Radio and Line Communication with the British Army's Abbot Self-Propelled Gun (SPG) and Command Post

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This article describes the collecting and putting together of the author's working Abbot SPG FV433 communications setup including that of the command post FV432, utilising the original Larkspur equipment and including a later fit of part-Clansman radio equipment.

General Description

The Abbot (FV433) was a 105 mm SPG gun built by Vickers of Newcastle-upon-Tyne from 1964 to 1967, entering service with the British Army (Royal Artillery) in 1965 – around 146 were delivered (an extra 80 were also supplied to India), eventually to be phased out in 1995, being replaced by the AS90 SPG (howitzer). The Abbot could reach speeds of around 30 mph, had a fully rotating turret, and consisted of a crew of four (excluding the two crew members who did not travel in the Abbot) with the loader also being the radio operator. The Abbot saw extensive service during the Cold War with the British Army of the Rhine (BAOR).

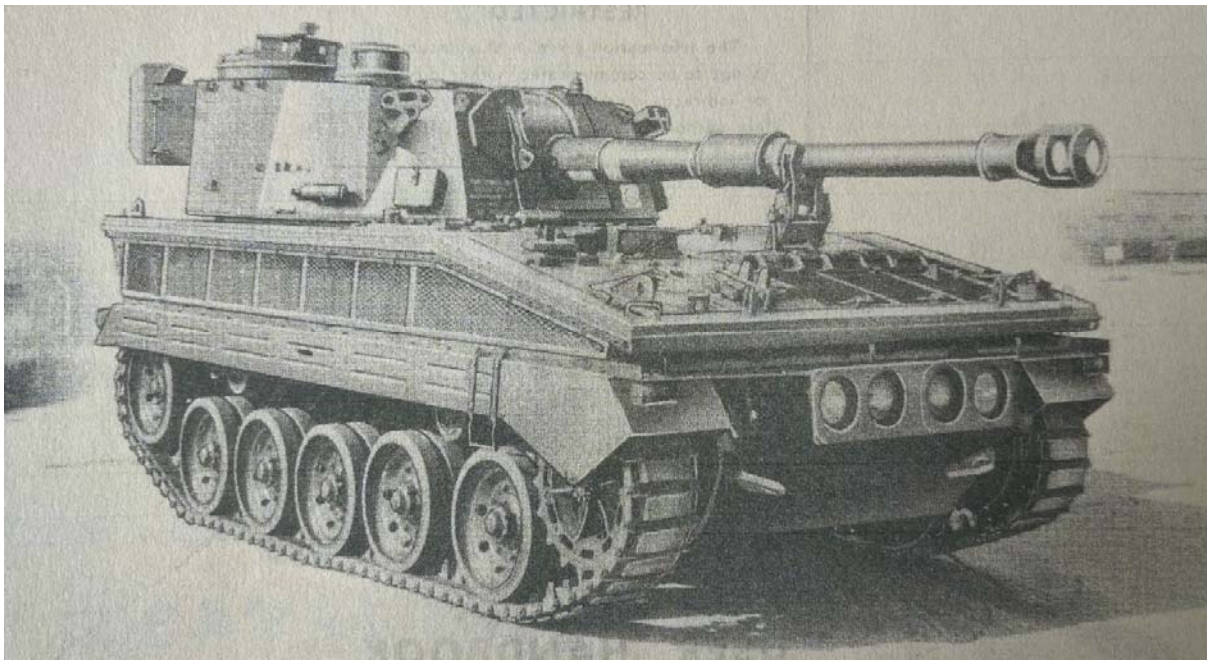

Figure 1. The Abbot FV433

An Abbot artillery battery would consist of six gun detachments/Abbots along with an FV432 armoured personnel carrier acting as the command post. Other vehicles would also support the battery – Stalwarts and a Ferret/Land Rover.

Orders from the command post would be transmitted to the Abbots in the battery via radio on the battery gun net (when on the move) or line (when stationary) which would be laid between each Abbot and the command post.

Communications

Abbot

The Abbot's original radio equipment was of the Larkspur and Larkspur era range, and consisted of essentially the B48 VHF station radio (see **Appendix** for specification) along with associated harness items, including remote fixed microphones, intercom facilities and induction loops for the crew in association with magnetic induction receivers/Amplivox noise-excluding headphones. There was also a special harness box made for the commander ('No. 1') to use, only fitted to the Abbot - the Radio-Line box.

Command Post

The command post was situated in an FV432 armoured personnel carrier, with a B48 also being used for radio communication to the Abbot when on the move. Additional special-to-type Larkspur harness line equipment was fitted – the Gun Control Unit/GCU - two off, to allow for communication from the command post officer/CPO to the Abbot(s). Additional radios were fitted in the command post - two Larkspur C45 station radios (see **Appendix** for specification) for the battery or

regiment nets and an R209 Mk 2 reception set for receiving weather data. Other equipment also included a radio telegraph adapter (RTA) connected into one of the C45's and teleprinter, and also (introduced later, around 1970*) was a Field Artillery Computer Equipment **[17]** computer (FACE) to communicate fire control data to the Abbots.

*A BBC archive video apparently dated 1967 shows a command post FV432 for an Abbot battery operating a FACE computer, with verbal fire instructions being passed to the Abbot(s) **[18]**.

The author's setup consists of all of the main Abbot battery equipment originally utilised in the command post as would have been fitted once FACE was utilised (excluding teleprinter and the FACE computer: the C-set C45 is also not fitted, purely for space reasons). Note that at some point after FACE was installed, an Artillery Weapons Data Transmission System (AWDATS) was fitted, to allow for **[19]** *almost instantaneous transmission and display of individual gun data at each gun, thereby eliminating the need for verbal transmission. The incorporation of AWDATS into the system, however, in no way precludes the use of verbal procedure.* The equipment would have comprised a Coder Digital Data (CDD) in the command post and a Data Display Unit (DDU) in the Abbot(s). Note the No. 1's microphone could then be connected into the radio-line box or the DDU.

The gun control units in the FV432 also found use in a 'lightweight gun control system' role **[8]** used by R.A. light, Para, Commando and Towed Medium Regts. using the Apparatus, Loudspeaking, No. 26 (Lightweight) consisting of gun control loudspeaker units and SI No. 7B remote handsets connected to the command post via D10 cable (see **Appendix** for specification). One of these units can be seen in **Figure 17** next to the command post C45. The unit was also tested in conjunction with a gun control unit.

