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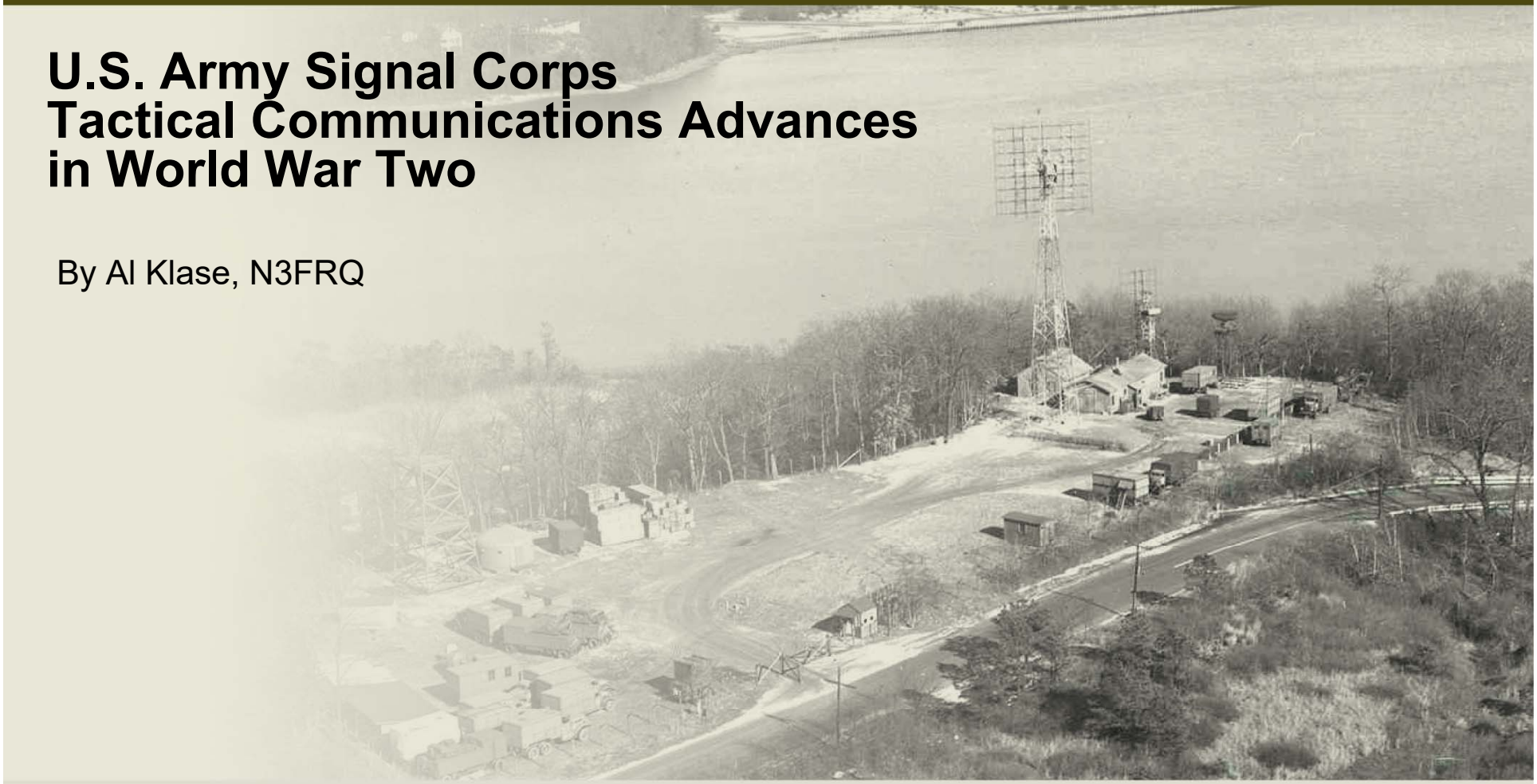
A Science/History Learning Center and Museum

U.S. Army Signal Corps Tactical Communications Advances in World War Two

By Al Klase, N3FRQ



Between the Wars

20 Years of Radio Progress

AM

SW

FM

TV

Technical Progress

- Improved and miniaturized vacuum tubes
  - –Smaller
  - –More rugged
  - –Better HF-VHF performance
  - –Support for portable applications
- Frequency Modulation to beat the noise
- Quartz-crystal frequency control

