5

System Differences

Contents

C. Fuel System

D. Powerplant

E. Hydraulic System

F. Landing Gear and Brakes

G. Flight Controls

H. Environmental System

I. Ice and Rain

J. Fire Protection System

K. Oxygen System

System Differences

General

This system differences chapter describes the differences of the systems of the Citation Jet series, such as CJ3/CJ2+/CJ1+/CJ/CJ1/CJ2 aircrafts.

The systems section is subdivided by aircraft system. Each system describes components, preflight and servicing procedures, and abnormal and emergency procedures.

The system differences chapter includes the following major sections:

- A. Aircraft Overview
- B. Electrical System
- C. Fuel System
- D. Powerplant
- E. Hydraulics
- F. Landing Gear and Brakes
- G. Flight Controls
- H. Environmental System
- I. Ice and Rain Protection
- J. Fire Protection and
- K. Oxygen

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A. Aircraft Overview

General

This section presents an overview of the Citation Jet series, such as CJ3/CJ2+/CJ1+/CJ/CJ1/CJ2 aircrafts.

It includes major features, airframe structures, dimensions, and danger areas. The Aircraft Overview references the manufacturer's unit numbers and publishes separate data and schematics where system differences warrant.

Unit numbers are assigned consecutively as construction begins, and each number remains with its aircraft regardless of the model serial number later assigned.

On all Citation Jet model aircraft, both the serial and unit number are stamped into the aircraft identification plate.

Aircraft Features

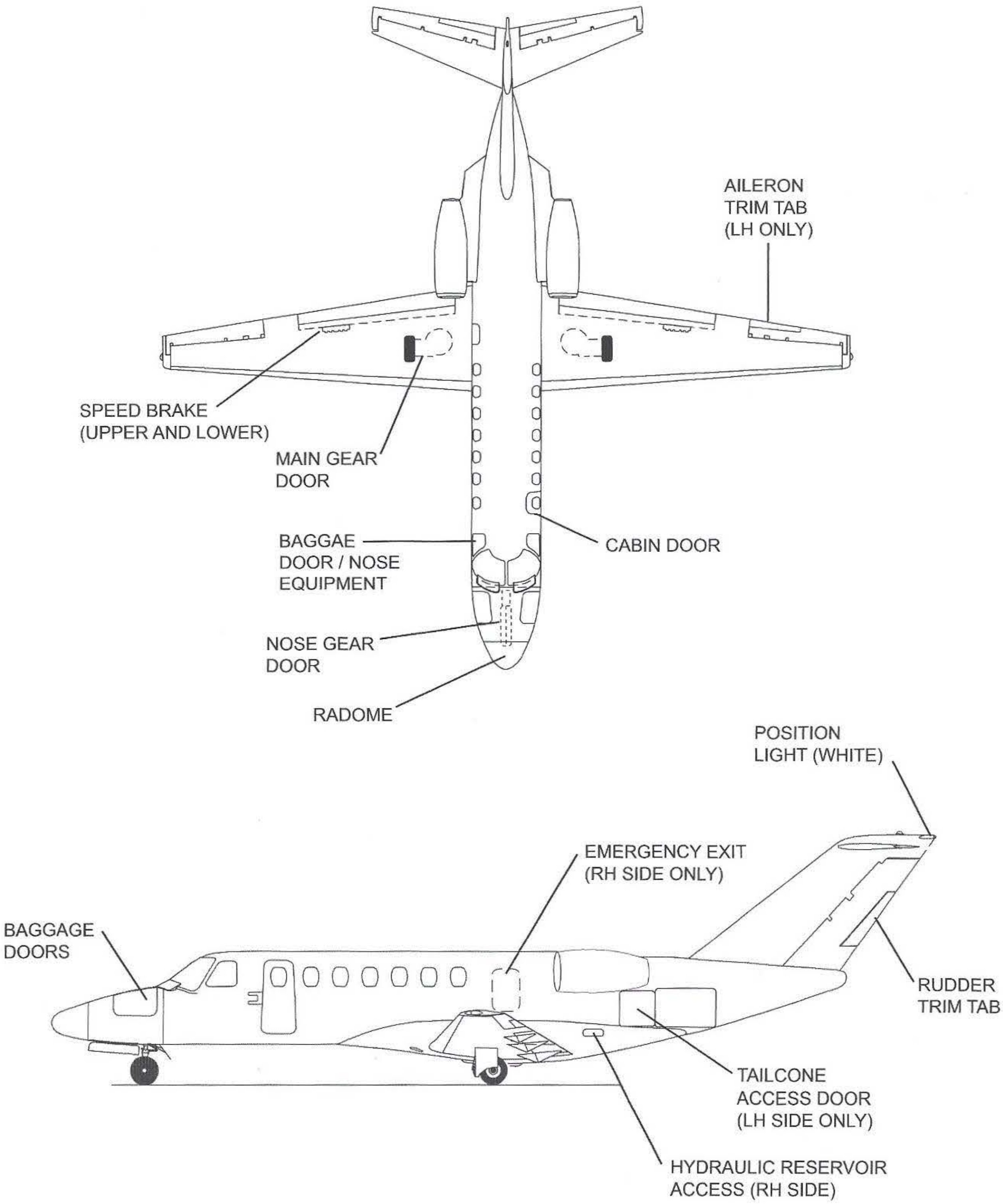

Figure 5-1: Aircraft Features

Aircraft Dimensions

CJ3

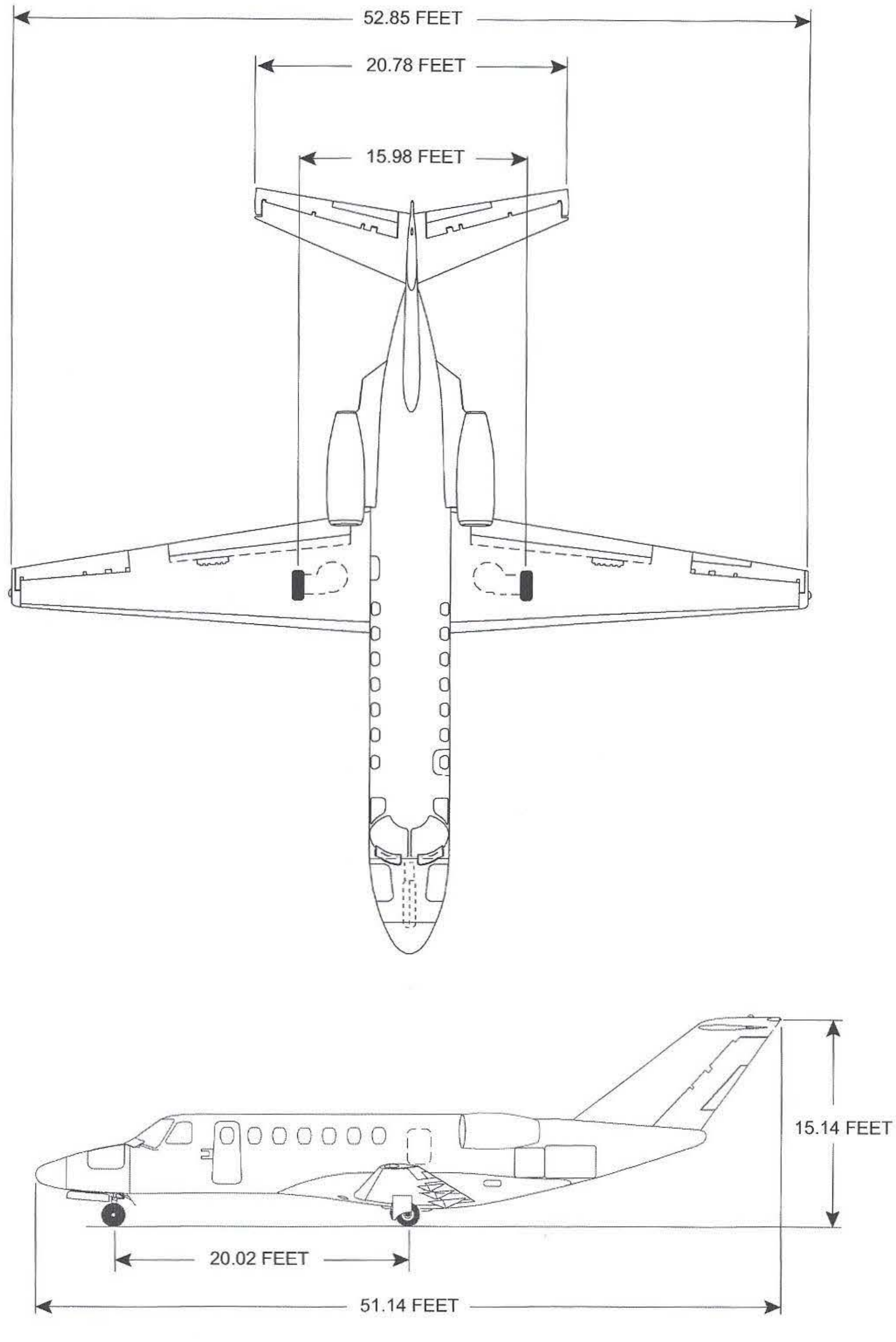

Figure 5-2: Aircraft Dimensions CJ3

Aircraft Dimensions - CJ3

Exterior

Radome to Rudder	51.14 ft.
Nose Gear to Main Gear	20.02 ft.
Main Gear to Main Gear	15.98 ft.
Wing Tip to Wing Tip	52.85 ft.
Horizontal Stabilizer, Tip to Tip	20.78 ft.
Ground to Top of Vertical Stabilizer	15.14 ft.

Interior

Length (Pressure Vessel)	20.62 ft.
Height	4.71 ft.
Width	4.78 ft.

> ***NOTE:*** See Taxiing and Towing, under the Expanded Normals Chapter for turning radii.

CJ2+

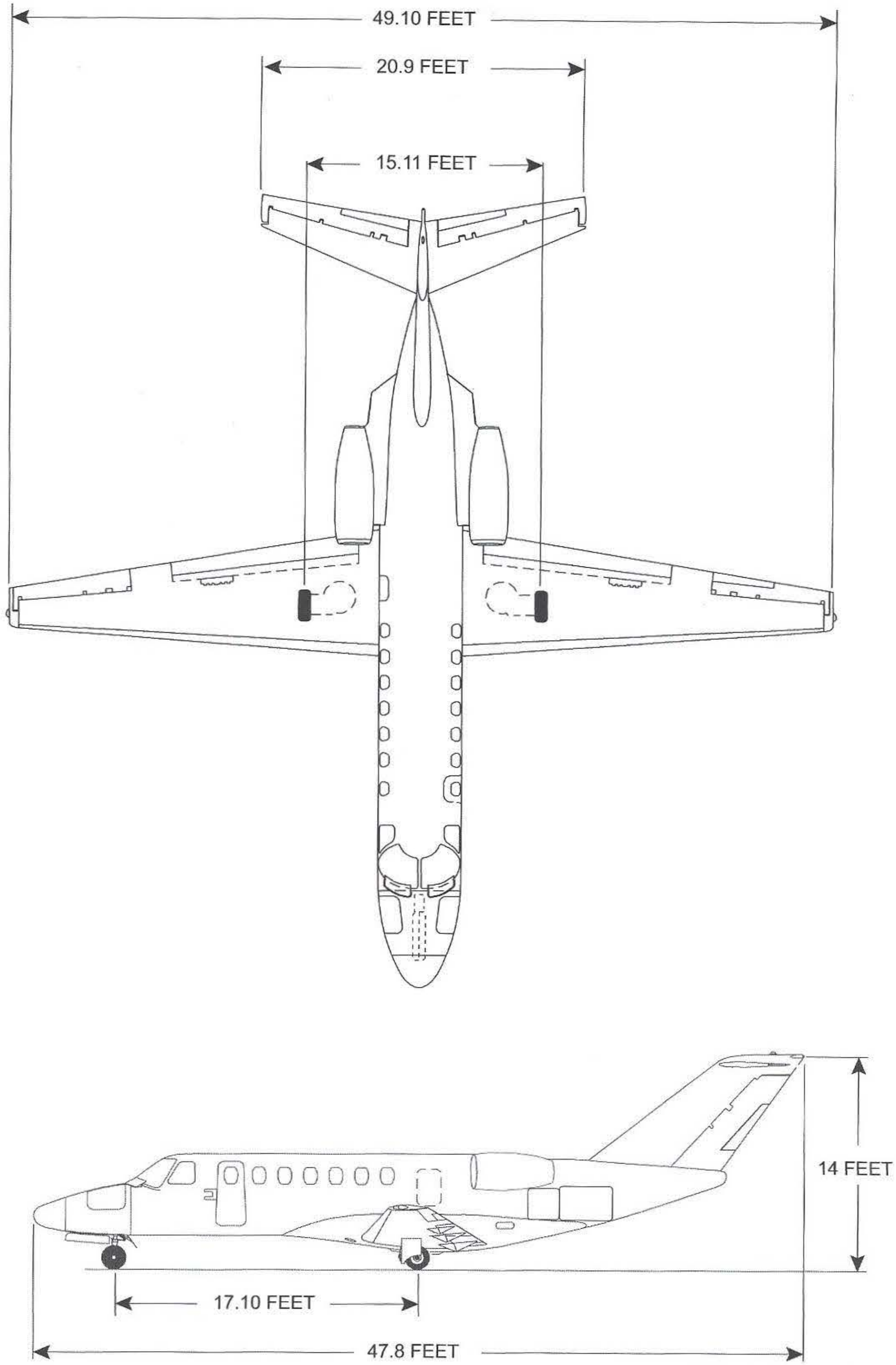

Figure 5-3: Aircraft Dimensions CJ2+

Aircraft Dimensions - CJ2+

Exterior

Radome to Rudder . . . . 47.8 ft.

