SECTION 10

FLIGHT CONTROLS

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LIST OF ILLUSTRATIONS

SECTION 10

FLIGHT CONTROLS

1. GENERAL (Figures 1 and 3)

The primary flight controls, consisting of roll control, yaw control, pitch control, flight spoilers and ground spoilers, are fully powered from all three hydraulic systems. Mechanical inputs from the pilots' controls in the flight compartment are conveyed via push/pull rods, quadrants and cables to power control units (PCU). There is no interconnection between hydraulic systems, and all PCUs are totally independent of each other. The secondary controls consist of the wing trailing edge flaps and control surface trim systems, and are electrically controlled and actuated.

The ailerons, elevators and flight spoilers are each powered by two of the three independent hydraulic systems. The rudder is powered by all three systems and the ground spoilers are powered by No. 1 system only. The primary flight control systems are capable of continued safe operation if jamming or disconnection of a component, loss of normal electrical power and, with the exception of the spoilers, loss of hydraulic systems No. 1 and/or No. 2 occur.

Jamming or disconnection of a component is nullified by incorporation of dual control circuits with anti-jam and/or disconnect mechanisms.

Loss of normal electrical power is overcome by an air-driven generator (ADG) which is capable of supplying emergency electrical power to drive hydraulic system No. 3.

Loss of hydraulic systems No. 1 and/or No. 2 is catered for by hydraulic system No. 3 which supplies a PCU for each of the primary controls except spoilers.

A. Control Disconnect Systems (Figure 2)

Control disconnect mechanisms are provided for disconnecting the control columns (pitch control) and the control wheels (roll control), if a jam occurs in their respective cable runs. The disconnect mechanisms are operated by the PITCH DISC and ROLL DISC T-handles on the centre pedestal.

If a jam occurs in the rudder control circuits, break-out bungees and an anti-jam mechanism isolate the jammed circuit. Yaw control is retained by both pilots.

B. Power Control Units

The primary flight control surfaces are fully power-operated by hydraulic actuators known as power control units. To provide for failsafe operation and eliminate fluid interflow between the three aircraft hydraulic systems, each aileron is powered by a dual PCU consisting of two independent actuators; each elevator is powered by two independent PCUs; and the rudder is powered by three independent PCUs.

Each PCU consists mainly of a control-valve-operated piston moving in a cylinder.

The PCUs are connected to the control surfaces by rod-end attachments and operate to move the control surfaces in the desired direction upon receipt of a signal from the pilots' controls or from the automatic flight control system (AFCS). A flight control monitoring unit monitors the operation of the PCUs. The flight control monitoring unit receives inputs from PCU proximity sensors and transmits warning signals to the servo monitor panel in the flight compartment.

C. Artificial Feel Mechanisms

Because the primary flight control surfaces are fully power-operated, artificial feel mechanisms, consisting of spring devices, are incorporated in the control systems to simulate aerodynamic forces and provide a means of sensing control loads under various flight conditions.

D. Trim Systems (Figures 5 and 6)

Trim inputs are introduced into the roll and yaw control systems by electrically driven actuators controlled by the AIL TRIM and RUD TRIM switches on the centre pedestal. Pitch trim is obtained by varying the angle of incidence of the horizontal stabilizer. Signals from the pitch trim switches on the control wheels, from the AFCS and from the stability augmentation system (SAS) are processed by a control unit to operate an electrically driven actuator which applies the required amount of stabilizer deflection. The pitch trim disconnect switch on each control wheel disconnects and brakes the pitch trim actuator in an emergency.

E. Control Surface, Trim and Flap Position Indicators (Figures 4, 5 and 7)

Flight control surface positions and trim angles are displayed on indicators located on the centre instrument panel. A flap position indicator on the copilot's instrument panel displays flap position angles. Inputs to the position indicators are provided by transmitters and trim actuators.

F. Gust Locks

Gust locking of the ailerons, rudder and elevators is provided by trapping hydraulic fluid within the PCUs whenever hydraulic pressure is removed from the PCUs. This arrangement locks the control surface against the effect of gusts but permits restricted movement of the surface, if a sufficiently large external force is applied continously.

2. ROLL CONTROL SYSTEM

Roll (lateral) control is achieved by hydraulically powered ailerons which are controlled primarily from conventional column-mounted horn-type wheels. Primary control is supplemented by an electrically actuated trim system.

The roll control system incorporates a dual PCU for each aileron, and a dual control system. Normally, both control systems are interconnected so that there is simultaneous movement of both ailerons; but it is possible to isolate a jammed aileron control circuit by means of a disconnect mechanism, thereby allowing limited control (one aileron only) through the unjammed circuit (refer to Figures 1 and 2).

Control wheel movement is transmitted by cables and pulleys which incorporate an artificial feel unit to the PCUs located outboard in the wing, forward of the rear spar.

Each PCU actuator is capable of aileron operation should there be a failure associated with the adjacent actuator.

Signal inputs from the AFCS are made through the right aileron system only. Therefore, should jamming of the right control system occur, the autopilot inputs would not be transmitted to the left aileron system (refer to Section 4).

A. Aileron Trim

An electrically driven actuator applies a bias to the primary control circuit, when required, by operation of the AIL TRIM switches located on the centre pedestal. The amount of trim applied to the ailerons is shown on the control surface trim position indicator.

B. Aileron Control Wheels (Figure 6)

The aileron control wheels are horn-type handwheels, spline-mounted on the control columns. Each control wheel mounts a pitch trim switch, a pitch trim disconnect switch, an autopilot/stick pusher disconnect switch, an autopilot touch control switch and a radio key.

C. Artificial Feel Mechanisms

Two artificial feel mechanisms provide the pilots with positive feel of the power-operated control system and act as centering devices.

3. YAW CONTROL SYSTEM

Yaw (directional) control is achieved by a hydraulically powered rudder, controlled primarily from conventional dual, cross-coupled pedals. Primary control is supplemented by an electrically actuated trim system.

The yaw control system incorporates three independent, parallel-connected PCUs and a dual control system which includes two anti-jamming mechanisms for isolating or overriding the effects of a jammed circuit, enabling control to be maintained via the intact circuit. The system is also protected by anti-jam mechanisms built into the PCU input levers, which act to isolate a jammed PCU.

Pedal assembly movement is transmitted by cables and pulleys which include artificial feel mechanisms, load limiters and a trim mixing system.

In addition to control inputs from the pedal assembly, inputs from the stability augmentation system of the AFCS are applied to the system through two yaw dampers in the trim mixing system (refer to Section 4).

A. Rudder Trim

An electrically driven actuator applies a bias to the primary control circuit, when required, by operation of the RUD TRIM control located on the centre pedestal. The amount of trim applied to the rudder is shown on the control surface trim indicator.

