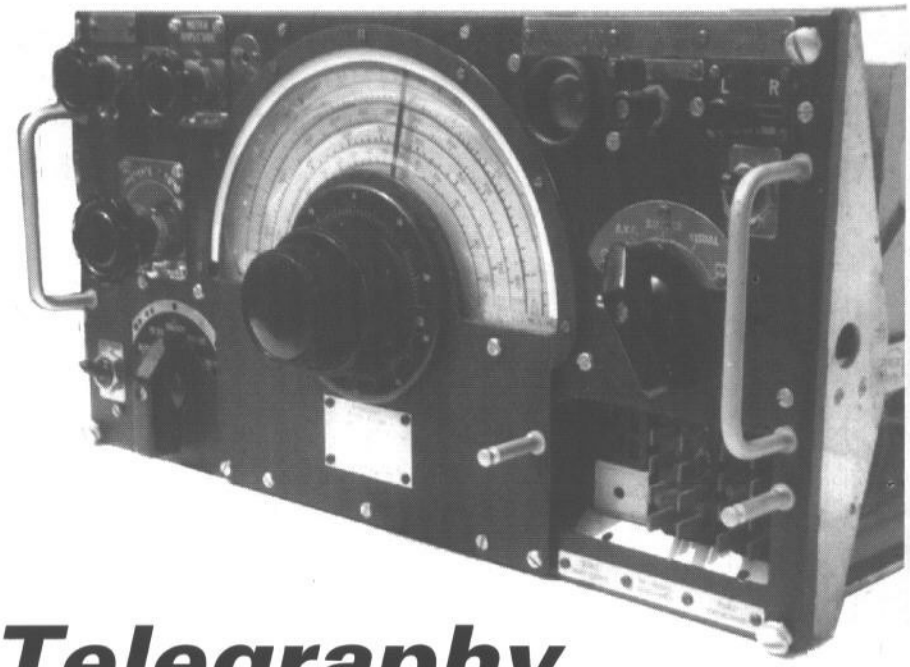
The standard long range radio equipment fitted in Royal Air Force aircraft during WWII was the transmitter type T1154 and its associated receiver type R1155. This equipment entered service in 1941 and some 80 000 examples were produced during the war years, with some variants remaining in service until the 1960s. S. Pope tells us more about these sets.



Wireless Telegraphy Set Type T1154/R1155

The RAF's general purpose aircraft radios at the start of the war were the transmitter type T1083 and receiver type R1082. These radios were unreliable and difficult to operate, for example, changes of frequency required the wireless operator to change over coils in both the transmitter and receiver as well as retuning the transmitter to the new frequency. These difficulties in operation were blamed for the loss of a number of bomber aircraft in bad weather during the early war years.

In 1937 the Marconi company had begun design work on their AD67/AD77 'all wave' transmitter and receiver radios. This equipment gave an 80W output over frequency ranges of 200-500kHz and 2.35-16.7MHz. The RAF became interested in the Marconi equipment as a replacement for the T1083/R1082 radios. A number of modifications were requested including pre-selection of frequency and direction finding (d.f.) facilities with visual indications. By the end of April 1940, design and layout of the new equipment, by now designated T1154/R1155, was complete. Production started in August, but output was slow and the first examples did not reach the RAF until the end of 1940.

As well as manufacturing the equipment, Marconi were also responsible for their installation into RAF aircraft. Fitting parties consisting of Marconi engineers were sent out to RAF stations where they carried out installation and checking of the T1154 and R1155 radios. Trial installations were made in all types of RAF bomber aircraft. These, however, showed that the electrical supply in these aircraft was insufficient. As a temporary measure, an additional accumulator was fitted to provide the extra power, later on extra engine driven generators were fitted. By 1942 when the RAF's own Maintenance Units were able to take over the task the Marconi teams had fitted out over 2000 aircraft.