The Beginnings…

The route to the full working setup for the Abbot (and command post) began when the author obtained a rather unusual Larkspur era harness item to add to his Larkspur collection. This turned out to be a Gun Control Unit (Interconnecting Box, Gun Control) used in the Abbot's FV432 command post, as shown in **Figure 2.**

Figure 2. The Gun Control Unit, the first item in the system obtained by the author

Once the author's curiosity had been roused, he set about discovering more information about the Abbot. A lot of information was available about the particular radio communication sets harnesses and also about that pertaining to the Abbot, including the availability of the relevant Electrical and Mechanical Engineering Regulations (EMERs), the original user handbook **[2]** and information originating from the Larkhill Royal School of Artillery **[11]**. However, there appeared to be nobody with the same interest in the complete (original) Abbot (and command post together) communications systems…

However, after a little bit of investigating, a museum was discovered in north Norfolk - the Muckleburgh Military Collection, that housed various military equipment and machinery including tanks and artillery pieces. After contacting the museum, the owner kindly gave permission for the author to visit the museum and spend - with full access, a day investigating the communications system installation of an Abbot that was on display.

Figure 3. The Abbot at the Norfolk museum that the author had access to. Note the *Clansman* antenna base on top of the turret

The day's visit turned out to be very interesting and helpful, if only to see how much equipment - radio and otherwise (as well as the crew members) could be 'shoe-horned' into such a small space. There was no ammunition now of course in the Abbot (originally 40 rounds would have been stowed **[2]** in the turret and fighting compartment) but the addition of this would of course have made the space even more cramped.

Unfortunately there was no radio present, this had presumably long since been removed – indeed other Abbots that the author has since gained access to were the same - that is, communications equipment had been removed.

Of course at some point in the Abbots' lifetime the radio equipment would have been replaced with the newer Clansman range (as would the command post's) although the original harness items and cabling appeared – at least with this particular Abbot - to have been kept in place***.** The Abbot visited in the Norfolk museum still had the original Larkspur harness and harness boxes (as was the case when the radios were upgraded to Clansman). The Clansman user handbook for the Abbot dated 1980 **[19]** still showed the original 'Larkspur' items fitted – the 'I' box, radio-line box, etc. and so the radio mounting tray in **Figure 4** is of the type that the Clansman replacement radio (UK/PRC-351/2) would have used. Similarly the antenna mounting on the outside top of the turret is of the Clansman era.

***** A 'small' number of Abbots apparently consisted of a complete Clansman harness and equipment fit, which included a Clansman Radio Lines box (RLB) which a later Abbot modification - the addition of a BATES display cell (Battlefield Artillery Target Engagement System) dated March '89 showed its interface with the *Clansman* RLB, described in COMMUNICATIONS INSTALLATION D325 **[7]**.

Figure 4. The radio tray, with the radio (Clansman) long since removed, as well as other radio items that were on the inside of the turret wall. Note the original installation with the B48 would have used a carrier type 81 for mounting

During the day's investigation, an additional (unseen previously) Larkspur type harness box was discovered – this was the Interconnecting Box, Radio-Line, used by the No. 1, and located next to his seat in the turret, as shown in **Figure 5.** Also located underneath it was the 'standard' Larkspur intercommunication 'I' box. The attempt to subsequently obtain a radio-line box for the author's setup proved to be quite problematical. An operational 'copy' was constructed successfully using a surplus Larkspur box of the same size, along with components from scrap Larkspur 'J1' and Clansman harness boxes, and used until an original box was sourced.

Figure 5. The interconnecting box, radio-line (top) and the 'I' box (bottom) next to the No. 1's seat in the turret

The opportunity whilst on site was also taken to ascertain more information about the induction loop that was supposedly located around the inside of the turret (there was also originally a second loop that was used outside the Abbot on the ground, when stationary).

It was discovered that the turret induction loop was actually a multicore cable which was interconnected/joined in a 'special' junction box (**Figure 6**) such that there were 12 individual cores making up the loop around the turret. This junction box was in fact the last item to be obtained for the author's setup, long after it was essentially 'complete' operationally. This was thanks to a kind and observant VMARS member**.**

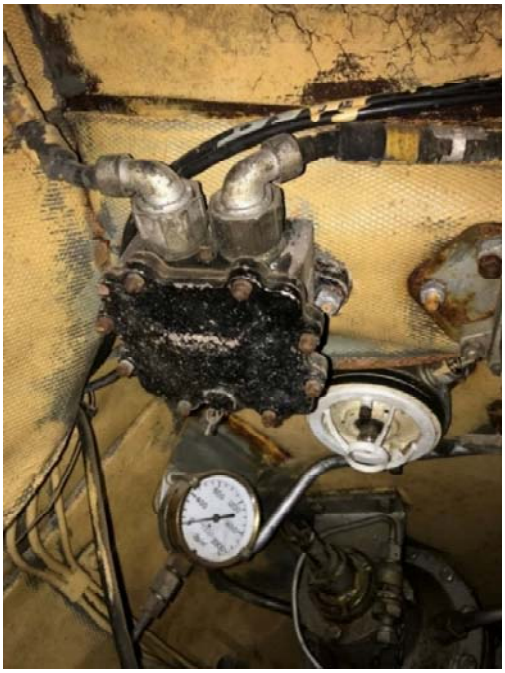

Figure 6. The 'special' induction loop junction box in the turret

To gain a little more practical experience and 'feel' of the Abbot the author signed up for a 'Tank Driving Day' at *Juniper Leisure* in Kent - and as well as trying out an FV432 and a Chieftain tank, the author was able to drive around the fields in an Abbot.

Figure 7. The author in the driving seat of the Abbot (with his instructor) taking it for a test drive…

Collecting equipment and radios and putting the system together

A decision was made at the start on which particular 'system' setup to opt for, as the author discovered slightly different arrangements of equipment, especially with the command post radios. The user handbook **[2]** and the TELECOMMUNICATIONS EMER L792 **[4]** showed a 'basic' setup (although the EMER excluded the command post additional radios) – whereas the Larkhill Royal School of Artillery Abbot and FV432 Communications manual **[11]** showed a slightly different command post version, especially between the arrangement of the A-, B-, and C- sets. This version also included the use of Larkspur 'J3' harness boxes, *i.e*. 3-radio set boxes, and the R209 Mk 2 reception set, and this is the 'version' the author opted for, shown in **Figure 9**.

