

A group of soldiers in camouflage gear standing in a field. The soldiers are wearing helmets and carrying equipment. The background is a blurred field with some trees and a fence.

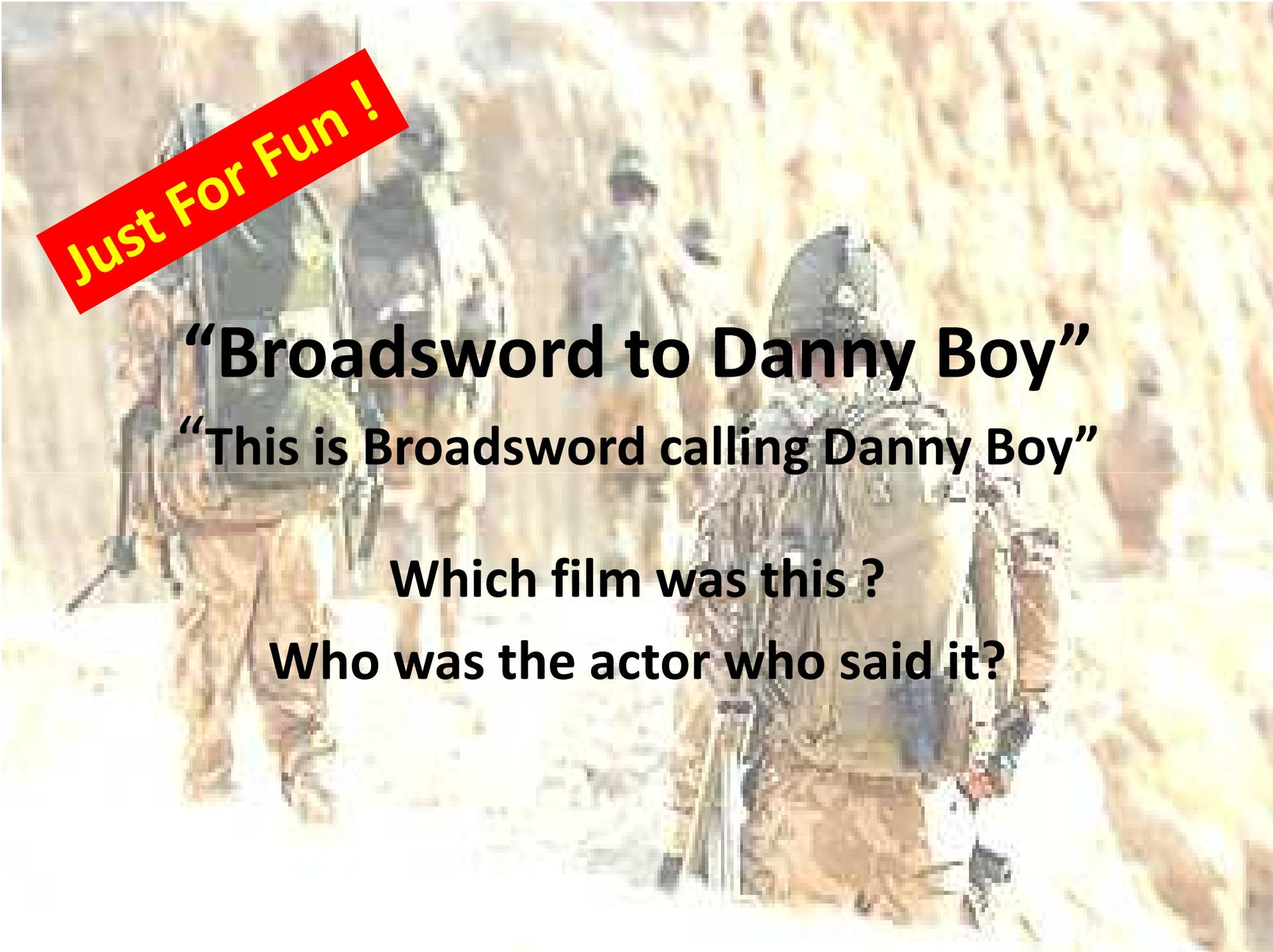
# **Clansman Radios Overview**

**Applications in Amateur Radio**

**Stewart Gebbie**

**G8YQN**

**VMARS Member**



**Just For Fun !**

**“Broadsword to Danny Boy”**

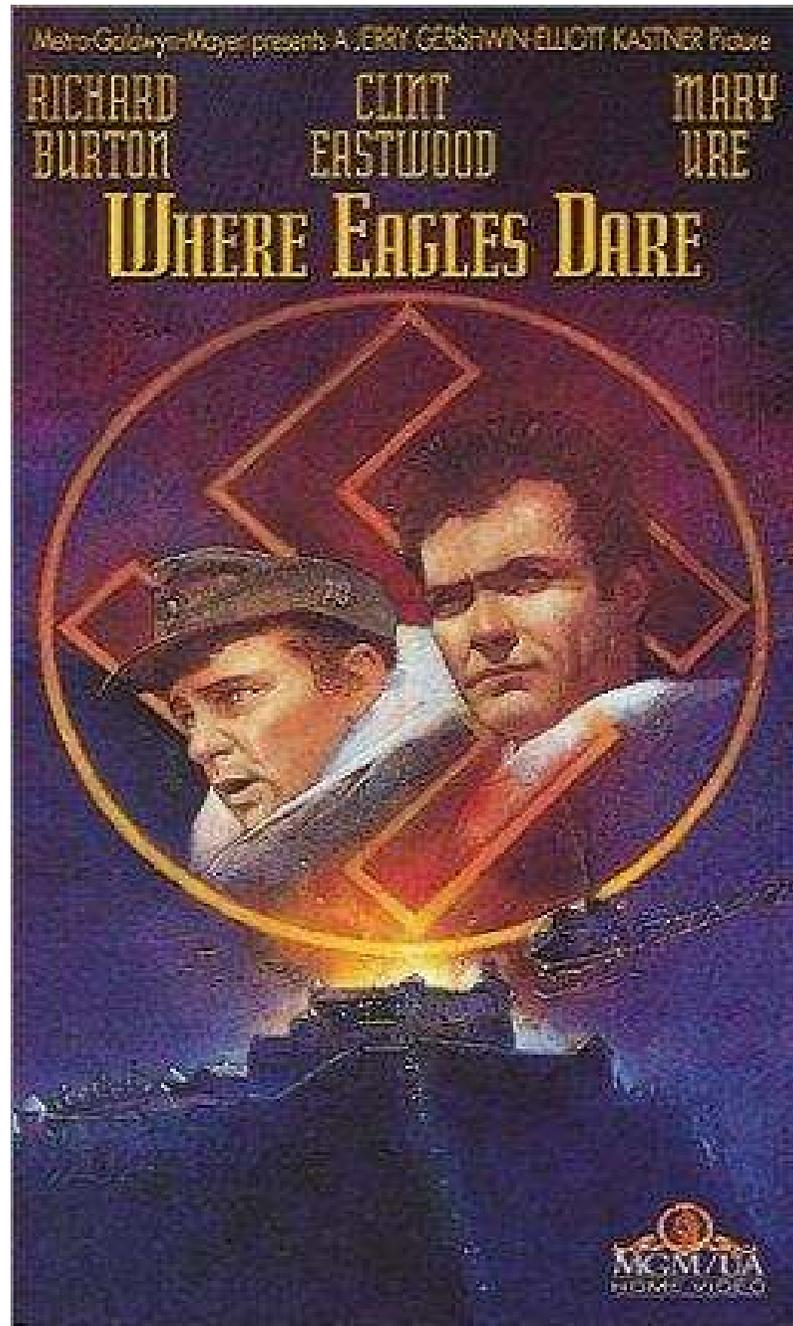
**“This is Broadsword calling Danny Boy”**

**Which film was this ?**

**Who was the actor who said it?**

Answer

He said it



# Agenda

- Glossary
- Quick History on the Clansman Radio Family
- Model Range
- Focus on four radios that are good for the amateur bands
- Accessories
- Summary



# Glossary

## (Boring Stuff That is Useful to Know)

- **Key Ones**

- **PRC** = Portable Radio Communications
- **VRC**= Vehicle ( ground) Radio Communications
- **RT**= Radio Transceiver
- **TURF**= Tuning Unit Radio Frequency
- **SURF**=Selector Unit Radio Frequency
- **DCCU**= Direct Current Charging Unit
- **ACCU**=Alternating Current Charging Unit

- **Others You Might Come Across**

- **CES** = Complete Equipment Schedule ( an RT + the whole kit)