Enabling New Tactics

- Maneuver Warfare - *Blitzkrieg*
- Close-in Air Support
- Radio-Equipped Infantry and Paratroopers

The Electro-Magnetic Spectrum

- MF: 300 KC – 3 MC (1000 – 100 meters)
  - Occupied: Broadcast, Marine, etc.
  - Antennas too large for portable/mobile use.
- HF: 3MC – 30 MC (100 – 10 meters)
  - Early tactical radios CW and AM in 3 - 6 MC range.
  - Limited spectrum space. Atmospheric Noise
  - Sky-wave propagation a double-edged sword.
- VHF: 30 – 300 MC (10 – 1 meters)
  - 10 times more space
  - Low noise
  - Line of sight propagation keeps things simple.
  - Circuit performance and stability are problems
  - An ideal environment for FM.

Development of U.S. Army field radios during WWII

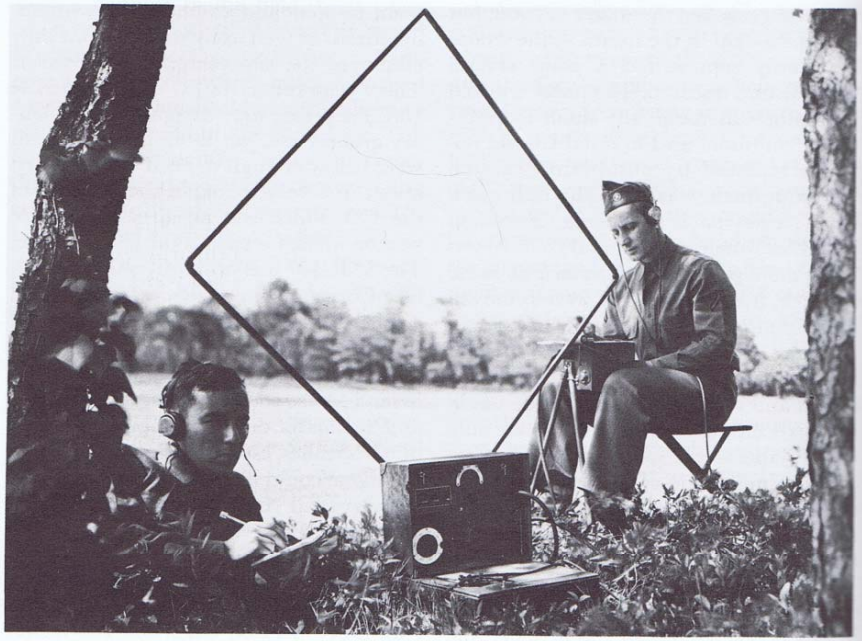
- Transportable Radios
- The Squad radio
- Man-packable Radios
- Mobile radios

Transportable Radios

Early Transportable

- **SCR-131** Field Receiver-Transmitter (BC-148)
  - Infantry and Cavalry, 4-4.36 MC (orig. 0.545-1.75), powered by dry batteries and GN-35 hand generator; LP-7 loop antenna for sending and receiving;
- **SCR-161** Field Receiver-transmitter (BC-151)
  - Artillery nets, 4.37-5.1 MC version of SCR-131
- **SCR-171** Field Radio Set (BC-156)
  - Ground to Air or Division Headquarters, 2-3 MC

- 1-Tube 5-watt transmitter
- 3-tube regenerative receiver
- Tunable
- CW (Morse code) only
- Range: 5 miles