The author's final command post setup – mainly for reasons of space, utilised only the A- (C45) and B- (B48) sets although the Radio Telegraph Adapter - RTA (item 27 in **Figure 9**) is operational on another of the author's Larkspur era radios.

Other differences included the addition of the B48 antenna rejector unit (Rejector Unit VHF No. 3) on the EMER command post installation schematic, and this has been included in the author's system.

The Abbot installation used was that depicted in the COMMUNICATIONS INSTALLATIONS D325 update **[6]** of November 1972 – see **Figure 22**.

The individual items for the system were mounted onto military Dexion, of the type commonly found in military land rovers, thus keeping a military radio 'feel' about the system (and of course a convenient means of mounting the equipment) and this in turn was fitted to the author's inside garage brick wall using Unistrut.

Most of the multiway connectors on the Larkspur equipment utilised the Plessey Mk 4 coarse thread brass type, with the exception of the 2 W audio amplifier audio (which additionally used the Belling Lee 'push' type 3-pin connector for the AF output) and the No. 1's foot acknowledgement switch in the Abbot (Thorn connector). It was to prove quite a challenge finding enough cables and connectors, and of course the multiple times connectors needed to be re-wired and re-orientated to obtain the correct requirement.

The Command post build

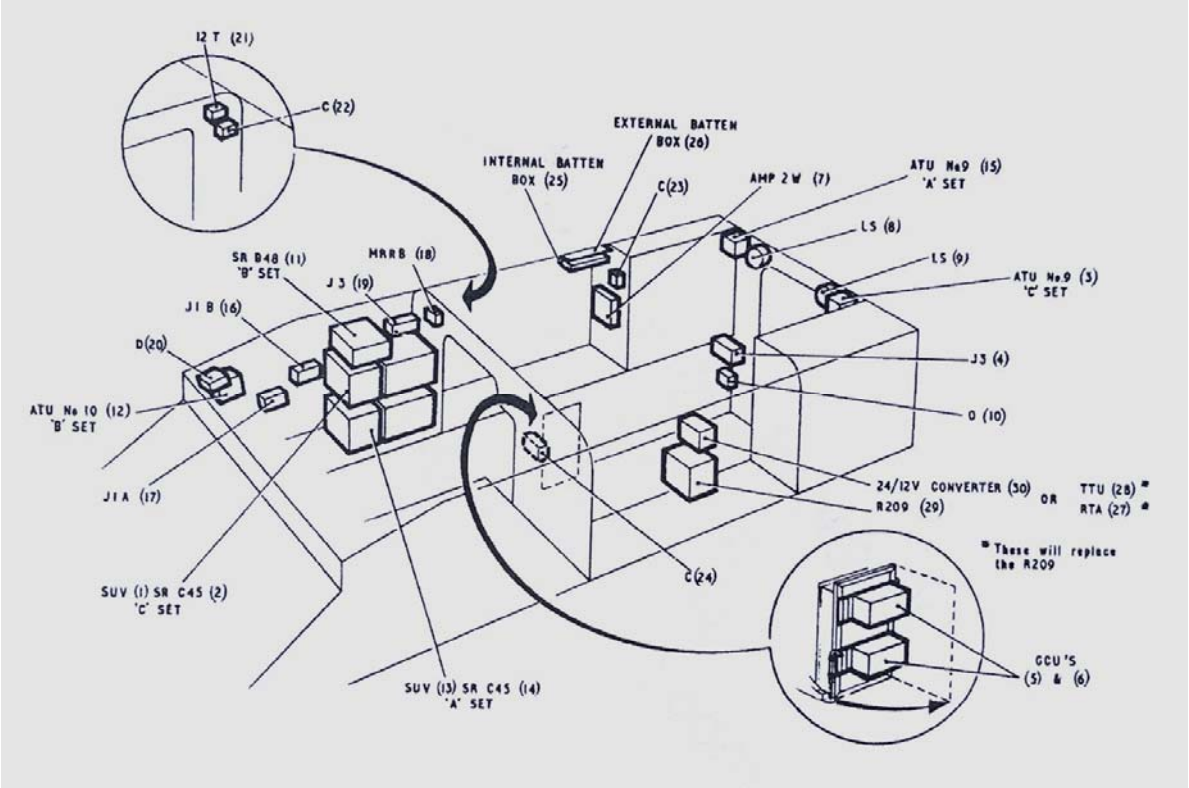

Figure 8. The Command post FV432 with the communications equipment layout

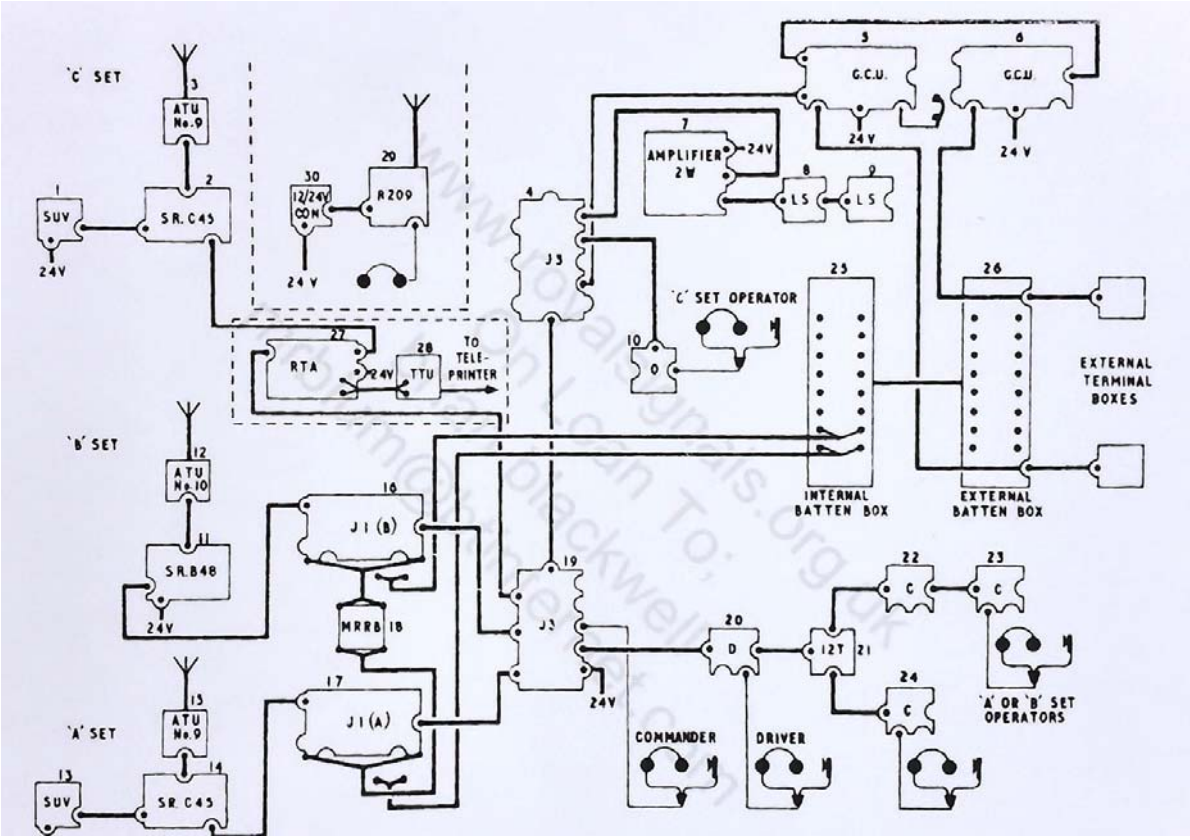

Figure 9. The (Larkhill) command post full radio installation

Gun control unit – items 5 and 6 in **Figure 9*** (two boxes required)

***All subsequent references to item numbers in the following command post section refer to **Figure 9** (and **Figure 8**).

The first item obtained for the system was a gun control unit (**Figure 2**) - and so energies were directed to obtaining the command post equipment initially. The author set about testing/repairing the box as necessary.

Two of these boxes were required in the command post, each box has four channels individually connected to the Abbots via line from the two external interconnecting box, terminal units but in practice the artillery battery would consist of six Abbots so two channels are spare.

When RADIO is selected the CPO can operate the radio via his (green) handset Telephone, Hand SI No. 7B. With any of the toggle switches operated he can also hear speech on the line circuits associated with the switch/Abbot concerned. When the CPO's pressel is operated, speech is transmitted over the radio and line circuits which are operated. When LINE is selected the CPO can receive on the radio and the selected line circuits but can only transmit on the line circuits. The corresponding gun control box 'channel' lights on the line circuit from the appropriate Abbot will light when a call or acknowledgement is received from the Abbot's No. 1.

Obtaining what the author considered was the correct test procedure was not straightforward. The author already possessed a Larkspur (radio installation harness testing) simulator unit for testing – Simulator, Transmitter-Receiver, Radio, EMER reference X501 **([16]** which has proven on other systems to be very useful/convenient for bench testing the more complex Larkspur harness items such as the 'J1', 'J2' and 'R' boxes, etc. (**Figure 10**). But the procedure also had a section specifically for the Abbot Communication System (called 'Test Pattern 5').

