm descent.

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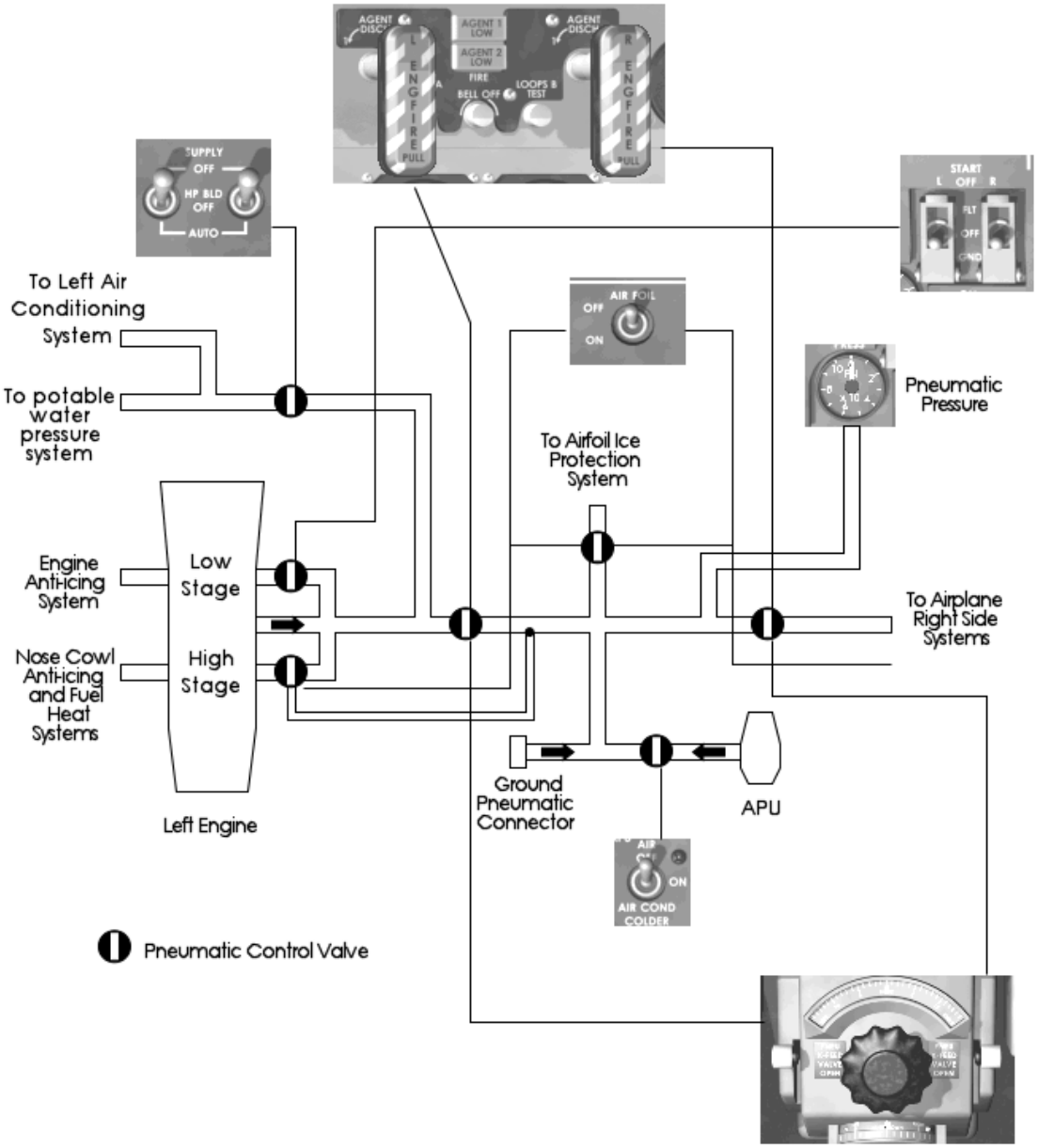
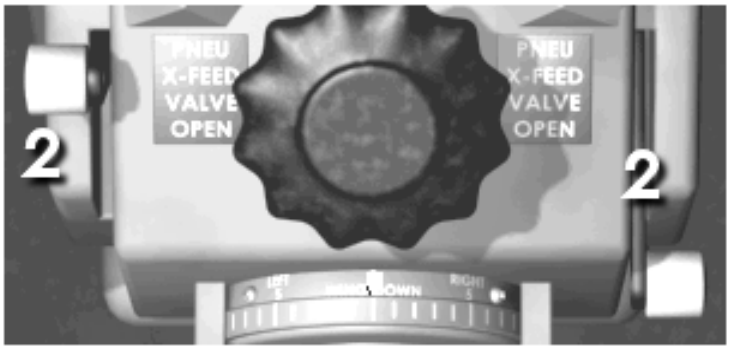
FUNCTIONAL SCHEMATIC - PNEUMATICS



CONTROLS AND INDICATORS



1. PNEUMATIC PRESSURE GAUGE

Indicates pneumatic pressure in the crossfeed manifold.

2. PNEUMATIC X-FEED VALVE LEVER

Open (Up) Supplies bleed air for air foil ice protection (in flight only), for operating both air conditioning packs from one operating engine, and for making pneumatic crossfeed starts from opposite operating engine. Also, on the ground, supplies APU bleed air or air from pneumatic ground source for operating one or both air conditioning packs or for engine starting.

Closed (Down) Shuts off engine bleed air for air foil ice protection and pneumatic crossfeed starts, and each air conditioning pack is supplied engine bleed air from its respective engine only. On the ground, APU bleed air or air from pneumatic ground source is shutoff and not available for air conditioning packs or engine starts.

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AIR CONDITIONING

1. TEMP CONTROL VALVE INDICATOR (L, R)

Indicates position of air conditioning system control valve.

COLD Indicates temperature control valve is closed and blocking hot air supply.

HOT Indicates temperature control valve is fully open to allow maximum hot air supply.

2. PRESSURE GAUGE

Indicates pneumatic supply pressure available for operation of each air conditioning pack.

3. COCKPIT TEMPERATURE SELECTOR

AUTO Temperature is automatically adjusted.

MANUAL COLD (Momentary) Moves TEMP CONTROL VALVE towards cold.

MANUAL HOT (Momentary) Moves TEMP CONTROL VALVE towards hot.

STOP (Momentary) Stops movement of TEMP CONTROL VALVE in manual mode.

4. CABIN TEMPERATURE SELECTOR

See Cockpit Temperature Selector.

5. SUPPLY SWITCH (L, R)

OFF Closes off all pneumatic valves for the air conditioning system.

HP BLD OFF Opens up the regulator valve but keeps the high press augmentation valve closed.

AUTO Opens up the regulator valve and adjusts the augmentation valve as necessary.

6. TEMPERATURE SELECT SWITCH

CABIN SPLY Selects cabin supply duct temperature for display on the Cabin Temperature Gauge.

CABIN Selects cabin supply duct temperature for display on the Cabin Temperature Gauge.

7. RADIO RACK VENTURI SWITCH

VENTURI Inflight, opens venture valve and turns off radio rack fan.

FAN Inflight, turns on primary radio rack fan and closes venture valve for radio rack cooling.

8. CABIN TEMPERATURE GAUGE

Indicates cabin temperature or cabin supply duct temperature as selected by Cabin Temperature Select switch.

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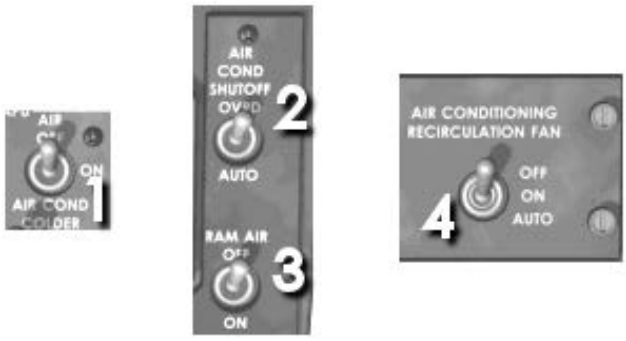

1. APU AIR SWITCH

ON — APU bleed control valve opens to provide APU bleed air to the airplane pneumatic system.

OFF — Closes the APU bleed control valve.

AIR COND COLDER — Closes turbine bypass valve and increases differential pressure across air conditioning turbine, thus lowering temperature of conditioned air during ground operation. Use of this switch position significantly reduces airflow in the cockpit and cabin.

2. AIR CONDITION SHUTOFF SWITCH

Not currently simulated.

3. RAM AIR SWITCH

Not currently simulated.

4. AIR CONDITIONING RECIRCULATION FAN SWITCH

OFF — Removes power from recirculation fan.

ON — Allows recirculation fan to operate on the ground to supplement air conditioning.

AUTO — Recirculation fan operates inflight only.

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PRESSURIZATION

1. TRANSFER LOCKOUT LIGHT (Blue)
Not currently simulated.

2. STDBY ON LIGHT (Blue)
Not currently simulated.

3. SYSTEM SELECTOR SWITCH
Used to manually transfer system from primary to standby or return the system from standby to primary.

4. LDG ALT SELECTOR KNOB
Used to set departure/destination airport altitude in the landing altitude window. The scale is numbered in 100 ft increments.

5. LDG BARO SELECTOR KNOB
Used to set departure/destination barometric pressure in Mb/In Hg window.

6. FLOW LIGHT
Indicates current air flow is insufficient maintain cabin pressure. The cause may be insufficient air conditioning inflow or excessive fuselage leakage. Press to test light.

7. RATE LIMIT CONTROL KNOB
Normally set at index mark and does not require adjustment unless a rapid climb or descent is anticipated.

8. CAB ALT AND DIFF PRESS GAUGE
Outer CAB ALT dial indicates existing cabin altitude in thousands of feet. Inner DIFF PRESS dial shows difference in pressure between cabin and ambient in PSI.

9. CABIN CLIMB GAUGE
Standard rate instrument, indicates rate of change in feet per minute in cabin altitude during automatic or manual control.

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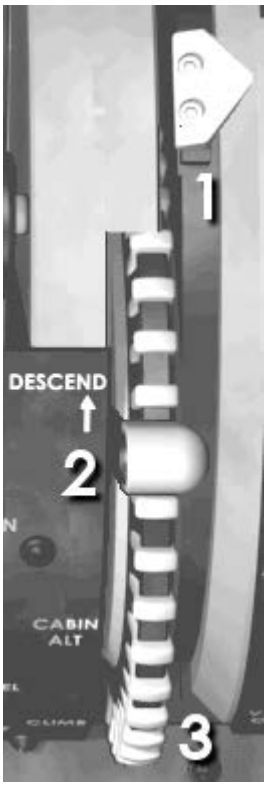

1. OUTFLOW VALVE POSITION INDICATOR

Indicates position of cabin air outflow valve. Fully forward – open, fully aft – closed.

2. CABIN ALT CONTROL LEVER

Auto	(Up) Cabin altitude is controlled automatically.
Manual	(Down) Cabin altitude is manually controlled by adjusting the Cabin Altitude Control Wheel.

3. CABIN ALT CONTROL WHEEL

With Cabin Altitude Control lever in auto (up) position, the control wheel rotates as cabin air outflow valve automatically adjusts to maintain cabin altitude.

With Cabin Altitude Control lever in manual (down) position, rotate the control wheel in the desired direction to adjust cabin air outflow valve.

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WARNING AND CAUTION LIGHTS

48. CABIN ALT LIGHT (Red)

Comes on when cabin altitude exceeds 10,000 ft. The CABIN ALT light is accompanied by the MASTER WARNING light. The NO SMOKING and FASTEN SEAT BELTS signs in the cabin also come on.

SECTION 7

ANTI-ICE AND RAIN PROTECTION

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SECTION 7:

SECTION 8: ANTI-ICE AND RAIN PROTECTION

GENERAL

General

The airplane ice protection systems employ hot air and electrical heating for anti-icing and anti-fogging functions. Rain removal is accomplished by chemical repellent and electrically operated windshield wipers.

Window Heat

Electrical heating provides heat for anti-icing and anti-fogging of the pilot's three windshields, and anti-fogging for the clearview and overhead windows.

Probe Heat

Electrical heating is used for anti-icing the pitot tubes, static port areas, stall angle of attack vanes, and ram air temperature probe.

Airfoil Ice Protection

The airfoil ice protection system provides anti-icing heat to the wing leading edge slats, forward strakes, and to the air conditioning ram air-scoop inlet in flight, when the air foil switch and associated pneumatic crossfeed valves are actuated.

De-icing is available for the horizontal stabilizer leading edge by the tail de-ice pushbutton. Heat is then diverted from the wing leading edge slats and strakes to the horizontal stabilizer. Tail de-icing is provided for 2.5 minutes, and then flow is reverted back to the wing slats and strakes again. When air foil anti-icing is selected, tail de-icing will automatically be selected every 15 minutes.

Forward strakes anti-icing is accomplished through the same system as the wing leading edge slats, and is controlled by the same switch.

Clear Ice Detectors

Triangular decals, with a piece of parachute cord attached, are installed on the upper inboard surface of both wings. The purpose of these decals is to assist the de-icing crew during de-icing. If clear ice is present the cords will remain frozen to the wing. De-icing fluid should be applied until the cords move freely. The triangles provide a secondary visual reference as the edges of the triangle will appear irregular if covered with clear ice.

Engine Anti-Ice

Engine anti-icing is provided by independent system, controlled by individual switches located on the overhead ice protection panel. Each engine provides ice protection for the respective engine, nose cowl, inlet bullet, and compressor inlet guide vanes.

CONTROLS AND INDICATORS

1. HEATER CUR METER
Displays current flow to each position as selected by the METER SEL & HEAT switch.

2. METER SEL & HEAT SELECTOR
When the selector is moved from the OFF position, all pitot tubes, rudder limiter, stall probes and static ports are heated.

3. AIR FOIL ANTI-ICE SWITCH
OFF Stops the flow of heated air to the wing leading edge slats, strakes, and horizontal stabilizer.
ON Opens up the pressure regulator valve to allow heated air to flow to the wing leading edge slats, strakes, and horizontal stabilizer.

4. TAIL DE-ICE PUSHBUTTON
Closes shutoff valve to the wings and strakes, and opens up the shutoff valve to de-ice the tail. After a timed period, 2.5 minutes, the system automatically reverts back to anti-icing the wings and strakes.

5. WINDSHIELD ANTI-FOG SWITCH
OFF Deactivates the anti-fog system.
ON Prevents and/or removes condensation on the inside surface of the windshields, clearview, and overhead windows.

6. WINDSHIELD ANTI-ICE SWITCH
OFF Deactivates the window anti-ice system.
ON Provides anti-ice heat to three windshields.

7. ENG ANTI-ICE SWITCHES (L, R)
OFF Closes valves to shut off air to engine anti-ice system.
ON Opens valves to provide heater air to anti-ice engine nose cowl, bullet, and inlet compressor guide vanes.

1. RAIL REPELLENT SELECTOR SWITCH

RES (Momentary) Positions selector valve from primary to reserve fluid container. Selector valve cannot be reset to primary until serviced by maintenance.

2. RAIN REPELLENT PUSHBUTTONS (L, R)

Discharges a metered quantity of fluid from spray nozzles onto the windshield.

3. WINDSHIELD WIPER SWITCH

Controls variable speed, electrically operated windshield wipers. Wipers should be used in conjunction with rain repellent.

15 & 22. ENG ANTI-ICE ON LIGHTS (L, R)(Blue)

Indicates engine anti-ice system is on.

16. WING ANTI-ICE ON LIGHT (Blue)

Indicates anti-ice heat has been selected for wing leading edge and strakes.

23. TAIL DE-ICE ON LIGHT (Blue)

Indicates de-ice heat has been selected for the leading edge of the horizontal stabilizer.

24. PITOT/STALL HEATER OFF LIGHT (Amber)

Comes on to indicate METER SEL & HEATER selector in OFF. MASTER CAUTION light also comes on.

66. RAIN REPELLENT RESERVE IN USE LIGHT (Blue)

Indicates reserve fluid container has been selected.

SECTION 8

AUTO-FLIGHT

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SECTION 9: AUTO-FLIGHT

GENERAL

General

The aircraft is equipped with two digital flight guidance computers (DFGC 1 and 2). Each DFGC operates independently of each other. The flight crew selects the operating DFGC with the 1-2 Selector on the Flight Guidance Control Panel. The 1-2 Selector is normally set to the side of the flying pilot. This allows the flying pilot's navigation radio to be connected to the operating DFGC and therefore to the autopilot.

Flight Mode Annunciator

Flight Mode Annunciators (FMA) are provided for the Captain and F/O. The FMA displays the armed or engaged modes of the Digital Flight Guidance System. The FMA provides legend displays for the Instrument Comparator, disengage lights for the autopilot and autothrottle, and four windows for the Flight Guidance Modes.

Autopilot

The AP function, in conjunction with the yaw damper function, automatically controls the airplane in pitch, roll and yaw maneuvering axes. The AP will actuate the appropriate control surfaces to control the aircraft for the selected AP mode of operation.

The AP modes of operation will automatically control the aircraft for the following maneuvers:

- maintain an existing altitude
- descend or climb to and maintain a preselected altitude
- maintain a selected vertical speed, indicated airspeed, or mach number
- maintain an existing heading
- fly to and maintain a preselected heading
- fly to, capture, and track a selected VOR or localizer course
- capture and track a glideslope
- runway alignment and flare for automatic landing.

The AP warning light on the FMA will come on if the AP disengages for any reason.

Flight Director

The FD function provides visual guidance commands to fly the aircraft manually or to visually monitor AP response to the guidance commands.

Pitch (including speed control) and roll guidance from the DFGC are displayed on the Attitude Director Indicator (ADI). A V-command bar on the ADI directs the pilot to turn, climb, or descend. A fast/slow indicator on the ADI reflects airplane speed in relation to selected speed on the FGCP or computed safe speed above stall (ALFA speed).

Speed control

With the speed control function active the aircraft will pitch up/down to loose/gain speed. Speed control inputs for attitude control are displayed by the V-command bar and fast/slow indicator on the ADI. IAS Hold mode and Mach Hold mode are available.

IAS and Mach Hold mode are used during climb and descent to maintain a constant airspeed.

During take-off mode of operation, the V-command bar on the ADI will command a pitch attitude to maintain V_2+10 KIAS for two engine operation.

During go-around mode, the V-command bar on the ADI will command the go-around speed, which is the same as landing approach speed.

Note: The default P3D TO/GA mode is used for take-off and go-around operation.

Autothrottle

The autothrottle function automatically positions the throttles to maintain airspeed or engine thrust as required for the operational mode selected. The autothrottle function will control the throttles for the following maneuvers:

- take-off
- climb
- cruise
- holding
- approach
- flare (not simulated, manually retard the throttles)
- go-around

The autothrottle function is engaged by moving the AUTO THROT switch from OFF to AUTO THROT position. When the autothrottle function is disengaged the THROTTLE warning light on the FMA will come on.

A clutch mechanism permits manual positioning of the throttles without disengaging the autothrottle function. However, the throttles should not be manually positioned, when the ATS is active, except when in CLMP mode or, during descent, when the autothrottle FMA annunciates LOW LIM. Overriding the autothrottle may cause excessive clutch wear requiring extensive down time to replace the autothrottle servo drive assembly.

Altitude Advisory System

The Altitude Advisory System automatically alerts the crew that the airplane is approaching the preselected altitude or that the airplane is deviating from a previously selected and captured altitude. An advisory light on the altimeters provides the alert for either of the above situations.

The advisory light will come on steady when the airplane is 750 feet from the selected altitude. The light will then stay on until the airplane is within 250 feet of the selected altitude.

If the airplane deviates from the acquired altitude with more than 250 feet, the advisory light will come on flashing, accompanied by an aural tone alert followed by the spoken word “Altitude”.

Performance Management System

The Performance Management System (PMS) operates as a fully integrated selectable mode of the Digital Flight Guidance System. The PMS is programmed to compute a cost efficient flight profile based on cost index value, airplane performance and manual inputs.

The PMS is programmed to provide automatic protection against engine overboost, overspeed, minimum speed, and 250kts speed restriction below 10,000ft.

The PMS continuously computes an optimum flight profile from present position to the bottom of descent (BOD). The PMS computed profile includes a top of descent (TOD) point for idle power descent to BOD.

The PMS has three modes of operation: CLB (climb), CRZ (cruise) and DES (descent). Each of these modes can be operated in the optimum (OPT) submode for minimum operating cost or in the non-optimum (NON-OPT) submode which uses manually entered speed, rate of climb/descent, and altitudes.

Note: The NON-OPT mode is currently not simulated. However, the pilot may manually input speed and altitude.

FLIGHT DIRECTOR

1. Captain's FD Switch
When switched to on, the V-command bar is displayed on the ADI providing the crew with pitch and roll guidance commands from the DFGC.

2. First Officer's FD Switch
See description of Captain's FD switch.

3. CADC Selector
For description, refer to Section 14 – Flight Instruments.

4. FD CMD Selector

NORM	DFGC 1 provides the Captain's V-command bar and fast/slow pointer with command inputs, and DFGC 2 provides the First Officer's V-command bar and fast/slow pointer with command inputs.
BOTH ON 1	DFGC 1 provides both the Captain's and First Officer's V-command bar and fast/slow pointer with command inputs.
BOTH ON 2	DFGC 2 provides both the Captain's and First Officer's V-command bar and fast/slow pointer with command inputs.

5. VERT GYRO

NORM	Vertical Gyro 1 provides input to the Captain's ADI, DFGC 1 and 2. Vertical Gyro 2 provides input to the First Officer's ADI, DFGC 1 and 2, and weather radar antenna.
L ON AUX	The Auxiliary Vertical Gyro replaces Vertical Gyro 1 inputs.
R ON AUX	The Auxiliary Vertical Gyro replaces Vertical Gyro 2 inputs.

6. FD Light
Comes on when the FD CMD Selector is out of the NORM position.

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AUTOTHROTTLE

1 Autothrottle Mode Selector Buttons

SPD SEL — Selects SPD SEL mode. The FMA will display SPD and the preselected speed value.

MACH SEL — Selects MACH SEL mode. The FMA will display MACH and the preselected Mach value.

EPR LIM — Selects EPR LIM mode. The FMA will display EPR and the thrust mode selected on the Thrust Rating Indicator. The exception to this is the TO FLEX mode where EPR plus the temperature selected on the ASSUMED TEMP selector is displayed on the FMA.

2. Autothrottle SPD/MACH Readout

Digital readout of the indicated airspeed or Mach value selected with the SPD/MACH select knob.

3. SPD/MACH select knob

Click the numbers to select the value in the SPD/MACH Readout. Press knob to momentarily switch between airspeed and Mach in the SPD7mach Readout.

4. AUTO THROT Switch

Engages the autopilot. The switch will automatically go to off when reverse power is applied or when a power loss occurs.

5. Airspeed Command Bug

Reflects the value set in the SPD/MACH Readout.

6. THROTTLE Warning Light (Red)

The light comes on flashing whenever the autothrottle disengages automatically or the AUTO THROT switch is moved to the OFF position. In the real aircraft the flashing light is turned off by pressing the autothrottle disconnect button on the throttle. In the panel, simply click the light to turn it off.

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ROLL MODE SELECTORS

1. Mode Selector Buttons

NAV — Pressing the NAV button arms the DFGC to capture and track a course input by the ONS. Arm FMA will annunciate NAV. Roll FMA will annunciate NAV CAP when capturing ONS course and NAV TRK when tracking ONS course.

VOR LOC — Arms DFGC to capture and track a selected VOR or LOC course. Arm FMA will annunciate VOR or LOC. Roll FMA will annunciate VOR or LOC CAP when capturing selected course, and VOR or LOC TRK when tracking selected course.

ILS — Arms DFGC to capture and track selected localizer and glideslope. Arm FMA will annunciate ILS. Roll FMA will annunciate LOC CAP when capturing selected localizer, and LOC TRK when tracking selected localizer. Pitch FMA will annunciate GS CAP when capturing selected glideslope and CAP TRK when tracking selected glideslope.

AUTO LAND — Arms the DFGC to engage AUTO LAND mode after selected localizer and glideslope has been captured. Arm FMA will annunciate LND. After AUT LND has been annunciated on the FMA, all other control modes except go-around mode are inhibited.

2. HDG Select knob

Click the numbers in the digital readout to select heading.

Push the knob in to activate Heading Hold mode. The DFGC will then hold the aircraft's current heading. The roll FMA will annunciate HDG HLD.

Pull the knob out to activate Heading Select mode. The DFGC will then give roll commands to capture the selected heading in the HDG Readout. The roll FMA will annunciate HDG SEL.

Note: Bank angle selection is currently not available in the panel.

3. HDG Readout

Digital readout of the heading selected with the HDG Select knob.

PITCH MODE SELECTORS

1. Pitch Profile Readout

The first part of the window displays the operating mode selected:

- V Vertical Speed
- M Mach
- S Indicated Airspeed
- P Turbulence

The next part of the window displays pitch reference: climb (+) or descent (-).

The last part of the window displays the appropriate numerical value according to the operating mode.

2. Pitch Control Wheel

Rotating the Pitch Control Wheel towards ANU (aircraft nose up) or AND (aircraft nose down) will change the Pitch Profile Readout, ADI v-command bar, and aircraft pitch attitude if the autopilot is engaged.

The Pitch Control Wheel is active in the following modes:

VERT SPD	Varies the vertical speed. Selection of a vertical speed of less than 100fpm engages the altitude hold mode.
IAS/MACH	Varies the speed. Aircraft will pitch up to loose speed and pitch down to gain speed.
TURB	Varies aircraft pitch attitude.
ALT HOLD	Disengages ALT HOLD mode and engages VERT SPD mode.

3. Mode Selector Buttons

ALT HOLD	Engages ALT HOLD mode which will hold the aircraft's current altitude. Pitch FMA will annunciate ALT HLD.
VERT SPD	Engages VERT SPD mode which will hold the aircraft's current vertical speed. The vertical speed can be varied with the Pitch Control Wheel. Pitch FMA will annunciate VERT SPD.
IAS/MACH	If the airplane is below FL270, IAS hold mode is selected when the button is pushed. Pressing the button again will select MACH hold mode. If the aircraft is above FL270, MACH hold will be selected when the button is pushed. Pressing the button again will select IAS hold mode. The speed can be varied with the Pitch Control Wheel. Pitch FMA will annunciate IAS or MACH.
PERF	PMS pitch command is coupled to the autopilot. Pitch FMA will annunciate the appropriate mode: PERF CLB, PERF CRZ or PERF DES.

4. AP ON Switch

Engages/disengages the autopilot. The switch will automatically disengage when a loss of power occurs.

5. DFGC 1 – 2 Switch
Selects DFGC 1 or 2 for all flight guidance system functions except FD. Note that if AP and/or ATS are engaged, switching DFGC will cause these to disengage.

6. ALT Preselect Readout
Digital readout of the altitude selected with the ALT Preselect knob.

7. ALT SET Knob
Click the digital readout to set the altitude. Pull the knob out to arm capture of the preselected altitude.

8. TURB Mode Button
Engaging the TURB mode provides dampened pitch and roll commands from the DFGC. The autothrottle will automatically disengage. Roll FMA will annunciate WNG LVL. Pitch FMA will annunciate TURB.

YAW DAMPER, MACH TRIM AND ALTITUDE ADVISORY LIGHT

1. YAW DAMP Switch

OFF	Disables yaw damper operation if AP is disengaged.
ON	Yaw damper operation is engaged regardless of AP status.
OVRD	Disables yaw damper operation regardless of AP status.

2. MACH TRIM COMP Switch

NORM	Mach trim compensation mode is in operation.
OVRD	Mach trim compensation mode is inoperative.

43. YAW DAMP OFF Light (Amber)
Comes on to indicate yaw damper is off.

60. MACH TRIM INOP Light (Amber)
Comes on to indicate Mach trim compensator is off, or Mach Trim Comp switch is in the OVRD position.

1. Altitude Advisory Light
The Altitude Advisory Light receives input from the altitude alert system. The light comes on steady when the aircraft is 750ft from the preselected altitude and goes off when the aircraft is within 250ft of the preselected altitude.

The light will come on flashing if the aircraft deviates from the captured altitude by 250ft or more. The altitude alert system is deactivated at glideslope capture.

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ATTITUDE DIRECTOR INDICATOR

1. Bank Angle Index
Bank angle markings at 10, 20, 30, 45 and 60 degrees.

2. Bank Indicator
Aircraft bank is displayed by the Bank Indicator against the fixed bank angle index.

3. Horizon Bar
Roll attitude is shown by the horizon bar relative to the stationary aircraft symbol. Pitch attitude is shown by vertical movement of the horizon, and read against the pitch calibration scale using the aircraft symbol as a reference.

4. Glideslope Deviation Display
Shows vertical deviation from the glideslope. The pointer is removed from view when no glideslope is tuned.

5. Test Button
Push the button to test the ADI. When pressed, the ADI will indicate a 20 degree right bank and 10 degree nose up attitude. The ATT flag will appear during the test.

6. Rising Runway
The Rising Runway symbol is actuated by the radio altimeter at and below 200ft AGL to indicate deviation from the glideslope. The Rising Runway symbol will be rising until it appears to touch the aircraft symbol at actual touchdown. The symbol is removed from view when no glideslope is tuned.

7. Slip Indicator
To fly coordinated the ball should be kept in the center position. If the ball is out of the center position, the aircraft is either slipping or skidding.

8. Fixed Aircraft Symbol
Indicates aircraft position in relation to the horizon index.

9. V-Command Bar
Provides roll and pitch guidance commands from the DFGC. The v-command bar is removed from view when the FD switch is in the OFF position.

10. Fast/Slow pointer
The fast/slow pointer gives an indication of the aircraft's current speed in relation to the autothrottle SPD/MACH readout, safe stall margin speed (ALPHA SPD) or PMS target speed. Full deflection either side indicates approximately 10 knots. The pointer will be removed when speed control data is invalid or when ATS is in RETD (retard) mode.

11. Decision Height Light
The light comes on when the aircraft has reached the decision height preselected on the Radio Altimeter.

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1. GS Flag
Appears when glideslope indication is unusable. The flag is removed from view when not tuned to a LOC station.

2. ATT Flag
Appears during ADI test and when attitude data is unusable.

3. Runway Flag
Appears when LOC or radio altimeter signals are unusable. The flag is removed from view when not tuned to a LOC station.

4. FD Flag
Appears when input data to v-command bar is unusable.

5. Speed Flag
Appears when input data for slow/fast indications are unusable.

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FLIGHT MODE ANNUNCIATOR

1. Autothrottle Mode Window (Green)
Annunciates the active autothrottle mode.

2. Armed Mode Window (Amber)
Annunciates the modes currently armed.

3. Roll Mode Window (Green)
Annunciates the active lateral DFGC mode.

4. Pitch Mode Window (Green)
Annunciates the active vertical DFGC mode.

5. FD and AP1/AP2 Lights (Blue)
The FD light indicates the FD switch on the glareshield is in the FD position. The AP1/AP2 light indicates whether DFGC 1 or DFGC 2 is providing guidance input.

6. THROTTLE Warning Light (Red)
The light comes on flashing whenever the autothrottle disengages automatically or the AUTO THROT switch is moved to the OFF position. In the real aircraft the flashing light is turned off by pressing the autothrottle disconnect button on the throttle. In the panel, simply click the light to turn it off.

7. AP OFF Warning Light (Red)
The light comes on flashing whenever the AP automatically disengages or the AP master switch is moved to the OFF position. In the real aircraft the flashing light is turned off by pressing the AP disconnect button on the flight controls. In the panel, simply click the light to turn it off.

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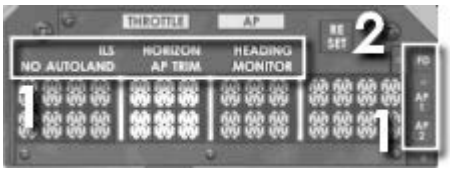
FMA – LEGEND LIGHTS



1. Flight Mode Annunciator Legend Lights

ILS Light (Amber)
The Legend comes on when a deviation between LOC/GS1 and LOC/GS2 has been detected.

Horizon Light (Amber)
Not currently simulated.

Heading Light (Amber)
Not currently simulated.

Monitor Light (Amber)
Not currently simulated.

No Autoland Light (Amber)
The legend comes on steady whenever a situation that does not permit autoland has been detected. The light comes on flashing during the Autoland Preflight Test.

AP Trim Light (Amber)
This legend indicates that the autopilot has a sustained out-of-trim horizontal stabilizer condition.

FD Light (Blue)
Indicates that the FD switch on the glareshield is in the FD position.

AP1/AP2 Light (Blue)
The AP1/AP2 light indicates whether DFGC 1 or DFGC 2 is providing guidance input.

2. RESET Button
Pushing this button resets the ILS, HORIZON, MONITOR and NO AUTOLAND legend lights on the FMA. Push the button a second time to recall all legend lights that has been reset. The Reset button will also reset the THROTTLE and AP legend lights.

FMA – AUTOTHROTTLE WINDOW

ALFA SPD — ATS is in ALFA mode. This mode is automatically engaged whenever the selected speed/mach in the digital SPD/MACH readout is lower than the minimum maneuvering speed for the current flap/slat and weight configuration. The autothrottle system will control the throttles to maintain a safe margin above stall speed.

ATS OFF — PERF mode is engaged and the autothrottle system is off. The display flashes as a reminder to engage the autothrottles.

AUTO LND — Autoland preflight test in progress.

CLMP — ATS is in clamp mode. Power is removed from the ATS servo which moves the throttle handles.

EPR 25 — ATS is in EPR LIM mode with TO FLX mode selected on the TRI and 25 degrees selected on the assumed temperature readout. ATS will maintain a de-rated takeoff thrust.

EPR CL — ATS is in EPR LIM mode with CL mode selected on the TRI. ATS will maintain maximum climb thrust.

EPR CR — ATS is in EPR LIM mode with CR mode selected on the TRI. ATS will maintain maximum cruise thrust.

