

 DC 9/80 OPERATIONS MANUAL	Flight Controls	I	
	Chapter 9 - 1/11	07/04/20	Rev 1

GENERAL

The primary flight controls consist of ailerons, rudder and elevators.

The secondary flight controls consist of adjustable horizontal stabilizer, spoilers, inboard and outboard flaps and slats.

LATERAL CONTROL SYSTEM

The lateral control system is provided by ailerons, which are supplemented, for higher roll rates, by inboard and outboard spoilers.

Conventional control wheels are cable connected to control tabs and aerodynamic forces move the ailerons.

Each aileron contains a conventional trim tab connected by cables to a trim knob on the pedestal.

DIRECTIONAL CONTROL SYSTEM

Directional control is provided by rudder, moved by conventional rudder pedals.

Normally rudder is hydraulically operated. Hydraulic power to the rudder control may be shut off by placing the rudder control lever in manual operations.

When hydraulic power to the rudder control unit is shut off, the rudder automatically reverts to manual operation, unlocking the rudder control tab. Trim is accomplished by turning a conventional trim knob on the pedestal. The rudder throw limiter is a mechanical device that limits rudder movements proportionally to airplane airspeed.

A yaw damper is installed in the rudder system to improve directional stability (for more information refers to chap. 03, Automatic Flight).

LONGITUDINAL CONTROL SYSTEM

The longitudinal control is provided by elevators and supplemented by a movable horizontal stabilizer.

The elevator control system operates a single tab on each elevator. Movements of the control column move the control tab, and aerodynamic force on the control tab moves the elevator. As each elevator moves, an additional tab moves to assist the control tab.

An anti float tab, geared to horizontal stabilizer movements, is installed on each elevator to improve the longitudinal trim in a forward center of gravity landing configuration.

An hydraulic power augmentor system is provided to assure airplane nose down capability under extreme high angle-of-attack conditions. An indication of augmentor system operation is provided on the annunciator panel (ELEVATOR POWER ON).

HORIZONTAL STABILIZER

A movable horizontal stabilizer provides longitudinal trim. The stabilizer is moved by a jackscrew driven by a primary electrical motor or an alternate electric motor.

The alternate motor is used by autopilot for trim.

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SPOILER SYSTEM

Each wing has two flight spoilers that are operational during all phases of flight and a ground spoiler that is operational on ground only.

In flight spoilers are used to supplement aileron lateral control providing the proper amount of flight spoiler extension in relation to aileron movements.

In addition, in flight, the SPEEDBRAKE lever permits a selectable extension of flight spoilers to serve as speedbrake.

On the ground all spoilers are used to a maximum of 60 degrees to increase braking efficiency during landing roll.

The system may be armed for automatic operation by pulling up on the speedbrake lever. When the system is armed, an actuator will automatically extend the spoiler after GSCM activation on ground contact.

FLAP SYSTEM

The flaps are a double slotted type, and move aft and down.

Normally the flaps are operated by both hydraulic systems, but they will continue to operate at a reduced rate with a single hydraulic system.

Flaps may be positioned in any of six permanent detents in a 0 to 40 degrees range by movement of the SLAT/FLAP lever.

The six detents are 0/RET, 0/EXT, 11°, 15°, 28° and 40°.

SLAT SYSTEM

The slat system high lift device located on the leading edge of the wings.

Normally the slats are operated by both hydraulic systems, but they will continue to operate at a reduced rate with a single hydraulic system.

The slats are manually actuated by the FLSP/SLAT lever. Three slat positions may be selected: retracted, mid-sealed and extended. The slats are in retract when are UP, mid-sealed when the flaps are in the 0 to 13 range and extended when the flaps are in the 15 to 40 range.

TAKE OFF CONDITION COMPUTER

Stabilizer takeoff settings are determined by entering calculated takeoff values for C.G. and flap setting into the pedestal mounted computer. When the appropriate C.G. and flap setting appear in their respective readout windows, the stabilizer setting numeric value will appear in the TAKE OFF CONDTN/LONG trim readout and the green bug of the long trim takeoff position indicator will be set.

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STALL WARNING SYSTEM

The stall warning system consists of two independent channels and receives inputs from an angle of attack vane and from horizontal stabilizer and slat/flap position transmitters.

When approaching stall speed, either channel will provide “Stall Recognition” by means of glareshield STALL red light and aural and vocal warning.

A STALL TEST switch is provided to give the capability of testing each channel individually.

