

# ECLIPSE 500



## Landing Gear & Brakes




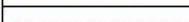

Do Not Use For Flight

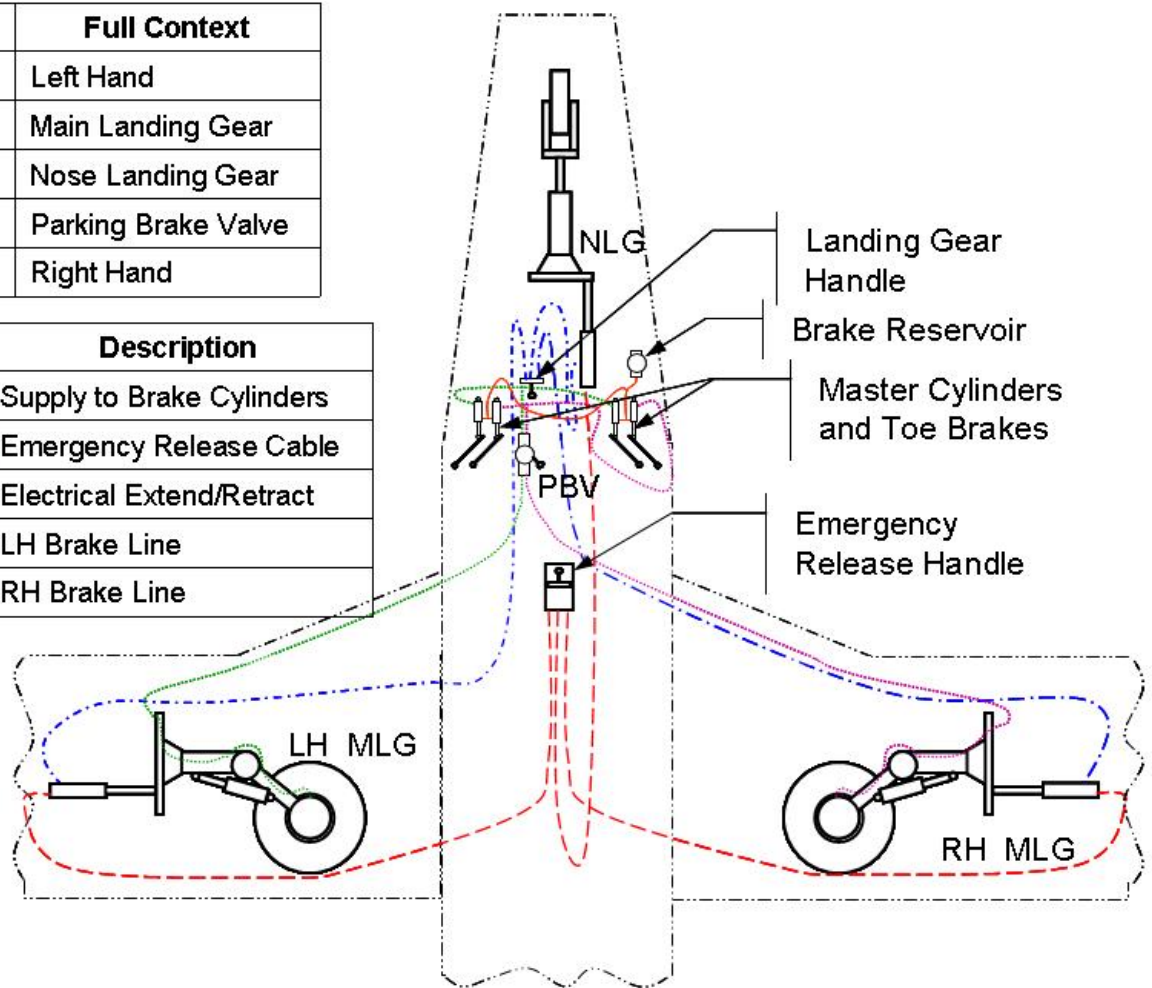
## 4. Landing Gear and Brakes

### 4.1 General

The landing gear is a conventional tricycle configuration, with nose wheel steering being accomplished mechanically through individually adjustable rudder pedals. Extension and retraction is accomplished by three electrically powered actuators. Mechanical brakes on the gear actuator motors hold the gear in the retracted position. These mechanical brakes also hold the gear in the extended position with the aid of over-center braces. These actuator brakes are capable of supporting the gear throughout the flight envelope. Normal extension takes approximately ten seconds and retraction takes approximately seven seconds.