B. Rudder Pedal Assemblies

Conventional rudder pedal assemblies enable foot control of the aircraft wheel brake system and the rudder control system.

Each set of pedals is provided with a hand-operated adjusting mechanism to cater to the individual requirements of pilots.

C. Anti-Jam Mechanisms

The two forward anti-jam mechanisms operate to nullify the effects of a jammed cable circuit and maintain normal pedal/rudder movement ratio.

The anti-jam mechanism on each rudder PCU acts as a push/pull rod for the PCU input linkage during normal operation. If the input linkage cannot move because of a jam in the PCU, the anti-jam mechanism breaks out to isolate the defective PCU from the system. The remaining PCUs continue to operate the rudder.

D. Artificial Feel Mechanisms

Two artificial feel mechanisms provide the pilots with positive feel of the power-operated system and act as a centering device for the system.

4. PITCH CONTROL SYSTEM

Pitch (longitudinal) control is achieved primarily by two independent, hydraulically powered elevators. Elevator movement is controlled from conventional control columns. Primary control is supplemented by an electrically actuated trim system which varies the angle of incidence of the horizontal stabilizer.

The pitch control system incorporates two parallel-connected PCUs for each elevator, and a dual control system. Normally, both control systems are interconnected so that there is simultaneous movement of both elevators, but it is possible to isolate a jammed circuit by means of a disconnect mechanism, thereby providing limited pitch control (one elevator only) through the remaining circuit (refer to Figures 1 and 2).

Control column movement is transmitted by cables and pulleys, through an artificial feel unit, to the PCUs.

Operation of the elevator PCUs is similar to that of the aileron PCUs.

Signal inputs from the AFCS are made through the rear quadrant of the left elevator control system only. Therefore, should jamming of the left cable circuit occur, the autopilot inputs would no longer be available to the elevator system.

A. Pitch Trim

The aircraft is trimmed in pitch by varying the horizontal stabilizer angle of incidence. Trim commands from the pilot's or copilot's control wheel switches, the AFCS and the stability augmentation system (SAS) are processed by a trim control unit to operate the electrically driven stabilizer actuator. Commands from the pilot's trim switch override those from the copilot's trim switch, the AFCS and the SAS. Commands from the copilot's trim switch override only those from the AFCS and the SAS. Both control wheels have a red disconnect button, PITCH TRIM DISC, which can be pressed to remove power from the system and brake the actuator. In order to enhance the longitudinal trim movement, the movement of the horizontal stabilizer is accompanied by a degree of elevator movement that alters the stabilizer/elevator camber. An elevator servo input is generated by the horizontal stabilizer movement to produce the required elevator deflection.

The electrically driven screw actuator, located at the top of the vertical stabilizer, varies the horizontal stabilizer angle of incidence. The actuator is driven by two electric motors directly connected to the drive train each containing a high and low trim rate. Manual trim commands from the control wheel pitch trim switches produce a steady rate of stabilizer movement of 1/2 degree per second. Depending on flap position, the autopilot commands variable high or low trim rates of 0.1 to 0.5 degree per second and 0.01 to 0.1 degree per second respectively. Mach trim commands a variable rate of stabilizer movement between 0.01 and 0.1 degree per second. Each of the electric motors driving the trim actuator is protected against overspeed by a dual coil brake.

The control unit controls the rate and direction of movement of the actuator. The unit consists of two independent channels and operates from two power busses so that electrical failure on one bus does not preclude operation of the stabilizer trim. A pilot reset capability allows channel transfer at the pilot's option.

The system normally operates on channel No. 1, with channel No. 2 performing only a monitoring and back-up function. Should a failure occur within a controller channel or its associated motor, the control unit automatically transfers to the back-up channel. In the event of an overspeed condition, the control unit removes power from the drive motor and operates the brake in the actuator. Channel failure, overspeed condition and channel change are indicated by switch/lights on the centre pedestal.

Two trim position sensors on the actuator send signals to the control unit. One sensor supplies the AFCS with stabilizer angle data and the second is connected to the flight recorder. Both position sensors provide travel limit signals for the control unit. Stabilizer trim position is also an input to the take-off configuration warning system. A third position sensor supplies position signals to the control surface trim position indicator.

B. Control Columns

The pilot's and copilot's control columns each consist of a conventional tubular column mounted vertically in a housing. A control column shaker, which is a component part of the stall protection system, is mounted on the column.

C. Gain Change Mechanisms

Two independent gain change mechanisms ensure that the rate of elevator movement increases as the control column is moved from neutral to provide the required control response.

D. Artificial Feel Mechanisms

Two artificial feel mechanisms, one for each elevator, provide the pilots with positive feel of the power-operated systems and act as centering devices for the systems. The system is designed to ensure a reduced feel force when rapid control column movement is required.

E. Anti-Jam Mechanisms

The elevator anti-jam mechanisms act normally as push/pull rods for the PCU input rod linkages. If a PCU input linkage cannot move because of a jam in the PCU, the mechanism breaks out to isolate the defective PCU from the system. The other PCU continues to operate the affected elevator.

When the mechanism breaks out, a proximity sensor is deactivated and the amber PITCH light on the SERVO MONITOR panel comes on (refer to Figure 4).

5. WING FLAP SYSTEM (Figures 1 and 7)

The flap system consists of externally hinged inboard and outboard double-slotted flap panels mounted on the trailing edge of each wing. The panels are electrically driven by a power drive unit (PDU) located in the main landing gear bay. The motor action of the PDU is translated to eight actuators, two to each flap panel, by flexible shaft assemblies. An asymmetry/overspeed detector and brake unit is incorporated in each flap drive system.

The outboard flaps have fixed leading edge vanes and the inboard flaps have movable leading edge vanes which automatically extend or retract as the flaps are lowered or raised.

The flaps are extended or retracted in response to command signals from the FLAPS control lever located on the centre pedestal.

The signals are fed to the PDU via the flap control unit. If the control unit logic detects an anomaly such as flap asymmetry or overspeed, power is removed, causing the PDU motor brakes and the asymmetry/overspeed detector brakes to stop the system. The FLAPS FAIL light on the copilot's instrument panel comes on when a system fault is detected.

A. Flap Control Unit

The flap control unit (FCU) is powered from dc bus No. 1 and dc bus No. 2. Although two power supplies are provided, only one is necessary to operate the unit. The function of the unit is to assess the flap extend/retract commands received from the FLAPS control lever and provide the correct activating signal to the PDU. Once a selected flap angle is reached, the flaps are locked in position by the PDU motor brakes and the asymmetry/overspeed detector brake units.

The FCU also signals the aural warning unit (refer to Section 3) to initiate aural warnings for airspeed/flap, take-off/flap and gear-up/flap configuration incompatibilities.

