

## PART 1

### CHAPTER 6 — OTHER AIRCRAFT CONTROLS AND FLIGHT INSTRUMENTS (Completely revised by AL6)

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#### 1 Rudder Pedal Adjustment and Rudder Trim

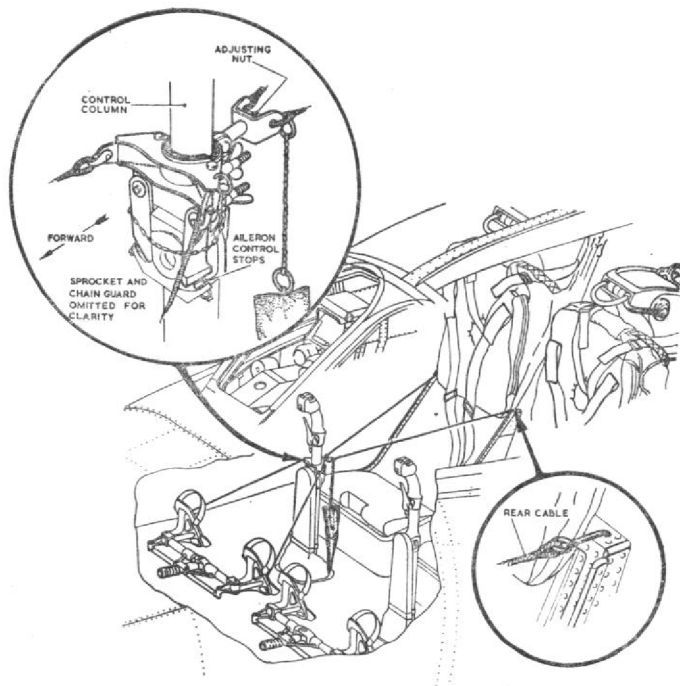
(a) The fore and aft adjustment of each pair of rudder pedals is controlled by a lever at the bottom of each pilot's instrument panel. To adjust the pedals, pull out the appropriate lever to release the spring-loaded locking pin and push the pedals forward or allow them to move aft under spring pressure to the required position. Release the lever and check that the locking pin has entered one of the holes in the adjusting shaft by pushing both pedals together.

(b) The electrically-actuated rudder trim tab is controlled by the combined aileron/rudder trim control on the port shelf; the trim control lock does not affect the operation of the rudder trim control. The similar control on the starboard shelf is for the aileron trim tab only. Combined rudder and aileron trim tab indicators are just forward of each control.

## 2 Autostabiliser

(a) To improve the damping of the lateral and directional oscillations of the aircraft a Mk 2 autostabiliser is provided and operates in conjunction with the rudder trim tab. The AUTOSTABILISER—OFF/STDBY/ON switch is on the centre panel. When switched from OFF to STDBY electrical power from No 1 group inverters is directed to a rate gyro only. When switched to ON, the rate gyro and the trim tab servo-motor are both energised and the autostabiliser is in operation. The OFF position should only be selected if the autostabiliser malfunctions or if it is essential to conserve electrical power, as the gyro, when not rotating, will be toppled and can be damaged.

(b) Post-mod 1376 (Mk 8B only), the autostabiliser is removed.



1—6 Fig 1 Internal Control Locks

### 3 Control Locks

(a) *Internal Locks.* To lock the control column and rudder pedals, arrange one of the two clamps so that its tongues are positioned firmly between the aileron stops and tighten the wing nut. Secure the other clamp to the control column and hook the ends of the four cables into four holes, one on each rudder pedal and one at each side of the ejection seat. The arrangement is shown at Fig 1.

(b) *External Locks.* Locking clamps are provided for all control surfaces.

Note: There is no control lock stowage in the aircraft.