Nose Gear to Main Gear . . . . 17.10 ft.

Main Gear to Main Gear . . . . 15.11 ft.

Wing Tip to Wing Tip . . . . 49.10 ft.

Horizontal Stabilizer, Tip to Tip . . . . 20.9 ft.

Ground to Top of Vertical Stabilizer . . . . 14 ft.

Interior

Length (Pressure Vessel) . . . . 13.7 ft.

Height . . . . 4.75 ft.

Width . . . . 4.83 ft.

> ***NOTE:*** See Taxiing and Towing, under the Expanded Normals Chapter for turning radii.

CJ1+

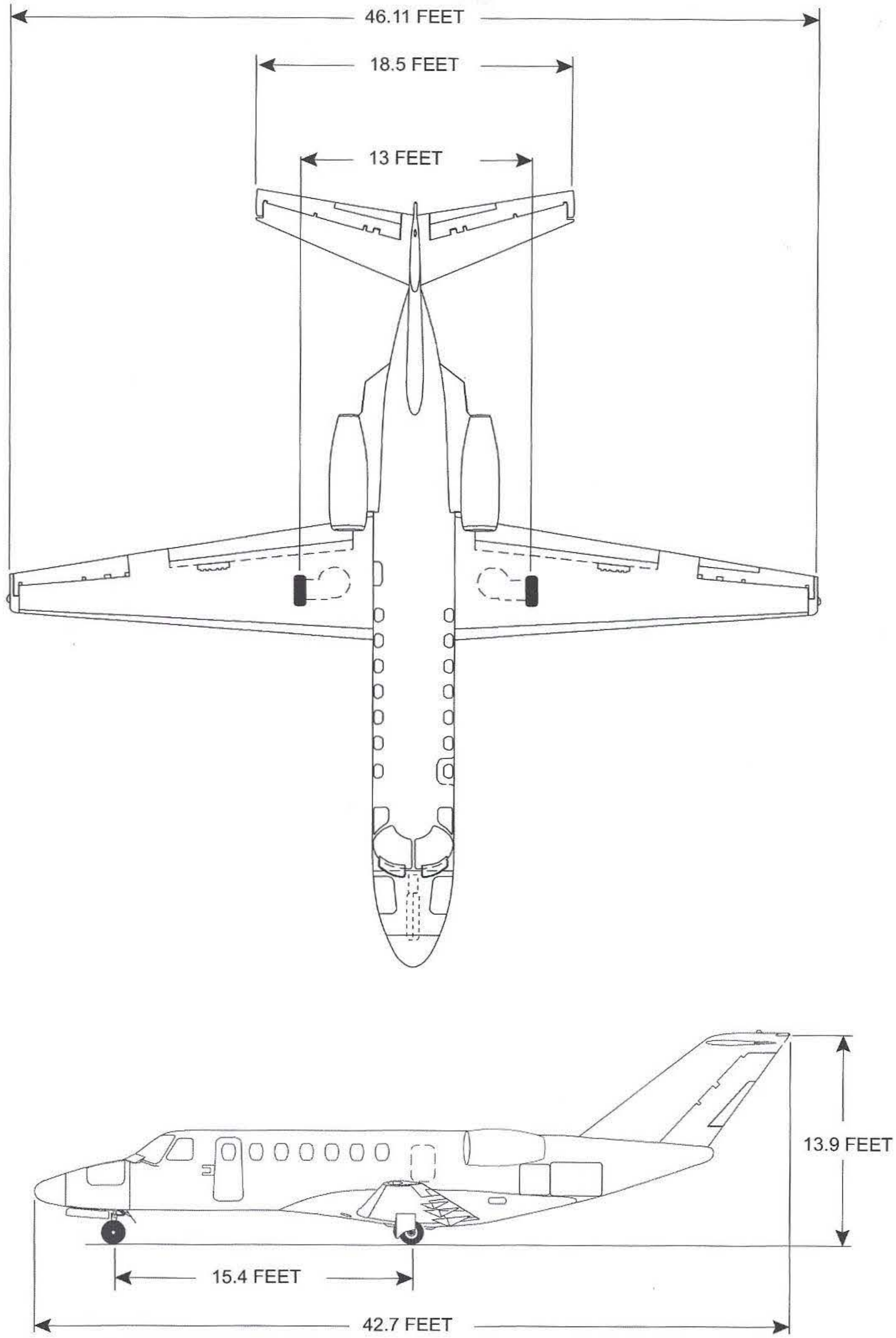

Figure 5-4: Aircraft Dimensions CJ1+

Airfoils

Wing

CL Airplane . . . . .NFL 0213 (MOD)

Vertical Tail

Root. . . . . NACA 0012

Tip . . . . NACA 0012

Horizontal Tail

Root. CESH525A1

Tip CESH525A2

Incidence

Wing

WS 30.00. . . . . +2.5º

WS 272.033. . . . . -5º

Horizontal Tail 00.00

Dihedral

Wing 5º

Engine Pylons 23º

Horizontal Tail 00.00

B. Electrical System

The CJ1/CJ2 equipped with the proline avionics and will have an A/C similar to that of the CJ3. The A/C system will only be used as a source of power for some passenger convenience items; whereas on the CJ, the AC inverters will convert DC power to AC to power all avionics equipment. The electrical system operates the same except for some limitations, bus items and emergency bus items.

Other Difference

1. Generator limits are 300 Amps on the ground and 300 in the air for the CJ/CJ1

   CJ2 limits are 250 Amps on the ground and the same as the CJ3 in the air. 300 to FL 410 and 250 above FL 410
2. On the CJ/CJ1 there are no yellow line markings between 250 and 300 on the ammeters
3. A/C inverters are used to power the avionics equipment on the CJ
4. There is no emergency Lighting switch on the CJ/CJ1/CJ2
5. CJ does not have PFD/MFD lighting switches.

Emergency Bus

The electrical system on the CJ differs from that on the CJ in that there is an AC system that powers avionics on the CJ/CJ1. The hot battery bus and emergency bus also does not power as many items as indicated by enclosed section.

Other significant differences include:

1. Generator limits are 300 on the ground and 300 in the air on the CJ/CJ. CJ2 limits are 250 on the ground and same as the CJ3 in the air
2. There are no yellow line marked between 250 and 300 Amps on the CJ/CJ1 ammeters
3. A/C power is used to power VG1 and 2 on the CJ/CJ1
4. There is no Emergency Lighting switch on the CJ/CJ1 or CJ2
5. CJ/CJ1 does not have PFD/MFD light switches.

General

Electrical power is normally supplied by two 29 VDC (Volt Direct Current) (28 VDC on the CJ1+), 300-ampere, engine driven starter/generators. A 24 Volt, 44 amp-hour, nickel-cadmium (NiCd) battery, (optional 42 amp-hour sealed lead/acid battery) is located in the tailcone compartment to supply power for starting and emergency requirements. A receptacle below the left engine pylon is provided for connection of an external power unit.

Direct Current (DC) Power

The Direct Current (DC) Power distribution system consists of the starter/generators, battery, indicators, switches and bus network. The DC buses supply power for all DC functions except engine starting. Normally, the left generator powers the left main DC bus, and the right generator powers the right main DC bus. Both operate in parallel, but in the event either generator is off the line, the crossfeed bus acts as a cross-tie so that the remaining generator will power both main DC buses. The crossfeed bus is protected at each end, where it connects to the left and right busses, by a 225 Amps fuse.

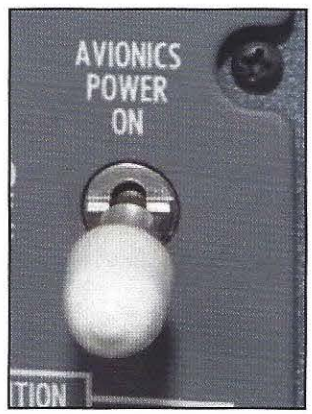

Figure 5-7: Avionics Power Switch

DC power to the avionics equipment is controlled by the AVIONIC POWER ON/OFF switch, which serves as an avionics master switch. Each main DC bus is controlled by a power relay, so that loss of one complete bus, in a common type of failure, will require the failure of one relay and at least one of the 225 Amps bus connecting fuses. This arrangement also protects the opposite bus, in the unlikely case of a bus-to-ground failure. DC-powered inverters provide AC power for electroluminescent cockpit lighting and for 110 VAC power outlets in the cabin.

An emergency DC bus powers those items of equipment which are required in an emergency. Placing the DC POWER switch to EMER will enable this equipment to be powered by the battery. The hot battery bus, which allows power to some items at all times when the battery is installed, completes the bus system.

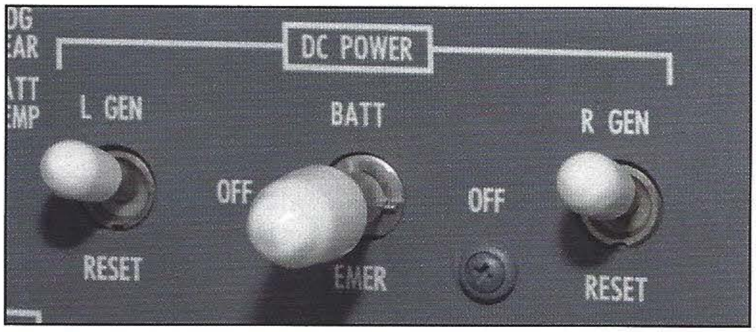

Figure 5-8: DC Power Switch

Direct Current (DC) Power Indicators

The indicators consist of two ammeters, a voltmeter and two amber generator failure lights (GEN OFF, L and R).

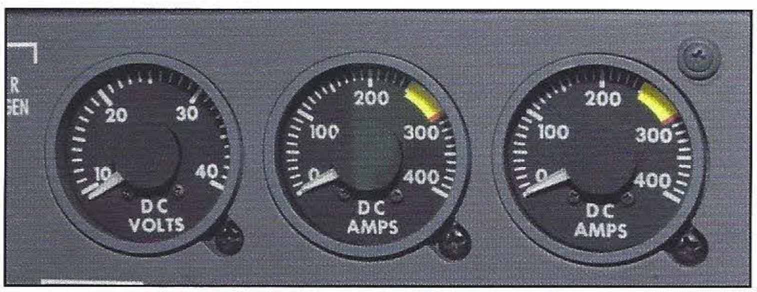

Figure 5-9: DC Power Indicators

The ammeters function as load meters, indicating the load being carried by each generator.

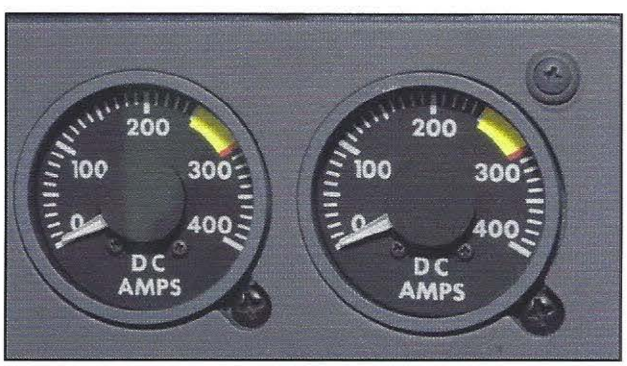

Figure 5-10: Ammeters

The voltmeter is wired through the battery switch and will indicate the voltage of the hot battery bus any time the battery switch is in the BATT or EMER position.

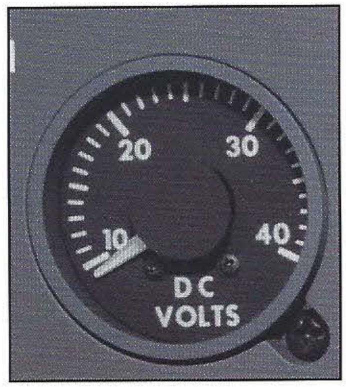

Figure 5-11: Voltmeter

The voltmeter selector switch can be rotated to the L or R GEN positions to check generator voltage output. Since the voltmeter reads the highest voltage on the bus, an accurate check of one generator is obtained only with the opposite generator off the line.

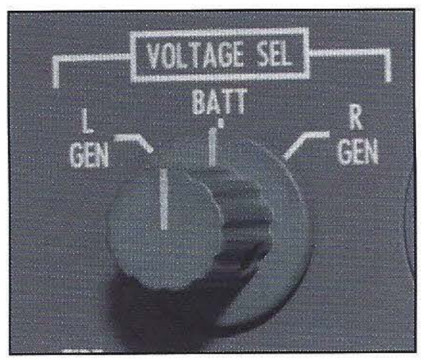

Figure 5-12: Voltage Selector Switch

Should either generator fail, the associated power relay will open, removing the generator from the system and illuminating the appropriate GEN OFF L/R amber annunciator panel light and the MASTER CAUTION light, and causing a voice announcement of “GENERATOR FAILURE”. Should both generators fail, the MASTER WARNING light will also illuminate. This is the only condition under which amber annunciator light illumination will trigger the master warning.