B. Power Drive Unit

Two PDU motors are coupled to a mechanical differential which drives the output shaft through a clutch and an output gear train. With power applied to the PDU, the motor brakes are released and the motor drives the flexible shaft assemblies and actuators. When the selected flap position is reached, the motors are de-energized and the motor brakes are re-applied.

If power to one of the PDU motors fails, the associated brake is automatically applied and the second motor continues to operate the system at half speed. In the event of overheating of a PDU motor, thermal switches de-energize the applicable motor and an amber overheat light on the copilot's instrument panel comes on. The thermal switches reset once the overheat condition has passed.

C. Asymmetry/Overspeed Detector and Brake Assemblies

The function of these assemblies is to transmit signals to the FCU to provide positive braking action to the flaps in the event of asymmetric movement of the left and right flaps, or overspeed.

6. SPOILER SYSTEM (Figures 1 and 8)

Wing lift modulation is achieved by the operation of flight and ground spoilers. The flight spoilers may be extended to any position, between 0 and MAX (40 degrees), required for the intended flight path. The ground spoilers have only two positions, fully retracted during flight or fully deployed (45 degrees) when activated with the aircraft on the ground, to assist other braking systems by dumping lift and increasing drag.

A. Flight Spoilers

The flight spoilers are two hydraulically powered panels, one hinged to the upper surface of each wing, forward of the outboard flaps, and are controlled mechanically through pilot movement of a lever on the centre pedestal. Each panel is powered by two hydraulically independent PCUs. Each PCU is independently connected to its spoiler and is capable of spoiler operation should the adjacent PCU fail either mechanically or hydraulically.

The spoiler control lever is connected to the PCUs via cables and pulleys. The spoilers are fully retracted when the lever is in the fully forward position. Pulling the spoiler control lever rearward deploys the flight spoilers, spoiler panel deployment being proportional with control lever movement.

Lever positions, when selected, are held by a serrated plate and plunger mechanism.

Spoiler panel position is transmitted to the control surface position indicator, the LH FLT SPLR and RH FLT SPLR lights and the LEFT and RIGHT FLIGHT SPOILERS lights.

A detent mechanism on both of the spoiler wing circuits prevents unacceptable spoiler asymmetry. If an asymmetry occurs, the detent mechanism closes the affected spoiler when the spoilers are less than one-half extended or retracts it to the one-half extended position when the spoilers are more than one-half extended. Operation of the LEFT and RIGHT FLIGHT SPOILERS lights indicate that the flight spoiler detent mechanism is serviceable and that blowback protection in an asymmetrical spoiler condition has been reset to the one-half extended position.

B. Ground Spoilers

The ground spoilers are two hydraulically powered panels, one hinged to the upper surface of each wing, forward of the inboard flaps, and are controlled electrically. Each panel is powered by one actuator supplied from a dual hydraulic selector valve.

The ground spoilers deploy automatically when armed, with a weight-on-wheels or wheel spin-up signal present, and the spoiler control lever and throttle lever selected to the proper positions (refer to Figure 8).

A spoiler control unit monitors weight-on-wheels and wheel spin-up signals, throttle lever position, GROUND SPOILERS switch position and the position of the two valves in the dual hydraulic selector valve. When all of the conditions for ground spoiler deployment have been met, hydraulic pressure is applied at the ground spoiler actuators, the actuators unlock and the spoilers are powered to the extended position. If the spoiler control unit detects a difference in the positions of the hydraulic selector valves, the ground spoilers, if extended, close and lock. If both throttle levers are not pulled back to IDLE simultaneously, the SPLRS INOP light will come on.

Ground spoiler operation is monitored via the LH and RH GND SPLR and SPLRS INOP lights. The system test is initiated via the GROUND SPOILERS switch.

7. STALL PROTECTION SYSTEM (Figure 9)

The stall protection system senses the aircraft angle of attack, provides the flight crew with a visual and tactile warning of an impending stall and, if no corrective action is taken, prevents flight into the stalled condition by activating a stick pusher mechanism. The principal system components consist of two trailing vane type angle-of-attack transducers, a dual-channel stall protection computer, two altitude transducers, two lateral accelerometers and two flap position transmitters. The system controls and indicators are:

Two stick shakers

A stick pusher sub-system

Stall protection test indicators

System warning lights and test switches

An aural warning horn (warbler)

When a dangerously high angle of attack is approached, the stall protection computer applies continuous ignition to the engines and, if the angle of attack continues to increase, activates the stick shakers to generate a stall warning in the form of a mechanical vibration of the control columns. If the aircraft angle of attack still continues to increase to the stick pusher trip point, the aural warning horn sounds and the stick pusher sub-system forces the control columns forward to effect recovery from the impending stall. When the aircraft angle of attack has decreased to a preset point below the pusher trip point, the aural warning horn stops and the stick pusher is deactivated. The stick shakers and continuous ignition switch off automatically when the aircraft angle of attack decreases through their respective trip points.

Red STALL/PUSH lights flash whenever the aural warning horn and stick pusher are operating.

If the autopilot is engaged when the aircraft approaches the stall, it is automatically disengaged on a signal from the stall protection computer when the aircraft angle of attack reaches the stick shaker trip point.

A. Angle-of-Attack Transducers

There are two angle-of-attack transducers, one on each side of the forward fuselage. Each transducer is attached to an externally mounted trailing vane. The trailing vane is moved by the local airflow which varies in proportion to the aircraft angle of attack. The angles of attack sensed by the left and right transducers are transmitted to the left and right channels respectively of the stall protection computer.

The transducer trailing vanes are protected against ice by built-in heater elements controlled from the ADS heater control panel (refer to Section 14).

B. Stall Protection Computer

The stall protection computer is divided into two identical and independent (left and right) channels. Each channel uses inputs from its associated angle-of-attack transducer, altitude transducer, lateral accelerometer and flap position transmitter to compute angle-of-attack trip points for auto-ignition, stick shaker operation, aural warning and stick push. If the angle of attack increases at a rate greater than 1 degree per second, the computer lowers the angle-of-attack trip points for the various system functions. This action prevents the aircraft momentum in the pitching plane from carrying it through the stall warning/stick pusher sequence into the stall.

The two altitude transducers provide altitude signals to the associated left and right sides of the stall protection computer. The transducers are connected to the left and right static systems via static source selectors on the pilot´s and copilot´s side panels (refer to Section 11).

As the altitude transducers signal an increase in altitude between 2,000 and 15,000 feet, the computer progressively lowers the angle-of-attack trip points for the stick shaker and pusher. Below 2,000 feet and above 15,000 feet, the trip points are constant. If one or both of the altitude signals is lost or if the difference between signals exceeds 2,000 feet, the computer automatically applies the trip points associated with the 15,000 foot altitude.

