# Chapter 2 RADAR INSTALLATION

*(Completely revised)*

## LIST OF CONTENTS



## LIST OF ILLUSTRATIONS



### Introduction

1. This chapter gives a brief description of the radar installations fitted, including notes on servicing and removal of components from the aircraft. Early aircraft were fitted with A.R.I. 5131(I.F.F. Mk.3GR) whereas later aircraft, that is those with ejection seats fitted, have A.R.I.5131A(I.F.F.Mk.3 GR) and A.R.I. 23013(Rebecca Mk.8) installations.

2. The difference between the I.F.F. Mk. 3 GR installations fitted in the early and later aircraft is structural, the purpose and function of the installations, A.R.I. 5131 and A.R.I. 5131A, being identical. In early aircraft, a conventional receiver, Type R.3121, was fitted, mounted in a Type 90 tray. In aircraft fitted with ejection seats, however, both tray and unit have been stressed for high speed aerobatics, the receiver then being a Type R. 3121A and the tray a Type 110. For simplicity, both installations are referred to as A.R.I. 5131 in this chapter.

### A.R.I. 5131 (I.F.F. Mk. 3 GR)

3. This equipment gives automatic identification to all normal interrogators of the I.F.F. Mk. 3 system, and can be switched to a ground-controlled intercepter station. The system of switching allows the equipment to be permanently operated on its A (air) band, with facilities for switching from A to G (ground) bands either temporarily, by use of a push-switch, or permanently, via a toggle switch. These switches are labelled AUTO G and ON-MANUAL G-OFF, respectively. A further toggle switch enables the G band to permanently transmit distress signals, this switch being labelled ON–G/D–OFF.

**4.** The installation comprises the following equipment with the exception that a receiver Type R.3121, and tray, Type 90, is substituted on early aircraft for the receiver and tray listed. Receiver, Type R.3121A, fitted to a Type 110 mounting tray; control unit, Type 89; control unit, Type 90; aerial, Type 90; and a push-switch, Type B, together with two toggle switches, Type 170. The Type 90 control unit central plug is a dummy plug on both early and later aircraft installations.

**5.** In each instance, the receiver is fitted in the cockpit immediately forward of bulkhead 2, starboard side. On early aircraft the three switches previously mentioned are fitted below the control unit, Type 89, on the port cockpit wall within reach of the pupil pilot, but on aircraft fitted with ejection seats these switches and the control unit, Type 89, are fitted to the starboard cockpit wall within reach of the instructor pilot.

**6.** On early aircraft, the control unit, Type 90, is fitted behind the instructor pilot's seat on the tie beam but on aircraft with ejection seats this component is fitted to the starboard cockpit wall, adjacent to the instructor pilot's seat. The Type 90 aerial is mounted, projecting downwards, near the starboard wing-tip.

**Servicing**

**7.** Before disconnecting any component, the aircraft must be made electrically safe by moving the ground/flight switch in the cockpit to GROUND, and ensuring that no external electrical supply is connected to the aircraft.

**8.** In situ checks for security and cleanliness of components and connections should be frequently carried out. Periodically, all cables should be checked for continuity and insulation resistance to earth, the cables being disconnected from the system components to avoid damage to capacitors and other unit components due to high voltages.

**9.** The aerial should be periodically examined for security of mounting and connections, ensuring that the aerial is clean and free from rust and corrosion.

**10.** Detailed servicing of the components forming the I.F.F. Mk. 3 GR installation is contained in A.P.2887D, Vol. 1 (third edition).

**Removal and refitting**

**11.** There is no set procedure for removing and refitting equipment in the aircraft. All equipment must be handled with great care, however, and the aircraft rendered electrically safe before disconnecting any components.

**12.** The R.3121 receiver is easily removed from its mounting tray by disconnecting the three plug connectors and the aerial connector, unscrewing the two knurled attachments and lifting the receiver forward and upward, thus disengaging the rear locating spigots. Refitting is the reverse of the above procedure.

**13.** The control units, Type 89 and 90, are conventionally mounted and may be easily removed after making the necessary electrical disconnections.