- **ATR**= Adaptor Telegraph Radio
- **ARFAT**=Adapter RF Antenna Tuning
- **TUAAM**=Tuning Unit Automatic Antenna Matching

# A Whole Range of Equipment





# **CLANSMAN QUICK HISTORY AND MODEL RANGE**

# History of Clansman Radios

- Development completed by SRDE in the 1970's ( **S**ignals **R**esearch and **D**evelopment **E**stablishment)
  - To replace the Larkspur radio family
  - **In Service Date** 1978, **Out of Service Date** start of 2009
- Made By MEL, Racal , MSDS and Plessey
- Used in N Ireland, Falklands, 1<sup>st</sup> and 2<sup>nd</sup> Gulf war. Afghanistan
- Falklands first used by 2<sup>nd</sup> Batalion Parachute Reg.
- Now replaced by a digital mesh radio family with GPS called Bowman
  - Issues on reliability, battery life and not able to communicate with US army radios

# The Family

- Nine main radio units
- With six that can be used as man-packs or by foot soldiers
- MOD Model Designation UK /PRC or UK /VRC
- Over 80,000 radios made and first radio entered service in 1976 ( In service date is when the main network was established)
- Being replaced by Bowman
  - GPS mesh radio system with much poorer battery life than the Clansman
- Most Clansman sets are available now to buy