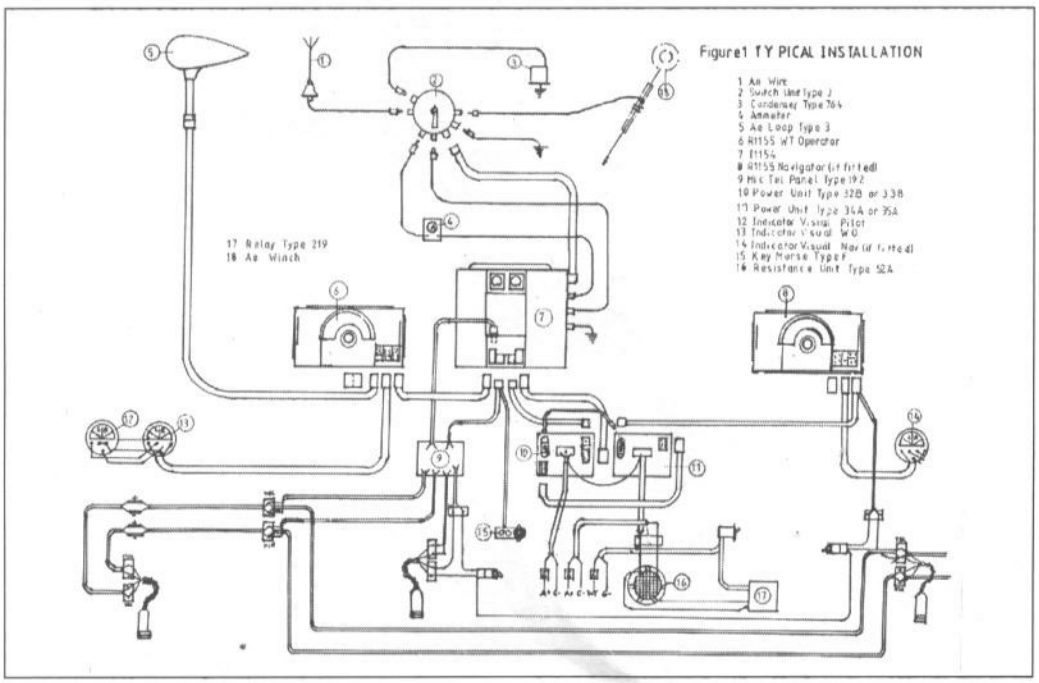


Fig. 1: Typical installation (Crown Copyright/RAF diagram).

Operational Use

Designed primarily for aircraft, the T1154/R1155 equipment provided Wireless Telegraphy (W/T) and Radio Telephony (R/T) communication in air to ground and air to air modes. Thirteen variants of the basic transmitter design and ten variants of the basic receiver design were produced (**Table 1**) and apart from their

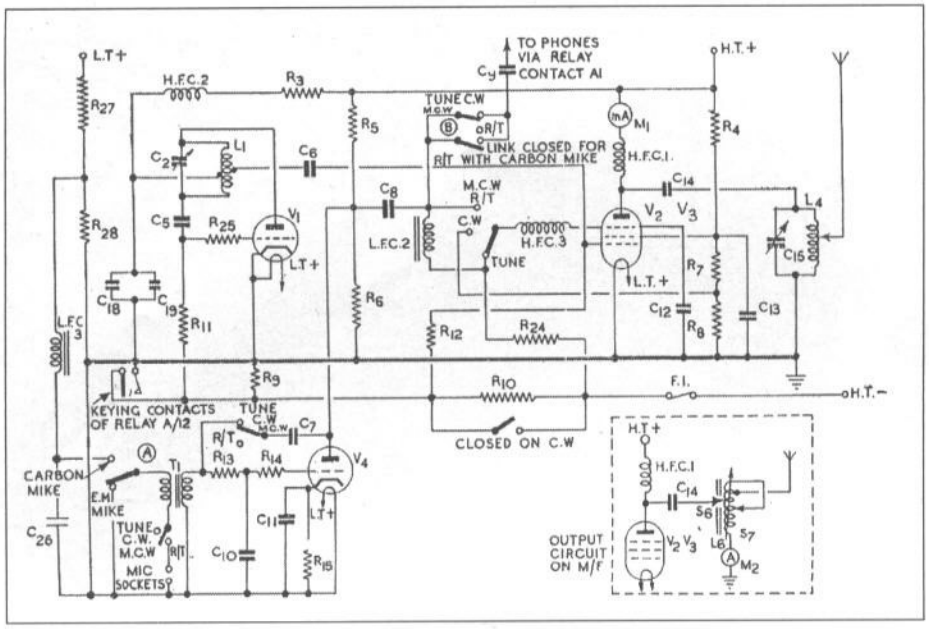


Fig. 2: Simplified circuit diagram T1154 (Crown Copyright/RAF diagram).

use in aircraft they were also to be found in ground stations, vehicles and RAF air sea rescue launches.

In bomber aircraft, the equipment was used by the wireless operator to obtain position and weather reports, as well as relaying strike reports from the target area. Position reports were plotted using the R1155 and its associated direction finding (d.f.) loop antenna to receive bearing signals from radio beacons. Bearings obtained by these methods were, however, not always reliable due to the effects of jamming and 'Meaconing'/'Meaconing' was a technique where transmitted signals from stations in Germany were used to mimic radio beacons in Britain giving misleading information.