Generators

A Generator Control Unit (GCU) provides starter regulation, overvoltage protection, feeder fault and ground fault protection for each generator. Three-position L and R generator switches are marked GEN, OFF and RESET.

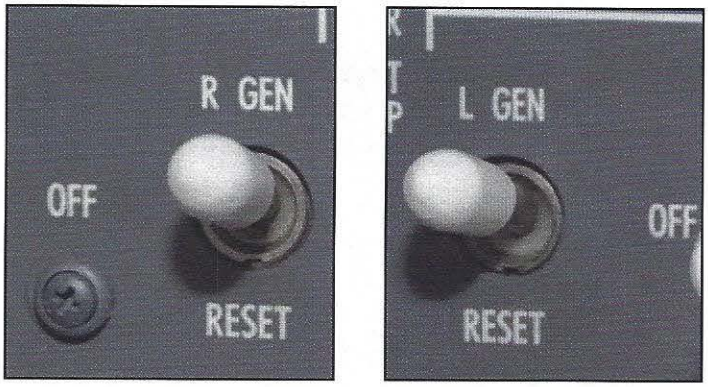

Figure 5-13: Generator switches (Right and Left)

a. In the GEN position, generator control is automatic for regulation, protection and load bus connection. This is the normal switch position for battery starting and all flight modes.

b. OFF is the switch position for external power starts. Placing the switch to OFF isolates the generator from its load bus.

c. The momentary RESET position resets a generator that has been tripped as a result of an overvoltage, feeder fault or engine fire switch actuation.

Each starter/generator is capable of a 50% overload (450 Amps) for 2 minutes. A single generator is normally capable of supporting the entire electrical system. However, if usage of electrical equipment is especially high, it may be advisable to reduce the electrical load.

Generator Limits

	CJ1+	CJ2+ and CJ3
Ground	210A	200A
In-Flight	Below FL350: 300A Above FL350: 250A	Below FL410: 300A Above FL410: 250A

The generators cross-tie through two 225 Amps current limiters and the crossfeed bus. If one generator goes off-line, the remaining generator powers both of the feed DC buses. Either generator is capable of supplying the entire normal DC electrical requirements of the aircraft.

The starter/generator, driven by the accessory gearbox, has a shear section in its drive shaft. If the starter/ generator mechanically fails (i.e., bearing failure), the shear section fails at 12% N_1 or less of torque to prevent damage to the engine accessory gearbox. Each starter/generator has an internal fan that cools the unit during ground operation; in flight, ram air cools the starter/generator. An air inlet duct on the forward engine cowling directs air to the starter/generator. An exhaust duct on the lower cowling directs cooling air overboard.

Battery

The Battery is a secondary source of Direct Current (DC) power available to supply the distribution system prior to start, during battery starts, or in the event of dual generator failure.

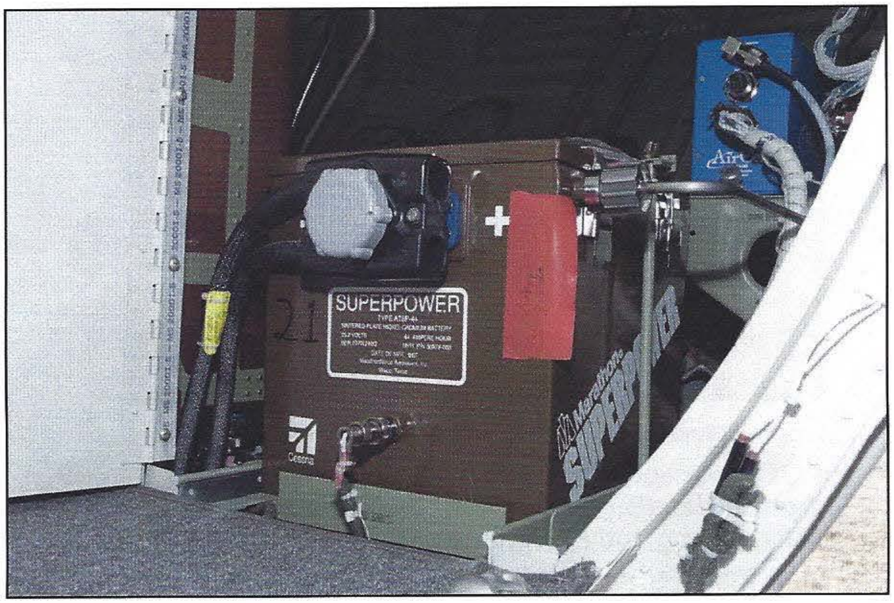

Figure 5-14: Battery Compartment

The three-position control switch is labeled BATT, OFF and EMER. Placing the switch to the BATT position closes the battery relay and powers the crossfeed bus, emergency bus and both main DC buses.

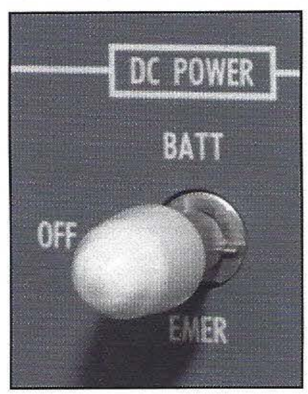

Figure 5-15: Three-Position Control Switch

This position also enables external power to be supplied to the entire system. In the OFF position, battery or external power is isolated from all but the hot battery bus.

A **BATTERY DISCONNECT** (NORMAL/DISC) switch is located on the left side of the cockpit, above the pilot's armrest. It is used to remove battery power from the system in case of a failed starter contactor or other malfunction. The battery disconnect switch should not be left in the DISC position for an extended period of time, since it draws current from the battery to hold the battery disconnect relay in the disconnect position, and will therefore, eventually discharge the battery.

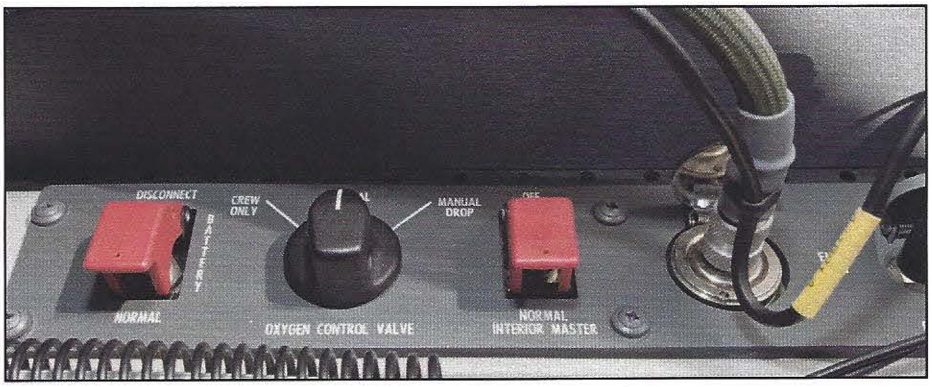

Figure 5-16: Battery Disconnect Switch

If it becomes necessary to use the DISC position in flight, damage to the battery may occur. The battery disconnect relay, between the battery and ground, is located under the forward side of the battery installation.

The hot battery bus is energized any time the battery is installed, the battery disconnect switch is in NORMAL, and/or external power is connected. The hot battery bus powers the emergency exit lights, tailcone compartment light, nose baggage compartment light, voltmeter, wing anti-ice overtemperature sensors and the wing anti-ice valves.

During each engine start using external power, the battery disconnect relay will automatically open interrupting battery power to the hot battery bus. The relay will close automatically at the end of the start cycle.

Placing the battery switch in the EMER position opens the battery relay. The emergency relay will energize when it is closed. This disconnects the main DC busses and the crossfeed bus from the battery and connects the battery directly to the emergency bus.

With both generators off, all electrical equipment will be inoperative, except the EMER (emergency) position of the battery switch, which will provide at least 30 minutes operation for selected instruments and systems.

> ***NOTE:*** Loss of Normal DC Power results in:
> - Valves Failing CLOSED -
>   - fuel transfer
>   - emergency pressurization
>   - wing anti-ice XFLOW
> - Valves Failing OPEN -
>   - engine anti-ice
>   - wing anti-ice
>   - windshield bleed air
>   - hydraulic loading
>   - speedbrakes
>
> Air source fails to both.

The following are powered from the CJ3 emergency bus:

COMM 1	Pilot's and Co-pilot's Audio Panels
Standby Pitot Heat	Landing Gear Control
NAV 1	Standby HSI (Co-pilot's AHRS)
Co-pilot's Pitot Heat	Landing Gear Monitor
RTU 1	Standby Engine N_1 indicators
Co-pilot's Air Data Computer	Overhead Floodlights
RIU L-R	Standby Flight Display
Flap Control	Voltmeter (internal battery)
Garmin 500 (optional)	RTU2

The following are powered from the CJ2+ emergency bus:

L and R Standby N_1	RTU 2
COMM 1	DME 1
NAV 1	Landing Gear Control and Indication
FMS 2 (GPS 500 only)	Flap Control
Transponder 1	Right Pitot and Static Heat
Audio 1 and 2	Cockpit Floodlights
AHRS 2	Voltmeter (BATT voltage only)
RTU 1 (Standby Horizontal Situation Indicator (HSI))	ADC 2
Marker Beacon	PA Amp
	Hydraulic System Control

The following are powered from the CJ1+ emergency bus:

L and R Standby N_1	RTU 2
COMM 1	DME 1
NAV 1	Landing Gear Control and Indication
FMS 2 (GPS 500 only)	Flap Control
Transponder 1	Right Pitot and Static Heat
Audio 1 and 2	Cockpit Floodlights
AHRS 2	Voltmeter (BATT voltage only)
RTU 1 (Standby Horizontal Situation Indicator (HSI))	ADC 2
Marker Beacon	PA Amp

Switching to EMER with either or both generators on the line, will have no effect on the electrical equipment, except that the battery will not charge. Placing the battery switch to OFF with either or both generators on the line will not result in loss of power to the emergency bus, since the emergency power relay remains de-energized as long as generator power is available.

A battery temperature sensor system continuously monitors the battery temperature. A battery temperature exceeding 63°C (145°F) is annunciated by a steady illumination of the red BATT O'TEMP light on the annunciator panel, as well as flashing illumination of the MASTER WARNING. If the aural warning system is installed a voice announcement of "BATTERY OVER TEMP" will be heard. A battery temperature exceeding 71°C (160°F) is shown by a flashing BATT O'TEMP and >160° annunciator light, a more rapid voice announcement of "BATTERY OVER TEMP" (if the aural warning system is installed), and a flashing MASTER WARNING.

The battery must be serviced as per the Aircraft Maintenance Manual when the battery temperature exceeds 63°C (145°F).

Alternating Current (AC) Power

An AC inverter is used to convert 28 VDC to 40 to 60 volts, 400 Hz AC. The electroluminescent panels use 40 to 60 volts, 400 Hz AC power.

Also additional AC power converters are used in the cabin areas for 110 VAC or 230 VAC for passenger conveniences. The inverter supplies 110 VAC or 230 VAC, depending on the installed configuration, to one or more standard wall outlets and can supply up to 1,200 Watts of power. Wall outlets are typically located in the co-pilot's cockpit sidewall, and/or cabin sidewall, adjacent to the pullout table(s) in front of selected seat locations. The system is protected by a 60 Amps current limiter, located in the aft junction box. An ON/OFF switch located in the wall outlet, turns the inverter ON, when a plug is inserted into the wall outlet and OFF, when the plug is removed.

> ***NOTE:*** The inverter will not function with the battery switch in the EMER position.

Lighting System

Lighting Control Panel

A third provision for emergency exit lighting is through a small battery in the cabin headliner which will power the interior exit lights any time a sensor is exposed to a lateral force and aft force of 5 Gs or more.

No No

No Emer Lights

Figure 5-17: Lighting Control Panel

Exterior Lighting

Exterior lighting consists of:

- Wing and Tail Mounted Navigation Lights
- Anti-Collision Lights (Strobes)
- Wing Inspection Light
- Combined Taxi/Recognition/Landing Lights
- Ground Recognition Beacon Light
- Emergency Overwing Exit Lights

All exterior lights are controlled by switches located on the pilot's instrument panel or switch panel.

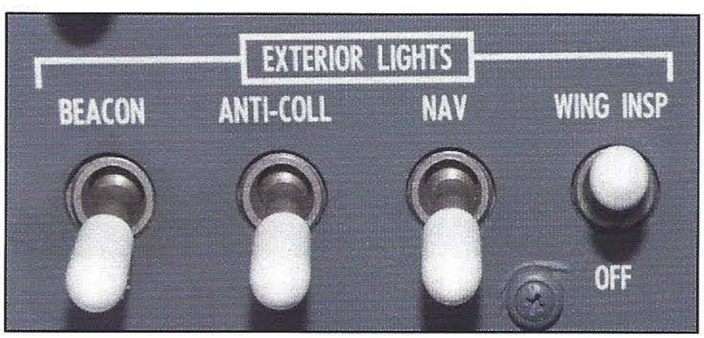

Figure 5-18: Exterior Light Switches

The light switches are labeled LANDING L or R, OFF, and RECOG/ TAXI.