## A.R.I.23013 (REBECCA Mk.8)

14. Rebecca Mk.8 equipment is an airborne interogator-responder which functions in conjunction with an Eureka Mk.7 ground transponder to show the pilot, by means of a range and heading meter, the position of the aircraft relative to the ground transponder, thus forming a radar homing and distance measuring system.

15. The airborne interogator(transmitter) operates on a choice of eight spot frequencies selected by the TX control knob on the Type 8197 control unit. The transmitter aerial radiates this selected pulse

which is received by the ground transponder this in turn automatically transmitting an answering pulse together with its own code signal. The airborne receiving aerials feed this signal into the transponder(receiver), the frequency of which is selected by the RX knob of the Type 8197 control unit. The operating frequencies of the interogator and responder are different to reduce the possibility of ground reflection errors.

16. The time between transmitting the interrogator pulse and receiving the response pulse is analysed in the airborne equipment and displayed on the range meter in nautical miles, the direction of the ground transponder being shown on this meter by the disposition of a heading pointer. The movement of this pointer is determined by the strength of signal received at each receiving aerial, such that if the starboard aerial receives a stronger pulse than the port the heading pointer will be deflected to the right.

17. Each ground station has its own code signal which is transmitted to and received by the airborne equipment. This signal is passed to the pilot's headset so that he can determine whether the airborne equipment is locked to the correct ground transponder. The airborne equipment therefore has two functions, to search for the correct ground transponder and, when finding it, to lock to and home on to that transponder. During searching no signal is received back from the ground transponder, and the range meter pointer traverses the scale slowly from left to right and then quickly back to zero. As soon as the aircraft comes within range of a transponder the airborne equipment locks onto it, the meter pointer settles and a flag bearing ON shows itself in the lock-on window of the meter.

18. If a code signal from the transponder is other than that required by the pilot for homing purposes he can release his equipment from the lock-to-transponder condition by depressing a strobe release button on the Type 8197 control unit, whereby the automatic searching will re-start.

19. Short range readings may be read on the meter by operating a switch, this switch magnifying the reading by ten. The switch fitted to the control unit Type 8197 is marked OFF, SB, 200 and 20, the latter being the short range setting mark. The SB position of the switch is incorporated for warming the equipment before use, so that when switched to the 200 position, the normal long range position, accurate readings will immediatly be obtained at the heading meter.

20. The units employed consist of a transmitter-receiver Type 8193 mounted with a junction box, Type 8196, inside the radio compartment on the forward face of bulkhead 3. A switch unit, Type 78A, is mounted adjacent to the starboard side of the T.R.8193 while a control unit Type 8197 and the range heading meter are fitted to the main instrument panel. Two Type 90 aerials are fitted projecting upwards at each wingtip, while a Type 91 aerial is fitted projecting outboard on each side of the fuselage at the aft section of the cannon bay.

Servicing

21. The general servicing instructions contained in para.7 to para.9 apply to the Rebecca Mk.8 installation whilst A.P. 2914 AG, Vol.1, deals with aech component giving detailed servicing information. A counterpoise, in the form of tin foil sheeting fastened to the uselage, is provided for the two transmitting aerials. This sheeting should be checked for continuity to the aircraft bonding system.

Removal and fitting

22. The transmitter/receiver, Type 8193 and Junction Box Type 8196 are mounted in a common mounting tray. The J.B. is secured by four 2 B.A. bolts, whilst two knurled attachment nuts secure the front of the transmitter/receiver, the two units being interconnected by a multi-pin plug and socket. The plug is fitted to the transmitter/receiver.

23. When both knurled nuts have been loosened and the front aerial connection removed, the handle of the transmitter/receiver may be lifted upwards and the set pulled gently away from the J.B. until the multi-pin plug and socket disconnect. The set is now free from the tray. The four bolts securing the J.B. may now be removed together with the seven cable connections.