Abbreviation	Full Context
LH	Left Hand
MLG	Main Landing Gear
NLG	Nose Landing Gear
PBV	Parking Brake Valve
RH	Right Hand

	Description
	Supply to Brake Cylinders
	Emergency Release Cable
	Electrical Extend/Retract
	LH Brake Line
	RH Brake Line

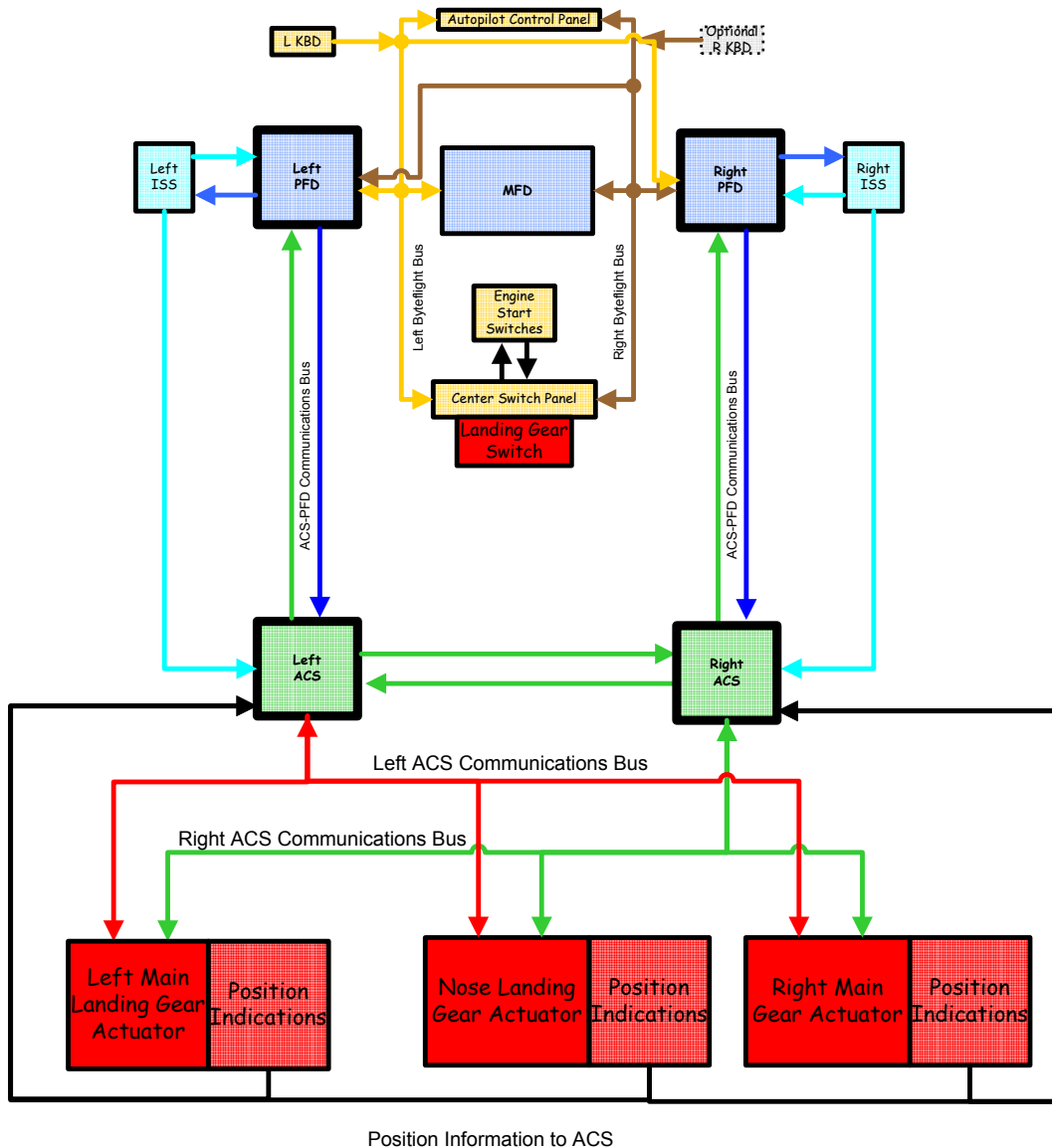


**Landing Gear Schematic**

## 4.2 Aircraft Computer Systems (ACS) Interfaces

The flight crew can retract or extend the landing gear using the landing gear switch on the center switch panel. Pilot commands from the landing gear switch are sent through the PFD to both ACS' which in turn command the three independent landing gear actuators. Commands for gear position go directly to the actuator motor and individual actuator status is sent back to the ACS. There are also several independent position indications from several proximity sensors that are also sent to the ACS for status display on the MFD.