EPR G/A — ATS is in EPR LIM mode with GA mode selected on the TRI. ATS will maintain maximum go-around thrust.

EPR MCT — ATS is in EPR LIM mode with MCT mode selected on the TRI. ATS will maintain maximum continuous thrust.

FLAP LIM — ATS is restricting thrust to prevent exceeding the flap limit airspeed. This mode engages automatically when a speed higher than the flap limit speed is selected in the SPD/MACH readout.

LOW LIM — ATS requires a throttle setting lower than the minimum authority.

MACH .830 — ATS is in MACH SEL mode. ATS will maintain .83 Mach as selected in the SPD/MACH readout.

MMO LIM — ATS is restricting thrust to prevent exceeding the maximum mach operating speed. This mode engages automatically when a speed higher than the MMO speed is selected in the SPD/MACH readout.

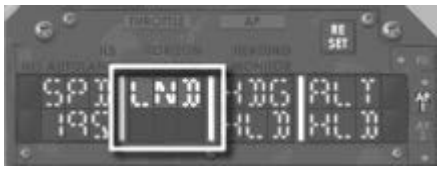
PERF CLB — ATS controlled by PMS to maintain climb thrust.

PERF CRZ — ATS controlled by PMS to maintain cruise thrust.

PERF DES — ATS controlled by PMS to maintain descent thrust.

PWR	ATS automatic power up test is in progress.
RETD	ATS is in retard mode. The throttles are automatically retarded during the flare maneuver of an autoland procedure.
SLAT LIM	ATS is restricting thrust to prevent exceeding the slat limit airspeed. This mode engages automatically when a speed higher than the slat limit speed is selected in the SPD/MACH readout. In this panel the FLAP LIM mode will be used to restrict thrust for both flaps and slats limit.
SPD 250	ATS is in SPD SEL mode. ATS will maintain the airspeed in the SPD/MACH readout.
SPD/ MACH ATL	ATS is in MACH SEL mode. ATS will maintain the mach number in the SPD/MACH readout.
VMO LIM	ATS is restricting thrust to prevent exceeding the maximum operating airspeed. This mode engages automatically when a speed higher than the VMO speed is selected in the SPD/MACH readout.

FMA – ARM WINDOW



ALT	The altitude in the Altitude Preselect window is armed for capture.
ILS	ILS mode is armed for capture of localizer and glideslope.
LND	LAND mode is armed for capturing of selected ILS for automatic landing.
LOC	LOC mode armed for capture of localizer course.
NAV	ONS mode armed for capture of ONS track.
PRE	Autoland preflight test in progress.
VOR	VOR mode armed for capture of VOR course.
UP	Automatic power up test in progress.

Go-around Modes:

When the autopilot or flight director is engaged in LOC TRK and G/S TRK modes, radio altimeter indicates less than 1500 feet, and the flaps are in the landing configuration, the FMA will annunciate whether autopilot, flight director, or manual go-around is available.

AUT G/A	Comes on to indicate that autopilot go-around is available.
F/D G/A	Comes on to indicate that flight director go-around is available.
MAN G/A	Comes on to indicate that only manual go-around is available.

FMA – ROLL WINDOW

ALN	When the autopilot is in LAND mode, the Align sub-mode is engaged when the aircraft descends below 150 feet AGL. The align mode will transition the aircraft from a crab angle for crosswind correction to a forward slip (sideslip) to bring the aircraft in to alignment with the runway.
AUT LND	The autopilot is in LAND mode, both radios are tuned to the ILS frequency, radio altitude is less than 1500 feet, flaps are in the landing configuration, the localizer and glideslope are being tracked, and the AUTOLAND logic has been satisfied.
FLT	Autoland preflight test in progress.
GO RND	Go-around mode has been engaged. If active, the autopilot and/or v-command bars will maintain the current heading of the aircraft.
HDG HLD	The autopilot is in heading hold mode. The DFGC will maintain the heading of the aircraft at the time the mode was engaged.
HDG SEL	The autopilot is in heading select mode. The DFGC is providing commands to maintain the heading in the HDG readout.
LOC CAP	The autopilot is engaged in either LOC, ILS or LAND mode, and capture of the localizer of the selected ILS has been initiated.
LOC TRK	The autopilot is engaged in either LOC, ILS or LAND mode, and the localizer of the selected ILS is being tracked.
NAV CAP	The autopilot is coupled to the Omega Navigation System, and capture of the selected ONS course has been initiated.
NAV TRK	The autopilot is coupled to the Omega Navigation System, and the selected ONS course is being tracked.
ROL OUT	At main gear spin-up, the autopilot will automatically switch to rollout mode. Go-around is disarmed. Runway center line will be maintained using the localizer.
TAK OFF	The FD take-off mode is engaged. The DFGC will command the v-command bar to maintain runway heading.
TST	Automatic power up test in progress.
VOR CAP	The autopilot is engaged in VOR mode, and capture of the selected VOR radial has been initiated.

VOR CRS	The autopilot is engaged in VOR mode, and VOR station passage is occurring (cone of silence). The DFGC is maintaining the magnetic VOR course displayed in the CRS readout.
VOR TRK	The autopilot is engaged in VOR mode, and the selected VOR radial is being tracked.
WNG LVL	The Turbulence mode is engaged. The DFGC maintains wings level.

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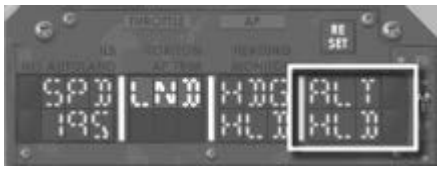
FMA – PITCH WINDOW



ALT CAP	The Altitude Preselect mode is engaged and the preselected altitude is being captured.
ALT HLD	The Altitude Hold mode is engaged. The DFGC is maintaining the aircraft's altitude at the time the mode was engaged.
AUT LND	The autopilot is in LAND mode, both radios are tuned to the ILS frequency, radio altitude is less than 1500 feet, flaps are in the landing configuration, the localizer and glideslope are being tracked, and the AUTOLAND logic has been satisfied.
BOX1	Automatic power up test in progress.
FLAR	The autopilot is in LAND mode, and the flare phase before touch down has been initiated.
G/S CAP	The autopilot is engaged in either ILS or LAND mode, and capture of the glideslope of the selected ILS has been initiated.
G/S TRK	The autopilot is engaged in either ILS or LAND mode, and the glideslope of the selected ILS is being tracked.
GO	Go-around mode has been engaged. If active, the autopilot and/or v-command bars will maintain 10 degree pitch up attitude.
IAS	The autopilot is engaged in IAS hold mode. The DFGC will maintain the aircraft's airspeed at the time the mode was engaged by giving pitch commands.
MACH	The autopilot is engaged in Mach hold mode. The DFGC will maintain the aircraft's Mach speed at the time the mode was engaged by giving pitch commands.
NO FLR	The autopilot is engaged in ILS mode. This annunciation will come on flashing if the autopilot is still engaged below 100 feet AGL.
PERF CLB	Climb pitch attitude is currently being determined by the PMS.
PERF CRZ	Cruise pitch attitude is currently being determined by the PMS.
PERF DES	Descent pitch attitude is currently being determined by the PMS.
ROL OUT	At main gear spin-up, the autopilot will automatically switch to rollout mode. Go-around is disarmed. The FD v-command bar will be centered.

SPD LOW	This light comes on when a selected pitch mode has resulted in an airspeed which is lower than the ALFA reference speed by 10 percent.
TAK OFF	The FD take-off mode is engaged. The DFGC will command the v-command bar to maintain V2+10.
TEST	Autoland preflight test in progress.
TURB	The Turbulence mode is engaged. The DFGC maintains the aircraft's pitch attitude at the time the mode was engaged. Use the pitch control wheel to adjust the pitch attitude of the aircraft.
VERT SPD	The autopilot is engaged in basic Vertical Speed mode. The airplane vertical speed is being maintained by pitch attitude control.

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PERFORMANCE MANAGEMENT SYSTEM

1. Data Display Area
The Data Display Area consists of four lines with 24 characters per line. Each character is display by a 7x5 LED dot matrix. The first line consists of the title and the scratchpad

2. Line Select Keys (1, 2, 3)
Pushing the Line Select Keys can transfer data entries from the scratchpad to the selected line, arm/select PMS sub modes, or call up additional data/pages.

3. Mode Annunciators (CLB, CRZ, DES)

CLB	PMS is engaged in climb mode.
CRZ	PMS is engaged in cruise mode.
DES	PMS is engaged in descent mode.

4. Function Keys

CLB	Selects display of performance and data related to climb.
CRZ	Selects display of performance and data related to cruise.
DES	Selects display of performance and data related to descent.
VERT WPTS	Selects displays the vertical waypoint data.
PLAN	Displays pages relative to preflight and en route planning.
CLEAR	Clears any alert/advisory messages in the scratchpad. Also clears data entered into the scratchpad.
STS TEST	When pushed and held down the button functions as a lamp/display test. All Mode Annunciators, Line Select Keys, PMS Failure Light and Data Display Area will light up. When released, the status page will be displayed.

5. Slew Switch
The Slew Switch is used when multiple pages are available under the same title. Up and down arrows in the upper right corner of the Data Display Area indicates that more data/pages can be reached by using the Slew Switch.

6. Dimmer Control Knob
Not simulated.

7. Data Entry Keys
These keys are used to enter data into the scratchpad. Dual function keys will normally enter the numerical value. However, if the Alternate Function Key (lower right corner) is pressed, the alternative character will be entered.

8. PMS Failure Light
Comes on when PMS data is not valid.

1. CDU MESSAGE Light

The light comes on to alert the crew that a message is displayed in the scratchpad of the PMS CDU. The light goes out when the message is cleared.

2. VERTICAL ALERT Light

The light comes on to alert the crew that a vertical speed or airspeed change is about to occur as a result of PMS operation.

Note: The PMS Alert lights are located just underneath the Flight Mode Annunciator.

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DATA DISPLAY AREA LINES

The Data Display Area consists of four lines with 24 characters per line. The first line is the Title/Scratchpad line. The scratchpad area is used to accept data from the data entry keys. The scratchpad area is also used to display various messages to the pilots. The following lines are called Line 1, Line 2, and Line 3.

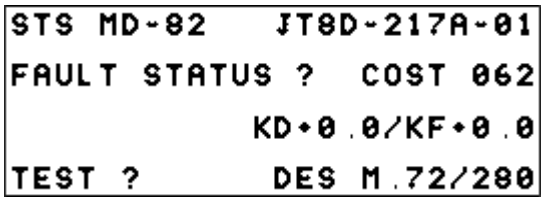
DATA ENTRY

For dual function keys, for example 'W4', the numerical value '4' will be entered into the scratchpad, unless the Alternate Function key is pushed first. If the Alternate Function key is pushed first, the letter 'W' will be entered into the scratchpad.

The '/' key is used when more that one parameter is loadable. For example, the PLAN-CRZ page Altitude parameters. Three altitudes may be entered as '220/290/330'. However, you could also enter '/290' to enter just the second altitude, or '//330' to enter just the third altitude.

STATUS PAGE

The Status page is accessed by pressing the STS TEST button. The Status page is also the default startup page when the PMS is powered on.



The Status page is used to test the PMS before flight. Hold down the STS TEST button to test the lamps and digital display on the PMS CDU.

The title/scratchpad line displays the page title, aircraft type, engine type, and software update status.

Line 1 gives access to the Fault Status page (not simulated) and displays the current cost index.

Line 2 displays the aircraft's specific drag factor (KD) and Fuel Flow Factor (KF).

Line 3 gives access to the Test page (not simulated). The Test page and Fault Status pages are normally only used by maintenance. Line 3 also displays the expected descent speeds.

Note: Only the cost index can be modified on this page.

CHANGE COST INDEX

Data Entry Keys KEY IN NEW COST INDEX

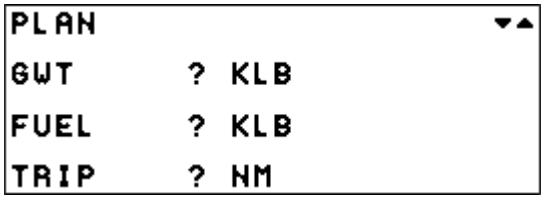
Key in new cost index (0 – 255).

Line Select Key 1 PRESS

The data keyed into the scratchpad is transferred into Line 1. The new cost index is now set.

PLAN PAGE

Normally, when the Status page has been checked, the pilot will enter the relevant flight plan data into the DATA page.



The data should be entered to make the Performance Optimization Algorithm (POA) operational. Without this data, the PMS cannot provide optimum performance commands to control speed and altitude.

The PLAN page is accessed by pressing the PLAN key.

ENTERING GROSS WEIGHT DATA

Data Entry Keys — KEY IN AIRCRAFT GROSS WEIGHT

The aircraft gross weight should be entered as pounds (LBS). You may key in, for example '150000'. You may also enter that same weight as '150'. Either way, the PMS will interpret this as 150,000lbs. Minimum GWT is 120,000lbs.

Line Select Key 1 — PRESS

The data keyed into the scratchpad is transferred into Line 1. Note: If you key in for example '150200', this will be displayed as 150KLB. However, the PMS will still perform all calculations using 150,200lbs.

ENTERING FUEL LOAD DATA

Data Entry Keys — KEY IN PLANNED FUEL LOAD FOR THE TRIP

The fuel load data should be entered as pounds (LBS). The same principle as for GWT entry applies to Fuel data entry. You may key in, for example '20000'. You may also enter that as '20'. Either way, the PMS will interpret this as 20,000lbs of fuel. Minimum fuel load is 5,000lbs.

Line Select Key 2 — PRESS

The data keyed into the scratchpad is transferred into Line 2.

ENTERING TRIP (DISTANCE) DATA

Data Entry Keys — KEY IN PLANNED FLIGHT DISTANCE

The flight distance should be entered in nautical miles (NM). You may key in, for example '800' for an 800NM flight. Minimum distance is 100NM.

Line Select Key 3 — PRESS

The data keyed into the scratchpad is transferred into Line 3.

BOTTOM OF DESCENT (BOD) DATA

When GWT, Fuel and Trip data has been entered, the PMS will automatically calculate and present Bottom of Descent (BOD) data. Line 1 will display the aircraft gross weight at the BOD point and Line 2 will display fuel remaining at the BOD point.

Note that this data is somewhat premature and can not be considered accurate. These numbers should however give you a rough estimate of what to expect in terms of fuel burn for the planned flight.

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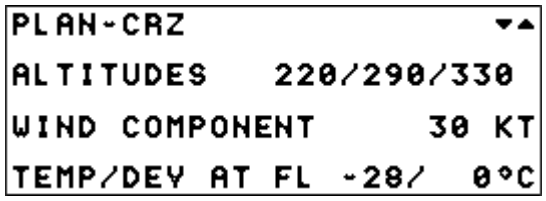
PLAN-CRZ PAGE

The PLAN-CRZ page is accessed through the PLAN page. Press the PLAN key. Then use the slew switch, up or down, to access the PLAN-CRZ page.

Data should be entered into this page to allow the PMS to calculate a flight plan profile that is optimum for the given environment conditions. Data entry to this page is optional and not required.

Up to three altitudes may be entered on Line 1. The expected wind component may be entered on Line 2. Air temperature or deviation from ISA at the first top of climb flight level may be added to Line 3.



ENTERING ALTITUDES

Data Entry Keys — KEY IN PLANNED FLIGHT LEVELS FOR THIS FLIGHT

Up to three altitudes may be entered. All altitudes should be entered as flight levels (3 digits). Use the slash '/' key to separate different altitudes. For example, key in '220/290/330'. If you wish to key in just the second altitude, you should key in a slash followed by the flight level. For example, '/290'. And if you would like to key in just the third altitude, you should key in double slashes followed by the flight level. For example, '//330'.

Line Select Key 1 — PRESS

The data keyed into the scratchpad is transferred into Line 1.

ENTERING WIND COMPONENT

Data Entry Keys — KEY IN EXPECTED WIND COMPONENT

Enter the expected wind component at the top of climb. Enter a positive number for a tail wind and a negative number for a head wind. Wind data should be entered as knots.

Line Select Key 2 — PRESS

The data keyed into the scratchpad is transferred into Line 2.

ENTERING TEMPERATURE

Data Entry Keys — KEY IN EXPECTED TEMPERATURE OR DEVIATION FROM ISA

Enter the expected temperature or ISA deviation at the top of climb. If you key in the expected temperature at the top of climb, the PMS will automatically calculate the ISA deviation. If you key in the ISA deviation, the PMS will automatically calculate the temperature at the top of climb. Temperature may be entered as Fahrenheit or Celsius, depending on your P3D settings.

Line Select Key 3 — PRESS

The data keyed into the scratchpad is transferred into Line 3.

REPLANNING

PLAN Key — PRESS
CLEAR Key — PRESS
Line Select Key 3 — PRESS

Line 3 will display 'Confirm Replan?'. Press Line Select Key 3 again to confirm.

Line Select Key 3 — PRESS

All data entered into PMS is cleared.

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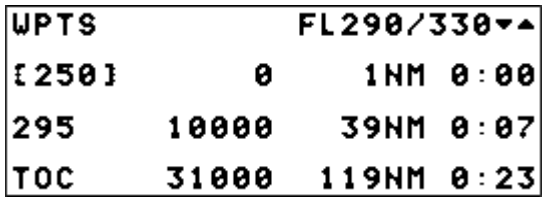
WAYPOINTS PAGE (WPTS)

The Waypoints page displays a complete list of all the vertical waypoints the PMS has calculated for the vertical profile of the planned flight.



The Title line displays the title along with the current optimum and maximum available flight levels.

The optimum flight level is the flight level calculated by the PMS to be the most efficient in terms of cost and time for the current flight.

The maximum flight level is the maximum altitude the aircraft will be able to cruise at with the current gross weight. For all practical purposes, this may be considered to be the aircraft's current service ceiling.

Line 1 through Line 3 displays the vertical waypoints. These may be scrolled up and/or down using the slew switch.

The data displayed for each waypoint are:

- Name
- Altitude (feet)
- Distance to waypoint (NM)
- Time to waypoints (hours and minutes)

Names used for waypoints:

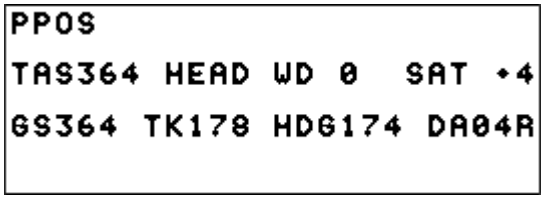
- 250, 295: Climb speeds
- TOC: Top of Climb
- ARM: Armed Altitude
- TOD: Top of Descent
- BOD: Bottom of Descent

Note: When a number is enclosed by brackets, the waypoint is a speed restriction waypoint.

PPOS PAGE

The first waypoint in the Waypoints page is always PPOS. This waypoint represents the aircraft's current position. The PPOS waypoint does not display the normal waypoint data. It displays the aircraft's current ground speed.

Push Line Select Key 1 outside the PPOS waypoint entry to bring up the PPOS page.



The PPOS page displays true airspeed, head/tailwind component, standard air temperature, ground speed, track, heading, and drift angle.

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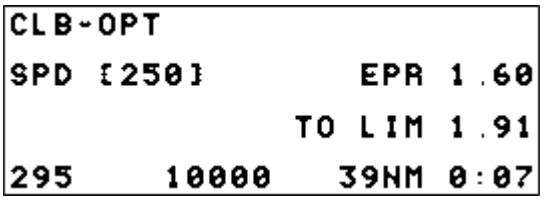
CLIMB PAGE

Press the CLB key to bring up the Climb page.



The Title says CLB-OPT signifying that the PMS is operating in the OPT, or optimum, mode. Note that this panel does not simulate any other modes than the optimum mode.

On Line 1 the Climb page displays the current climb speed; SPD [250]. The speed readout is enclosed by brackets when this is a speed restriction, such as 250kts speed restriction below 10,000ft. Line 1 also displays the current EPR (Engine Pressure Ratio).

Line 2 displays the TRI (Thrust Rating Indicator) mode together with the EPR Limit calculated by the TRI.

Line 3 displays the next vertical waypoint. Distance and time display will count down as you approach the waypoint.

Note that although the Climb page is displayed, the PMS may not necessarily be in climb mode. The Mode Annunciators will display which PMS mode is currently active.

MODIFYING THE CURRENT AIRSPEED

The aircraft airspeed may be modified by keying in a new airspeed and inserting it to Line 1. This will cause the PMS to command the aircraft to fly at a non-optimum airspeed. However, in this panel the title line will still say OPT.

Data Entry Keys KEY IN NEW AIRSPEED
Enter the new airspeed. For example '270'.

Line Select Key 1 PRESS
The data keyed into the scratchpad is transferred into Line 1. Note that the airspeed can only be modified on the Climb page if the PMS is in climb mode, and so on.

MODIFYING THE NEXT ALTITUDE

The altitude of the next vertical waypoint may be modified by inserting a new altitude into Line 3. This will cause the PMS to command the aircraft to fly at a non-optimum altitude. However, in this panel the title line will still say OPT.

Data Entry Keys KEY IN NEW ALTITUDE
Enter the new altitude. For example '23000' or '230' for 23,000ft.

Line Select Key 3 PRESS
The data keyed into the scratchpad is transferred into Line 3. Note that the altitude can only be modified on the Climb page if the PMS is in climb mode, and so on.

Note: This function is intended for changing the altitude you are currently climbing to or descending to. However, you can also change the altitude while in cruise. The PMS will not switch to CLB or DES mode though.

LEVELING OFF PRIOR TO TOC

If required, for example by ATC instruction, it is possible to have the PMS level off the aircraft at an altitude lower than the TOC altitude.

When climbing in CLB mode:

Altitude Preselect window — SET NEW LEVEL OFF ATITUDE

Simply arm a lower altitude in the Altitude Preselect window on the Flight Guidance panel. Notice that the next waypoint now says 'ARM*' indicating that the PMS will level off the aircraft at an altitude lower than the TOC.

CONTINUING THE CLIMB FROM AN INTERMEDIATE ALTITUDE

When the PMS is in cruise mode on an 'ARM' altitude lower than the TOC, arm a higher altitude and go to the Climb page to initiate the climb.

Altitude Preselect window — SET NEW LEVEL OFF ATITUDE

Arm a higher altitude. This can be the TOC altitude, or a lower altitude if required by ATC to step climb up to your final TOC.

Function Key — PRESS CLB

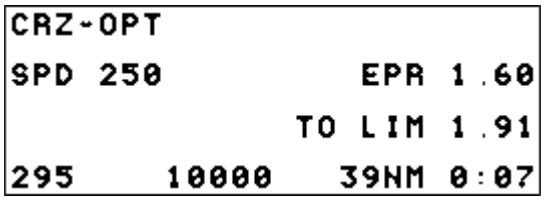
This brings up the Climb page. Notice that Line Select Key 1 is blinking, indicating that the PMS is ready to initiate a climb.

Line Select Key — PUSH LINE SELECT KEY 1

The PMS will now initiate the climb to the next armed altitude.

CRUISE PAGE

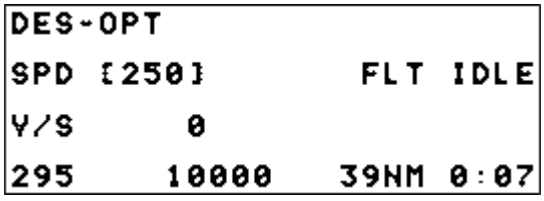
Press the CRZ key to bring up the Cruise page.



The display and operation of the Cruise page is the same as for the Climb page. Please see the description for the Climb page.

DESCENT PAGE

Press the DES key to bring up the Descent page.



On Line 1 of the Descent page 'FLT IDLE' is displayed indicating that the throttle setting for descent is flight idle. On Line 2 the current vertical speed is displayed. Line 3 displays the next vertical waypoint.

The operation of the Descent page is the same as for the Climb page. Please see the description for the Climb page.

ENGAGING PERF MODE

To have the PMS control the vertical profile of the flight, engage PERF mode on the DFGS.

Push the PERF mode selector button on the Flight Guidance panel to engage PERF mode. Note that PERF mode requires that the Auto Throttle System is armed. If ATS is not armed, 'ATS OFF' will flash in the FMA throttle window for 5 seconds. If ATS has not been armed within 5 seconds, the PERF mode will automatically disengage.

PMS MESSAGES

The PMS can display the following messages:

- BOD FUEL
  - Data input to the PLAN page results in fuel level at the BOD which is to low.
- ARM ALT
  - No altitude has been armed on the DFGS. The pilot should immediately arm a new altitude.
- ADD DRAG
  - The pilot should add drag and increase rate of descent in order to avoid overshooting the BOD.
- PMS DISC
  - The PMS has automatically disconnected from the DFGS. This is normal when passing the BOD.

Whenever the PMS has a message to display, the PMS Annunciator on the main panel will light up to alert the pilots.

SECTION 9

APU

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SECTION 10: APU

GENERAL

General

The Auxiliary Power Unit (APU) is a gas turbine engine installed to supply pneumatic requirements for cabin air conditioning and engine starting as well as electrical power for normal airplane systems operation while on the ground. The APU is operable in flight to supply an alternate source of electrical power. The APU installed aft of the rear pressure bulkhead in the unpressurized area of the lower fuselage.

All APU controls and indicators are located on the overhead panel.

Limitations

The APU can be started on the ground or in-flight. Maximum operating altitude for the APU is FL350. Maximum starting altitude for the APU is FL240. APU bleed air is only available on the ground.

Electrical system

A 40 KVA power AC generator is mounted on the APU to provide electrical power to either or both electrical systems.

CONTROLS AND INDICATORS

1. APU EGT GAUGE
Indicates percent of maximum continuous APU exhaust gas temperature.

2. APU PERCENT RPM GAUGE
Indicates APU RPM as a percentage of an established normal operating RPM. Normal operating range is indicated by a green arc between 95 and 105 percent RPM.

3. APU FIRE AGENT SWITCH
For description see Fire Protection – Section 12.

4. APU AIR SWITCH (Ground operation)
ON APU bleed control valve opens to provide APU bleed air to the airplane pneumatic system.
AIR COND COLDER Closes turbine bypass valve and increases differential pressure across air conditioning turbine lowering temperature of conditioned air during ground operation. Use of this switch position, although providing cooler air, significantly reduces cockpit / cabin airflow.
OFF Remove electrical power from door control circuit.

5. APU FIRE CONT SWITCH
For description see Fire Protection – Section 12.

6. APU MASTER SWITCH
START (Momentary) Initiates APU start. Release to RUN after observing initial rise in RPM.
RUN Normal APU operating mode.
OFF Automatically shuts off bleed air regardless of AIR switch position and shuts down APU. Note: The APU is also shut down if the battery switch is set to OFF.

7. APU DOORS CONTROL SWITCH
AUTO Automatically selects ram door position for starting and non ram door position for ground and flight operation.
RAM (Momentary) Provides manual override to open ram door.

Note: The click area to open/close the guard, is located just right of the switch.

SECTION 10

COMMUNICATIONS

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SECTION 11: COMMUNICATIONS

GENERAL

VHF COMMUNICATIONS SYSTEMS

The VHF communication systems are two separate identical systems designated VHF-I and VHF-2. The transmitting and receiving frequency selection is controlled from the VHF COMM control panels. Each panel has two frequency selectors and a transfer switch to select the transmitter frequency to be used. The VHF radios are located just aft of the throttle quadrant.

MODE S TRANSPONDER

A Mode S transponder is installed in the aircraft. In addition to ground replies for altitude identification, the Mode S transponder provides air-to-air surveillance and communication with other Mode S equipped airplanes for the purpose of collision avoidance. The transponder is located on the forward part of the pedestal.

SELCAL

Not currently simulated in the panel.

CONTROLS AND INDICATORS

1. VHF FREQUENCY READOUT (2)
Readout indicates selected VHF frequency.

2. VHF FREQUENCY SELECTOR (2)
Click the frequency readout to change the frequency.

3. VHF TFR SWITCH
The VHF transfer switch selects which frequency is currently active. This permits communication on either of the selected VHF frequencies.

4. VHF SQ DISABLE SWITCH
Disables squelch circuit to verify VHF receiver reception.

5. VHF COMM SELECTOR BAR
Appears when VHF frequency is not in use.

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1. FUNCTION SELECTOR

STBY Supplies power to transponder but does not allow transponder to reply to interrogation signals.

ON Allows transponder to reply to interrogation signals.

NOTE: On the ground, the transponder is in standby operation when function selector is in either STBY or ON position. Ground control relays keep the transponder in standby operation until liftoff, when the function selector is in the ON position. At liftoff, function selector in ON, ground control relays automatically switch transponder from standby operation to on operation. At touchdown, function selector in ON, ground control relays automatically switch transponder from on operation to standby operation.

2. NORM/TEST SWITCH

NORM Monitor light comes on when the transponder is being interrogated by a ground station.

TEST If the transponder is operating correctly the monitor light will come on.

3. MONITOR LIGHT (Green)

4. CODE READOUT

Digital readout of code numbers selected with code selector knobs.

5. TFR SWITCH

Used to select either ATC transponder 1 or ATC transponder 2. Only one transponder, ATC transponder 1, is installed in this panel.

6. IDENT BUTTON

Used only on request of ground controller. When pushed, an identification signal is transmitted for approximately 20 seconds.

7. ALT RPTG (Altitude reporting) SWITCH

OFF Disables altitude reporting function.

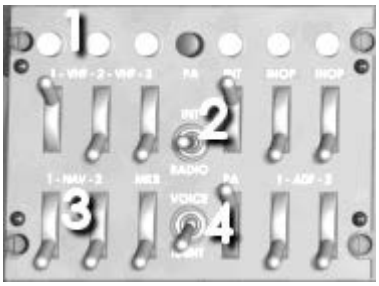
ALT RPTG Transponder will transmit a RPTG reply giving altitude of airplane in response to interrogation.

8. MODE SELECTOR

Used to set the transponder mode as requested by ground controller. Usually set to mode A.

9. CODE SELECTOR KNOBS

Click the numbers in the code readout to change the transponder code.



1. MICROPHONE SELECTOR BUTTON (7)

Push to select. Integral light comes on to indicate selection. Because of mechanical interlock, only one button can be latched down at a time.

2. RADIO/INT SWITCH

Momentary in RADIO only.

RADIO Keys radio transmission circuit for mask or boom microphone as selected by the microphone selector buttons.

INT Depending upon position of boom/mask switch, boom or mask microphone is "hot" and connected to flight interphone.

3. VOLUME CONTROL LEVER (12)

Move lever to adjust volume. Note: In the panel, up is on and down is off.

4. VOICE/IDENT SWITCH

VOICE Filters out audio code signals.

IDENT Unfiltered reception. Permits reception of both code and voice signals.

ACARS

(Aircraft Communications Addressing and Reporting System)

Description

The ACARS system permits transceiving operational and informational data digitally over a third VHF COMM transceiver dedicated to the ACARS data-link and operating on a discrete frequency of 131.55 MHz.

The ACARS system in this panel has a very limited range of functionality compared to the one in the real aircraft. The ACARS unit in this panel has three key functions:

- Insertion of departure station, destination station and flight number, which is used for loading a flight plan in the ONS (Omega Navigation System).
- OOOI (Out-Off-On-In) information.
- GMT display.

Control Unit (CU)

The CU provides a terminal for entering and displaying data. The CU is located on the forward part of the pedestal.

OUT–OFF–ON-IN (OOOI) Reports

These reports are generated for automatic transmission by the following sensors:

OUT	Forward entrance door closed, Parking Brake released.
OFF	Nose gear strut extension.
ON	Nose gear strut compression.
IN	Parking Brake set, forward entrance door opened.

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CONTROL UNIT

1. GMT BUTTON
When pressed, present GMT in hours, minutes and seconds will be displayed. Pressing pushbutton when GMT is displayed, removes GMT display.

2. OUT-OFF-ON-IN (000I) BUTTONS
Displays (while pressed) the GMT and station where selected event occurred. When released, display returns to blank or previous status.

3. ALPHANUMERIC DISPLAY
Displays ACARS information and data input from the keyboard and slew switches. When a function selector is used, the left side of the display will indicate an abbreviated designation for the information being displayed or needing to be inserted. The right side of the display will indicate the currently entered data, or if data needs to be entered, it will indicate "0" where a numeric entry is required and "/" where an alpha (letter) entry is required. The basic display mode is GMT.

4. SLEW SWITCHES
Used to insert alpha characters in the display directly above each switch. Click directly on the characters in the display to change the character. Note that this panel can accept up to 4 characters for the identifier (ICAO codes). The real aircraft accepts only 3 characters for the identifier (IATA codes).

5. KEYBOARD
Used to insert numeric data prior to entry. Inserted number is displayed in the right most display and shifts left as next number is inserted.

6. CLR BUTTON
Used to clear displayed numeric data prior to entering new data or if an error is made during data insertion.

7. ENT BUTTON
Transfers data manually inserted (via Keyboard or Slew Switches and being displayed on the Alphanumeric Display) into the Management Unit.

8. FUNCTION SELECTORS
Used to initiate data entry. To deselect any function that has been initiated but not entered, re-press the Function Selector, or select another function.

FLT NO Button
Used to insert flight number (max 5 digits).

DEST STA and DEPT STA Buttons
Permits use of the Slew Switches to insert destination or departure station. When pressed, any previously entered station will appear in the display. If there is no station entered, an oblique line (/) appears above each Slew Switch.

OPERATION

The ACARS unit is used to request and receive flight plans for the Omega Navigation System. In order to facilitate this, the Departure Station, Destination Station and Flight Number must be entered into the ACARS unit. Based on this information, the correct flight plan is requested from Dispatch and loaded into the ONS.