The two lateral accelerometers monitor skid or sideslip and signal the corresponding channel of the computer. Each of the computer channels uses the signals to generate compensated angle-of-attack values produced by manoeuvres involving skid or sideslip. The compensated angles insure that adequate stall protection is provided during uncoordinated flight. The trip points are also lowered progressively, on signals from the two flap position transmitters, as the flaps move through the 0-, 20-, 30- and 45-degree positions. If one or both of the flap position signals are lost, the computer automatically applies the stick shaker, continuous ignition and stick pusher trip points associated with the next higher flap setting.

The weight-on-wheels inputs from the landing gear control unit enable the computer to disable the stick shakers and pusher and the system failure warning lights while the aircraft is on the ground, except during system test.

To prevent inadvertent operation of the stick pusher due to a failure in one of the computer channels, the computer does not command a stick push unless both of the computer channels signal a stick push simultaneously.

C. Stall Protection System Monitoring

The stall protection computer monitors the operation of the system for possible mechanical defects in the angle-of-attack transducers and for faults in the electrical circuitry.

D. Stick Shakers

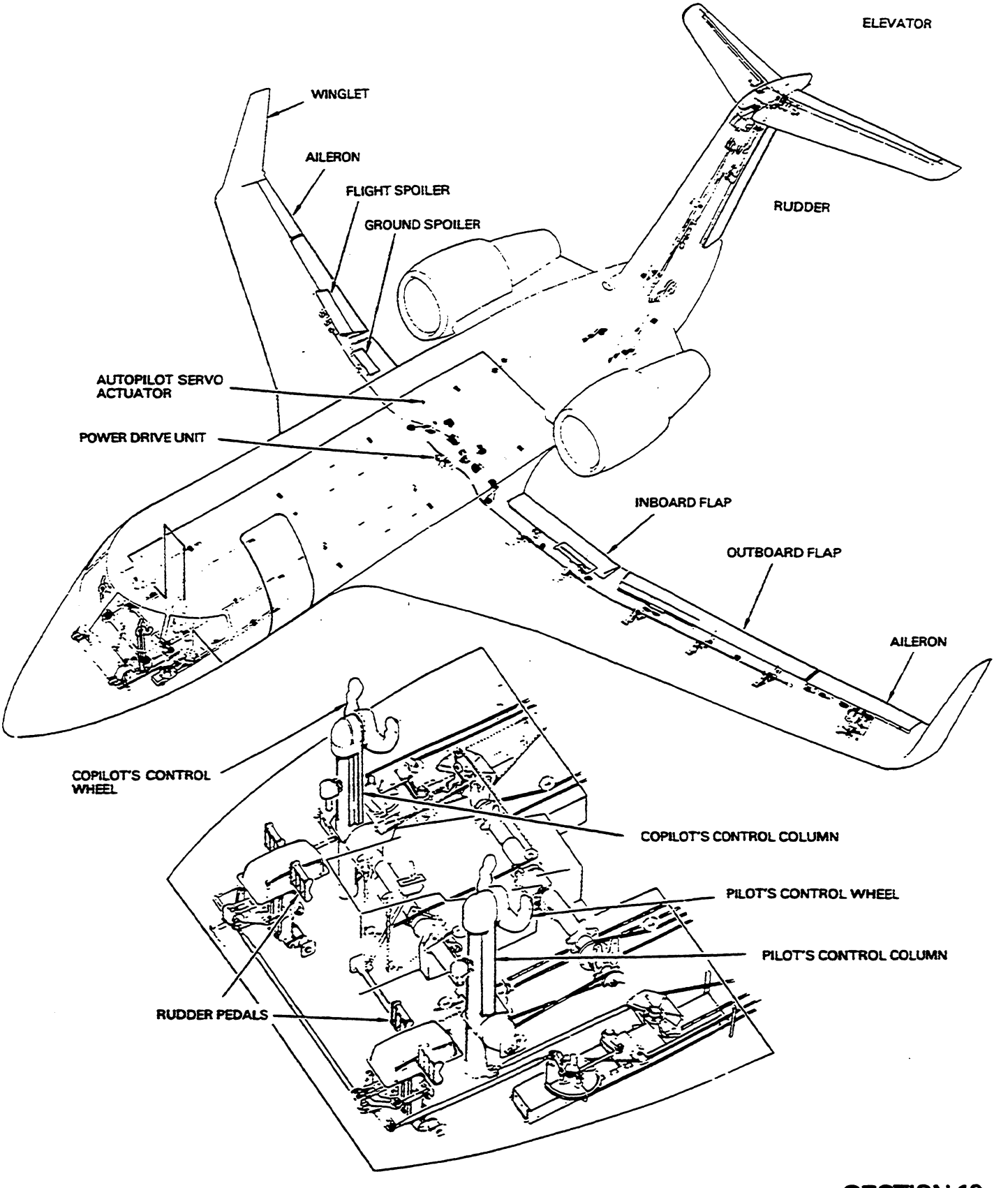
There are two stick shakers, one on the pilot's and one on the copilot's control column. Each shaker is a dc electric motor driving an eccentric weight. The shakers operate independently of each other and are powered by their respective stall protection computer channels. The noise of the stick shakers operating is sufficiently loud to constitute an aural warning of shaker operation.

E. Stick Pusher Sub-system

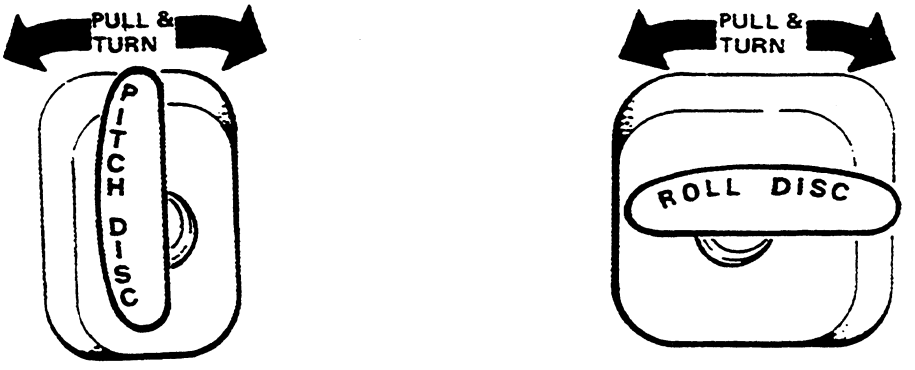
The stick pusher consists of a rotary actuator driven by a dc electric motor which operates on the right elevator control. The pusher logic circuits are so arranged that pusher signals must be transmitted simultaneously from both channels of the stall protection computer before a stick push can be initiated. When in operation, the stick pusher exerts an 80-pound forward push on the control columns. Red STALL/PUSH lights flash whenever the stall protection system computer commands a stick push.

In order to prevent the aircraft from flying into a low or negative G condition during the stick push, two accelerometer switches disconnect the pusher drive if the aircraft reaches 0.5 G during the pitching manoeuvre induced by the stick push.

