Part I—Description and Management of Systems

Chapter 16—Navigational and Radio Equipment

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1 Compasses

(*a*) *Mk.* 4B *compass*

(i) The Mk. 4B compass master indicator is on a panel at the nav/plotter's station and a repeater is on each instrument flying panel. Each repeater embodies synchronising and setting knobs. The control panel (C/2) is at the rear of the port console. The detector unit is installed in the outboard edge of the port wing tip.

(ii) The Mk. 4B compass is subject to small turn errors, which are monitored out when the aircraft returns to straight and level flight. However, while this is taking place, heading errors are being fed to the GPI and NBC. In order that these errors are not allowed to accumulate in the navigation and bombing systems, a Mk. 4B TRN C/OUT switch, fitted on the AC controls panel, can be used to isolate the detector unit (which is responsible for the transmission of incorrect headings). With the switch set to ON any angle of bank in excess of 6° will cause the detector unit to be cut out and for both pilots' repeaters to operate as directional gyros. When the aircraft is again level, the detector unit becomes operative. With the cut-out switch set to OFF the Mk. 4B compass functions normally.

(iii) The Mk. 4B compass is operated from the 28-volt DC and 115-volt AC supply. The No. 3 inverter normally provides AC supply but alternative supplies are available from the No. 2 inverter.

(iv) A PORT-STBD. switch on the port console enables heading information for the auto-pilot and zero-reader to be obtained from either the port or starboard gyro unit, irrespective of selection on the Mk. 4B compass selector switch.

When making either a manual or auto/ILS instrument approach, it is essential to have this switch selected to the same gyro unit that is selected on the Mk. 4B compass selector switch so that compass and not gyro information is fed to the auto-pilot and zero-reader.

(*b*) *Type* E2B *stand-by compasses*

Two magnetic stand-by compasses are mounted at the outboard top corners of the windscreen centre panel.

2 Radio/radar altimeters

(*a*) *Radio altimeter*

(i) The low range radio altimeter Mk. 5 (A/3) and the three amber, green and red limit lights (C/19) are on a panel to the

left of the 1st pilot's instrument panel. The altimeter is controlled from an ON-OFF switch on the AC control panel at the nav/plotter's station, and the limit switch (C/24) on the port console.

(ii) The transmitter and receiver aerials are installed on the starboard and port underside of the aircraft respectively.

(*b*) *Radar altimeter*

(i) A high range radar altimeter Mk. 6A is fitted at the nav/radar's station and is controlled by an ON-OFF switch on the AC control panel.

(ii) The transmitter and receiver aerials are installed on the port and starboard underside of the aircraft respectively.

(*c*) No reliance should be placed on readings obtained on the low range radio altimeter Mk 5 when the angle of bank exceeds 20°, or when the high range radar altimeter Mk. 6A is switched on.

(*d*) *Electrical supplies*

Power supplies are 28-volt DC for both altimeters, and 115-volt, 1,600 CPS AC for the Mk. 6A altimeter, the latter supply being normally taken from No. 3 inverter. An alternative supply is available from No. 2 inverter in the event of failure of No. 3 inverter. Fuses for DC supplies are on the AC supplies panel and the panel on the starboard side of the cabin for the Mk 5 and Mk. 6A altimeters, respectively. AC supply for the Mk. 6A altimeter is taken from a fuse on the AC supplies panel.

3 ILS and zero-reader

(*a*) *ILS*

(i) The ILS control panel and warning light are at the AEO's station on the port wall of the cabin. The ON-OFF switch (at C/14) and the ILS-ADF audio switch (at C/14) are on the port console. An indicator (A/29) with adjacent marker indicator (A/30) is on the co-pilot's flying instrument panel.

(ii) ILS signals will be fed to the auto-pilot when the TRACK and GLIDE switches are pulled. (See Chap 14 of this Part).

(iii) The marker, localiser and glide path aerials are fitted on the lower surface of the fuselage aft of the nosewheel bay, and the port and starboard wing tips respectively.

(iv) The equipment is operated from a 28-volt DC supply.

(*b*) *Zero-reader*

(i) A zero-reader indicator (A/11) and (A/32) is fitted to each pilot's instrument panel. The combined control unit and course selector (A/15) is located above the indicator on the 1st pilot's instrument panel.

(ii) Power supplies are 28-volt DC and 115-volt 3 phase AC, the latter supply being normally from No. 3 inverter. An alternative supply is available from No. 2 inverter in the event of failure of No. 3 inverter. Fuses for each supply are on the AC supplies panel.

4 VHF installation

(*a*) The VHF installation incorporates two transmitter-receivers TR 1985-TR 1986, both 10-channel sets. They are controlled by two controllers (at C/11) on the port console.