Figure 10. The Larkspur simulator box

However, this procedure did not address all of the functions of the Abbot and command post control boxes. Additional test procedures were found in the EMER section L794 (Field and Base Repairs) **[9]** but this utilised the use of a special Abbot testing box (EMER M140 – **[10]**). Needless to say these pieces of test equipment are probably no longer in existence/circulation so the author set about making his own (**Figure 11**) from the EMER data. A very convenient case (complete with the appropriate Plessey brass Mk 4 connectors and switches) was to be found in a surplus ('donor') Larkspur 'DM' box (originally used for the army's combat net BID150 encryption system).

Figure 11. The author's 'home-made' Abbot test box, with the gun control unit and the CPO's handset undergoing test

It was found that the addition of the EMER still did not address the testing of all of the functions of the gun control box so an additional set of testing notes was written by the author to accompany the rest of the procedures.

Larkspur B48 station radio – items 11 and 12 (plus the VHF rejector unit)

This is a VHF transmitter-receiver covering 26-38 MHz, with an RF output of 0.5 – 0.75 W. This set is the B-set and is used primarily for transmitting the fire control data to the guns.

A set was obtained and was then bench tested/repaired and aligned to ensure correct operation. Also required for the radio was the ATU unit – Aerial Tuning Unit No. 10, along with a VHF rejector unit – Rejector Unit VHF No. 3 (used to limit interference between the C45 (the A- and C- sets and the B48. There would have been two 4' sections of antenna rod normally connected to the VHF base.

The B48 obtained was a 12 VDC version (the rest of the system was 24 VDC) and so a separate 12 V supply was used for this.

Figure 12. The B48 (mounted on its carrier type 81) complete with its ATU No. 10 and VHF rejector connected into the system. Note the VHF antenna base on top of the ATU

2 watt AF amplifier and loudspeaker – items 7 and 8

The amplifier, shown in **Figure 13** is known as the Amplifier AF 2 watt, Sealed, No. 1 and drives a 5-inch 3 Ω loudspeaker (also called Apparatus Loudspeaking ALS No. 19 when including the loudspeakers).

The amplifier has its own volume control, with HT voltage for the valves being developed by an internal vibrator-based power supply.

The amplifier is operative when the appropriate radio set is selected by the 'J3' box (see later section).

Figure 13. The 2 W amplifier and the 3 Ω 5” loudspeaker

The ‘J1’ harness box – items 16 (for the B48 B-set) and 17 (for the C45 A-set)

The ‘J1’ box(s) are standard Larkspur items and connect the A- and B- sets into the harness via the ‘J3’ box – item 19. The boxes allow for remote control by the CPO to the Abbots with a remote handset by switching the B48 ‘J1’ box to REMOTE and connecting its remote terminals to the internal batten box (which in turn is connected to the external batten box and handset). Similarly remote control by the commander can take place with the A-set if its ‘J1’ box is connected appropriately to the batten boxes. The (green) remote handset is a carbon type, Telephone Hand SI Remote Control No. 1.

Manual or automatic rebroadcast can be utilised between the A- and B- sets by switching both ‘J1’ boxes to RRB and the ‘MRRB’ box (item 18) to AUTO or MANUAL as required. A break-in facility BK.IN is also provided by the ‘J1’ boxes if required by the commander.