# Model Range

- Range has HF ( 2-30Mhz) Low VHF ( 30-76Mhz)
- Power outputs from 0.1W to 400 watts
- Most use 24V batteries ( except sub one watt out radios which are 15V)
- Battery range includes 4AH Ni-cads, 16AH Lithium and half size versions too
- All Headphones and phone handsets, testers, charging cables, batteries are interchangeable from ground troop vehicles to man-pack
- In general, chargers are common to many radios, DCCU for 24V and 12V
  - fits tanks to Land-Rovers
  - ACCU also available to charge multiple batteries

# Why Buy/Use them ?

- Keeps a bit of history alive
- High quality build above and beyond Japanese Black Box construction
- Low prices, but starting to rise
  - I can give an idea on prices for any of this gear ( not selling any !)
  - Greatly depends on condition of the equipment
- Excellent portable equipment e.g. 30W on battery man-pack on HF
  - Long Battery Life
- Supplies are not indefinite and ex MOD supplies will run out
- Investment : A 19 set bought in 1968 for £2.50 is worth £400 today.  
What is a Japanese box from the 1970's worth today?
- The accessories are all interchangeable with the whole family of sets - saves on cost
- So which ones are useful?



**PRC 351 AND PRC 352 MAN-PACK  
RADIOS**

# PRC351/2

- PRC351/352 : Racal VHF FM Manpack
- 4 watts 30-75.975Mhz in 25Khz steps
  - Two versions RT351 and RT351M
  - M version good for fast data on 4m and 6m due to higher audio bandwidth ( 200hz to over 8Khz)
  - Antenna : 1.2m whip, Battle-whip, BNC connection
  - 24V battery 1Ah or 4ah 18 hours at 1:9 Tx : Rx
  - Worn on a backpack
  - Frame also to fit to a landrover
- PRC 352 is a PRC351 with a 20W PA (AM352)
  - Limited to 4 W using the whip or “battle antenna” 20W amp only used with an external antenna
- Good for 6 metres and 4 metres FM
- SURF used to ensure comms with radios receiving that are one metre apart
  - Not needed for amateur use



# PRC351/2 Other Modes

- There are other operating modes :
  - Remote use up to 3Km away
  - With intercom
  - Using two together or with other Clansman radios as a repeater
  - Not time to cover these as not really relevant for amateur use