(*b*) Power for the VHF is from the 28-volt DC section. Selection of No. 2 VHF set by the change-over switch (C/25) energises change-over relays. Therefore when leaving the aircraft on the ground the change-over switch should be left at No. 1. Both sets are mounted on racks on the starboard side of the nose compartment in the cabin.

(*c*) A press-to-transmit pushbutton (A/7) is on each control column handle. A VHF volume control is on station box (C/5).

(*d*) A rod-type aerial, attached to a shark-fin shaped holder is on top of the aircraft, above No. 2 tank.

5 UHF installation

(*a*) The UHF transmitter/receiver ARC/52 is in the nosewheel bay and the controls (C/6) are on the 1st pilot's port console. It is possible to select 1,750 channels at 0·1 MCS intervals or 19

preset channels, one of which is tuned to 243 MCS. In addition, a separate receiver allows a guard frequency of 243 MCS to be superimposed on any selected channel. MCW transmission is available if required.

WARNING: UHF transmissions must not be made in the ILS glide path frequency band of 328·6 to 335·4 MCS, as the ILS display of the parent or any other aircraft within 5 miles may be affected during an ILS approach.

(*b*) The remote control unit on the port console, operated by the 1st pilot, carries the following controls:

(i) A 20-position rotary switch, giving selection of 18 pre-set channels, the guard frequency (channel G) and MANUAL.

(ii) Four manual control switches. The first selects either 200 or 300 MCS, the second selects 0 to 90 MCS in tens, the third selects 0 to 9 MCS and the fourth 0 to 0·9 MCS. These switches are only operative when MANUAL is selected on the 20-position switch.

(iii) A volume control.

(iv) A four-position function switch, giving selection of:

OFF

T/R, normal transmission and reception.

T/R + G, with the guard frequency superimposed on reception

ADF, inoperative.

(*c*) Also on the port console, beside the radio altimeter limit switch, are the aerial selector and the tone switches (at C/14). The aerial selector switch is labelled No. 1 and No. 2; No. 1 is the lower aerial and No. 2 the upper.

(*d*) It is possible to reset the pre-set channels in the air, if necessary. To do so, the cover plate on the control unit is removed by undoing the milled screws. The channel selector is then turned until the number to be selected is indicated on the resetting panel (this will *not* correspond to the selector switch indication). The resetting pins are then moved to the required positions and the cover plate closed.

(*e*) *Power supplies*

The UHF uses 28-volt DC.

(*f*) Both aerials are of shark fin design with a straight rod projecting horizontally to the rear. The aerials are mounted on the aircraft skin, No. 1 aerial being below the bomb aimer's blister and No. 2 being above the No. 1 tank bay on the port side.

6 Tone release

Tone release facilities are available for simulated bombing practice and may be obtained from either VHF or UHF. The controls are on the bombing control panel and consist of a 3-position UHF—OFF—VHF switch, a start switch and light. When the start switch is pressed, the service selected radiates a continuous 1 KCS note until the bomb is supposedly released by either the NBS circuit or operation of a bomb release switch. When Mod 638 is embodied provision is made to vary the frequency of the tone release signal.

7 Intercommunication

(*a*) Intercommunication is by amplifier A1961, controlled by a NOR—EMER—OFF switch at the AEO's station. In addition, a separate A1961 amplifier is provided for conference intercomm. Should the normal intercomm system fail, setting the control switch to EMER will provide intercomm facilities through the amplification stage of the VHF. Mic-tel sockets for the various crew stations are provided, one at each crew station.

(*b*) External intercomm sockets are provided in the nosewheel bay and in the tail section, the system being controlled by ON—OFF switches at the AEO's station.

(*c*) Two MONITOR ALARM switches, one (E/32) at the co-pilot's station and one at the AEO's station are provided to select monitor or alarm from the aural warning circuits of the ECM equipment.

8 Station boxes

(*a*) Identical station boxes (C/5) (A/37) are provided at each crew station, the controls on which permit a crew member to:

(i) Select one of any five SPEAK-LISTEN services.

(ii) Mix incoming radio and intercomm signals without interfering with selection made by other crew members.

(iii) Call other aircrew members on the intercomm irrespective of the services they have selected.

(*b*) The station boxes known as Type 7681 carry the following controls:

(i) *Four ON—OFF switches at the top of the box*

These provide mixer services for listening only. These consist of:

HF
Conference intercomm
Airborne warning
Normal intercomm

(ii) *Three volume controls below the ON—OFF switches*

These provide further listening services on UHF ADF or ILS and VHF. The VHF or UHF control must also be turned up to maximum volume when using the appropriate SPEAK—LISTEN service (see (iii) below).