Figure 14. One of the two ‘J1’ boxes

The ‘C’, ‘D’ and ‘O’ control boxes, items 22, 20 and 10 respectively

The ‘C’ operator’s control unit box, ‘D’ driver’s control unit box and the adapter unit ‘O’ box are standard Larkspur harness items and can be seen in the completed system in **Figure 21**. Microphone/headsets are connected into all units, noting though that the driver can only use his microphone for the intercom. Gain controls are available. The standard microphone/headset used is the Microphone Magnetic SI No. 6 complete with Headgear SI Double No. 1 (or 1A).

The ‘O’ box however, is only fitted to the C-set (C45) and so is essentially a ‘one-set’ installation and operated by the C-set operator - this operator will not have an intercom, although a gain control is fitted to the box.

In the communication diagram of **Figure 9** it can be seen that the ‘D’ box feeds into a ‘splitter (‘12T’, item 21) which then splits/feeds into multiple ‘C’ boxes. The author’s installation consists of the ‘D’ and a single ‘C’ box (and hence no ‘12T’ box for space limitation reasons).

The ‘J3’ harness box – items 4 and 19

The ‘J3’ box is a standard Larkspur item, designed for use with a 3-set installation. With the Abbot’s command post FV432 an additional ‘J3’ is utilised to give another operating position, indicated in **Figure 9**.

The 2 W audio amplifier is connected to one of the two ‘J3’ boxes and the radio set to be broadcast on the loudspeaker is selected by *that particular* ‘J3’ switch ‘OFF-A-I-B-C’ *i.e.* the selector switch used needs to be the one on the ‘J3’ with the 2 W amplifier connected.

The commander, through his Microphone Magnetic SI No. 5 can select any of the ‘A-, B- or C- sets to control by means of its switch. In addition, in conjunction with his monitor switch on his microphone and the relevant set toggle switch on the ‘J3’ he can monitor in one earpiece any of the other sets. A live intercom facility is provided when the commander’s microphone is set to ‘I’. The commander can also break in on other crew members who are not switched to intercom by switching his microphone to ’I’ and operating his pressel.

Figure 15. One of the two ‘J3’ boxes (the ‘left-hand’ unit in Figure 21)

Interconnecting box, terminal unit (not shown in **Figure 9**)

This unit(s) – two off 4-way are used, connect to the external batten boxes, then to up to each of the Abbots on line using D10 cable*****. No batten boxes are used in the author’s setup and so the two terminal units connect direct to the gun control units.

*****The terminal units have an in-built polarity checker/lamp, used with the aid of a 24 V supply.

Figure 16. One of the two interconnecting box, terminal units

C45 A-set and ATU No. 9 – items 14 and 15 including the ‘MRRB’ box (item 18)

The C45 station radio (No.1 type) along with its power supply - Supply Unit Vibratory No. 12 Mk 2 can be seen in **Figure 17**.

This is the A-set in the author’s command post, and would normally be operated on the battery or regiment nets. The C45’s ATU – ATU No. 9 can be seen in **Figure 21**. There would have been two 4’ sections of antenna rod normally connected to the VHF base. **Figure 9** shows the C45 connected through its own ‘J1’ box into the ‘first ‘J3’ but also connects via its remote terminals to the remote terminals of the B-set (B48) ‘J1’ via a standard Larkspur harness remote control unit ‘MRRB’ box – see **Figure 18.**

Figure 17. The C45 A-set, mounted on to a standard Larkspur tray/carrier type 82, and also showing the ALS26 loudspeaker unit gun control at the left hand side – together with its Handset SI No. 7B

This allows for automatic rebroadcast between the A- and B- sets, when the 'J1' boxes are selected to RRB and the 'MRRB' is set to AUTO. Rebroadcast is then achieved using the relevant set's squelch control circuits to automatically put the next set to transmit. Manual rebroadcast can be used when the 'MRRB' is set to MANUAL in which case the sets need to be manually monitored and the appropriate radio to transmit is manually set using the SEND control on the top of the box (with the direction of travel of the SEND switch in the 'direction' of the radio set to transmit). The ATU can be seen in the completed command box photo in **Figure 21.**

Note in **Figure 15** – the 'left hand' installed 'J3' has two connectors on its top – these are for the A- and B- set connections, the last connector on the top is for the C-set, which is not fitted in this setup. However, the system has been tested by (temporarily) fitting another set (a C42 – identical to the C45 except for frequency range) into this 'J3' box C-set connection and operating through the commander's microphone/headset.

Figure 18. The top of the C45 A-set showing the 'MRRB' box (top left) and 'J1' box – items 18 and 17 respectively. The box at the bottom left is one of many 'LT' 24-volt distribution boxes, none shown in Figure 9 for clarity. Note the items are assembled onto a standard Larkspur top tray for this type of set

R209 Mk 2 reception set – Item 29 in **Figure 9**

The R209 Mk 2 (see **Appendix** for specification) is an HF receiver and is used for the reception of weather data. It is directly powered by 12 VDC and in the original installation a 24/12 VDC converter was also used. The set is not connected into the harness and is 'stand-alone'.

Figure 19. The R209 Mk 2 reception set used for reception of meteorological data

Radio Telegraph Adapter (RTA)

This unit, together with its associated teleprinter interface unit – Applique 'B', and the C45 C-set, is used to provide teleprinter facilities – two-wire simplex operation in the 'FACE' command post role. The R209 Mk 2 radio receiver would then usually not be fitted. The RTA is shown below in **Figure 20** – note this is not part of the author's physical Abbot/command post setup but is used in another role in his collection (the Larkspur era C11 SSB).