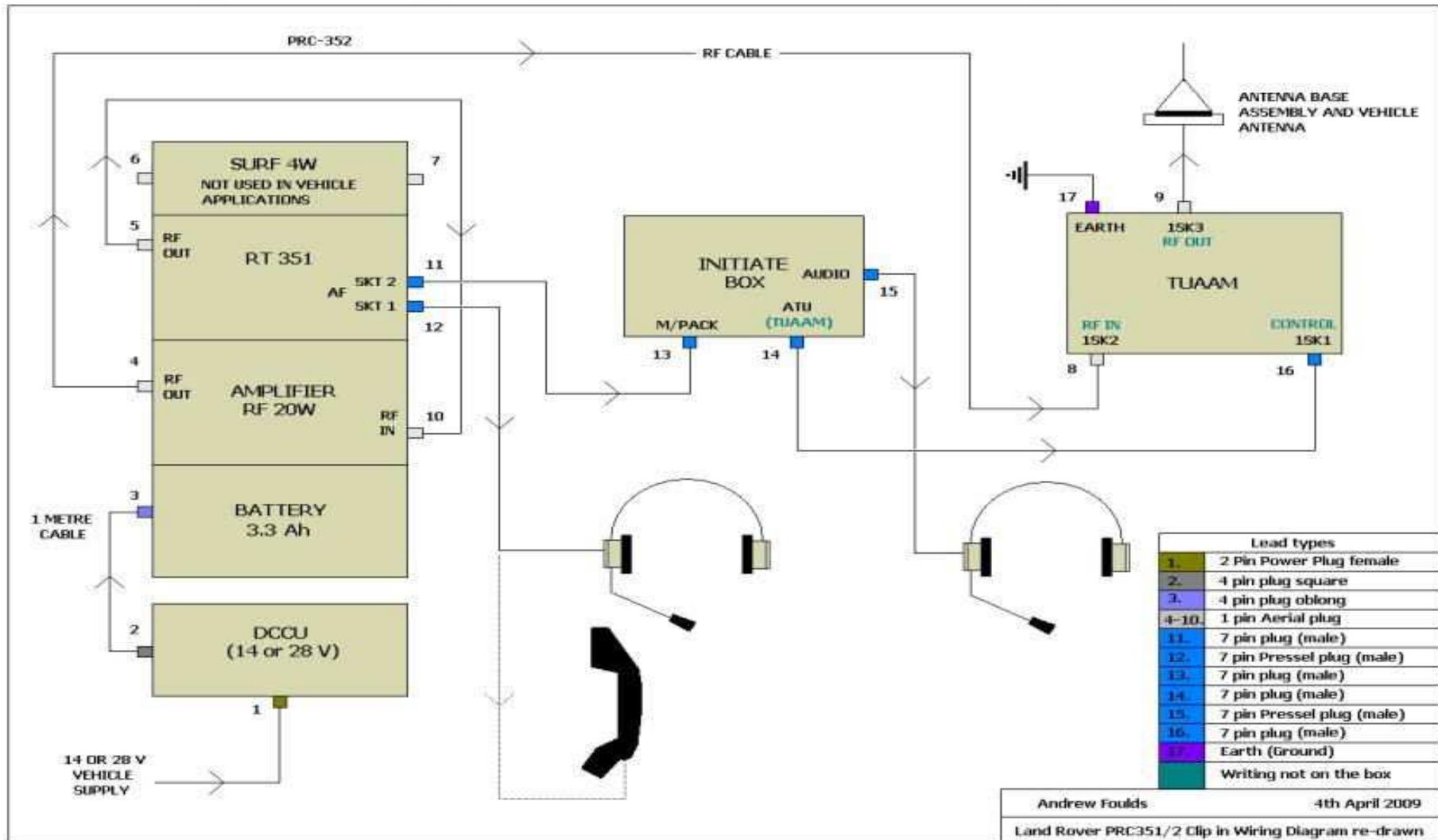
# PRC351/2



Carrying Frame



# PRC 352 Block Diagram



Lead types	
1.	2 pin Power Plug female
2.	4 pin plug square
3.	4 pin plug oblong
4-10.	1 pin Aerial plug
11.	7 pin plug (male)
12.	7 pin Pressel plug (male)
13.	7 pin plug (male)
14.	7 pin plug (male)
15.	7 pin Pressel plug (male)
16.	7 pin plug (male)
17.	Earth (Ground)
	Writing not on the box

Andrew Foulds 4th April 2009  
 Land Rover PRC351/2 Clip in Wiring Diagram re-drawn

# PRC 352 In the Field





## **PRC320 MAN-PACK RADIO**

# PRC320

- Entered Service 1976 ( one of the first in the family to enter service)
  - Over 15,000 sets supplied worldwide
- PRC320 : Plessey built HF 2-30Mhz 30/3 W USB, CW, AM transceiver, 100Hz resolution
  - used in man pack and Land-rovers
  - Yugoslavian version was LSB and the radio can be converted to USB/LSB
  - Has built in ATU for end fed long wire antenna and a BNC for external antenna
  - Very first sets used in Southern Rhodesia to establish British army peacekeeping net in 1979
  - Battery 24V 4Ah 12 hour life at 1:9 Tx:Rx
- CES includes, long wire, Dipole, Battle whip, morse key, four radial counterpoise, headset, gas mask microphone ( needed in Filey)
- There are some variants around with only 1Khz resolution – so care needs to be taken when purchasing – **don't buy the 1Khz version!**

# RT320 HF Transceiver



# PRC320

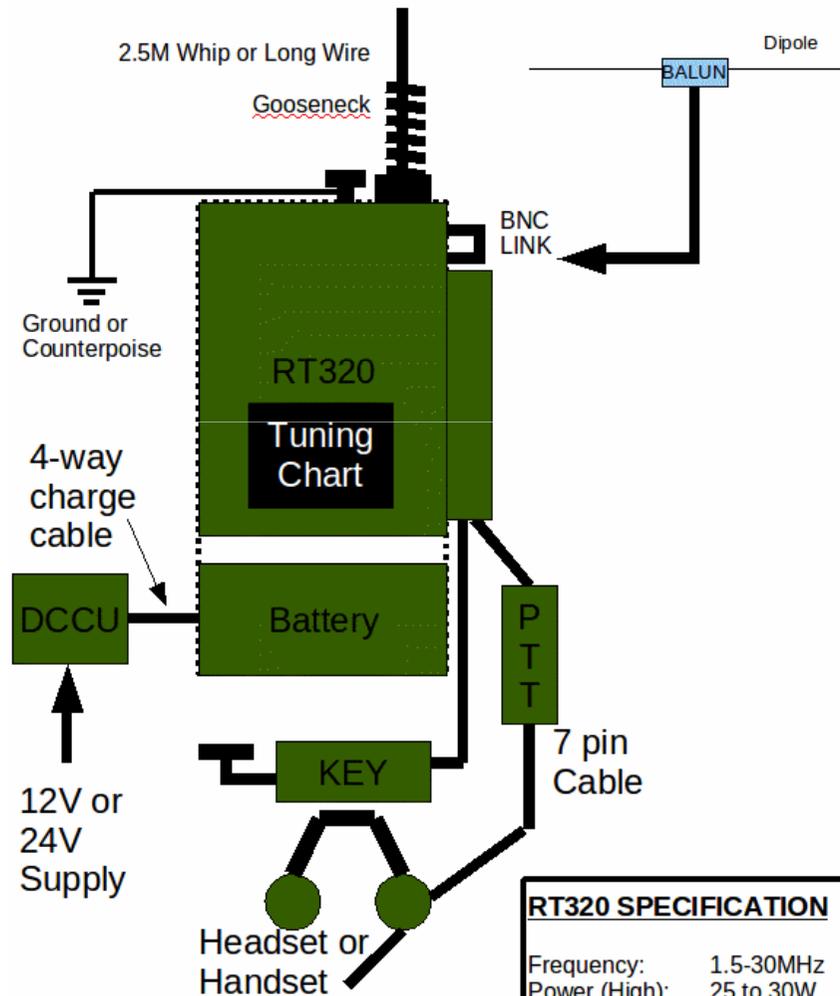


**With Battery Pack Attached**

**Manpack ready for Long walks!**



# RT 320 It's Easy to Operate



RT320 SPECIFICATION	
Frequency:	1.5-30MHz
Power (High):	25 to 30W
Power (Low):	5W
DC Input Volts:	24 to 28V
Modes:	USB, AM, CW
Batteries:	1AH or 4AH NiCd Or 16AH Lithium