Entering Departure Station

DEPT STA Button PRESS
KEYBOARD KEY IN THE 4 LETTER
ICAO DEPARTURE
STATION IDENTIFIER.
ENT Button PRESS

Entering Destination Station

DEST STA Button PRESS
KEYBOARD KEY IN THE 4 LETTER
ICAO DESTINATION
STATION IDENTIFIER.
ENT Button PRESS

Entering Flight Number

FLT NO Button PRESS
KEYBOARD KEY IN THE FLIGHT
NUMBER WITH THE
NUMERIC KEYS
(1-5 DIGITS)
ENT Button PRESS

SECTION 11

ELECTRICAL

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SECTION 12: ELECTRICAL

GENERAL

General

The MD-80 electrical system is designed for simple and automatic operation. When a problem occurs, the system automatically takes the best course of action to maintain electrical power to the system.

The airplane electrical power system consists of a 115 volt, 400 Hz AC power generating and distribution system. For control circuits, lighting and other load devices requiring DC power, 28 volt DC power is supplied by transformer-rectifiers (TR).

Power for the DC system is supplied from two batteries when the main power distribution system is de-energized.

A battery charger, powered from an AC bus, maintains the batteries in a charged state.

The controls and indicators for the electrical system are located on the left side of the overhead panel.

AC power generating system

AC power is normally supplied by any of two or three AC generators, one on each engine and one on the auxiliary power unit (APU). Each generator is rated at 40 KVA maximum continuous output and is capable of supplying sufficient power for operation of essential electric systems in the event of loss of the other two generators.

For ground operations, an external power source may be connected to the airplane. The external power receptacle is located on the lower fuselage, left side.

The APU generator is mounted directly on the APU, and driven at a constant speed by the APU governing system.

Each engine-driven generator is driven through a constant-speed drive (CSD), which converts the variable speed output of the engine to a constant speed.

AC power distribution system

The electrical system is comprised of independent left and right systems which are normally powered by the respective engine driven generator. APU power and external power may be selected to power either or both generator buses.

The Ground Service Bus provides power to those circuits necessary for ground servicing operations.

An automatic priority system is installed to determine which power source is used. Power is automatically applied from the highest available priority source.

Electrical system priority:

1. Engine generator
2. APU generator
3. External power
4. AC crosstie relay

Example: If the APU is supplying power to the bus, and an engine driven generator is placed on the bus, the APU generator will automatically be taken off the bus.

The shutdown of a generator will automatically transfer the load from that generator to the remaining operating generator, through the AC crosstie relay.

DC power distribution system

The function of the DC power distribution system is similar to the AC system in that the right and left system function separately. The DC system has a manual crosstie in the event of a failure of either side. In addition to the left and right systems, DC power is supplied from the battery.

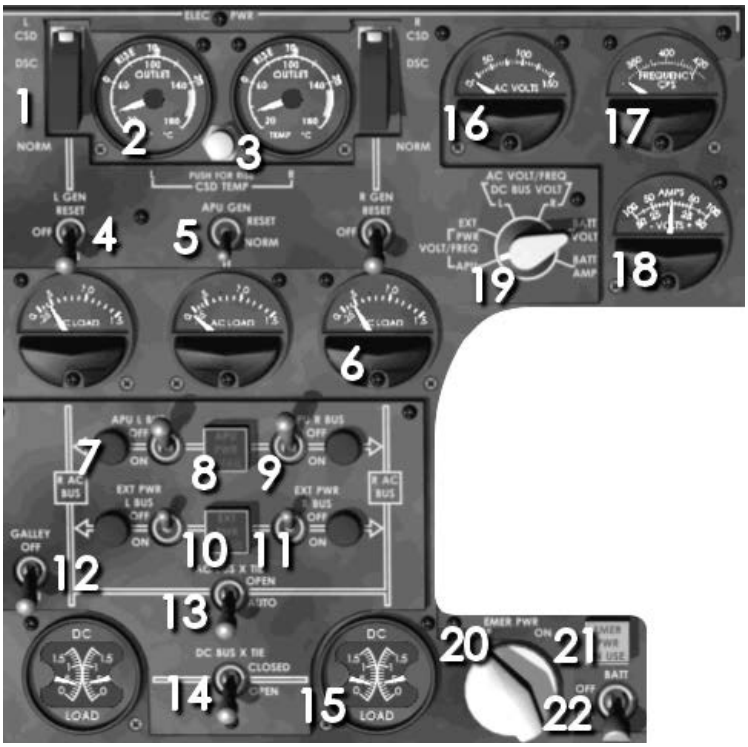
Batteries

Two 14 volt batteries are connected in series to supply 28 volt DC power. The battery is automatically being charged when electrical power is on the aircraft and the battery switch is ON. When operating on emergency power, the batteries should last for 30 minutes.

Battery charger

The battery charger is operative when the aircraft power is on, and the battery switch is in the ON position. When the battery is fully charged, the battery charger will be in a pulsating mode. If the battery is in a low state of charge, the ammeter will indicate a continuous current of approximately 65 amperes, and then switch into a pulsating mode as the battery becomes fully charged.

CONTROLS AND INDICATORS



1. CSD DISCONNECT SWITCH (L, R)

NORM Guarded switch normally in this position.

DISC (Momentary) Disconnects CSD from engine drive.

Note: Once disconnected, the CSD can not be reconnected. This must be done by maintenance personnel on the ground. In the simulator, you can click a hotspot between the CSD Oil Temperature gauges to reconnect the CSD when on the ground.

2. CSD OIL TEMPERATURE GAUGE (L, R)

Indicates CSD oil outlet temperature or oil temperature rise across the drive.

3. CSD TEMP PUSH FOR RISE BUTTON

When actuated, temperature rise (outlet temperature minus inlet temperature) is displayed on outer scale of indicator.

4. GEN SWITCH (L, R)

RESET (Momentary) Resets generator control circuit.

OFF Disconnects generator from AC power distribution system.

ON Connects generator to AC power distribution system.

5. APU GEN SWITCH

RESET (Momentary) Resets generator control circuit.

NORM For normal operation.

6. AC LOAD METER (3)

Indicates the load each AC generator is delivering to the distribution system. Indicates from 0 to 1.5 with 1.0 indicating 100% of generator rated capacity.

7. POWER IN USE LIGHT (4)
Indicates selected power source is connected to respective bus.

8. APU PWR AVAIL LIGHT
Indicates APU power is available.

9. APU BUS SWITCH (L, R)
OFF Removes APU power from respective buses.
ON Selects APU power to respective buses.

10. EXT PWR AVAIL LIGHT
Indicates external power is available.

11. EXT PWR BUS SWITCH (L, R)
OFF Removes external power from selected bus.
ON Selects external power to respective bus.

12. GALLEY SWITCH
OFF De-energizes galley power relays removing power from all galleys.
ON Energizes galley power relays which supply power to all galleys.

13. AC BUS X TIE SWITCH
OPEN Opens AG crosstie relay, isolating left and right AG distribution systems. Prevents automatic closing of relay with loss of left or right AG bus power.
AUTO Normally operated in this position. With loss of left or right AG bus power, relay closes automatically, connecting the two buses together.

14. DC BUS X TIE SWITCH
CLOSE Connects left and right DC buses, allowing any combination of T/R's to power both DC buses.
OPEN Normal position. Isolates left and right DC distribution systems.

15. DC LOAD METER (L, R)
Indicates load the respective T/R is delivering to the distribution system. Reading of 1 indicates 100% of T/R rated capacity.

16. AC VOLTS METER
Indicates voltage output of generators or external power.

17. FREQUENCY METER
Indicates frequency control of generator or external power in cycles per second.

18. DC VOLTS/AMPS METER
Indicates charge or discharge current of battery, battery voltage, or DC bus voltage.

19. INDICATOR SELECTOR SWITCH
When moved to either L or R positions, AC voltage and frequency for selected sources are read on respective meters. All other positions select only a single source as indicated on switch placard.

20. EMER PWR SWITCH
OFF Removes battery as source of emergency power.
ON Connects battery as source of emergency AC and DC power.

21. EMER PWR IN USE LIGHT
Indicates emergency power is on.

22. BATT SWITCH
OFF Removes battery from battery bus, battery charger and DC transfer bus.
ON Connects battery to battery bus. Selects battery to battery charger, and DC transfer bus.

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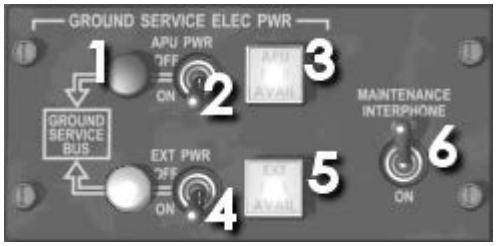

1. GROUND SERVICE BUS POWER IN USE LIGHT
(2) (Blue)
The light indicates that the selected power source is connected to the Ground Service Bus and supplying power.

2. APU PWR SWITCH

OFF	Removes APU generator power from the Ground Service Bus
ON	Connects APU generator power to the Ground Service Bus.

3. APU PWR AVAIL LIGHT (Blue)
Indicates that APU generator power is available.

4. EXT PWR SWITCH

OFF	Removes external power from the Ground Service Bus
ON	Connects external power to the Ground Service Bus. Note: External power will be selected to power the Ground Service Bus if both APU generator and external power switches are selected ON.

5. EXT PWR AVAIL LIGHT (Blue)
Indicates that external power is available.

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WARNING AND CAUTION LIGHTS

3. APU GEN OFF LIGHT (Amber)
Comes on to indicate APU is operating but APU generator is not in use. MASTER CAUTION lights also come on.

4. AC BUS OFF LIGHT (L) (Amber)
Comes on to indicate generator bus is not powered. MASTER CAUTION lights also come on.

5. GEN OFF LIGHT (L) (Amber)
Comes on to indicate generator relay is open, disconnecting generator from its bus. MASTER CAUTION lights also come on.

6. CSD OIL PRESS LOW LIGHT (L). (Amber)
Comes on to indicate oil pressure in CSD is below operating limits. MASTER CAUTION lights also come on.

8. AC CROSSTIE LOCKOUT LIGHT (Amber)
Comes on to indicate AC crosstie relay is locked open and automatic AC crosstie is inoperative. MASTER CAUTION lights also come on.

9. BATTERY OFF LIGHT (Amber)
Amber light that comes on when Battery switch is in the OFF position.

10. DC TRANSFER BUS OFF LIGHT (Amber)
Not in use.

11. AC BUS OFF LIGHT (R) (Amber)
Comes on to indicate generator bus is not powered. MASTER CAUTION lights also come on.

12. GEN OFF LIGHT (R) (Amber)
Comes on to indicate generator relay is open, disconnecting generator from its bus. MASTER CAUTION lights also come on.

13. CSD OIL PRESS LOW LIGHT (R). (Amber)
Comes on to indicate oil pressure in CSD is below operating limits. MASTER CAUTION lights also come on.

14. DC BUS OFF LIGHT (Amber)
Comes on to indicate either left or right DC bus is not powered. MASTER CAUTION lights also come on.

49. AC EMER BUS OFF LIGHT (Red)
Comes on to indicate emergency AC bus is not powered. MASTER WARNING lights also come on.

56. DC EMER BUS OFF LIGHT (Red)
Comes on to indicate emergency DC bus is not powered. MASTER WARNING lights also come on.

SECTION 12

FIRE PROTECTION

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SECTION 13: FIRE PROTECTION

GENERAL

General

A fire detection system is provided for each engine and the APU. Each detection system consists of two detector loops mounted parallel to each other.

With the loop switch set to BOTH, only one loop needs to detect a fire or overheat condition to activate the fire warning system.

Fire Warning System

The fire warning for an engine fire consists of the following lights and warning sounds:

- A red ENG FIRE light located in the fire handle on the upper main instrument panel.
- The MASTER CAUTION light on the glareshield.
- Aural warnings (fire bell and vocal) from the central aural warning system.

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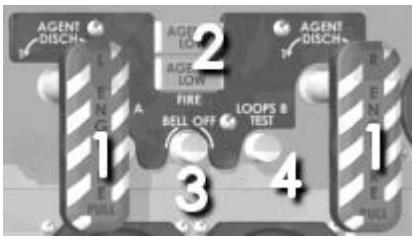
CONTROLS AND INDICATORS



1. ENG FIRE Handle (L and R)
Provides fire warning indication and protection for the applicable engine. Lights within the handle are turned on by the engine fire detection system or test circuit. Pulling the handle will silence the aural warnings and shut off engine fuel.

2. AGENT LOW Light (1 and 2) (Amber)
Comes on to indicate fire extinguishing agent has been discharged (pressure below required minimum).

3. FIRE BELL OFF Switch
Push to turn off aural warnings for engine fire.

4. LOOPS TEST Button (A and B)
Push to test the fire detection system loops circuits.

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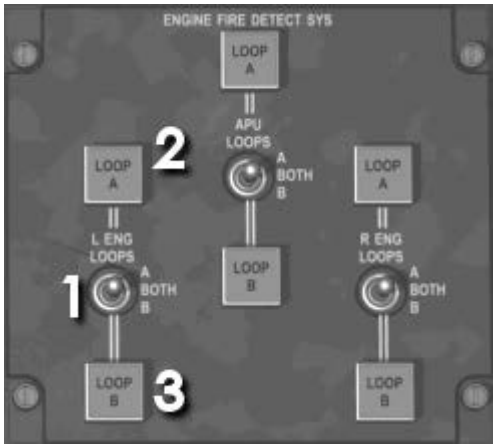
1. APU FIRE AGENT SWITCH
(No. 1 and No. 2)
(Momentary) Moving switch to DISCH with FIRE CONT switch in OFF & AGENT ARM discharges respective fire extinguishing agent into the APU compartment.

2. APU FIRE CONT SWITCH
NORM Provides control power to APU MASTER switch for normal operation.
OFF & AGENT ARM Shuts down APU and arms APU FIRE AGENT switches for subsequent discharge of fire extinguishing agent.



1. LOOPS Selector Switch (L Eng, R Eng, APU)
The Loops Selector switch connects the applicable engine or APU to the selected fire detection loop(s). The switch is normally set to BOTH, except when isolating and testing for malfunctioning and/or inoperative loop(s).

2. LOOP A Light (L Eng, R Eng, APU) (Amber)
The light comes when activated by associated fire detection loop or when the LOOPS Test switch is pressed. Note: Pressing LOOPS Test switch B will test both LOOP A and LOOP B. (LOOPS Test switch A is currently not simulated)

3. LOOP B Light(L Eng, R Eng, APU) (Amber)
Same as LOOP A light.

SECTION 13

FLIGHT CONTROLS

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SECTION 14: FLIGHT CONTROLS

GENERAL

The primary flight controls of the airplane consist of aileron, rudder and elevator control systems. Secondary flight controls consist of leading-edge slats, flight and ground spoilers, inboard and outboard flaps, and horizontal stabilizer.

PRIMARY FLIGHT CONTROLS

Lateral Control System

The ailerons provide the primary roll control and are augmented by the flight spoilers when increased roll control is required.

The control column in the cockpit is cable connected to an aileron control tab which controls aileron movement. In flight, the deflecting control tab will cause the aileron to aerodynamically position.

Aileron trim is provided by a separate tab on each aileron. The trim tab is cable controlled by the Aileron Trim knob on the aft pedestal.

Longitudinal Control System

Each elevator operates independently. Each elevator is controlled by a single control tab located inboard on the elevator. The control tabs are cable connected to the control column.

A gear tab is installed outboard of the control tab on the elevator. The gear tab is linked to move in the opposite direction of the elevator. Thus, the gear tab always assists the operation of the control tab.

An anti-float tab, geared to horizontal stabilizer movement, is installed outboard of the gear tab. The purpose of the anti-float tab is to fly the elevator up when the horizontal stabilizer is trimmed nose up. Without this tab, the elevators tend to float at extreme nose-up trim settings.

Stabilizer trim is accomplished by actuation of the LONG TRIM handle on the pedestal.

Engine strakes are added to the engine nacelles to enhance longitudinal control for stall recovery.

The elevators normally operate aerodynamically. However, for extreme high angle of attack flight conditions, a 3000 PSI hydraulic power augmentation system is installed for additional nose down capability. This feature is called Elevator Augmentation. The main purpose for the Elevator Augmentation system is to allow the airplane to recover from a deep stall when natural airflow across the tail is insufficient to "fly" the elevators.

A Mach Trim Compensator is installed on the First Officer's control column. The Mach Trim Compensator provides force to move the columns slightly aft when the airspeed is above M.80. This action offsets the effects of Mach Tuck that occurs at high speeds.

When the airplane is parked, it is possible for the elevators to split due to tail winds. When this occurs, the flight crew may notice the control columns feel locked in position. The condition is removed as soon as the airplane is taxied and the natural airflow of the tail "flies" the elevator toward the neutral position.

Rudder System

The rudder normally operates in the powered mode and is actuated by hydraulic pressure. In the event of a system failure or by pilot selection, the rudder may operate in manual mode actuated by a control tab.

Powered Rudder Operation

During powered rudder operation, the control tab is locked and the rudder is actuated by hydraulic pressure from the right system based on rudder pedal input. Hydraulic power to the rudder may be shut off by placing the rudder power control handle in the manual position. When hydraulic pressure drops below 950 PSI, the rudder automatically reverts to manual operation. Trim is accomplished by turning the trim knob on the pedestal.

Manual Rudder Operation

During manual rudder operation, rudder pedal movement operates a control tab on the rudder. Trim is accomplished by turning the trim knob on the pedestal.

Rudder Throw Limiter

A Rudder Throw Limiter is installed to protect the empennage from overload in case of inadvertent application of excessive rudder control. The limiter operates by ram air pressure from the pitot tube on the leading edge of the vertical stabilizer. The higher the speed, the more restriction on rudder movement.

A Rudder Unrestricted light on the overhead annunciator panel comes on whenever full rudder throw is available.

Nose strakes are added to the forward part of the fuselage to enhance directional control during high angle of attack flight.

The rudder pitot tube is electrically heated whenever probe heat is on.

Yaw Damper

A yaw damper is installed to provide damping of any lateral directional oscillation.

SECONDARY FLIGHT CONTROLS

Spoiler System

Each wing has inboard and outboard flight spoilers that are operational during all phases of flight.

Flight Spoilers

There are two Flight Spoiler panel on each wing. These panels have a threefold purpose:

- They are used as roll augmentation devices.
- They are used as speed brakes when the aircraft is in-flight.
- They are used on the ground to act as Ground Spoilers.

Speed Brakes

In flight, manually moving the spoiler lever aft will extend the four flight spoilers to serve as speed brakes. When used as speed brakes, the spoiler panels will extend symmetrically up to a maximum of 35 degrees.

In flight, if the speedbrakes are extended with the flaps extended 6 degrees or more, the Spoiler/Flap Extended light on the overhead annunciator panel and the Master Caution light will come on, and a warning horn will sound accompanied by the word "Speedbrake".

On the ground, if either throttle is advanced with the spoiler lever not fully forward, the take-off warning horn will sound accompanied by the word "Spoilers".

Ground Spoilers

There is one inboard Ground Spoiler panel on each wing. These panels are locked down in-flight and electrically unlocked on the ground. The Ground Spoilers will only operate during landing and rejected take-offs.

Spoiler Operation – Take-Off

The spoilers are armed for take-off by squeezing the spoiler handle and raising it to the armed position. Arming the spoilers for take-off without positioning the AUTO BRAKE selector to TO causes the take-off warning horn to sound (when the throttles are advanced) accompanied by the words "Auto brake". Likewise, positioning the AUTO BRAKE switch to TO without arming the spoilers will cause the take-off warning horn to sound accompanied by the words "Auto Spoiler".

When the throttles are retarded to idle and reverse thrust selected during a rejected take-off, the spoilers will automatically deploy and initiate automatic braking. All spoiler panels will be extended to 60 degrees. Auto spoilers and auto brakes are applied until pilot takeover, by stowing the spoilers, or the airplane comes to a full stop.

Spoiler Operation – Landing

At main gear wheel spin up or nose strut compression, the spoilers are automatically deployed and extended to 60 degrees.

In the event of a go-around, the spoilers will automatically retract upon advancing the left throttle lever.

Flaps System

There are two flap segments on the trailing edge of each wing. The segments are interconnected to form one flap on each wing.

Flaps may be positioned in any of six permanent detents in a 0 to 40 degree range by movement of the flap/slat handle.

Leading Edge Slat System

The leading edge slat system provides wing lift augmentation. There are six slat segments on the leading edge of each wing. The segments are interconnected to form one slat on each wing. The slats are hydraulically operated.

The slats are actuated by the flap/slat handle. Three slat positions may be selected:

- Retracted
- Mid-sealed
- Extended

When the flap/slat handle is in the UP/RET position, the slats are retracted. When the flap/slat handle is positioned in the 0° to 13° range, the slats are in the mid-sealed position. When the flap/slat handle is position in the 15° to 40° range, the slats are in the extended position.

Maximum airspeed with the slats in the extended position is 240 KTS.
Maximum airspeed with the slats in the mid-sealed position is 280 KTS.
Maximum airspeed with the slats in the retracted position is V_{mo} or M_{mo}.

The aural and vocal warning system will be activated if the throttles are advanced for take-off and the slats are not extended.

Horizontal Stabilizer

A movable horizontal stabilizer provides longitudinal trim. The stabilizer is moved by a jackscrew driven by an electric motor. The stabilizer trim is operated by moving the trim control handle on the pedestal. Operation of the trim control handle will cause the autopilot to disengage.

A cable operated indicator moves for and aft along a track on the pedestal to indicate the current nose up or nose down trim setting.

When the horizontal stabilizer is moved, an audio signal will sound for every 2° of stabilizer movement. A vocal warning will be sounded whenever the stabilizer is moved by the autopilot at a rate greater than 20° in 30 seconds. A switch on the aft pedestal is used to stop a primary-trim runaway stabilizer condition.

Note: In the real airplane the warning sounds are for every 1° of stabilizer movement and rate greater that 2° in 30 seconds. These values have been increased as the P3D autopilot is very active on the stabilizer trim. This would have generated quite a bit of noise in the cockpit if the real values had been used.

The stabilizer trim is electrically operated, thus stabilizer trim will be unavailable if a total loss of electric power occurs. The stabilizer will then be locked in the position it had at the time the electrical power was lost.

Take-Off Condition Computer

The Take-off Condition Computer (TCC) is used to determine the take-off trim setting. The TCC is a geared computer device that display a trim setting based upon crew input of CG and flap setting. The take-off trim setting is displayed numerically and by a green pointer. The crew will trim the stabilizer until the white Stabilizer Position Indicator is adjacent to the centerline of the green pointer.

Take-off Warning

A take-off audible warning signal and voice warning will sound if the throttles are advanced for take-off together with at least one of the following conditions:

- the stabilizer trim is not set according to the computed take-off trim setting
- the flap/slat handle is not set in accordance with the setting on the Take-off Condition Computer
- the slats are not extended
- the spoiler lever is not fully forward
- the parking brakes are on.

Stall Protection System

Prior to the onset of a stall, the stall protection system will be activated. The airplane is equipped with two stall detection systems, each receiving input from an angle-of-attack vane, the horizontal stabilizer and the slat/flap position transmitters.

When approaching a stalled condition the following will be activated:

- SPD LOW in the Pitch FMA window
- Stick Shaker will be activated.
- At stall the claxon aural warning and vocal "Stall" will sound.
- Stall warning light will come one.
- Stick Pusher will be activated.

Autoslats

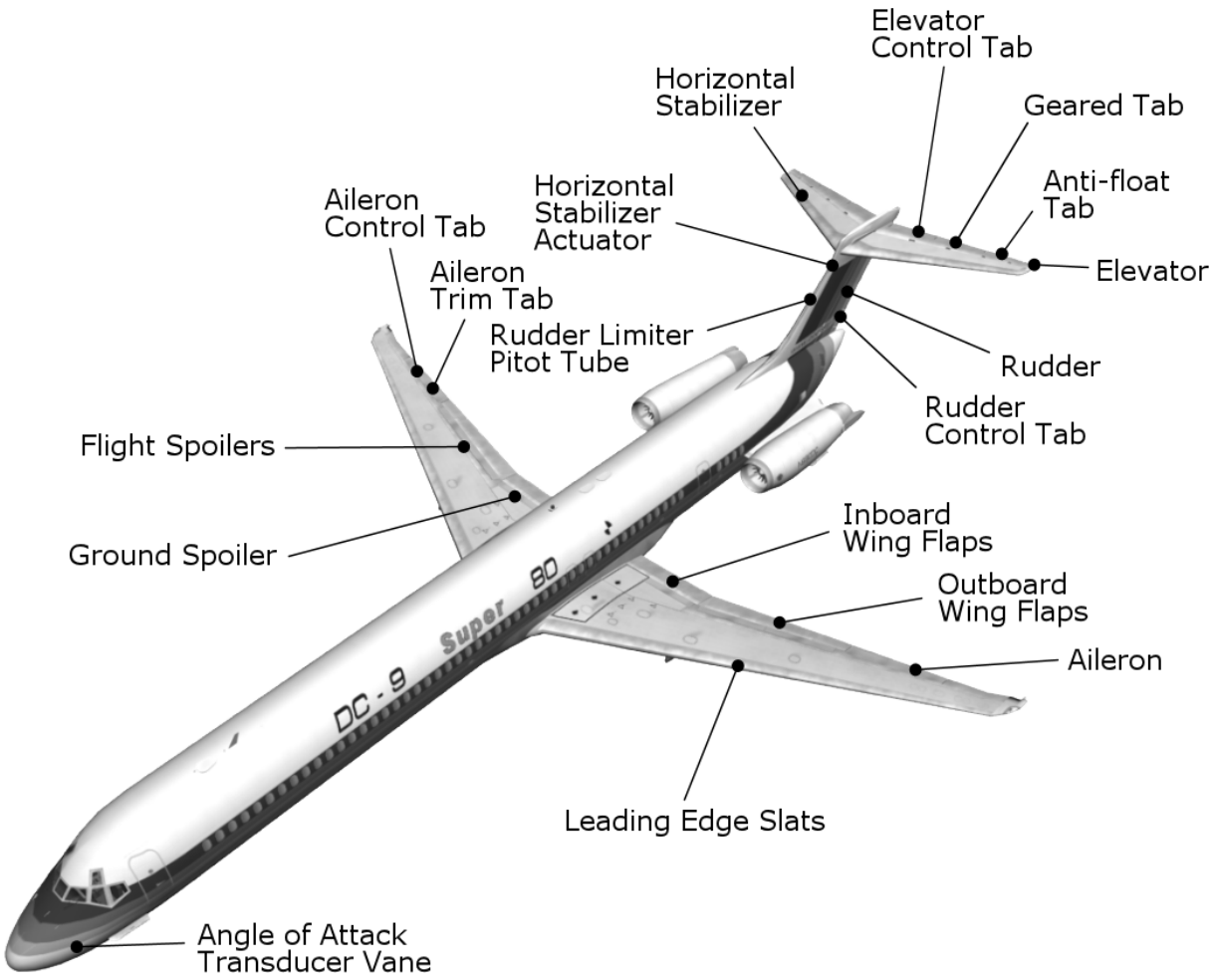
When the flap/slat handle is set to the 0 – 13 degrees range and the aircraft speed is less than 240kts, the slats will automatically be extended from the mid-sealed to the extended position if a stalled condition is detected. The slats DISAGREE and AUTO lights will come on indicating the autoslat system is operating. The slats will automatically be retracted to the mid-sealed position when the stalled condition ends.

The slat system will automatically do a self-test whenever take-off flaps is selected (0 – 13) on the ground. The slats DISAGREE and AUTO lights will come on during the test.

Post Stall Pusher System

Whenever a stall is detected, the control column will be abruptly moved forward, the STICK PUSHER PUSH TO INHIBIT glareshield light will come on, and the autopilot, if engaged, will be disconnected. The Post Stall Pusher System will keep forward pressure on the control column until the airplane has come out of the stalled condition or the STICK PUSHER PUSH TO INHIBIT glareshield light is pushed in.

MAJOR COMPONENT LOCATION



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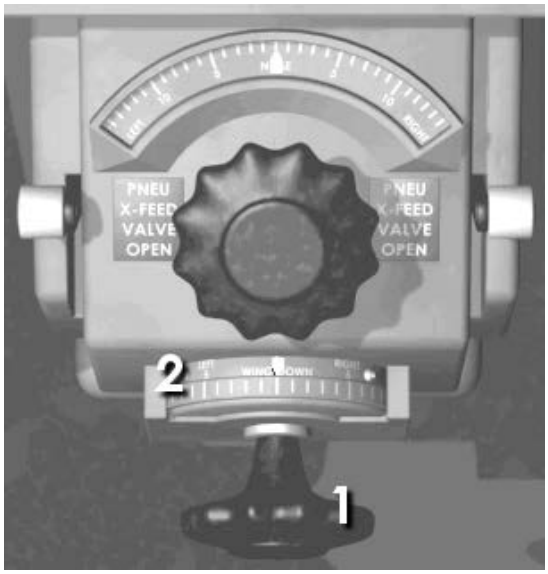
LONGITUDINAL CONTROL AND TRIM

Control Column (2)
Movement of the control wheel deflects an aileron control tab. Aerodynamic forces on the control tab moves the aileron.



1. AILERON TRIM Control
Rotate the trim control knob left or right to deflect and aerodynamic trim tab on each aileron.

2. AILERON TRIM Indicator
Indicates the amount of left or right wing down aileron trim setting.

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1. ALT LONG TRIM Control

Alternate longitude trim control.

Currently not simulated.

2. STABILIZER TRIM – PRIMARY MOTOR BRAKE Switch

This switch is only used to stop a runaway stabilizer condition.

NORM Normal stabilizer trim operation.
STOP Brake applied to prevent stabilizer movement.

Currently not simulated.

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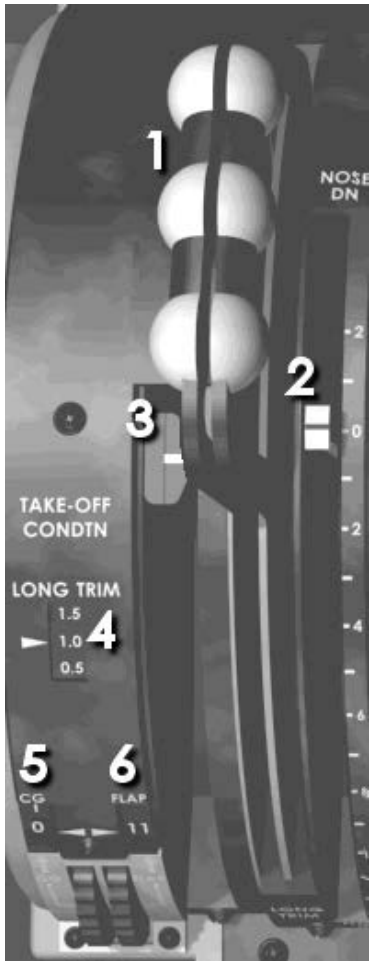

1. LONG TRIM Handles
Move both handles simultaneously in the same direction to trim the stabilizer.

2. LONG TRIM Indicator
The LONG TRIM indicator is mechanically connected to the stabilizer. It indicates position and movement of the stabilizer.

3. LONG TRIM TAKE-OFF POSITION Indicator
This indicator is positioned by the Take-off Condition Computer based on CG and flap setting input. The LONG TRIM indicator must be aligned with this indicator prior to take-off.

4. TAKE-OFF CONDTN LONG TRIM Readout
Indicates longitude trim setting for take-off based on CG and flap setting input.

5. CG Readout
Take-off Condition Computer CG input.

6. FLAP Readout
Take-off Condition Computer flap setting input.

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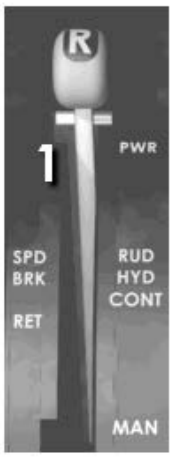
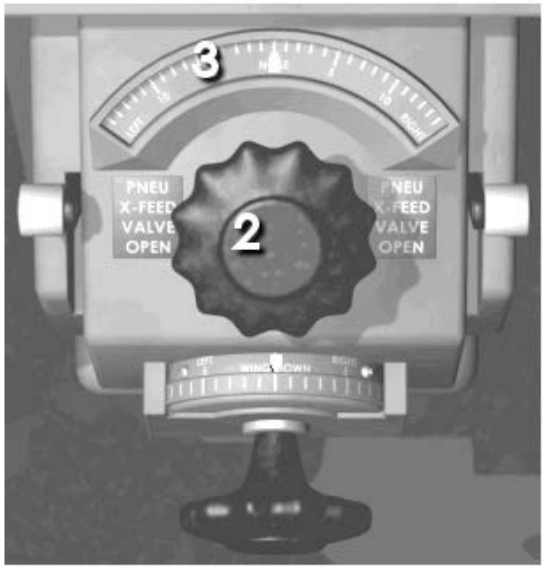
RUDDER CONTROL AND TRIM





1. RUD HYD CONT Lever
(Rudder Hydraulic Control Lever)

PWR Locks rudder control tab in faired position. Rudder movement is hydraulically assisted.

MAN Rudder control tab is unlocked. Hydraulic power to the rudder is removed.

2. RUDDER TRIM Control
Rotate trim knob left or right to trim rudder during power operation and trim rudder control tab during manual operation.

3. RUDDER TRIM Indicator
Indicates the amount of left or right rudder trim setting.

4. YAW DAMP Switch

OFF Yaw damper operation is disabled if the autopilot is disengaged. If the autopilot is engage, yaw damper operation is automatically provided.

ON Yaw damper operation is provided regardless of autopilot status.

OVRD Stops all yaw damper operation.

Rudder Pedals
Push left or right pedal to yaw the airplane left or right.

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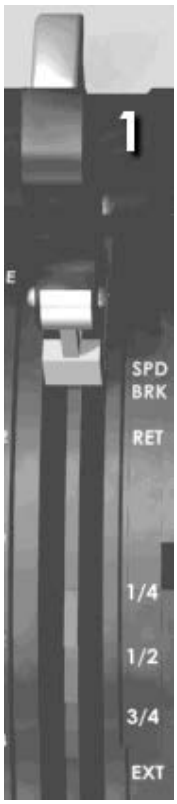
SPEEDBRAKE/SPOILER



1. SPEEDBRAKE/SPOILER Lever

Manual — In flight, the speedbrake/spoiler lever is used to control the flight spoilers to act as speedbrakes by pulling the lever aft to the EXT position. On the ground, the lever is used deploy all spoiler panels, flight spoilers and ground spoilers.