At any time, the pilot or copilot can stop the stick pusher and disconnect the autopilot by pressing and holding the AP/SP DISC switch installed on the left horn of each control wheel. The stick pusher is capable of operating immediately when the switch is released. The stick pusher can be deactivated by either of two PUSHER toggle switches, located on the pilot's and copilot's STALL PROTECTION panels, which would cause flashing STALL PROTECT FAIL lights to come on.



Flight Controls
Figure 1



PITCH DISC AND ROLL DISC T-HANDLES

Provides a disconnecting mechanism for control columns and control wheels if a jam occurs in respective cable runs.

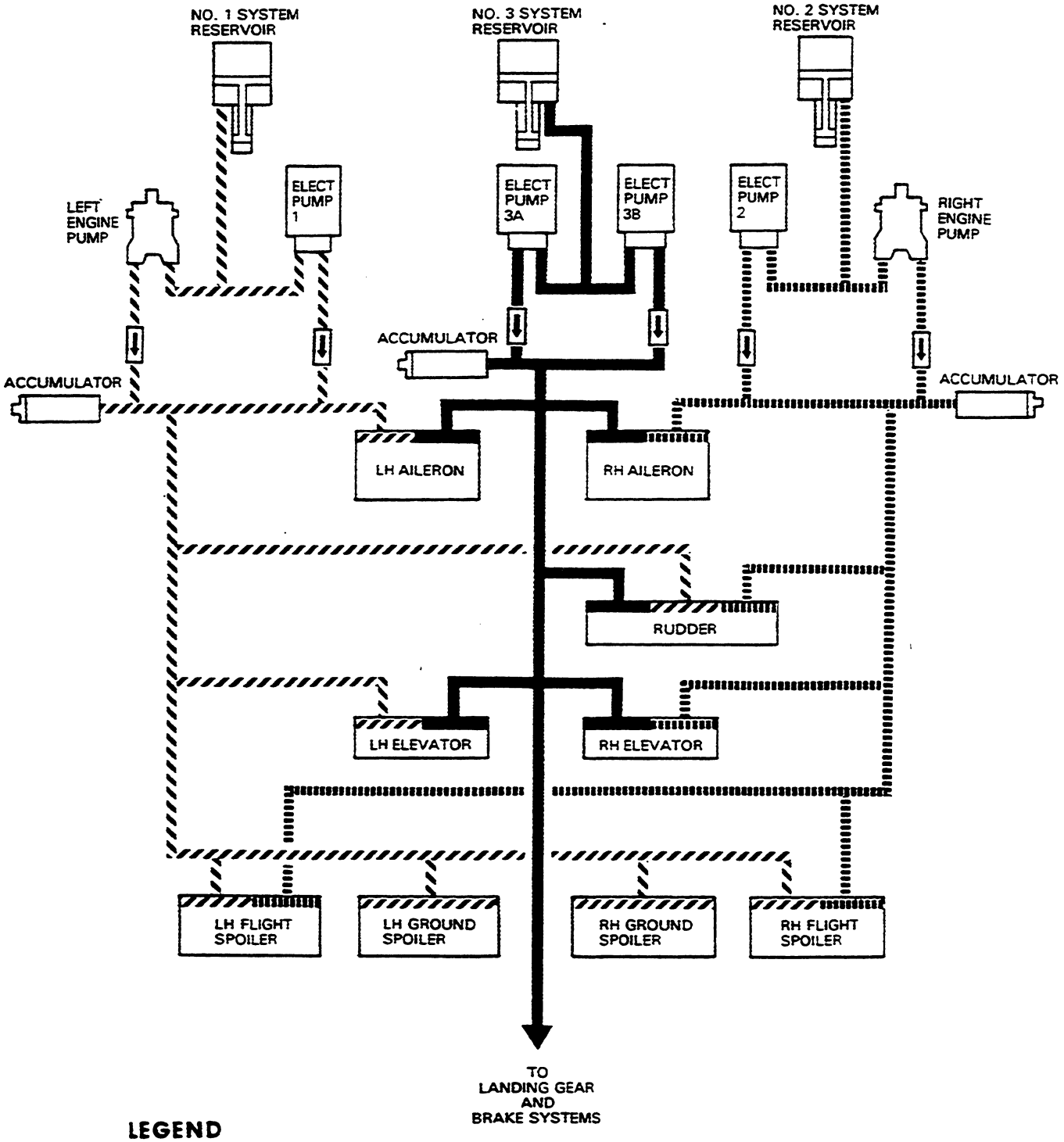
Pulling either handle disengages associated mechanism. Then, rotating handle left or right secures handle in disconnected position. Releasing handle into stowed position, reconnects associated controls and re-aligns control column or wheels, as appropriate.

When PITCH DISC handle is pulled, pilot controls left elevator and copilot controls right elevator.

When ROLL DISC handle is pulled, pilot controls left aileron and copilot controls right aileron.

CENTRE PEDESTAL

Control Disconnect T-Handles
Figure 2



LEGEND

- NO. 1 HYDRAULIC SYSTEM
- NO. 2 HYDRAULIC SYSTEM
- NO. 3 HYDRAULIC SYSTEM

Flight Controls - Hydraulics
Figure 3

CONTROL SURFACE POSITION INDICATOR

Provides a continuous indication of control surface positions over their operating range.

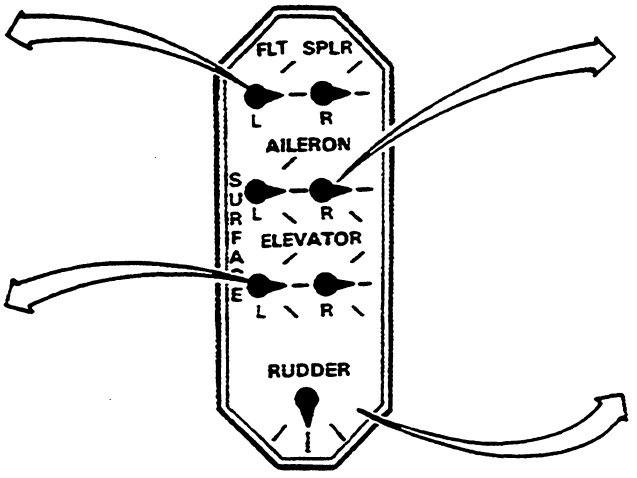
L AND R FLT SPLR

Flight spoiler up indications.