### 4 Landing Gear

(a) The hydraulically-operated landing gear is electrically controlled by UP and DOWN buttons on the left of the port instrument panel; a second set of UP and DOWN buttons together with a third, red, button is on the right of the starboard instrument panel. With the red button pressed in, both starboard buttons are out and the port buttons are operative. When a starboard UP or DOWN button is pressed, the red button is released and the port buttons are inoperative. The red button can only be pressed in to pass control to the port buttons when both pairs of buttons are similarly selected and the battery master switch is on. When the aircraft is on the ground, an electro-mechanical lock prevents the UP buttons being pressed in. When the main landing gear legs extend after take-off, a microswitch on each leg operates to release the locks and allow the landing gear to be selected up (see also para 5).

**WARNING 1:** To prevent inadvertent operation of the landing gear if the selector interlock malfunctions, it is essential to check that both pairs of buttons are similarly selected before pressing the red button.

**WARNING 2:** The UP and DOWN button must always be pressed fully in to ensure that the electrical contacts are made.

(b) A standard landing gear position indicator with

day/night screens and a green bulb changeover switch is adjacent to the port landing gear buttons. A red warning light below the buttons comes on if the throttle is less than one-third open with the landing gear not locked down.

## **5 Landing Gear Emergency Operation**

(a) In the event of an electrical or hydraulic failure, the landing gear can be lowered irrespective of the position of the normal selector buttons by air pressure from the landing gear emergency air cylinder. The pressure in the cylinder (2000 PSI minimum) is shown on a gauge on the cockpit port wall. When the landing gear emergency lowering control on the port shelf is pulled to its full extent (after first pushing in the central knob), air is released from the cylinder to the wheel unit jacks (bypassing the sequence valves) which operate to lower and lock the landing gear down. After using the emergency lowering system, the landing gear cannot be retracted until the system is reset on the ground.

(b) If it is necessary, in an emergency, to retract the landing gear when the aircraft is on the ground, the operative UP button should be rotated clockwise to release the lock and allow the button to be pressed in. This method is inoperative if the emergency lowering system has been used. If the UP button cannot be pressed in normally after take-off, the landing gear must be left down as the cause could be the failure of a leg to extend fully; retraction of the landing gear in this condition could result in damage to the leg fairings.

## **6 Flaps**

(a) The hydraulically-operated flaps are electrically controlled by the FLAPS—UP/DOWN selector lever on the left of the port instrument panel; detents allow selection of eight positions corresponding to flap settings of UP, 15°, 23°, 30°, 38°, 45°, 60° and DOWN (80°). A selector lever on the right of the starboard instrument panel is similar except that the lever can be moved into or out of a gate beyond the UP position when a safety catch is released. When the lever is in the gate, the port selector

is operative; any other selection overrides the selection made on the port selector.

Note: If the lever is moved into the gate with the port selector at any position other than UP, the flaps lower to the selected position.

(b) A flap position indicator is on the port instrument panel.

(c) If the flaps are lowered at speeds in excess of the flap limiting speeds (Part 2, Chapter 2), the extent to which they lower depends on the air loads. If the speed is increased beyond the limiting speeds with the flaps lowered, the flap angle reduces according to the air loads.

## 7 Flap Emergency Operation

In the event of an electrical or hydraulic failure, the flaps can be lowered irrespective of the position of the normal selector levers by air from the flaps emergency air cylinder. The pressure in the cylinder (2000 PSI minimum) is shown on a gauge on the cockpit port wall. When the flaps emergency lowering control on the left of the port instrument panel is pulled to its full extent (after first pushing in the central knob), air is released from the cylinder to the flap jacks to lower the flaps fully; intermediate positions cannot be selected. After using the emergency lowering system, the flaps cannot be raised until the system is reset on the ground.

## 8 Airbrake

(a) The hydraulically-operated under-fuselage airbrake is electrically controlled by a 3-position switch, spring-loaded to the centre-off position, on each throttle lever. Momentary selection of IN (forward) or OUT (aft) retracts or extends the airbrake fully; no intermediate selections can be made in flight. A magnetic indicator on the left of the port instrument panel shows white when the airbrake is out and black when it is fully in.