Figure 5-19: Light Switches (Landing and Advisory)

A. OFF position removes power from the lights.
B. The selection of LANDING causes the brightest illumination for landing.
C. RECOG/TAXI position inserts a resistor into the circuit causing lower illumination, enabling use of the lights as recognition or taxi lights, while at the same time significantly extending lamp life because of operation at the reduced voltage level.

Wing and Tail Mounted Navigation Lights

The Navigation Lights include the red and green lights mounted in the wing tips and the white light mounted in the tail at the top of the vertical stabilizer.

Figure 5-20: Wing Navigation Light

The left wing tip houses a red navigation light and the right wing tip houses a green navigation light.

C. Fuel System

General

The CJ3 fuel system has a greater capacity than that installed in the CJ/CJ1/CJ2. The CJ3 holds 4,710 lbs, CJ 3,220 lbs, CJ1 3,400 lbs, CJ2 3,960 lbs of fuel. The CJ3 also has a fuel transfer system rather than the fuel cross feed system installed in the early CJ's. Some later CJ models also have this system. In the case of the transfer system, the selector knob is pointed away from the tank which if feeding the system.

Other differences are:

- The motive flow fuel passed through an oil to fuel heat exchanger to heat the fuel prior to entering the primary ejector pumps. This prevents the need for using PRIST
  - The CJ/CJ1 require PRIST and the CJ2 does not
- CJ3 has 7 fuel capacitive probes in each wing
  - The CJ/CJ1 has 6 and CJ2 has 7
- CJ3 has 5 fuel drains under each wing
  - The CJ/CJ1 has 4 per wing and the CJ2 has 3
- CJ3 has a fuel delivery unit instead of a fuel control unit
- CJ3 FDU receives inputs from FADEC
- CJ3 has 3 ejector pumps in each fuel tank instead of 2 per tank.

Electric Boost Pump

One DC electric, centrifugal-type Boost Pump in present in each tank sump. The Electric Boost Pump provides fuel pressure for engine starting, transfer, and acts as a backup for the primary ejector pump. Operation is indicated by illumination of the FUEL BOOST ON L/R annunciator panel lights.

The pumps are controlled by a pair of three-position switches located on the left switch panel. The switches are marked OFF, NORM and ON.

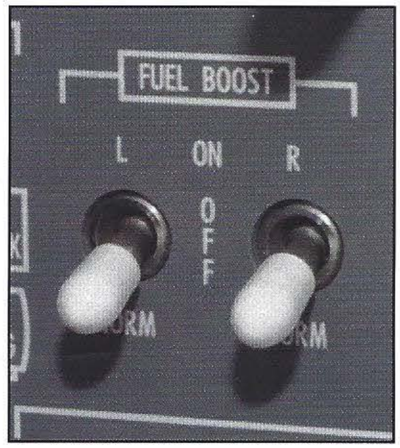

Figure 5-21: Fuel Boost Pump Switch

In NORM the boost pump function remains automatic for start and crossfeed, and is also activated by the low pressure switch should output from the primary ejector pump be insufficient (below 4.65 PSI). The respective boost pump, when in NORM, is disabled any time the throttle is in cut-off, to preclude pump activation by low pressure sensing during shutdown. The ON position causes the selected pump to operate continuously, regardless of throttle position.

During transfer operation, the supply tank boost pump must be selected ON or NORM. The receiving tank boost pump must be selected OFF or NORM. Transfer will not occur if both pumps are operating, or if the boost pump in the supply tank is not operating.

Boost pump operation is not automatic during engine start with the pump switch OFF. In the OFF position the pumps are de-energized and will not turn ON if an engine START button is pressed. OFF is OFF. However, in most cases, the engine will start without the boost pump. To ensure uninterrupted fuel flow to the engines, the boost pump switches must be positioned ON, when the FUEL LOW LEVEL L/R annunciator illuminates.

Operating the boost pumps without fuel in the wing damages the boost pumps.

Ejector Pumps

Three Ejector Pumps in each fuel tank (on the CJ3) and two Ejector Pumps in each fuel tank (on the CJ2+ and CJ1+), use existing fuel pressure in conjunction with a venturi to produce a high-volume flow. As high pressure fuel is forced through the ejector orifice, a low pressure area is created at the pump inlet, drawing in a comparatively large volume of fuel, and pushing it out at low pressure.

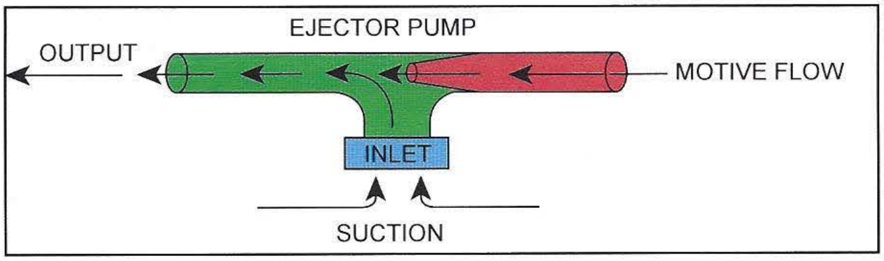

Figure 5-22: Ejector Pump

The primary ejector pump uses bypass fuel from the engine-driven pump as its motive flow source to pick up fuel from the sump area and deliver it to the engine. Two transfer ejector pumps in each tank operate similarly, except they use bypass fuel from the main supply line as a motive flow source. Its function is to ensure a constant supply of fuel to the sump by scavenging from the lowest points in the tank.

Fuel Transfer

Fuel Transfer is controlled by a selector on the left switch panel. The selector is labeled with an arrow which indicates the direction of fuel transfer. The selector has three positions labeled L TANK L ENG/OFF/ R TANK R ENG. When transfer is selected, a white FUEL TRANSFER annunciator will illuminate when the crossfeed valve is open.

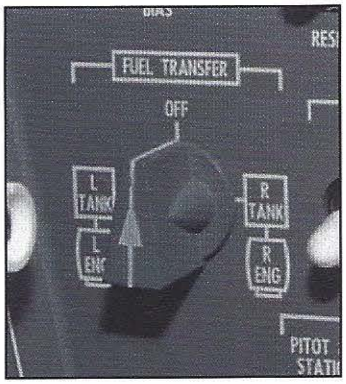

Figure 5-23: Fuel Control Panel

Selecting either tank, automatically turns on the electric boost pump in the opposite tank, (if the boost pump switch is in NORM position), and opens the crossfeed valve. Returning the selector to OFF reverses the sequence.

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D. Powerplant

Turbofan Engine

2400 lbs CJ2

Turbine engines produce thrust by accelerating air. It is the product of the mass of the air and the increase in velocity that determines thrust output. Thrust is generated in two ways: a small volume of air accelerated to a very high velocity, or a large volume of air accelerated to a lower velocity.

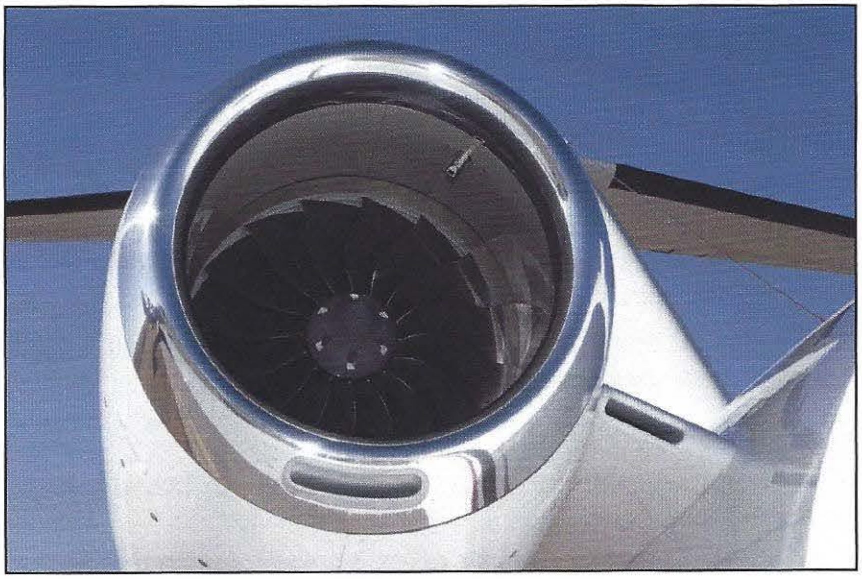

Figure 5-24: Turbofan Engine

The turbofan engine uses both methods. It compresses a small portion of the incoming air, mixes it with fuel, ignites and burns the fuel/air mixture, and exhausts the hot combustion gases. The fan, in turn, accelerates a large volume of air at a lower velocity, and bypasses it around the engine core.

Air is directed from the nacelle inlet to the engine air intake. The outer span section of the fan compresses and accelerates a large mass of air at a low velocity into the full-length bypass duct.

Simultaneously, the inner span section compresses and accelerates a volume of air to the primary gas path axial compressor stage. Air pressure is increased by the booster stage and directed to the high pressure compressor which accelerates the air mass and directs it through a diffuser. The diffusion process changes the velocity energy to pressure energy. A relatively small portion of the air enters the combustion chamber where fuel is added and ignition occurs. The combustion process results in expansion and acceleration. The rest of the compressed air is used to operate various bleed air services on the airplane and for internal cooling in the engine.

The high pressure turbine extracts energy to drive its compressor and the accessory section. The low pressure turbine extracts energy to drive the forward mounted fan. The remaining energy is directed into the exhaust section where it joins with the bypass airflow to provide thrust.

Components

Major components of the engine are:

- Low Pressure (LP) shaft module
- Fan group
- Core module
- LP turbine group
- Accessory gearbox
- FADEC

Low Pressure (LP) Shaft Module

For CJ3 and CJ2+, the LP Shaft Module consists of the LP shaft, No.1 and No. 1.5 bearing supports, No. 1 ball bearing, No. 1.5 roller bearing, and No.1 carbon seal.

For CJ1+, the LP shaft module consists of the LP shaft, No.1 bearing support, No. 1 ball bearing, and No. 1 carbon seal.

Fan Group

The fan group consists of the spinner, fan rotor, fan housing and fan stator. Additionally:

- For CJ3, the fan group consists of the 3-stage Intermediate Pressure (IP) compressor, and the IP stator stages.
- For CJ2+, the fan group consists of the 3-stage LP compressor, and LP stator stages.
- For CJ1+, the fan group consists of the single-stage intermediate pressure (IP) compressor, and IP stator stages.

Core Module

The Core Module is made up of the interstage housing with integral oil tank and first reduction bevel gear, the High Pressure Compressor (HPC) and Compressor Cover, the HP shaft, Pinion Gear and No. 2 ball bearing, the Diffuser Assembly, Combustor Cover Assembly, Fuel Manifold and Seal Assembly, Fuel Slinger and Seal, and High Pressure (HP) Turbine Nozzle and Primary Plate Assembly, the HP Turbine, and the first Low Pressure Turbine (LPT) Nozzle, including the No. 3 and No. 4 Roller Bearings and Seals.

LP Turbine Group

The LP Turbine Group consists of the LP turbine module (first stage LP turbine rotor, then second stage LP turbine nozzle assembly, the second stage LP turbine rotor), rear housing, a heat exchanger, and the rear case with exhaust mixer.

Accessory Gearbox

The Starter/Generator, Fuel Pump, Fuel Delivery Unit (FDU), Hydraulic Pump, and Oil Pump are driven by the Accessory Gearbox mounted below the engine. Power to drive the gearbox is transmitted from the N_2 section through the tower shaft and a series of bevel gears. Lubrication is provided by the engine oil system.

FADEC

Dual channel Full Authority Digital Engine Controls (FADECs) provide automation and efficiency in engine management. Detents in the throttle quadrant (takeoff, maximum continuous, high speed cruise, and idle) give pilots the optimal power settings for each phase of flight based on ambient conditions. The system also provides Time-Limited Dispatch (TLD), diagnostics, and engine synchronization.

Engine Indicating System (EIS)

The EIS displays N_1, N_2, ITT, oil pressure, oil temperature, fuel temperature, fuel flow, and fuel quantity (individually for each engine). A compressed format of the EIS is automatically selected for certain enhanced display modes of the MFD. The ENG button, located on each Display Control Panel (DCP), alternately toggles between the normal and compressed formats. In the compressed format, placing either throttle in the Takeoff detent will automatically cause the EIS to display the normal format.

Digital data for N_1, N_2, and ITT are provided to the EIS by the respective engine FADEC. The FADEC also provides analog N_1 information (untrimmed) to the standby N_1 display, which may differ from the EIS value by as much as 1.2% N_1. Analog data for oil pressure, oil temperature, fuel temperature, fuel flow, and fuel quantity are provided to the EIS by the respective Data Concentrator Unit (DCU).

The EIS display format on the MFD is normally a full-time expanded display. The display consists of:

- N_1 - Vertical analog scales, moving pointers, digital readouts, and reference bugs.
- ITT - Vertical analog scales and moving pointers.
- IGN - Legend appears on the top left or right side of the ITT scale to indicate the left or right engine ignition system provides power to the exciter boxes.
- N_2 - Boxed digital readouts.
- OIL PSI - Consists of full-time analog scales, moving pointers, and part-time digital readouts.