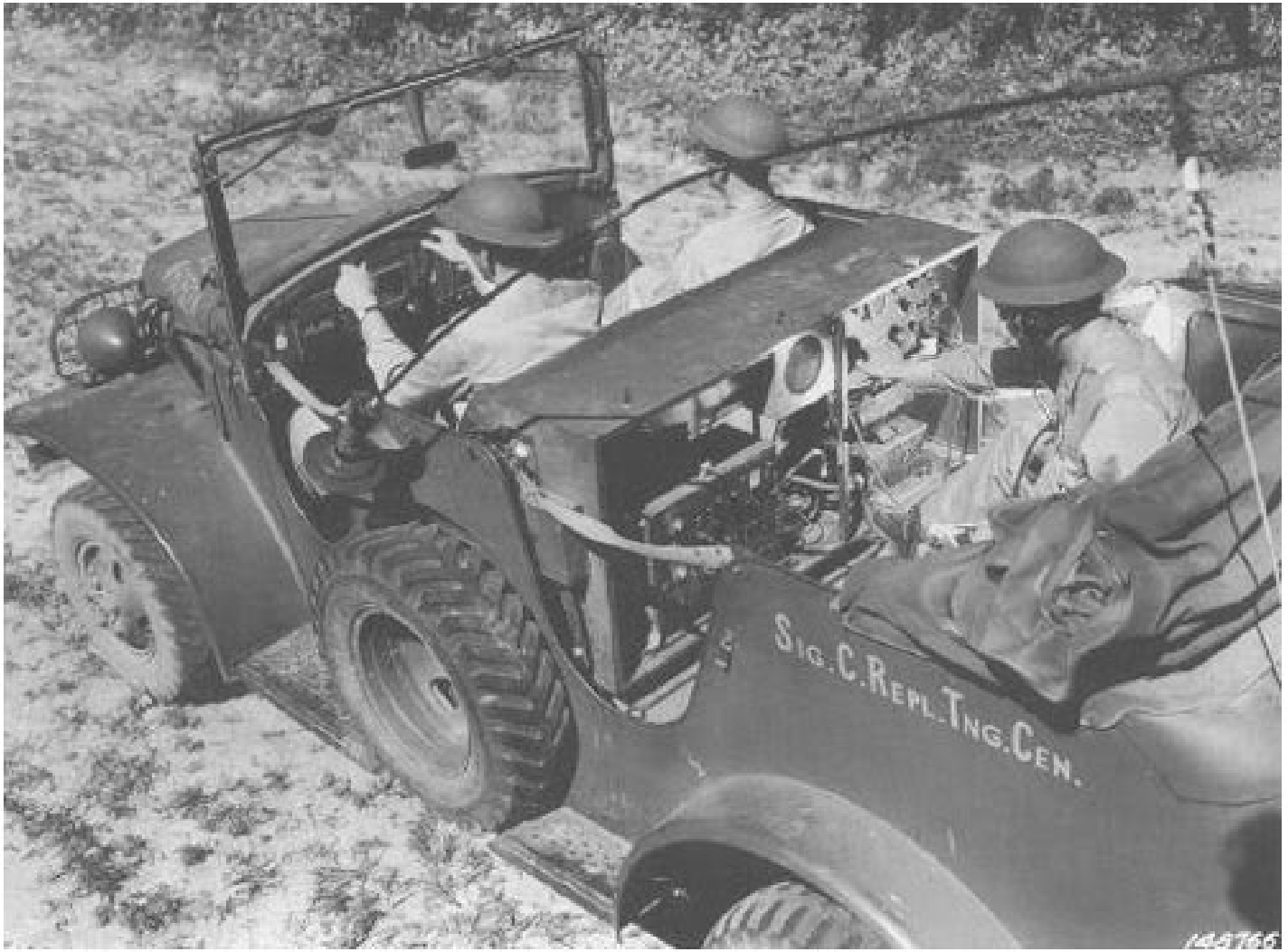
THE SCR–131 *in operation at Fort Monmouth in 1941.*

Transportable ca.1941

SCR-177B: BC-191transmitter, BC-312 & BC-314 receivers; 1941. MF and HF, AM and CW

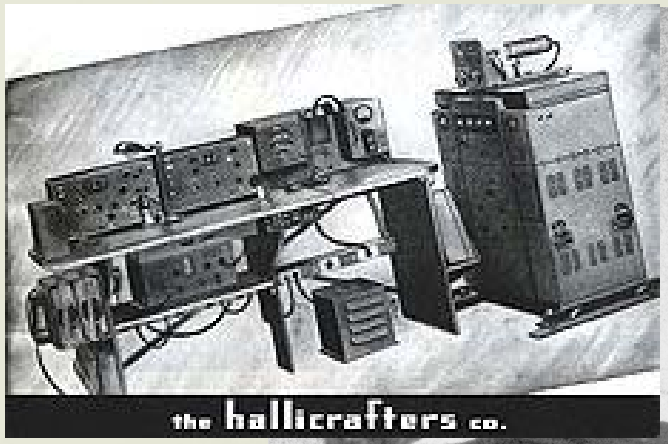
SCR-245

- BC-312 RX
- BC-322 TX
- 2-5.8 MC
- 25 watts
- AM-CW



AF-I 100 Miles on the Move!