## RT320 Operating Instructions

### Manpack Connections

- 1) Ensure BNC link is connected between TX O/P and ATU
- 2) Insert Gooseneck adapter at top of set
- 3) Make sure set is switched off
- 4) Attach battery to bottom of set
- 5) Assemble 2.5M whip and insert it into Gooseneck adapter
- 6) Connect headgear and morse key to audio sockets as required

### Fixed Station Connections – wire antenna:

- 1) Connect wire antenna to gooseneck or push terminal at top of set
- 2) Connect counterpoise or earth to screw terminal on top of set
- 3) Ensure BNC link is in place
- 4) Make sure set is switched off
- 5) Attach battery to bottom of set
- 6) Connect headgear and morse key to audio sockets as required

### Fixed Station Connections - Dipole:

- 1) Remove BNC link
- 2) Connect coax from dipole BALUN centre to TX O/P BNC
- 3) Make sure set is switched off
- 4) Attach battery to bottom of set
- 5) Connect headgear and morse key to audio sockets as required
- 2) Disconnect BNC lead from RT321 to PA input and keep safe

### Pre-Use Checks:

- 1) Main Switch should be at OFF (get fresh battery if not)
- 2) Set band switch to range containing desired frequency
- 3) Set desired frequency on decade switches
- 4) Set desired mode on mode switch
- 5) Set Range and Load switches according to table on top/back of set
- 6) Move main switch to BATT CHK and verify meter reads 4 to 5 divisions
- 7) Move main switch to LP and check that tone stops after 5-10s and that signals are then heard

**NOTE:** If band switch and frequency set on decade switches are not Matched then permanent tone will be heard. This is an indication not a fault.

### Operating Instructions – whip or wire antenna:

- 1) After pre-use checks set main switch to ANT
- 2) Press key or PTT and adjust TUNE control for maximum meter reading
- 3) Set desired mode AM CW or SSB(USB) on mode switch
- 4) Set HP or LP on main switch

### Operating Instructions – dipole antenna:

- 1) After pre-use checks set main switch to ANT
- 2) Press key or PTT and check meter. Trim dipole length and repeat until Dipole length for maximum meter reading is found
- 3) Set desired mode AM, CW or SSB on mode switch
- 4) Set HP or LP on main switch

# Adding LSB to the RT320

www.vmarsmanuals.co.uk/newsletter\_articles/rt320lsb.pdf

The VMARS Newsletter Issue 28

## Adding Lower Sideband to the RT 320

Dr Andrew Smith, G4OEP

The RT230 (UK/PRC 320) is a super rig for amateur use, particularly on 7MHz, where its limitation to 30WPEP is not a problem. But it is precisely on this band that the absence of LSB is particularly noticeable. Adding LSB is quite an easy modification, but anyone who has one of these rigs is aware that they are very much sought after by collectors, and any modifications must be done with great care so that the interest value of the rig is not to be destroyed. Fortunately it is possible to do the modification in a way that no-one who is unaware of it could ever discover that it is there without the modification.

**General.**  
The final IF of the RT320 is at a nominal frequency of 1.750MHz. Due to a subtractive frequency conversion earlier in the system, an incoming USB signal appears as LSB in the 1.750MHz system. So to avoid confusion, USB and LSB will henceforth be used to refer to the incoming signal (or transmitter output) unless specifically stated otherwise.

The existing carrier insertion oscillator (CIO) for frequency generation is a 1.750MHz signal derived from a reference oscillator for the synthesiser. This signal is fed to the IF board (SD-D 218834) via a relay which is controlled by the handset microphone. The modification takes the form of a relay which is controlled by the handset microphone and switches the CIO running at 1.74680MHz (for USB) to the IF board whose output is switched to the antenna when LSB is selected. This relay is controlled by the handset microphone so that it is only in use when the handset is in use. The relay is activated by either of the handset microphone connectors (on the back panel) which have been connected to pins D (audio out) behind the handset socket. These connections have been cut. Pins G and H are joined together, and to pin 9 (previously unused) of the 9-way D plug marked 2PL3 on the back panel of the rig. Pin 9 of the mating socket on the main chassis is connected to the coil of a relay which is located (in this arrangement) under the IF board, and the relay coil circuit is completed to the incoming 24v via the front-panel switch. The correct connection to the switch can be found by testing with a continuity tester for a switchable through-connection to the external 24v battery-connection lug, with the battery removed.