24. To refit the equipment to the tray, first fit the J.B. Locate the transmitter/receiver in the tray, press the multi-pin plug and socket connection together, lower the handle of the transmitter/receiver and turn the two knurled securing clamp screws so that the handle is held in the down position. Tighten the knurled securing clamp screws until the equipment is safely secured.

25. The switch unit, Type 78A, mounted on the starboard side of the T.R.8193 location can be removed by disconnecting the three aerial connectors and the T.R.8193 interconnecting cable, then removing the three 2 B.A. screws securing the unit to the forward face of bulkhead 3. Access to this is gained by way of the starboard wing root access panels.

26. To remove either the Type 8197 control unit or range and heading meters, the main instrument panel must first be hinged rearwards and downwards. To facilitate this operation all six Oddie pin fasteners securing the panel must be released and the panel hinged rearward to the extent of the check wires. Both units may then be disconnected and removed from the panel. Refitting is the reverse of the removal procedure.

Note...

The range and heading meter is a precision instrument and must therefore always be handled with great care.

27. The two fuselage aerials are conventionally fitted, as shown in the illustration, and are easily removed. When refitting, ensure that the thin edge of the aerial blade faces forward.

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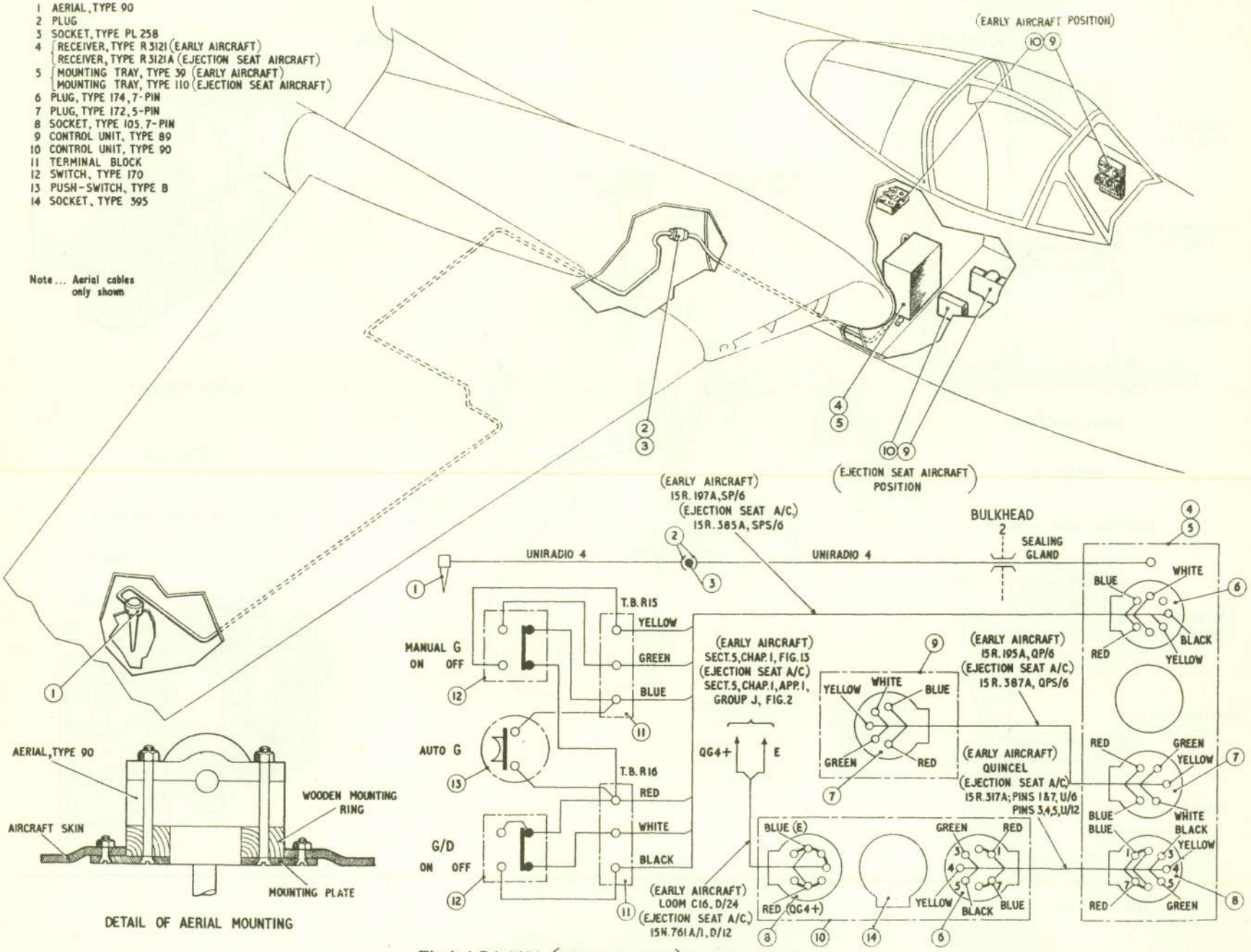
1 AERIAL, TYPE 90
2 PLUG
3 SOCKET, TYPE PL 258
4 { RECEIVER, TYPE R 3121 (EARLY AIRCRAFT)
  { RECEIVER, TYPE R 3121A (EJECTION SEAT AIRCRAFT)
5 { MOUNTING TRAY, TYPE 39 (EARLY AIRCRAFT)
  { MOUNTING TRAY, TYPE 110 (EJECTION SEAT AIRCRAFT)
6 PLUG, TYPE 174, 7-PIN
7 PLUG, TYPE 172, 5-PIN
8 SOCKET, TYPE 105, 7-PIN
9 CONTROL UNIT, TYPE 89
10 CONTROL UNIT, TYPE 90
11 TERMINAL BLOCK
12 SWITCH, TYPE 170
13 PUSH-SWITCH, TYPE B
14 SOCKET, TYPE 395