Max	40 degrees
3/4	28 degrees
1/2	16 degrees
1/4	5 degrees

L AND R ELEVATOR

Up	23.6 degrees
Down	18.4 degrees



L AND R AILERON

Up	21.3 degrees
Down	21.3 degrees

RUDDER

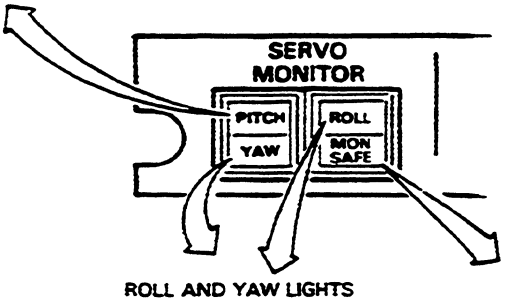
Left/right indications

LEFT	25 degrees
RIGHT	25 degrees

CENTRE INSTRUMENT PANEL

PITCH LIGHT

Amber PITCH light comes on when proximity sensors detect a jammed control valve or input linkage at the elevator power control units.



MON SAFE LIGHT

Green MON SAFE light comes on when all aileron and rudder PCUs are unpressurized (all hydraulic systems off) and all elevator PCUs are unjammed.

ROLL AND YAW LIGHTS

Amber ROLL and YAW lights come on whenever proximity sensors detect a jammed control valve or hydraulic pressure deficiency at the respective power control units.

CENTRE PEDESTAL

NOTE

With hydraulic power off, servo monitor panel lights are as follows:

- ROLL light is on
- YAW light is on
- PITCH light is out
- MON SAFE light is on.

Control Surface Position Indicator and Servo Monitor Lights
Figure 4

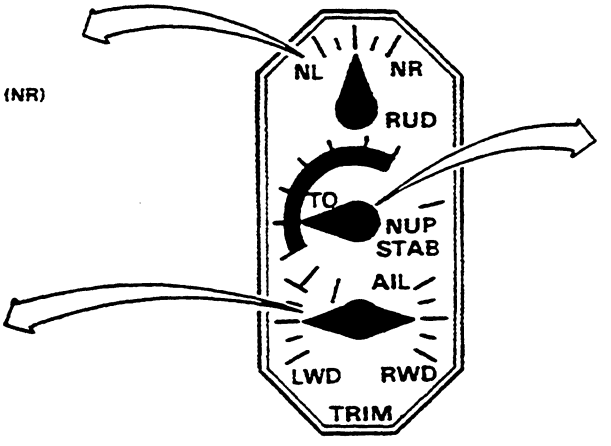
TRIM POSITION INDICATOR

Provides a continuous indication to trim position over their operating range.

RUD NL AND NR

Nose (left) NL/nose right (NR) indications

Left 8.5 degrees
Right 8.5 degrees



STAB NUP

Nose up (NUP) indications.

Stabilizer moves from 0 to -9 degrees incidence. Green band indicates take-off (TO) trim range.

AIL LWD AND RWD

Up 7.5 degrees
Down 7.5 degrees

CENTRE INSTRUMENT PANEL

NOTE

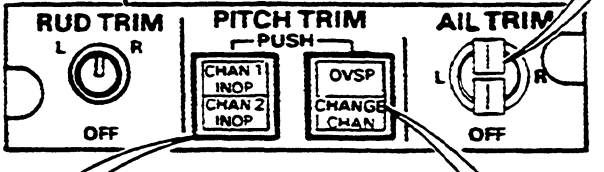
If input signals to trim indicator are lost, aileron and rudder pointers move off scale 90 degrees from zero index. Stabilizer pointer moves off scale to a point between scale end points.

RUDDER TRIM CONTROL

Control switch sets rudder trim left and right.

AILERON TRIM CONTROLS

Control switches sets aileron trim up and down.



CHANNEL INOPERATIVE SWITCH/LIGHT

CHAN 1 INOP
CHAN 2 INOP

Amber lights indicate failure in respective channel.

Pressing switch/light in conjunction with OVSP/CHANGE CHAN switch/light activates pitch trim system.

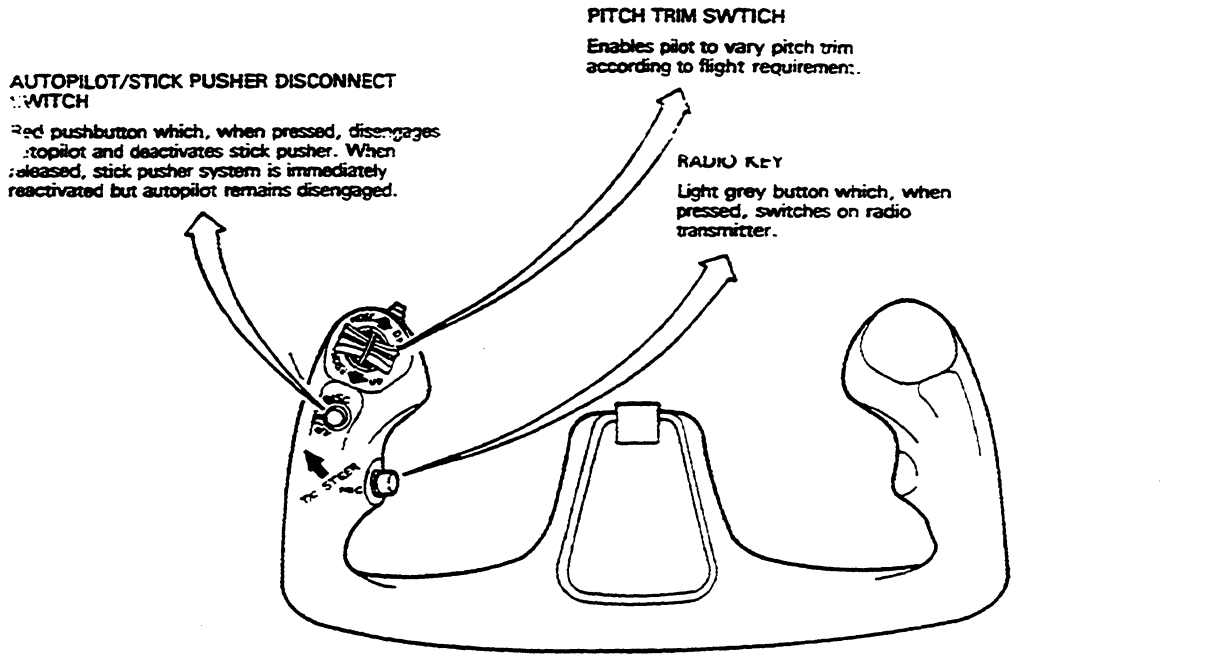
OVERSPEED/CHANNEL CHANGE SWITCH/LIGHT

Amber lights indicate pitch trim overspeed or channel change. Can be used to change from one channel to other for test.