Automatic — When the speedbrakes are armed prior to landing, all spoiler panels will deploy upon main wheel spin up at touchdown and the lever will move to the EXT position. If the speedbrakes are armed prior to take-off, the spoiler panels will deploy when reverse thrust is selected for a rejected take-off. The speedbrakes are armed by pulling the lever up in the RET position.

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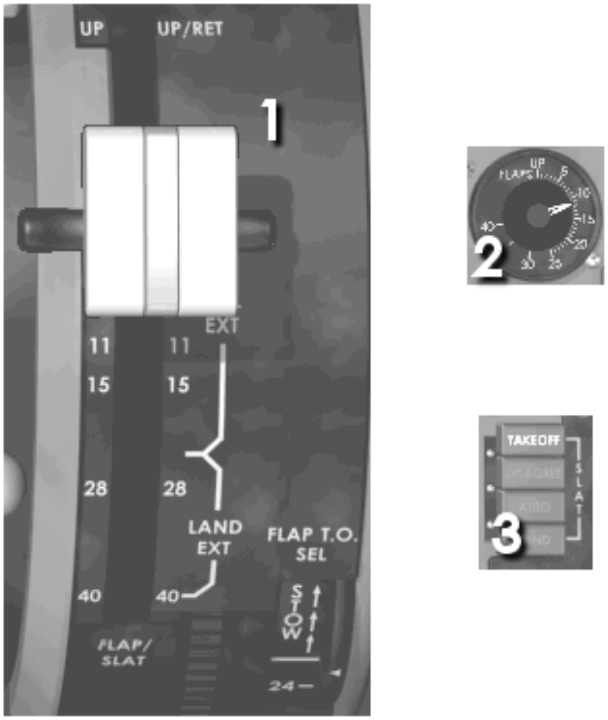
FLAP/SLAT SYSTEM



1. FLAP/SLAT Lever

Move FLAP/SLAT lever to any of the six permanent detents to set flap and slat as required by the current flight conditions.

2. FLAP POSITION Indicator

The indicator has two needles, indicating the position of the left and right flaps respectively.

3. SLAT ADVISORY LIGHTS

TAKE-OFF	(Blue) Indicates the FLAP/SLAT lever and wing slats are in the take-off range.
DISAGREE	(Amber) Indicates left and/or right wing slats position disagrees with the FLAP/SLAT lever.
AUTO	(Blue) Indicates the slats have automatically been extended from the mid-sealed to the extend position by the stall warning system.
LAND	(Green) Indicates FLAP/SLAT lever is set at more than 24 degrees and slats are fully extended.

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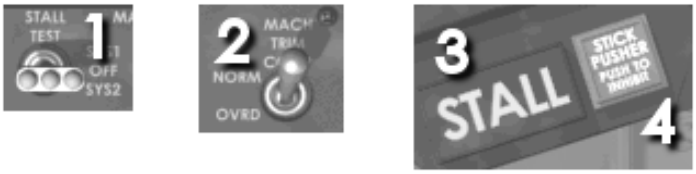
MACH TRIM AND STALL WARNING



1. STALL TEST Switch

SYS2 Tests right stall system. The system will operate the stick shaker on the control column, turn on the STALL and STICK PUSHER PUSH TO INHIBIT lights, and test the stall recognition speakers.

OFF Turns the test off, normal operating mode.

SYS1 Tests the left stall system. Same tests performed as with SYS2.

2. MACH TRIM COMP Switch

NORM The system will automatically provide Mach trim when needed.

OVRD Deactivates the Mach trim system. Mach trim INOP light will come on.

3. STALL Light (Red)

A flashing STALL light indicates the airplane is in a stalled condition, or a test of the stall warning system.

4. STICK PUSHER PUSH TO INHIBIT Light (Amber)

Comes on whenever the post stall pusher is activated, or during stall warning test.
Push – Disengages post stall pusher system.

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WARNING INDICATORS

43. YAW DAMP OFF Light (Amber)
Comes on to indicate Yaw damper is not operating.

53. SPOILER DEPLOYED (Amber)
Comes on to indicate Ground Spoiler is extended in flight, or any spoiler is deployed on the ground with the spoiler lever in the stowed position.

57. RUDDER TRAVEL UNRESTRICTED Light (Blue)
Comes on to indicate full rudder travel is available (22 degrees).

60. MACH TRIM INOP Light (Amber)
Comes on when the MACH TRIM COMP switch is placed to OVRD.

71. ELEVATOR PWR ON (Blue)
Comes on to indicate that the hydraulic elevator augmentation system is active.

78. SPOILER/FLAP EXTENDED Light (Amber)
Comes on to indicate speedbrakes are extended with flaps extended beyond 6 degrees. MASTER CAUTION light will also come on. The light will not come on when on the ground.

79. RUDDER CONTROL MANUAL Light (Amber)
Comes on to indicate there is no hydraulic power to the rudder.

SECTION 14

FLIGHT INSTRUMENTS

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SECTION 15: FLIGHT INSTRUMENTS

GENERAL

Pitot/Static Systems

The pitot/static system provides air data sensing to the number 1 and 2 Central Air Data Computer (CADC). The CADC provide outputs of airspeed, Mach, altitude and vertical speed.

Three separate pitot/static systems are installed. The Captain's pitot/static system provides input to CADC 1, the FO's pitot/static system provides input to CADC 2, and the auxiliary pitot/static system provides input to the standby altimeter and airspeed indicator.

The pitot tubes are mounted on top of the nose radome. The static ports are installed on both sides of the fuselage.

Primary Flight Instruments

The primary flight instruments are the airspeed/Mach indicator, vertical speed indicator, and altimeter.

CADC 1 provides input to the Captain's primary instruments and CADC 2 provides input to the FO's primary instruments. In the event of a CADC failure, either CADC may be selected to provide input to both the Captain's and FO's primary instruments.

Overspeed Warning

When the maximum operating airspeed (V_{MO} or M_{MO}) is exceeded, a "clacking" sound followed by the spoken word "overspeed" will be heard from the Central Audio Warning System (CAWS) until airspeed is back within limits.

When the airspeed exceeds 280 knots with the slats extended, a "clacking" sound followed by the spoken word "slat overspeed" will be heard from the Central Audio Warning System (CAWS) until airspeed is back below 280 knots or the slats are retracted.

Standby Instruments

The standby instruments consist of the standby horizon, standby altimeter, standby airspeed indicator and standby magnetic compass. These instruments are powered by the DC transfer bus and should operate at all times, even if a loss of generator power occurs.

The standby magnetic compass is currently not simulated.

Radio Altimeter

The radio altimeter provides radio altitude indications up to a maximum of 2500 feet AGL. During an ILS approach, the radio altimeter will actuate the rising runway symbol on the ADI at approximately 200 feet AGL.

Ground Proximity Warning System

A Ground Proximity Warning System is installed to alert the crew of potentially dangerous flight conditions. The system provides warning annunciations for the following situations:

- Excessive rate of descent
- Excessive terrain closure rate
- Altitude loss after take-off
- Descent in wrong configuration
- Descent below the glideslope

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AIRSPEED/MACH INDICATOR

1. Mach Readout
Indicates current computed Mach number. Minimum Mach readout is .150.

2. VMO Pointer
Indicates maximum computed permissible airspeed. Failure of the VMO advisory system will drive the pointer to 257.5 knots.

3. Airspeed Pointer
Indicates computed airspeed.

4. Airspeed Reference Bugs
Freely movable pointers normally used to alert the pilot to specified airspeeds. Click the corners of the ASI to manually position the bugs.

5. Airspeed Command Bug
Refer to section 8 – Auto-flight, for description.

6. OFF Flag
Appears when Mach input data is unusable.

7. A/S Flag
Appears when airspeed input data is unusable.

8. MAX SPD WARN TEST Switch
(Momentary) Set switch to TEST to test the overspeed warning system. A "clacking" sound followed by the spoken word "overspeed" will be heard from the Central Audio Warning System (CAWS).

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CADC AND STATIC AIR SWITCHING

1. CADC Selector

NORM	Captain's primary instruments receive input from CADC 1 and FO's primary instruments receive input from CADC 2.
BOTH ON 1	Both the Captain's and FO's primary instruments receive input from CADC 1.
BOTH ON 2	Both the Captain's and FO's primary instruments receive input from CADC 2.

2. CADC Light (Amber)

The light comes on to indicate that the CADC Selector switch is out of the NORM position.

3. STATIC AIR Selector

NORM	When the Captain's Static Air Selector is in NORM, CADC 1 receives static pressure from the Captain's static port.
ALT	When the Captain's Static Air Selector is in ALT, CADC 1 receives static pressure from the alternate static system.

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ALTIMETER

1. Altitude Alert Advisory Light
Refer to section 8 – Auto-flight, for description.

2. Altitude Reference Index (Orange)
The index is set with the Reference Index knob.

3. Digital Readout
The Digital Readout is made with a continuously rotating drum which indicates barometric altitude from -1000 to 50,000 feet. The leftmost number on the drum counter is marked green in the "0" position to alert of altitudes of less than 10,000 feet.

4. 100 Foot Pointer
The pointer will make a full circle for each 1,000 feet of altitude gained or lost.

5. MB/IN HG Readout
Digital readout of the current barometric pressure setting expressed in millibars and inches of mercury.

6. Baro Set Knob
Used to change the barometric pressure setting.

7. Reference Index Knob
Used to set altitude reference index.

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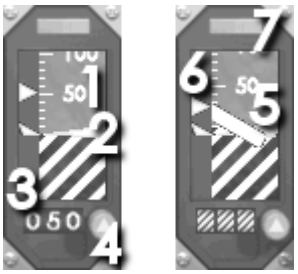
RADIO ALTIMETER



1. Tape

Below 0	Black and white diagonal stripes.
0 – 1000	Green.
1000 – 2500	Blue.
Above 2500	Black.

2. Fixed Altitude Reference Marker (Orange)
Reference mark indicating radio altitude above the terrain.

3. Decision Height Digital Readout
Indicates the currently set Decision Height, as set with the Set Knob.

4. Set Knob
The Set Knob is used to set the Decision Height in the Decision Height Digital Readout window.

5. Warning Flag (Yellow)
Appears when power to the instrument is lost.

6. Decision Height Bug (Orange)
The Decision Height Bug is set using the Set Knob. The bug travels with the altitude tape.

7. Decision Height Light (Amber)
The light will come on when descending through the set Decision Height. The light will also come on when descending through 1000 feet. Push the light to extinguish. An aural warning is heard 50ft prior to reaching the Decision Height.

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STANDBY INSTRUMENTS AND CLOCK

Standby Horizon Indicator

Standby Altimeter

Standby Airspeed Indicator

Clock

1. Roll Attitude Pointer
The Roll Attitude Pointer indicates aircraft roll against the fixed roll index marks. All index marks are in 10 degree increments.

2. Pitch Attitude Scale
The Pitch Attitude Scale indicates aircraft pitch in 5 degree increments up and 10 degree increments down.

3. Airplane Symbol
The Airplane Symbol indicates pitch attitude referenced against the horizon drum pitch attitude scale.

4. Erection and Trim Knob
Used for fast erection of the gyro and adjustment of the aircraft symbol. Currently not simulated.

5. 100 Foot Pointer
The pointer will make a full circle for each 1,000 feet of altitude gained or lost.

6. Digital Readout
The Digital Readout is made with a continuously rotating drum, except for the two first digits, which indicates barometric altitude from -1000 to 50,000 feet. The leftmost number on the drum counter is marked with black and white diagonal stripes in the "0" position to alert of altitudes of less than 10,000 feet.

7. MB/IN HG Readout
Digital readout of the current barometric pressure setting expressed in millibars and inches of mercury.

8. Baro Set Knob
Used to change the barometric pressure setting.

9. Standby Airspeed Pointer
Indicates airspeed as determined from the uncorrected alternate pitot/static inputs.

10. Clock
Eight-day, stem wound clock with sweep second hand. The clock indicates Zulu time.

Click the clock to increase/decrease time.

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VERTICAL SPEED INDICATOR

1. Vertical Speed Pointer
The pointer indicates vertical speed in feet per minute.

2. OFF Flag
The flag appears when the vertical speed data is unusable.

GROUND PROXIMITY WARNING SYSTEM

1. GND PROX WARN Switch

OVRD — The override position prevents the GPWS from actuating during an intentional flap up landing.

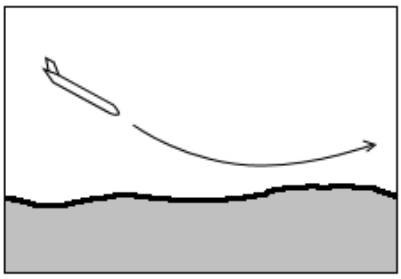
NORM — Normal mode. The system remains silent during all normal flight conditions, and annunciates dangerous flight conditions.

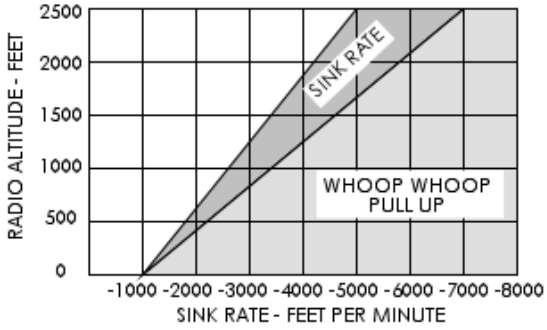
TEST — (Momentary) Performs a systems integrity test. The GPWS, BELOW G/S, and GPWS FAIL lights will come on, accompanied by the aural alert "Whoop Whoop" and the vocal alerts "Pull up" and "Glideslope".

2. Below G/S Switch and Light (Amber)
The light comes on to indicate that corrective action is required due to excessive deviation below the glideslope. The light is accompanied by the aural annunciation "Glideslope". Pushing the switch will inhibit the below glideslope warning and extinguish the light.

3. GPWS Warning Light (Red)
The GPWS warning light comes on to indicate that corrective action is required due to airplane proximity to the ground or the airplane is not in the proper configuration for descent. The light is accompanied by an aural alert, "whoop Whoop, pull up". Push to test the light.

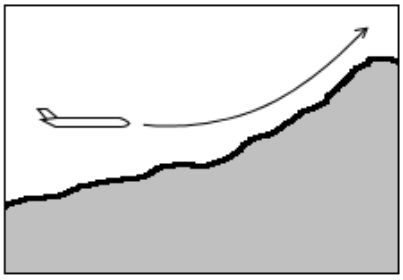
MODE 1 - EXCESSIVE DESCENT RATE

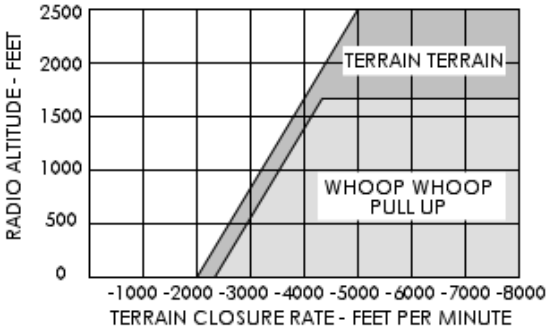




This mode indicates that rate of descent is excessive for the current altitude and the condition should be corrected. The mode is independent of aircraft configuration and is active from 2450 feet to 50 feet AGL.

MODE 2 - EXCESSIVE TERRAIN CLOSURE RATE





This mode indicates that terrain closure rate is too excessive for the current altitude and the condition should be corrected. During an approach, when the aircraft is in the landing configuration, “pull up” annunciation is replaced by “terrain”.

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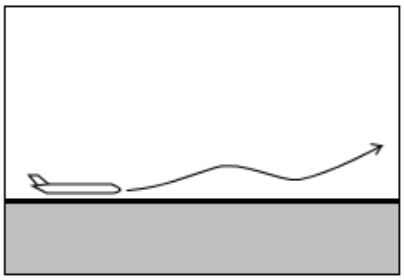
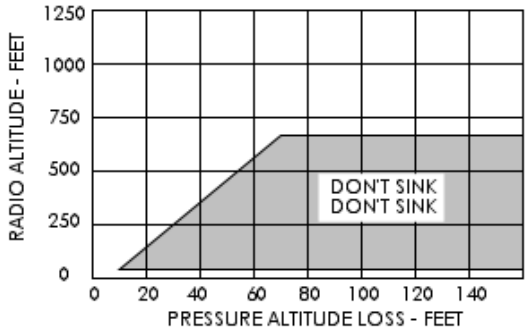
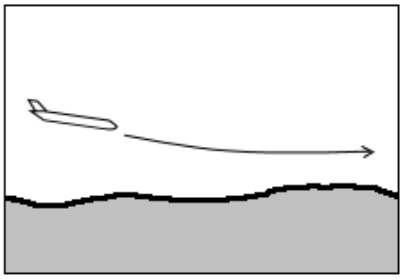
MODE 3 - ALTITUDE LOSS AFTER TAKEOFF

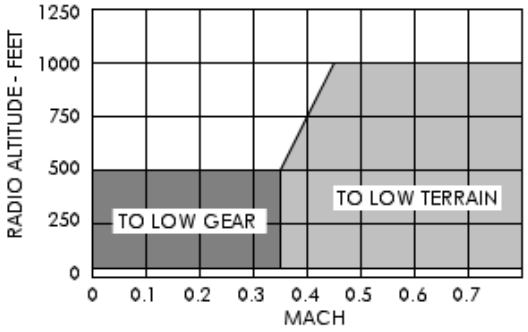




This mode is activated if the aircraft looses more than 10% of the initially gained altitude after takeoff. The warning will be repeated until a positive rate of climb has been established. However, the GPWS will continue to compare the current aircraft altitude to the initial altitude of descent. Should the aircraft descend again before reaching the initial altitude, another warning will be generated. The mode is active below 700 feet down to 65 feet AGL.

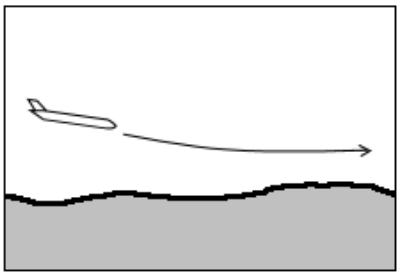
MODE 4A - TERRAIN CLEARANCE (Descent In Wrong Configuration - Gear Up)

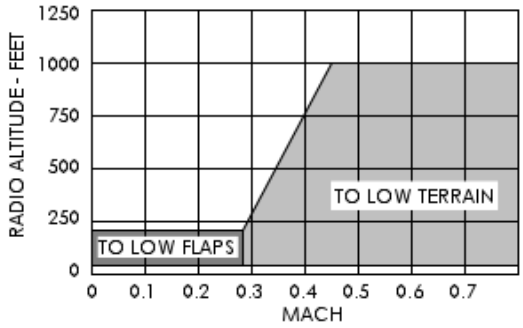




This mode is activated upon clearing 700 feet AGL after takeoff. Below Mach 0.35 and 500 feet AGL with the landing gear not extended, “too low gear” is announced. Above Mach 0.35 and below 1000 feet AGL, “to low terrain” is announced. The mode is inhibited below 50 feet AGL.

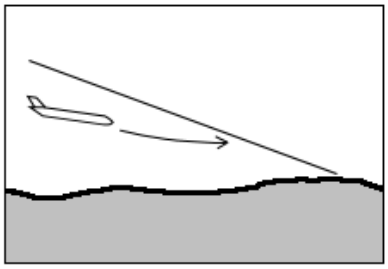
MODE 4B - TERRAIN CLEARANCE (Descent In Wrong Configuration - Flaps Up)

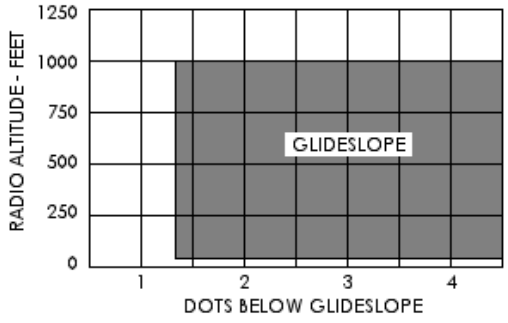




This mode is activated upon clearing 700 feet AGL after takeoff. Below Mach 0.29 and 200 feet AGL with the flaps not extended, "too low flaps" is announced. Above Mach 0.29 and below 1000 feet AGL, "to low terrain" is announced. The mode is inhibited below 50 feet AGL.

MODE 5 - DESCENT BELOW GLIDESLOPE





This mode warns that the aircraft is deviating excessively below the ILS glideslope when the aircraft is below 1000 feet AGL and a valid ILS frequency is received. The mode is inhibited below 100 feet AGL.

WARNING INDICATORS

46. GPWS FAIL

Comes on to indicate that the Ground Proximity Warning System is inoperative. The light will also come on when testing the GPWS.

SECTION 15

FUEL

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SECTION 16: FUEL

GENERAL

General

The MD-80 aircraft is equipped with three fuel tanks. The total fuel capacity is 39 128 lbs (5840 US gallons). The main wing tanks each have a capacity of 9 266 lbs. The center wing tank has a capacity of 20 596 lbs.

The Fuel Control Panel is located on the overhead panel.

Fuel feed

Each fuel tank has two AC boost pumps installed. Each main boost pump can supply both engines at take-off power.

Fuel is normally provided to each engine from the respective main wing tank. Crossfeed from either main tank to either engine is available, but fuel transfer is not. The purpose of crossfeed operation is to correct a main tank imbalance. The Fuel Crossfeed Valve Lever is located on the pedestal.

Fuel loaded in the center tank should be used before the main wing tank fuel. The two center tanks pumps are connected in series to provide higher pressure than that of the wing tank pumps, connected in parallel, and insure usage of the center tank fuel even with both main tank pumps operating.

A 28 volt DC start pump, operated by a switch on the overhead panel, is installed in the right main tank and is used for APU or engine starting when AC power is not available.

Low fuel pressure at the engine inlet is indicated by a light on the annunciator panel. Each engine can suction feed from the respective main tank. The APU can suction feed from the right main tank. Neither engine nor the APU can suction feed from the center tank.

Fuel quantity display

The Digital Fuel Quantity Display is located on the left side of the center instrument panel. It displays the fuel quantity of each main tank, the center tank, total fuel quantity and aircraft gross weight.

The precision of the Fuel Quantity Display is 25 LBS.

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CONTROLS AND INDICATORS

1. START PUMP SWITCH

OFF Pump is off.

ON Pump is on supplying fuel pressure to the right engine and APU.

2. FUEL BOOST PUMP SWITCHES (left, center, right) (aft and forward)

OFF Turns off applicable fuel boost pumps.

ON Turns on applicable fuel boost pumps.

3. FUEL HEAT SWITCHES (left and right)

OFF Normal Position

ON Momentary. Turns on fuel heater for left or right engine. The fuel heater is automatically switched off when the fuel heater cycle is complete.

1. FUEL TEMP GAUGE (L, R)

Indicates temperature of fuel after fuel has flowed through the air/fuel heat exchanger.

2. FUEL FLOW GAUGE/FUEL USED READOUT (2)

Dial indicates fuel flow rate delivered to engine. Digital readout indicates total fuel used by engine.

3. FUEL USED RESET SWITCH

(Momentary) When switch is moved up to RESET, the digital counter on FUEL USED Digital Indicator moves to zero.

4. DIGITIZED FUEL QUANTITY DISPLAY

Displays individual tank quantity, total fuel quantity, and gross weight. When ANNUN/DIGITAL LTS TEST button is pressed, each digit displays the number 8.

5. SELF TEST KNOB

Test will indicate 3000 lbs in each tank, total fuel will indicate 9000 lbs and ZFW will indicate existing ZFW plus 9000 lbs.

6. SET ZFW BUTTON

Calculated Zero Fuel Weight (ZFW) is set by rotating the button in the required direction. Release button and ZFW and fuel quantity will add up to gross weight. As fuel is used, quantity shown continuously reduces to represent actual gross weight.

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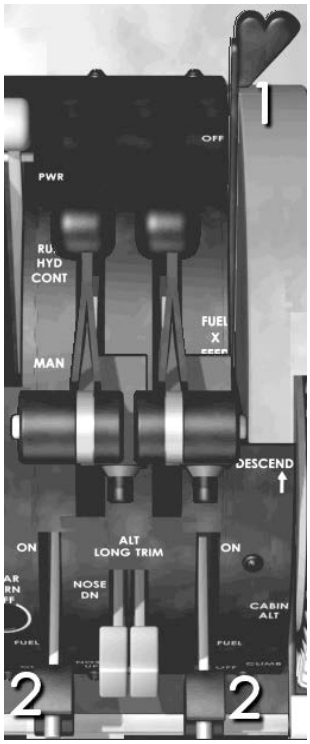

1. FUEL X-FEED LEVER

OFF Fuel crossfeed valve is closed, allowing left main fuel tank to feed left engine and right main fuel tank to feed right engine and APU.

ON Opens fuel cross feed valve, allowing either or both main tanks to feed both engines and APU.

2. FUEL CONTROL LEVERS (L, R)

Fuel lever lock/release button must be depressed to unlock lever prior to actuation to ON or OFF.

OFF Shuts off fuel to applicable engine, and then turns off ignition.

ON Turns on ignition to applicable engine, and then turns on fuel.

Note: When a fuel lever is set to ON, ignition is turned on for the applicable engine regardless of ignition switch position.

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WARNING INDICATORS

1. CTR FUEL PRESS LO LIGHT (Amber)
Not in use.

2. FUEL LEVEL LOW (Amber)
Comes on to indicate either wing (main) tank fuel quantity has reached 2500 pounds.

34 & 41. INLET FUEL PRESS LO LIGHT (L, R) (Amber)
Comes on to indicate low fuel supply pressure at the engine. Light also comes on when engine is operating on suction feed. MASTER CAUTION Lights also come on.

FUEL DISTRIBUTION GUIDE

Fuel in Pounds. Based on 6.7 Lbs/Gal.

TOTAL FUEL LOAD	LEFT & RIGHT MAIN TANKS (EACH)	CENTER TANK
1,000	500	0
2,000	1,000	
3,000	1,500	
4,000	2,000	
5,000	2,500	
6,000	3,000	
7,000	3,500	
8,000	4,000	
9,000	4,500	
10,000	5,000	
11,000	5,500	
12,000	6,000	
13,000	6,500	
14,000	7,000	
15,000	7,500	
16,000	8,000	
17,000	8,500	
18,000	9,000	
18,532	9,266	
19,032	(FULL)	500
19,532		1,000
20,032		1,500
20,532		2,000
21,032		2,500
21,532		3,000
22,032		3,500
22,532		4,000
23,032		4,500
23,532		5,000
24,032		5,500
24,532		6,000

TOTAL FUEL LOAD	LEFT & RIGHT MAIN TANKS (EACH)	CENTER TANK
25,032	(FULL)	6,500
25,532		7,000
26,032		7,500
26,532		8,000
27,032		8,500
27,532		9,000
28,032		9,500
28,532		10,000
29,032		10,500
29,532		11,000
30,032		11,500
30,532		12,000
31,032		12,500
31,532		13,000
32,032		13,500
32,532		14,000
33,032		14,500
33,532		15,000
34,032		15,500
34,532		16,000
35,032		16,500
35,532		17,000
36,032		17,500
36,532		18,000
37,032		18,500
37,532		19,000
38,032		19,500
38,532		20,000
39,032		20,500
39,128		20,596
(FULL)		(FULL)

SECTION 16

HYDRAULICS

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SECTION 17: HYDRAULICS

GENERAL

The MD-80 hydraulic system consists of independent left and right systems. Each system has a reservoir and is pressurized by a single engine-driven pump.

Hydraulic Supply

The left and right hydraulics reservoir is located in the left and right main gear wheel wells. Each reservoir supplies fluid to its own system respectively.

Hydraulic Pumps

The left hydraulic system is pressurized by a pump mounted on the left engine and the right hydraulic system is pressurized by a pump mounted on the right engine. Each of the engine-driven pumps can operate in a high pressure or low pressure mode. The high pressure mode provides 3000 PSI and is used for taxi, take-off and landing. The low pressure mode provides 1500 PSI and is selected on the After Take-off Checklist to reduce wear on the system.

An auxiliary, electrical pump is installed in the right hydraulic system and is designed for continuous operation at 3000 PSI.

A power transfer pump is installed to transfer pressure between the left and right hydraulic system. Note that there is no transfer of fluid between the left and right hydraulic system. For the transfer pump to operate, either the left or right system must be pressurized to provide energy to drive the transfer pump. The transfer pump is normally used during taxi, take-off and landing as a backup source of pressure.

Hydraulic System Fluids

Standard:

Chevron Hyjet IVA

Substitutes:

Chevron Hyjet IV
Monsanto Skydrol 500B4
Skydrol LD4

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CONTROLS AND INDICATORS

1. HYD PRESS GAUGE (2)

Indicates system hydraulic pressure between pumps and reservoir.

2. TRANS HYDRAULIC PUMP SWITCH

ON Mechanically connects left and right hydraulic systems.

OFF Mechanically separates left and right hydraulic systems.

3. ENG HYD PUMPS SWITCH (L, R)

HI Engine-driven pump operate at 3000 PSI (upper green band).

LOW Engine-driven pump operate at 1500 PSI (lower green band).

OFF No pressure output for system circulation other than pump lubrication and cooling.

4. AUX HYDRAULIC PUMP SWITCH

ON Turns on electrically drive hydraulic pump. Operates at 3000 PSI.

OFF Pump inoperative.

OVRD Auxiliary pump turned on.

5. HYD FLUID QUANTITY GAUGE (2)

Indicates quantity of hydraulic fluid in reservoir.

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WARNING AND CAUTION LIGHTS

75 & 82. HYD PRESS LOW LIGHTS (L, R) (Amber)

Comes on when hydraulic pressure to the spoiler supply system drops below normal levels. The MASTER CAUTION light will also come on.

SECTION 17

LANDING GEAR

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SECTION 18: LANDING GEAR

GENERAL

The airplane is equipped with a fully retractable tricycle landing gear consisting of nose gear and main gear assemblies. The landing gear is actuated by the landing gear handle. When retracted, the landing gear is fully enclosed by doors. In case of a hydraulics failure, the landing gear may be mechanically released to freefall to the extended locked position.

Braking is provided by dual hydraulic multi-disc wheel brakes with anti-skid systems (ABS) on the main gears.

A visual and aural indicating and warning system provides indication of gear and brake system status.

Spray deflectors are installed on both main gear and nose gear assemblies to minimize water and slush ingestion on take-off and landing.

A tail bumper assembly, mounted on the bottom of the aft fuselage, prevents structural damage if the aft fuselage should make contact with the ground.

Nose Gear

The nose gear assembly is steerable, has dual wheels, and is mounted in a wheel well in the forward lower section of the nose of the airplane.

A ground shift mechanism, mounted on the nose gear strut, is operated by compression and extension of the nose gear strut. This mechanism is used to establish ground or flight modes of operation.

Nose Gear Doors

The nose gear wheel well doors consist of two forward doors and to aft doors. The forward doors are closed when the gear is extended.

Nose Wheel Steering

The nose wheel steering system is hydraulically controlled through a full range of 164 degrees, 82 degrees to either side of center, by a steering wheel located on the captain's left console. When the steering cylinders are in the neutral position, they act as shimmy dampers.

Main Gear

The airplane is equipped with two main landing gear and one nose gear, all with dual wheels and locks mounted on a shock strut. When extended, each main landing gear is locked down by over-center linkage. When retracted, the main landing gear assemblies are held up by hydraulic pressure, providing the engine driven pumps are selected to supply 3000 PSI. If the pumps are selected to supply 1500 PSI, the main gear will rest upon the doors. If hydraulic power is unavailable for gear extension, the main gear doors latches may be released by the emergency gear extension lever.

Main Gear Doors

The main gear doors consist of a hydraulically operated main door and a mechanically operated outboard door. The main gear doors are mechanically latched when closed. The main gear doors cycle to the closed position when the gear is approaching the extended position.

Visual/aural Indicating and Warning System

The landing gear position and status is indicated by annunciator lights on the upper main instrument panel. Three landing gear position lights come on green to indicate that the landing gear is down and locked. The lights will come on red when the landing gear is in any intermediate position. The landing gear door annunciator will come one anytime either of the main landing gear doors are not closed and latched.

The landing gear warning horn and vocal warning will sound when the airplane is at or below 210 KTS and either one of the throttles are closed and the landing gear handle is not in the down position. The landing gear warning horn and vocal warning will also sound whenever the flaps are extended to beyond 26 degrees and the landing gear handle is not in the down position.

Reference markings on each main gear landing gear over-center linkage provide visual confirmation that the landing gear is down and locked. Nose gear verification is provided by a green indicator pin on the pedestal just behind the throttle quadrant.

Brakes

Each main gear wheel is fitted with a dual system, disc-type power brake. Each brake contains two independent cylinder and passageway systems. Each system contains four hydraulic cylinders, one bleed port and one hydraulic pressure port.

The wheel brakes are controlled by two completely independent hydraulic brake systems. Each system is capable of supplying reserve brake pressure in the event of a hydraulic pressure failure in the other system.

The airplane wheel brakes may be mechanically applied by depressing the brake pedals.

A fully automatic anti-skid system is installed to obtain a more effective braking application, through control of wheel rotation at the point of maximum braking efficiency. The system is deactivated whenever the landing gear handle is not in the down detent, parking brakes set, arm switch at OFF, or airplane is at low taxi speeds.

Both main landing gear wheels and nose gear wheel are fitted with spin brakes. The purpose of the spin brake is to stop the tire rotation after take-off.

A gauge and annunciator light proved visual indication of brake temperature.

The parking brakes are set by pulling up the park brake control knob (located on the captain's left console). Park brake on is indicated by an annunciator light on the overhead panel. If the throttles are advanced to a take-off setting with the parking brake set, the aural/vocal warning system will be activated.