TAKEOFF WARNING SYSTEM

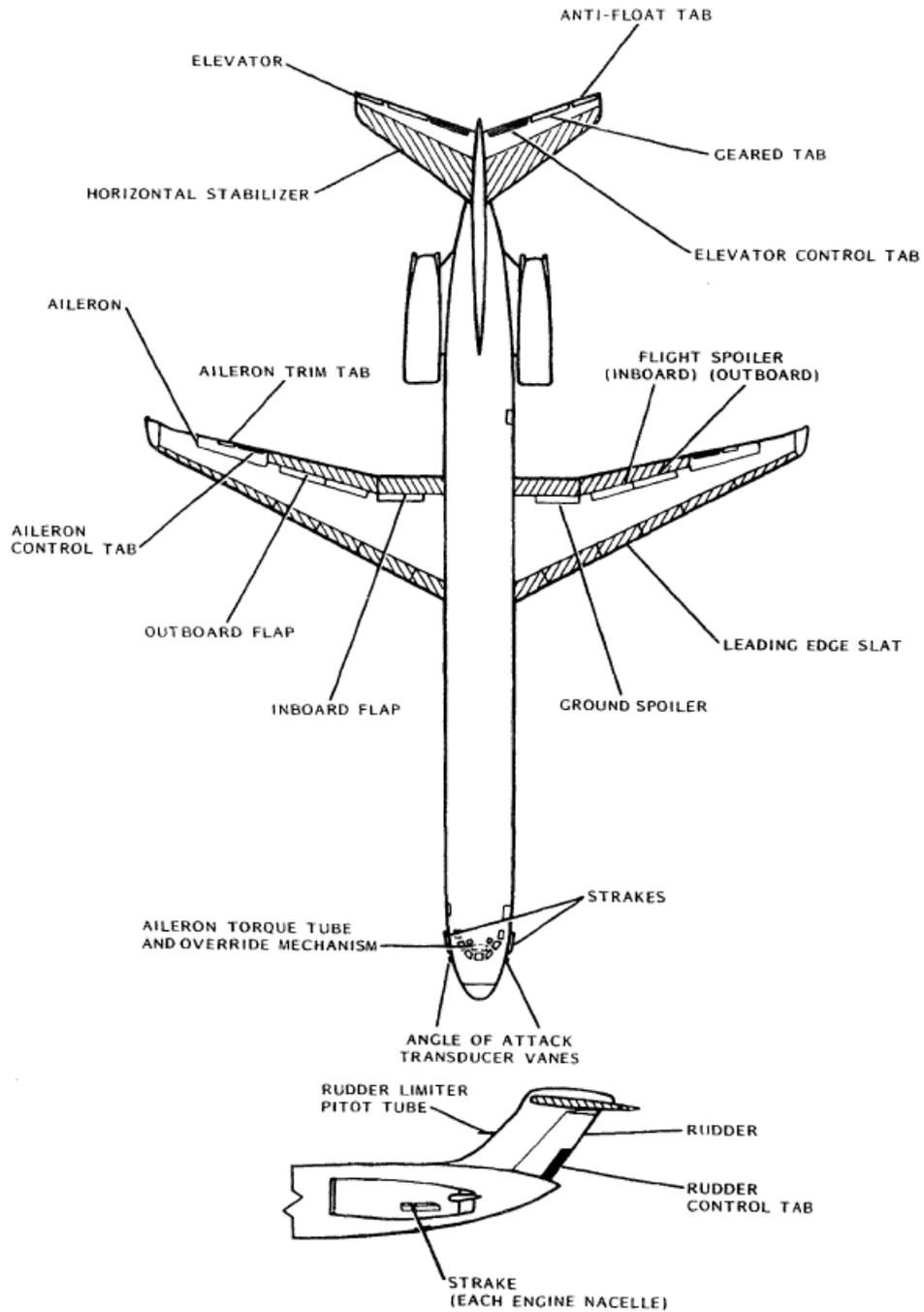
Take off warning signal (intermittent warning horn and voice) will sound if takeoff is attempted with the following conditions:

- FLAP/SLAT lever not in agreement with the value set in the FLAP readout of the takeoff condition computer.
- Horizontal stabilizer is not set within the green band area of the LONG TRIM indicator.
- Slats are not extended.
- Spoiler handle not in the retract detent.
- Parking brake is on.

STABILIZER IN-MOTION WARNING SYSTEM

When the horizontal stabilizer is being moved by the pilot or the autopilot, an audible signal is sounded once for approximately each ½ degree of stabilizer movement. A vocal warning “STABILIZER MOTION” will be sounded when either the autopilot or a runaway trim motor moves the stabilizer more than 2 degrees in 30 seconds.

FLIGHT CONTROLS – COMPONENTS



LATERAL CONTROL SYSTEM

Pilot's Control Wheel:

Controls aileron and flight spoilers. When the control wheels move approximately 5 degrees throw, a mixer arrangement begins spoiler operations.



Rudder Trim Knob and Indicator:

In both powered and manual operation, directional trim is accomplished by rotation of the trim control knob.

The pointers indicate in which direction (LEFT or RIGHT) the trim is displaced from neutral.



AFT PEDESTAL

STABILIZER TRIM Switch:

NORM: Primary stabilizer may be used.

STOP: A brake is applied to stop or to prevent primary motor movement.

Aileron Trim Indicator:

Indicates entity of aileron trimming. The pointer indicates in which direction (LEFT or RIGHT) the trim is displaced from neutral

Aileron Trim Knob:

The lateral trim control is mechanically connected to a trim tab on each aileron. Later trim is accomplished by rotation of the trim control knob.