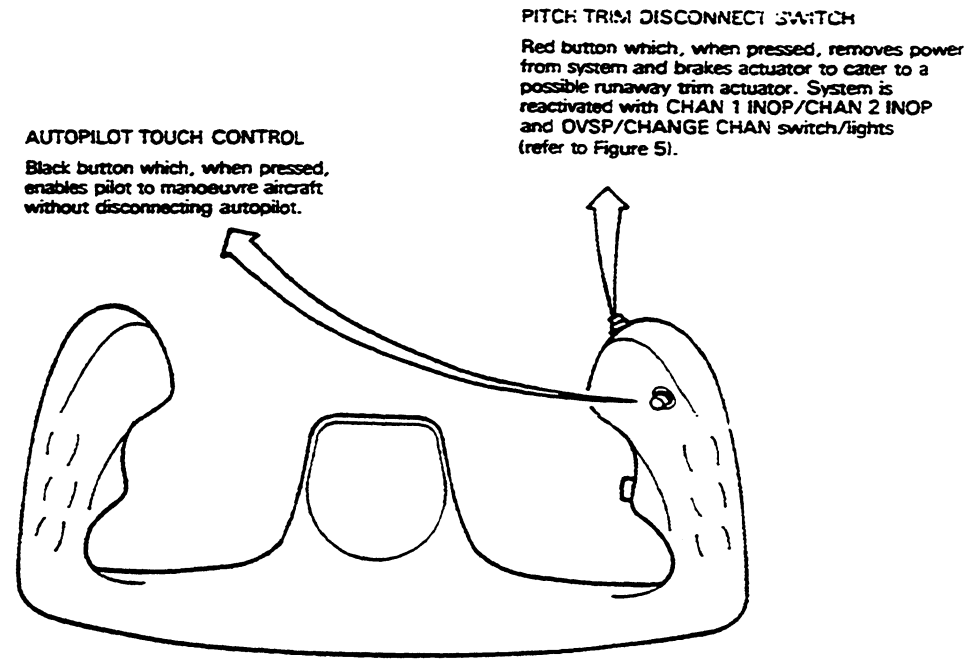
Pressing switch/light in conjunction with CHAN 1/CHAN 2 switch/light activates pitch trim system.

CENTRE PEDESTAL

Trim Controls and Trim Position Indicators
Figure 5

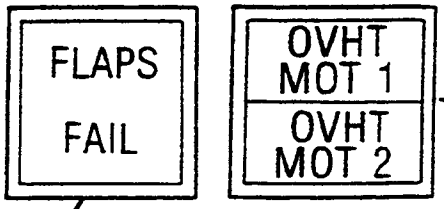


FRONT VIEW



REAR VIEW

Control Wheel
Figure 6

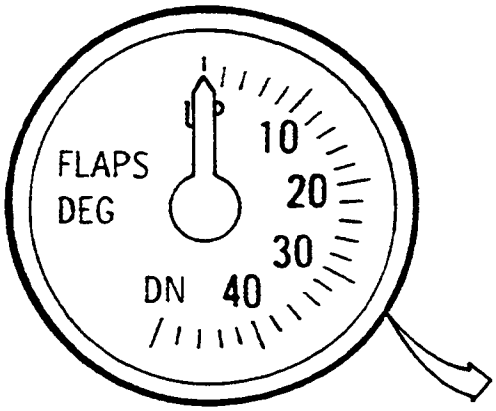


PDU MOTOR OVERHEAT LIGHTS

Amber light comes on to indicate an overheat condition in the associated PDU motor.

FLAP FAIL LIGHT

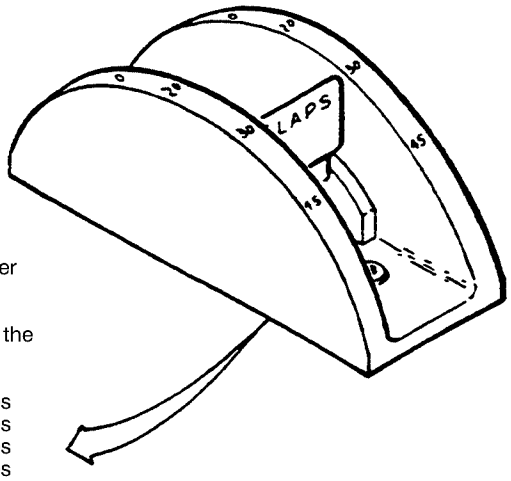
Amber light comes on to indicate a flap asymmetry or speed response fault.



FLAP POSITION INDICATOR

Provides a continuous angular indication of the flaps over their operating range.

COPILOT'S INSTRUMENT PANEL



FLAP CONTROL LEVER

Controls operation of flap power drive unit (PDU).

Lever quadrant is marked with the four flight modes:

Flight/Taxiing	0 degrees
Take-off	20 degrees
Approach	30 degrees
Landing	45 degrees

Each mode corresponding with a detented position of the lever.

CENTRE PEDESTAL

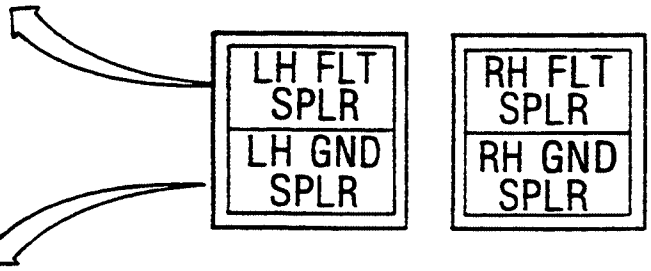
Wing Flap Controls and Indicators
Figure 7

FLIGHT SPOILER DEPLOYED INDICATON

Amber lights come on steady when flight spoilers are not fully retracted. Lights come on flashing and take-off configuration aural warning sounds when N1 rpm is increased beyond 75% and flight spoilers are not retracted.

GROUND SPOILER DEPLOYED INDICATION

Amber lights come on when ground spoilers are at any position other than fully retracted.



GLARESHIELD

SPOILER CONTROL LEVER

To deploy flight spoilers, lever may be moved rearwards to any one of eight detented positions according to flight path requirements until MAX position stop is reached.

FLIGHT SPOILERS LEFT AND RIGHT INDICATION

Green lights come on when flight spoilers are extended beyond one-half position.