- SCR-299 by Hallicrafters
- Spring 1942



14,700 Units Produced

Vortex Joe with his BC-610

Squad Radios

Close-in coordination for infantry and airborne troops

The Walkie-Talkie

- **SCR-194** Radio Set (BC-222), 28-52 Mhz (artillery)
- **SCR-195** Radio Set (BC-322), 52-65 Mhz (infantry)
- Designed at SCL - Ft. Monmouth
- Early ‘30’s ham-radio technology
- 2 tubes, Super-regenerative Receiver
- 1-mile range
- Requires a skilled operator
- Fragile antenna
- Introduced 1935
- 20,000 units produced

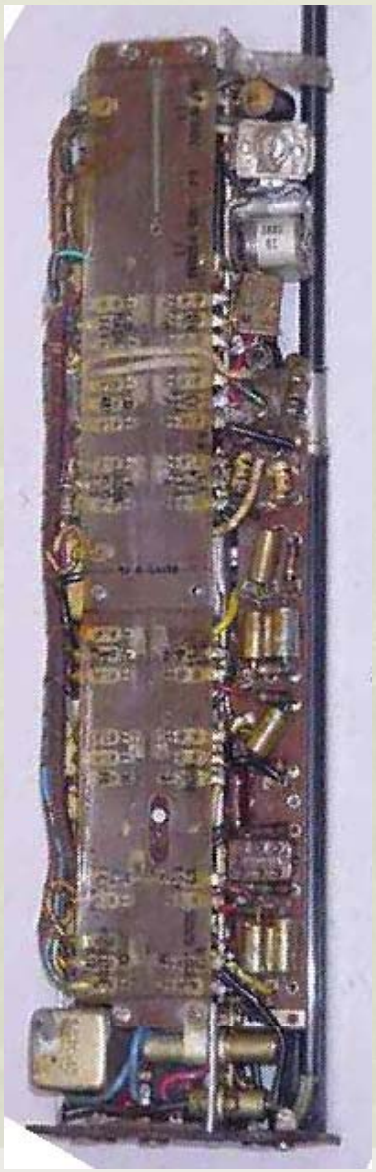
SCR-536 (BC-611)

The Handi-Talkie SCR-536 (BC-611)

Galvin Corp. – early 1942

- Frequency coverage: 2.0 - 6.0 mc
- Crystal controlled – 1 Channel
- Type of signal: AM , voice
- Type of receiver: superheterodyne
- Power Output: 0.3 watts
- Tubes: 5
- Weight: 5 pounds
- Range: 1 mile +

