FLIGHT CONTROLS

GENERAL

All aerodynamic controls, with the exception of the flaps and speedbrakes, are mechanically actuated by cables. The ailerons, elevator and rudder have trimmed control surfaces and cockpit trim position indicators.

Flaps are electrically powered and can be operated to 15 degrees at 200 KIAS or below and 40 degrees (full travel) at 174 KIAS or below. Spoiler-type speedbrakes are hydraulically actuated and electrically controlled and can be extended throughout the flight envelope.

AILERONS

The ailerons provide excellent lateral control throughout the entire operating envelope. Full range of travel is 19 degrees, +1 or -1 degree up and 15 degrees, +1 or -1 degree down. One trim tab, located on the left aileron, is mechanically controlled by a knob on the center pedestal. An indicator on the pedestal shows the amount of trim selected in relation to a neutral position. Full travel of the tab is 20 degrees, +1 or -1 degree up and down.

ELEVATOR

Elevator control is mechanical through four cable assemblies. Full elevator travel is through a range of 20 degrees, +1 or -1 degree up, to 15 degrees, +1 or -1 degree down. Elevator trim tabs installed on each elevator can be positioned electrically or mechanically through cockpit trim tab actuators. Full travel of the tabs is 7 degrees, +1 or -1 degrees up and 8 degrees, +1 or -1 degrees down. An elevator trim wheel on the pedestal provides manual trim control. A trim switch, located on the left side of the pilot's control wheel, controls an electric trim motor which in turn positions the elevator tabs. The copilot's trim switch is located on the right side of the copilot's control wheel. The pilot's trim switch has priority and will interrupt and override the copilot's control. 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 copilot's yoke. Pulling the PITCH TRIM circuit breaker on the left circuit breaker panel will remove power from the electric trim motor.

RUDDER

Rudder control is very effective at all flight speeds. Full rudder deflection is 22 degrees, +1 or -1 degree either side of center. The rudder trim tab is a servo type which reduces pedal pressures and provides adjustable trim. For each degree of angular displacement of the rudder, the trim tab will move approximately one-half degree in the opposite direction. The rudder trim is mechanically operated by the rudder trim wheel on the center pedestal. With the rudder in the trail position, the trim tab will deflect 10 degrees, +1 or -1 degree left and right. An indicator on the pedestal shows trim tab position relative to neutral.

NOSE GEAR STEERING

The nose gear is mechanically steered by the rudder pedals to approximately 20 degrees either side of center. Steering is accomplished through mechanical linkage with a bungee that allows the nose gear to center before entering the wheel well on retraction. Additional castering of the nose wheel can be achieved against the bungee by application of differential power and braking. When steering with nose wheel steering and wheel braking, approximately 64° of nose wheel deflection can be obtained. For towing, maximum deflection of the nose wheel is 95 degrees either side of center.