Figure 20. The RTA teleprinter adapter

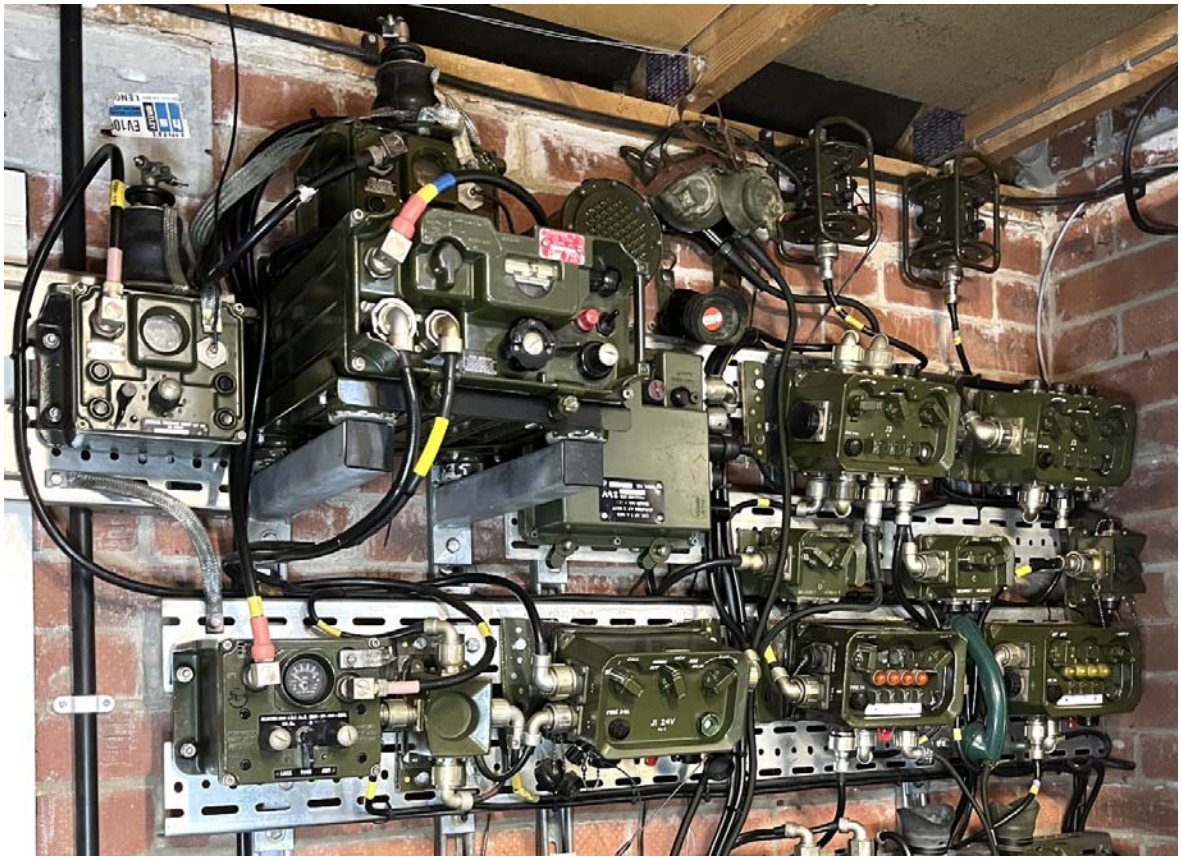

Figure 21. The completed command post. The microphone/headset at the top centre is the commander's - Microphone Magnetic SI No. 5/Receivers Headgear SI Double No. 1/1A, connected into the FV432's 'forward' 'J3' item 19. The green handset connected into the gun control unit is the CPO's - Telephone Hand SI No. 7B. Note the two VHF aerial bases, one for the B48 B-set and one for the A-set C45. The ATU No. 9 for the C45 is just visible on top of the B48 (The R209 Mk 2 reception set is out of sight underneath).

Also visible under the two 'J3' boxes is the 'D' driver's box, the 'C' operator's box and on the far right is the 'O' box used for the C-set only

The Abbot communications system build

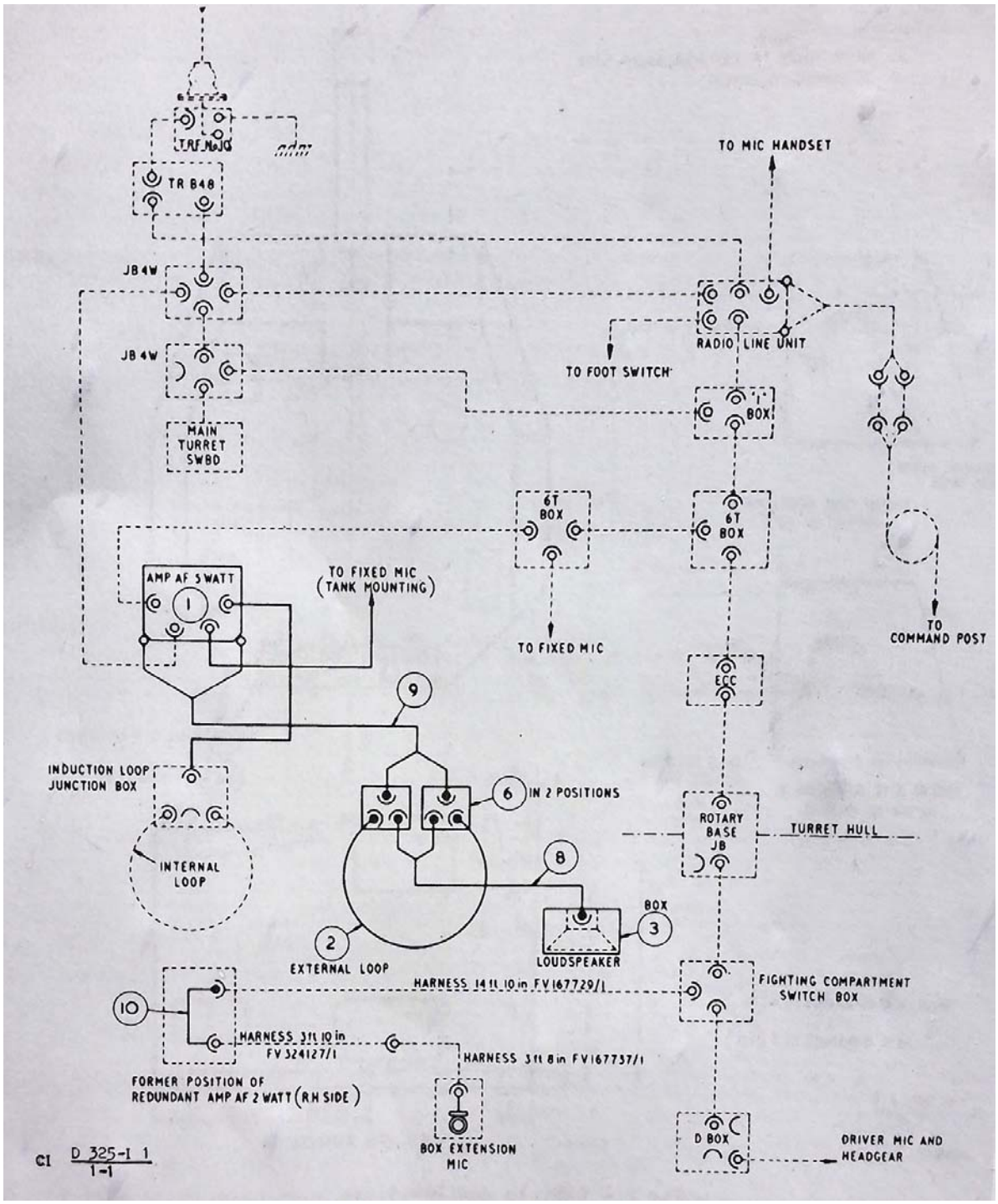

Figure 22. The Abbot gun communications installation. Note the B48 is replaced by the Clansman UK/PRC-351 in the author's installation

