

Wireless Set A40

A brief description of the Wireless Set A40 plus information on operating it as a manpack using Ni.Cd. batteries and a French inverter for their PP-8A set.

Part 1

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Note

The 4 digit component identifiers used in the text are the last 4 digits of their NATO Part No.

Introduction

The A40 is a 13 valve, 6 channel, crystal controlled, VHF FM manpack transceiver covering 47 to 55.4 MHz. It was designed in the mid 1950s, produces an RF output of about 300mW, has an overall size of 27.3x12.7x7.6cms and weighs 4.5kg including its battery.

It is similar to the Canadian CPRC-26 set. Both sets use the same ancillaries and valves and some of the internal modules are interchangeable between the set types.

EMER Tels.F 462 for the A40 refers to the CPRC-26 as 'Canadian/US Set CPRC-26'. The reference to 'US' is puzzling. No similar set appears to have entered volume service with the US Army. However, the A40 and CPRC-26 incorporate many features of the 1950 RCA development of the US PRC-10. These include plug-in modules, a 4.3MHz IF frequency, AFC control of the transmitter frequency from the receiver local oscillator and FM modulation by a magnetic transductor.

A US root for the A40 design is suspected but unproven. If any reader knows of one share it with the Bulletin.

The A40 replaced the older, 4 channel WS-88A and B sets and marks the change from all B7G valves in the WS-88 to 'pencil' valves. The A40 uses 11 pencil valves plus two B7G valves.

Like the WS-88, the A40 comes in two versions differentiated by their working frequencies, the A40A for infantry and the A40B for mortars.

The A40A set is ZA.53443, NATO Pt.No.5820-99-911-0845. The A40B set is ZA.53445.

The receiver crystals frequencies are 4.3MHz below the channel frequencies. The minimum channel

spacing is 200kHz and the normal channel frequencies are:

| Channel | A40A | A40B |
|---------|----------|----------|
| 1 | 47.0 MHz | 47.0 MHz |
| 2 | 47.4 MHz | 47.4 MHz |
| 3 | 47.6 MHz | 47.6 MHz |
| 4 | 47.2 MHz | 47.8 MHz |
| 5 | 48.8 MHz | 52.6 MHz |
| 6 | 54.2 MHz | 54.4 MHz |

From the mid 1970s the A40 was progressively replaced by the Clansman PRC-350. The PRC-350 has a 2W RF output, a narrower bandwidth (25kHz channel spacing), weighs 3.1kg and provides reliable set-to-set ranges of 5km on a 1.2m whip.

Portage

The WS-88 consisted of a set and a separate battery (or battery box) of similar size to the set. These were carried in left and right hand chest pouches slightly larger than the WWII British webbing ammunition pouches.

The A40 is a single unit carried at the operators waist clipped to the back of his combat belt using 'Harness Web and Pad Assembly W/S A40' (ZA.46606) or, alternatively, it could be carried in the standard small army back pack. Back portage allowed the operator to lie prone without fouling the whip antenna. This could be a problem with the chest portaged WS-88.

Construction

The A40 front panel is cast in aluminium alloy and the set case and battery box in magnesium alloy. The set is screwed shut, sealed and its internals desiccated. Consequently, most sets are still in good internal condition. The battery box is secured to the set base with a toggle clamped webbing strap.

The A40 adopts and extends the PRC-10, A41, A42 feature of using plug-in modules similar in size to a B7G valve. The modules contain the pencil valve, coils, semiconductor diodes, capacitors and resistors. Except for the transmitter output and master oscillator, the main stages of the A40 are contained in 14 colour coded plug-in modules. This allows rapid servicing by module replacement. Plugs and sockets are also employed between main set assemblies so that it can be stripped to its major parts using only a screw driver.

Printed circuit boards were not in general use when the A40 was designed. However, it goes some way to anticipate their arrival. The sockets for the plug-in modules and valves are moulded into one

common polythene platen which forms the major component of the chassis deck.

The A40 retains the Philips 'bee hive' trimmer capacitors used and proved in the WS-88. There are 18 of these trimmers. Even by the standards of the day they were bulky and limited the size reduction of the set that pencil valves and modularised construction could theoretically have permitted.

Circuit

The A40 employs a stable, crystal controlled, receiver local oscillator and regulates the transmitter frequency against it via an automatic frequency control (AFC) loop with an offset for the 4.3Mhz receiver IF frequency.