Emergency extension of the landing gear is a direct mechanical release and does not require ACS control to accomplish. There is a emergency landing gear handle proximity switch that is monitored by the ACS that reports if the emergency gear handle remains extended following an emergency gear extension.



**Landing Gear-ACS Interface**

### 4.3 Limitations and Specifications

#### 4.3.1 Airspeed, Mach and Altitude Limitations

Maximum Gear Speed	
V <sub>LO</sub> .....	200 KEAS
V <sub>LE</sub> .....	275 KEAS

#### 4.3.2 Tire Speed Limitation

Maximum Speed.....	139 Knots Ground Speed
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#### 4.3.3 Tire Pressure

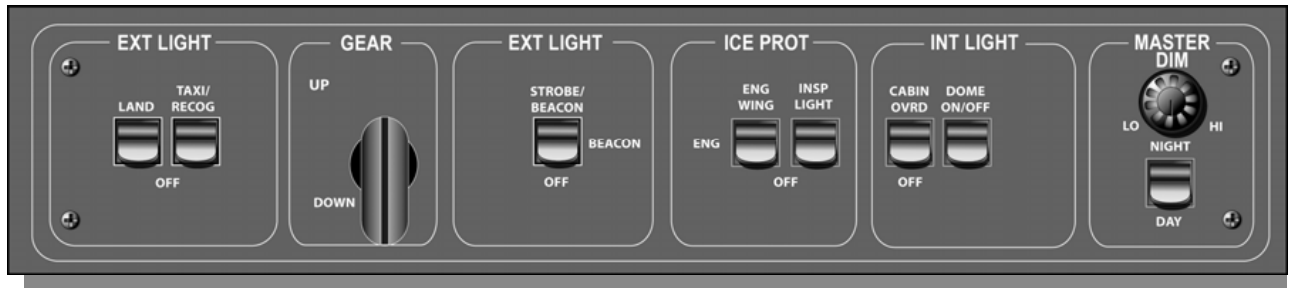
Main Gear .....	103 +/- 2 PSI
Nose Gear .....	70 +/- 2 PSI

#### 4.3.4 Hard Landing Indicators

A maintenance inspection of the landing gear is required before takeoff if any hard landing indicator shows evidence of a hard landing.

## 4.4 Controls and Indicators

### 4.4.1 Gear Handle



### Gear Handle Location

#### 4.4.2 Emergency Gear Release Handle



### Emergency Gear Release Handle Location

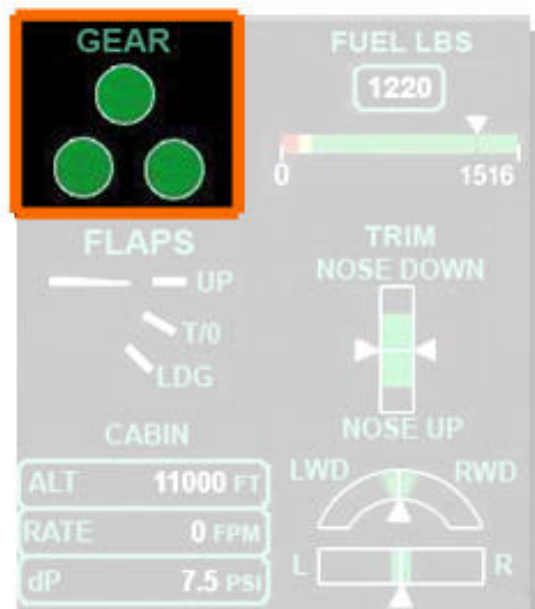
#### 4.4.3 Landing Gear Position Annunciation

A position annunciation for each gear is displayed on the upper portion of the MFD.



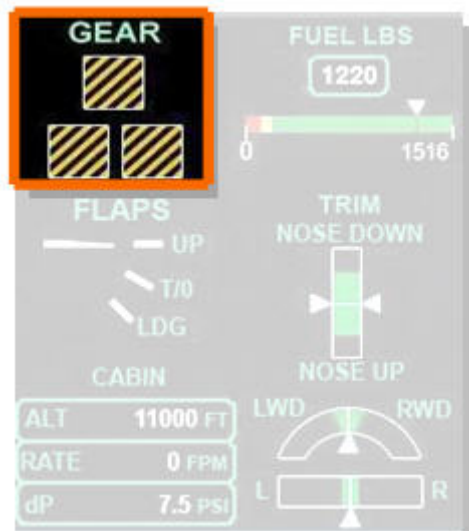
#### Landing Gear Position Annunciation

- A green circle with white border indicates the gear is Down and Locked.



