PART 2

CHAPTER 3—COMMUNICATIONS RADIO

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General

1. *Radio Racks.* The communications radio equipment, which is cooled by means of electrically-operated fans (Chapter 1, para 58 to 60), is installed in two racks as follows:

a. *In the Left Radio Rack:*
No 1 VHF transmitter
No 1 VHF receiver
No 1 and No 2 PA amplifiers
No 1 HF transmitter/receiver
No 1 UHF transmitter/receiver
IFF/SSR transponder

b. *In the Right Radio Rack:*
No 2 VHF transmitter
No 2 VHF receiver
Selcal unit
No 2 HF transmitter/receiver
No 2 UHF transmitter/receiver

2. Power supplies for the radio equipment consist of:
28-volt DC
115-volt AC

3. DC circuit breakers and DC and AC fuses associated with this equipment are on panels at the engineer's station.

4. Radio power supplies are switched from a panel at the navigator's station.

5. Limitations and restrictions on the use of radio equipment are given in Pilot's Notes—Flying, Part 1, Chapter 4.

5A. A telephone handset, adjacent to the left-hand forward passenger entrance door, provides communication between the aircraft and the station telephone exchange via a 4-pin plug on the intercom access panel in the right-hand nosewheel bay.

Intercom

6. *General.* The intercommunication system provides a means of selecting a number of transmitter and receiver services and an incorporated intercom facility at station boxes; intercom only is also available at various points throughout the aircraft.

7. *Facilities.* The principal facilities provided by the system are as follows:

a. Two-way communications between aircrew; between aircrew and ground crew in attendance, also between personnel servicing the aircraft.

b. Selection of any one of six transmitters.

c. Selection of up to thirteen receiver only facilities plus I/C, each with its own independent volume control.

d. Override of all telephone circuits.

e. An emergency system.

8. *Installation.* The following are located behind the navigator's hinged panel:

Main and sub-junction boxes
Ground crew amplifier
Voice/range filter units
Flight deck loudspeaker amplifiers

There are five station boxes together with microphone selector panels, jack sockets, I/C—OFF—R/T switches and oxygen mask connectors situated at the captain's, co-pilot's, navigator's, engineer's and supernumerary stations. A sixth station, on the right radio rack, has full facilities but no station box is fitted. However, as all station boxes are interchangeable, if it becomes necessary to use the radio rack position, a box may be transferred from the flight deck.

9. Eleven ground crew type jack boxes, two ALM handsets plus three I/C sockets and associated switches at the engineer's station and pilot's centre console respectively complete the installation.

10. *Flight Deck Intercom.* The flight deck system serves the five crew stations and the station at the right radio rack; it is permanently linked to three of the ground crew jack boxes. The cabin crew system is also linked to the flight deck but the facility for isolating ALM microphones is retained.

11. *Station Boxes*

a. Each station box contains a two-stage transistor microphone and telephone amplifier with an input fuse rated at 1 ampere which is on the front of the box. The receiver services are selected by pressing in the appropriate pushbutton, rotating the button controls the volume to the headset. The rotary TRANSMITTERS switch is for simultaneous selection of transmitter and receiver services, UHF 1, UHF 2, VHF 1, VHF 2, HF 1 and HF 2. It should be noted that when a facility is selected at the TRANSMITTERS switch the associated pushbutton volume control is effective irrespective of whether the button has been pressed in or not.

b. Voice/range filters are used in the ADF and VOR circuits. The filters provide separate or joint reception of the voice and range signals from a composite voice/range transmission.

c. Operation of the OVERRIDE button enables the operator to pass messages at high volume to all crew members irrespective of the position of their IC switches and volume controls.

d. A CALL LIGHT on each box comes on when pressed and causes the call lights on the other station boxes to come on. When the light is released all call lights go out.

e. *EMERGENCY/NORMAL Switch.* Intercom and all selected receiver services are fed through the telephone amplifier in the station box. If the amplifier, the 1 ampere fuse or the power supply fail, nothing will be heard until the EMERGENCY /NORMAL Switch is selected to EMERGENCY. This enables the selected receiver services to bypass the unserviceable amplifier and be fed directly to the headphones. All volume controls will also be bypassed. Normal I/C will not be available; the procedure to obtain emergency intercom is given in Pilot's Notes—Flying, Part 2, Chapter 3.

12. *Cabin Crew Intercom*

a. The ALM I/C system, which is connected to the ground crew I/C amplifier at the navigator's station, comprises two handsets located on panels L and LB at the forward and aft ALM stations respectively. Three jack sockets are provided, one on the luggage rack above seat 2C, one under the aft ALM table and one at the rear passenger-entrance door forward of the wing.

b. With the exception of the main passenger door socket, the ALM microphone circuits are controlled by the DITCH/NORMAL/QUARTERMASTER switch on the pilots' centre console. In the NORMAL setting neither ALM can speak to the flight deck nor can they speak to each other. In the DITCH and spring-loaded QUARTERMASTER settings, the microphone lines are connected to the ground crew amplifier so that normal intercommunication is possible. The switch is normally left in the DITCH setting so that the cabin crew can talk to the flight deck at any time.

13. *Ground Crew Intercom.* The ground crew amplifier with its microphone and telephone amplifiers not only serves the ALM stations but also eleven ground crew jack boxes situated throughout the aircraft. Three of these boxes have the microphone and telephone lines made at all times, the remaining eight positions have the microphone lines controlled by the GROUND CREW JACK BOXES switch on the engineer's panel. Plugging into a jack box makes a microswitch which switches on the ground crew amplifier.

14. *Jack Boxes*

a. Each pilot's headset plugs into a jack socket in the headset stowage compartment outboard of his seat.

b. Jack boxes for the navigator and engineer are situated at their respective stations whilst the supernumerary station jack box is at the rear of the centre console. Another jack box belonging to the flight deck system is towards the front of the right radio rack. An additional jack box is in the electrics bay, adjacent to the forward freight hold access door. A 35 feet long intercom extension lead is in a stowage on the forward face of the access door. It is for use when entering the forward freight hold when frozen food containers are carried. (Frozen food containers give off CO_2 gas). Associated with these jack sockets and, in the case of the navigator, engineer, supernumerary and radio rack stations integral with the jack box, are three-position I/C—OFF—R/T switches. The pilots' switches are on the control columns. When I/C is selected the crew member's microphone is connected to the microphone amplifier in his station box. When the switch is held in the spring-loaded R/T setting the microphone is connected via the rotary TRANSMITTERS switch on the station box to the selected transmitter, and the transmitter is keyed. When the station box is selected to EMERGENCY the microphone is permanently connected to the transmitter selected at the rotary TRANSMITTERS switch and the I/C—OFF—R/T switch is only used to key the selected transmitter.

c. Eleven other jack boxes are provided:

(1) Three available from inside the aircraft:
One in the tail
Two on the left radio rack*

(2) Eight available on the outside of the aircraft:
One in the nosewheel bay*
One in each mainwheel bay
One in each outer engine nacelle
One at each refuel point
One at the top of the fin

*These jack boxes have their microphone circuits made at all times, so that intercom is always possible with the flight deck.

15. *Microphone Selector Boxes and Loud Speaker System*

a. Microphone selector boxes are provided at each crew station and at the right radio rack to enable either BOOM or MASK microphones to be selected. HAND microphones are not used.

b. Two loudspeakers are provided on the flight deck, one on the left wall behind the captain's seat, the other on panel C. They are controlled by the SPEAKER ON and SPEAKER VOLUME controls on the captain's and co-pilot's microphone selector boxes respectively. Each speaker is fed from the respective station box via amplifiers at the navigator's station. The amplifiers are muted when any I/C — OFF — R/T switch is selected to I/C or R/T.

PA System

16. The Passenger Address system enables the pilots or an ALM to make announcements to all parts of the aircraft. The installation consists of 25 speakers spaced throughout the cabin in the underside of the hatracks, served by two amplifiers located in the left radio rack. No 1 PA amplifier feeds 12 speakers, 6 left and 6 right while No 2 PA amplifier feeds 13 speakers, 7 left and 6 right. Should one of the amplifiers fail therefore, the system still functions but at reduced efficiency.

17. Switches for controlling the PA amplifiers are on the navigator's panel marked PA AMPLIFIERS No 1, No 2. A HIGH FLIGHT — LOW GROUND switch on the aft ALM panel enables preset volume controls to be selected for ground or air use.

18. The pilots make announcements using their boom or mask microphones in conjunction with the modified OXYGEN MASK I/C-PA switch outboard of their seats. Sidetone is obtained by selecting PA on the station box.