expected. Start by adjusting the CIO to suit the activity of the crystal. It is important to get the frequency exactly right (with a reasonably accurate frequency counter you can do this quite easily enough with care) by adjusting the CIO. Listen to the antenna and listening to the broad-band noise. There should be no noticeable change when you change from LSB to USB. If you have a reasonably accurate frequency counter you can get a very exact setting - see notes below on RT320 frequencies. Alternatively if you have an oscilloscope and an audio sig-gen proceed as follows. - With the '320 connected to a dummy load, select SSB, USB and low power. Using an appropriate audio attenuator feed a 1KHz audio signal into the mic socket, and connect the 'scope to the dummy load. Press the PTT and observe the rf output. Raise the audio frequency until the rf output voltage falls to half its original value (or any measured amount). Note the AF frequency. Then find the lower cut-off frequency by lowering the AF frequency. Switch to LSB and do the same. Adjust the CIO frequency until the upper and lower cut-off frequencies are the same for USB and LSB. On the fourth hand - I have found that the panoramic frequency display which is part of the Digipan PSK32 software (search for Digipan on the net) gives a very clear impression of the ssb filter pass band if you disconnect the antenna and adjust the volume so as to view the receiver noise. I expect you could use this to view the effect of shifting the CIO frequency- the passband would move up or down in the audio band, and should be the same (about 300Hz to 2800Hz) on both sideband settings.

c) Reservations. The system as described here works well and produces very acceptable LSB SSB which

**Cost of Components for the Conversion approx £25**

# Can Be Connected to PC's

- Example

## A Clansman-computer interface

Richard Powell M1CFW

With an interest in data modes it was decided to make a small interface unit in keeping with the 'green' theme of the Clansman series. Required is a means of operating the PTT from the keyboard and an attenuator to reduce the sound card audio out to microphone input levels. This article describes the hardware necessary to get the system, described by Simon Dabbs G4GFN in the previous article, up and running.

### Construction

The circuit diagram of the interface unit is shown in Figure 1.

The original method of holding the unit together had to be dispensed with. A blob of silicon sealer was substituted and will allow the unit to be opened without too much difficulty should it develop a fault.

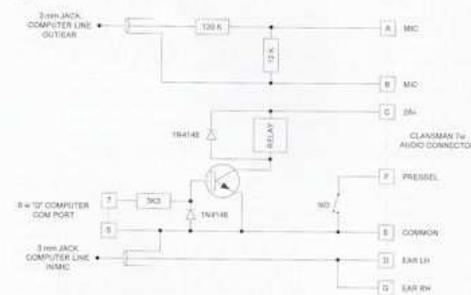


Figure 1. Circuit diagram of the interface

A defunct pressel switch (Figure 2) was the starting point and a piece of strip board 9 holes wide and 19 holes long was cut to fit inside. This has to be insulated on its lower surface with a similar size of 'plastic' material, as the inside of the container is coated with a metalized spray for screening.



Figure 2. The stripboard and components with pressel switch casing

Most software allows PTT via the computer com port RTS signal. A simple transistor and relay switch, and 10-1 attenuator, will fit on the strip board. Connections to the computer, two 3 mm jacks and a 9 way 'D' socket, were fed through the original retaining clamp and grommet. A plug to plug lead was made up to connect to the VRC321. As many laptop computers no longer have a com 1 port, an RS232/USB converter may be required. The detail of the leads is shown in Figure 3.

With this unit and Fidigi software, the station is now ready to combat the poor HF conditions with PSK31, Domino, and many other interesting modes.



Figure 3. The interface with detail of the leads



**VRC 321 VEHICLE HF RADIO**

# VRC321

- Entered service in 1977
  - 5000 made
- Covers 1-30Mhz
- Output 25/5W CW or 40/5W PEP on USB
- Was used as the exciter for the higher power station the VRC322
- Operates from 24V DC