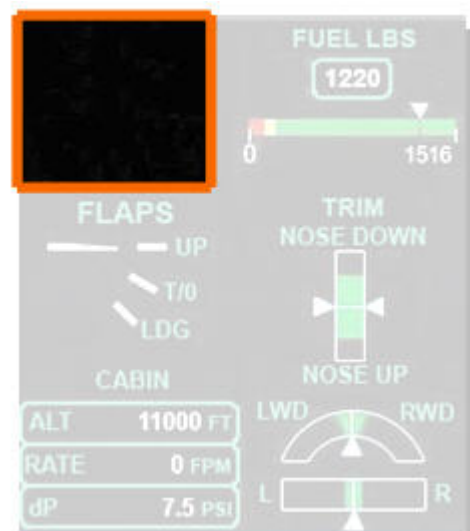
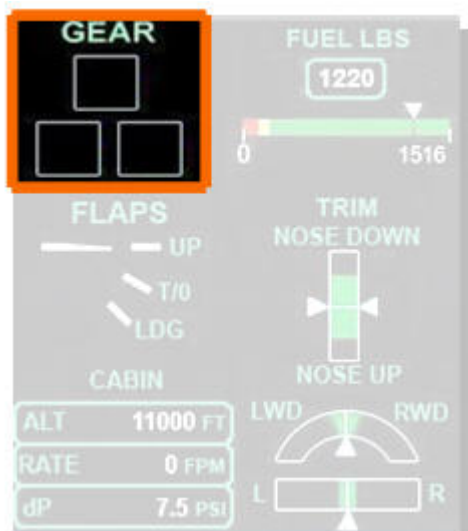


- A amber hatched square indicates the gear is in transit



- A hollow white square indicates the gear is Up and Stowed.

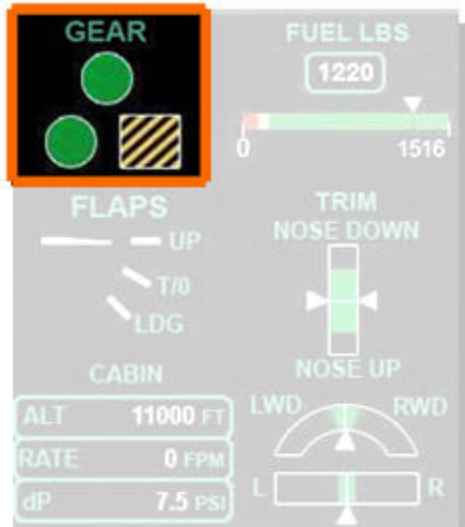
When all three landing gear are Up and Stowed for ten seconds, the white squares will disappear.



### ⇒ NOTE:

During composite mode operation on the PFD, when gear is displayed on the upper right hand portion of the PFD, gear Up and Stowed position annunciation does not disappear after ten seconds.

- If any indicator is not Up and Stowed or Down and Locked, the entire display stays in view and the failed gear is indicated with amber hatched squares. If any gear is in transit for more than 15 seconds, a LANDING GEAR FAIL caution message appears and the in-transit symbol remains displayed.