FLIGHT CONTROLS

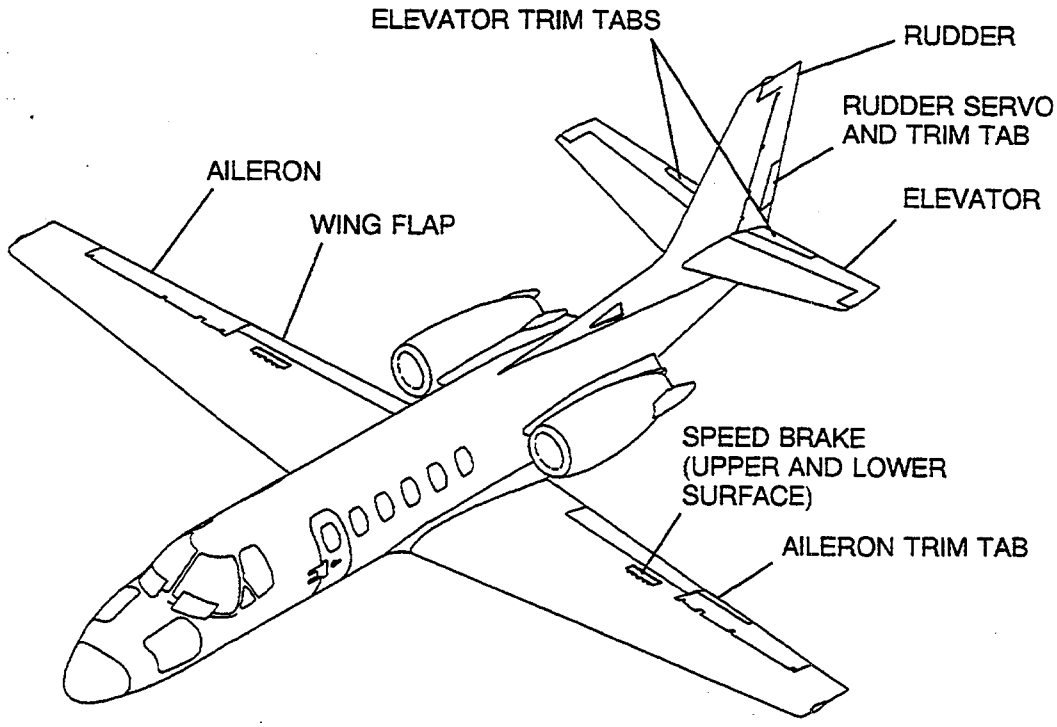

Figure 2-17

SPEEDBRAKES

The speedbrakes are installed on the upper and lower surfaces of each wing to permit rapid rates of descent without exceeding V_{MO}/M_{MO} and to spoil lift during landing roll. The speedbrakes are electrically controlled and hydraulically actuated by a switch located on the throttle quadrant, and may be selected to the fully extended or fully retracted positions. The angular travel for the speedbrake panels is 58 degrees, +2 or -2 degrees. The lower speedbrake panels close with the upper panel.

When the speedbrake switch is positioned to EXTEND, electrical power is applied to close the bypass valve in the hydraulic system return line and open the speedbrake control valve. This allows hydraulic fluid at 1500 PSI to flow to the extend side of the speedbrake actuators. Once the speedbrakes are extended, the speedbrake control valve closes to create a hydraulic lock and hold the speedbrakes open. The bypass valve opens and the hydraulic system returns to an open center condition. Moving the speedbrake switch to RETRACT again pressurizes the system, and the speedbrake control valve allows fluid to go to the retract side of the speedbrake actuator.

When the speedbrakes are fully retracted, the control valve closes, the hydraulic system bypass valve opens and open center operation resumes.

Microswitches in the tailcone prevent speedbrake extension at engine power settings above approximately 85 percent N_2 . If the speedbrakes are extended at lower power settings and the throttles are subsequently advanced above 85 percent, the speedbrakes will retract and the switch will return to the RETRACT position.

In the event of an electrical failure while the speedbrakes are extended, the control valve fails to the open position and the speedbrakes will trail. If a dual hydraulic pump failure or fluid loss should occur with the speed brakes extended, moving the switch to RETRACT will deenergize the speedbrake control valve and the speedbrakes will trail.

FLAPS

The trailing edge flaps are constructed of metal ribs and spars with a fiberglass cover. They are mechanically controlled and electrically actuated by two geared DC motors connected in parallel. The design of the drive system and the parallel operation of the flap motors are intended to preclude the possibility of a split flap condition. They operate through a range of 0 to 40 degrees and any intermediate position can be selected through the range of travel, however detents are provided at only the T.O. & APPR. (15°) and LAND (40°) positions. The LAND or UP (0°) flap positions are reached by pushing down on the flap lever when passing through the T.O. & APPR detent.

A gear warning horn will sound any time the flaps are selected past the T.O. & APPR position with the gear not down and locked. The horn cannot be silenced with the Horn Silence button in this situation; the condition causing the horn to sound must be corrected.

CONTROL LOCK

The control lock is mechanically operated and, when engaged, locks the ailerons, elevators and rudder in the neutral position and the throttles in the OFF position. The control lock handle, located below the instrument panel on the left side, controls the system. When the handle is pulled straight aft to the detent, the flight controls and throttles are locked. To release the control lock system, rotate the T-handle 45 degrees clockwise and push it in. With the control lock engaged, the maximum deflection of the nosewheel is restricted to 60 degrees either side of center. Exceeding the degree of turn will cause excessive force to be placed on the control lock mechanism and rudder control cables. Towing the airplane with the control lock engaged should be avoided. The controls should be neutralized before engaging the lock.

STALL WARNING - STICK SHAKER

Stall warning is achieved by the use of a stick shaker mounted on the forward side of the pilot's control column. An electric motor with rotating weights induces a vibration feel to the control column. The pilot is alerted to impending stall by the vibration of the control column, which occurs approximately 8% to 10% above the actual stall speed. Stick shaker activation will occur before stall buffet, except in the clean configuration where the speed of natural stall buffet and activation of the stick shaker occur at nearly the same time, and either could occur first. The stick shaker is energized by inputs from the angle-of-attack system. The test switch on the pilot's switch panel provides a means of checking the shaker prior to flight.