(b) The airbrake switches are inoperative until the landing gear UP button is pressed. If the landing gear is lowered (using the normal or emergency systems) when

the airbrake is out, the airbrake automatically retracts. Airbrake retraction must not normally be obtained by lowering the landing gear because the airbrake extends if the landing gear UP button is subsequently pressed.

(c) The airbrake operation can be tested on the ground by a spring-loaded switch on the centre pedestal. When the switch is held to TEST (with the battery master on and hydraulic power available), the airbrake extends through 10° and then retracts with a slight bump; the magnetic indicator shows white whilst the airbrake is out.

## **9 Wheelbrakes**

(a) The hydraulic wheelbrakes are operated by a lever on the forward face of each control column and a differential relay valve operated by the rudder pedals.

(b) The main hydraulic pressure (2800 to 3000 PSI) and the pressure at each wheelbrake (1500 to 1600 PSI maximum) are shown on the triple pressure gauge on the port shelf.

(c) Maxaret brake units are fitted. The units can only operate if the wheels are rotating; the brakes must not be applied at touchdown.

(d) If the hydraulic supply pressure fails, two hydraulic accumulators provide a reserve of pressure, when fully charged, for about 40 operations of the brake units. During the landing run, one continuous brake application should be made to conserve pressure; heavy braking should be avoided as the accumulator pressure is rapidly exhausted if the maxaret units are allowed to operate. A gauge on the port shelf adjacent to the triple pressure gauge shows the air pressure in the brake accumulators. The gauge reads 3000 PSI (maximum) when the accumulators are fully charged and 750 PSI (the initial charge pressure) when the accumulators are exhausted. The brakes function with reducing effectiveness as the pressure drops until, with the gauge reading 750 PSI, no further braking is available.

## **10 Brake Parachute**

(a) The brake parachute, stowed in a container above

the tail cone, is controlled by a guarded 2-position OFF-JETTISON/STREAM switch on the armament control panel or by a guarded 3-position JETTISON/off/STREAM switch on the centre panel. The 2-position switch is only operative when the 3-position switch is at the centre-off position. Normally, the 2-position switch should be at OFF-JETTISON and the 3-position switch should be at the centre-off position. The switches are in-operative unless the circuit breaker at the aft end of the port shelf is made.

(b) Selecting the 2-position switch to STREAM ejects the parachute; returning the switch to OFF-JETTISON jettisons the parachute.

(c) Selecting the 3-position switch to STREAM ejects the parachute; returning the switch to off jettisons the parachute. The JETTISON selection is for emergency jettisoning of the parachute after it has been streamed using the 2-position switch.

(d) When the parachute is streamed, a red STREAM caption above the centre instrument panel coaming illuminates; the caption remains illuminated after the parachute is jettisoned.

(e) If the parachute stowage doors open because of a malfunction, the parachute is ejected and automatically jettisoned and the STREAM caption illuminates.

(f) A TEST TAIL CHUTE switch is provided at the aft end of the port shelf. When the switch is pressed, the STREAM caption illuminates to indicate that the release circuits are serviceable and that the circuit breaker (which is adjacent to the switch) is made. The test switch can be operated in flight if required.

(g) After jettisoning the parachute, or if the parachute fails to jettison, the switch should be returned to STREAM immediately otherwise the release unit may be damaged by the electrical overload.

Note: If the parachute stowage doors malfunction and fail to open when STREAM is selected (ie no STREAM caption), the switch should be returned to OFF-JETTISON (or off in the case of the starboard switch) within 30 seconds to avoid overloading the door release solenoid.

(h) Post-NSM 3066, three ganged TAIL CHUTE/ ARRESTER HOOK — NORMAL / EMERGENCY switches above the starboard instrument panel enable the system to be operated from the standby batteries. When NORMAL is selected, the power supplies for operating the brake parachute (and the arrester hook) are from the main batteries; when EMERGENCY is selected, the power supplies are from the standby batteries.