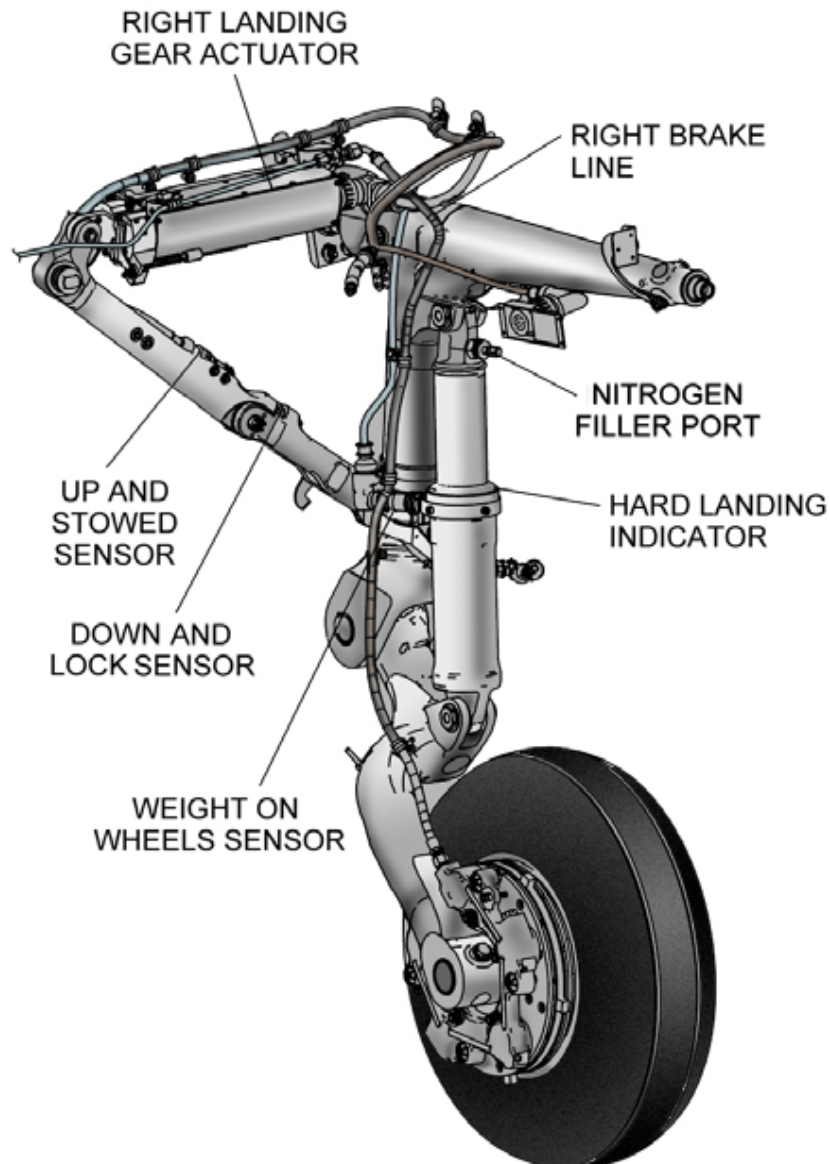
## 4.5 System Description

### 4.5.1 Main Gear

The main landing gear consists of single wheels supported by trailing link strut assemblies. Each assembly includes a shock absorber filled with hydraulic fluid and nitrogen. When the gear is retracted, the wheel and tire assemblies are not enclosed and protrude from the wheel well approximately 1/2 inch. Fairings on the outer hubs make the wheels aerodynamically clean.

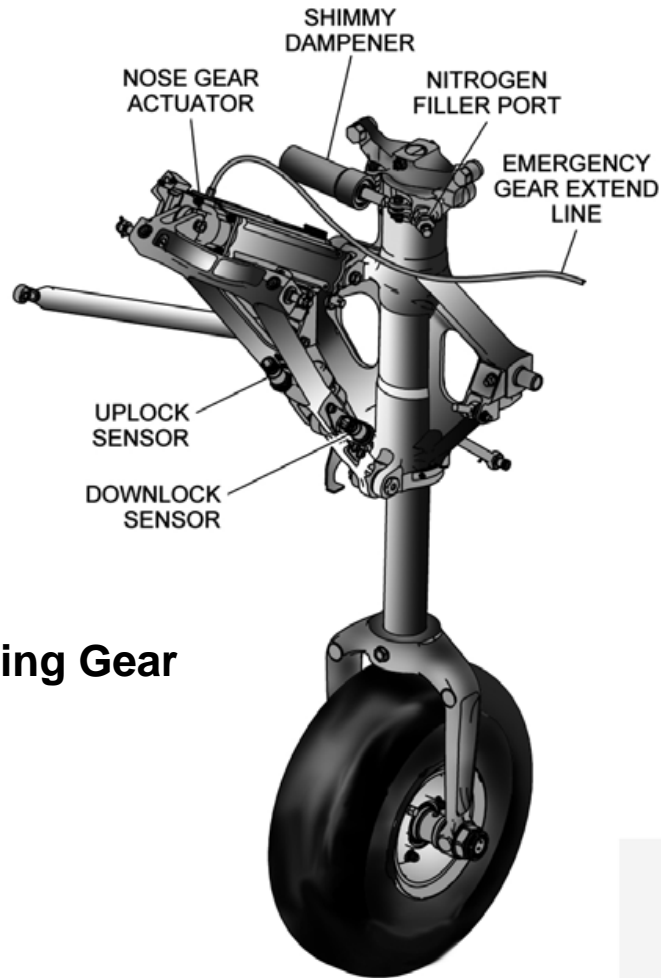
The main gear is held in the retracted position by mechanical brakes on the actuator motors and in the extended position by the actuator brakes and over-center folding braces.