Automatic Brake System (ABS)

The Automatic Brake System (ABS) is an electrically controlled means of automatically applying the brakes in order to maintain a constant level of deceleration. The ABS has two modes of operation; landing mode and take-off mode.

The landing mode provides pilot selection of three levels of deceleration; MIN, MED, and MAX. In the MIN and MED position, the system compares actual airplane deceleration with the pilot's selection. In the MAX position, full brake system pressure is applied to the brakes and maximum deceleration is limited to anti-skid system operation.

During the rollout from a landing or rejected take-off, the Auto Brake System will automatically disarm under the following conditions:

- Speed brakes are stowed
- Either throttle is advanced
- Airplane comes to a full stop

When the ABS disarms, the ABS light on the glareshield will come on.

The take-off warning horn and vocal ('AUTO BRAKE') will sound if the AUTO BRAKE selector is in a position other than TO with the Spoiler Lever armed.

CONTROLS AND INDICATORS

1. GEAR LIGHT (LEFT, NOSE, RIGHT)

Green	Comes on to indicate: gear handle is down and landing gear is down and locked; gear down and locked with emergency gear extension lever raised.
Red	Comes on to indicate; landing gear handle down and landing gear not down and locked; landing gear in transit or not in agreement with landing gear handle; gear up and locked and either one or both throttles retarded to idle.
OFF	Indicates landing gear handle up and landing gear up and locked.

2. GEAR DOOR OPEN Light

Comes on to indicate either one or both main gear doors are not fully closed and locked.

3. NOSE GEAR DOWN LOCK INDICATOR

A pin indicator (green) will appear (up) when the nose gear is down and locked. The pin will disappear (down) when the gear is up and locked.

4. GEAR HORN OFF Button

When the airspeed comes below 210 KTS, the landing gear warning horn and vocal will sound if either one or both throttles are retarded to idle and the landing gear is not down and locked. Pushing the Gear Horn Off button will silence the landing gear warning horn and vocal if flaps are set to less than 26 degrees. If the flaps are set to more than 26 degrees, the landing gear warning horn and vocal can not be silenced.

5. GEAR HANDLE

UP	Positions control valve to retract the landing gear.
DOWN	Positions control valve to hydraulically unlock, extend, and lock the landing gear.

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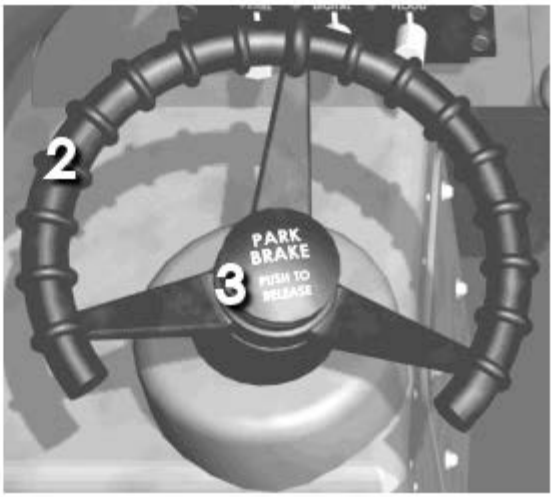

1. EMERGENCY GEAR EXTENSION LEVER
Mechanically releases the main gear and nose gear uplock latches allowing the landing gear to free fall and lock in the down position. The Emergency Gear Extension Lever is located on the right hand side of the pedestal on the floor. Open the cover plate to uncover the lever.

2. NOSE GEAR STEERING WHEEL
The Nose Gear Steering Wheel provides control of the nose gear steering during ground operations.

3. PARK BRAKE CONTROL
To set parking brake, lift the park brake control in the center of the Nose Gear Steering Wheel. Release the park brake by depressing the Park Brake Control or by depressing the brake pedals.

If the park brake is set and the throttles advanced for take-off, a take-off warning will sound.

1. BRAKE PRESS Gauge

Indicates left and right brake system hydraulic pressure.

2. ANTI-SKID Switch

OFF	Anti-skid system is inoperative.
ON	Activates the anti-skid system. The anti-skid system will monitor the wheel speed to provide maximum braking without skidding the wheels.

3. TEST CHK Switch

OFF	Test circuit inoperative.
TEST	(Momentary) Activates anti-skid test circuit. Anti-skid lights on overhead annunciator panel will come on.

4. WHEEL NOT TURNING Light

Comes on when any of the main gear wheel is moving 20% slower than the fastest moving main gear wheel.

5. AUTO BRAKE ARM/DISARM Switch

ARM	ABS is armed for automatic braking during take-off or landing. The switch is magnetically held in the arm position.
DISARM	ABS is inoperative. Manual braking available.

6. AUTO BRAKE Selector

TO	Provides automatic brake during a rejected take-off.
OFF	ABS inoperative. Manual braking available.
MIN	After landing the brakes are automatically applied with a minimum force.
MED	After landing the brakes are automatically applied with a medium force.
MAX	After landing the brakes are automatically applied with a maximum force.

In LAND mode (MIN, MED, MAX), only the right hydraulic system is used for braking. For TO mode, both right and left hydraulic system is used for braking.

7. ABS DISARM Light

The ABS Disarm light comes on anytime the Auto Brake System is automatically disarmed. The ABS Disarm light will also come on if the AUTO BRAKE Selector switch is in any position other than OFF and the AUTO BRAKE ARM/DISARM switch is positioned to DISARM.

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1. BRAKE TEMP GAUGE
Indicates selected or hottest brake temperature.
Hot brakes: 200°C - 400°C
Overheated: Over 400°C

2. OVHT LIGHT
Comes on when the brake temperature exceeds 305°C and goes off when the temperature has cooled to 260 °C.

3. BRAKE TEMP TEST BUTTON
Tests the brake temperature circuit and overheat light. Temperature gauge will indicate 450°C and overheat light will come on.

4. BRAKE TEMP SELECTOR SWITCH
Selects which brake temperature to display on the Brake Temp gauge. When set to ALL, the gauge will display the temperature of the hottest brake.

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WARNING AND CAUTION LIGHTS

72. PARKING BRAKES ON LIGHT
Comes on to indicate the parking brakes are set.

76. L OUTBD ANTI-SKID LIGHT
77. L INBD ANTI-SKID LIGHT
83. R OUTBD ANTI-SKID LIGHT
84. R INBD ANTI-SKID LIGHT
Comes on to indicate a malfunction in the anti-skid system. All these lights will also come on when testing the anti-skid system with the anti-skid TEST CKT switch.

SECTION 18

MISCELLANEOUS

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SECTION 19: MISCELLANEOUS

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COCKPIT LIGHTING

OVHD CONSOLE LTS Knobs

PANEL On/off switch for integral lights on overhead panel.
FLOOD On/off switch for overhead panel flood lights.

1. CKT BKR LT Switch

On/dim/off switch for circuit breaker panel floodlights.

2. STBY COMP LT Switch

On/dim/off switch for standby compass floodlights.

3. THNDRSTRM LT Switch

OFF Lighting is controlled individually by the FO and captain.
ON Overrides individual light settings and turns on all cockpit floodlights to full intensity.

4. CKPT FLOOD Lights Switch

OFF Turns off cockpit overhead flood lights
ON Turns on one light in both cockpit overhead floodlights.
ALT Turns on both lights in both cockpit overhead floodlights.

INSTRUMENT PANEL LTS Knobs

PANEL On/off switch for instrument panel and console integral lights.
DIGITAL On/off switch for the digital readouts of the Flight Mode Annunciator and HSI.
FLOOD On/off switch for instrument panel flood lights.

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CTR INSTR & PED LTS Knobs

PANEL On/off switch for center instrument panel integral lights.
DIGITAL On/off switch for the digital readouts on the Fuel Quantity display unit.
FLOOD On/off switch for the center instrument and pedestal flood lights.

Flight Guidance Control Panel Lights

1. FGCP Digital Lights Knob on/off.
2. FGCP Mode Buttons and Integral Lighting Knob on/off.

VOICE RECORDER

1. COCKPIT MONITOR MICROPHONE
Actuated by audible sounds in the cockpit. Sounds are transmitted from the microphone to a recorder containing a 30 minute loop tape.

2. TEST Button
When pushed a test signal is sent to the recorder at 0.8 seconds interval for each of the four channels. The test cycle is completed in 5 seconds.

3. ERASE Button
When the Erase button is pushed and held for more than 2 seconds, the tape will be erased. The aircraft must be on the ground and the parking brakes must be engaged for this feature to be enabled.
(Currently not simulated)

4. HEADSET Jack
When a headset is plugged in and the test button is pushed, a 600Hz tone indicates that the system is operational.

5. TEST MONITOR METER
The Test Monitor Meter indicates recording level during test. A minimum recording level of 8 should be indicated by the needle. A reading of zero indicates a failure of respective channel.

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ANNUNCIATOR PANEL

1. CTR FUEL PRESS LO LIGHT (Amber)
Not in use.

2. FUEL LEVEL LOW (Amber)
Comes on to indicate either wing (main) tank fuel quantity has reached 2500 pounds.

3. APU GEN OFF LIGHT (Amber)
Comes on to indicate APU is operating but APU generator is not in use. MASTER CAUTION lights also come on.

4. AC BUS OFF LIGHT (L) (Amber)
Comes on to indicate generator bus is not powered. MASTER CAUTION lights also come on.

5. GEN OFF LIGHT (L) (Amber)
Comes on to indicate generator relay is open, disconnecting generator from its bus. MASTER CAUTION lights also come on.

6. CSD OIL PRESS LOW LIGHT (L). (Amber)
Comes on to indicate oil pressure in CSD is below operating limits. MASTER CAUTION lights also come on.

7. EMER LIGHT NOT ARMED (Amber)
Comes on to indicate the Emergency Lights switch is out of the ARM position.

8. AC CROSSTIE LOCKOUT LIGHT (Amber)
Comes on to indicate AC crosstie relay is locked open and automatic AC crosstie is inoperative. MASTER CAUTION lights also come on.

9. BATTERY OFF LIGHT (Amber)
Amber light that comes on when Battery switch is in the OFF position.

10. DC TRANSFER BUS OFF LIGHT (Amber)
Not in use.

11. AC BUS OFF LIGHT (R) (Amber)
Comes on to indicate generator bus is not powered. MASTER CAUTION lights also come on.

12. GEN OFF LIGHT (R) (Amber)
Comes on to indicate generator relay is open, disconnecting generator from its bus. MASTER CAUTION lights also come on.

13. CSD OIL PRESS LOW LIGHT (R). (Amber)
Comes on to indicate oil pressure in CSD is below operating limits. MASTER CAUTION lights also come on.

14. DC BUS OFF LIGHT (Amber)
Comes on to indicate either left or right DC bus is not powered. MASTER CAUTION lights also come on.

15. ENG ANTI-ICE ON LIGHTS (L, R)(Blue)
Indicates engine anti-ice system is on.

16. WING ANTI-ICE ON LIGHT (Blue)
Indicates anti-ice heat has been selected for wing leading edge and strakes.

22. ENG ANTI-ICE ON LIGHTS (L, R)(Blue)
Indicates engine anti-ice system is on.

23. TAIL DE-ICE ON LIGHT (Blue)
Indicates de-ice heat has been selected for the leading edge of the horizontal stabilizer.

24. PITOT/STALL HEATER OFF LIGHT (Amber)
Comes on to indicate METER SEL & HEATER selector in OFF. MASTER CAUTION light also comes on.

29. FUEL HEAT ON (L) (Blue)
Comes on to indicate bleed air supply to air/fuel heat exchanger is open.

30. ENG SYNC ON Light (L, R)
Comes on to indicate ENG SYNC switch is selected to N_1 or N_2 when landing gear handle is in the down position.

31. L START VALVE OPEN (Amber)
Comes on to indicate the engine starter valve is open, allowing bleed air to flow into the compressor stage of the turbine.

34. L INLET FUEL PRESS LO LIGHT (Amber)
Comes on to indicate low fuel supply pressure at the engine. Light also comes on when engine is operating on suction feed. MASTER CAUTION Lights also come on.

36. FUEL HEAT ON (R) (Blue)
Comes on to indicate bleed air supply to air/fuel heat exchanger is open.

37. ART INOP
Comes on to indicate a failure has been detected in the ART system, or the ART switch is in the OFF position.

38. R START VALVE OPEN (Amber)
Comes on to indicate the engine starter valve is open, allowing bleed air to flow into the compressor stage of the turbine.

41. R INLET FUEL PRESS LO LIGHT (Amber)
Comes on to indicate low fuel supply pressure at the engine. Light also comes on when engine is operating on suction feed. MASTER CAUTION Lights also come on.

43. YAW DAMP OFF Light (Amber)
Comes on to indicate Yaw damper is not operating.

46. GPWS FAIL
Comes on to indicate that the Ground Proximity Warning System is inoperative. The light will also come on when testing the GPWS.

48. CABIN ALT LIGHT (Red)
Comes on when cabin altitude exceeds 10,000 ft. The CABIN ALT light is accompanied by the MASTER WARNING light. The NO SMOKING and FASTEN SEAT BELTS signs in the cabin also come on.

49. AC EMER BUS OFF LIGHT (Red)
Comes on to indicate emergency AC bus is not powered. MASTER WARNING lights also come on.

53. SPOILER DEPLOYED (Amber)
Comes on to indicate Ground Spoiler is extended in flight, or any spoiler is deployed on the ground with the spoiler lever in the stowed position.

55. APU FIRE (Red)
Comes on when APU fire system is activated. MASTER WARNING lights also come on.

56. DC EMER BUS OFF LIGHT (Red)
Comes on to indicate emergency DC bus is not powered. MASTER WARNING lights also come on.

57. RUDDER TRAVEL UNRESTRICTED Light (Blue)
Comes on to indicate full rudder travel is available (22 degrees).

60. MACH TRIM INOP Light (Amber)
Comes on to indicate Mach trim compensator is off, or Mach Trim Comp switch is in the OVRD position.

61. FIRE DETECTION LOOP Light (Amber)
Comes on when testing the Fire Detection system.

66. RAIN REPELLENT RESERVE IN USE LIGHT (Blue)
Indicates reserve fluid container has been selected.

68. APU OIL PRESS LOW (Amber)
Comes on the APU oil pressure is to low. The light should come on during APU start.

71. ELEVATOR PWR ON (Blue)
Comes on to indicate that the hydraulic elevator augmentation system is active.

72. PARKING BRAKES ON LIGHT
Comes on to indicate the parking brakes are set.

75. L HYD PRESS LOW LIGHTS (Amber)
Comes on when hydraulic pressure to the spoiler supply system drops below normal levels. The MASTER CAUTION light will also come on.

76. L OUTBD ANTI-SKID LIGHT
Comes on to indicate a malfunction in the anti-skid system. The light will also come on when testing the anti-skid system with the anti-skid TEST CKT switch.

77. L INBD ANTI-SKID LIGHT
Comes on to indicate a malfunction in the anti-skid system. The light will also come on when testing the anti-skid system with the anti-skid TEST CKT switch.

78. SPOILER/FLAP EXTENDED Light (Amber)
Comes on to indicate speedbrakes are extended with flaps extended beyond 6 degrees. MASTER CAUTION light will also come on. The light will not come on when on the ground.

79. RUDDER CONTROL MANUAL Light (Amber)
Comes on to indicate there is no hydraulic power to the rudder.

82. R HYD PRESS LOW LIGHTS (Amber)
Comes on when hydraulic pressure to the spoiler supply system drops below normal levels. The MASTER CAUTION light will also come on.

83. R OUTBD ANTI-SKID LIGHT
Comes on to indicate a malfunction in the anti-skid system. The light will also come on when testing the anti-skid system with the anti-skid TEST CKT switch.

84. R INBD ANTI-SKID LIGHT
Comes on to indicate a malfunction in the anti-skid system. The light will also come on when testing the anti-skid system with the anti-skid TEST CKT switch.

87. AFT STAIRWAY DOOR
Comes on to indicate the aft stairway door is open.

88. AFT CABIN DOOR
Comes on to indicate the aft cabin door is open.

89. AFT GALLEY DOOR
Comes on to indicate the aft galley door is open.

90. FWD STAIRWAY DOOR
Comes on to indicate the forward stairway door is open.

91. FWD CABIN DOOR
Comes on to indicate the cabin stairway door is open.

92. AFT CARGO DOOR
Comes on to indicate the aft cargo door is open.

93. MID CARGO DOOR
Comes on to indicate the mid cargo door is open.

94. FWD CARGO DOOR
Comes on to indicate the forward cargo door is open.

98. FWD GALLEY DOOR
Comes on to indicate the forward galley door is open.

SECTION 19

NAVIGATION

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SECTION 20: NAVIGATION

GENERAL

General

The airplane navigation system provides visual and aural information to the flight crew to safely maneuver and navigate the airplane. This information is in operation during pre-takeoff, takeoff, en route flight, approach and landing. When the airplane is in an air traffic controlled area it also transmits information to ground control personnel to determine airplane identity, location and altitude.

Compass Systems

There are two compass systems. Each compass system is stabilized by an associated directional gyro and receives magnetic heading inputs from an associated flux valve. Compass heading is displayed on the compass indicators and HSIs at all times.

VHF Navigation System

There are two independent VHF navigation systems: VOR1/LOC1 and VOR2/LOC2.

Automatic Direction Finding Systems

The single ADF system consists of a control panel, receiver, a loop antenna and a sense antenna. The control panel on the pedestal selects the operating mode and frequency for the ADF system. The ADF system provides bearing input to the two pointers on the Compass indicator. There is only one ADF system installed in this aircraft.

Marker Beacon System

The pre-tuned marker beacon system provides visual and aural signals to the flight crew. Three lights on the instrument panel provide visual position indications when passing over an outer, middle, or an inner/airway marker. An aural tone will sound simultaneously with a light.

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COMPASS INDICATOR

1. ROTATING COMPASS CARD

2. VOR/ADF 1 POINTER
Indicates bearing to VOR station selected on the VHF NAV1 control panel or ADF control unit.

3. VOR/ADF 2 POINTER
Indicates bearing to VOR station selected on the VHF NAV2 control panel or ADF control unit.

4. VOR/ADF 1 SELECTOR KNOB

VOR	VOR/ADF 1 pointer displays bearing to VOR station selected on VHF NAV1 control panel.
ADF	VOR/ADF 1 pointer displays bearing to ADF facility selected on ADF control panel

5. VOR/ADF 2 SELECTOR KNOB

VOR	VOR/ADF 2 pointer displays bearing to VOR station selected on VHF NAV2 control panel.
ADF	VOR/ADF 2 pointer displays bearing to ADF facility selected on ADF control panel

HORIZONTAL SITUATION INDICATOR (HSI)

1. MILES NO. 1 READOUT
Digital readout of DME 1.

2. MILES NO. 2 READOUT
Digital readout of DME 2.

3. GLIDE SLOPE DEVIATION DISPLAY
Shows vertical deviation from glide slope. Glide slope pointer is removed from view when an ILS frequency is not selected on the VHF NAV control panel.

4. COURSE POINTER
In RAD mode, the Course Pointer indicates selected VOR course as set by the CRS select knob on the VHF NAV control panel. In NAV mode, the Course Pointer indicates the desired track to the next waypoint.

5. HEADING CURSOR
In RAD mode, the Heading Cursor indicates selected heading set by HDG knob on the flight guidance control panel. In NAV mode, the Heading Cursor indicates the actual track over the ground.

6. MINIATURE AIRPLANE SYMBOL
Symbol is fixed to center of indicator and represents the airplane in relation to movable parts of the indicator.

7. NAVIGATION WARNING FLAG
Indicates radio information not valid.

8. COURSE DEVIATION BAR AND SCALE
In RAD mode, the Course Deviation Bar Indicates deviation from a selected VOR/LOC course. The bar aligns with the course pointer when the airplane is on course. In NAV mode, the Course Deviation Bar indicates cross track error (XTK).

9. TO/FROM INDICATOR
Indicates direction to or from selected station along selected course.

10. ROTATING COMPASS CARD

11. MAG/TRU HEADING MODE ANNUNCIATOR
- MAG Compass card displays magnetic heading.
- TRU Compass card displays true heading.

12. RAD/NAV ANNUNCIATOR
- RAD The HSI operates in RAD (Radio) mode. Indications will be based on radio navigation input.
- NAV The HSI operates in NAV (Navigation) mode. Indications will be based on input from the Omega Navigation System.

Note: The HSI only operates in NAV mode when the Omega Navigation System is coupled to the DFGS. Otherwise, the HSI operates in RAD mode. The ONS is coupled to the DFGS by pressing the NAV button on the Flight Guidance Panel. In NAV mode, the HSI makes indications relative to True North.

VHF NAV CONTROL PANEL AND ADF CONTROL PANEL

1. VOR/LOC FREQUENCY READOUT
Digital readout of frequency selected with VOR/LOC frequency select knob.

2. VOR CRS SELECT READOUT
Digital readout of course selected with CRS select knob.

3. VOR/LOC FREQUENCY SELECTOR
Click the numbers in the frequency readout to increase and/or decrease the frequency.

4. VOR/LOC FREQUENCY SELECTOR
Click the numbers in the course readout to increase and/or decrease the course.

5. VHF NAV CP 1 & 2 SELECTOR
In this panel NAV1 and NAV2 are located on top of each other. Click the number to toggle between NAV1 and NAV2.

1. FREQUENCY INDICATOR
Displays frequency selected by frequency select knob.

2. TFR SWITCH
Permits selection of either left or right-hand displayed frequencies. A red bar covers frequency not selected.

3. FREQUENCY SELECT KNOBS (2)
Click the numbers in the frequency readout to increase and/or decrease the frequency.

4. A1/NORM SWITCH
Not currently simulated.

5. ADF/ANT SWITCH
Not currently simulated.

MARKER BEACON

INNER/AIRWAY MARKER BEACON LIGHT (White)
Airplane is positioned over inner/airway marker beacon when light is on. An aural tone will also be heard if MKR volume on audio control panel is adjusted properly.

MIDDLE MARKER BEACON LIGHT (Amber)
Airplane is positioned over middle marker beacon when light is on. An aural tone will also be heard if MKR volume on audio control panel is adjusted properly.

OUTER MARKER BEACON LIGHT (Blue)
Airplane is positioned over outer marker beacon when light is on. An aural tone will also be heard if MKR volume on audio control panel is adjusted properly.

LTN-311 OMEGA/VLF NAVIGATION SYSTEM SUPPLEMENT

General

The LTN-31l Omega/VLF Navigation System is a worldwide, all-weather navigation system. The system processes the signals transmitted by selected very low frequency Omega Navigation and VLF communication stations to determine the airplane's position in terms of latitude and longitude.

The system is capable of displaying information related to the airplane's track (referenced to true north) and how this track compares to a desired great circle track between previously inserted waypoints in such terms as cross-track error, drift angle, ground speed, time and distance to the next waypoint, etc.

In addition, by using aircraft true airspeed and heading information, the system is capable of calculating wind direction and speed and, in the event Omega/VLF signals become marginal or unusable, use these parameters in a dead-reckoning mode of operation.

The system is capable of interfacing with the ACARS for automate loading of flight plan waypoint data.

Omega and VLF stations transmit on frequencies from 1O to 30 KHz. The radiated signals have wavelengths about 16 miles long.

The Omega/VLF system computes changes in position from a known starting point by measuring the changes in the phase angles of the received OMEGA/VLF signals which result from the airplane's movement through the wave.

Using the departure point latitude and longitude coordinates, the system will automatically synchronize itself with the wave patterns being generated by the Omega/VLF stations, establish a starting point, and select the stations to be used automatically based on the signal strength and crossing angles of the stations being received.

Date and time (UTC) are also required during initialization to provide the system with a reference for making wave propagation corrections. These corrections are necessary because the long range of the Omega/VLF transmissions is attained by bouncing the signals along between the surface and the ionosphere, but the height of the ionosphere changes from day to night, causing a shift in wave propagations. This shift is predictable, however, and a programmed correction based on time of day can be made.

After entering the latitude/longitude coordinates of the enroute waypoints (either manually or automatically through ACARS) and initiating the first leg, the system will automatically navigate from waypoint to waypoint, providing a continuous output of navigational data. At any time during flight, the position can be updated, waypoints can be changed, and track changes can be made (including the capability of flying offset tracks). The system can also be interrogated to determine distance and flying time between any two points of the flight plan (directly or along the flight plan route).

The ONS Control Display Unit (CDU) is located on the pedestal.

ONS Navigation Data

Navigation terms used with the Omega/VLF Navigation System.

Note that the HSI will automatically display true headings when the ONS is coupled to the Digital Flight Guidance System and the lateral navigation mode is active (NAV switch).

TK Track is the angle between True North and airplane's actual track over the ground.

GS Ground Speed.

HDG Heading is the airplane's heading with respect to True North.

DA Drift Angle is the angle between the airplane's heading and its ground track.

XTK Cross Track Distance is the shortest distance between the airplane's position and the desired track.

TKE Track Error is the angle between the airplane's actual ground track and the desired track.

POS Present Position is the computed latitude and longitude position of the airplane.

WPT Waypoint (geographical fix).

DTG Distance To Go. The great circle distance from present position to the TO waypoint.

TTG Time To Go. Time to fly to the TO waypoint if on the desired track. If off the desired track, time is to a line perpendicular to the desired track passing through the TO waypoint.

DTK Desire Track is the angle between true north and the great circle track between the FROM and TO waypoints.

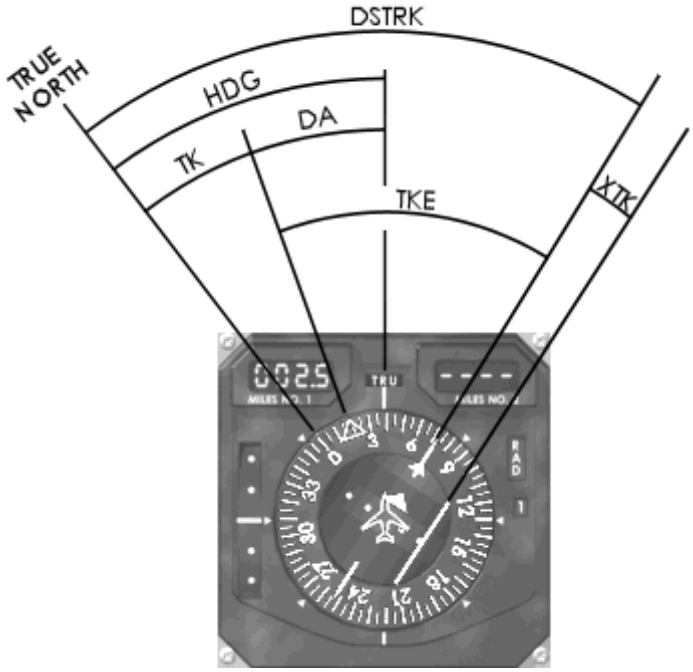


Illustration of an off track situation.

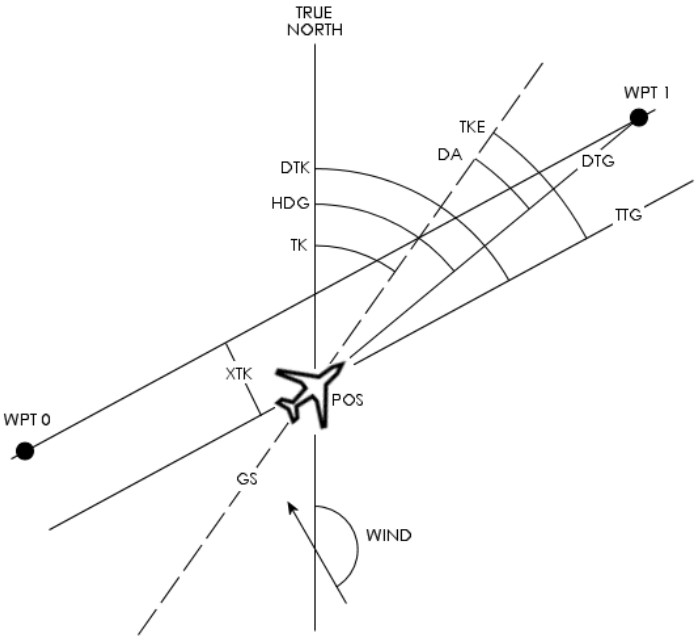
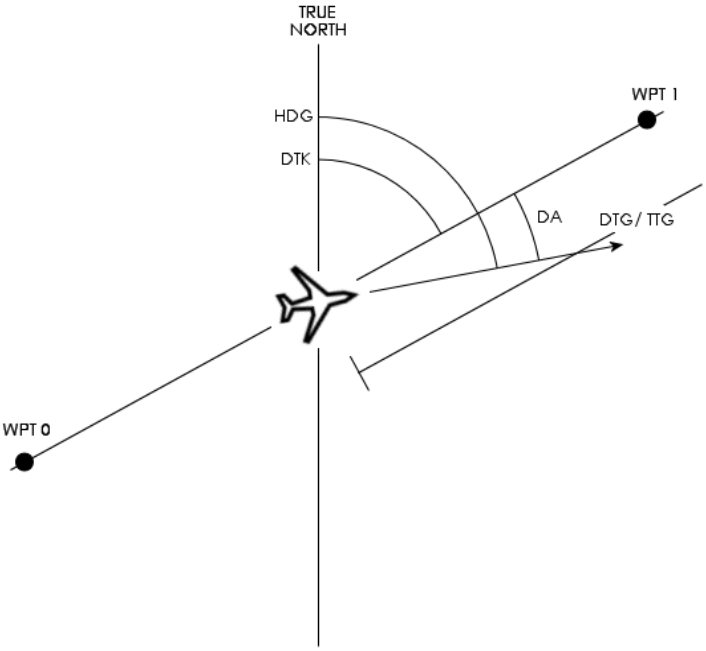
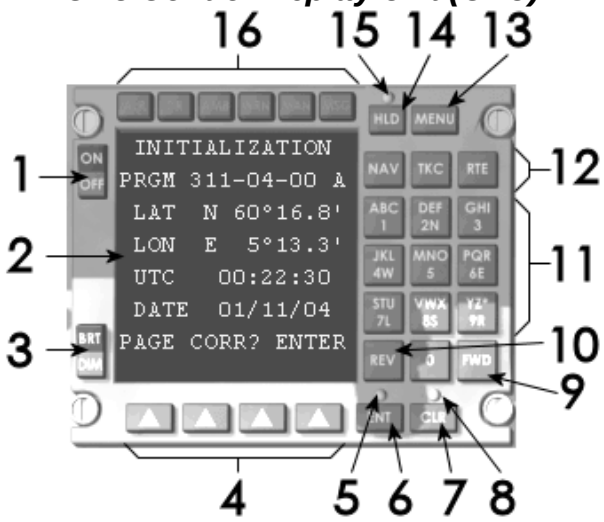


Illustration of an on track situation.



Note: These illustrations are not related to the HIS illustration on the previous page.

ONS Control Display Unit (CDU)



1. ON/OFF SWITCH
Used to turn system on or off.

2. DATA DISPLAY
Data is displayed on an LED display. A display of data is referred to as a "page".

Sample page:

```
  ROUTE  ETA 1/2
  ENBR->BTA    A
02 BTA     11:24
03 STD     11:26
04 KRM     11:30
05 RSY     11:33
     WPT __
SUP COPY TTG STS
```

The general page layout is as follows:

Line 1 Page Title. The notation 1/2, 2/2, etc. will appear on the right side of the line if the page contains more than one screen of information, e.g., 1/2 means page 1 of 2 pages.
Line 2 Current to/from waypoints. The A or M on the right side of line 2 indicates whether the system is operating in the A (automatic) or M (manual) mode.
Line 3–6 Data and/or information.
Line 7 Combination message and scratchpad display. All entries from the keyboard are displayed in the scratchpad (left to right).
Line 8 Used to display changing functions of each Soft Key.

4. SOFT KEYS
Keys whose functions change depending upon the current page being displayed. The function of each key is displayed on the data display line directly above the associated key.

5. ENTER LIGHT (Green)
When illuminated, it is acting as a prompt, indicating that the system is ready for entry of data. Extinguishes when the ENT button is pressed.

6. ENT (Enter) BUTTON
Used to enter scratchpad data into the system.

7. CLR (Clear) BUTTON
Used to clear scratchpad data.

8. CLEAR LIGHT (Green)
Not currently simulated.

9. FWD (Forward) BUTTON
Used to access the next page of a sequence of pages.

10. REV (Reverse) BUTTON
Used to access the previous page of a sequence of pages.

11. KEYBOARD
Used to input data.
- If a number is to be input, press the applicable key.
- If an alpha character is to be input, first press the key bearing the letter, then press the appropriate Soft Key.
- When keying in position data, e.g. latitude or longitude, start data entry by pressing the appropriate direction key (N, S, W, E).
- Press ENT (Enter) button when data input is complete.

12. PAGE ACCESS BUTTONS
Used to directly access a specific main menu page without having to go through the menu.

NAV Button
Used to access the NAV DATA page.

TKC Button
Used to access the TRACK CHANGE page.

RTE Button
Used to access the ROUTE page.

13. MENU BUTTON
Press to access the main menu. The main menu consists of two pages. A total of seven items are listed in the main menu. Press the appropriate numeric key to access the sub-menus.

14. HLD BUTTON
Not currently simulated.
(In the real airplane this button is used to activate position hold when updating the OMEGA/VLF position and/or realigning the system.)

15. HOLD LIGHT (Green)
Not currently simulated.

16. ANNUNCIATOR LIGHTS
Not currently simulated.

Operations – Flight Plan

Creating a Flight Plan

The LTN-311 ONS loads standard P3D Flight Plans.

To create a flight plan in P3D go to the "Navigation" menu and click the "Flight Planner" item. This will bring up the P3D Flight Planner.

When you have created your flight plan, you need to save it with a special file name. If the flight plan is saved without using the special naming convention the LTN-311 ONS will not be able to retrieve the flight plan you have just created.