(iii) *A rotary SPEAK—LISTEN selector switch at the bottom of the box*

This switch permits selection of one of the following five services:

Conference intercomm
HF
UHF
VHF
Normal intercomm

With the switch OFF and the intercomm listening switch OFF, a crew member can isolate himself from the rest of the crew when listening to incoming signals.

(iv) *A spring-loaded CALL switch to the right of the SPEAK—LISTEN switch*

This switch is used in conjunction with the I/C position of the SPEAK—LISTEN switch to call all crew members regardless of their selection.

(v) *A NORMAL—OFF—DIRECT switch to the left of the SPEAK—LISTEN switch*

On NORMAL, incoming signals are fed through a two-valve amplifier, powered by a fused 28-volt supply. The fuse and a spare one are on the front of the box. If fuse or valve failure occurs, selection of DIRECT will by-pass the amplifier and switch it off. Only the selected SPEAK—LISTEN facility will be available (at reduced volume) and the LISTEN ONLY switches will be inoperative.

(*c*) Both pilots have press-to-transmit buttons on their control columns. The AEO has a press-to-transmit button and a morse key. No transmission facilities are provided for the navigators.

(*d*) *Control of services*

The control of the various services fed to the station boxes is as follows:

(i) *Pilot*
UHF and VHF selection
ILS—ON—OFF switch
ILS/ADF Audio selection
UHF aerial change-over switch

(ii) *AEO*
Airborne warning
HF
ILS channel selection
I/C ON—OFF and NORMAL—EMERGENCY switches
Conference I/C ON—OFF switch
ADF power switch

(iii) *Nav/plotter*
ADF

9 HF installation

(*a*) The HF transmitter-receiver is under the control of the AEO and is fitted at his station.

(*b*) The equipment, which operates from a 28-volt DC supply, consists of a 24-channel crystal-controlled transmitter and receiver, operating in the HF band, 2·8 to 18·1 MCS. Operation may be on CW, MCW or R/T with a transmitter carrier output of approximately 100 watts. It is used in conjunction with a suppressed aerial fitted in the lower part of the dorsal fin.

10 ADF (Radio compass)

(*a*) This system is remotely controlled from the nav/plotter's station, the control system being electrical. The bulk of the equipment is mounted in a compartment above the fuselage tank-bay. A bearing indicator (B/19) and a repeater indicator is provided on the nav/plotter's instrument panel and on the co-pilot's instrument flying panel, respectively. Selection of either ILS or ADF is controlled by the switch (at C/14) on the port console.

(*b*) A suppressed loop aerial is installed amidships in the roof of the bomb-bay. A suppressed axe-type aerial, in the fibre-glass fin cap is used as a sense aerial.

(*c*) Power supplies are 28-volt DC and 115-volt, 400 CPS AC, the latter supply being normally from No. 3 inverter. An alternative supply is available from No. 2 inverter in the event of failure of No. 3 inverter. Fuses for both supplies are in the AC supplies panel.

11 Gee

(*a*) Gee Mk. 3 is under the control of the nav/plotter and is fitted at his station. The aerial is built in to the cap at the extreme tip of the fin.

(*b*) Power supplies are 28-volt DC and 115-volt, 1,600 CPS AC, the latter supply being normally from No. 3 inverter. An alternative supply is available from No. 2 inverter in the event of failure of No. 3 inverter. Fuses for both supplies are in the AC supplies panel.

(*c*) Post-Mod. 1630, Tacan is introduced in lieu of Gee Mk. 3. The controller and indicator are at the nav/plotter's station, in the position previously occupied by Gee. A repeater indicator is on the pilots' centre panel.

12 IFF Mk. 10

(*a*) IFF Mk. 10, with SIF and I/P facilities, is installed and the control unit which contains all the necessary switches and controls is fitted on the AEO's panel immediately below the R/T panel.

(*b*) Two shark's-fin type aerials are fitted, one to the upper surface and one to the lower surface of the fuselage skin.

(*c*) Power supplies are 28-volt DC and 115-volt, 1,600 CPS AC, the latter supply being normally from No. 3 inverter. An alternative supply is available from No. 2 inverter in the event of failure of No. 3 inverter. Fuses for both supplies are in the AC supplies panel.

13 Sextants

(*a*) Mountings are provided in the cabin for the installation of two Mk. 2 periscopic sextants, one port and one starboard. Each mounting holds the sextant in the retracted or operating position and is provided with an integral heating element. The switch provided on each mounting should normally be left ON.

(*b*) Two ON—OFF switches (which are more readily accessible), one on the port panel and one on the starboard panel on the cabin walls behind each pilot, control the 28-volt DC supply to the heater and sextant head on their respective sides of the aircraft.