Each main gear assembly has three proximity sensors—Down and Locked, Up and Stowed, and Weight On Wheels (WOW). The WOW sensor prevents gear retraction when there is weight on the landing gear.



#### 4.5.2 Nose Gear

The nose gear assembly incorporates a shock absorbing strut filled with hydraulic fluid and nitrogen, as well as a shimmy dampener. The nose gear is held in the retracted position by mechanical brakes on the actuator motor, and in the extended position by the actuator brake and an over-center folding drag brace. When the nose gear is retracted, it is completely enclosed by the gear doors. There are two proximity sensors on the nose gear—Down and Locked and Up and Stowed.



### Nose Landing Gear

#### 4.5.3 Landing Gear Actuators

The main gear and nose gear have electromechanical actuators that retract to extend the gear and extend to retract the gear. This design provides minimum exposure of the extended portion of the actuator to the elements for increased reliability.

Each actuator assembly consists of a ball-screw actuator, an electric motor, and a mechanical actuator brake.

#### 4.5.4 Landing Gear Actuator Brakes

The main gear and nose gear actuator assemblies contain a spring-driven mechanical brake that prevents the motor from turning when electrical power is removed. The actuator brakes hold the gear in the retracted or extended position and require power to unlock.

In the event of electrical failure, the actuator brakes lock in place and prevent any movement of the actuators. Manual gear extension is accomplished with an

emergency gear release handle that mechanically releases the actuator brakes, allowing the gear to freefall.

The actuator brakes are capable of supporting the gear in the retracted position without sagging with g-loads up to 2.0 g. The gear may sag at loads above 2.0 g, but automatically retract when the g-load is reduced. When the actuator sag tolerance is exceeded, the ACS applies power to the actuator motors, unlocking the brakes. The motors drive in the retract direction until the gear is re-stowed, at which point the actuator brakes are re-engaged.

**⇒ NOTE:**

When this occurs, the pilot can expect to see a gear unsafe indication for the gear or gears that are being re-stowed.

#### **4.5.5 Landing Gear Warning Horn**

The landing gear warning horn sounds under 12,500 feet MSL, if any gear is not Down and Locked under three conditions:

1. Flaps extended beyond T/O setting
2. Airspeed less than 120 knots with one or both throttles below mid-range (30 degrees TLA)
3. Airspeed less than 140 knots with one or both throttles below mid-range (30 degrees TLA)

**⇒ NOTE:**

The warning horn is NOT silenceable for conditions 1 and 2.

The warning can be silenced for condition 3 with the GEAR MUTE button on either sidestick.

#### **4.5.6 Nose Wheel Steering**

Nose wheel steering operates through mechanical linkage. With weight on the nose gear, a steering lever at the top of the nose gear engages a mating lever attached to the rudder pedals. When the gear is retracted and weight is off the nose wheel, the steering lever disengages, and the gear self-centers with a pair of internal cams. The cams will not reengage until weight is back on the nose wheel; this prevents landing with the nose wheel turned.

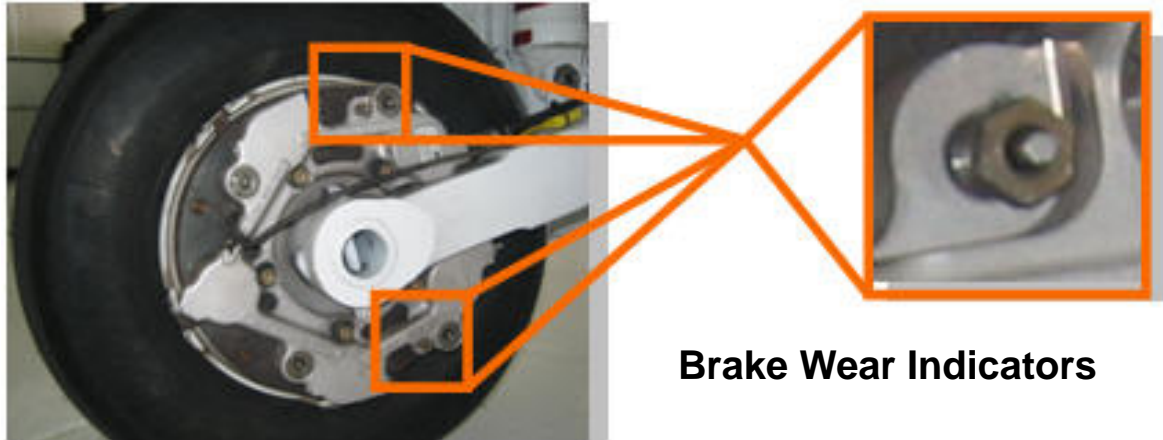
The rudder pedals provide +/- 15 degrees of steering angle. Turns beyond 15 degrees are accomplished with differential braking. When the steering angle exceeds 15 degrees, the steering cams disengage and allow free castering to a total of +/- 55 degrees. The cams also disengage to allow +/- 55 degrees of turning when the airplane is towed. When the nose wheel returns within the +/- 15 degree angle, the cams reengage, returning steering control to the rudder pedals.