Master Bomber

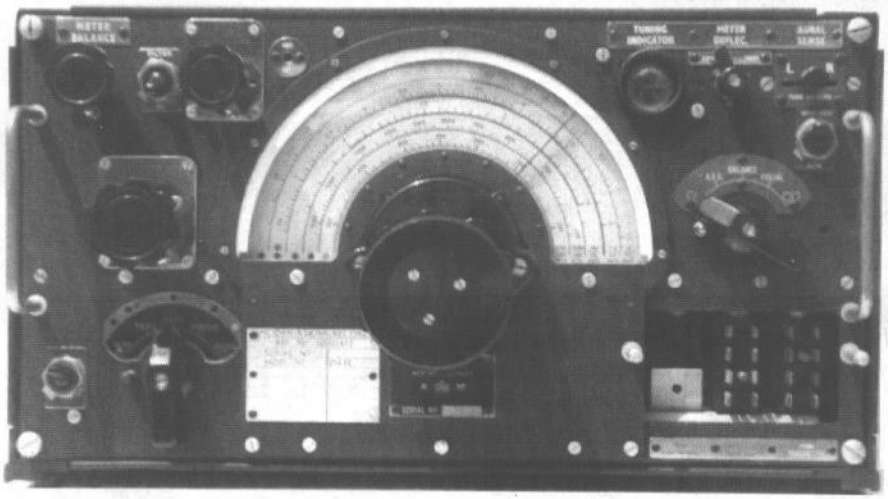
Another role for the equipment in Bomber Command was to control the progress of a bomber raid. One aircraft in the formation called the 'Master Bomber" was detailed to assess the target marking and bombing results during the course of the raid. This control aircraft used its T1154 transmitter to issue instructions to other aircraft via their R1155 receivers. Communication was by R/T on a frequency of 7000kHz over a range of 40km. However, the use of the equipment in this role was not successful and the Master Bomber technique did not become wide spread until the introduction of very high frequency (v.h.f.) R/T equipment in 1943.

Some RAF aircraft also used the T1154/R1155 set in a Radio Counter Measure (RCM) role. These aircraft were fitted with a microphone in one of their engine nacelles. Noise picked up by the microphone was transmitted by the T1154 and used to jam the R/T communications between German ground controllers and their night fighters.

Table 1

T1154/R1155 variants

Type	Sec/Ref	Features	Fitted to
T1154	10D/97	m.c.w., c.w., R/T multi click stop	
T1154A	10D/99	m.c.w., c.w., R/T multi click stop	
T1154B	10D/196	m.c.w., c.w., R/T multi click stop	Handley Page Halifax only
T1154C	10D/198	m.c.w., c.w., R/T multi click stop	Coastal Command aircraft
T1154D	10D/730	m.c.w., c.w., R/T multi click stop	Mobile Ground stations used with receiver Type R1188
T1154E	10D/731	m.c.w., c.w., R/T multi click stop	
T1154F	10D/893	m.c.w., c.w., R/T multi click stop	Coastal Command aircraft
T1154G		Did not enter production	
T1154H	10D/1180	m.c.w., c.w., R/T uni click stop Aluminium case & circuits to reduce interference with compass	Handley Page Halifax Short Sunderland
T1154I		Did not enter production	
T1154J	10D/1329	m.c.w., c.w., R/T multi click stop	
T1154K	10D/1330	m.c.w., c.w., R/T multi click stop Steel case version of T1154F	
T1154L	10D/1455	m.c.w., c.w., R/T uni click stop	Marine craft, Training aircraft
T1154M	10D/1587	m.c.w., c.w., R/T as T1154K with uni click stop	General
T1154N	10D/1588	m.c.w., c.w., R/T steel case version of T1154B	Marine craft
R1155	10D/98	Aluminium case	
R1155A	10D/820	Filters to prevent m.f. interference	Handley Page Halifax
R1155B	10D/13045	Aluminium case h.f. choke to prevent radar interference	
R1155C	10D/1105	Aluminium case Modified for h.f. d.f.	
R1155D	10D/1331	Steel case	
R1155E	10D/1332	Steel case Filters to prevent m.f. interference	
R1155F	10D/1333	Aluminium case h.f. choke to prevent radar interference	All bombers except Handley Page Halifax
R1155G			
R1155H		These variants did not enter production	
R1155J			
R1155K			
R1155L	10D/1477	Aluminium case As R1155B or F but frequency range altered	General
R1155M	10D/1597	Aluminium case filters to prevent m.f. interference	Ground Schools only
R1155N	10D/1667	Steel case As R1155B or F but frequency range altered	General use except bombers Marine craft



Installation

In a typical aircraft installation (**Fig. 1**) the transmitter was the focal point and was usually mounted either on top of, or to one side of, the receiver. Power was obtained from the aircraft's electrical supply of 12 or 24V through two rotary transformers. One of these power supplies, a Type 35, provided 1200V h.t. for the transmitter, whilst the other, a Type 33, provided 217V h.t. and 7V l.t. for the receiver and 6.3V l.t. for the transmitter.