The flight plan created with the P3D Flight Planner must be saved with the following name elements:

- Departure name, 4 letters
- Dash "-"
- Destination name, 4 letters
- Dash "-"
- Flight number, 0-99999, max 5 digits

The suffix ".PLN" is automatically added to all flight plans created with P3D Flight Planner.

Some examples of valid flight plan names are:

- enbr-engm-336.PLN
- khyw-kfaa-1.PLN
- zbaa-yssy-4712.PLN
- lfpg-eggp-17358.PLN

Note: Do not use leading 0's in the flight number such as "014".

Preparing to load a Flight Plan

The LTN-311 ONS in the MD-80 does not have any flight plans stored in the unit in the aircraft. All flight plans loaded in the ONS are uploaded via ACARS to the ONS from the airline's central dispatch center.

This centralized approach is very different from most modern navigation systems used today where all the flight plans used by the airline are stored in the unit in the aircraft.

The ACARS request for a flight plan is initiated by the ONS. However, the ONS uses some of the data input to the ACARS system in the flight plan request. These are:

- Departure station
- Destination station
- Flight number

These data must be input to the ACARS system before the ONS can make a flight plan request.

You may have noticed that these data are the same as those required when creating a flight plan in the paragraph above.

Please see Section 10 on how to load the required data into the ACARS unit.

Loading a Flight Plan

See AUTOMATIC ACARS UPLINK and/or MANUALLY REQUESTING AN ACARS FLIGHT PLAN in the system description that follows.

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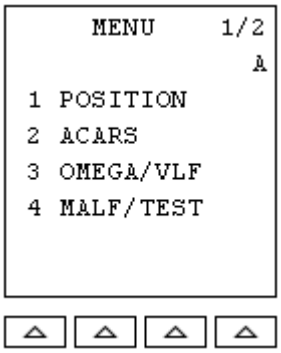
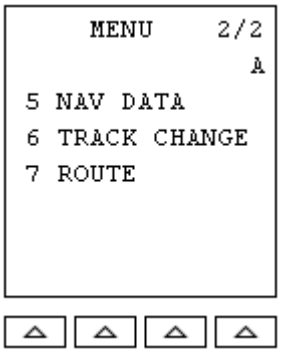
Operations – ACARS Page

On the LTN-311 ONS, all functions are performed and data is displayed on "pages". Pages are selected for display either automatically by the system, or by going through the MENU page. Pages can also be directly accessed using Page Access buttons or from other pages using Soft Keys.

The main MENU page can be accessed anytime by pressing the MENU button.



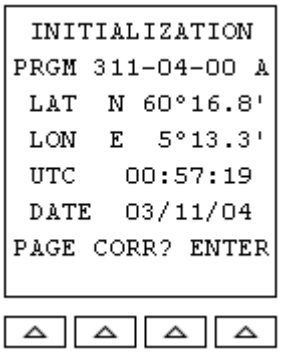


To select a page from the main MENU, press that page's number on the keyboard. The selected page will then be displayed and the various functions associated with that page can then be selected from submenus and/or accessed through Soft Keys.

A description of the basic LTN-311 operational pages and the functions performed on them follows.

INITIALIZATION

When the system is turned ON, following the power on page, the INITIALIZATION page is displayed.



The INITIALIZATION page displays:
- Program number
- Present position
- Time (UTC)
- Date (UTC)

TO COMPLETE THE INITIALIZATION PROCESS:

ENT Button PRESS

Initialization is complete. The system will automatically go to the ACARS DATA page and seek an uplinked flight plan.

The ACARS page enables the pilot to request that a flight plan be uplinked to the ONS.

The ONS will automatically make a request for a new flight plan upon completion of the initialization process.

When an ACARS flight plan has been uplinked, the pilot can accept the route and replace the current supplemental route. This flight plan can then later be made the active route. The pilot can also reject the route and load all the waypoints manually.

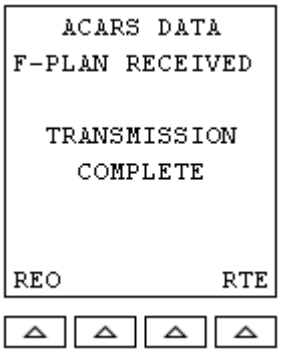
The ONS maintains two separate flight plans, or routes, for display. One is the active and the other is the supplemental route. The active route is used by the ONS to navigate the airplane. The supplemental route is an alternate flight plan which may be altered without affecting the airplane's course.

AUTOMATICS ACARS UPLINK

After the initialization process is complete, the following page will be displayed:

Soft Key functions
CNCL Cancels the ACARS flight plan request.

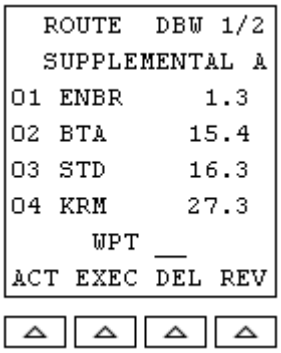
When an uplinked flight plan has been received, the following page will be displayed:



Soft Key functions
REQ Re-request an ACARS flight plan.
RTE SUPPLEMENTAL ROUTE page will be displayed.

Note that when an automatic ACARS uplink is made, the flight plan is automatically stored as the supplemental route.

SUPPLEMENTAL ROUTE PAGE



Soft Key functions

ACT Accesses the ACTIVE ROUTE page for loading a route manually.

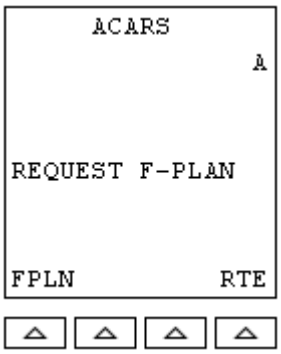
EXEC Press to make the supplemental route the active route.

DEL Delete the supplemental route.

REV Press to re-sequence the waypoints on the supplemental route in reverse order. This feature can be used to create the flight plan for the return flight.

MANUALLY REQUESTING AN ACARS FLIGHT PLAN

MENU button PRESS
Keyboard PRESS 2
ACARS page is displayed:



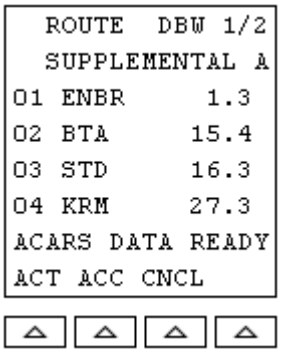
Soft Key functions

FPLN Initiates request for a new ACARS route.

RTE Accesses the supplemental route page.

When a new flight plan has been requested, the "Flight plan requested awaiting completion of transmission" page will be displayed.

The current SUPPLEMENTAL ROUTE page will appear, with a message stating "ACARS DATA READY", indicating that the new ACARS flight plan is being held in memory.



Soft Key functions

ACT Accesses the ACTIVE ROUTE page.

ACC Accepts the ACARS flight plan held in memory and makes it the supplemental route, replacing the current supplemental route.

CNCL Cancels the ACARS flight plan held in memory. Normal SUPPLEMENTAL ROUTE page soft keys appear.

Operations – Route Page

The ROUTE page is used to load, view and modify (change, add, delete, reverse) route waypoints. Two routes, an active and a supplemental route, are stored in the system.

The active route is used by the ONS for navigation. The supplemental route resides in memory and can, at any time, be made the active route.

Whenever a supplemental route is designated to be the active route, the currently active route will become the supplemental route.

All waypoints are cleared when the ONS is switched OFF.

Each route may contain up to 99 waypoints.

ROUTE LOADING THROUGH ACARS

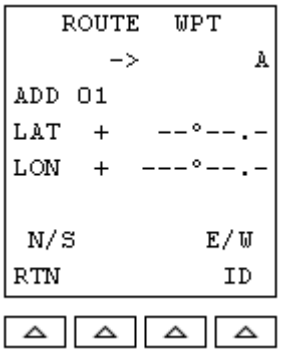
Refer to ACARS Page section.

MANUAL ROUTE LOADING

Route waypoints can be loaded manually on both the active and the supplemental route page.

Select the Route Page by pressing a RTE Soft Key, the RTE button, or by access through the menu (MENU button). On the keyboard key in 0 – 1 to start adding waypoint 01.

The WPT ADD page will be displayed:



Soft Key functions

RTN Return to basic ROUTE page.
ID Used to initialize a waypoint ID entry.

When accomplishing waypoint entry, the coordinates or the ID may be entered first. A waypoint may also be entered into the flight plan without an ID.

ID Soft Key PRESS
Line 7 prompts for entry of an ID consisting of from 1 to 6 alpha/numeric characters.
On keyboard KEY IN ID
When ID entry is complete
ENT Button PRESS

On keyboard KEY IN LATITUDE
Press N or S button to initialize latitude input. Then key in coordinates at the prompt on line 7.
On keyboard KEY IN LONGITUDE
Press E or W button to initialize longitude input. Then key in coordinates at the prompt on line 7.

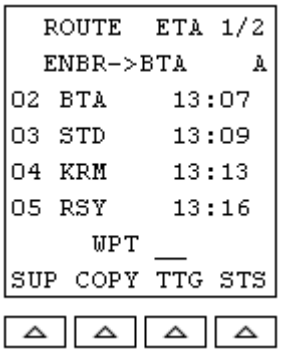
ENT button PRESS
Waypoint is inserted into the current flight plan.

When all waypoints are loaded
RTN Soft Key PRESS
Basic ROUTE page appears for viewing of entire route.

TO VIEW A COMPLETE ROUTE

To view a complete route, select the ROUTE page for display by pressing the RTE button, a RTE Soft Key, or by access through the menu (MENU button).

The basic ACTIVE ROUTE page:



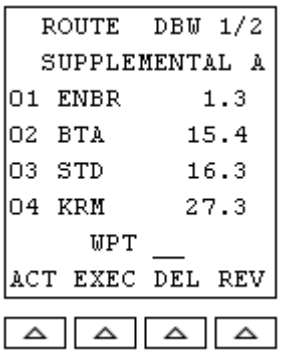
This page will display all the waypoints in the active route. Use the FWD and REV buttons to scroll through all the waypoints in the flight plan. The current TO/FROM waypoint pair is shown on line 2.

The prompt on line 7 can be used to enter a waypoint number in order to obtain more information about that waypoint.

Soft Key functions

SUP Access to the SUPPLEMENTAL ROUTE page.
COPY Copy the active route onto the supplemental route, replacing the old supplemental route.
TTG Press to toggle the information shown on the ROUTE page. Pressing this Soft Key will toggle between: ETA, TTG, DTG and DBW.
STS Access the Omega/VLF status page.

The basic SUPPLEMENTAL ROUTE page:



Soft Key functions

ACT Accesses the ACTIVE ROUTE page for loading a route manually.
EXEC Press to make the supplemental route the active route.
DEL Delete the supplemental route.
REV Press to re-sequence the waypoints on the supplemental route in reverse order. This feature can be used to create the flight plan for the return flight.

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TO CHECK EACH WAYPOINT ON A ROUTE

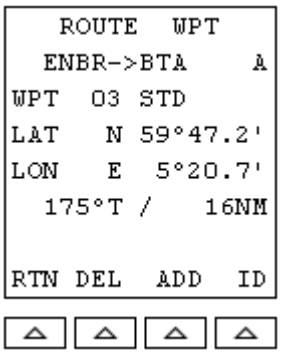
The coordinates of any waypoint on the active or supplemental route may be checked along with DTK and DIS to that waypoint from the preceding waypoint.

With the active or supplemental route page displayed:

On keyboard	KEY IN NUMBER OF WAYPOINT TO BE EXAMINED

Example: For waypoint 03, press 0 – 3.

The ROUTE WPT page appears:



This example is for the active route. For the supplemental route, line 2 would indicate SUPPLEMENTAL.

Use the FWD and REV buttons to browse through the waypoints.

Soft Key functions

RTN	Returns to the basic ROUTE page.
DEL	Press to delete the current waypoint.
ADD	Press to initiate insertion of a waypoint at this waypoint location.
ID	Press to change the waypoint's ID.

To change the coordinates of the current waypoint, press the N – S – E – W buttons to initiate the procedure. A prompt will then occur to accept further position data input.

TO CHANGE A WAYPOINT'S ID

RTE button	PRESS
	ROUTE page will be displayed.
On keyboard	KEY IN NUMBER OF WAYPOINT TO BE CHANGED
	ROUTE WPT page will be displayed.
ID soft key	PRESS
	Input new name for waypoint.

TO CHANGE A WAYPOINT'S COORDINATES

RTE button	PRESS
	ROUTE page will be displayed.
On keyboard	KEY IN NUMBER OF WAYPOINT TO BE CHANGED
	ROUTE WPT page will be displayed.
On keyboard	PRESS N/S/E/W
	Input latitude/longitude data for waypoint.

TO ADD A WAYPOINT

RTE button	PRESS
	ROUTE page will be displayed.
On keyboard	KEY IN NUMBER OF POSITION WHERE NEW WAYPOINT IS TO BE INSERTED.
	ROUTE WPT page will be displayed.
ADD soft key	PRESS
	The WPT ADD page will appear.
ID soft key	PRESS
	Input new name for waypoint.

On keyboard PRESS N/S/E/W
Input latitude/longitude data for new waypoint.
ENT button PRESS

Another WPT ADD page will appear automatically for loading the next sequential waypoint. Press RTN to go back to the basic ROUTE page.

Note that when adding a waypoint between existing waypoints, all subsequent waypoints will be shifted downwards one position.

When adding a waypoint to the end of flight plan, note that the ONS will automatically select the next available waypoint number.

Example: If there are 8 waypoints in the active route, and a new waypoint is added to position 12, the ONS will automatically put the new waypoint in position 9, not 12.

Operations – Track Change Page

Once an initial track is activated, the ONS will navigate from waypoint to waypoint. Track changes are made automatically if the system is in the automatic track change mode (A). If the system is in the manual (M) mode, track changes must to be made manually.

The ONS allows the pilot to initiate, at any time, a track change from present position to any waypoint. This feature is comparable to the "Direct To" function seen in many other Flight Management Systems.

The TRACK CHANGE page is also used to accomplish remote ranging. Remote ranging permits display of distance, time and desired track between any two waypoints or between present position and any waypoint, either along the programmed route or on a direct route.

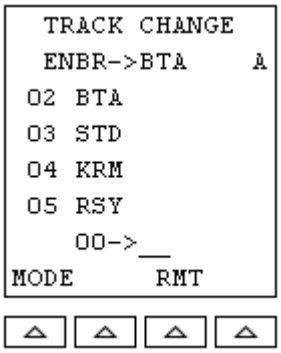
When remote ranging, the computed time is based on the airplane's current ground speed, if the airplane's speed is higher than 110 knots, otherwise a fixed value of 480 knots is used.

The TRACK CHANGE page is accessed by pushing the TKC button, or by selection in the menu (MENU button).

TO INITIATE A TRACK CHANGE

If the DFGS is coupled to the ONS, select another mode, e.g. HDG HLD, before changing the active track leg. Reconnect the DFGS after the track change has been made.

TKC button PRESS
TRACK CHANGE page appears:



The current track leg is shown in line 2. Lines 3 through 6 show the next 4 waypoints. The FWD button can be used to show subsequent waypoints.

The prompt for selecting TO and FROM waypoints for the new desired track are shown on line 7. The present position (00) is the default FROM waypoint.

Soft Key functions

MODE Used to change the track change mode: automatic (A) or manual (M).

RMT Used to initiate remote ranging function.

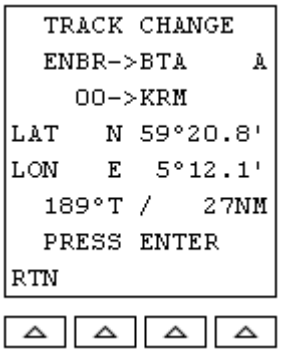
TRACK CHANGE FROM PRESENT POSITION DIRECT TO ANY WAYPOINT

With the TRACK CHANGE page displayed:

On keyboard — KEY IN DESIRED 'TO' WAYPOINT

The TRACK CHANGE WPT page appears so that TO waypoint data can be viewed before the track leg change is activated.

The TRACK CHANGE WPT page:



Soft Key functions

RTN — Returns to the TRACK CHANGE page.

The proposed track change leg is show on line 3. The coordinates for the new TO waypoint along with DTK and DIS are also displayed on the page.

ENT button — PRESS

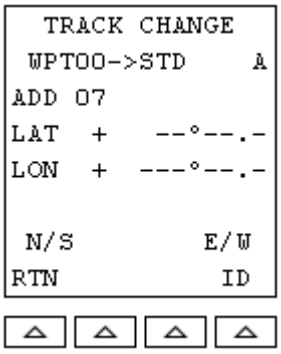
Track leg change is activated. The display automatically selects the NAV DATA page for the new track change leg for display.

TRACK CHANGE FROM PRESENT POSITION DIRECT TO ANY POINT NOT CURRENTLY PROGRAMMED AS A WAYPOINT

With the TRACK CHANGE page displayed:

On keyboard — KEY IN WAYPOINT LOCATION NUMBER NOT CURRENTLY BEING USED (WHICH IS BEYOND THE CURRENT ROUTE)

The WPT ADD page appears prompting that an ID and/or coordinates for the new TO waypoint be entered.



Soft Key functions

RTN — Returns to the TRACK CHANGE page.

Upon entering the ID and coordinate data, the TRACK CHANGE WPT page will appear.

ENT button — PRESS

The track leg change is activated and the system automatically displays the NAV DATA page for the new track change leg for display. The FROM waypoint WPT00 indicates the airplane's present position.

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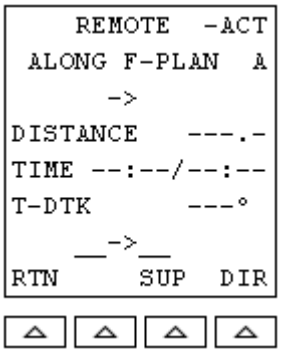
REMOTE RANGING

With the TRACK CHANGE page displayed:

RMT Soft Key PRESS

The REMOTE RANGE page is displayed. The page indicates remote range mode: ALONG F-PLAN or DIRECT PATH on line 2, the TO/FROM waypoints on line 3, along with distance, ETE, ETA and initial DTK info. The prompt at line 7 accepts TO/FROM waypoint input for which remote ranging is desired.



Soft Key functions

RTN Returns to the TRACK CHANGE page.

SUP Selects the supplemental route fore remote ranging. Line 1 will then indicate –SUP.

ACT (When displayed) Selects the active route for remote ranging. Line 1 will then indicate – ACT.

DIR Selects DIRECT PATH remote ranging. Line 2 will then indicate DIRECT PATH.

IDIR (When displayed) Selects ALONG F-PLAN remote ranging. Line 2 will then indicate ALONG F-PLAN.

DIR or IDIR Soft Key PRESS AS REQUIRED

ACT or SUP Soft Key PRESS AS REQUIRED

On keyboard KEY IN THE FROM AND TO WAYPOINT BETWEEN WHICH REMOTE RANGING IS DESIRED

NOTE:
If the FROM waypoint is to be the present position of the airplane, key in 00 as the FROM waypoint position.

Remote ranging can also be accomplished to a point not on the programmed route. This is done by keying in 99 as the TO waypoint. The ADD WPT page will appear and prompt for the insertion of ID and/or coordinates for a new waypoint. This waypoint will not be inserted as a new waypoint in the flight plan.

Operations – NAV Data Page

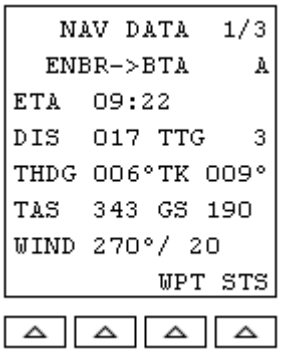
The NAV DATA page is a source of information for the following navigation data related to the currently active track:
Estimate time of arrival at the next waypoint
Distance and Time-To-Go to the next waypoint
True heading and track
True airspeed and groundspeed
Wind data
Desired track
Drift angle
Track angle error
Cross track error
Expanded wind data (headwind, tailwind, crosswind)

The NAV DATA page is accessed by pressing the NAV button or by accesses through the menu (MENU button).

TO DISPLAY NAV DATA

NAV button PRESS
NAV DATA page is displayed on three separate pages. Use the FWD and REV buttons to flip through the pages.

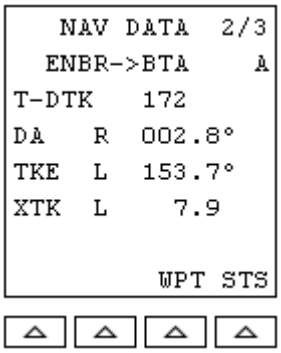
NAV DATA page 1:



ETA Estimated time of arrival at the TO waypoint.

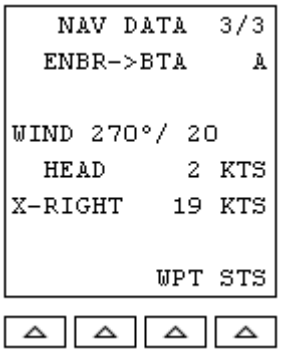
DIS Distance from present position to the TO waypoint.
TTG Time-To-Go (in minutes) to the TO waypoint. Time is based on current groundspeed.
THDG Airplane true heading.
TK Airplane track.
TAS True airspeed.
GS Ground speed.
Wind Wind direction and speed.

NAV DATA page 2:



T-DTK Desired track angle (true).
DA Drift angle. Preceding R (right) or L (left) indicates drift direction from heading.
TKE Track angle error. Preceding R (right) or L (left) indicates direction of error from desired track.
XTK Cross-track distance. Preceding R (right) or L (left) indicates direction of offset from desired track.

NAV DATA page 3:



WIND Wind direction and speed.
HEAD/TAIL Head or tailwind component.
X-RIGHT (LEFT) Crosswind component.

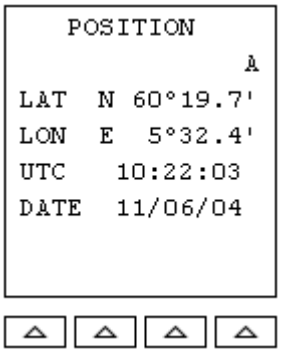
Soft Key functions

WPT Accesses the ROUTE WPT page for the current TO waypoint.
STS Accesses the OMEGA STATUS page.

Operations – Position Page

The POSITION page displays information about the airplanes current position, current time and date.

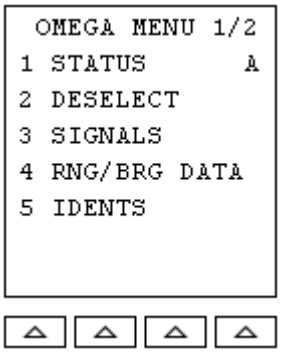
To access the POSITION page:
MENU button PRESS
MENU page is displayed.
On keyboard PRESS 1
POSITION page is displayed:

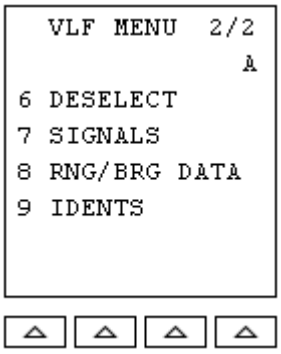


Operations – OMEGA/VLF Page

These pages display status, data and information about the Omega and VLF navigation system and stations.

The OMEGA/VLF pages are currently not simulated in this panel.

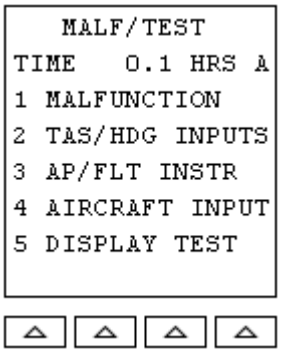




Operations – MALF/TEST Page

Used primarily by Maintenance to check the system and for troubleshooting.

The MALF/TEST page is currently not simulated in this panel.



SECTION 20

OXYGEN

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SECTION 21: OXYGEN

GENERAL

General

The aircraft is equipped with two independent oxygen systems. One oxygen system is installed in the cockpit for the Flight Crew, and the other oxygen system is installed in the passenger compartment for the passengers and Flight Attendants.

Flight Crew Oxygen System

Oxygen to the Flight Crew is supplied from a high-pressure gaseous oxygen supply cylinder.

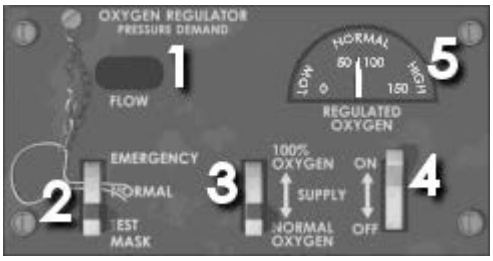
For normal operation of the system the supply toggle switch must be set to ON, the diluter control switch to NORMAL OXYGEN and the TEST MASK/NORMAL/EMERGENCY switch to NORMAL. This setup will supply oxygen to the masks upon demand.

In the event of a cabin decompression at altitudes above 28,000 feet, the system will automatically sense the change in cabin pressure and supply the masks with 100% pure oxygen.

In the event of an emergency where protective breathing is required (such as smoke in the cabin, etc.) the diluter control switch must be set to the 100% OXYGEN position.

If a oxygen regulator failure occurs, the diluter control switch must be set to 100% OXYGEN and the TEST MASK/NORMAL/EMERGENCY switch must be set to EMERGENCY. (The TEST MASK/NORMAL/EMERGENCY switch is currently not simulated)

CONTROLS AND INDICATORS



1. FLOW INDICATOR

Provides a visual indication of oxygen flow from the regulator to the masks.

2. TEST MASK/NORMAL/EMERGENCY CONTROL

EMERGENCY	The regulator supplies oxygen under pressure to the masks. Note that the safety pin must be pulled to place the lever in the EMERGENCY position.
NORMAL	This is the normal operating position.
TEST MASK	(Momentary) The regulator supplies oxygen under pressure to the masks for testing purposes.

3. DILUTER DEMAND CONTROL

100% OXYGEN	The regulator supplies 100% pure oxygen at all altitudes.
NORMAL OXYGEN	The regulator supplies oxygen mixed with cabin ambient air at a ratio varying with altitude to the masks. Above 28,000 feet, oxygen under pressure is supplied to the masks.

4. SUPPLY TOGGLE

ON	Oxygen is supplied to the regulator.
OFF	Oxygen to the regulator is shut off.

5. REGULATED OXYGEN PRESSURE GAUGE

The meter indicates the oxygen pressure in the supply line to the regulator.

SECTION 21

POWER PLANT

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SECTION 22: POWER PLANT

GENERAL

The airplane is equipped with two axial-flow, bypass, turbofan, Pratt and Whitney JT8D engines, which have a normal static take-off thrust rating of 20,000 pounds and a maximum take-off thrust rating of 20,850 pounds.

The JT8D axial flow turbofan engine utilizes a 14-stage split compressor, a 4-stage split turbine, a 9-can combustion chamber, two integral accessory drive cases, and a full length integral fan annular discharge duct.

An automatic reserve thrust (ART) system is installed. In the event of an engine failure, the ART system increases the thrust on the remaining engine (not simulated).

Engine Starting

Either engine may be started by using a pneumatic ground supply or by pneumatic supply from the auxiliary power unit. When one engine is operating, the opposite engine may be started by using the pneumatic crossfeed system.

An electrically controlled, pneumatically actuated starter air shutoff valve on each engine controls the starter of the respective engine.

Ignition Systems

Two ignition systems, one 20-Joule (high energy ignition system) and one four-Joule (low energy ignition system), are provided for each engine. An IGN (ignition) switch is provided on the ENG panel for ignition system selection.

IGN switch position:

OVRD — High energy ignition is supplied to both ignitors on both engines, regardless of fuel lever and engine starter positions.

CONTIN — Low energy ignition is supplied to a single ignitor on the engine, depending on fuel lever position.

With the engine starter switches in GND or FLT, high energy ignition is supplied to both ignitors on the engine, depending on fuel lever position.

Engine Oil System

Oil is pumped from the oil tank by the main oil pump and delivered to the system through an oil filter. Oil quantity is sensed in the oil tank and displayed on the OIL QUANTITY gauge.

Engine Fuel System

Fuel, from the fuel supply system, passes through the engine driven first stage centrifugal pump. From the pump, the fuel flows through the air/fuel heat exchanger. The fuel is then filtered before entering the fuel control valve. The fuel may bypass the filter if it becomes clogged. A fuel flow transmitter measures fuel delivered from the fuel control to the engine.

Thrust Reversers

Two thrust reverser doors (each engine) provide the means for directing fan air and exhaust gases. The thrust reverser direct flow for reverse engine thrust, to achieve aircraft ground deceleration.

When the thrust reverser unlatches, an amber ENG REVERSE UNLOCK light on the center instrument panel comes on. When the reverser is fully extended, a blue ENG REVERSE THRUST light on the center instrument panel comes on.

Engine Synchronizer System

The engine synchronizer system automatically matches the N_1 or N_2 RPM speed of both engines provided the N_1's or N_2's (as selected) are within 1% of each other when the synchronizer is turned on.

An ENG SYNC ON annunciator light on the overhead panel will come on when the landing gear handle is in the down position and the ENG SYNC selector is in the N_1 or N_2 position.

Note: The ENG SYNC switch must be OFF during takeoff, landing, thrust reverse operation, or when the airplane is below 1500ft AGL.

Automatic Reserve Thrust (ART).

The ART system provides for the automatic detection of an engine failure during takeoff and a subsequent thrust increase on the operating engine.

The ART system consists of a two position switch and three annunciator lights. A green ready light comes on when the ART self test has been completed. The amber ART light comes on when the system has detected an engine failure (one N_1 30% less than the other N_1).

When ART has been activated:

- Fuel control is adjusted to a thrust schedule resulting in an 850 pound increase in thrust.
- Operating engine instruments display an increase in N_1, N_2, EPR and fuel flow.
- EPR LIM readout will display a computed reserve thrust EPR LIM.
- EPR reference bug will be set according to computed reserve thrust EPR LIM.

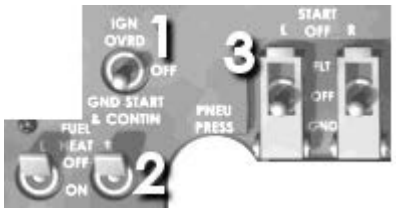
An amber ART INOP light on the overhead annunciator panel indicates a failure in the ART system, or the ART switch is in the OFF position.

System operation is fully automatic with the ART switch in the AUTO position. Self test will be initiated with the airplane on the ground, both engines running and slats extended. With the green READY light on, the ART system is armed when power on both engines is advanced beyond 64% N_1. After takeoff, the ART system is disarmed when slats are retracted. However, the ART system will also disarm if both engines are retarded to below 58% N_1. When disarmed by slat retraction, the system can only be rearmed with the airplane on the ground. When disarmed by power reduction, the READY light will come on, and the system will rearm when power on both engines is advanced beyond 64% N_1.

Approach Idle

Five seconds after the nose gear indicates down and locked, the engines shift from normal idle to approach idle. Approach idle RPM is approximately 10% higher than normal idle RPM. During landing, five seconds after nose strut compression, the engines shift back to normal idle. Approach idle is currently not simulated in this panel.

CONTROLS AND INDICATORS



1. ENG IGN SWITCH

OVRD	Provides power to high energy ignitors in both engines, bypassing start switches and fuel levers.
OFF	Power is removed from all ignitors with start switch and fuel lever in OFF.
CONTIN	Provides power to low energy ignitors with fuel control levers in ON.

2. FUEL HEAT SWITCH (L, R)

ON	(Momentary) Timer is energized for one minute, opening shutoff valve, supplying hot air to air/fuel heat exchanger. FUEL HEAT ON annunciator light comes on.
OFF	Removes power from fuel heat circuit.

3. ENGINE START SWITCH (L, R)

FLT	Provides power to high energy ignitors with fuel lever on.
OFF	Removes power from ignitors and engine start valve.
GND	Provides power to high energy ignitors with fuel lever on. Provides power to open start valve. The START VALVE OPEN annunciator light will come on when the start valve is open.

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1. ENG SYNC SELECTOR

OFF Engine RPM synchronization system is disabled.

N_1 Left engine N_1 RPM is matched to right engine N_1 RPM.

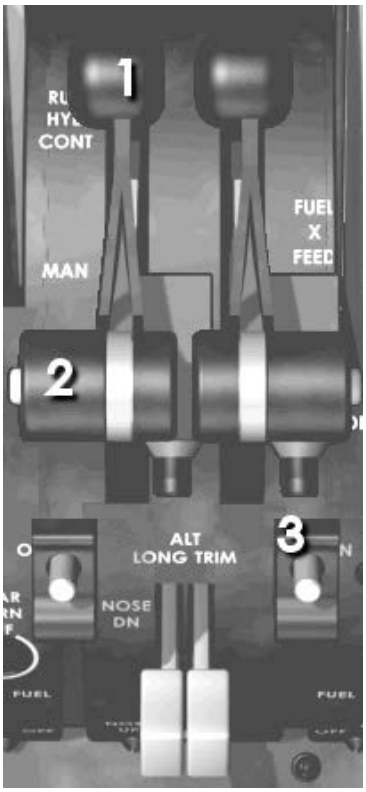
N_2 Left engine N_2 RPM is matched to right engine N_2 RPM.

2. ENG REVERSE THRUST LIGHT (L, R) (Blue)

Comes on when thrust reverser doors are fully extended.

3. ENG REVERSE UNLOCK LIGHT (L, R) (Amber)

Comes on when thrust reverser are unlatched and extending.



1. THRUST REVERSER LEVER (L, R)

Moving thrust reverser lever aft actuates thrust reverser.

2. THROTTLE (L, R)

Each throttle is cable connected to its respective engine fuel control unit to regulate engine thrust.

3. FUEL LEVER

ON Completes ignition circuit, then turns on fuel.

OFF Shuts off fuel, then shuts off ignition.

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1. EPR POINTER
Indicates current operating EPR of engine. Digital EPR readout displays corresponding value.