GROUND SPOILERS SWITCH

ON – Arms ground spoilers for deployment. Ground spoilers deploy automatically if a weight-on-wheels or wheel spin-up signal is present and either of the following two sets of conditions has been met:

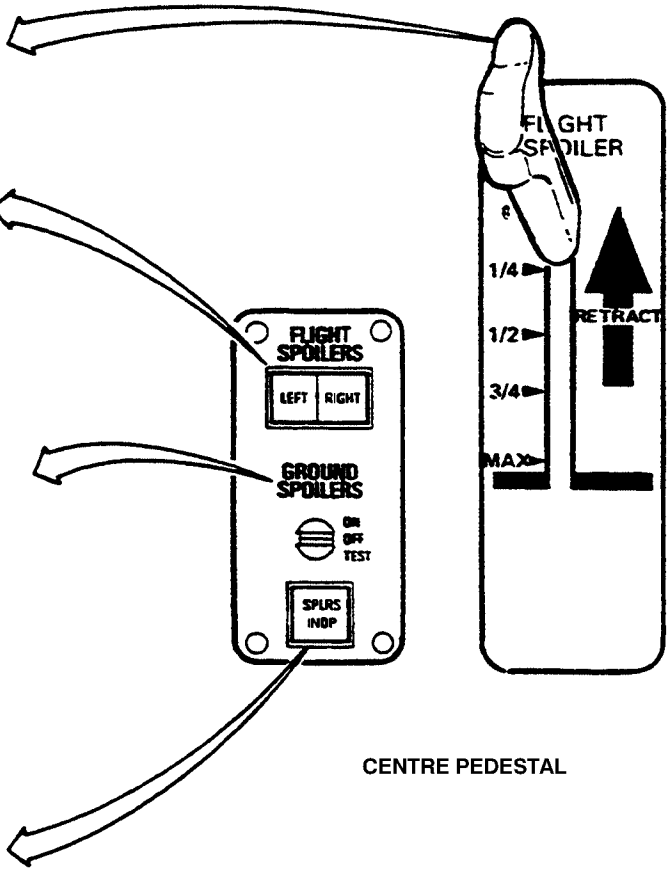
- Spoiler control lever at or above 0 through to 1/4 positions and both throttle levers have been advanced above IDLE then returned to IDLE or SHUTOFF positions.
- Spoiler control lever is between 1/4 and MAX positions and both throttle levers are at IDLE or SHUTOFF positions.

OFF – Ground spoilers are disarmed and cannot be depioyed.

TEST – LH and RH GND SPLR and SPLRS INOP lights come on to indicate correct operation of ground spoiler control system. Refer to Volume 1, NORMAL PROCEDURES for test procedure.

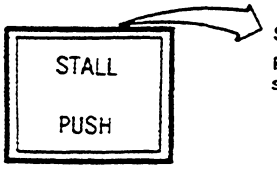
GROUND SPOILER INOP LIGHT

Amber light comes on if spoiler control unit detects fault in ground spoiler hydraulic selector valves or if both throttle levers are not pulled back to IDLE simultaneously.



CENTRE PEDESTAL

Spoiler Controls and Indications
Figure 8

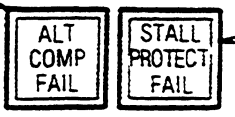


STALL/PUSH LIGHTS (2)

Red lights flash when angle of attack reaches stick pusher trip point.

ALT COMP FAIL LIGHTS (2)

Red lights come on if one or both altitude signals to SPS computer are lost or if 2000 foot difference between them is detected. 15,000 foot angle of attack trip points are applicable when lights are on.



STALL PROTECT FAIL WARNING LIGHTS (2)

Red warning lights flash in the following cases:

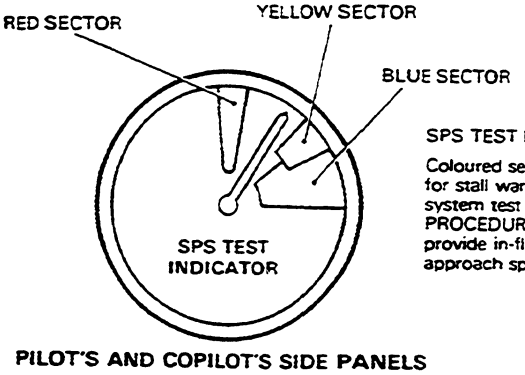
- To indicate a system fault.
- Whenever one of th AP/SP DISC buttons on the control wheels is pressed.
- During system test.

Lights come on steady when power is removed from system.

GLARESHIELD

NOTE

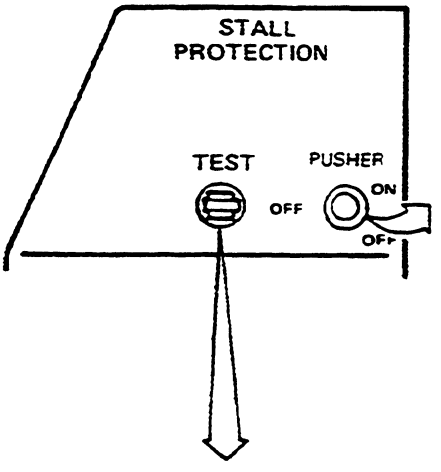
Stick pusher can only be tested on the ground; all other tests can be conducted on the ground or in-flight.



SPS TEST INDICATORS (2)

Coloured sectors on indicator provide references for stall warning/stick pusher sequence during system test (refer to Volume 1, NORMAL PROCEDURES). Indicator is not calibrated to provide in-flight angle of attack indication or approach speed reference.

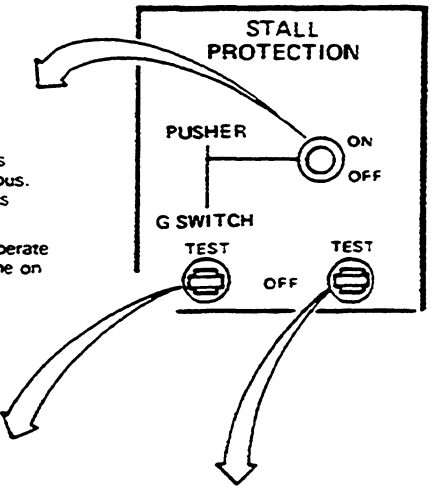
PILOT'S AND COPILOT'S SIDE PANELS



STICK PUSHER SYSTEM SWITCHES (2)

Two-position toggle switches wired in series between stick pusher actuator and battery bus. When both switches are set to ON, power is available for stick pusher operation.

If one switch is OFF, stick pusher cannot operate and both STALL PROTECT FAIL lights come on steady.



PILOT'S STALL PROTECTION TEST SWITCH

Spring-loaded toggle switch. Holding switch on activates self-testing of stall protection system. During test, simulated approach to stall is observed as pointer of left SPS TEST INDICATOR moves from the blue to the red sector. Stick pusher can be checked only when pilot's and copilot's TEST switches are held on simultaneously.

G SWITCH TEST SWITCH

Spring-loaded toggle switch tests operation of one of the accelerometer switches on stick pusher actuator. During stick pusher test, correct operation of accelerometer switch is indicated if stick pusher is immediately de-energized when G SWITCH TEST switch is set to TEST.

COPILOT'S STALL PROTECTION TEST SWITCH

Spring-loaded toggle switch. Holding switch on activates test of right side of system. Test is identical to test of left side of system activated by pilot's TEST switch except that right stick shaker operates and ALT COMP FAIL lights do not come on.

PILOT'S FACIA PANEL

COPILOT'S FACIA PANEL

Stall Protection System Controls and Indicators
Figure 9