The receiver line up is - one CV2237 RF amplifier, a CV2254 mixer with a CV2237 crystal controlled local oscillator, 4 off CV2254 IF amplifiers, one CV2254 limiter, one discriminator and a CV2238 AF amplifier. The transmitter has a CV2237 AFC driver supplied from the receiver mixer, an AFC discriminator, a CV2237 modulator, a CV2240 master oscillator and a CV2240 PA output stage.

The A40 provides side tone, i.e. the transmitted signal is heard on the receiver ear piece to provide a partial check that the set is operating correctly. Side tone is derived from the transmitter AFC discriminator

The set introduced a WHISPER mode to British military manpacks. This increases the microphone gain by a factor of about 10 (20db) to allow the operator to whisper when working close to an enemy. The WHISPER mode also decreases the receiver audio gain to reduce noise leak from the headphones or the handset earpiece. The A40 has no squelch and no volume control.

The performance of an A40 with a battery in good condition is:

Receiver

Sensitivity 20db signal plus noise to noise ratio for a 2 microvolt signal.

IF bandwidth 65 to 85kHz at 6db down and 60db down at 250kHz.

Transmitter

RF output greater than 275mW.

Deviation ± 5 to ± 11 kHz for an AF input of 250mV in NORMAL and 25mV in WHISPER.

Battery

The set battery is 'Battery Dry, 90/45/1.5/-3volts No.1', NATO Pt.No.6135-99-901-2230, interchangeable with the NBA-289. The battery powers the set for approximately 18 hours in a 9:1 receive:transmit operating regime.

Maximum battery drains are tabled below:

| | Transmit | Receive |
|-------|----------|---------|
| 90V | 37mA | 3.5 mA |
| 45V | 10mA | 15.5mA |
| 1.25V | 975mA | 600mA |

A test meter for the A40, BA289 battery and the A41, A42, BA279 was available to the operator.

The battery life can be significantly degraded if it is exposed to sub zero temperatures. For cold weather working a battery extension lead (ZA50320) was provided to allow the battery to be detached from the set and worn under the operator's clothing and take advantage of his body heat.

Audio Accessories

For connecting its headset and handset the A40 has two 5 pin in-line sockets for plugs of the type used with the A41 and A42 No.1 sets the Canadian CPRC-510 and CPRC-26. This allows the operator's headset to be connected together with a second set of audio gear for an officer or monitor. Once fitted the audio plugs are retained by a spring loaded swinging arm. The arm was a service modification.

The headset is the same as for the A41 No.1 i.e. Microphone Receiver Headgear Assembly YA.1017 or the later Headset/Microphone S.I.No.1A (4146) The handset is Telephone Hand S.I.No.4G (YA10708).

An audio adaptor (Z1/ZA.47706), 'Adapter Socket 5/10 Way' was available to increase the number of audio connections to the set. Also available were 6m audio extension cables (7350). Up to three of these could be connected in series for the remote control of the set. (See the notes under T/R switching).

The accessories were carried in Haversack No.1 (Z1/ZA/1/8465-400047) or Satchel Signals No.1, Mk.1/1 (Z1/ZA.27294).

T/R Switching

The A40 has no T/R relay. The filaments of valves powered in both transmit and receive, e.g. the receiver mixer, are switched on via the front panel OFF-WHISPER-NORMAL switch. The filament supplies to the other valves are routed through the

pressel switch in the handset or headset from the front panel switch. When the pressel switch is operated the transmitter valves filaments are energised. When it is released the receive only valves are energised.

On early sets it was possible for the operator's pressel switch to select RECEIVE at the same time as the officer's pressel switch was selecting TRANSMIT. This powered all valves in the set at the same time. The set transmitted but the battery drain increase significantly.

On late model sets only the socket designated as OPERATOR is wired to control TRANSMIT/RECEIVE switching.

A feature of this form of T/R switching is that the filament current passes through the headset or handset cable. The cable has a voltage drop so that the voltage reaching the valve filaments is reduced. The longer the audio leads the worse the loss of filament voltage. When using the audio extension leads their voltage drop is excessive and virtually no filament voltage reaches the set.

To overcome this a T/R relay unit (number unknown) was produced to plug into the set audio socket. The audio accessories or extension leads were plugged into the relay unit. The pressel switches controlled the relay and relay contacts directly on the set audio socket switched the filament supplies.

The operator's handbook suggests that the voltage lost in the handset/headset cabling alone can be significant as the battery reaches the end of its life. To squeeze the most out of the battery it suggests the T/R relay unit be used for portable operation.