## 11 Arrester Hook

(a) A 1.5g arrester hook is provided for emergency use. The hook is retained in the up position by an electromagnetic release unit controlled by either of two ARRESTER HOOK — UP/DOWN switches (spring-loaded to UP); one (guarded) switch is on the armament control panel and the other is on the centre panel. A red light adjacent to the switch on the centre panel comes on when the hook is lowered through 30°.

(b) When either switch is selected to DOWN the release unit operates and the hook lowers under the action of a pneumatic damper. The damper also serves to hold the hook in contact with the ground. To avoid damage to the damper and airframe caused by hook bounce, the hook should not be lowered until after touchdown. The hook can only be raised manually on the ground.

(c) Post-NSM 3066, three ganged TAIL CHUTE/ ARRESTER HOOK — NORMAL / EMERGENCY switches above the starboard instrument panel enable the system to be operated from the standby batteries. When NORMAL is selected, the power supplies for operating the arrester hook (and the brake parachute) are from the main batteries; when EMERGENCY is selected, the power supplies are from the standby batteries.

## 12 Flight Instruments

(a) Pitot and static pressures are provided by a pressure head, Mk 9 series, on the leading edge of the port wing tip. The pressure head is electrically heated and the heater element is controlled by a PRESS HEAD — ON/OFF switch below the centre of the port instrument panel.

(b) The pressure-operated flight instruments are:



Airspeed indicators Mk 12A  
Machmeters Mk 3A  
Vertical speed indicators Mk 3Q  
Altimeter Mk 29B (port panel)  
Altimeter Mk 30A (starboard panel)  
Cabin altimeter Mk 18 or 21 (centre panel).

- (c) (i) The Mk 30A altimeter is a servo-operated counter-pointer instrument which also provides an electrical output to the Mk 29B altimeter; additionally it provides an electrical output in the form of an encoded signal to the IFF/SSR for altitude reporting on Mode C. The transmitted altitude is based on a 1013 mb datum irrespective of the setting on the millibar scale. In the event of servo malfunction or a power failure, a red/black striped flag obscures the counters and the outputs to the Mk 29B altimeter and the IFF/SSR are disconnected.

Note: If the millibar setting is adjusted with AC power off, the altitude counters and the pointer do not move. If the millibar setting is increased more than 90 mb with AC power off, a travel limit switch within the instrument opens and prevents AC power being connected to the instrument. If the failure flag does not clear when AC power to the instrument is switched on, wind the millibar setting towards the lower end of the scale until the flag clears. Normally the millibar setting should only be adjusted with AC power on.

- (ii) The Mk 29B altimeter is a servo-operated counter-pointer instrument with a reversion capability to capsule operation (standby mode) either automatically or by selection. In the servo-operated mode, the altimeter takes signals from the Mk 30A altimeter. A 3-position, spring-loaded to centre, standby/reset knob marked S—R on the instrument allows manual selection of the standby (S) or servo (R) mode. When S is selected momentarily and released, the altimeter reverts to capsule operation, an integral DC vibrator starts up and a STBY flag appears. When R is selected momentarily and released, the altimeter resets to the servo mode (provided that power supplies and the required input are available), the vibrator stops and the STBY flag clears. The 10,000 feet counter shows black/white

stripes below 10,000 feet and red/white stripes below zero feet. When electrical power is switched off, the altimeter reverts to the standby mode. The altimeter automatically reverts to the standby mode in the event of:

1. Primary power failure.
2. Servo amplifier failure.
3. Servo motor failure.
4. Failure within any part of the detection circuit.
5. Differences greater than the pressure equivalent of about 4000 feet at sea level (up to 10,000 feet at altitude) occurring between the standby capsule altitude and the servo-indicated altitude.