19. The cabin crew have two PA handsets, one on the forward ALM panel, the other on the aft ALM panel. A press-to-talk switch is incorporated in the handgrip.

20. An announcement made from the flight deck overrides a cabin announcement.

VHF

21. VHF facilities are provided by twin Marconi transmitters and receivers which operate in the 118·00 MHz to 135·95 MHz range. They are fitted in the left and right radio racks, and the control units are on the centre console. Both sets can be operated simultaneously, and the receiver boxes are interchangeable with the NAV receivers.

22. *Control Unit.* Two knobs are used for frequency selection, the right-hand knob carries an on/off switch which is marked VOL OFF but the volume control is inoperative. The equipment tunes automatically as a frequency is selected.

UHF

23. UHF facilities are provided by twin UHF sets which operate in the 225·0 MHz to 399·9 MHz range. They are fitted in the left and right radio racks and the controllers are on the centre console. Both sets can be operated simultaneously.

24. *Control Unit.* The CHAN control is a 20-position rotary switch, preset channels 1 to 18, G being set to the guard frequency of 243 MHz and M for manual frequency selection using the four rotary selector knobs. The volume control is operative and should be set to approximately ¾ volume to avoid distortion.

25. The function switch has four settings:

a. OFF — No power to the equipment.

b. T/R — Normal position for reception and transmission on the selected frequency.

c. T/R + G — Transmission and reception on the selected frequency plus listen only facility on the guard frequency of 243 MHz.

d. ADF — Not used.

26. Either UHF set can be used for emergency intercom but usually the No 1 box should be selected as it can be powered from the standby TRU busbar should the normal supply fail.

HF

27. HF facilities are provided by twin Collins 618T transmitter/receivers, one in the left radio rack and one in the right radio rack. Both control units are on the centre console. Aerial tuning units are situated in the base of the fin. ▶◀ The equipment is capable of single sideband and double sideband operation (AM). Only one transmitter may be used at a time as an interlock renders the other transmitter inoperative. Receivers are muted when a transmission is taking place.

28. *Control Unit.* The control units incorporate a function switch, frequency selectors and an RF SENS control.

a. *Function Switch*

OFF — No power to the equipment.

USB — Transmission and reception on upper sideband.

LSB — Transmission and reception on lower sideband.

AM — Transmission and reception on the more widely used double sideband amplitude modulated mode.

DATA — Not used.

CW — Not used.

b. *Frequency Selectors*

Four selectors giving a frequency range of 2 to 29·999 MHz in 1 kHz steps. The equipment is used for transmission and reception below 25 MHz and, due to aerial limitations, for reception only above 25 MHz.

c. *RF SENS Control*

Varies the RF gain of the receivers and is normally left at or near maximum.

29. *Transmitter/Receiver.* The transmitter/receiver is switched on by selecting the function switch to the required mode and allowing a warm-up period of at least 1 minute. On switching on, the green TUNE light (situated at the forward end of the centre console) comes on and a tone is heard in the headphones until the frequency is reselected. When the equipment is required, selecting the desired frequency causes the transmitter/receiver to tune to that frequency in less than 8 seconds. While tuning is in progress the receiver is muted.

30. *Aerial Tuning Unit.* Before transmission can take place the ATU must be activated to match the aerial to the transmitter frequency. This is achieved by selecting the appropriate HF on the rotary TRANSMITTERS switch on the station box and selecting the I/C — OFF — R/T switch to R/T momentarily. Whilst the ATU is tuning, the green light is on and the tone is heard in the headphones. The light and tone cease when tuning is complete, indicating that the equipment is ready for use. Should the ATU not tune within 45 seconds a thermal relay operates to stop the tuning process but the light and tone remain on. To reset the relay, recycle the frequency and allow at least 1 minute for the set to cool before attempting to tune the aerial again. A separate TRU is introduced to supply each ATU with 28 volts DC. The TRU has a dual output — one to each ATU. If a failure occurs in an output line, or if the TRU fails, the associated ATU revert to ordinary aircraft power, indicated by either or both of the HF ATU DC FAIL lights on the navigator's panel coming on.

Selcal

31. The selective calling system enables a continuous watch of selected HF and/or VHF frequencies to be kept without having to 'listen out'. A control panel in the roof above the co-pilot has a SELCAL OFF/ON switch, and VHF1/HF1 and VHF2/HF2 changeover switches. Associated with the changeover switches are a pair of amber lights on each pilot's instrument panel. The lights are of the press-to-test type and can only be tested when the Selcal is switched ON.

32. The twin-channel unit is located in the right radio rack. Each aircraft is allocated a Selcal code consisting of 4 audio tones. Transmission by a ground station giving the correct sequence of tones are detected by reeds in the decoder unit and a relay operates to activate the appropriate amber lights and a set of chimes located behind the pilots' instrument panel. Pressing the illuminated SELCAL light cancels the light and chimes and resets the relay.

33. Selcal codes allocated to the aircraft are shown on labels adjacent to the lights and also on the decoder unit in the radio rack.

IFF/SSR

34. The IFF/SSR is installed to provide identification and information for military purposes (IFF) and civil secondary surveillance radar (SSR).

35. The IFF/SSR transponder is part of a system that allows the aircraft to be interrogated by IFF or SSR ground radar stations and rapidly and automatically make an identifying transmission. It can also, by selection, transmit coded altitude information.

36. An identification of position (I/P) facility is provided to enable a ground station to identify the aircraft from other aircraft replying on the same code.

37. The system has the following basic components:

a. *Transponder*: on the left radio rack, which requires AC and DC supplies. It operates in the 950 MHz to 1150 MHz band on two fixed frequencies, one for reception of interrogation signals and one for automatic transmission of replies.

b. *Aerials and Aerial Switching Unit*: two sharks fin aerials, one on top of the forward fuselage, the other below the fuselage; they are alternately switched to the transponder 42 times per second by the aerial switching unit to give all round reception and transmission cover. A three-position AERIAL C/O TEST switch marked UPPER/FLIGHT/LOWER, adjacent to the transponder, is used for ground test purposes and is normally set at the guarded FLIGHT setting. With the switch at UPPER, the aerial switching unit connects the transponder to the upper aerial, and at LOWER, to the lower aerial only.

c. *Control Unit on the Forward Roof Panel* (para 42).

38. When the equipment is replying to an interrogation, the TACAN equipment (which operates in the same frequency band) is momentarily suppressed. IFF/SSR is similarly suppressed when TACAN is transmitting.

39. The ground station interrogates with pulses in pairs and these are referred to as 'framing pulses'. The time interval between them is set to a given value by the ground stations and six different time intervals can be used, each referred to as a mode. (See **Table 1**).

40. The transponder reply pulses are transmitted as framing pulses between which there are twelve information pulse positions. The presence or absence of the information pulses is determined by the mode selected. Manual selection can be made when Modes 1, 3A or B are in use; Mode 2 coding is always preset and allocated to a particular aircraft. Mode C passes automatically coded height information.

Controls and Indicators.

41. An IFF FAILURE press-to-test warning light, on the centre panel, comes on to give warning that the transponder is switched off or not replying to an interrogation.

42. The IFF/SSR control unit, on the forward roof panel has integral lighting and carries the controls and indicators listed in **Table 2**.

Table 1 — List of Modes

Mode	*Use*	*Control*
1	General Military control and Command identification Airways crossing under an ATC radar unit	Military radar or ATCRU
2	The Codes used are Secret and are preset on the transponder unit	Air Defence Radar Stations
3/ALPHA	Air Traffic Control purposes, airways crossings, indication of in-flight conditions	Military, Civil and joint ATC centres
BRAVO	An extension of Mode ALPHA to give increased cover in confined airspaces which have a dense flow of traffic	As Mode 3/ALPHA
CHARLIE	Gives coded altitude information when interrogated	As Mode 3/ALPHA
DELTA	To be determined	