Antennae

The A40 antenna base is identical to the A41, A42 and CPRC-510 short antenna base. (It also has a tapped center hole which accepts the PRC-10 series laminated steel tape antenna with gooseneck.) All three sets plus the CPRC-26 can use the same short whip antennae. Two whips were normally carried with the set because of the risk of damage in the field.

There are two common versions of the whip antenna. 'Aerial Vertical 4 Foot No.5' (ZA47360) is a single assembly incorporating the whip, the flexible base section and the mounting to match the set base. The later version is a 3 part assembly with an overall height of nearly 5 feet, consisting of separate base adapter (4216), gooseneck (4215) and whip (4217). To improve reception, a counterpoise

wire earth (Z1/ZA.32962 or Z1/ZA.47202) 'Aerial Horizontal Wire 4ft.2in', can be plugged into the set front panel and tucked into the operator's clothing. For very short range working, about 0.8km, the counterpoise wire could be used in place of the whip.

Since the goose neck has to be bent through 90 degrees for both recommended portage methods, it is illogical that the set was not provided with an antenna base at right angles to the existing one.

Also provided was a 50 ohm BNC connector to feed a ground mounted antenna. This consists of a 10 foot, self-erecting whip antenna, (a half wave vertical), 'Aerial 10 Foot No.2' (0960) for use with a remote antenna base (7959) containing a broad band, tuned matching transformer. The base mounts on a ground spike (ZA34630). The set couples to the antenna base with 50 ohm co-axial cable, i.e. 1.4m BNC adapter cable plus one or two 7.6m lengths of co-axial cable.

In favourable conditions set-to-set ranges of 2km are obtainable on the set mounted whip antennae. With both sets operating on the 10 foot remote antennae ranges up to 8km are possible.

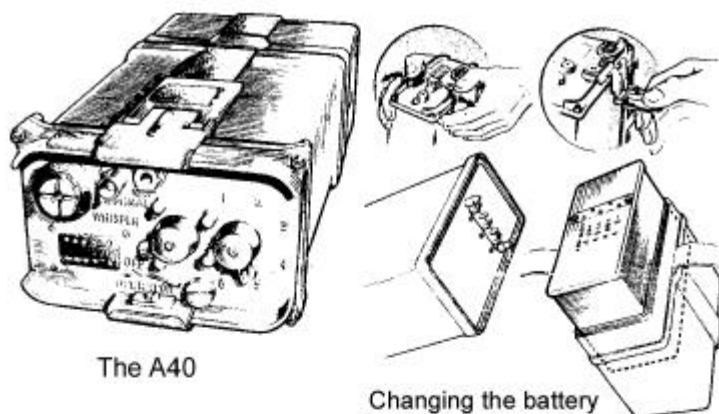
A torch bulb RF output indicator (2069) could be connected across the antenna socket and was normally carried. The belt pad harness had pouches for the whip antenna.

Other Nations

The multiplicity and weight of 'bits and pieces' that the A40 operator might have to carry in addition to the basic set contrasts with the American, German and French approach. Their equivalent sets, the PRC-6, PRC-6/6 and PP-8A 'handie-talkies', were self contained. No ancillaries were necessary other than an H-33*/PT handset if the set was to be shoulder portaged but even that was unusual.

The A40 operator could be faced with a Meccano set of bits and pieces. This arose because the technology of the day could not provide a set with all the in-built performance the army desired. External add-ons became the order of the day. With the arrival of the Clansman sets technology caught up with desire and the options were bundled into the basic set.

However, by carrying and using the remote half wave antennae the A40 range could be up to 4 times greater than the 'handie-talkies'.



Information

The above is a brief outline of the A40. If a reader wants more information the CES (kit list W.O. Code 12336), the Operator's Instruction Plate (ZA.47823), the Operator's Handbook (W.O.Code No.12045) and the EMERs (Tels.F462) are available off the shelf from the sources listed at the end of this note.

Next Stage

Though interesting in its own right, the A40 was acquired to prove the point that it could be used as a portable, operating from the French inverter for the PP-8A handie talkie. Part 2 of this note will describe attempts to do so.

Sources

Bob Eggerton (MWARS 9) has handsets, headsets, both types of whip antennae, signal satchels, counterpoise earths, RF output indicators, remote antenna bases, 10 foot whips, co-ax leads, aluminium instruction plates, audio extension leads, operators handbooks and CESs for the A40.

Ian Mant (MWARS 70) has A40 EMER Tels. F462. and the CES.

Peter Gray (MWARS 340) had PP-8A inverters.

No source of A40 sets themselves is known. If a reader has knowledge of one, share it with the Bulletin.