206,000 units produced



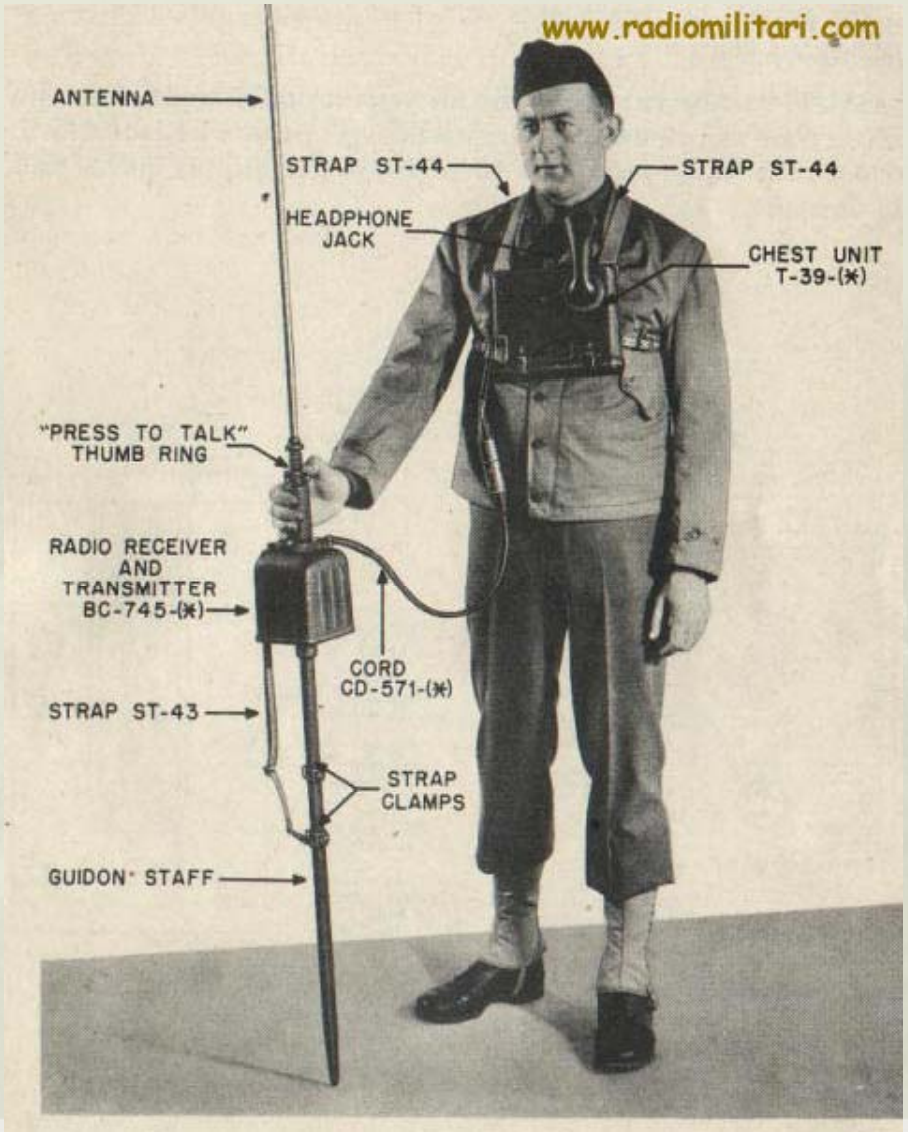
The “Guidon” Set (The Horsie-Talkie)

The Horsie-Talkie SCR-511 (BC-745)

Galvin Corp. – mid 1942

- Frequency coverage: 2.0 - 6.0 mc
- Crystal controlled
- Type of signal: am , voice
- Type of receiver: superheterodyne
- Power Output: 0.75 watts
- Range: 5 miles (?!)
- Tubes: 3 x 1T4, 1 x 1S5, 5 x 3S4
- Power Supply: with BA-49 or BB-54

24,000 units produced



The Horsie-Talkie SCR-511 (BC-745)

Man-Packable Radios

Medium- to long-range communications for those on foot.

SCR-284 (BC-654)

- Crosley Corp. – Intro 1942 – Lagging Development
- Frequency Range 3.8-5.8 Mc
- Type of signal: AM or CW
- Range: 10 to 15 miles
- Power output: 25 W CW, 12 W AM
- Vehicle mount or pack transportable
- 3-man carry: 55 pounds each
- 64,000 Produced

SCR-288 (BC-474)

- RCA , 1st Signal Corps delivery1941 – The Swedish Sets, MI-8751
- Frequency Range 2.5-6.3 Mc
- Type of signal: AM, CW
- Range: 8 to 15 miles
- Power output: 5 W
- Frequency Control: VFO
- 2-man carry: 35 pounds each
- 24,000 Produced

SCR-694 (BC-1306)

- Intro 1944
- Frequency Range 3.8-6.5 Mc
- Type of signal: AM, CW, MCW
- Range: 10 to 15 miles
- Power output: 25 W CW, 12 W AM
- Frequency Control: 2 crystals + VFO w/200 KC calibrator
- Vehicle mount or pack transportable
- Water tight
- 3-man carry: 35 pounds each
- 24,000 Produced

Mobile Radios

Early Mobile

Frequency Modulation

Yet another radio miracle from Edwin Howard Armstrong!