Table 2 — IFF/SSR Control Panel

Control : Marking	*Function*
Four-position rotary switch with a fifth 'push to turn' facility: OFF/ SBY / LOW / NORM / EMGY PUSH	OFF: No power is supplied to equipment: indicated by a steady IFF FAILURE warning light SBY: Power to equipment; transponder accepting interrogations only but cannot reply. If interrogated on a selected mode, the IFF FAILURE warning light flashes. After 50-second warm-up period the equipment is ready for full operation when selected LOW: Equipment functioning but with reduced sensitivity. Used only when requested by ground station, to reduce clutter NORM: Equipment functioning fully. Transponder accepts selected interrogations and transmits reply. (If selected from OFF, 50-second warm-up required) EMGY PUSH: When pressed and turned from SBY, LOW or NORM to EMGY PUSH, immediate emergency replies are made to Modes 1, 2, 3A or B interrogations irrespective of Mode switches selection (see also CIVIL/MIL switch). If selected from OFF, the 50-second warm-up delay is accompanied by a steady IFF FAILURE warning light
Four on / off MODE switches: (Up for on)	MODE 1: Transponder accepts Mode 1 interrogations; transmits selected Mode 1 code MODE 2: Transponder accepts Mode 2 interrogations; transmits preset aircraft code MODE C: Accepts Mode C interrogations; transmits altitude information in code MODE D: Not in use
Three-position rotary switch: 3A/OFF/B	OFF: Transponder will not accept or reply to Mode 3A or Mode B interrogation 3A: Transponder accepts Mode 3A interrogation and replies using selected Mode 3/A/B B: Transponder accepts Mode B interrogation and replies using selected Mode 3/A/B
Code number selector for Mode 1 and for Mode 3A or B transponder reply	Each set of four selectors used to set appropriate Code number. Indicators show 0000 to 7777 allowing 4096 possible codes to be set
Mode 1 (four digits selectors and digit indicators)	Use Mode 1 selectors for Coding Mode 1 replies
Mode 3 (four digit selectors and digit indicators)	Use Mode 3 selectors for Coding Mode 3A or B replies
Two-position emergency Coding switch: CIVIL/ MIL	Use only in conjunction with EMGY PUSH to establish emergency reply code MIL: Normally used. Codes selected on unit or transponder (Military Modes 1, 2 or 3) are transmitted in emergency form in response to interrogation CIVIL: Code 7700 automatically selected for emergency reply transmission to civil Mode (A or B) interrogation
Two-position switch (spring-loaded to off): I/P	When operated momentarily and released, an identification pulse is automatically transmitted for 20 seconds. The identification pulse takes the following forms: Mode 1: repeat of selected code Mode 2: 3A or B — selected code plus one extra pulse Mode C: altitude information code plus one extra pulse

continued over

Table 2 — IFF/SSR Control Panel — *continued*

Control : Marking	*Function*
Self - test push button, incorporating a double filament green light: ST PRESS	When pressed, with equipment switched on, carries out a check of receiver sensitivity, transmitter power output and Mode serviceability. Set NORM, press TEST (after 50 second warm-up). If check is satisfactory green TEST light comes on. IFF FAILURE warning light should then be/go out. Unsatisfactory test is indicated by a steady IFF FAILURE warning light and no green TEST light. IFF FAILURE flashing during test indicates master switch is at SBY. IFF FAILURE warning steady during test may indicate that master switch is at LOW. The test light filaments can be checked, with a DC supply available, by pressing the IFF FAILURE light

43. The IFF FAILURE warning light automatically comes on to indicate:

a. Master switch at OFF.

b. Master switch at SBY and transponder being interrogated but unable to reply (flashing light).

c. Transponder unserviceable.

d. Self-test not satisfactory (para 42).

44. In certain cases modes and codes to be used are established before flight, but ground stations can request particular modes and codes to be selected. Mode 3/A codes 7600, 7700 and 3100 are selected as follows:

a. 7600 — to indicate radio failure.

b. 7700 — to indicate an emergency.

c. 3100 — to indicate unlawful interference with the flight (hi-jacking).

45. *Height Encoder Test Sockets.* ▶◀ A height encoder reporting test socket (HERTS), together with a 28-volt DC and 115-volt AC supply test socket (on panel RL, shelf No 1) is adjacent to the transponder on the left radio rack.

Aerials

46. The following communications radio aerials are fitted:

a. *UHF.* Two aerials, one under the fuselage, slightly aft of the nosewheel bay and one on top of the fuselage but slightly more forward.

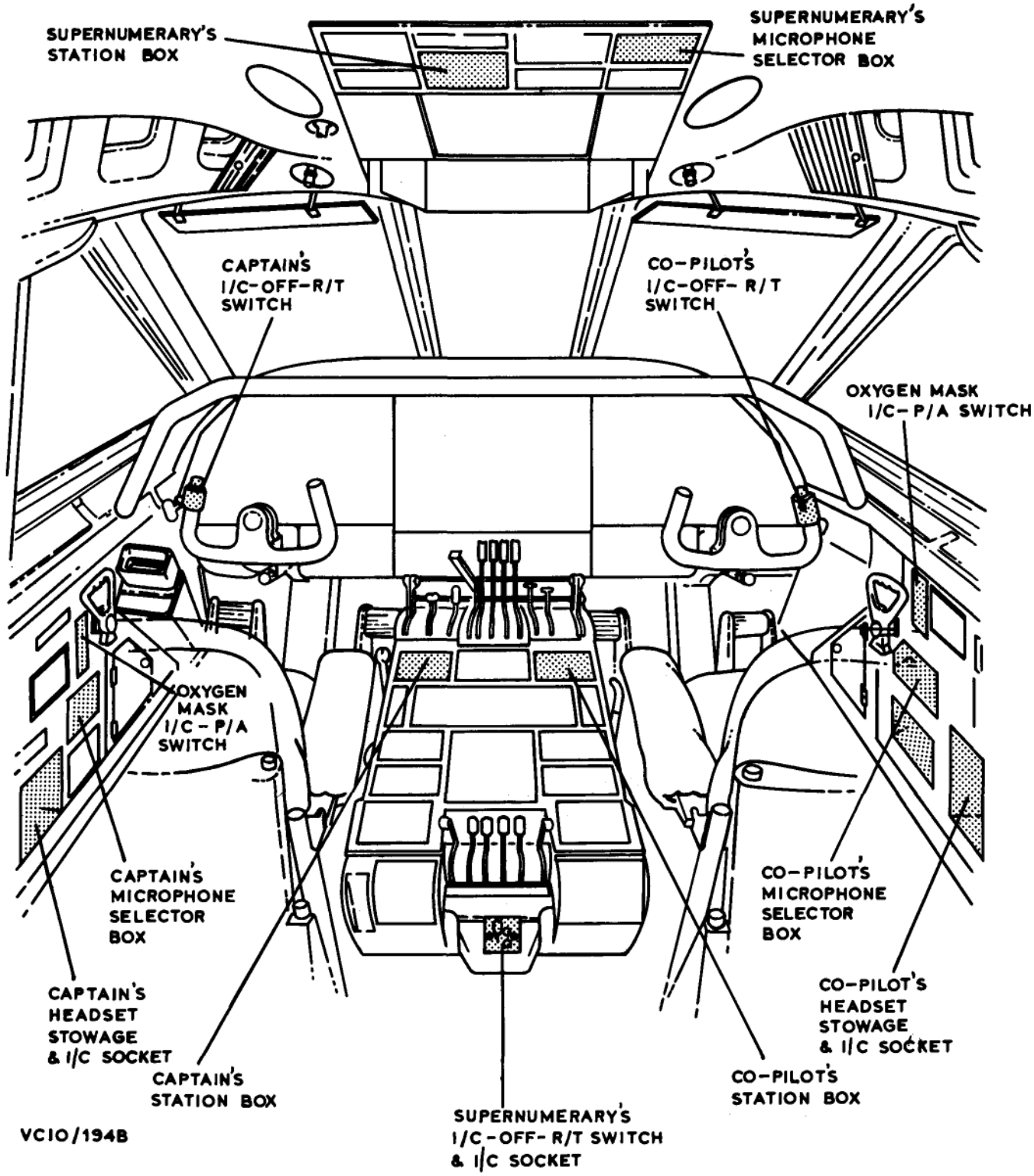
b. *VHF.* Two fin-type aerials, one under the fuselage aft of the forward freight doorway structure and one further aft near the wing trailing edge.

c. *HF.* Two notch aerials in the lower leading edge of the fin.