Note... Aerial cables only shown




DETAIL OF AERIAL MOUNTING

Fig.1. A.R.I. 5131 (I.F.F. Mk.3 GR) installation

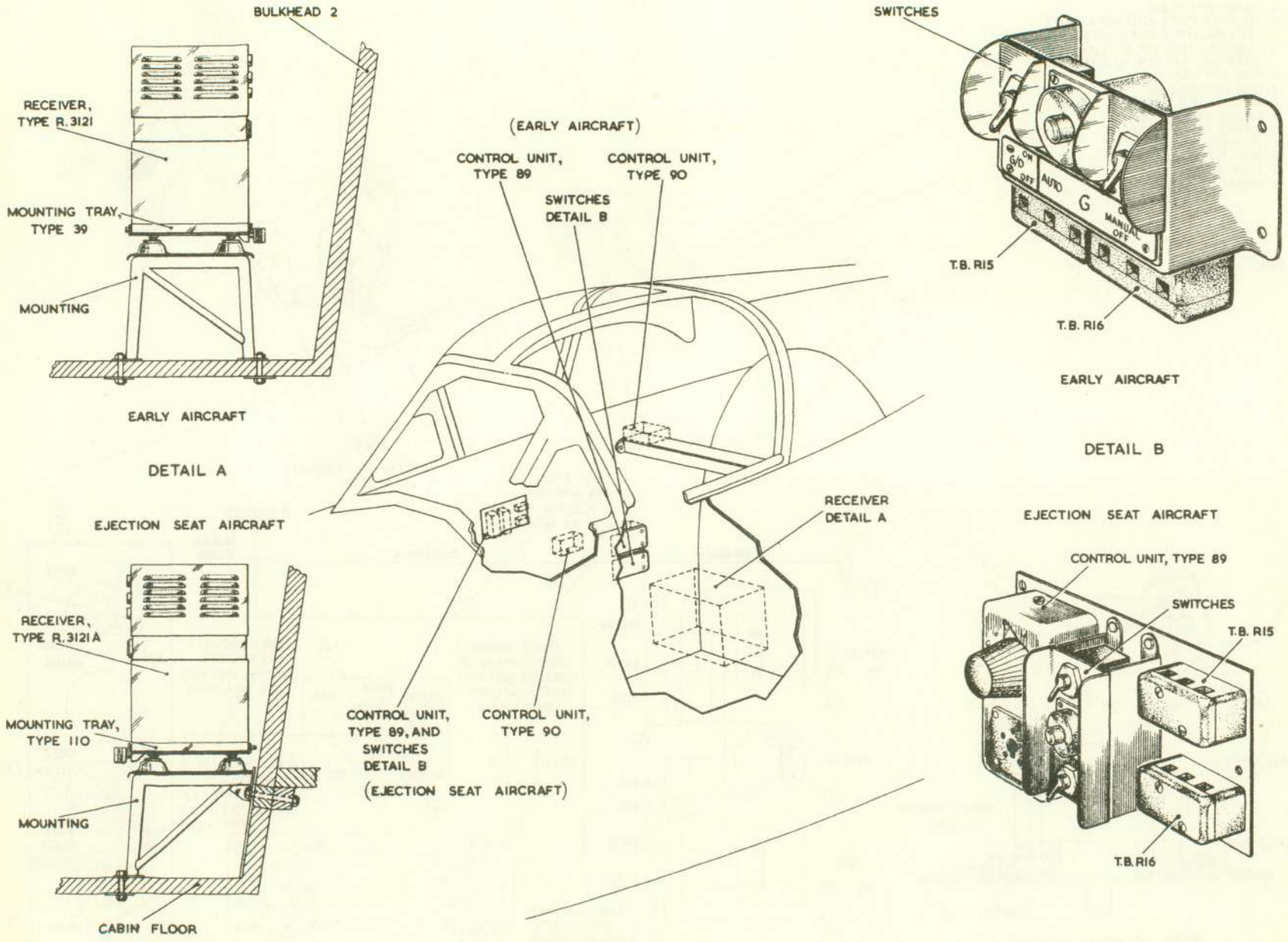



Fig. 2. A.R.I. 5131 (I.F.F. Mk. 3 GR) unit mountings