Routing of the transmitted output to the appropriate antenna was via an Antenna Selector Switch Type J. Five positions were available, allowing for

- signals to be routed with h.f. through a fixed antenna and m.f. through a trailing antenna
- or h.f. through the trailing
- m.f. through the fixed
- d.f., where the fixed antenna was used for reception together with the d.f. loop and earth where all antennas were connected to earth.

Transmitter Circuit

The T1154 transmitter provided c.w., m.c.w. and R/T facilities on frequency ranges of 200 to 500kHz (m.f.), 3 to 5.5MHz (h.f.) and 5.5 to 10MHz (h.f.). The transmitter circuit (**Fig. 2**), consisted of a master oscillator stage driving two pentode power amplifier valves in parallel, control being provided through the transmitter master switch. The master oscillator used a VT105 valve connected as a series fed Hartley oscillator. The two directly heated power amplifiers used VT104 pentodes and were shunt fed through a choke on both m.f. and h.f. ranges. On m.c.w. another VT105 valve provided side-tone and modulation of the transmitted output during R/T operation. When transmitting voice, use could be made of either carbon or electromagnetic microphones.

Transmitter Operation

In operation, the h.f. and m.f. ranges were selected via the antenna switch Type J. The transmitter master switch was then set to STB.B1, starting up the l.t. power unit providing power to the transmitter and receiver valves. After a few seconds the master switch was then set to TUNE causing the h.f. power unit to start up. The master oscillator condensor for the frequency range selected was then adjusted by back tuning to the receiver. The Morse key was depressed and the condenser rotated until the magic eye tuning indicator on the receiver closed. With the master oscillator stage set up the power amplifier stage was tuned until a dip was obtained on the antenna feed meter.

Frequency selection was made easy by the use of a unique click stop mechanism on the transmitters. Set up by wireless mechanics on the ground prior to flight it locked the frequency controls enabling the operator to select frequencies with ease. Two types were fitted, a multi click system where all chosen frequencies were selected in turn as the tuning dial was rotated, and a uni click type where only one click stop was in use at any one time on any range. These click stop facilities were only available on the h.f. ranges, the m.f. ranges were set by the operator once in flight.

Receiver Circuit

The R1155 receiver consisted of a ten-valve superheterodyne (**Fig. 3**) operating on frequency ranges of 75 to 500kHz, 600 to 1500kHz and 3 to 18.5MHz. Facilities were also provided on the first two ranges for direction finding using a visual indicator.

A five-position master switch gave the following functions - *OMNI* providing normal communications functions, *AVC* providing automatic volume control, *Balance* where the visual indicator was balanced during d.f. functions, *Visual* where the visual indicator was switched into circuit and ∞ where bearings were taken aurally from radio beacons and sense circuitry was used to determine signal direction.

The r.f. amplifier stage consisted of a VR100 pentode valve whose variable μ characteristic allowed its gain to be controlled by varying the grid bias. Frequency changing from the r.f. signal down to i.f. was carried out by a VR99 triode hexode valve. The i.f. stage included two stages of amplification and operated at 560kHz. Both manual and automatic volume control were available. Detection was by means of a VR101 double diode triode valves, the triode section of which acted as the output stage.

Direction finding was available both aurally and visually. The aural method used a Type 3 loop antenna which was adjusted for a minimum signal. The visual system used a 'switched heart' circuits. Here a push-pull oscillator was used to switch the fixed antenna in such a way that the voltages were applied alternatively in phase and anti-phase with the instantaneous voltage due to the loop. At the same time, the oscillator switched the rectified output of the detector stage to two pairs of moving coils operating the visual indicator needles. To allow the receiver to be used with a variety of d.f. loops a number of impedance matching units were produced. Workshop testing of the receiver was carried out using a Test Set Type 66.

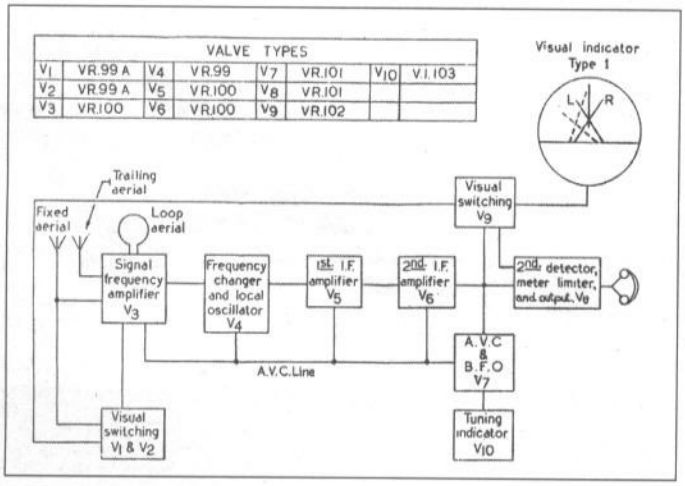


Fig. 3: Receiver schematic diagram (Crown Copyright/RAF diagram).