Note: When the Mk 29B altimeter is being operated in the servo (R) mode, it is possible for a fault in the system to cause both altimeters to indicate the same incorrect height without any warning flag indications. It is recommended, therefore, that the Mk 29B altimeter is selected to standby (S) for take-off and at the beginning of a descent/recovery procedure.

(iii) A pressure error correction unit (PECU) is provided to correct the Mk 30A altimeter reading (and the outputs to the Mk 29B altimeter and IFF/SSR) for pressure error when drop tanks or rocket launchers are carried on the outboard pylons. The PECU must be plugged in or out according to the configuration; this can only be done on the ground. When the PECU is not in use (or fails), a PE warning flag appears on the face of the Mk 30A altimeter. If outboard drop tanks or rocket launchers are jettisoned in flight the altimeter readings will be in error by the sum of the PECU correction applied and the normal PE correction applicable without drop tanks or rocket launchers. In this case, the Mk 29B altimeter can be operated in the standby mode and the normal PE corrections applied to it.

(iv) The 115 volt, 400 Hz AC power supply for the Mk 30A altimeter is provided by a type FI-45E static inverter; control is by the engine master switch. The type 108 inverter (Tacan and IFF/SSR) can be used as a standby for the type FI-45E inverter by selecting the ALTIMETER POWER SUPPLY — NORMAL/STANDBY switch on the port instrument panel to STANDBY. Following an inverter changeover, the Mk 29B altimeter must be reset to the servo (R) mode.

(d) The electrically-operated flight instruments are:

G4FT compass

Artificial horizon Mk 4 (port panel)

Artificial horizon Mk 6C (starboard panel)

Turn and slip indicators Mk 2.

(e) The G4FT compass is operated by DC from the main busbar and AC from the No 1 group inverters. A compass correction panel is on the bulkhead behind the port seat.

(f) (i) The pupil's Mk 4 artificial horizon is operated by AC from the No 2 group inverters. Power failure indication is shown by an OFF flag. The fast erection button must not be used until 15 seconds after switching on, and it must not be pressed for more than 1 minute or after the instrument has erected.

(ii) The instructor's Mk 6C artificial horizon is also operated by AC from No 2 group inverters. The fast erection button of this instrument must not be used until 30 seconds after switching on and must not be pressed for more than 1 minute or after the instrument has erected. The power failure indicator shows an orange and black disc when electrical power is lacking.

(iii) With both Mk 4 and 6C artificial horizons, the fast erection button must only be operated in un-accelerated flight.

(g) Each turn and slip indicator is operated by DC whenever electrical supply is available. If electrical supply is lacking an OFF flag shows. Below each instrument is a TURN & SLIP — NORMAL/EMERGENCY switch. With NORMAL selected, the supply is taken from the main busbar; with EMERGENCY selected, the supply is from the standby batteries.

### 13 Accelerometer

The accelerometer on the centre panel indicates, by means of three concentrically-mounted pointers, all vertical accelerations imposed on the aircraft. One pointer

indicates instantaneous g, the other two register the maximum and minimum g readings respectively until reset by pressing the knob on the instrument case.

#### **14 Windscreen Wipers**

The windscreen wipers are driven by a single hydraulic motor supplied from the main hydraulic system and controlled by the SCREEN WIPERS — PARK/TURN TO RUN knob at the bottom left of the port instrument panel. The wiper speed can be varied by adjusting the control knob. The wipers must not be operated when the windscreens are dry or at speeds above 300 knots. When the wipers are not in use, the control knob must be turned *fully* to the PARK position to avoid the possibility of loss of pressure in the hydraulic system.

#### **15 Standby Compass**

The E2B standby compass is on the windscreen arch above the centre panel. Large deviations must be expected when the GGS master switch is on, the GGS recorder is fitted, the canopy is open or the generators are off line. A 3-position switch and a dimmer switch on the centre pedestal control the illumination of the compass. When the switch is set to NORMAL, the supply is from the main busbar; when it is set to EMERGENCY, the supply is from the standby batteries.



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