- OIL °C - Consists of full-time analog scales, moving pointers, and part-time digital readouts.
- FUEL °C - Digital readout of temperature in each wing tank.
- FUEL PPH - Digital readout of fuel flow for each engine.
- FUEL QTY LBS - Consists of vertical analog scales, moving pointers, and a digital readout for each tank.

On the EIS, colors indicate the status of systems:

- Green indicates within normal limits.
- Yellow indicates transient limits above or below normal limits, typically limited by time. Amber indicates a possible need for future corrective action
- Red indicates red-line limits and a need for immediate corrective action.

Engine indicating system includes:

- Engine Fan Speed (N_1) Indication
- Engine Turbine Speed (N_2) Indication
- Inter-Turbine Temperature (ITT) Indication

Figure 5-25: Standby N_1

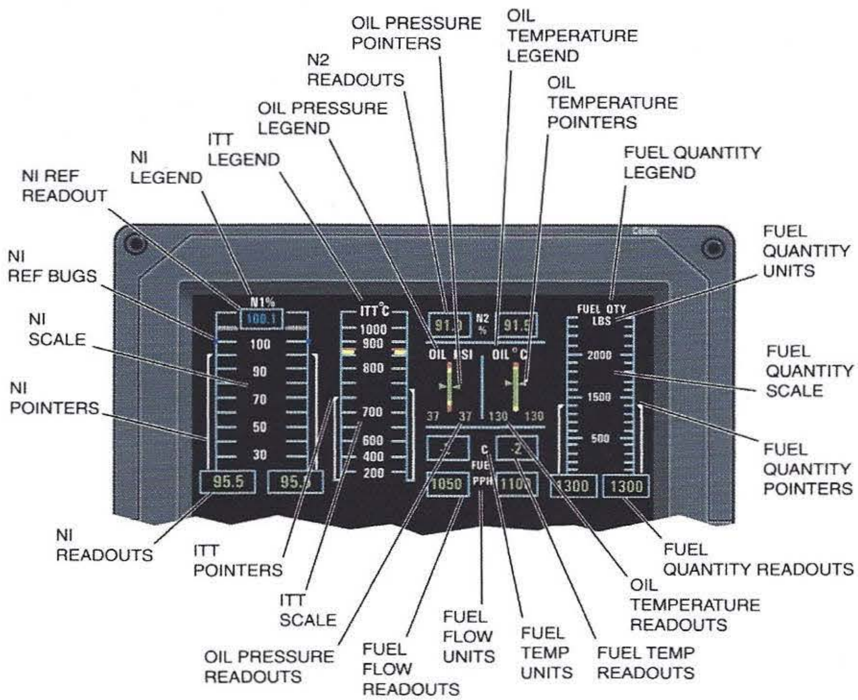

Figure 5-26: Engine Indicating System Normal Display

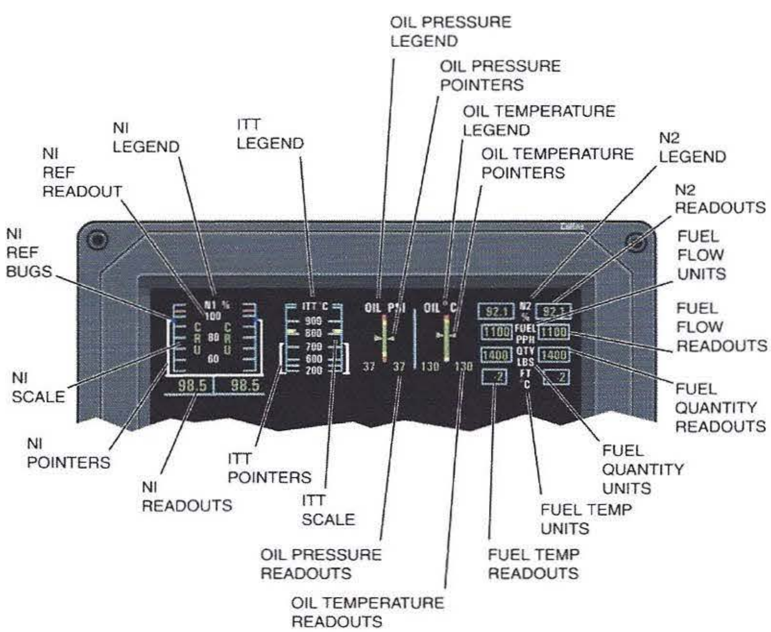

Figure 5-27: Engine Indicating System Compressed Display

Engine Fan Speed (N_1) Indication

The Fan Speed (N_1) indicating system has a dual channel cockpit display and a dual channel FADEC. The system also includes the wiring from the fan (low-pressure shaft) dual channel magnetic speed pickup assembly on each engine to each channel of the FADEC. It includes the ARINC data wiring from the FADEC to the Multifunctional Flight Display (MFD). And also includes the analog signal wiring from the FADEC to the standby N_1 indicator.

N_1 Indicator

The fan speed is shown on the MFD in the center instrument panel.

The N_1 digital readouts show the current fan speed for the left and right engines.

The readouts for CJ3 and CJ2+ are shown in numerical values as follows:

Scale Markings	Red Line	102.9% RPM
Tape/Pointer/Digital Readout	Red	≥ 104.0% RPM 102.9 - 103.9% RPM for ≥ 20 sec
	Yellow	102.9 - 103.9% RPM for < 20 sec
Tape/Pointer	White	≤ 102.8% RPM
Digital Readout	Green	≤ 102.8% RPM

> ***NOTE:***
> - Tape, Pointer and Digital Readout will turn red or yellow, if outside normal operating limits.
> - Pointer and Digital Readout will flash for 5 seconds, and then remain steady if outside normal operating limits.
> - White Tape Pointer represents Green band.

The readouts for CJ1+ are shown in numerical values as follows:

Scale Markings	Red Line	102.7% RPM
Tape/Pointer/Digital Readout	Red	≥ 102.7% RPM
Tape/Pointer	White	≤ 102.6% RPM
Digital Readout	Green	≤ 102.6% RPM

The fan speed is shown as a vertical bar graph digital display, and a digital Liquid Crystal Display (LCD) format. Separate displays are supplied for each engine.

The left and right signal inputs to the MFD are separate.

The current fan speed is also shown as a digital readout on the N_1 standby indicator. The indication flashes when the value is equal to or greater than 102.9 %.

Engine Turbine Speed (N_2) Indication

The Engine Turbine Speed (N_2) indicating system has a dual channel cockpit display and a dual channel FADEC. The system also includes the wiring from the turbine (High Pressure shaft) dual channel magnetic speed pickup assembly on each engine to the FADEC. It also includes the ARINC data wiring from the FADEC to the MFD.

N_2 Indicator

The turbine speed is shown on the MFD in the center instrument panel.

The readouts are shown in numerical values as follows:

Digital Readout	Red	≥ 100.8% RPM (≥ 100.1% for CJ1+) 100.1 - 100.7% ≥ 20 sec
	Yellow	100.1 - 100.7% < 20 sec
	Green	≤ 100.0% RPM

> ***NOTE:*** Digital Readout will flash red or yellow for 5 seconds, and then remain steady if outside normal operating limits.

The N_2 indicator speed is shown as a numeric value on the MFD. The MFD uses a digital LCD. Separate digital displays are supplied for each engine.

Inter-Turbine Temperature (ITT) Indication

The engine ITT indicating system has a dual channel cockpit display and a dual channel FADEC. The system also includes the dual channel wiring from each engine-mounted ITT connector to the FADEC and the ARINC data wiring from the FADEC to the MFD.

ITT Indicator

The ITT is displayed on the MFD in the center instrument panel.

The ITT is shown in degrees Celsius (°C). The range of the display is from 200°C (392°F) to 1,100°C (2,012°F). The scale from 600°C (1,112°F) to 1,100°C (2,012°F) is expanded for more precise indication.

For the CJ2+, the scale range is 100°C to 1,050°C, with tick marks at 200, 400, 600, 650, 700, 750, 800, 850, 900, 950, 1,000, and 1,050°C. Four linear scale portions exist, with scaling change above 600°C, 800°C, and changing again above 900°C.

The ITT is shown in a vertical tape format. Separate displays are supplied for each engine.

The left and right signal inputs to the MFD are separate.

Red, yellow, and green markings on the temperature scale show the warning, caution, and normal operating ranges, in that order.

The indications for CJ3 and CJ2+ are shown as follows:

Engine Start

Scale Markings	Red Triangle	1,001°C
	Red Line	878°C
	Yellow Band	841°C - 877°C
Tape/Pointer	Red	> 1,000°C
	White	≤ 1,000°C

> ***NOTE:***
> - Tape will turn red and Pointer will flash red for 5 seconds, and then remain steady red if outside normal starting operating limits.
> - Engine Running Red Line and Yellow Band do not apply while ITT Start Limit (Red Triangle) is in view.
> - White Tape Pointer represents Green band.

One Engine Running

Scale Markings..........Red Line.. 878°C
Yellow Band................................841°C - 877°C

Tape/Pointer...............Red..≥ 878°C
841°C - 877°C for ≥ 10min
Yellow...........841°C - 877°C for ≥ 3 min, < 10min
White..≤ 840°C
841°C - 877°C for < 3min

> ***NOTE:***
> - Tape will turn red or yellow, the Pointer will flash red or yellow for 5 seconds, and then remain steady if outside normal operating limits.
> - White Tape Pointer represents Green band.

Two Engines Running

Scale Markings..........Red Line..878°C
Yellow Band................................841°C - 877°C

Tape/Pointer...............Red..≥ 878°C
841°C - 877°C for ≥ 5 min
Yellow...........841°C - 877°C for ≥ 3 min, < 5 min
White..≤ 840°C
841°C - 877°C for < 3 min

> ***NOTE:***
> - Tape will turn red or yellow, the Pointer will flash red or yellow for 5 seconds, and then remain steady if outside normal operating limits.
> - White Tape Pointer represents Green band.

The indications for CJ1+ are shown as follows:

Engine Start

Scale Markings............Red Triangle..1,001°C
Red Line...856°C
Yellow Band..............................836°C - 855°C

Tape/Pointer................Red..> 1,000°C
White..≤ 1,000°C

> ***NOTE:***
> - Tape will turn red and Pointer will flash red for 5 seconds, and then remain steady red if outside normal starting operating limits.
> - Engine Running Red Line and Yellow Band do not apply while ITT Start Limit (Red Triangle) is in view.
> - White Tape Pointer represents Green band.

One Engine Running

Scale Markings..........Red Line.. 856°C
Yellow Band.................................836°C - 855°C

Tape/Pointer...............Red..≥ 856°C
836°C - 855°C for ≥ 10min
Yellow...........836°C - 855°C for ≥ 3 min, < 10min
White...≤ 835°C
836°C - 855°C for < 3min

> ***NOTE:***
> - Tape will turn red or yellow, the Pointer will flash red or yellow for 5 seconds, and then remain steady if outside normal operating limits.
> - White Tape Pointer represents Green band.

Two Engines Running

Scale Markings..........Red Line..856°C
Yellow Band...............................836°C - 855°C

Tape/Pointer...............Red..≥ 856°C
836°C - 855°C for ≥ 5 min
Yellow...........836°C - 855°C for ≥ 3 min, < 5 min
White...≤ 835°C
836°C - 855°C for < 3 min

> ***NOTE:***
> - Tape will turn red or yellow, the Pointer will flash red or yellow for 5 seconds, and then remain steady if outside normal operating limits.
> - White Tape Pointer represents Green band.

Powerplant System

FADEC

The FADEC is aircraft installed (in an unpressurized area) and consists of two identical channels with the cross channel (Input/Output) I/O interface necessary to provide complete redundancy and transparent transition from one channel to the other. Power, communications and engine control are passed into and out of the FADEC through a series of D sub-miniature connectors. Each channel incorporates three connectors, one for engine control and sensor interfaces, one for aircraft, cross FADEC and cross channel communications and one for aircraft I/O (other than communications).

Each channel contains a micro-controller, volatile and non-volatile memory, analog input circuits, Input/Output (I/O) discrete drivers, power conditioning, ARINC 429 and RS-422 communication drivers and an independent N_2 overspeed protection circuit. FADEC software is comprised of three components: an Operating System (OS), an Online Loader (OLL) and the Application Software (AS).

The OS provides software interface to the I/O drivers for all engine control data inputs, communication and data interfaces, and to the ECU electronics for Built In Test (BIT) and fault diagnostics. The OLL manages software programming of the FADEC channels. The AS provides the controlling algorithms for the engine system. Identical software resides in each channel of the FADEC.

Fuel Delivery Unit (FDU)

The FDU is engine driven through the FDU-to-gearbox attachment and includes the main engine fuel pump, main engine fuel filter, metering components and a PMA.

Permanent Magnet Alternator

The FDU contains an integral PMA that supplies redundant three phase power to the FADEC. The PMA is geared to the pump shaft and rotates at twice the speed of the pump.

Ignition System

The Ignition System provides spark to ignite the fuel-air mixture inside the combustion section. The ignition switching system gives 29 VDC to the engine ignition exciters as required for proper engine operation. The engine has two ignition systems. The left and right ignition switching systems operate independently of each other.