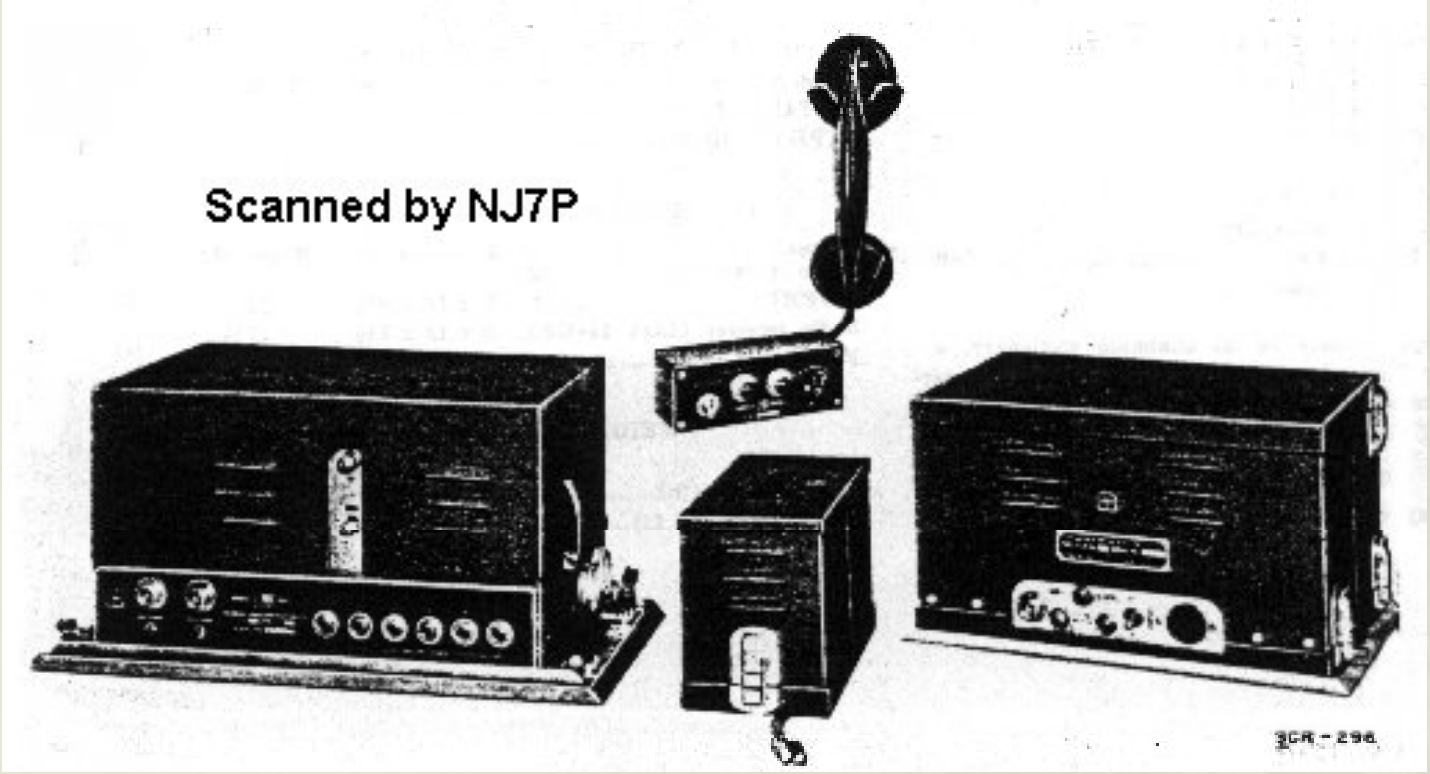
- Regeneration
- The superheterodyne
- Super-regeneration
- FM

ARMSTRONG FAMILY ARCHIVES

- Overcomes ignition and atmospheric noise.
- "Capture effect" suppresses interference from weaker stations.
- "Squelch" keeps radio quiet in standby mode.

Early FM Mobile SCR-298

- Mobile FM Radio Set, early, 30-40 Mhz, 35 W
- Based on Link 25-XMTR police-car set used by CT State Police



“We’re all through with radio; hereafter we want communications.”