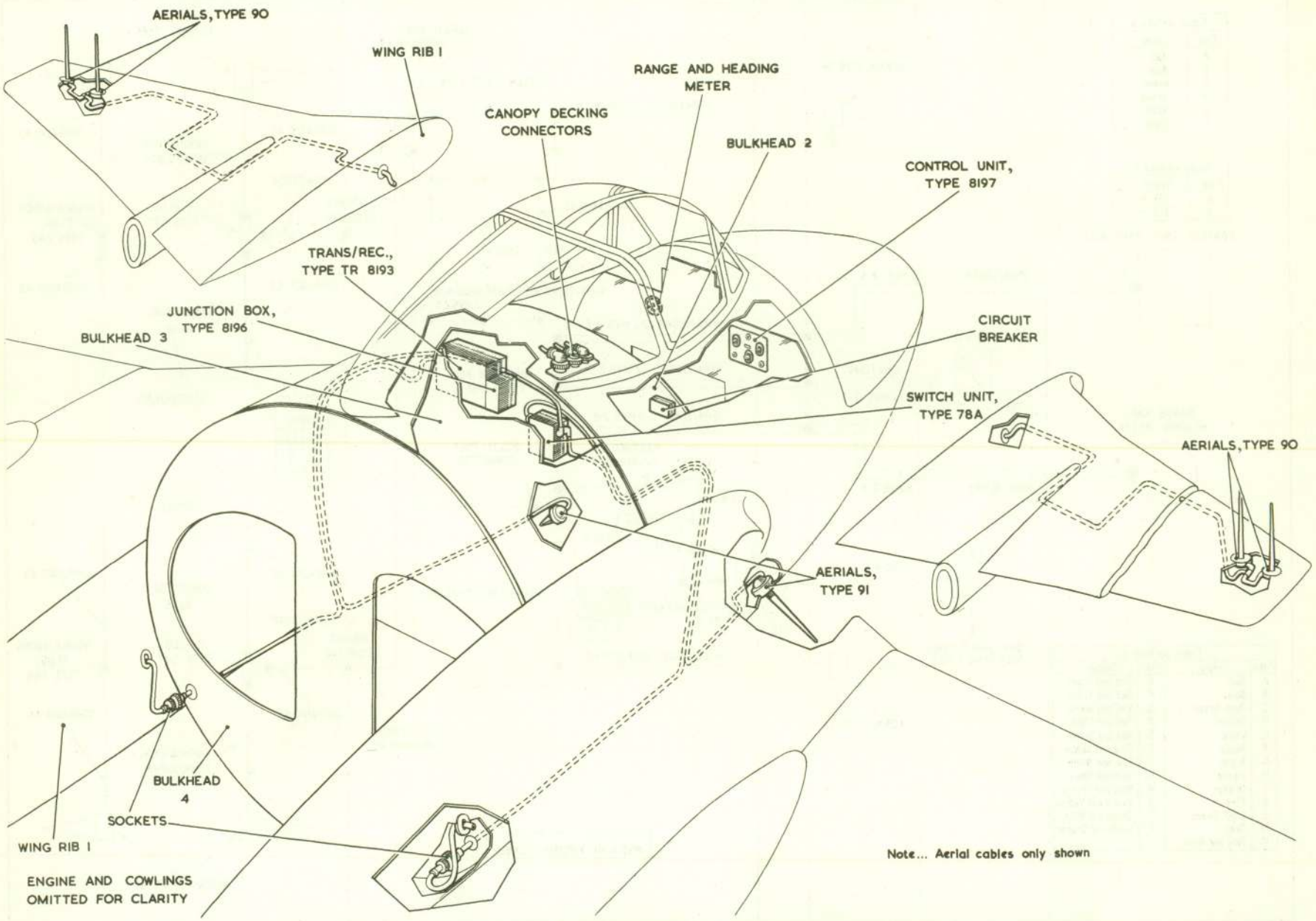



Fig.3. A.R.I. 23013 (Rebecca Mk.8) installation