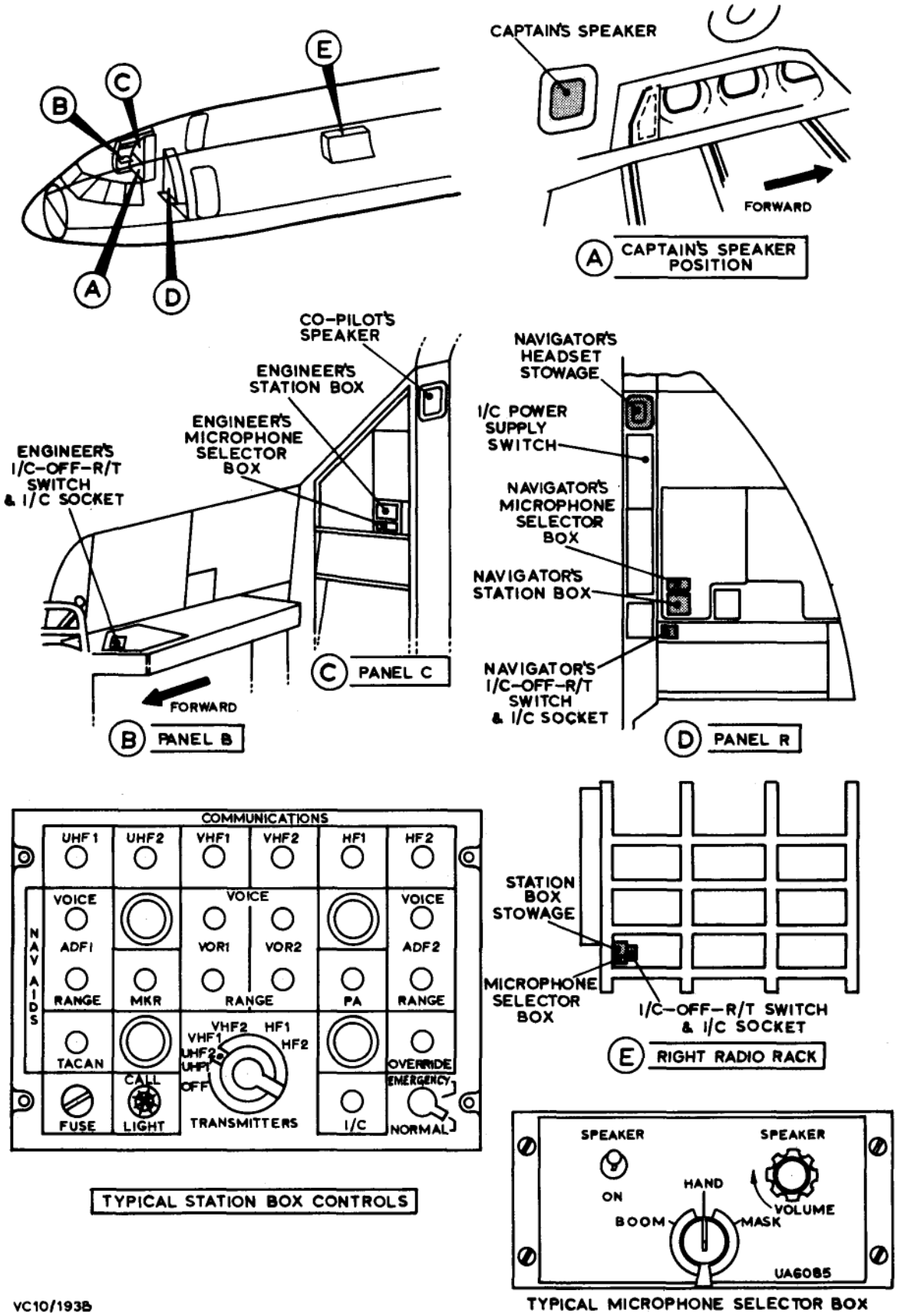
d. Two IFF/SSR aerials, one on top of the forward fuselage and one below the fuselage. The IFF AERIAL — UPPER / LOWER / FLIGHT switch (on panel RL, shelf No 1, on the left radio rack) permits independent selection for ground testing purposes.

Loud Hailers

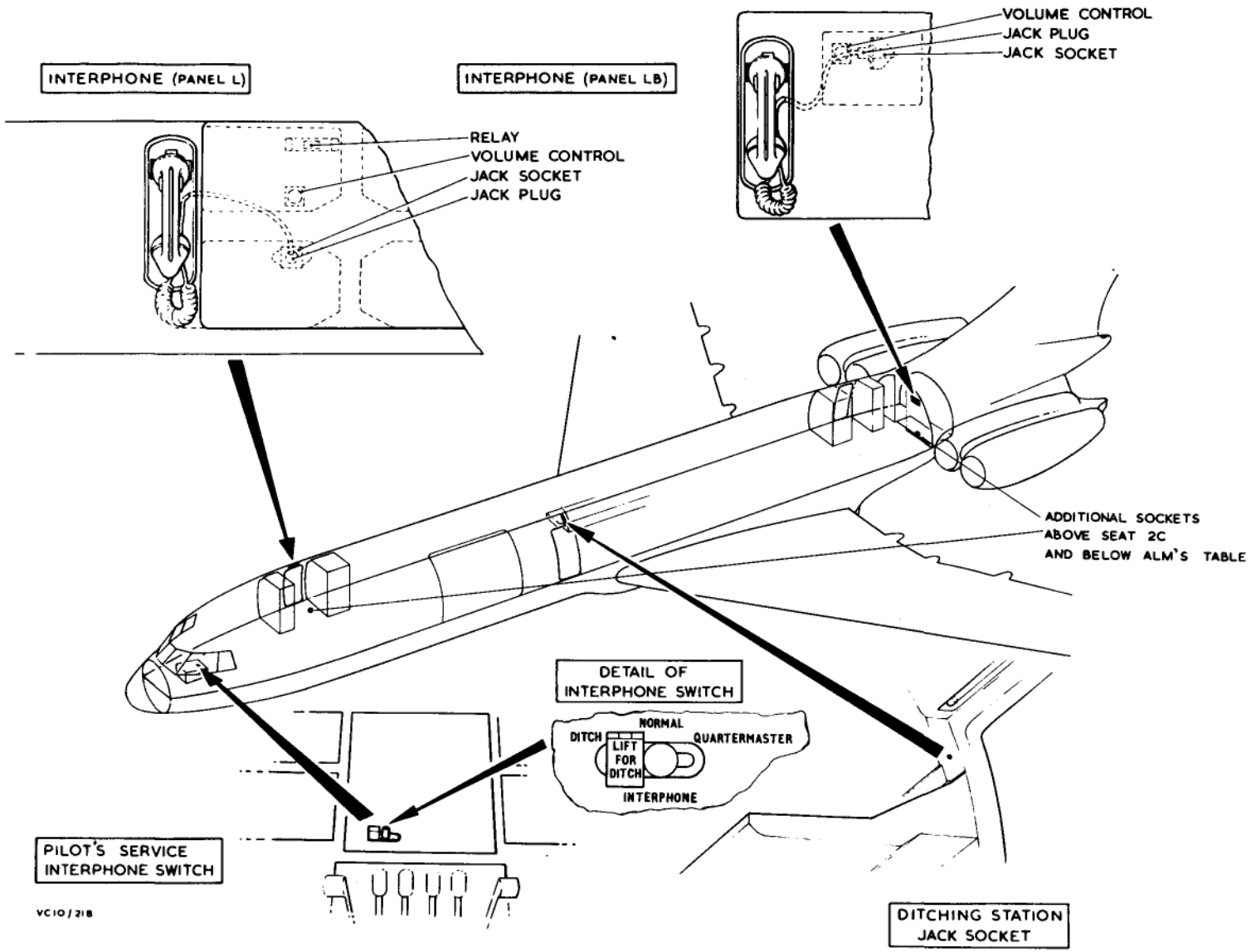
47. Two battery-operated loud hailers are provided, stowed in the passenger cabin roof, one by the forward galley area and one by the rear galley area. They are used as an emergency means of communications between crew members and passengers.