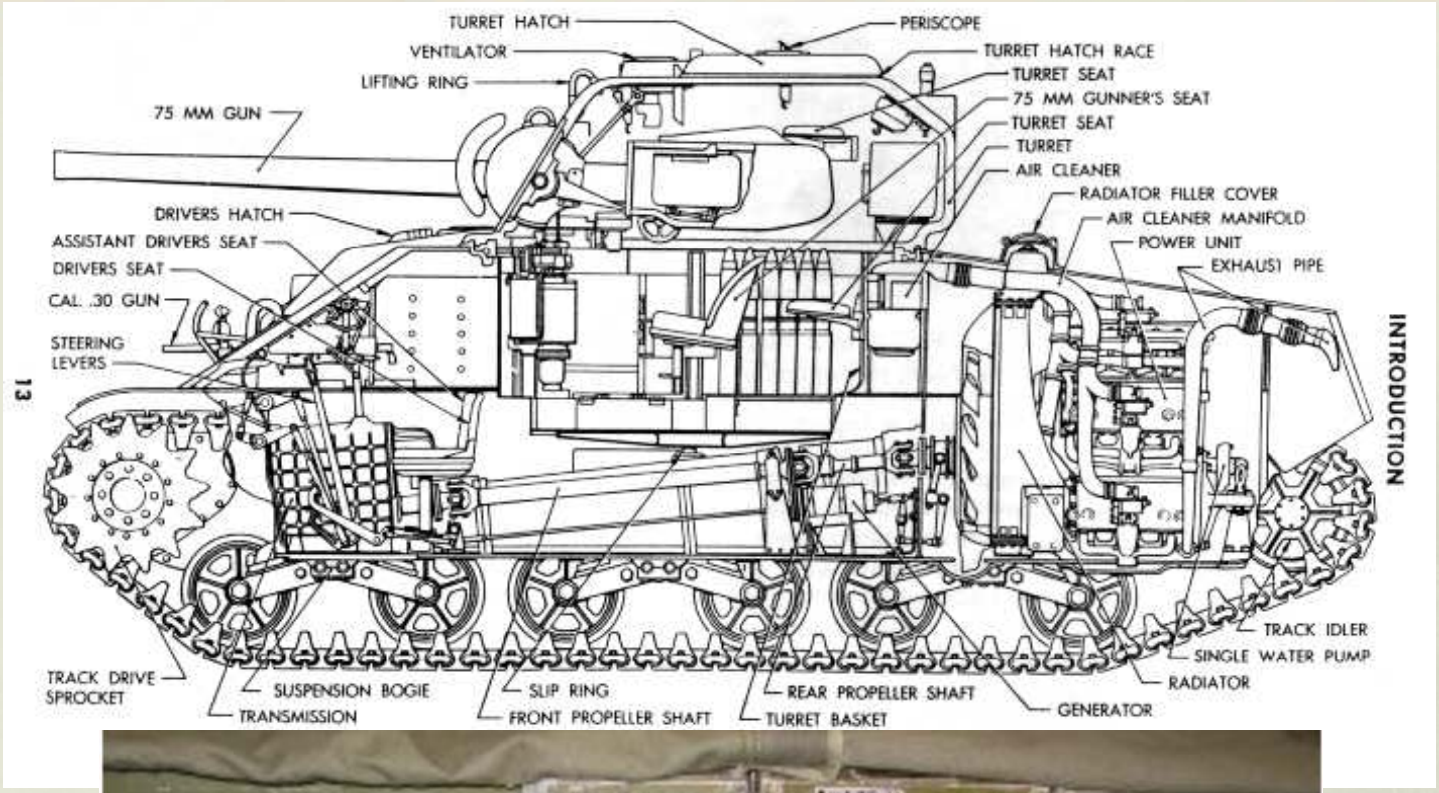
– Col. James D. O’Connell of the Signal Corps Laboratory, after evaluating the performance of 2-way mobile FM radios in pre-war maneuvers.