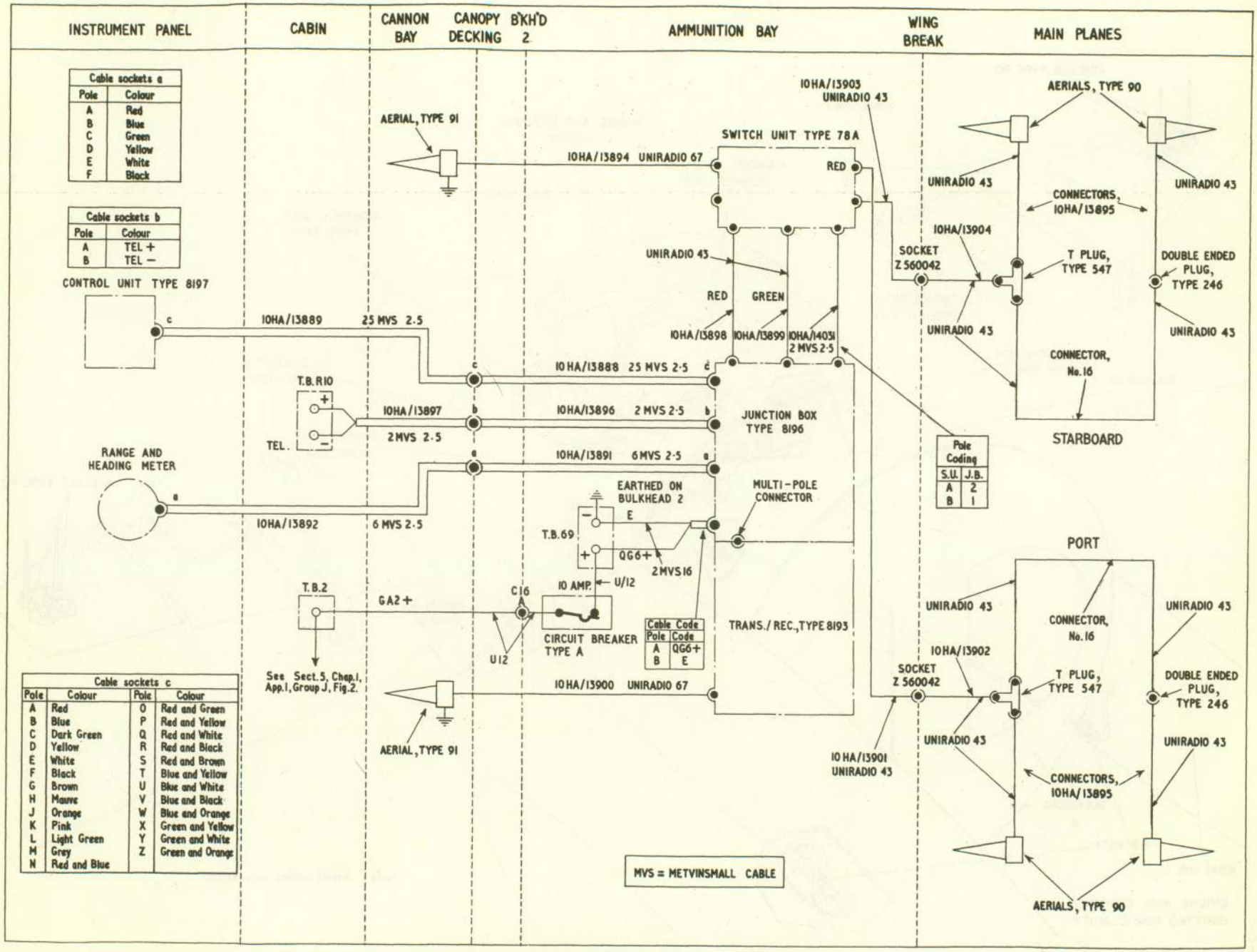
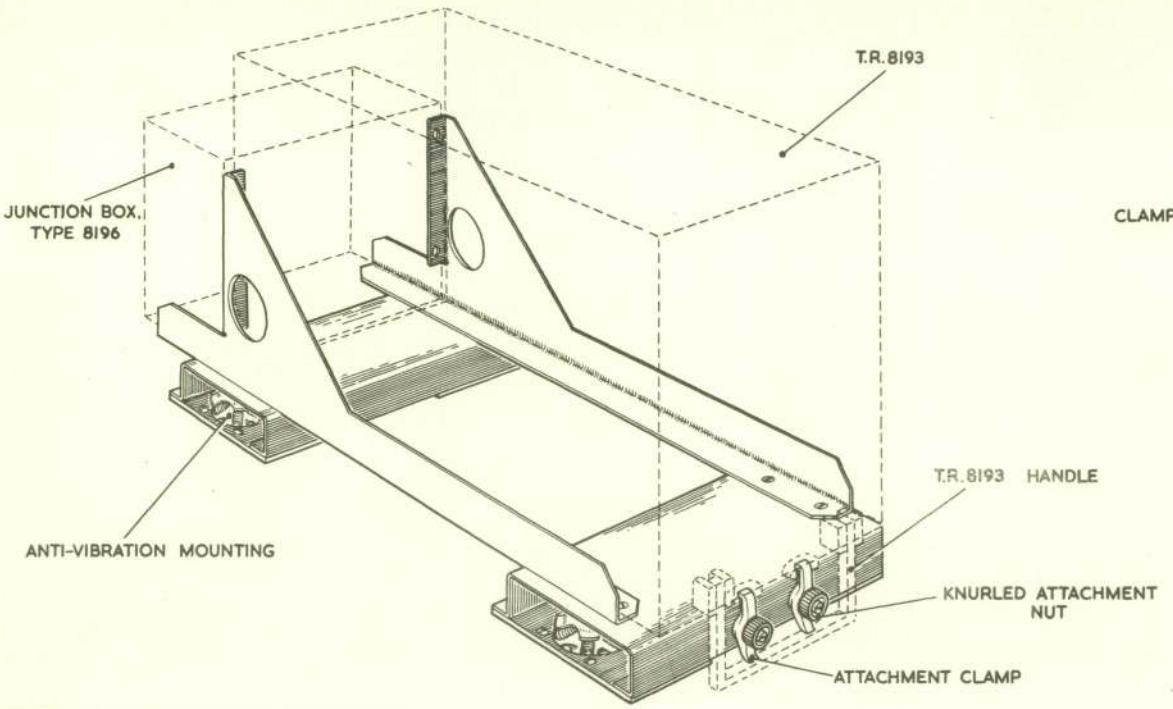
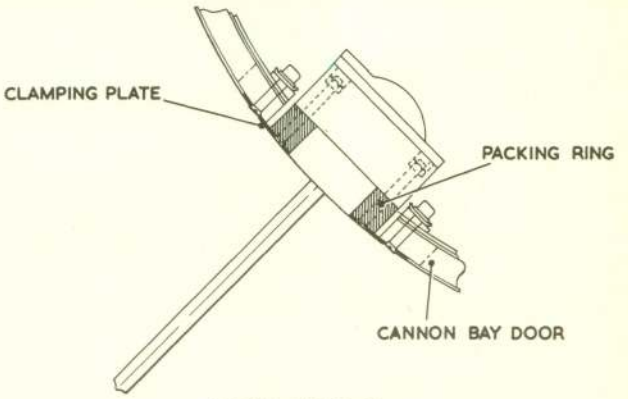