#### **4.5.7 Brakes**

The braking system is mechanically actuated and hydraulically operated. Braking is provided by hydraulically operated single disc brakes on each main gear. When pressure is applied to the toe brakes, hydraulic pressure is applied to the corresponding main gear brake.

There is a brake fluid reservoir outside the forward pressure bulkhead. An optical sensor triggers a BRAKE FLUID LOW advisory message when the brake fluid is low.

Each main gear brake assembly incorporates two brake wear indicator pins. As brake pads wear, the pins are pulled into the housing. When the pins are flush with the hex head of the pin retainer housing, the brakes require servicing.



**Brake Wear Indicators**

#### **4.5.8 Parking Brake**

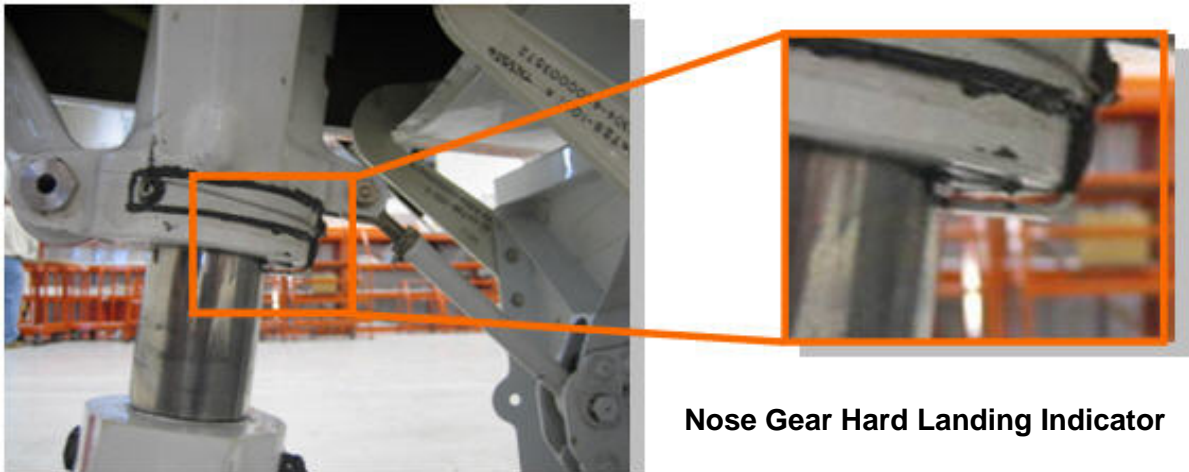
The parking brake is set from either pilot seat by depressing both brake pedals and simultaneously pulling the parking brake handle on the center pedestal. This moves a mechanical lever on the parking brake cylinder which traps pressure between the parking brake cylinder and the wheel brakes. When the parking brake is set, the valve handle position is sensed by a proximity switch that triggers a PARKING BRAKE status message.

The parking brake is released by pushing in the parking brake handle. If the parking brake is engaged when takeoff power is applied a CONFIG PARKING BRAKE warning message appears

#### **4.5.9 Hard Landing Indicators**

The main landing gear shock absorbers have mechanical hard landing indicators consisting of red painted grooves at the upper end of the shock absorbers. The grooves are normally covered by a silver split-ring. A hard landing compresses the shock absorber to the point that the split-ring is forced out of the groove, revealing the red paint.

For the nose gear, a hard landing will bend a tab near the top of the nose gear strut on the aft side.