# VRC 321





**VRC353 VEHICLE VHF RADIO**

# VRC353

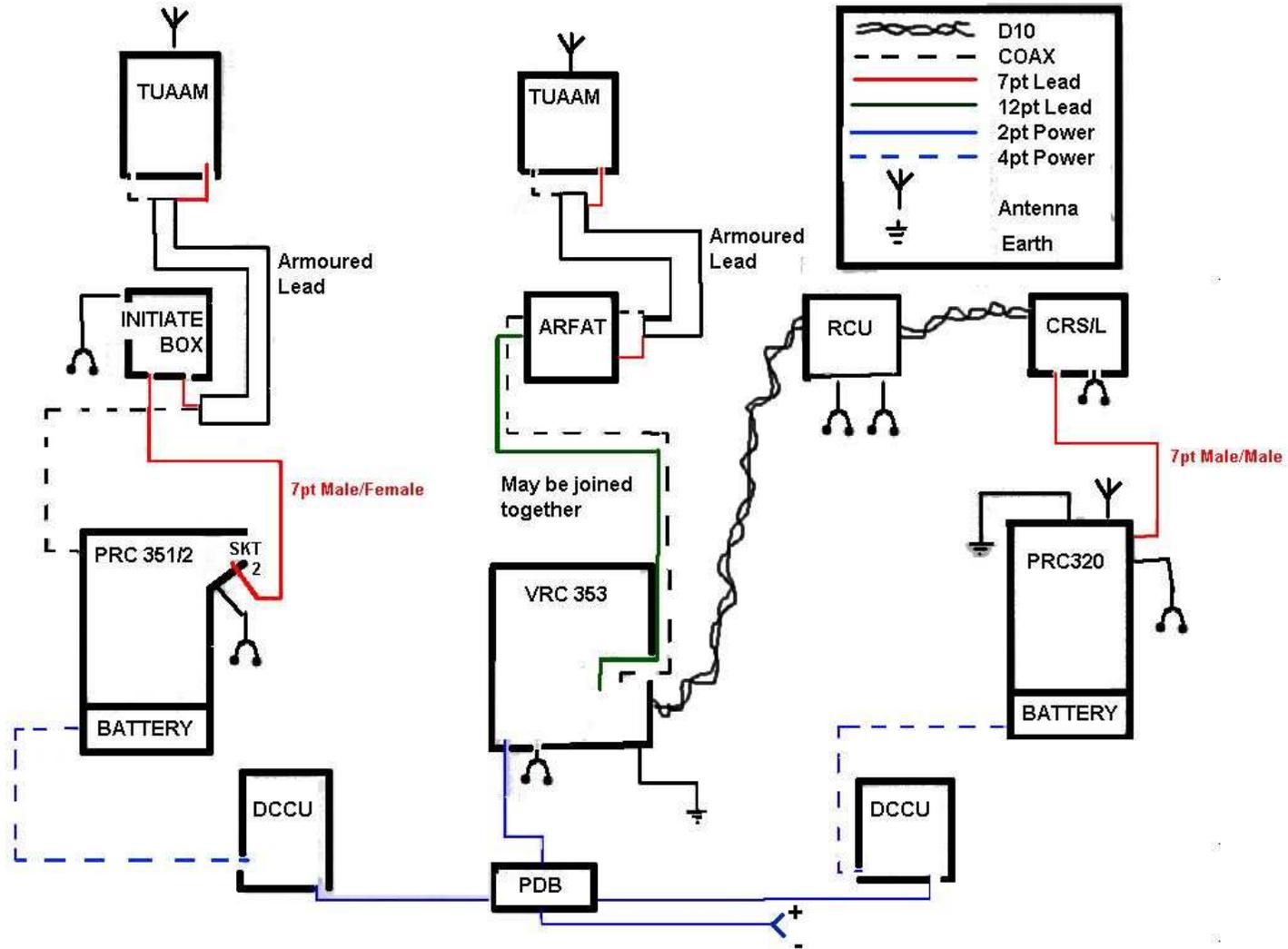
- Entered service 1976
  - Made by Marconi Secure Radio Systems in Fife
  - Designed in Portsmouth
- Coverage 30-75.975Mhz FM
- Selectable 0.1W 1W 15W and 50W
- Could interoperate with Larkspur
- Works with an ATR
- Not a good amateur choice
  - Has motor driven tuning ( problematic?)
  - Rather old fashioned even for its time with a valve PA

# VRC353



# Vehicle Installation Example

## CLANSMAN 'B' VEHICLE INSTALLATION





**ONE SLIDE ON OTHER CLANSMAN  
RADIOS**

# Examples Of Less Useful Radios for the Amateur

- **PRC 319**: built only by MEL ( so unofficial Clansman family member)
  - Man portable, VHF/HF 1.5-40Mhz up to 50W
  - 10 pre programmed channels
  - Fully automatic ATU which can be located < 50 metres from the transceiver using coax
- **PRC 349** : Portable VHF 37 - 46.975Mhz 0.25 watts
  - There are versions with 10Mhz blocks in the band 30-76Mhz, but hard to find



**USEFUL ACCESSORIES FOR THE  
RADIO AMATEUR**

# Accessories

## Clansman Test Set



- Tests PRC 320 /349/ 350 /351/352 VRC 321/353
- Tests :
  - Batteries
  - TX Output Power AM FM CW SSB
  - Rx Sensitivity
  - BNC Cables
- Uses the radio power supply via the connection cable to the radio
- Does a comparison test with a “good radio”

# Accessories

## Clansman Test Set



# Accessories : VRC353 Mast Antenna

- The “Pineapple”
- For mounting on a mast
- Low SWR 30-76Mhz
- Dipole rated at 70W
- But poor performance across the band compared to a band specific antenna



# Accessories -Chargers

- All Batteries NiCad 24 V so chargers are
  - DC Charging Unit ( DCCU)
  - AC Charging Unit ( ACCU)
  - And Hand Crank !!