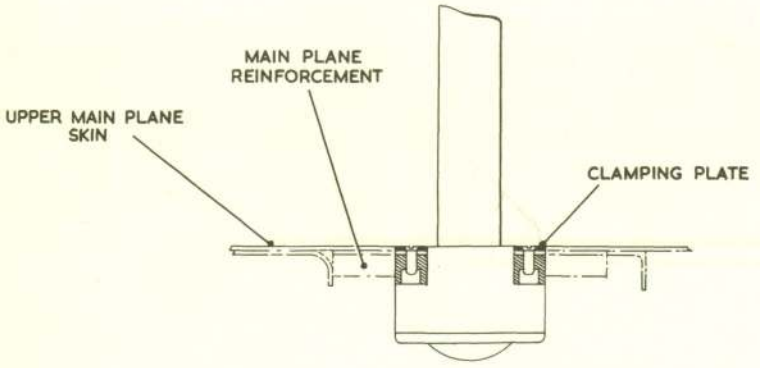

Fig. 4. A.R.I. 23013 (Rebecca Mk. 8) wiring



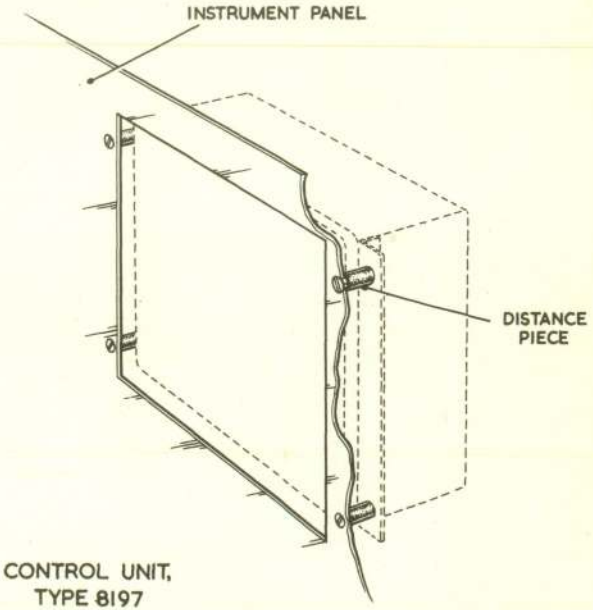

T.R. 8193 MOUNTING TRAY




AERIAL, TYPE 91




AERIAL, TYPE 90




CONTROL UNIT, TYPE 8197

Fig. 5. A.R.I. 23013 (Rebecca Mk.8) unit mountings