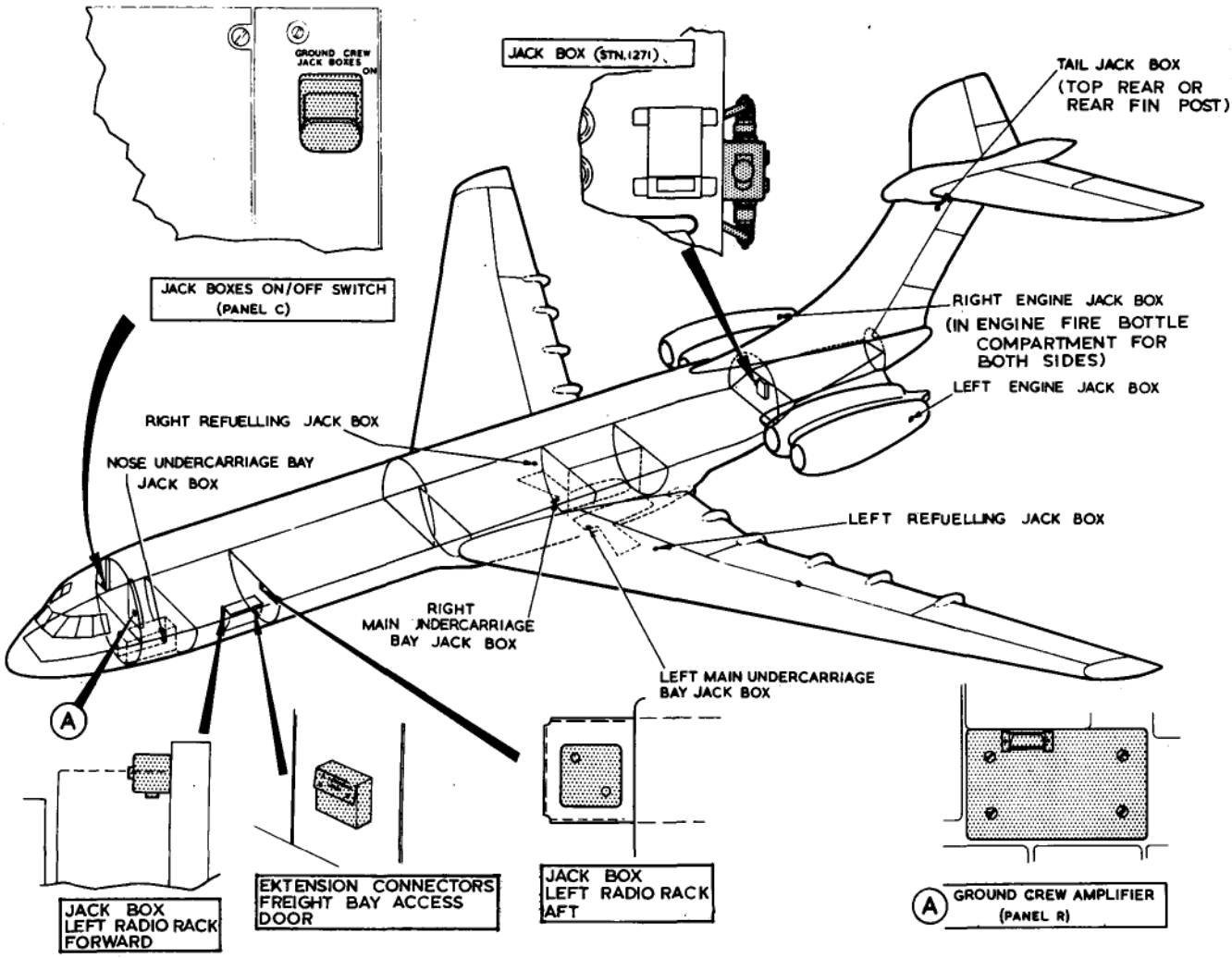
2—3 Fig 1 Intercom — Flight Deck (1)