The Ignition system includes:

- Igniter Boxes and Igniters
- Ignition Controls and Switches
- Ignition Indicators

Igniter Boxes and Igniters

Each engine incorporates dual exciter units and two igniters. The exciter units convert battery or generator input to high voltage DC, store it momentarily until a given energy level is reached, and allow it to discharge in spark form through the igniters. System wiring is such that malfunction of one igniter or exciter will not affect normal operation of the other.

Ignition Controls and Switches

Cockpit Control consists of two-position R and L Ignition Switches on the left switch panel. Each ignition switch has two selections: ON and NORM.

In NORM, function is automatic during start or during engine anti-ice operation. Moving the throttle to IDLE with at least 8% N_2 after depressing the start button activates ignition until it is terminated automatically at approximately 45% turbine RPM (N_2) (40% turbine RPM (N_2) for CJ1+). Continuous ignition occurs any time the respective engine anti-ice switch is in either the ENG ON or ENG/WING position, the ignition switch is ON, or landing gear is extended in flight.

Figure 5-28: Ignition Switches

The ignition switching system gives 29 VDC to the engine ignition exciters when the applicable L IGNITION or R IGNITION circuit breaker on the left circuit breaker panel is engaged and any of the conditions that follow.

- The ignition switch in the ON position will override the FADEC control of the igniters. The IGNITION switch ON forces the igniters ON and can be used anytime there is power on the normal bus system.
- The IGNITION switch in the NORM position lets the FADEC control the igniters. The FADEC can control each engine igniter independently (Left FADEC controls left engine igniters, Right FADEC control right engine igniters). During start modes, the FADEC gives the igniter ON commands.
- During ground engine starts, only one igniter is used. The FADEC uses one and then the other for each subsequent start. For altitude restarts, both igniters are used.

- The FADEC will use both igniters during the following conditions.
  - **Approach** - The landing gear is down and locked and TLA is less than Max Continuous power setting. The FADEC will turn the igniters off after a weight-on-wheels is sensed and after 8 seconds.
  - **Engine Flameout** - When a flameout is sensed by the FADEC, (due to an unexpected decreasing rate of change of N_2) both igniters will come on. The FADEC will turn off the igniters when the FADEC senses that an engine relight has occurred or if the engine fails to relight and spools down below ~44% N_2.

The Igniter Control Printed Circuit Boards are in the aft power junction box. Electrical power to the exciters is controlled by logic circuitry on the IGNITER CONTROL printed circuit boards.

Ignition Indicators

Ignition Indicator Lights on the left switch panel near the ignition switches, will come on when power is supplied to the engine ignition exciters. The indicator lights can be dimmed by the EL PANEL LIGHT CONTROL on the left instrument panel.

A small green light above each ignition switch illuminates and IGN is displayed to the left and right of the ITT tapes whenever one or both exciters are receiving electrical power.

A green IGN icon will show on the MFD to the left of the N_1 indicator when power is applied to either igniter of the left engine. A green IGN icon will show on the MFD to the right of the N_1 indicator when power is applied to either igniter of the right engine.

CAUTION
If the igniter circuit breaker is pulled, do not attempt to reset the circuit breaker until the start has been aborted.

If one igniter should fail, ignition will still be available from the remaining igniter. For ground starts, a single igniter is powered and alternated with each start. Failure to obtain normal ignition indications during a ground start indicates a failure with one channel of the exciter box or ignition.

At all other times both igniters are powered. If ignition indications are not present when ignition should be automatically provided, select ignition switches on and check the ignition circuit breakers on the left CB panel.

Engine Starting

Engine Start Limitations
Maximum Tailwind............................12 Kts (10 Kts for CJ1+) (10 Kts with SB 73-02)
Maximum Crosswind.......................16 Kts (12 Kts for CJ1+) (10 Kts with SB 73-02)
Max time to light off...........................10 secs
Min battery voltage....... 24 VDC
Max airport elevation for battery start................ 10,000 ft. (14,000 ft. with SB 73-02)

The FADEC schedules fuel flow and N_2 acceleration rate during engine start. When the throttle is positioned in the idle detent or higher and N_2 is at or above 8%, the FADEC will schedule light off fuel flow as a function of TT_2, PT_2 and N_2 speed and will send a signal to the aircraft commanding the engine ignition system be activated.

For ground starts, the FADEC will alternate between left and right hand ignition exciters to preserve igniter life.

For altitude restarts, both igniters are commanded on. Upon detection of engine light off, the FADEC adjusts fuel flow as required to maintain a scheduled N_2 acceleration rate. During the start, the FADEC will cut back fuel flow as required to limit start ITT, except that the FADEC cannot reduce fuel flow below allowable minimum fuel flow. It is the pilot's responsibility to monitor ITT and abort the start if ITT exceeds published limits.

Engine starting is divided into two general categories:

- Ground Starting
- Air Starting

Ground starting can be accomplished by battery start, generator-assisted start, and External Power Unit (EPU) start. See the Electrical section of this manual for engine starting description.

> ***NOTE:*** If the battery has been cold soaked for 2 hours or longer at ambient surface temperature of -18°C (0°F) or lower, it must be preheated to above -18°C (0°F) prior to start.

Air starting is divided into starter assisted (battery) and windmilling airstart. An airstart follows the sequence of a second engine ground start. However, the offside start relay is disabled by the squat switch ground command to the start logic printed circuit board, indicating an in-air condition. This allows the battery to start the engine while the operating generator powers the rest of the airplane.

All types of airstarts must be performed in accordance with the airstart envelope.

Ensure the aircraft is started within the crosswind and tailwind limitations. An engine start should be aborted for any of the following conditions:

- False engine start – No ITT/fuel flow within 10 seconds (12 seconds for CJ1+) after advancing the throttle to IDLE.
- Hot engine start – ITT rapidly approaching l,000°C (1,832°F).
- No N_1 rotation by 12% N_2 RPM (25% N_2 RPM for CJ2+ and CJ1+).
- Hung start – Slow or no rotation after ITT increases and prior to reaching idle RPM.

To abort the start, move the throttle to OFF, motorize the engine for 15 seconds, and disengage the starter by pushing the START DISG.

Power Setting

The FADEC schedules engine speed between ground idle and takeoff power settings as a function of aircraft Throttle Lever Angle (TLA), engine inlet total temperature (TT_2) and engine inlet total pressure (PT_2). The FADEC schedules N_1 speed at high power and N_2 speed at low power. The FADEC contains throttle detents for shutdown, idle (GND & AIR), max cruise, max continuous (Climb), and takeoff power settings.

The FADEC automatically adjust power settings for aircraft bleed air requirements, anti-ice requirements, and flight conditions.

Primary temperature (TT_2) input to the FADEC is taken from the engine sensor when operating with the engine TT_2/PT_2 sensor heater de-powered. Primary temperature (TT_2) input to the FADEC is taken from the aircraft TAT sensor when the engine TT_2/PT_2 heater is powered (anti-ice selected ON).

Synchronization

Synchronization is provided by the FADEC for twin engine operation. Two airframe discrete inputs activate synchronization and determine the master/slave engine.

Communication between twin FADECs is through a RS-422 cross engine serial communication link. Speed synchronization is available at all power settings with N_1 synchronization available at high power settings and N_2 synchronization available at low power settings (while on N_2 governor schedule).

TLA, N_1 and N_2 must be matched reasonably close to establish synchronization. Synchronization will break if TLA, N_1 or N_2 split sufficiently or if engine control system faults occur while in synchronization. Synchronization is disabled above max continuous throttle position.

Acceleration/Deceleration

Engine acceleration/deceleration is scheduled based on speed error to throttle setting (TLA) and is scheduled as a function of the rate of change in fuel flow, N_2, TT_2 and PT_2. When engine acceleration or deceleration is commanded, the FADEC issues a command to the FDU to open the inducer bleed valve during the transient to reduce the air load on the HP compressor and increase transient surge margin.

Flameout Detection

The FADEC monitors the time rate of change of ITT and N_2 speed to determine if engine combustion has been lost. If a flameout has been detected, a recovery fuel flow is scheduled and a request to activate the igniters sent to the aircraft.

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F. Landing Gear and Brakes

Landing Gear Brakes and Steering

Landing gear on the CJ2 is the same as the CJ3. It is equipped with a nose gear with a rudder centering cam and lock. When the nose gear strut is fully extended the centering lock will engage to center the nose wheel during retraction. When the strut compresses on touchdown, the centering lock will release. This enhances ground directional control.

Other differences:

1. The CJ2 brakes are carbon whereas the CJ and CJ1 brakes are steel
2. The CJ/CJ1 anti-skid system is analog. The CJ2 has a digital system which is the same as the CJ3
3. CJ nose tire pressure is 120/-5 PSA and main tire pressure is 98 ± 5
4. CJ1 nose tire pressure is 120 ± 5 and the main tire pressure is 102 ± 5
5. CJ2 nose tire pressure is 120 ± 5 the main tire pressure is 114 ± 5
6. CJ/CJ1 both have master cylinders behind the brake pedals connecting directly to a metering valve. These cylinders have been removed on all CJ's beginning with the CJ2.
7. CJ/CJ1 do not have anti-skid touch down protection as does the CJ2 and CJ3
8. The brake power pump is activated ON and OFF at 950 to 1,300 on the CJ/CJ1/CJ2 and 1,175 to 1,300 on the CJ3

Brake System

Wheel Brakes

Brake Metering Valve and Cable System Operation

The brakes are operated by a separate, closed center hydraulic system, with an independent reservoir, pump/electric motor, and accumulator. A pressure switch located near the fluid end of the accumulator, senses brake system pressure and commands the pump on and off accordingly. There is no cockpit switch for the brake pump.

The pump is powered on any time the gear handle is in the down position and the accumulator pressure is below 1,175 ± 75 PSIG. When the accumulator pressure reaches 1,500 ± 50 PSIG, the power is removed for the pump. A separate low pressure switch built into the pump, monitors the system for low pressure.

If the system pressure drops below (750 ± 50 PSIG) and the gear handle is down, the low pressure switch causes the PWR BRK LOW PRESS annunciator to illuminate. During normal operation, the accumulator provides pressurized fluid to the brake metering valve, which regulates pressure (0 to 1,000 +50/-20 PSI), to the brake assemblies in proportion to the brake pedal deflection of the pilot's or co-pilot's brake pedals. Braking can be controlled independently from either cockpit position.

The cable system that transmits pedal deflection to the brake metering valve, is designed such that pedal inputs by the pilot do not cause the co-pilots pedals to move, and vice versa.

If the pilot's and co-pilot's pedals are depressed simultaneously, the brake system accepts the highest input. Since the brake system is a cable controlled 'power brake system', the braking feel force at the pedals is created by the springs in the mixer, the springs within the brake metering valve and a proportional hydraulic feedback force generated by the brake metering valve.

Figure 5-29: Anti-Skid Control Circuit Breakers

Anti-Skid System Operation

The cockpit controls for the anti-skid system consist of a single ANTI-SKID switch which is an ON/OFF lever lock switch, located just right of the gear handle.

> ***NOTE:*** The anti-skid must be turned on and the self-test sequence completed while the aircraft is stationary.

Figure 5-30: Anti-Skid Control Switch

The primary function of the anti-skid system is to provide maximum braking efficiency under all runway conditions. In addition, the anti-skid system provides touchdown protection, which prevents braking, until adequate wheel spin-up has occurred, and locked wheel crossover protection, that prevents adverse differential braking.

Anti-Skid Protection

Anti-Skid Protection is provided to allow maximum braking efficiency, which in turn, minimizes landing distances. If the pilot applies enough brake pedal force to cause slippage between the tires and the runway, the wheel speed transducer data, received by the control box, indicates a sudden deceleration for the slipping wheel.

The control box will determine the severity of the impending skid, and send the appropriate current signal to the anti-skid servo valve, to reduce brake pressure accordingly. Dual servo valves reduce pressure for either brake independently. Therefore, a single wheel skid will result in the reduction of brake pressure at the skidding wheel only. Anti-skid protection will be available, unless the touchdown protection mode is active.

Touchdown Protection

Touchdown protection is provided to prevent the application of brake pressure, prior to wheel spin-up. During a landing, the wheels must be allowed to spin-up, to provide the anti-skid system a 'reference' velocity to which individual wheel speeds can be compared. Touchdown protection is active only when an AIR signal is sensed by both main gear squat switches.

In touchdown protection mode, the control box commands the anti-skid servo valves to dump all brake pressure. The full dump command will remain active for 3 seconds after WOW or until wheel spin-up has occurred.

Under normal circumstances, the wheels will spin-up almost immediately after touchdown. Therefore, the system incorporates a spin-up override feature.

When the velocity of a wheel exceeds 59 ± 2 Kts, touchdown protection is overridden, and brake pressure application is allowed to that wheel.

Each wheel is independent in regard to spin-up override. Touchdown protection mode is overridden for each wheel independently, only when the speed of a given wheel is in excess of 59 ± 2 Kts. The wheel spin-up override will remain active until the wheel velocity falls below 15 ± 2 Kts.