2. CMD EPR REFERENCE READOUT
Digital readout of EPR reference as set with EPR reference set knob. EPR reference bug is set in correspondence with CMD EPR Reference readout. A mask will cover the numbers when EPR reference set knob is pushed in.

3. EPR REFERENCE BUG
Indicates reference EPR. Manually set with the EPR reference set knob, or automatically set according to the selected EPR limit thrust mode on the Thrust Rating Indicator.

4. EPR READOUT
Digital readout of current operating EPR of engine. EPR pointer displays corresponding value.

5. EPR REFERENCE SET KNOB
Pull out knob to unmask CMD EPR reference readout. Rotate knob to set desired EPR reference readout. When knob is pushed in, a mask will cover the CMD EPR reference readout, and the EPR reference bug will be set to an EPR value applicable to the selected EPR limit thrust mode selected on the Thrust Rating Indicator.

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1. N1 TACHOMETER (L, R)
Indicates RPM of N_1 compressor stage. Small dial is graduated in 1% increments. Large dial is graduated in 2% increments.

2. N2 TACHOMETER (L, R)
Indicates RPM of N_2 compressor stage. Small dial is graduated in 1% increments. Large dial is graduated in 2% increments.

3. EGT GAUGE (L, R)
Indicates exhaust gas temperature in centigrade.

4. FUEL FLOW GAUGE/FUEL USED READOUT (L, R)
Dial indicates fuel flow rate delivered to engine. Digital readout indicates total fuel used by engine.

5. FUEL TEMP GAUGE (L, R)
Indicates temperature of fuel after fuel has flowed through the air/fuel heat exchanger.

1. OIL PRESS GAUGE (L, R)
Indicates oil pressure in distribution lines on engine side of main oil filter.

2. OIL TEMP GAUGE (L, R)
Indicates temperature of oil that has passed through fuel/oil cooler.

3. OIL QUANTITY GAUGE (L, R)
Indicates usable oil in tank.

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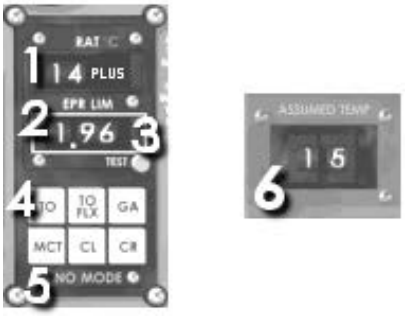

1. RAT READOUT
Displays digital readout of RAM air temperature.

2. EPR LIM READOUT
Displays digital readout of EPR limit for selected operating mode.

3. TEST BUTTON
Pushing the button causes a 12 PLUS to be displayed in the RAT readout, and a 2.04 value to be displayed in the EPR LIM readout. All lights should be off. When the button is released, the EPR LIM flag will appear, the NO MODE light will come on, and all mode buttons will be off.

4. TRI MODE SELECT BUTTONS

TO — If the ART switch is in AUTO, pushing the TO mode button will cause the max take-off EPR limit to be displayed on the EPR LIM readout. If the ART switch is in the OFF position, pushing the TO mode button will cause a computed reserve thrust EPR limit to be displayed on the EPR LIM readout.

TO FLX — Pushing the TO FLX mode button will cause a reduced EPR limit to be displayed on the EPR LIM readout. Reduced EPR limit is determined by selecting an assumed temperature that is higher than ambient temperature.

GA — Pushing the GA mode button will cause EPR limit for go-around mode to be displayed on the EPR LIM readout.

MCT — Pushing the MCT mode button will cause EPR limit for max continuous thrust mode to be displayed on the EPR LIM readout.

CL — Pushing the CL mode button will cause EPR limit for climb thrust mode to be displayed on the EPR LIM readout.

CR — Pushing the CR mode button will cause EPR limit for cruise thrust mode to be displayed on the EPR LIM readout.

5. NO MODE ANNUNCIATOR LIGHT
Comes on to indicate no EPR mode has been selected. The NO MODE light is also accompanied by the EPR LIM flag covering the EPR LIM readout.

6. ASSUMED TEMPERATURE SELECTOR
Rotate thumbwheels to set assumed temperature for the TO FLX mode. Temperatures from 0 to 59°C or 0 to 140°F can be selected.

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1. ART SWITCH

AUTO Automatic Reserve Thrust system is enabled. If engine failure occurs during take-off, operating engine will automatically provide EPR limit, corresponding to thrust increase.

OFF Automatic Reserve Thrust system is disabled.

2. READY and ART Lights

READY (Green) Comes on to indicate self test of ART system is performed properly.

ART (Amber) Comes on to indicate an engine failure has been detected by a sensor, and the Automatic Reserve Thrust system has been actuated.

WARNING AND CAUTION LIGHTS

29 & 36. FUEL HEAT ON (L, R) (Blue)
Comes on to indicate bleed air supply to air/fuel heat exchanger is open.

30. ENG SYNC ON Light (L, R)
Comes on to indicate ENG SYNC switch is selected to N_1 or N_2 when landing gear handle is in the down position.

31 & 38. L/R START VALVE OPEN (Amber)
Comes on to indicate the engine starter valve is open, allowing bleed air to flow into the compressor stage of the turbine.

34 & 41. INLET FUEL PRESS LOW (L, R)
Comes on to indicate low fuel pressure at engine. MASTER CAUTION light also comes on.

37. ART INOP
Comes on to indicate a failure has been detected in the ART system, or the ART switch is in the OFF position.

SECTION 22

RADAR

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SECTION 23: RADAR

GENERAL

General

A color weather radar system displays weather and ground targets at up to 320 nautical miles range.

Antenna

The radar antenna is gyro stabilized in pitch and roll. The antenna tilt is controllable from 15 degrees up, to 15 degrees down.

Indicator

The digital indicator displays weather or mapping targets in green, yellow and red colors. Areas of light precipitation or ground targets with low level reflectivity are represented by green areas on the display. Areas of lower density precipitation or ground targets with moderate reflectivity are represented by yellow areas on the display. Areas of high density precipitation or ground targets with high reflectivity are represented by red areas on the display.

Note:

In this panel the targets displayed on the radar screen are not a true representation of the current weather system in the simulator.

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CONTROLS AND INDICATORS

1. BRT (Brightness) CONTROL
Adjusts the intensity of the display. Currently not simulated.

2. RANGE SELECTOR
Selects the range to be displayed.

10	10NM range with 2 range marks at 5NM intervals.
20	20NM range with 2 range marks at 10NM intervals.
40	40NM range with 4 range marks at 10NM intervals.
80	80NM range with 4 range marks at 20NM intervals.
160	160NM range with 4 range marks at 40NM intervals.
320	320NM range with 4 range marks at 80NM intervals.

3. GAIN CONTROL
Adjusts radar receiver sensitivity. Currently not simulated.

4. MODE SELECTOR

OFF	Turns the radar system off.
TEST	The indicator displays a test pattern consisting of three arcs; green, yellow and red.
WX	The indicator displays areas of high density precipitation in red, lower density precipitation in yellow and light precipitation in green.
TURB	Not simulated.
MAP	Not simulated.

5. STAB SWITCH

ON	Engages antenna gyro stabilization, which compensates for airplane roll and pitch.
OFF	Disengages antenna gyro stabilization. The antenna is aligned to the airplane fuselage reference plane.

6. ANTENNA TILT CONTROL
The tilt control switch is used to vary the vertical scan plane of the outgoing radar beam. Tilt limits are from 15° down to 15° up.

7. DIGITAL RANGE (RNG) READOUT (Blue)
Indicates selected range on the Range Selector.

8. SELECTED MODE READOUT
Indicates selected mode on the Mode Selector.

9. DIGITAL RANGE MARK (MRK) READOUT (Blue)
Indicates the distance between each range mark.

10. ANTENNA TILT READOUT (Blue)
Indicates the antenna tilt angle up or down.

11. WEATHER OR GROUND TARGET
Areas of light precipitation or ground targets with low level reflectivity are represented by green areas on the display.

Areas of lower density precipitation or ground targets with moderate reflectivity are represented by yellow areas on the display.

Areas of high density precipitation or ground targets with high reflectivity are represented by red areas on the display.

12. RANGE MARKS (Blue)

13. AZIMUTH MARKS (Blue)

SECTION 23

PERFORMANCE

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SECTION 24: PERFORMANCE

GENERAL

Standard Take-Off Thrust

In general, standard take-off thrust should be used where permitted. The use of standard thrust will improve engine reliability, lengthen engine life, and substantially reduce operating costs by reducing peak pressures and temperatures

If an engine failure occurs during the take-off roll at or after V_1, standard thrust on the remaining engine will satisfy the take-off requirements.

Some conditions which prohibit the use of standard thrust:

- Tailwind
- Snow, slush, ice or standing water on the runway
- De-ice/anti-ice fluid has been applied and temperatures at or below 6°C/42°F
- Engine anti-ice ON
- MEL item that requires a take-off weight penalty
- Actual TOW from load close-out or ACARS is greater that assumed TOW

In the above conditions, a higher than standard thrust take-off setting may be required.

Cruise Information

Cruise EPR tables are provided for various Mach numbers and True airspeeds at standard temperature.

The Long Range Cruise table permits determination of the most economical cruise (most NM flow per thousand pounds of fuel burned).

A 320 knots cruise table is provided for use at altitudes below the 320 knots/Mach crossover altitude.

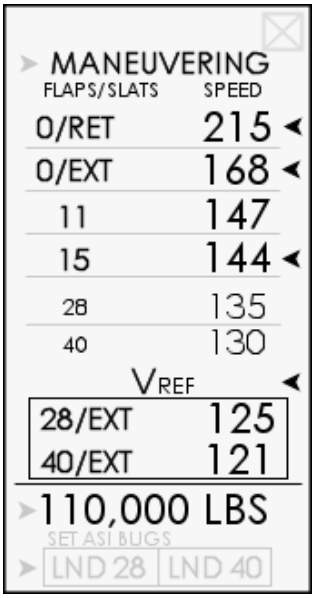
Speed Cards

Two sets of quick reference Speed Cards are available to the pilots. One set for take-off and a second set for maneuvering/landing.

The take-off Speed Cards provide the pilots with various take-off speeds, such as for example V_1, V_R and V_2, for various aircraft configurations and weights.

The maneuvering/landing Speed Cards provide the pilots with various maneuvering/landing speeds, such as for example V_{REF}, for various aircraft configurations and weights.

Sample speed card:



Using the Speed Cards:

1. Click the header to switch between Take-off and Maneuvering.
2. Click the weight to increase or decrease the aircraft weight.
3. Click the bottom flap setting boxes to transfer the speeds on the speed card, for the selected configuration, to the Airspeed Indicator bugs. The speeds pointed to by the black arrowheads will be transferred to the ASI.

TAKE-OFF

TAKE-OFF STABILIZER SETTINGS

	ALL UNITS ARE AIRPLANE NOSE UP			
	TAKE-OFF FLAP SETTINGS			
CENTER OF GRAVITY % MAC	4	11	17	24
00	8.4	9.5	9.9	9.9
01	8.1	9.3	9.9	9.9
02	7.9	9.1	9.9	9.9
03	7.7	8.8	9.6	9.9
04	7.5	8.5	9.3	9.9
05	7.3	8.2	9.0	9.9
06	7.1	7.9	8.7	9.9
07	6.9	7.7	8.4	9.5
08	6.6	7.4	8.1	9.1
09	6.3	7.1	7.9	8.8
10	6.1	6.9	7.6	8.5
11	5.8	6.6	7.3	8.1
12	5.6	6.3	7.1	7.7
13	5.4	6.0	6.8	7.4
14	5.2	5.8	6.5	7.1
15	5.0	5.6	6.2	6.7
16	4.8	5.3	5.9	6.4
17	4.6	5.0	5.6	6.1
18	4.4	4.8	5.3	5.8
19	4.2	4.6	5.0	5.5
20	4.0	4.4	4.8	5.2
21	3.7	4.1	4.5	4.8
22	3.5	3.8	4.1	4.5
23	3.3	3.6	3.9	4.2
24	3.1	3.4	3.6	3.9
25	2.9	3.2	3.4	3.6
26	2.6	2.9	3.1	3.3
27	2.4	2.6	2.8	3.0
28	2.2	2.3	2.5	2.7
29	2.0	2.1	2.2	2.4
30	1.8	1.9	2.0	2.1
31	1.5	1.6	1.7	1.8
32	1.3	1.4	1.5	1.6
33	1.1	1.2	1.3	1.3
34	0.9	0.9	1.0	1.0
35	0.9	0.9	1.0	1.0

RESERVE TAKE-OFF EPR

BASED ON:
AC Pack ON.
Airfoil Anti-Ice ON or OFF.
Engine Anti-Ice ON or OFF.

CORRECTION:
AC Pack OFF +0.025

OAT °F	PRESSURE ALTITUDE - 1000 FEET						
	-1000	SL	1000	2000	3000	4000	> 5000
< 60	1.94	1.98	2.00	2.02	2.04	2.05	2.07
70	1.94	1.98	2.00	2.02	2.04	2.05	2.06
80	1.94	1.98	2.00	2.02	2.02	2.02	2.02
90	1.94	1.96	1.97	1.97	1.97	1.97	1.97
100	1.91	1.81	1.91	1.91	1.91	1.91	1.91
110	1.87	1.87	1.87	1.87	1.87	1.87	1.87
120	1.83	1.83	1.83	1.83	1.83	1.83	1.83
122	1.82	1.82	1.82	1.82	1.82	1.82	1.82
130	1.78	1.78	1.78	1.78	1.78	1. 78	1.78
140	1.72	1.72	1.72	1.72	1.72	1.72	1.72

RESERVE TAKE-OFF N_1

BASED ON:
AC Pack ON.
Airfoil Anti-Ice ON or OFF.
Engine Anti-Ice ON or OFF.

CORRECTION:
AC Pack OFF +0.9%

OAT °F	PRESSURE ALTITUDE - 1000 FEET						
	-1000	0	1000	2000	3000	4000	>5000
- 40	81.0	83.1	83.8	84.9	85.8	86.8	87.8
- 30	81.9	84.0	84.8	85.9	86.8	87.9	88.9
- 20	82.9	85.0	85.8	86.9	87.8	88.9	89.9
-10	83.8	86.0	86.8	87.9	88.8	89.9	90.9
0	84.8	86.9	87.7	88.9	89.8	90.9	91.9
10	85.7	87.9	88.7	89.8	90.8	91.9	92.9
20	86.6	88.8	89.6	90.8	91.7	92.8	93.9
30	87.5	89.7	90.5	91.7	92.7	93.8	94.9
40	88.4	90.6	91.5	92.7	93.6	94.8	95.8
50	89.3	91.5	92.4	93.6	94.6	95.7	96.8
60	90.1	92.4	93.3	94.5	95.5	96.6	97.7
70	91.0	93.3	94.2	95.4	96.4	97.6	97.7
80	91.8	94.2	95.1	96.3	96.4	96.4	96.4
90	92.7	93.7	94.5	94.5	94.5	94.5	94.5
100	92.3	92.3	92.2	92.2	92.2	92.2	92.2
110	91.5	91.5	91.5	91.5	91.5	91.5	91.5
120	90.9	90.9	90.9	90.9	90.9	90.9	90.9
122	90.8	90.8	90.8	90.8	90.8	90.8	90.8

MAX TAKE-OFF EPR

BASED ON:
AC Pack ON.
Airfoil Anti-Ice ON or OFF.
Engine Anti-Ice ON or OFF.

CORRECTION:
AC Pack OFF +0.025

OAT	PRESSURE ALTITUDE - 1000 FEET						
°F	-1000	SL	1000	2000	3000	4000	> 5000
< 60	1.88	1.93	1.95	1.97	1.99	2.02	2.04
70	1.88	1.93	1.95	1.97	1.99	2.02	2.02
80	1.88	1.93	1.95	1.97	1.98	1.98	1.98
90	1.88	1.90	1.92	1.92	1.92	1.92	1.92
100	1.86	1.86	1.86	1.86	1.86	1.86	1.86
110	1.81	1.81	1.81	1.81	1.81	1.81	1.81
120	1.77	1.77	1.77	1.77	1.77	1.77	1.77
122	1.76	1.76	1.76	1.76	1.76	1.76	1.76

MAX TAKE-OFF N_1

BASED ON:
AC Pack ON.
Airfoil Anti-Ice ON or OFF.
Engine Anti-Ice ON or OFF.

CORRECTION:
AC Pack OFF +0.9%

OAT	PRESSURE ALTITUDE - 1000 FEET						
°F	-1000	0	1000	2000	3000	4000	> 5000
-40	78.8	80.6	81.6	82.6	83.6	84.7	85.9
-30	79.7	81.6	82.6	83.6	84.6	85.7	86.9
-20	80.7	82.5	83.5	84.6	85.6	85.7	87.9
-10	81.6	83.5	84.5	85.5	86.5	87.7	88.9
0	82.5	8't.4	85.4	86.5	87.5	88.6	89.9
10	83.4	85.3	86.3	87.4	88.4	89.6	90.9
20	84.3	86.2	87.3	88.3	89.4	90.6	91.8
30	85.1	87.1	88.2	89.2	90.3	91. 5	92.8
40	86.0	88.0	89.1	90.1	91.2	92.4	93.7
50	86.9	88.9	89.9	91.0	92.1	93.3	94.7
60	87.7	89.7	90.8	91.9	93.0	94.3	95.6
70	88.5	90.6	91.7	92.8	93.9	95.2	95.3
80	89.4	91.4	92.6	93.7	93.8	93.8	93.8
90	90.2	90.9	91.9	91.9	91.9	91.9	91.9
100	90.3	90.3	90.3	90.3	90.3	90.3	90.3
110	89.7	89.7	89.7	89.7	89.7	89.7	89.7
120	89.1	89.1	89.1	89.1	89.1	89.1	89.1
122	89.0	89.0	89.0	89.0	89.0	89.0	89.0

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V_1 – V_R – V_2 – DEPARTURE SPEEDS - FLAPS 4 AND 11

	PRESS ALT 1000 FT	TEMPERATURE - °F																	
	7 to 8 6 to 7										76 or less			76 or less 77 to 85			77 to 85 86 to 94		
	5 to 6 4 to 5							67 or less 85 or less			68 to 85 86 to 94			86 to 94 95 to 103			95 to 103 104 to 122		
	3 to 4 2 to 3	76 or less			76 or less 77 to 85			77 to 85 86 to 94			86 to 94 95 to 103			95 to 103 104 to 122			104 to 122		
	1 to 2 -1 to 1	85 or less 94 or less			86 to 94 95 to 103			95 to 112 104 to 112			113 to 122 113 to 122								
	TOGW 1000 LBS	**V_1**	**V_R**	**V_2**	**V_1**	**V_R**	**V_2**	**V_1**	**V_R**	**V_2**	**V_1**	**V_R**	**V_2**	**V_1**	**V_R**	**V_2**	**V_1**	**V_R**	**V_2**
FLAPS 4	90	112	122	130	113	122	130	114	123	130	115	124	130	116	124-	130	116	125	130
	100	121	129	138	122	130	138	123	131	138	125	132	138	126	132	138	127	132	138
	110	129	137	145	131	137	145	132	138	145	133	138	145	134	139	145	135	140	145
	120	137	145	152	138	145	152	139	145	152	141	146	152	142	146	152	143	147	152
	130	145	151	158	146	151	158	147	152	158	149	153	158	150	153	158	151	153	158
	140	152	158	164	153	158	164	155	158	164	157	158	164	157	159	164	158	160	164
	150	158	164	170	160	165	170	161	165	170	163	165	170	164	166	170	166	167	170
	160	167	170	177	168	170	177	170	171	177	172	172	177	173	173	177	175	175	177
FLAPS 11	90	130	119	127	103	117	125	104	115	123	106	115	121	107	115	121	108	115	121
	100	111	121	129	112	119	127	113	119	127	114	119	127	115	121	127	116	122	127
	110	119	125	133	120	125	133	121	126	133	122	126	133	123	127	133	124	128	133
	120	125	131	139	126	132	139	128	132	139	129	132	139	130	133	139	130	134	139
	130	132	137	144	133	138	144	135	138	144	136	138	144	137	139	144	138	139	144
	140	138	143	150	140	144	150	142	144	150	143	144	150	144	147	150	145	148	150
	150	145	149	155	146	149	155	148	149	155	149	149	155	150	150	155	152	152	155
	160	152	154	161	154	154	161	155	155	161	157	157	161	158	158	161	160	160	161

V_1 SLOPE CORRECTION:
+3 KTS EACH 1% UPSLOPE
-1.5 KTS EACH 1% DOWNSLOPE

DEPARTURE SPEEDS:

	GROSS WEIGHT - 1000 POUNDS							
	90	100	110	120	130	140	150	160
0/EXT FLAP RET.	V_2 + 5							
0/ RET SLAT RET.	157	165	173	181	188	195	202	209
0/RET MIN. MAN.	194	205	215	225	234	243	251	260

TARGET PITCH ATTITUDE:

TOGW 1000 LBS	FLAPS 4	FLAPS 11
	PITCH ATTITUDE - °	
90	24	23
110	22	21
130	20	19
150	18	17
160	16	15

NOTES:
Target Pitch Attitudes are approximate sea level reference in degrees for a V_2 + 5 climb.

V_1, V_R and V_2 values that fall in the shaded area, must be compared to the Minimum V_1/V_{MCG}, V_R and V_2 table values.

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V_1 – V_R – V_2 – DEPARTURE SPEEDS - FLAPS 17 AND 24

	PRESS ALT 1000 FT	TEMPERATURE - °F																	
	7 to 8 6 to 7										76 or less			76 or less 77 to 85			77 to 85 86 to 94		
	5 to 6 4 to 5							67 or less 85 or less			68 to 85 86 to 94			86 to 94 95 to 103			95 to 103 104 to 122		
	3 to 4 2 to 3	76 or less			76 or less 77 to 85			77 to 85 86 to 94			86 to 94 95 to 103			95 to 103 104 to 122			104 to 122		
	1 to 2 -1 to 1	85 or less 94 or less			86 to 94 95 to 103			95 to 112 104 to 112			113 to 122 113 to 122								
	TOGW 1000 LBS	**V_1**	**V_R**	**V_2**	**V_1**	**V_R**	**V_2**	**V_1**	**V_R**	**V_2**	**V_1**	**V_R**	**V_2**	**V_1**	**V_R**	**V_2**	**V_1**	**V_R**	**V_2**
F	90	99	115	126	99	116	124	100	114	122	102	112	120	103	110	118	104	108	116
L	100	106	115	126	107	116	124	108	114	122	109	112	122	110	110	122	111	114	122
A	110	114	120	128	115	120	128	115	120	128	116	120	128	117	120	128	118	121	128
P	120	120	126	134	122	127	134	123	127	134	124	127	134	125	128	134	126	128	134
S	130	127	132	139	129	132	139	130	132	139	132	133	139	133	133	139	135	135	139
	140	134	138	145	135	138	145	137	138	145	139	139	145	140	140	145	142	142	145
17	150	141	144	150	143	144	150	144	145	150	146	146	150	148	148	150	150	150	1'50
F	90	95	115	123	96	113	120	97	111	118	96	109	115	99	109	116	100	109	116
L	100	102	115	123	103	113	120	104	111	118	106	109	116	107	109	116	107	109	116
A	110	109	115	123	110	114	122	111	115	122	111	115	122	112	115	122	112	115	122
P	120	116	121	128	116	121	128	116	121	128	117	121	129	119	122	128	120	122	128
S	130	122	126	133	123	126	133	125	126	133	127	127	133	128	128	133	130	130	133
	140	129	131	138	130	131	138	132	132	138	134	134	138	135	135	138	137	137	138
24	150	136	137	143	137	137	143	139	139	143	141	141	143	142	142	143	146	146	146

V_1 SLOPE CORRECTION:
+3 KTS EACH 1% UPSLOPE
-1.5 KTS EACH 1% DOWNSLOPE

DEPARTURE SPEEDS:

	GROSS WEIGHT - 1000 POUNDS						
	90	100	110	120	130	140	150
0/EXT FLAP RET.	V_2 + 15						
0/ RET SLAT RET.	157	165	173	181	188	195	202
0/RET MIN. MAN.	194	205	215	225	234	243	251

TARGET PITCH ATTITUDE:

TOGW 1000 LBS	FLAPS 17 and 24
	PITCH ATTITUDE - °
90	22
110	20
130	18
150	16

NOTES:
Target Pitch Attitudes are approximate sea level reference in degrees for a V_2 + 10 climb.

V_1, V_R and V_2 values that fall in the shaded area, must be compared to the Minimum V_1/V_{MCG}, V_R and V_2 table values.

MINIMUM V_1/V_{MCG}

OAT	PRESSURE ALTITUDE				
°F	-1000 TO S.L.	2000	4000	6000	8000
-40 TO 65	116	113	111	107	103
70	116	113	111	106	102
80	116	113	109	104	101
90	115	111	107	103	99
100	113	108	104	100	97
110	110	106	102	98	-
120	108	103	-	-	-
122	107	103	-	-	-

MINIMUM V_R

OAT	PRESSURE ALTITUDE				
°F	-1000 TO S.L.	2000	4000	6000	8000
-40 TO 65	121	119	117	114	110
70	121	119	117	112	109
80	121	119	115	111	107
90	120	117	112	109	105
100	118	114	110	106	103
110	116	112	108	104	-
120	114	110	-	-	-
122	113	109	-	-	-

MINIMUM V_2

OAT	PRESSURE ALTITUDE				
°F	-1000 TO S.L.	2000	4000	6000	8000
-40 10 65	131	127	124	121	117
70	131	127	124	120	116
80	131	127	123	119	114
90	130	125	121	117	112
100	127	122	118	114	110
110	125	120	115	112	-
120	122	118	-	-	-
122	121	117	-	-	-

NOTE:

When comparing calculated V_1/V_{MCG}, V_R and V_2 to Minimum V_1/V_{MCG}, V_R and V_2, use the greater value.

Minimum V_1/V_{MCG}, V_R and V_2 are applicable for all flap settings.

CLIMB

MAX CLIMB EPR

BASED ON:
AC Pack ON.
Airfoil Anti-Ice OFF.
Engine Anti-Ice OFF.

CORRECTION:
AC Pack OFF below 1000 feet-0.9%
Engine Anti-Ice -0.08
Airfoil Anti-Ice
2 Engines Operating -0.02
1 Engines Operating -0.04

PRESS ALT- FEET	-20 AND BELOW	RAT - °C -10	0	+10	+20	+30	+40	+50
SL	1.96	1.96	1.92	1.86	1.78	1.74	1.73	1.61
1000	1.97	1.97				1.75		
2000	2.00	1.99				1.77		
3000	2.02					1.78		
4000	2.04				1.79	1.79		
5000	2.06				1.80	1.80		
10000	2.06				1.84	1.82		
15000	2.05			1.88	1.88	1.81		
20000		1.98	1.91	1.90	1.87	1.80		
25000		1.98	1.97	1.94	1.87	1.80		
30000 AND ABOVE		2.02	2.00	1.94				

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MAX CONTINUOUS EPR

BASED ON:
AC Pack ON.

PRESS ALT 1 000 FT	RAM AIR TEMP - °C									
	-7 & BELOW	0	+10	+15	+18	+20	+30	+40	+41.5	+50
0	1.96	1.92	1.86	1.82	1.82	1.82	1.82	1.82	1.82	1.76
699	1.97	1.92	1.86	1.82	1.82	1.82	1.82	1.82	1.82	1.76
700	1.97	1.97	1.97	1.97	1.97	1.96	1.90	1.83	1.82	1.76
1000	1.98	1.98	1.98	1.98	1.98	1.96	1.9Q	1.83	1.82	1.76
2000	2.00	2.00	2.00	1.99	1.98	1.96	1.90	1.83	1.82	1.76
3000	2.02	2.02	2.00	1.99	1.98	1.96	1.90	1.83	1.82	1.76
4000	2.04	2.04	2.00	1.99	1.98	1.96	1.90	1.83	1.82	1.76
5000	2.06	2.04	2.00	1.99	1.98	1.96	1.90	1.83	1.82	1.76
10000	2.06	2.04	2.00	1.99	1.98	1.96	1.90	1.83	1.82	1.76
15000	2.05	2.03	2.00	1.98	1.97	1.95	1.89	1.82	1.81	1.75
20000	2.04	2.02	1.99	1.97	1.96	1.94	1.88	1.81	1.80	1.74
25000	2.03	2.01	1.98	1.96	1.95	1.93	1.87	1.80	1.79	1.73
30000	2.02	2.00	1.97	1.95	1.94	1.92	1.86	1.79	1.78	1.72
35000	2.01	1.99	1.95	1.94	1.93	1.91	1.85	1.78	1.77	1.71
37000	2.01	1.98	1.95	1.93	1.92	1.91	1.84	1.78	1.77	1.70

ADJUSTMENTS:

A/C PACK OFF

PRESS AL T FEET	ADJ.
SL-10000	+0.02
15000	+0.03
20000	+0.04
25000	+0.05
30000	+0.06
35000 & ABOVE	+0.07

AIRFOIL A/I ON

PRESS ALT FEET	ADJ.
SL - 35000	-0.05
35001 & ABOVE	-0.06

ENGINE A/I ON

PRESS ALT FEET	ADJ.
SL - 37000	-0.08

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CRUISE

MAX CRUISE EPR

BASED ON:
AC Pack ON.
Airfoil Anti-Ice OFF.
Engine Anti-Ice OFF.

PRESS ALT 1000 FEET	-30 AND BELOW	RAT - °C -20	-10	0	+10	+20	+30	+40
5000	2.06	2.00	1.93	1.86	1.79	1.71	1.61	1.52
10000	2.06	2.00	1.93	1.86	1.79	1.71	1.61	1.51
20000	2.04	1.98	1.91	1.84	1.77	1.69	1.59	1.49
23000	2.04	1.97	1.90	1.83	1.77	1.68	1.58	1.49
25000	2.03	1.97	1.90	1.83	1.76	1.68	1.58	1.48
27000	2.05	1.99	1.92	1.85	1.78	1.70		
29000	2.07	2.01	1.93	1.86	1.80	1.71		
31000	2.07	2.01	1.94	1.87	1.80	1.72		
33000	2.07	2.01	1.94	1.87	1.80	1.72		
35000 AND ABOVE	2.06	2.00	1.93	1.86	1.79	1.71		

CORRECTIONS:

A/C Packs OFF:

PRESS ALT	
5000	+0.02
10000	+0.02
20000	+0.04
23000	+0.05
25000	+0.05
27000	+0.03
29000	+0.01
31000	+0.01
33000	+0.01
35000 AND ABOVE	+0.02

Airfoil Anti-Ice ON:
2 Engines Operating

Below 15000	-0.02
Above 15000	-0.03

1 Engine Operating

Below 15000	-0.04
Above 15000	-0.05

Engine Anti-Ice ON:

All Altitudes	-0.08

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320 KNOT CRUISE

BASED ON:
250 KIAS to 10,000 feet.
320 KIAS above 10,000 feet.