2.3 Fig. 2. Intercomm. — Flight Deck (2)

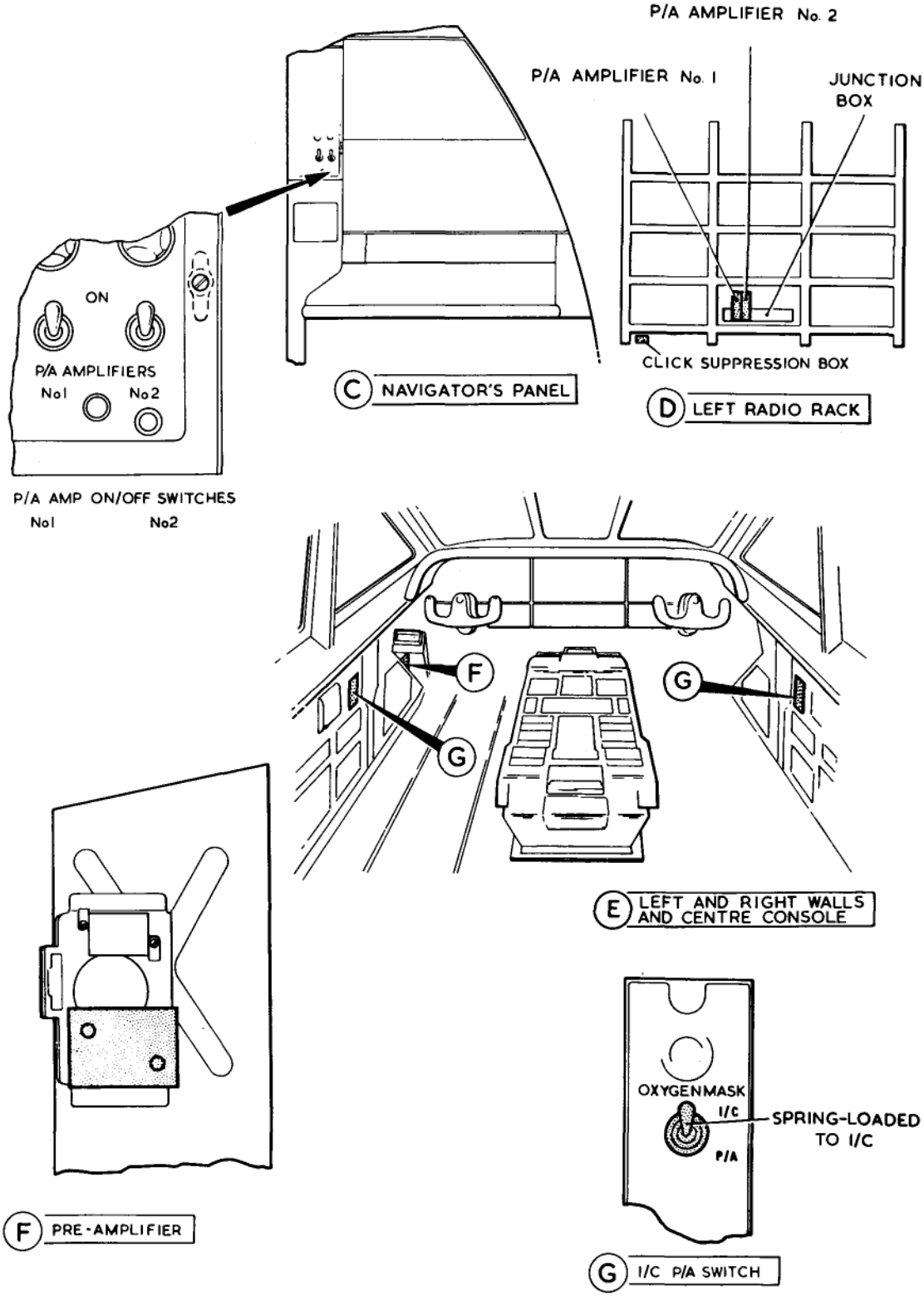


2.3 Fig. 3. ALM's Intercomm. System



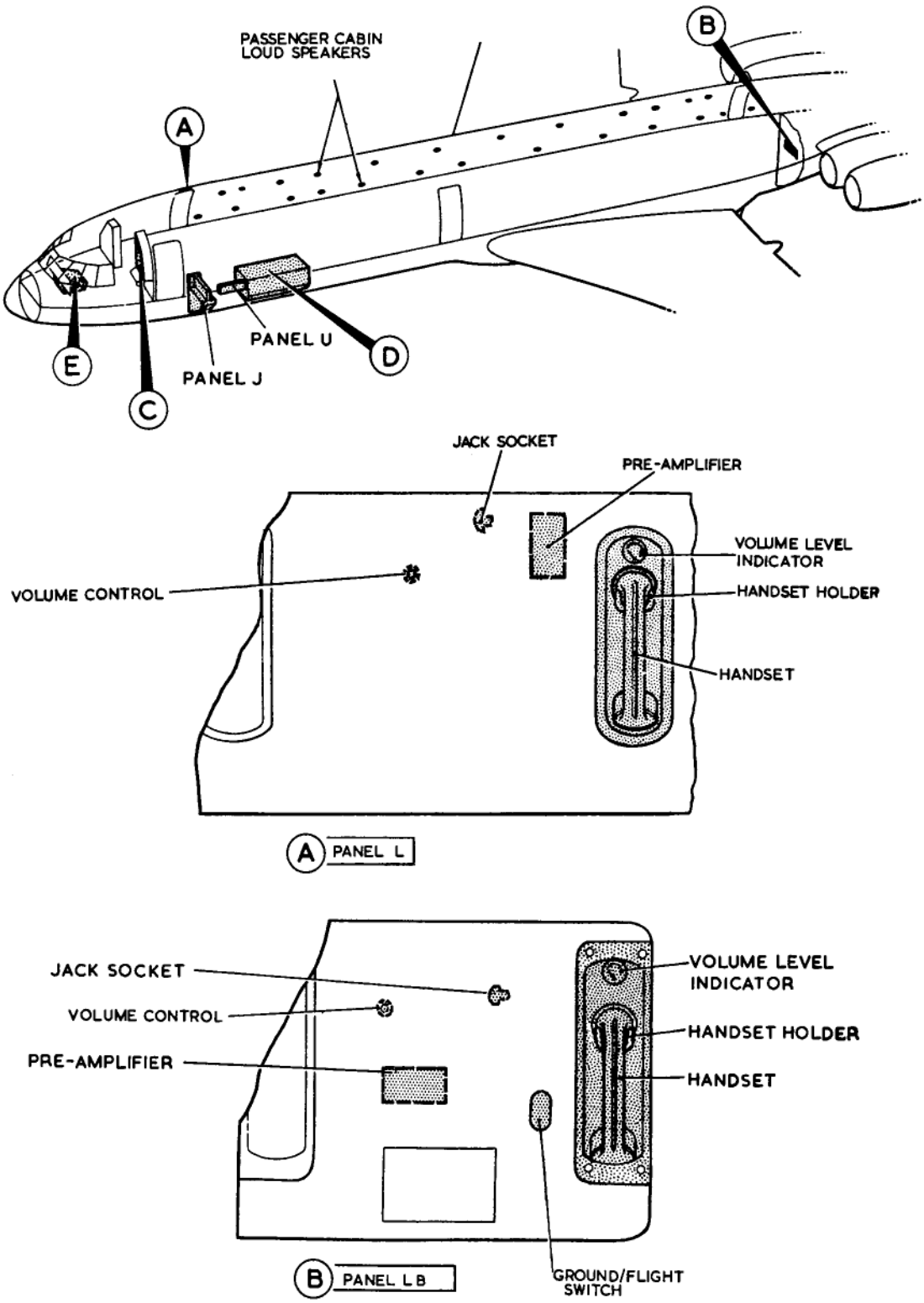
VC10/196C

2–3 Fig 4 Ground Intercom System
Illustration Updated



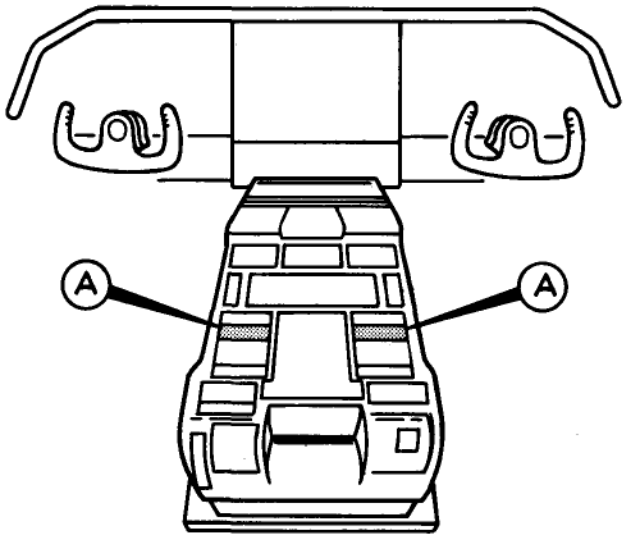
VC10/24B

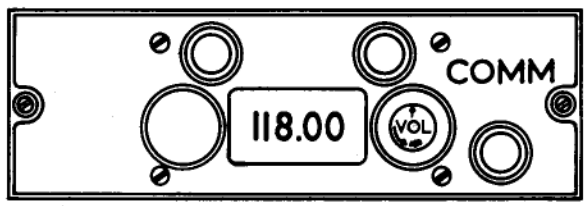
2–3 Fig 5 PA Installation – Pilots'