G. Flight Controls

General

CJ-CJ3 flight control differences are:

- CJ3 incorporates a rudder bias system to assist the pilot in case of an engine failure. If an engine fails either in flight or on takeoff on the runway, the rudder bias system will move the rudder in the opposite direction to assist in directional control. If the rudder bias should fail, the pilot will have normal rudder control. The rudder bias system is tested prior to flight using the rotary test knob. An annunciator is found on the pilot's instrument panel under the master warning to advise the pilot of system malfunction.
- The CJ3 utilizes an A/P sync button to replace the TCS button on the CJ model. Both buttons perform the same function.
- The CJ3 stick shaker stall warning system has a high altitude barometric switch to give increased stall warning above FL 310.
- The CJ3 features a rudder centering cam and nose gear centering lock to improve directional stability during ground maneuvering. The lock engages at full extension of the nose wheel strut, and disconnects when the nose gear compresses during landing.

Elevator Trim

Elevator Trim tabs installed on each elevator can be positioned electrically or mechanically through cockpit trim tab actuators easily accessible to both pilots. Full travel of the tabs is 9° ± 1° up and 17° ± 1° down. An elevator trim wheel on the pedestal provides manual trim control.

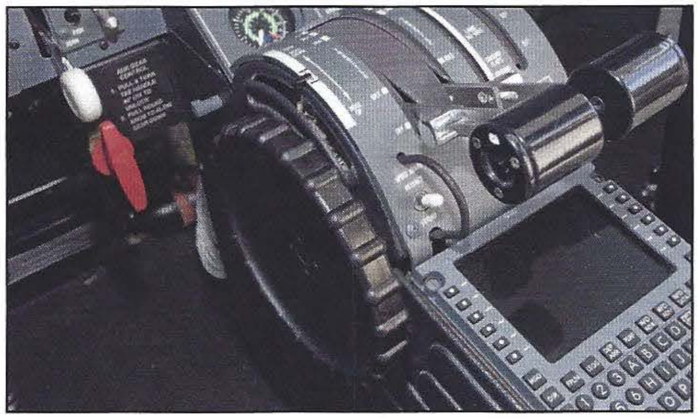


Figure 5-31: Elevator Trim Wheel

Electric Trim Switches

A trim switch, located on the left side of the pilot's control wheel and on the right side of the co-pilot's control wheel, controls an electric trim motor, which in turn positions the elevator tabs. The pilot's trim switch has priority and will interrupt and override the co-pilot's control.

Figure 5-32: Trim Switches

If the electric trim malfunctions, it can be overridden by the manual trim system, or momentarily disabled by pressing the AP/TRIM DISC switch on the pilot's or co-pilot's yoke. Pulling the PITCH TRIM circuit breaker on the left circuit breaker panel will remove power from the electric trim motor.

Rudder

The Rudder on the trailing edge of the vertical stabilizer provides effective yaw control of the aircraft at all flight speeds. A direct connect cable system from both sets of rudder pedals to the tail section drives the aircraft rudder. Full range of motion is 30 ± 1° either left or right of center.

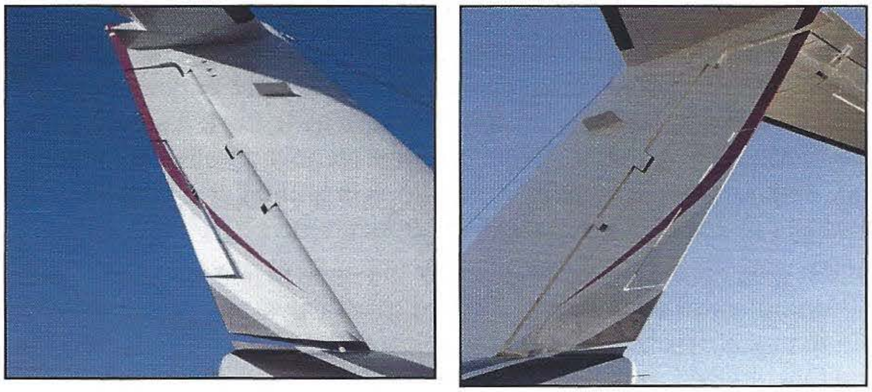


Figure 5-33: Rudder (Left and Right)

Torque tube and bridge assemblies connect the pilot's and co-pilot's rudder pedal sets together. The connection provides corresponding rudder pedal movement between the sets.

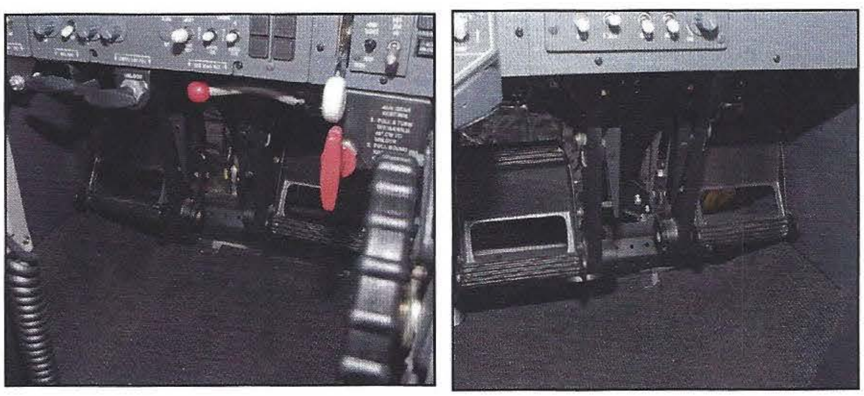


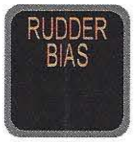
Figure 5-34: Rudder Pedals (Pilot and Co-Pilot side)

Depressing the rudder pedals transmits directional information through fuselage cables to the rudder bellcrank. The rudder bellcrank transmits movement information to a torque tube that deflects the rudder.

Rudder Bias System (Only on CJ3 and CJ2+)

The CJ3 also has a rudder bias system to help with directional control in case of engine failure on takeoff.

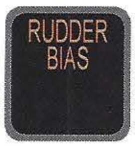
The CJ3 has a pneumatic rudder bias system incorporated into the flight control system to automatically provide assistance to the pilot during an engine failure.



The Rudder Bias System is electronically controlled and pneumatically actuated through the normal DC power and service bleed air system. Components of the system are the Rudder Bias Valve, Rudder Bias Actuator Assembly, Bleed Air Plumbing, and a RUDDER BIAS annunciator.

Rudder Bias Valve

A solenoid operated Rudder Bias Valve is installed between the engine bleed air lines and the rudder bias actuator assembly. The rudder bias valve is energized open upon power up, to port right engine bleed air to the right command half and left engine bleed air to the left command half, of the rudder bias actuator. When power is removed from the rudder bias valve, engine bleed air from both engines is shutoff and both command halves of the actuator are vented to atmosphere.



A rudder bias valve is monitored and in the case of a failure the RUDDER BIAS annunciator will come on. The shutoff valve solenoid is powered, when the electrical bus is energized with the DC POWER switch placed in the ON position and power has been applied to the airplane.

Rudder Bias Actuator

A Rudder Bias Actuator assembly operates the rudder bias arm assembly to turn the rudder torque tube left or right. The rudder bias arm assembly drives the rudder directly and back drives the rudder control cables and the autopilot servo, in the event of an engine failure.

Bleed Air Plumbing

Separate Bleed Air Plumbing for the left and right engines connect each engine's bleed air supply to the rudder bias valve. The separated bleed air then goes to opposite sides of the rudder bias actuator. A small orifice is at the low point of each side to allow any moisture in the lines to be vented overboard.

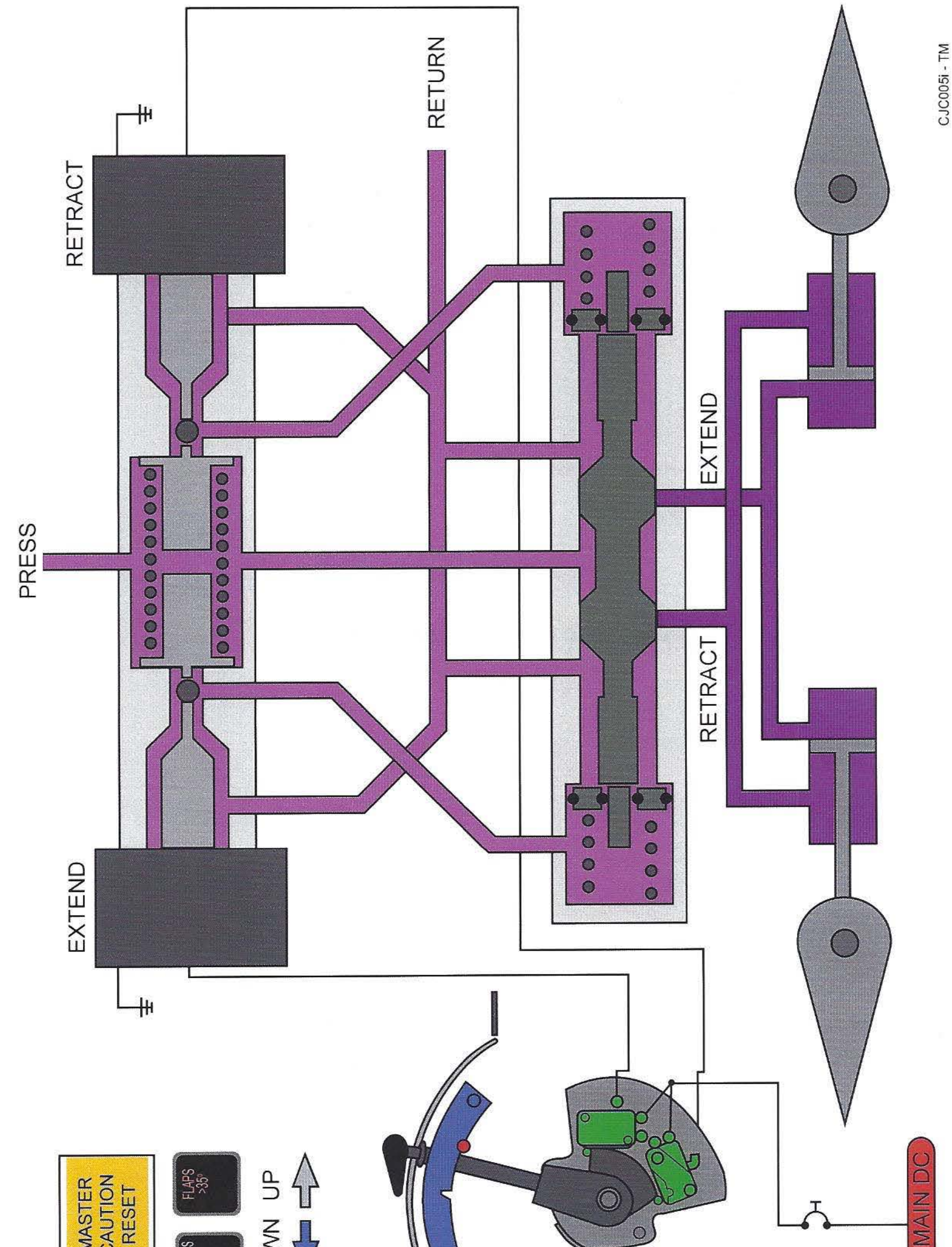
RUDDER BIAS Annunciator

The RUDDER BIAS annunciator is on the annunciator panel for rudder bias system annunciations. The RUDDER BIAS and MASTER CAUTION annunciators will come on when the rudder bias valve is in the bypass position.

Rotary Test

When the TEST switch, on the left instrument panel, is set to the RUDDER BIAS position, power is temporarily interrupted to the rudder bias valve which causes it to move to the bypass position. The RUDDER BIAS and MASTER CAUTION annunciators will come on until power is restored to the rudder bias valve.

Flaps System



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H. Environmental System

Very few differences exists between the CJ3 and the CJ/CJ1 and CJ2 environmental systems. From an operational standpoint, the CJ3 panel has the same ground idle switch as the CJ2 which alters engine idle speed for taxiing. Otherwise the panel is a copy of the CJ panel, and operates the same.

Other differences:

1. Max pressure differential is 8.9 PSI on the CJ3 the same as the CJ2. CJ/CJ1 is 8.6 PSI
2. Change to read: The CJ3 like the CJ2 uses fan bypass air to pass over the pre cooler which exits into the engine exhaust air. The CJ/CJ1 use air that enters the plyon through an inlet on the bottom side of the pylon.
3. The CJ3 and the CJ2 red altitude warning annunciator says: CAB ALT. and the CJ/CJ1 red altitude warning light says: CAB ALT 10,000 ft.
4. Cabin dump altitude is 13,000 ft. for the CJ/CJ1 and 14,500 ft. for the CJ3 and CJ2
5. You set the departure altitude in the pressure controller for the CJ3/CJ2 and for the CJ/CJ1 you set field elevation -200
6. The CJ3 like the CJ2 has a high altitude pressure mode whereas the CJ/CJ1 pressure controller does not have a high altitude mode
7. CJ/CJ1 you must select emergency pressurization. Emergency pressure is automatically activated on the CJ2/CJ3 when cabin altitude reaches 14,500 ± 500 ft.