DIRECTIONAL CONTROL SYSTEM

RUD HYD CONT Lever:
PWR(UP): Opens a shutoff valve allowing hydraulic pressure to lock the rudder control tab and to power the rudder control.
MAN(DOWN): Closes the shutoff valve. The rudder control tab is unlocked and respond directly to rudder pedal movements.



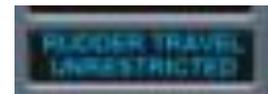
FWD PEDESTAL

**RUDDER CONTROL
MANUAL Light:**

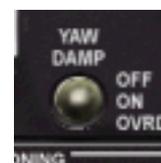
ON: Indicates that there is no hydraulic power to the rudder.



RUDDER TRAVEL UNRESTRICTED Light:
ON: Indicates that the rudder travel is not restricted as a function of airspeed.
OFF: The rudder travel is proportionally restricted as a function of airspeed.



YAW DAMPER Switch:
Refer to chapter 03
AUTOMATIC FLIGHT



OVERHEAD PANEL

LONGITUDINAL CONTROL SYSTEM – ELEVATOR

ELEVATOR PWR ON Light:

ON: Indicates hydraulic power is being used to power the elevator to airplane nose down.



MACH TRIM COMP Switch:

NORM: Normal operating position (not simulated)

OVRD: Retracts the actuators.



OVERHEAD PANEL



MACH TRIM INOP Light:

ON: Indicates the Mach trim compensator monitor has deactivated the system.

LONGITUDINAL CONTROL SYSTEM – STABILIZER

TAKEOFF COND/LONG TRIM Readout:

LONG TRIM settings will appear when both takeoff C.G. and flap setting value are entered in computer.

Long Trim Takeoff Position Indicator (green bug):

Indicator is positioned by computer at the LONG TRIM setting for takeoff.

TAKEOFF COND/CG Thumbwheel:

Sets calculated CG in the CG readout.



LONG TRIM HANDLES:

When both handles are moved to up or down position the primary stabilizer motor moves the stabilizer.

LONG TRIM Indicator:

The indicator is mechanically connected to the horizontal stabilizer. Setting must match TAKE OFF CONTDN LONG TRIM readout before takeoff.

TAKEOFF COND/FLAP Thumbwheel:

Sets calculated takeoff flaps settings in the FLAP readout.



ALT LONG TRIM Levers:

Operate alternate electric stabilizer trim system. The alternate motor is currently used by autopilot for longitudinal trim.

SPOILER/SPEEDBRAKE SYSTEM



SPEEDBRAKE Lever:

Select or control the operating modes of the spoiler/speedbrake system.

SPEEDBRAKE OPERATION:

During flight lever is used to control the flight spoiler to act as speedbrakes by pulling lever to either $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ or EXT position.

GROUND SPOILER OPERATION:

Before landing the lever is pulled up to arm spoiler for automatic extension at touchdown (AUTOSPOILER).

NOTE: The lever can be armed only in flight, when either thrust is advanced, the speedbrake lever automatically returns to the retract (RET) position.

SPOILER/FLAP EXTEND Light:

ON: Indicates that the speedbrake lever is not in the retract (RET) position with flaps extended beyond 6 degrees.

SPOILER/FLAP EXTEND

SPOILER DEPLOYED Light:

ON: Either ground spoiler extended in flight or any spoiler is deployed more than 10° on the ground with speedbrake lever stowed.

SPOILER DEPLOYED

FLAP AND SLAT SYSTEM

FLAP/SLAT Lever:

FLAP/SLAT lever has 6 detents.

UP: Flaps 0 and slats retracted.

0: Flap 0 and slats extended to mid position.

11: Flap 11° and slats extended to mid position.

15: Flap 15° and slats extended to mid position.

28: Flap 28° and slats fully extended.

40: Flap 40° and slats fully extended.



FLAP T.O. SEL Readout:

Indicates in degrees the preselectable detent that has been selected.

FLAP POSITION Indicator:

Two sliding bar indicates the position of both outboard and inboard flaps.



FLAP T.O. Selector:

Provides a takeoff flap setting detent for any flap setting between 0 to 13 and 15 to 24 degrees in addition to the permanent 0, 11, and 15 degrees detent.

SLAT ADVISORY Lights:

T/O: Indicates flaps are in the takeoff range.

DISAG: Indicates that slats position does not agree with FLAP/SLAT lever position.

AUTO: Indicates slats have automatically extended from mid to extend position by stall warning system. Lights comes also on during AUTOSLAT test.

LAND: Indicates FLAP/SLAT is set at 28° or 40° and slats are fully extended.

STALL WARNING SYSTEM



OVERHEAD PANEL

STALL TEST Switch:

SYS2: Test the channel 2 which, if operative, causes the activation of all system warnings.

OFF: Normal operating position.

SYS1: Test the channel 1 which, if operative, causes the activation of all system warnings.

STALL Light:

Illuminates when the airplane is rapidly reaching the stall condition. Light will also illuminate during system test.



STICK PUSHER Light:

Illuminates when the stick pusher activates. Light will also illuminate during system test. When pushed will test the system, and the STALL IND FAILURE message will be visible in the EOAP.

STALL IND FAILURE