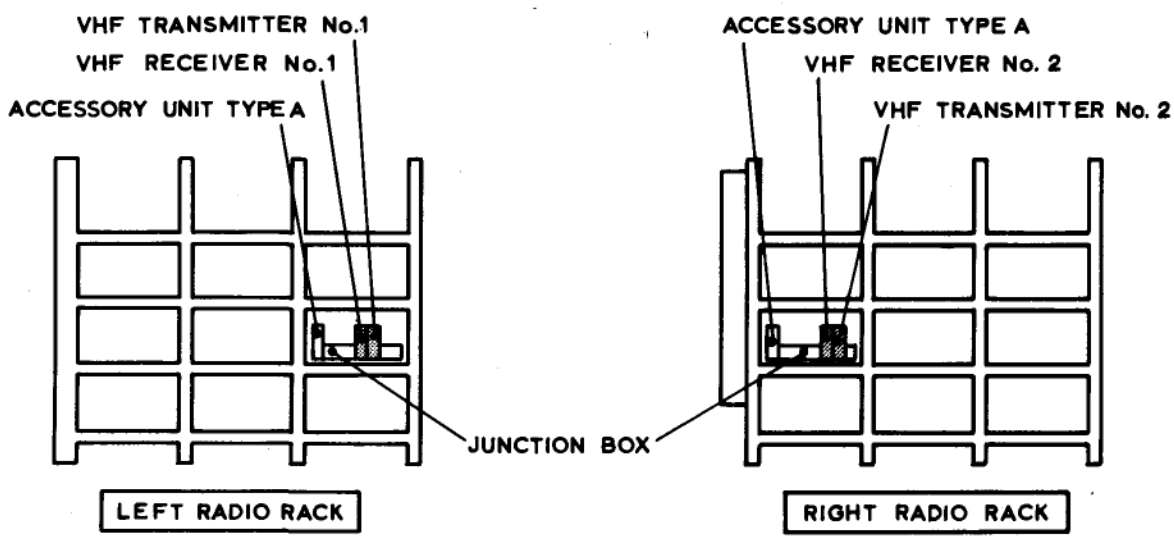
V010/23A

2.3 Fig. 6. PA Installation — ALM's



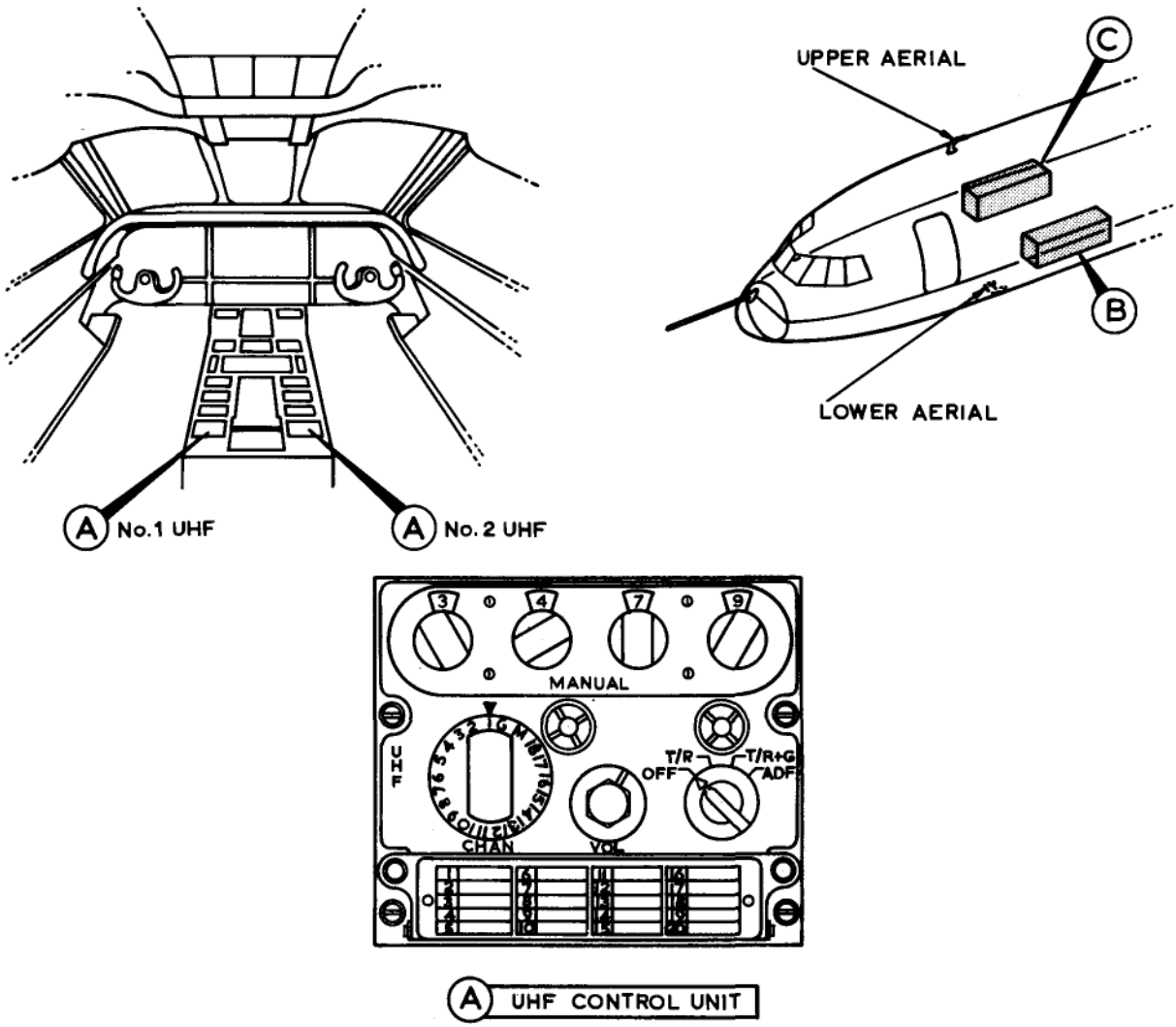


(A) VHF CONTROL PANEL



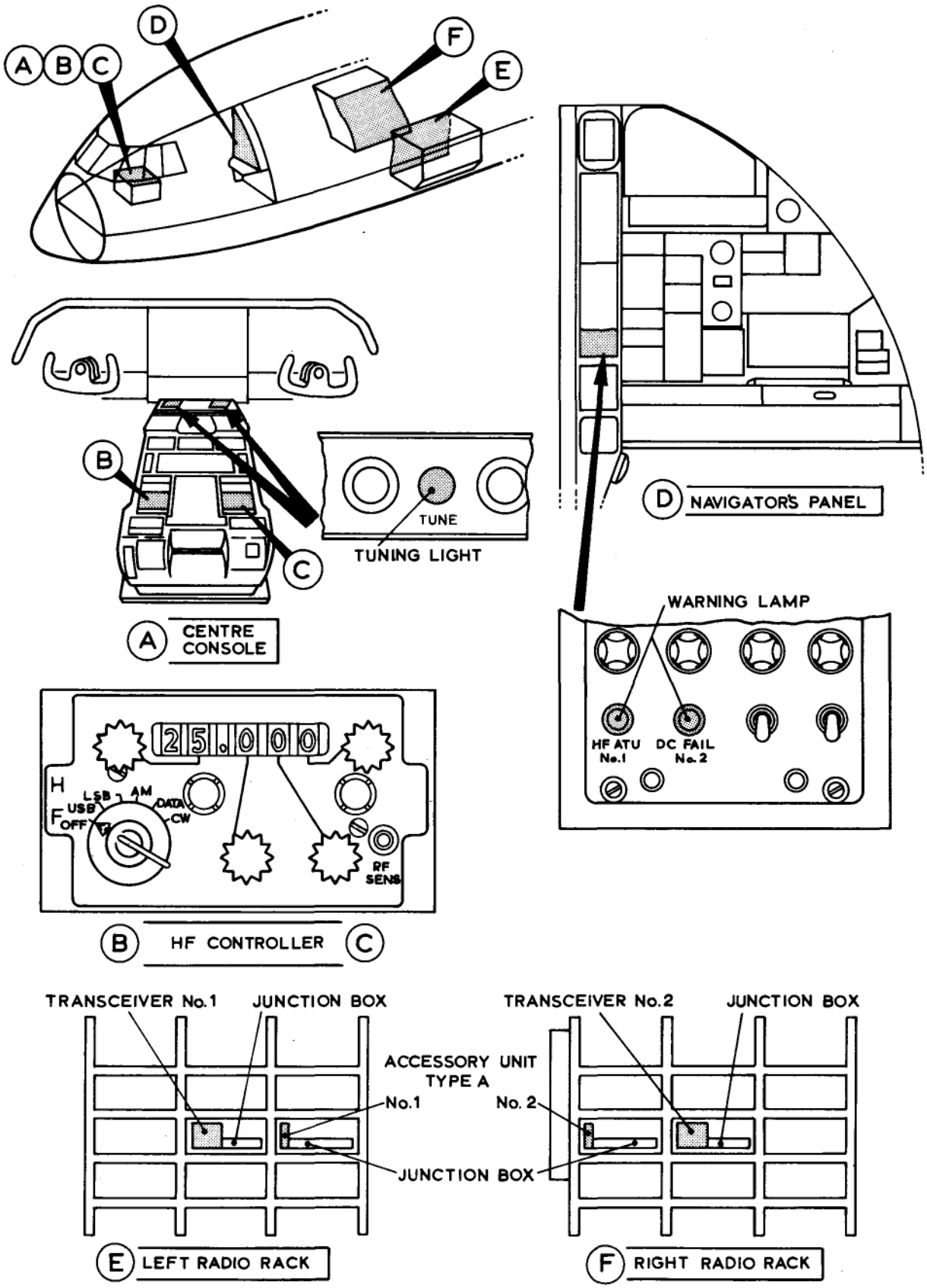
VC10/192A

2.3 Fig. 7. VHF System

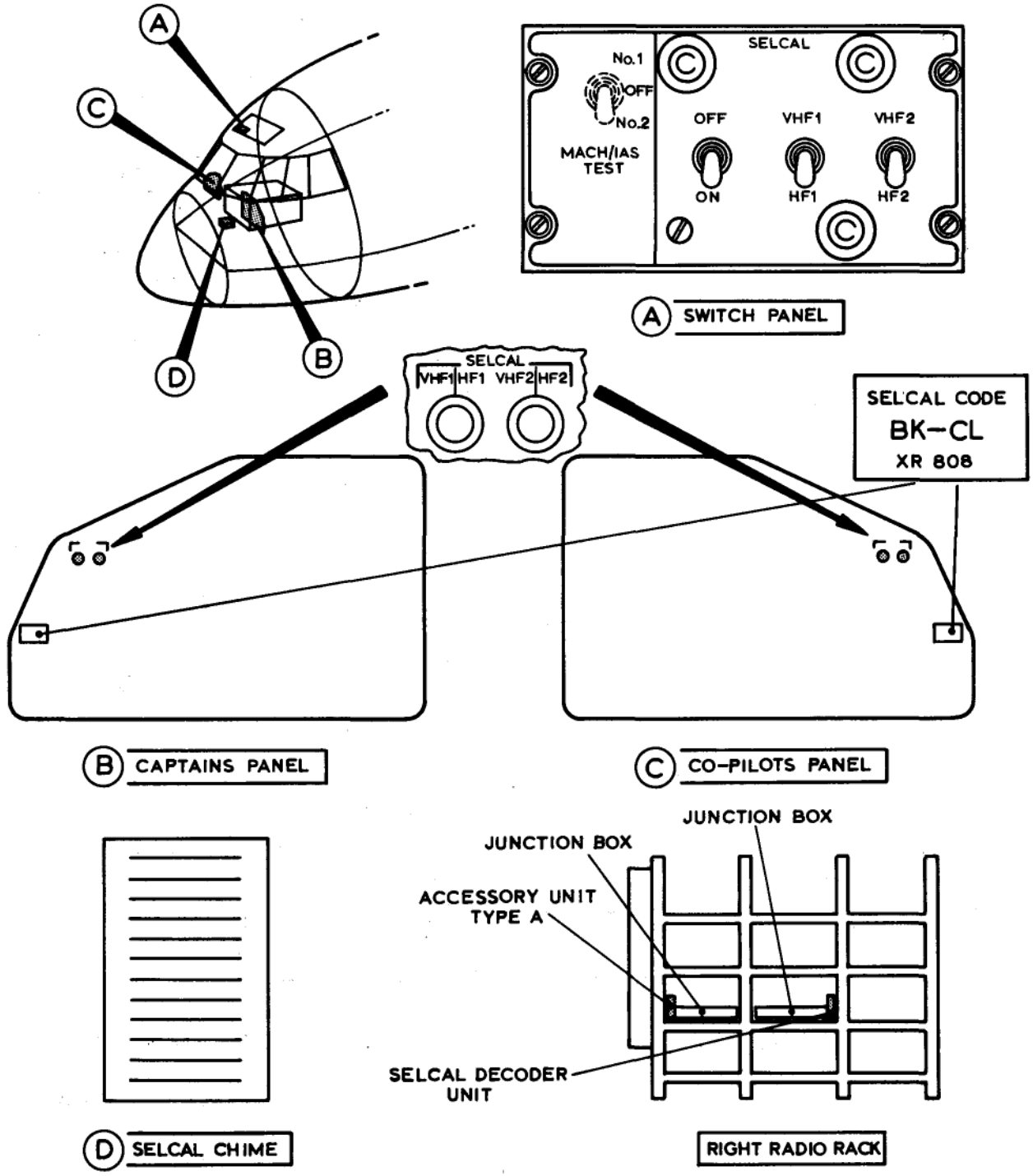


VC10/191A