Cabin Dump Switch

The cabin dump switch, located on pressurization environmental control panel, may be actuated to reduce cabin pressure. The switch disables the electrical controls and activates the primary outflow climb solenoid, to pull air out of both the outflow valve control chambers, and dump cabin pressure to the limits of the cabin altitude limit valves.

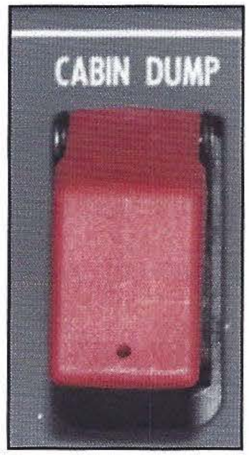

Figure 5-35: Cabin Dump Switch

Cabin altitudes above 15,000 ft. will be prevented. In the event of a pressurization system failure, select Pressurization System Select Switch to MANUAL and control the cabin altitude with the MANUAL UP/ DOWN switch.

Pressurization Controller

The Pressurization Controller is comprised of two digital windows marked SET ALT and RATE, an FL button, an EXER button, and a SET ALT knob. The controller is normally operated in the AUTO mode, which is selected by positioning the MANUAL/AUTO switch on the pressurization environmental control panel to AUTO.

Figure 5-36: Pressurization Controller

The digital pressurization controller has a Light Emitting Diode (LED) light, on the upper left corner of the controller. The light changes from yellow to red to indicate various conditions with the controller.

The yellow caution light indicates interruption of the Air Data Computer (ADC) information flow to the controller, automatically switching the controller flight mode from AUTO to ISOBARIC. If ADC data resumes, the yellow caution light extinguishes and the system returns to normal operation.

A steady red light indicates complete internal failure of the cabin pressure controller. The digits appear blank and the outflow valves capture and hold current cabin pressure. Use the red MANUAL knob while referencing the cabin differential pressure gauge to manually control cabin pressure.

The digital pressurization controller has a built-in schedule that automatically controls cabin altitude based on aircraft altitude, and adjusts cabin rate-of-climb/descent versus aircraft rate-of-climb/descent.

On CJ1+, with an aircraft altitude of 41,000 ft. (FL 410), the controller maintains a maximum cabin altitude of 8,000 ft.

On CJ3 and CJ2+, with an aircraft altitude of 45,000 ft. (FL 450), the controller maintains a maximum cabin altitude of 8,500 ft.

Automatic Mode

In AUTO mode the operator normally selects the landing field pressure altitude before takeoff, by setting the information into the upper window with the SET ALT knob. Then, in flight the controller will continuously generate an auto-schedule based on the departure field elevation (add 200 ft. to field elevation for the CJ1+), the maximum altitude in flight sensed by the air data sensor, and any operator changes of the landing field pressure altitude.

The controller determines the pressure rate of change, and the cabin pressure altitude, based on the auto-schedule and the air data computer indicated altitude. The auto-schedule will de-pressurize the cabin at the set landing altitude before landing. Cabin rate-of-change is an automatic function of the system and is not directly selectable.

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I. Ice and Rain

The ice and rain protection system installed on the CJ3 is very similar to the system on the CJ/CJ1 and CJ2.

Noted differences between CJ3 and CJ/CJ1 and CJ2

1. The CJ3 and CJ2 pylons ram air inlets are bleed air heated when wing anti-ice switch is selected ON. The CJ/CJ1 are electrically heated when either the engine or wing/engine anti-ice switch is selected ON.
2. Annunciator lights on the CJ3 include:
   - Tail de-ice fail light
   - L and R wing Overheat light

The amber tail de-ice fail light is the same as on the CJ2. It will illuminate under the following conditions:

- Failure of the de-ice timer clock
- Tail de-ice circuit breaker is either popped or has been pulled
- Voltage to the valve is not within limits
- Pressure to the boots is not within limits

General

The Ice and Rain Protection systems are divided into two classes: anti-ice and deice.

Anti-ice systems act to deter the formation of ice and require the pilot to anticipate possible icing conditions, and put the system into operation, before icing conditions are encountered. Anti-ice systems are not designed to remove ice which has already accumulated.

Deice systems are designed to remove ice which has already formed. The only deice system on the Citation Jet airplanes is the horizontal stabilizer system which is operated from the 23 PSI service air system.

The Citation CJ3/CJ2+/CJ1+ utilize three methods to protect aircraft surfaces from ice and rain:

- Engine bleed air prevents ice formation on the windshield anti-ice system, pylon inlet, engine cowl, generator inlet, and the wing leading edges.
- Electric heating elements protect the pitot/static ports, the Angle-of-Attack (AOA) probe, TT_2/PT_2.
- Pneumatic deice boots remove ice from the horizontal stabilizers.

All anti-ice and deice systems should be turned ON when operating in visible moisture and the indicated RAT is 10°C (50°F) or below.

Ice Detection

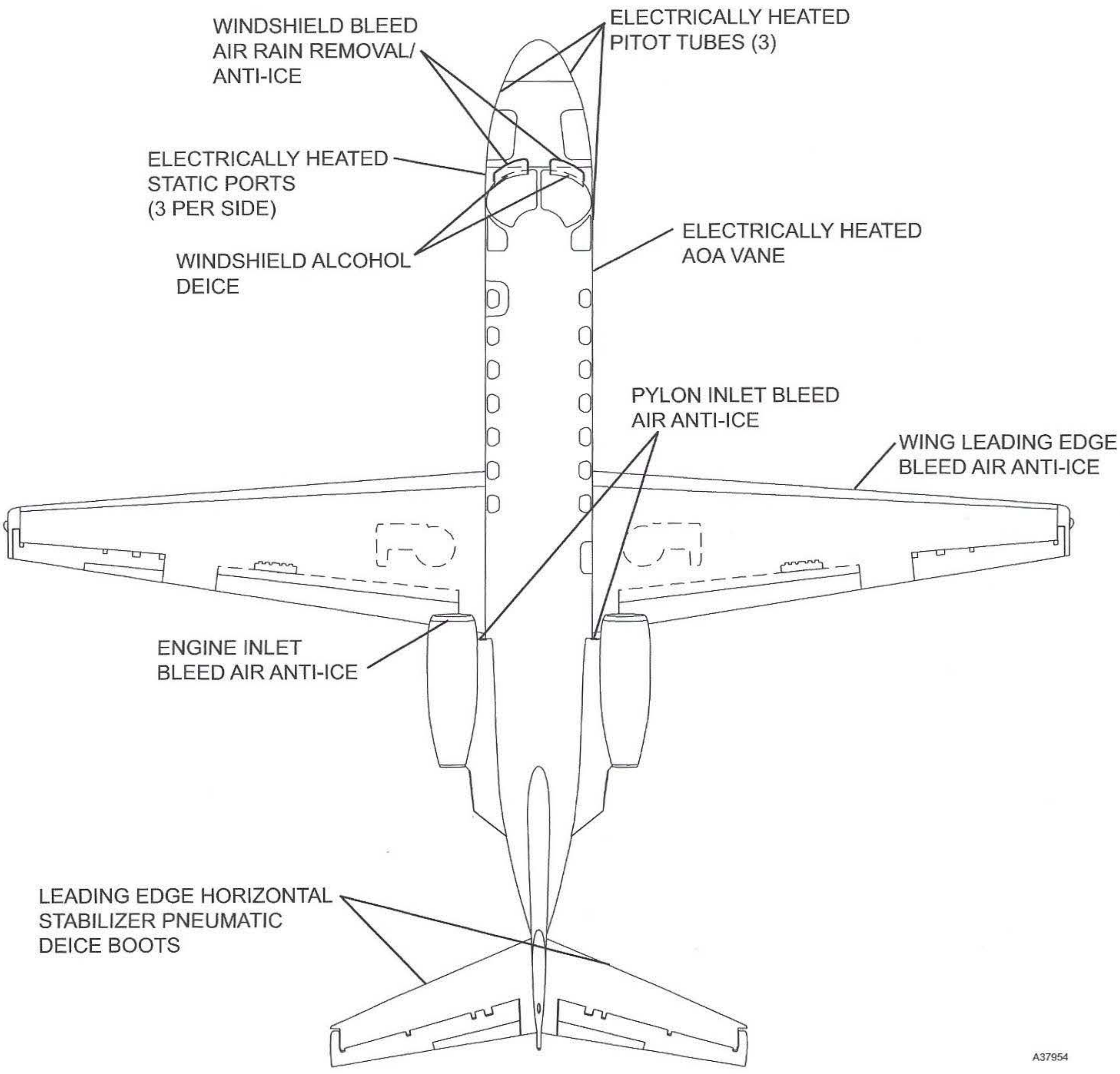
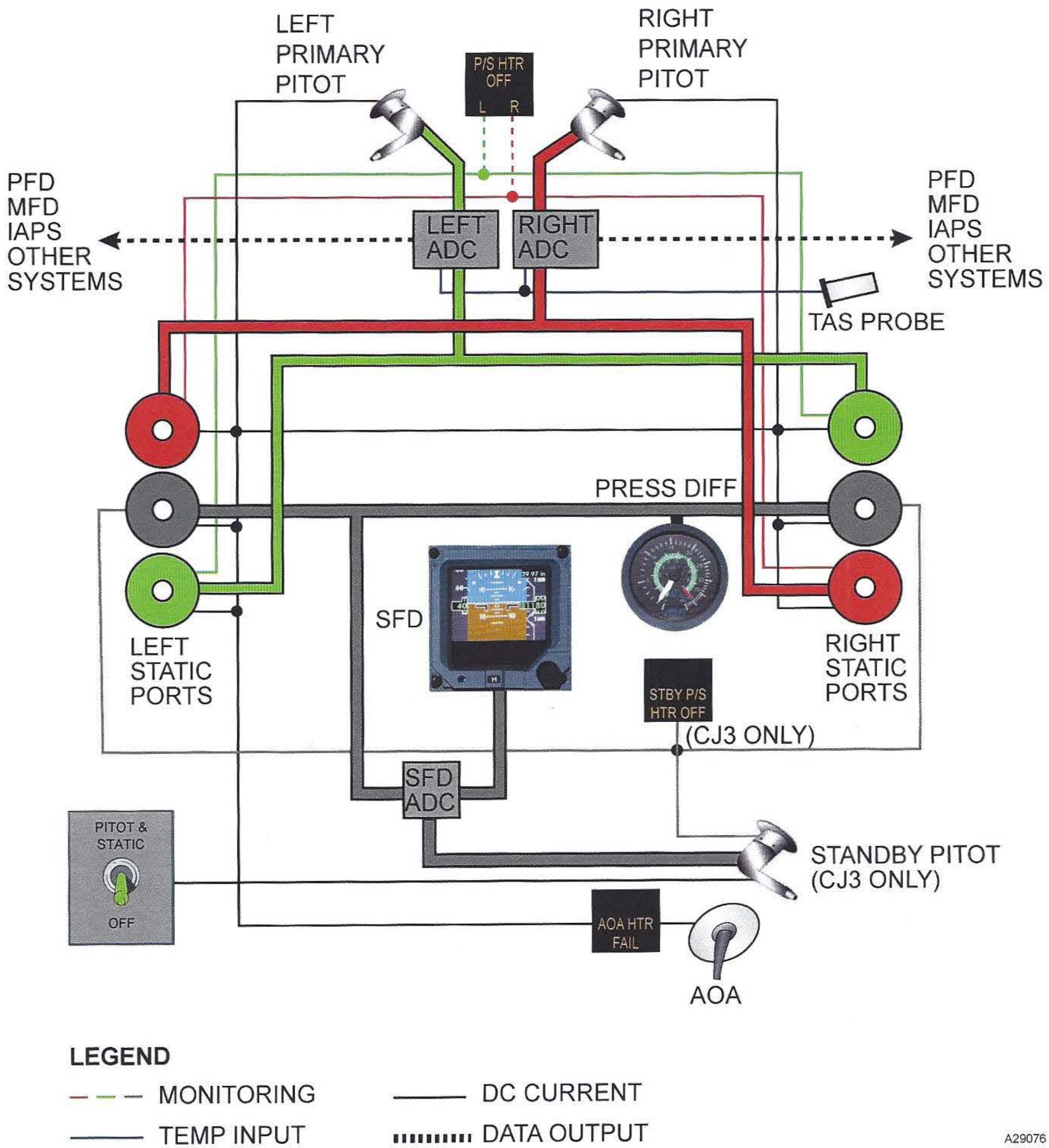


Figure 5-37: Ice and Rain Protection Systems

Pitot Static System



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J. Fire Protection System

General

From an operational standpoint in the cockpit their are no differences between the fire protection system between the CJ3 and CJ/CJ1 and CJ2. The only major difference is the location of the fire bottles in the aft baggage compartment. In the CJ/CJ1 the fire bottles are located in the center panel and in the CJ3 location is the same as the CJ2 - left panel. During preflight, the fire bottles will be found on the upper left side of the aft baggage compartment.

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K. Oxygen System

General

Auto drop of the PAX oxygen masks occur at 14,500 ± 500 ft. on the CJ3/CJ2. The CJ/CJ1 auto drop occurs at 13500 ± 600 ft. The standard oxygen bottle on the CJ3 is 50 cubic foot instead of a 22 cubic foot which is standard on the CJ/CJ1 and CJ2.

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