The Abbot communications system is shown in **Figure 22** which the author's system is essentially based on. This diagram is taken from the COMMUNICATIONS INSTALLATIONS D325 update **[6]** of November 1972 which provides for the replacement of the existing 'free' induction loop with a fixed external loop – mounted on the back of the turret, and the replacement of both 2 W amplifiers with a single 5 W amplifier **[6]** and **[14]**.

However, once the Clansman range of radios had superseded Larkspur, the B48 was replaced with a Clansman UK/PRC-351/2 and its associated components – noting that the rest of the installation/harness remained the same - the user handbook section for the communications system fitted with Clansman radio **[19]** was dated December 1980 where the remaining existing Larkspur harness and components are still fitted.

During the sourcing of the necessary components for the Abbot harness, it was found impossible to obtain another B48, and so the decision was taken to base the author's Abbot system on the later Clansman-based radio system, which essentially meant the original Larkspur system and harness remained but with the UK/PRC-351/2 replacing the B48. In addition, the author also possessed a 5 W amplifier so this was included, replacing the two 2 W amplifiers, as per the official modifications

in the COMMUNICATIONS INSTALLATIONS D325. Note that all headsets used in the Abbot are of the noise-reducing Amplivox type E22.

The Clansman UK/PRC-351 and associated components

The Clansman setup is shown in **Figure 23.** Note that the Abbot literature refers to the set as the UK/PRC-351/2 (meaning with the …/2 that the set included the 20 W amplifier). So it would appear that this was an option at the time(?) to have either a UK/PRC-351 (4 W RF output) or a UK/PRC-352 (20 W RF output). Indeed, the user handbook **[19]** shows both options. The 'option' the author has in his installation is the 4 W (351) – noting that the set being replaced is the B48 which 'only' had an RF output of 0.5 W – 0.75 W.

Figure 23. The UK/PRC-351. Note the additional Clansman items – the 24 V battery (fitted to the radio set), DCCU battery charger, TUAAM automatic antenna matching unit and initiate box: the Interconnecting Box Radio Adapter - IBRA box (top right) interfaces the Clansman radio into the existing (original) Larkspur harness, the output of the IBRA feeding directly into the Larkspur radio-line box. To the left of the Clansman's TUAAM unit is the 50 Ω dummy load

Radio-line box

This is a special control box, used on the Abbot only. The box is located next to the No. 1's seat (**Figure 5**). The No. 1's microphone and headset are connected into this, microphone type Microphone Magnetic SI No. 9. This is also special to the Abbot. The radio-line box controls whether line or radio communication is used from the Abbot**.** The radio-line box also has an in-built voltage control circuit for the B48, as this set was not designed to have one fitted.

Outputs from the radio-line box are fed to the UK/PRC-351 (superseded the B48), and also to the intercom circuits via the 'I' box. The two external terminals on the box are connected to line (using D10 cable) and are run up to the command post to connect into the command post's gun control unit as are all other Abbots in the battery. Each Abbot carries on its external reel ¼ mile of D10 cable. When in line communication mode with the command post, its appropriate light in the gun control unit will be switched on/enabled (*i.e.* Abbot No. 1 acknowledges) when acknowledgement is required, by operating the foot switch (shown in **Figure 33**) connected into the radio-line box or by the operation of No. 1's pressel.

Figure 24. The radio-line box

The microphone has a 4-position selector (‘AI’ –‘I’ – ‘IA’ – ‘CALL’) and the pressel. Note CALL is not used.

When set to ‘AI’, the microphone and one earpiece are connected to radio or line, depending upon the setting on the radio-line box, the other earpiece monitors the intercom.

At position ‘I’, the microphone and both earpieces are on gun intercom but a connection in the radio-line box superimposes radio or line control communication on both earpieces.

At position ‘IA’, the microphone and one earpiece are on intercom and the second earpiece monitors radio or line control depending upon the setting of the radio-line box.

The ‘I’ intercom box

This box is a standard Larkspur item and is the (300 mW) amplifier for the gun intercom circuit. Outputs are then fed to the 5 W AF amplifier (and hence the headgear for the crew via the induction loop(s)) and the driver’s headgear, as well as accepting inputs from the fixed microphones. The ‘I’ box is shown in **Figure 25**.

Figure 25. The ‘I’ intercom and amplifier box

The ‘D’, ‘6T’ and ‘LT’ boxes

These are all standard Larkspur type harness boxes and can be seen in the completed installations - **Figure 33** and **Figure 34,** except the ‘D’ box which is shown in **Figure 27**. The ‘D’ box is the driver’s unit, the ‘6T’ boxes are the splitter/adapters for the intercom line and the ‘LT’ boxes are the 24 VDC supply distribution boxes.

Figure 26. The driver’s ‘D’ box can be seen at the top centre, with his Microphone Magnetic SI No. 6 and Amplivox E22 noise-reducing headphones hanging on the right. Also visible is a ‘6T’ box and two ‘LT’ boxes, and the ECC emergency crew control box top left - the (external) induction loop associated loudspeaker is just out of sight above the ECC unit

Fixed microphones

There are two fixed microphones inside the turret - Fixed Mic SI (for the loader and layer) and one outside. The microphones are live when rotated upwards. The microphone is shown in **Figure 27.**

Figure 27. One of the three fixed microphones

ECC emergency crew control box

This box, along with the 'Tannoy' (carbon) microphone is for operation by the No.1 to communicate (one-way) to the driver in the event of failure of the intercom system. The ECC box along with the microphone is shown in **Figure 28.**

The ECC contains a microphone transformer, the secondary of which connects across the driver's headphone connections. Also included are two parallel connected 330 Ω 12 W resistors in series with the transformer primary to supply the carbon microphone. A supply of 24 V is required, being fed into two (exposed) terminals underneath.