2.3 Fig. 8. UHF System

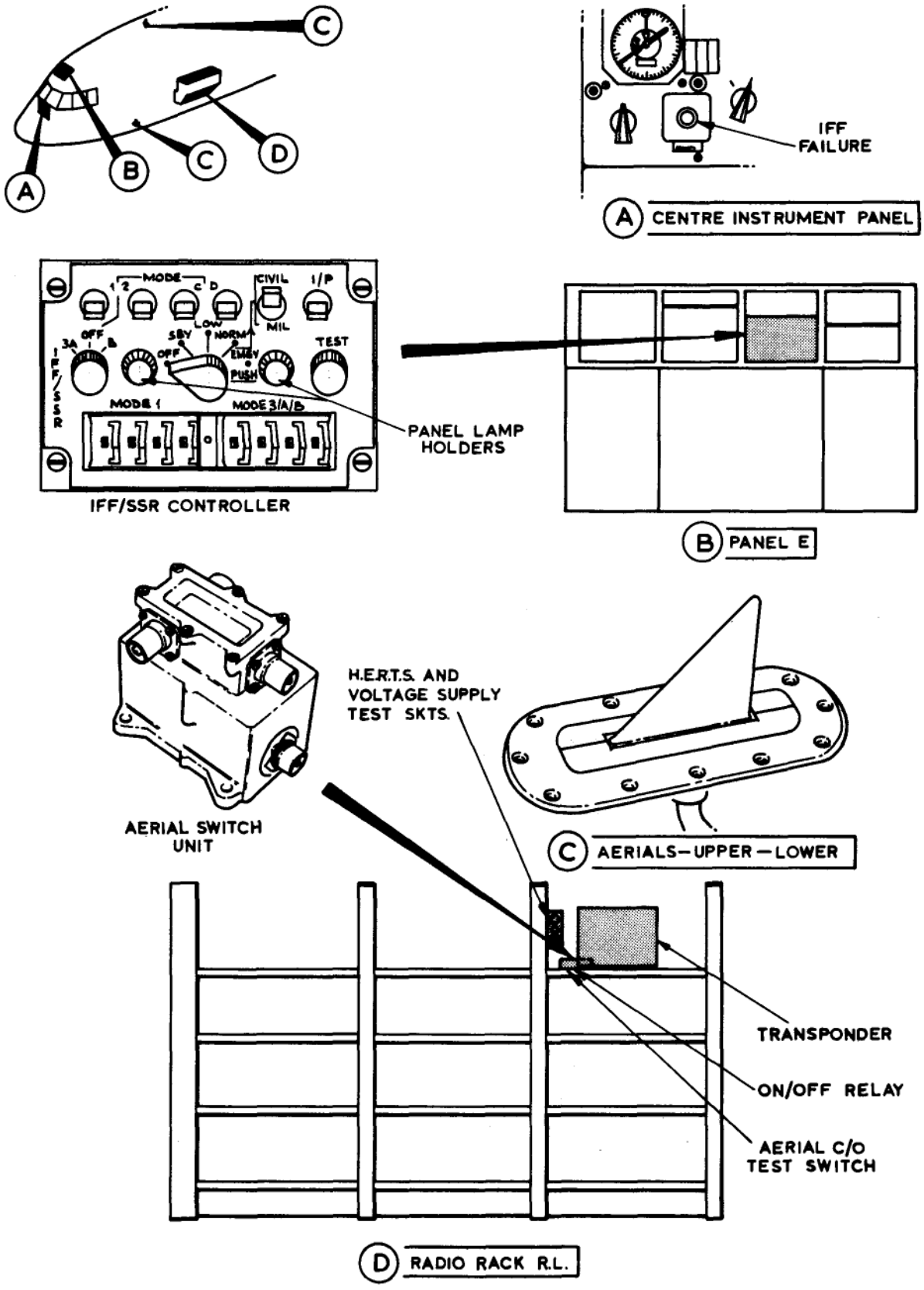


2.3 Fig. 9. HF System

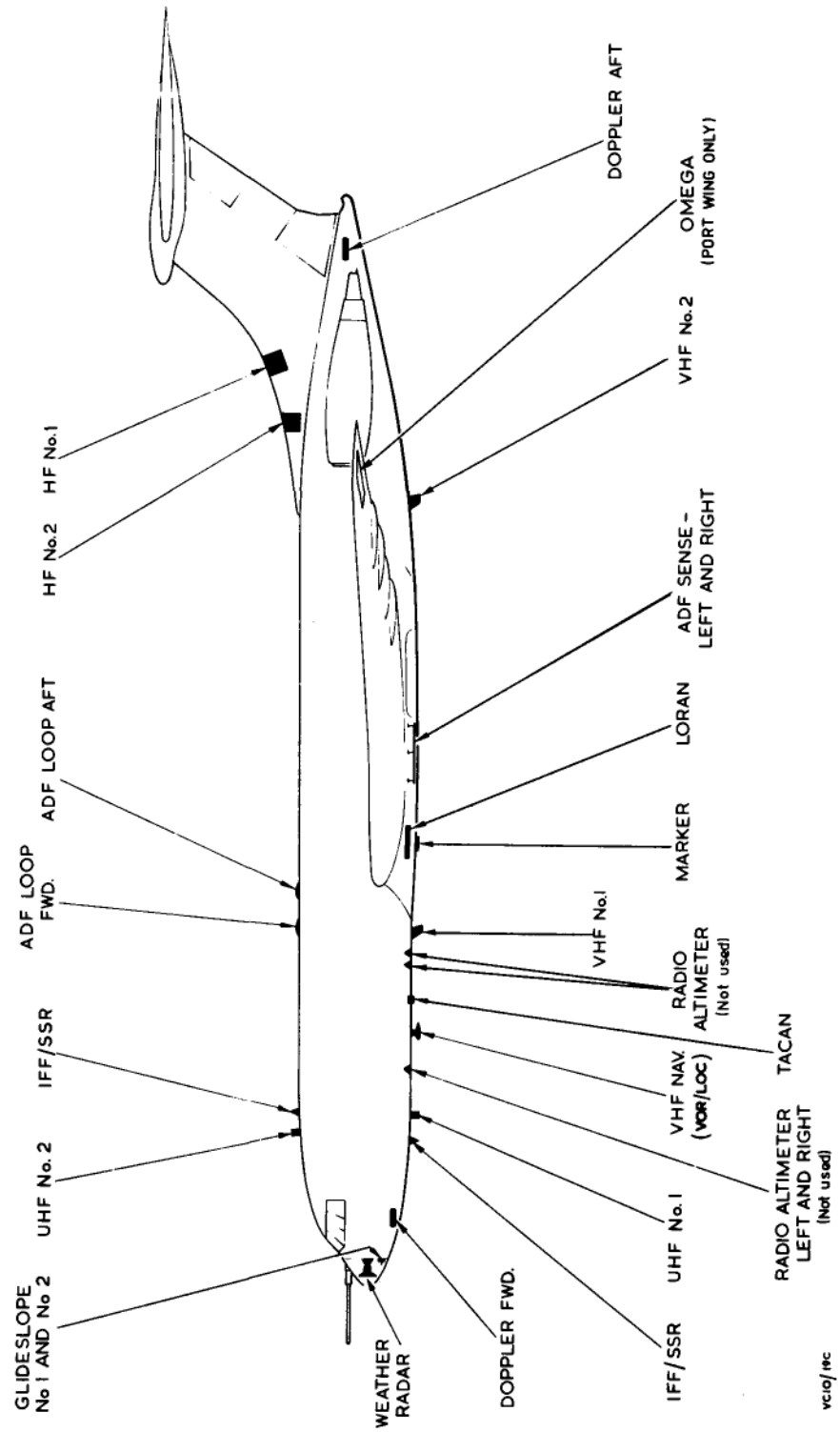


VC10/189A

2.3 Fig. 10. Selcal Installation



2.3 Fig. 11. IFF/SSR



VC10/19C

2–3 Fig 12 General Arrangement of Aerials
(Omega Aerial Introduced)