**Nose Gear Hard Landing Indicator**

### **Main Gear Hard Landing Indicator**



**⇒ NOTE:**

If a hard landing is indicated by either the split-ring or tab, a maintenance inspection of the landing gear is required before flight.

## **4.6 Normal Operations**

### **4.6.1 Gear Retraction**

When the gear handle is placed in the UP position, the ACS releases the three actuator brakes and applies power to the gear motors in the retract direction. When each gear folding brace moves away from the gear-down proximity sensor, the gear position annunciation changes from green (Down and Locked) to amber/hatched (In Transit).

The nose gear retracts forward into the nose wheel well. Each main gear retracts inboard into the main gear wheel well.

When each gear reaches the up position, power is removed from the actuator motor and the actuator brake is automatically set.

All gear doors are mechanically linked to the respective gear assembly. Movement of the main gear causes the strut mounted main gear doors to close with the gear. Movement of the nose gear opens two aircraft mounted forward nose gear doors, allowing the gear to pass between them. As the nose gear retracts into the wheel well, the two nose gear doors close along with an aft strut mounted door.

When each gear moves to the gear-up proximity sensor, the gear position annunciation changes from amber/hatched (In Transit) to white bordered (Up and Stowed). If all gear indicate Up and Stowed for ten seconds, the white borders and the word "Gear" disappear.

### **4.6.2 Gear Extension**

When the gear handle is placed in the DOWN position, the ACS releases the three mechanical actuator brakes and applies power to the gear motors in the extend direction. When each gear moves away from the gear-up proximity sensor, the gear position annunciation reappears as amber/hatched (In Transit).

When each gear reaches the down position, power is removed from the actuator motor and the actuator brake is automatically set.

The landing gear is mechanically held in the down position by the over-center mechanism and the actuator brakes.

Movement of the nose gear opens and closes the forward nose gear doors for passage of the gear. When the nose gear is extended, the forward nose gear doors are closed while the aft door remains open.

When each gear moves to the gear-down proximity sensor, the gear position annunciation changes from amber/hatched (In Transit) to green (Down and Locked).

## 4.7 Abnormal Procedures

### 4.7.1 Emergency Gear Extension

In the event of a failure of the normal gear extension system a LANDING GEAR FAIL caution message appears and the gear can be mechanically extended using the emergency gear release handle on the cockpit floor aft of the pedestal between the pilots. Emergency extension of the landing gear is accomplished by gravity, with air load assisted freefall of the nose gear. The momentum of the freefalling gear and the back-driving of the gear motors ensure the drag/side braces go into the over-center locked position.

When the emergency gear cable is fully extended, the gear actuator brakes are mechanically released. When the emergency gear handle is re-stowed, the actuator brakes are reapplied. If the emergency gear handle is not stowed following an emergency gear extension an EMER GEAR HANDLE caution message appears reminding the pilot to stow the handle.

The Emergency Gear Extension procedure is:

1. Put the gear handle in the DOWN position.
2. Reduce airspeed to between 195 and 200 knots
3. Open the emergency release handle door, and pull the emergency release handle up and aft. This causes two things to happen:
  - A proximity switch sends a signal to the ACS to remove electrical power from the three gear actuator motors.
  - At full throw, the emergency gear handle cable mechanically releases the actuator brakes, allowing the gear to freefall.

#### ⇒NOTE:

Pulling the emergency gear handle requires approximately 18 lbs of force to pull and should be pulled to full extension in one smooth motion.

4. When three green Down and Locked indications are displayed, return the emergency gear release handle to the stowed position to apply the mechanical actuator brakes.

#### ⇒NOTE:

Actuator brakes will NOT engage unless the emergency gear release handle is returned to the fully stowed position

### 4.7.2 Weight On Wheels Sensor Fault

In the event that there is a disagreement between the two weight on wheels sensors, a WOW SENSOR FAULT advisory message appears.

#### ⚠CAUTION:

*This will cause the aircraft to depressurize when the speed goes below 60 KEAS and the autopilot, including yaw damper and stick pusher, to be lost.*



## 4.8 Crew Alerting System Messages

### Landing Gear CAS Messages

Message	Condition	Category
EMER GEAR HANDLE	Emergency gear handle is not stowed	Caution
LANDING GEAR FAIL	Landing gear system failure	Caution
BRAKE FLUID LOW	Low brake fluid	Advisory
WOW SENSOR FAULT	Weight on wheels sensors disagree	Advisory
PARKING BRAKE	Parking brake is set	Status