PRESS ALT. 1000FT	STD DAY TAS	IAS KTS	STD TEMP °C	GROSS WEIGHT - 1000 LBS.															
				146	142	138	134	130	126	122	118	114	110	106	102	98	94		
25	458	320	-34	1.71 56.2	1.70 56.9	1.69 57.6	1.68 58.3	1.67 58.9	1.66 59.5	1.65 60.2	1.64 60.8	1.63 61.4	1.62 62.0	1.62 62.5	1.61 63.0	1.60 63.5	1.60 64.0	1.59 64.5	
23	445	320	-31	1.65 55.0	1.64 55.6	1.63 56.3	1.62 56.9	1.61 57.5	1.60 58.0	1.60 58.6	1.59 59.1	1.58 59.6	1.57 60.2	1.57 60.7	1.56 61.2	1.56 61.7	1.55 62.2	1.55 62.7	
21	432	320	-27	1.60 53.2	1.59 53.8	1.58 54.3	1.57 54.8	1.57 55.4	1.56 56.0	1.55 56.5	1.55 57.0	1.54 57.6	1.53 58.1	1.52 58.6	1.52 59.1	1.51 59.5	1.51 60.0	1.50 60.4	
19	419	320	-23	1.56 51.3	1.55 51.8	1.54 52.3	1.53 52.9	1.53 53.4	1.52 53.9	1.52 54.4	1.51 54.9	1.50 55.4	1.50 55.9	1.49 56.3	1.48 56.6	1.48 57.2	1.47 57.6	1.47 58.1	
17	407	320	-19	1.52 49.6	1.51 50.1	1.50 50.6	1.49 51.0	1.49 51.4	1.48 51.8	1.48 52.2	1.47 52.6	1.47 53.1	1.46 53.6	1.46 54.0	1.45 54.4	1.44 54.8	1.44 55.2	1.43 55.7	
15	395	320	-15	1.48 47.6	1.47 48.1	1.46 48.6	1.45 49.0	1.45 49.4	1.44 49.8	1.44 50.2	1.43 50.6	1.43 51.0	1.42 51.5	1.42 52.0	1.41 52.5	1.41 52.9	1.40 53.4	1.40 53.9	
13	384	320	-11	1.44 45.9	1.43 46.4	1.43 46.8	1.42 47.2	1.42 47.6	1.41 48.0	1.41 48.4	1.40 48.8	1.40 49.2	1.39 49.6	1.39 50.0	1.38 50.4	1.38 50.8	1.37 51.2	1.37 51.6	
11	373	320	-7	1.41 44.2	1.40 44.6	1.39 45.0	1.39 45.4	1.38 45.8	1.38 46.2	1.37 46.6	1.37 47.0	1.36 47.4	1.36 47.8	1.36 48.1	1.35 48.4	1.35 48.8	1.34. 49.2	1.34 49.5	
9	285	250	-3	1.33 41.9	1.32 42.6	1.31 43.3	1.30 44.0	1.29 44.6	1.28 45.2	1.28 45.8	1.27 46.4	1.27 47.0	1.26 47.6	1.26 48.2	1.25 48.8	1.25 49.4	1.24 50.0	1.24 50.6	
7	276	250	1	1.30 39.9	1.29 40.5	1.28 41.1	1.27 41.7	1.27 42.3	1.26 42.9	1.26 43.5	1.25 44.1	1.25 44.7	1.24 45.3	1.24 45.9	1.23 46.5	1.23 47.1	1.22 47.7	1.22 48.3	
5	268	250	5	1.27 37.6	1.26 38.2	1.26 38.8	1.25 39.4	1.25 40.0	1.24 40.6	1.24 41.2	1.23 41.8	1.23 42.4	1.22 43.0	1.22 43.6	1.21 44.2	1.21 44.8	1.20 45.4	1.20 46.0	

1) EPR required.
2) Specific Range (NM/1000 LBS)

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MACH .76 CRUISE

PRESS ALT 1000FT	STD TAS KTS	IAS KTS	STD RAT °C	GROSS WEIGHT – 1000 POUNDS															
				146	142	138	134	130	126	122	118	114	110	106	102	98	94	90	
37	436	245	-33							1) 2)	1.88 79.5	1.85 82.0	1.83 84.0	1.81 86.4	1.79 88.5	1.77 90.5	1.75 92.5	1.73 94.5	1.71 96.3
35	438	257	-30					1.88 72.4	1.86 74.5	1.84 76.2	1.82 78.1	1.79 79.9	1.78 81.5	1.76 83.2	1.74 84.8	1.72 86.4	1.71 87.9	1.69 89.5	1.68 91.2
33	442	269	-26		1.88 66.4	1.86 68.1	1.84 69.5	1.82 71.0	1.80 72.6	1.78 73.9	1.76 75.3	1.75 76.7	1.73 78.0	1.72 79.3	1.70 80.5	1.69 81.9	1.67 83.2	1.66 84.6	1.65 85.9
31	446	281	-21	1.83 63.7	1.81 65.1	1.79 66.4	1.78 67.5	1.76 68.6	1.75 69.7	1.74 70.8	1.72 71.9	1.71 72.9	1.70 74.1	1.68 75.2	1.67 76.3	1.66 77.4	1.65 78.5	1.64 79.6	1.63 80.6
29	450	294	-17	1.78 61.8	1.76 62.8	1.75 63.7	1.74 64.7	1.72 65.6	1.71 66.5	1.70 67.3	1.69 68.3	1.68 69.2	1.67 70.2	1.66 71.1	1.65 72.0	1.64 72.9	1.63 73.7	1.62 74.5	1.61 75.4
27	454	306	-13	1.73 59.3	1.72 60.1	1.71 60.8	1.70 61.5	1.69 62.3	1.68 63.1	1.67 63.9	1.66 64.7	1.65 65.4	1.64 66.2	1.63 66.9	1.62 67.6	1.62 68.3	1.61 69.0	1.60 69.6	1.60 70.3

1) EPR required
2) Specific Range (NM/1000 LBS)

TO OBTAIN TOTAL FUEL FLOW:

Total Fuel Flow = TAS / Specific Range x 1000 (LBS/HR)

Correct STD TAS for deviation from standard temperature before computing total fuel flow. Add 1 KTS for every 1°C above standard temperature, or subtract 1 KTS for every 1°C below standard temperature.

ENGINE ALTITUDE CAPABILITY:

Airplane altitude capability at Mach .76 is not limited by engine performance.

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MACH .77 CRUISE

PRESS ALT 1000FT	STD TAS KTS	IAS KTS	STD RAT °C	GROSS WEIGHT – 1000 POUNDS															
				146	142	138	134	130	126	122	118	114	110	106	102	98	94	90	
37	442	249	-32						1) 2)	1.94 75.1	1.91 77.7	1.88 80.2	1.85 82.5	1.83 84.7	1.80 86.8	1.78 88.8	1.76 90.8	1.75 92.6	1.73 94.5
35	444	261	-29				1.93 68.6	1.91 70.8	1.88 72.8	1.86 74.8	1.84 76.6	1.81 78.3	1.79 80.0	1.78 81.6	1.76 83.2	1.74 84.7	1.73 86.3	1.71 88.0	1.69 89.6
33	448	273	-25	1.92 53.1	1.90 64.9	1.88 66.6	1.86 68.2	1.84 69.7	1.82 71.1	1.80 72.6	1.78 73.9	1.76 75.2	1.75 76.5	1.74 77.8	1.72 79.1	1.71 80.5	1.69 81.8	1.68 83.1	1.66 84.4
31	452	285	-21	1.85 62.6	1.83 63.8	1.81 65.0	1.80 66.2	1.78 67.3	1.77 68.3	1.75 69.5	1.74 70.5	1.73 71.6	1.71 72.8	1.70 73.9	1.69 75.0	1.68 76.1	1.66 77.1	1.65 78.1	1.64 79.1
29	456	298	-16	1.80 60.7	1.78 61.6	1.77 62.5	1.76 63.4	1.74 64.3	1.73 65.2	1.72 66.2	1.71 67.1	1.69 68.0	1.68 68.9	1.67 69.8	1.66 70.7	1.65 71.6	1.64 72.4	1.63 73.2	1.62 74.0
27	460	311	-12	1.75 58.1	1.74 58.9	1.73 59.7	1.72 60.5	1.71 61.2	1.70 62.0	1.69 62.8	1.68 63.5	1.67 64.3	1.66 65.0	1.65 65.7	1.64 66.4	1.63 67.0	1.62 67.7	1.62 68.3	1.61 69.0

1) EPR required
2) Specific Range (NM/1000 LBS)

TO OBTAIN TOTAL FUEL FLOW:

Total Fuel Flow = TAS / Specific Range x 1000 (LBS/HR)

Correct STD TAS for deviation from standard temperature before computing total fuel flow. Add 1 KTS for every 1°C above standard temperature, or subtract 1 KTS for every 1°C below standard temperature.

Example:
FL310
GWT 144,000
RAT -15°C

From chart:
Specific Range = 63.8
RAT -15°C = STD + 6
TAS = 452 + 6 = 458
Total Fuel Flow = 458 / 63.8 x 1000 = 7178 LBS/HR

ENGINE ALTITUDE CAPABILITY:

Airplane altitude capability at Mach .77 is not limited by engine performance.

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MACH .78 CRUISE

PRESS ALT 1000FT	STD TAS KTS	IAS KTS	STD RAT °C	GROSS WEIGHT – 1000 POUNDS 146	142	138	134	130	126	122	118	114	110	106	102	98	94	90
37	447	253	-31							1)	1.94	1.91	1.89	1.86	1.83	1.81	1.79	1.77	1.75
										2)	74.9	77.5	79.9	82.1	84.3	86.5	88.4	90.4	92.3
35	450	264	-29					1.94	1.91	1.89	1.87	1.84	1.82	1.80	1.78	1.76	1.75	1.73	1.72
								68.2	70.3	72.4	74.2	76.0	77.9	79.5	81.1	82.7	84.3	85.9	87.5
33	454	277	-24		1.93	1.91	1.89	1.87	1.85	1.83	1.81	1.79	1.77	1.76	1.74	1.73	1.71	1.70	1.68
					62.6	64.3	66.0	67.5	69.0	70.6	72.0	73.3	74.6	76.0	77.3	78.6	79.9	81.2	82.5
31	458	289	-20	1.88	1.86	1.83	1.81	1.79	1.78	1.76	1.75	1.74	1.72	1.71	1.70	1.68	1.68	1.67	1.66
				60.6	61.8	64.4	65.6	66.7	67.8	68.9	70.0	71.1	72.1	73.2	74.3	75.4	75.4	76.4	77.4
29	462	302	-16	1.82	1.81	1.79	1.78	1.76	1.75	1.74	1.73	1.71	1.70	1.69	1.68	1.67	1.66	1.65	1.64
				59.1	60.0	60.9	61.8	62.8	63.7	64.6	65.5	66.4	67.3	68.3	69.1	69.9	70.8	71.8	72.3
27	466	315	-11	1.78	1.76	1.75	1.74	1.73	1.72	1.71	1.70	1.69	1.68	1.67	1.66	1.65	1.64	1.64	1.63
				56.7	57.5	58.3	59.0	59.8	60.5	61.3	62.1	62.1	63.5	64.2	64.9	65.6	66.2	66.8	67.4

1) EPR required
2) Specific Range (NM/1000 LBS)

TO OBTAIN TOTAL FUEL FLOW:

Total Fuel Flow = TAS / Specific Range x 1000 (LBS/HR)

Correct STD TAS for deviation from standard temperature before computing total fuel flow. Add 1 KTS for every 1°C above standard temperature, or subtract 1 KTS for every 1°C below standard temperature.

ENGINE ALTITUDE CAPABILITY:

PRESS ALT 1000 FT	TEMP DEV FROM STD - °C +5 AND BELOW	+10	+15	+20
	GROSS WEIGHT - 1000 POUNDS			
37	130	128	126	116
35	142	142	136	126
33	149	149	140	134
31	↓	↓	148	146
29			149	146
27			↓	149
25				148

NOTE:
The weights in this table are the maximum gross weights at which Mach .78 can be achieved without exceeding maximum cruise EPR limits.

MACH .80 CRUISE

PRESS ALT 1000FT	STD TAS KTS	IAS KTS	STD RAT °C	GROSS WEIGHT – 1000 POUNDS															
				146	142	138	134	130	126	122	118	114	110	106	102	98	94	90	
37	459	260	-31							1) 2)	2.04 66.6	2.02 68.7	1.99 71.0	1.96 73.7	1.93 73.7	1.89 79.3	1.87 81.5	1.84 83.9	1.82 85.9
35	461	272	-28					2.04 60.5	2.02 62.3	1.99 64.3	1.97 66.4	1.94 68.7	1.91 71.1	1.88 73.2	1.86 74.9	1.84 76.8	1.82 78.6	1.79 80.3	1.78 82.0
33	465	285	-23		2.02 56.6	2.02 57.0	1.99 58.6	1.96 60.4	1.94 62.3	1.92 64.3	1.89 66.1	1.87 67.6	1.84 69.2	1.83 70.6	1.81 72.1	1.79 73.5	1.77 74.9	1.76 76.1	1.74 77.3
31	469	297	-19	1.98 53.9	1.96 55.4	1.94 57.0	1.92 58.6	1.89 60.2	1.87 61.4	1.85 62.8	1.83 64.0	1.82 65.2	1.80 66.4	1.78 67.6	1.77 68.6	1.76 69.7	1.74 70.7	1.73 71.7	1.72 72.6
29	474	311	-16	1.91 53.9	1.89 55.1	1.87 56.1	1.85 57.3	1.84 58.3	1.82 59.3	1.81 60.3	1.79 61.3	1.78 62.2	1.76 63.1	1.75 64.0	1.74 64.8	1.73 65.6	1.72 66.4	1.71 67.2	1.70 67.9

1) EPR required
2) Specific Range (NM/1000 LBS)

TO OBTAIN TOTAL FUEL FLOW:

Total Fuel Flow = TAS / Specific Range x 1000 (LBS/HR)

Correct STD TAS for deviation from standard temperature before computing total fuel flow. Add 1 KTS for every 1°C above standard temperature, or subtract 1 KTS for every 1°C below standard temperature.

ENGINE ALTITUDE CAPABILITY:

PRESS ALT 1000 FT		TEMP DEV FROM STD - °C						
	-15	-10	-5	0	+5	+10	+15	+20
	GROSS WEIGHT - 1000 POUNDS							
37	130	124	124	122	116	114	110	102
35	142	142	142	132	128	128	124	110
33	149	148	144	142	134	128	124	116
31	↓	149	149	149	149	136	130	122
29		↓	↓	↓	↓	142	134	146
27						142	140	126
25						140	124	120

NOTE:

The weights in this table are the maximum gross weights at which Mach .80 can be achieved without exceeding maximum cruise

2 ENGINES LONG RANGE CRUISE

PRESS ALT.	STD	GROSS WEIGHT - 1000 LBS						
1000 IT.	TEMP - °C	150	140	130	120	110	100	90
37	-57			1) 2) 3) 4)	1.89 247 438 78.9	1.82 246 436 84.7	1.76 244 433 90.6	1.69 237 420 96.0
35	-54			1.87 258 440 72.9	1.81 257 438 77.6	1.76 255 435 82.4	1.70 249 424 87.2	1.64 240 409 92.9
33	-50		1.86 270 443 67.6	1.80 270 443 71. 7	1.75 267 438 75.2	1.70 261 428 79.5	1.65 252 413 83.5	1. 59 239 392 88.6
31	-46	1.92 281 445 62.5	1.79 281 445 64.2	1.75 278 441 69.2	1.70 273 433 72.8	1.65 265 420 76.3	1.60 252 399 80.5	1.54 239 379 85.3
29	-42	1.78 293 442 60.4	1.73 289 436 63.0	1.69 286 432 66.3	1.65 276 417 68.9	1.60 265 400 72.2	1.55 251 379 76.5	1.48 234 353 80.7
27	-38	1.72 300 443 59.0	1.69 295 435 61.4	1.64 286 422 64.0	1.62 276 407 67.0	1.55 263 388 70.3	1.49 248 366 74.4	1.45 238 351 78.3
25	-35	1.68 306 438 57.1	1.64 297 425 59.4	1.60 287 411 62.0	1.55 274 392 64.8	1.50 261 374 68.0	1.45 250 358 71.4	1.41 242 346 75.1
23	-31	1.65 312 433 55.3	1.61 300 417 57.6	1.56 285 396 59.8	1.51 273 379 62.8	1.46 259 360 65.8	1.42 250 348 68.7	1.38 245 341 72.3

NOTES:

- The highest altitudes (grey) are optimum.
- Correct STD TAS for deviation from standard temperature before computing total fuel flow. Add 1 KTS for every 1°C above standard temperature, or subtract 1 KTS for every 1°C below standard temperature.
- Reduce specific range by 5% for Engine Anti-Ice ON.
- Reduce specific range by 10% for Engine and Airframe Anti-Ice ON.

ENGINE ALTITUDE CAPABILITY:

Airplane altitude capability at LRC is not limited by engine performance.

CRUISE MACH/280 KIAS DESCENT

BASED ON:

- 800 feet per minute rate of descent at Cruise Mach (0.76) down to Mach Crossover (31,000 feet - 280 KIAS).
- 280 KTS descent thereafter with idle power down to 10,000 feet.
- 250 KTS or less (idle power) below 10,000 feet down to initial approach configuration.
- Clean configuration above 2000 feet.
- Add 80 pounds fuel burn for each minute of terminal area maneuvering.

PRESSURE ALTITUDE FEET	TO SEA LEVEL		
	DISTANCE NM	TIME MINUTES	FUEL POUNDS
37,000	150	27.0	1500
35,000	132	24.5	1320
33,000	115	22.0	1050
31,000	96	19.8	900
29,000	89	18.2	860
27,000	82	17.0	820
25,000	75	16.0	790
23,000	69	15.1	760
21,000	63	14.3	730
19,000	58	13.5	700
17,000	53	12.6	680
15,000	48	11.7	660
13,000	43	10.9	640
11,000	38	10.1	620
10,000	33	9.5	600

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HOLDING SPEEDS AND FUEL FLOW

Holding speeds vary with gross weight and altitude as given in the following chart. These speeds provide the minimum practical fuel flow and corresponding performance (40% stall margin in 30° bank, 50% in level flight) required to guard against speed instability and buffet.

BASED ON:
2 Engines Operating.
Flaps and Gear UP.
AC Pack ON.
Anti-Ice OFF.

PRESS ALT 1000 FT	SID TEMP °C	GROSS WEIGHT - 1000 POUNDS 140	135	130	125	120	115	110	105	100	95	90
		HOLDING SPEED - KIAS. 242	236	233	229	224	220	215	210	205	200	194
37 *	- 57	-	-	-	-	-	5.3	5.0	4.8	4.6	4.3	4.1
35 *	- 54	-	-	-	5.8	5.5	5.2	5.0	4.7	4.5	4.3	4.0
33 *	- 50	6.6	6.3	6.0	5.7	5.5	5.2	5.0	4.7	4.4	4.2	4.0
31	- 46	6.5	6.3	5.9	5.7	5.4	5.1	4.9	4.6	4.4	4.2	4.0
9	- 42	6.4	6.2	5.9	5.7	5.4	5.1	4.9	4.6	4.4	4.2	4.0
27	- 38	6.4	6.2	5.9	5.7	5.4	5.1	4.9	4.6	4.4	4.2	4.0
25	- 35	6.3	6.1	5.9	5.7	5.4	5.1	4.9	4.7	4.4	4.2	4.0
23	- 31	6.3	6.1	5.8	5.6	5.4	5.1	4.9	4.7	4.5	4.3	4.1
21	- 47	6.3	6.1	5.8	5.6	5.4	5.2	5.0	4.8	4.5	4.3	4.1
19	- 23	6.3	6.1	5.9	5.6	5.4	5.2	5.0	4.8	4.6	4.4	4.2
17	- 19	6.4	6.2	6.0	5.7	5.5	5.3	5.1	4.9	4.6	4.4	4.2
15	- 15	6.5	6.3	6.1	5.8	5.6	5.4	5.2	5.0	4.7	4.5	4.3
13	- 11	6.6	6.4	6.2	5.9	5.6	5.4	5.2	5.0	4.8	4.6	4.4
11	- 7	6.7	6.5	6.3	6.0	5.7	5.5	5.3	5.1	4.9	4.7	4.5
9	- 3	6.8	6.6	6.4	6.1	5.8	5.6	5.4	5.2	5.0	4.8	4.6
7	+ 1	6.9	6.6	6.4	6.2	5.9	5.7	5.5	5.3	5.1	4.9	4.7
5	+ 5	7.0	6.7	6.5	6.3	6.0	5.8	5.6	5.4	5.2	5.0	4.8
3	+ 9	7.1	6.7	6.6	6.4	6.1	5.9	5.7	5.5	5.3	5.1	4.9
1	+ 13	7.2	6.8	6.7	6.5	6.3	6.0	5.8	5.6	5.4	5.2	5.0

* Add 5 knots to given holding speed (10 knots for grey box values) when holding above 32,000 feet.

CORRECTIONS:

- Increase/decrease fuel flow by 100 LBS/HR (0.1) for every 1 °C above/below Standard temperature.
- Increase fuel flow by 5%, 200 – 300 LBS/HR (0.2 – 0.3), for Engine Anti-Ice ON.
- Increase fuel flow by 20%, 800 – 1300 LBS/HR (0.8 – 1.3), for Engine and Wing Anti-Ice ON.

NOTE:
Notify ATC when holding at speeds faster than the following ATC holding speeds:

ALTITUDE	ATC HOLDING SPEEDS
SL - 14,000 FEET	230 KNOTS
ABOVE 14,000 FEET	265 KNOTS

ARRIVAL

MINIMUM CONTROL SPEEDS – V_{MCA}

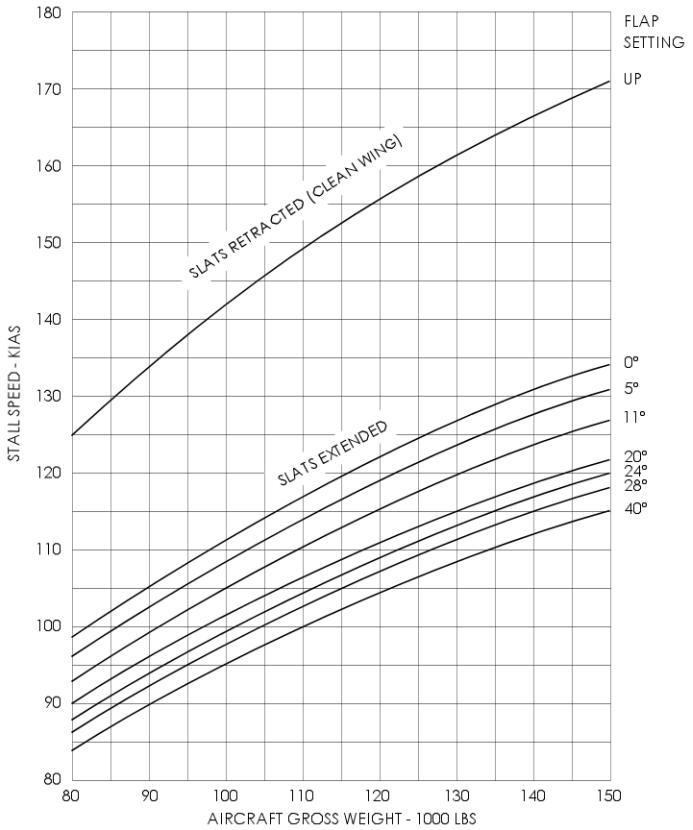
BASED ON:
Slats Extended
One Engine Inoperative.
Max Reserve Thrust
Any Bleed Air Configuration.

TEMP - °F	FLAPS			
	4/EXT	11/EXT	17/EXT	24/EXT
81 & BELOW	119	116	114	111
102	115	113	110	108
122	110	109	107	104

ADJUSTMENTS:

TEMP - °F	KNOTS PER 1000 FT ABOVE S.L.
81 & BELOW	-1.5
82 & ABOVE	-2.0

STALL SPEEDS



GO-AROUND EPR

BASED ON:
Both AC Packs ON.
Engine Anti-Ice ON or OFF.

CORRECTION:

1 AC Pack Only	+0.02
Airfoil Anti-Ice ON	
2 Engines Operating	-0.02
1 Engine Operating	-0.04

AIRPORT PRESS ALT - FT	REPORTED GROUND TEMPERATURE - °F						
	70 AND BELOW	80	90	100	110	120	122
-1000	1.92	1.92	1.92	1.92	1.88	1.83	1.82
SL	1.96	1.96	1.96	↓	↓	↓	↓
1000	1.98	1.98	1.98	↓	↓	↓	↓
2000	2.00	2.00	↓	↓	↓	↓	↓
3000	2.02	2.02	↓	↓	↓	↓	↓
4000	2.04	2.03	↓	↓	↓	↓	↓
5000 & ABOVE	2.06	2.03	↓	↓	↓	↓	↓

GO-AROUND N_1

BASED ON:
Both AC Packs ON.
Engine Anti-Ice ON or OFF.

CORRECTION:

AC Pack OFF	+0.5%
Airfoil Anti-Ice ON	
2 Engines Operating	-0.5%
1 Engine Operating	-1.0%

AIRPORT PRESS ALT - FT	REPORTED GROUND TEMPERATURE - °F												
	-40	-20	0	+20	+40	+60	+70	+80	+90	+100	+110	+120	+122
-1000	80.0	81.9	83.8	85.6	87.4	89.2	90.0	90.9	91.7	92.6	91.8	91.2	91.1
SL	82.3	84.2	86.2	88.0	89.9	91.7	92.6	93.4	94.3	92.7	↓	↓	↓
1000	82.8	84.8	86.7	88.6	90.4	92.2	93.1	94.0	94.9	↓	↓	↓	↓
2000	83.9	85.9	87.9	t;39.8	91.7	93.5	94.4	95.3	95.0	↓	↓	↓	↓
3000	85.2	87.2	89.2	91.1	93.0	94.9	95.8	96.7	↓	↓	↓	↓	↓
4000	86.2	88.3	90.3	92.3	94.2	96.1	97.0	96.9	↓	↓	↓	↓	↓
5000 & ABOVE	87.3	89.3	91.4	93.4	95.3	97.2	98.1	↓	↓	↓	↓	↓	↓

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NORMAL FLAPS/SLAT CONFIGURATION

MINIMUM MANEUVERING AND REFERENCE SPEEDS

	GROSS WEIGHT - 1000 LBS																				
	86	90	94	98	102	106	110	114	118	122	126	130	134	138	142	146	150	154	158	160
0/RET MIN MAN	190	194	199	203	207	211	215	219	223	227	230	234	237	241	244	248	251	255	258	260
0/EXT MIN MAN	148	152	155	159	162	165	168	171	174	177	180	183	186	188	191	194	197	199	202	203
11/EXT MIN MAN	130	133	136	139	142	145	147	150	153	155	158	160	163	165	167	169	172	174	176	177
15/EXT MIN MAN	128	131	134	136	139	142	144	147	149	152	154	157	159	162	164	166	169	171	173	174
28/EXT MIN MAN	119	122	124	127	130	132	135	137	139	142	144	146	149	151	153	155	157	159	161	162
40/EXT MIN MAN	115	118	120	123	125	128	130	132	135	137	139	141	144	146	148	150	152	154	156	157
28/EXT V_{REF}	111	114	116	118	121	123	125	128	130	132	134	136	138	140	142	144	146	148	150	151
40/EXT V_{REF}	107	110	112	114	117	119	121	123	126	128	130	132	134	136	138	139	141	143	145	146

NOTE:

APPROACH SPEED

Approach Speed is the final approach speed. Normally, the approach speed is equal to V_{REF}, adjusted for wind and gust as follows:

APPROACH SPEED = V_{REF} + ½ WIND + GUST.

Tailwind is excluded.

NOTES:

- Minimum Approach Speed = V_{REF} + 5
- Maximum Approach Speed = V_{REF} + 20

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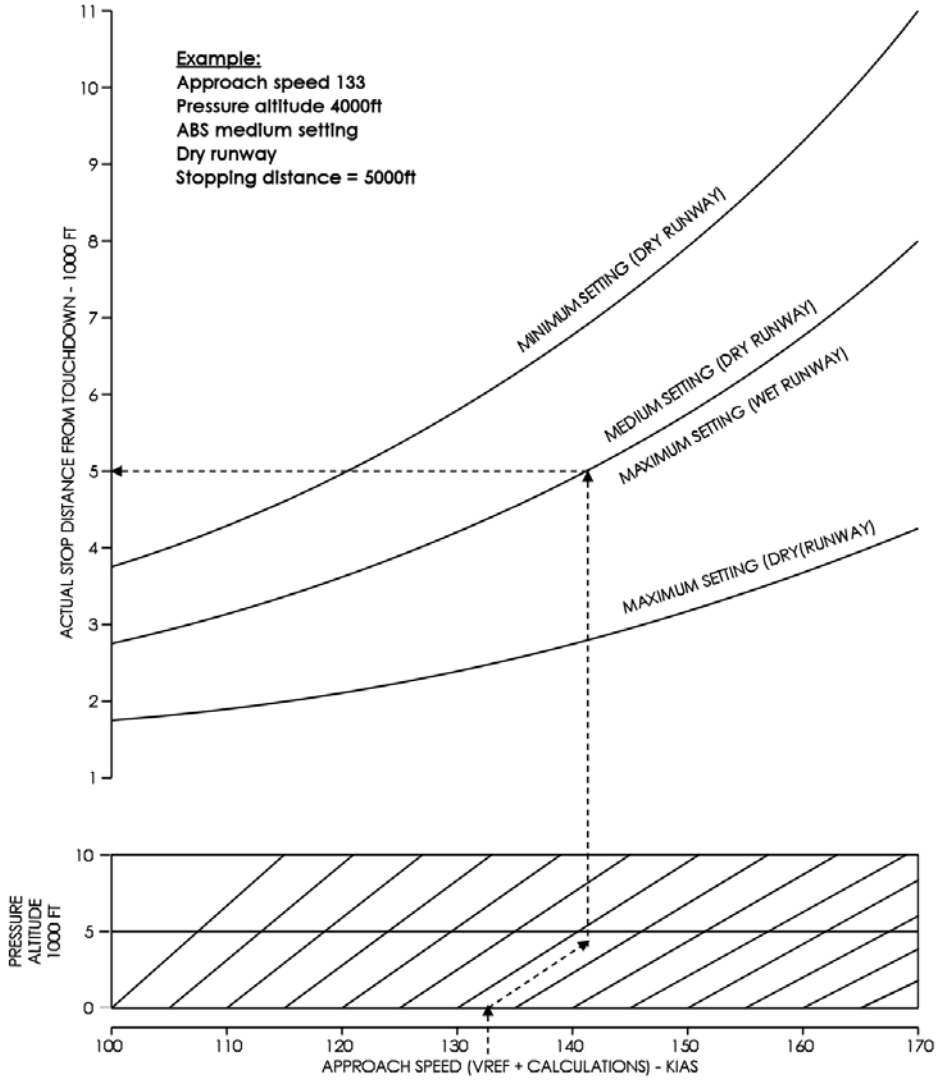
STOPPING DISTANCE WITH AUTOMATIC BRAKE SYSTEM

TOUCHDOWN TO FULL STOP

BASED ON:
Flaps 28 or 40.
Spoilers deployed.
No wind.
No reverse thrust.



CORRECTIONS:

ABS SETTING	FOR TAILWINDS: ADD FEET PER EACH 5 KNOTS TAILWIND	FOR TEMP DEV ADDD FEET PER EACH 10°F ABOVE STD	FOR DOWNHI SLOPE: ADD FEET PER EACH 1% DOWNHILL
MAXIMUM	150	50	100 DRY, 200 WET
MEDIUM	250	100	0
MINIMUM	350	150	0

MISCELLANEOUS

ENROUTE CLIMB

BASED ON:
Standard temperature.
250 knots up to 10,000 feet.
290 knots/M.72 above 10,000 feet.

PRESS ALT 1000 FEET	RAT °C	AV CLIMB SPEED KTS	GROSS WEIGHT – 1000 LBS																
			160	155	150	145	140	135	130	125	120	115	1110	105	100	95	90	85	80
37	-56	380						1) 2)	25 43.8	22 39.8	20 16.5	18 33.8	17 31.3	15 29.1	14 27.0	13 25.1	12 23.3	11 21.7	10 20.1
35	-54	377				27 49.6	24 45.0	22 41.6	20 38.3	18 35.6	17 33.1	16 30.9	15 28.9	14 27.0	13 25.2	12 23.5	11 21.9	10 20.4	9 18.9
33	-50	374	28 55.6	26 50.5	23 46.4	21 43.0	20 40.0	18 37.3	17 34.9	16 32.7	15 29.7	14 28.7	13 26.9	12 25.2	11 23.6	11 22.1	10 20.6	9 19.2	8 17.8
31	-46	368	23 48.0	21 44.6	20 41.7	18 39.0	17 36.6	16 34.4	15 32.3	14 30.4	13 28.5	13 26.8	12 25.2	11 23.6	10 22.2	10 20.7	9 19.4	8 18.1	8 16.8
29	-42	361	20 43.5	19 40.7	18 38.7	16 36.0	15 33.9	15 31.9	14 30.0	13 28.3	12 26.6	11 25.1	11 23.6	10 22.2	9 20.8	9 19.5	8 14.2	8 17.0	7 15.8
27	-38	354	18 39.8	17 37.4	16 35.3	15 33.2	14 31.4	13 29.6	12 27.9	12 26.3	11 24.8	10 23.4	10 22.0	9 20.7	9 19.5	8 18.2	8 17.1	7 15.9	7 14.8
25	-34	345	15 35.5	15 33.5	14 31.7	13 29.9	12 28.3	12 26.7	11 29.3	10 23.9	10 22.5	9 21.3	9 20.0	8 18.9	8 17.7	7 16.7	7 15.6	6 16.6	6 13.6
23	-30	335	13 31.7	13 30.0	12 28.4	11 26.9	11 25.4	10 24.1	10 22.8	9 21.5	9 20.4	8 19.2	8 18.2	7 17.1	7 16.1	6 15.1	6 14.2	6 13.3	5 12.4
21	-26	326	12 28.2	11 26.7	10 25.3	10 24.0	9 22.8	9 21.6	8 20.5	8 19.4	7 18.3	7 17.3	7 16.4	6 15.4	6 14.5	6 13.7	5 12.8	5 12.0	5 11.2
19	-22	317	10 25.0	9 23.7	9 22.5	8 21.4	8 20.3	8 19.3	7 18.3	7 17.3	6 16.4	6 15.5	6 14.7	5 13.9	5 13.0	5 12.3	5 11.5	4 10.8	4 10.1
17	-18	308	9 22.1	8 21.0	8 20.0	7 19.0	7 18.0	7 17.1	6 16.2	6 15.4	6 14.6	5 13.8	5 13.1	5 12.3	4 11.6	4 10.9	4 10.3	4 9.6	3 9.0
15	-14	289	7 19.3	7 18.4	7 17.5	6 16.6	6 15.8	6 15.0	5 14.3	5 13.5	5 12.8	5 12.2	4 11.4	4 10.9	4 10.2	4 9.6	3 9.1	3 8.5	3 7.9
13	-10	289	6 16.7	6 15.9	6 15.2	5 14.4	5 13.7	5 13.0	5 12.4	4 11.8	4 11.2	4 10.6	4 10.0	3 9.4	3 8.9	3 8.4	3 7.9	3 7.4	3 6.9
11	-6	278	5 14.3	5 13.6	5 12.9	4 12.3	4 11.7	4 11.1	4 10.6	4 10.0	3 9.5	3 9.0	3 8.5	3 8.1	3 7.6	3 7.2	2 6.7	2 6.3	2 5.9
9	-2	264	4 10.5	4 10.0	3 9.5	3 9.1	3 8.7	3 8.2	3 7.8	3 7.4	2 7.1	2 6.7	2 6.3	2 6.0	2 5.6	2 5.3	2 5.0	2 4.7	2 4.4
7	1	260	3 8.2	3 7.8	3 7.4	2 7.1	2 6.7	2 6.4	2 6.1	2 5.8	2 5.5	2 5.2	2 4.9	2 4.7	2 4.4	1 4.1	1 3.9	1 3.7	1 3.4
5	5	256	2 5.8	2 5.6	2 5.3	2 5.1	2 4.8	2 4.6	1 4.4	1 4.1	1 3.9	1 3.7	1 3.5	1 3.3	1 3.2	1 3.0	1 2.8	1 2.6	1 2.5
3	9	252	1 3.5	1 3.3	1 3.2	1 3.0	1 2.9	1 2.8	1 2.6	1 2.5	1 2.4	1 2.3	1 2.1	1 2.0	1 1.9	1 1.8	1 1.7	1 1.6	0 1.5

1) Time – Minutes
2) Fuel – 100 LBS

Taxi fuel and time is not included in the table. Add 40 LBS of fuel for every minute of OUT to OFF time.