The Tannoy microphone used was also manufactured by 'others' and would appear to have been in use since WWII – in tanks, and as well as being used in the Abbot SPG (in service until 1995) it appeared in the Clansman communications user handbook section **[19]** for the Abbot, dated 1980!

Figure 28. The ECC box with the Tannoy microphone plugged in. Note the microphone will be stowed when not in use

5 W amplifier

This amplifier is specific to the Abbot and replaced the two off 2 W amplifiers with COMMUNICATIONS INSTALLATIONS D325, Inst. Instr. No. 1 **[6]**. It drives both magnetic induction loops and the external loudspeaker as well as acting as an electrical 'junction' for one of the fixed microphones.

Figure 29. The 5 W audio amplifier

Magnetic induction loop

There were two induction loops fitted, one around the inside of the turret and one (a later modification) fitted around the outside back of the turret. In the previous version of the 'outside' loop, this would simply have been placed outside on the ground together with the induction loop junction box and loudspeaker (a standard Larkspur 5" 3 Ω type) for the ammunition loaders. Both are now fed by the (new) 5 W amplifier (note: both modifications carried out together under the same instruction **[6]**).

The author has an original type magnetic induction loop fitted to his installation, *i.e.* utilising the 5 W amplifier driving the loop (consisting of approximately 3.5 m of 12-core cable) connected into an original induction loop junction box. The internal connections of the two Plessey Mk 4 connectors in the box that the two ends of the loop are connected to are connected together, one to one but offset to a' subsequent' terminal each time, thus pin 'a' from one connector will connect to pin 'b' of the next connector and so on, the result being that the loop will then consist of 12 continuous turns in series.

Figure 30. The induction loop box showing the two (12-core) cable ends of the loop entering the box on the left hand side via the Plessey Mk 4 brass connectors, and the connection back to the 5 W amplifier from the right hand side via the Belling Lee push-fit connector. Also note the (original) battery master on-off switch at the bottom right

The induction loop will then supply the orders (one way) to the layer and ammunition numbers when loading ammunition, via their pocket induction receivers (**Figure 31**), together with the Amplivox noise-reducing headphones. The pocket receivers are battery operated, the author's receiver operated by two lithium CR2 3-volt batteries (original fit was a Mallory 6.75 V dry battery).

Figure 31. A pocket induction receiver – Receiver, Induction No. 1 - together with the Amplivox noise-reducing headphones

Additional Abbot communications-related equipment

Also fitted in the Abbot was a firewire warning system **[2]** and **[3].** This is manufactured by Graviner, of Colnbrook, England and is designed to give warning of a fire in the power pack/engine compartment. This is achieved by means of a stainless steel coaxial conductor containing a temperature sensitive silica based compound inside. When the firewire is heated to a certain critical temperature, the resistance will fall and capacitance increase to a certain value which will trigger an alarm via the Graviner control unit.

Audible and visual alarms would activate in the Abbot but a signal was also supplied to the intercom circuit for the crew via the firewire control box and intercom junction box which would cause a ‘nominal’ 600 Hz signal to sound in the headphones worn by the crew.

Figure 32. The Graviner firewire control unit. The firewire connections enter via the two Thorn connectors on the top right of the unit

An original Graviner fire wire control unit was obtained by the author and fitted into his Abbot system. In the original Abbot installation the audible signal was generated externally to the control unit in conjunction with a fire alarm horn. In the author’s case, a small simulator unit was constructed to both simulate a fire (using a test capacitor) and to generate the audible signal (660 Hz). This was fitted into a surplus ‘MRRB’ Larkspur box and can be seen in **Figure 26** to the right on the Graviner box.

Note the two Thorn firewire connectors – these proved rather difficult to source but eventually two military surplus pre-wired cable harnesses were purchased, which included the required connectors - ex-Gazelle helicopter items!

Figure 33. The completed Abbot FV433 installation (excluding the driver’s section to the right – see Figure 26). The No. 1’s Microphone Magnetic Sl No. 9 and the induction loop pocket receiver can be seen at the bottom on the table, complete with the Amplivox E22 noise-reducing headphones. The No. 1’s (black) foot acknowledgement switch can be seen on the bottom Dexion rail in the centre

Figure 34. The completed Abbot and command post installation (excluding the driver's section, shown in Figure 26). The command post's C45 A-set and its associated items are at the bottom left corner

Conclusions

The putting together of the Abbot and command post communications system was a fairly long-term project (for the author!) and stretched over a year or two. However, this proved to be a very interesting project to undertake.

As one of the author's goals is to actually collect and use as many as possible separate Larkspur/Larkspur era pieces of equipment connected into *original* operational setups (noting that there are many variations of installations of the equipment between different vehicles - from land rovers to tanks) this project has been ideal in that respect.

In fact, the author had to venture into new territory with the use of Clansman, but nonetheless a potentially new interesting area for the hobby maybe…

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https://groups.io/g/wireless-set-no19

www.royalsignals.org.uk

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Appendix

Radio sets basic specification:

B48:

Frequency:	26 to 38 MHz, 100 kHz steps
Mode:	FM voice, ±15 kHz max. deviation
RF Output:	0.5 W - 0.75 W HP, 10 mW LP
Sensitivity:	2 µV for quieting of 10 dB

C45:

Frequency:	23 to 38 MHz, 100 kHz steps (for No. 1 set)
Mode:	FM voice, ±15 kHz max. deviation
RF Output:	15 W HP, 0.5 W LP
Sensitivity:	1.25 µV for quieting of 10 dB

R209 Mk 2:

Frequency:	26 to 38 MHz
Mode:	AM/FM/CW
Sensitivity:	3.5-5 µV for sig/noise ratio of 20 dB

UK/PRC-351:

Frequency:	30 to 76 MHz, 25 kHz steps
Mode:	FM voice, ±5 kHz max. deviation
RF Output:	4 W
Sensitivity:	1 µV for quieting of 10 dB

Line Cable:

D10

Twisted pair cable consisting of three steel and four copper strands with a polythene and nylon insulation.

Loop resistance 220 Ω/mile.