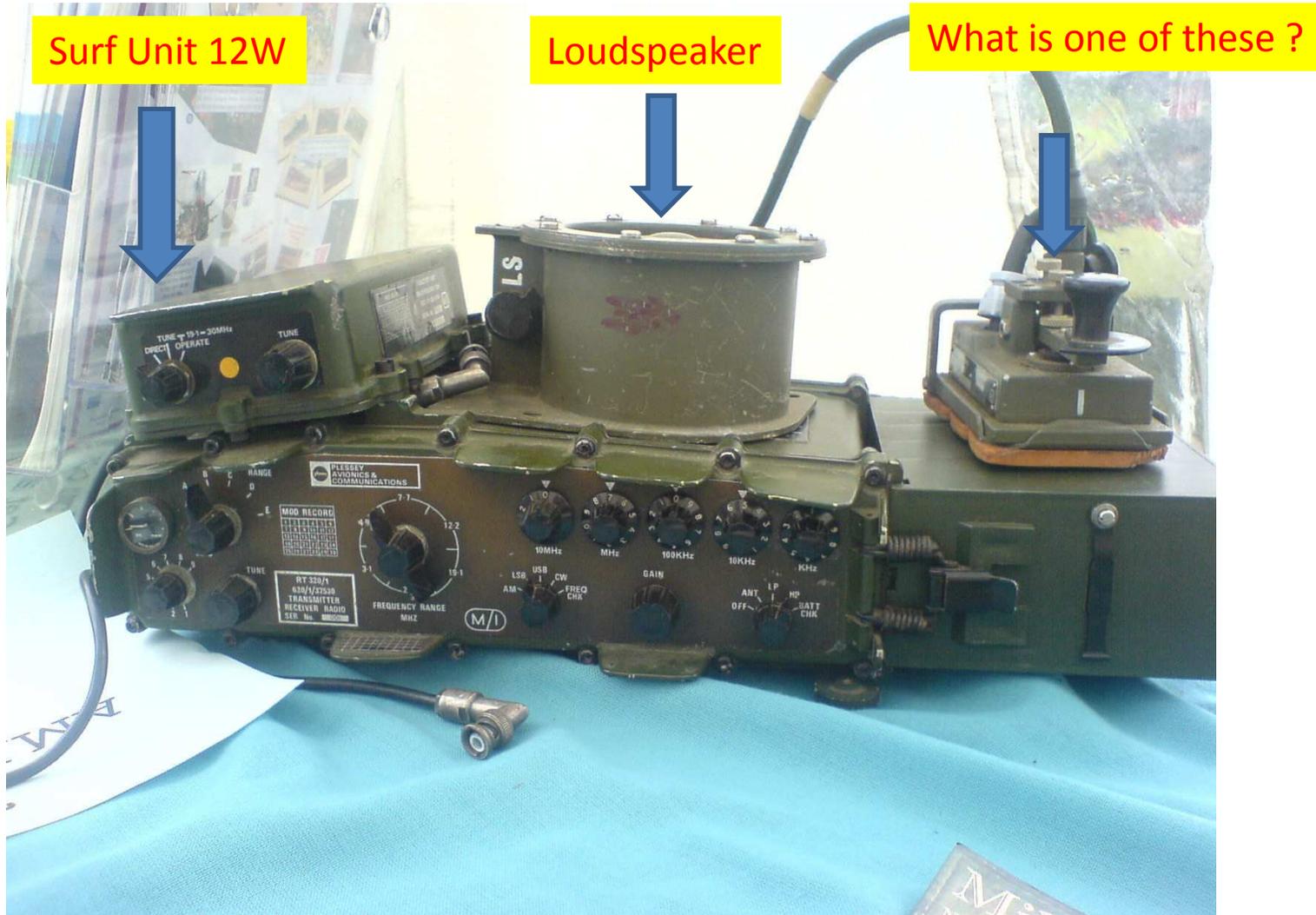


# Accessories - Batteries

- Nicads 24V 4AH, 1AH
- Lithium 28V 16AH,4AH
- DCCU float charged battery  
In vehicle  
Lithium half weight vs Nicad  
But not re-chargeable



# RT320 With Accessories



# Accessories – Adapter Telegraph Radio ( ATR)

- For the RTTY fans !!

- Go retro !

- 750 baud  
on FM

- “Digital” up  
to 20kbps

- Works with  
VRC321

- Can be used  
as a remote  
console with  
headset & CW  
key





**AND FINALLY.....**

# Useful Websites

- <http://www.milradio.com> Good Radio info
- <http://www.vmars.org.uk/> Vintage Military Amateur Radio Society for manuals
- Johnsons of Leeds “off the pile” untested Clansman RT351 and RT320’s for sale
  - [www.johnsonsofleeds.co.uk](http://www.johnsonsofleeds.co.uk)
- <http://www.g0ozs.org/clansman/index.shtml>
- And Of Course The Inevitable.....



# Summary

- PRC 320 and PRC 352 are the best compromise for amateur radio
  - Only touched on some of their features in this talk
- Good performance at relatively low cost
- Still readily available but for how long?
- Great Fun !!!!

**Thanks for Listening.....Any Questions?**

**With thanks to Iain Moffat G0OZS and Mike Berriman W5/G4JBI for allowing use of their images in this presentation and feedback from many members of VMARS**