SCR-293/294

- **SCR 293 (TX-RX) – SCR-294 (RX only)**
- Link Corp.
- Frequency range : 20 to 27.9 MC
  Frequency control : Crystal
  Power output : High 25 Watt, Low ½ Watt
- Principal Components:
  Transmitter/Receiver BC 500
  Receiver BC 499
  Mounting FT-239
  Antenna AN-42
- 138 SCR-293's and 554 SCR-294's delivered by January 1942.
- First FM radios in combat (North Africa late 1942)

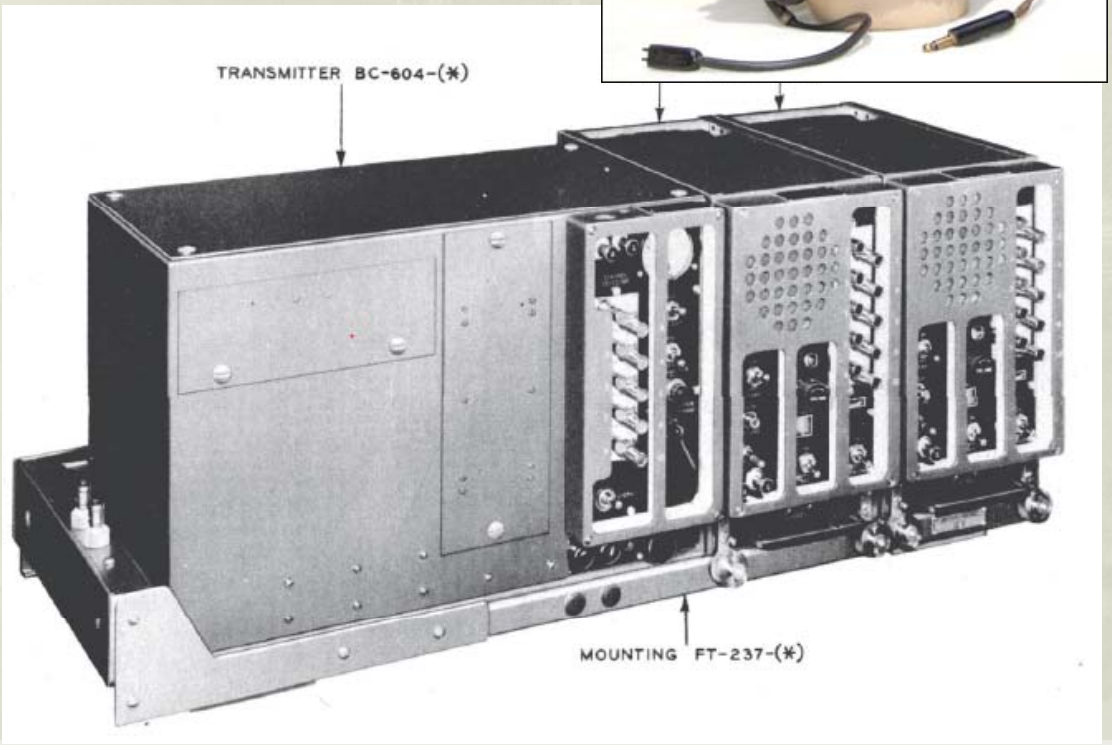
AF-III FM Tank Radios

M-4
“Sherman”



SCR-508/528 FM Tank Radios

- Western Electric Co
- Frequency Range:
  - SCR-508/528 - 20.0 to27.9 Mc (Armor)
  - SCR-608/628 – 27.0 to 38.9 MC (Artillery)
- Type of signal: FM voice
- 10 push-button channels
- Range: 10 to 15 miles
- Power output: 30 W
- 100,000 Produced



AF-IV The “Jeep” Radios

- SCR 509/510 : 20 to 27.9 MC
  SCR 609/610 : 27 to 39.9 MC
- Developed at SCL, Mfg. Galvin
- Portable & vehicular versions
- Type of signal: FM voice
- 2 Channels – xtal control
- Power output: 1 watt
- Range: 5 miles
- 162,000 Produced

SCR-300 (BC-1000) FM Back-pack Set

SCR-300 (BC-1000)

Galvin Corp. – Entered service 1943

- Frequency coverage: 40-48 mc
- Tunable w/ crystal reference
- Type of signal: FM , voice
- Power Output: 0.3 watts
- Tubes: 18
- Range: 10 miles w/long (10 ft.) antenna
- Weight: 32-38 pounds
- AN/VRC-3 Mobile version

88,000 units produced

- Shift from Morse code to voice.
- Crystal control avoids confusion
- Emergence of the squad radio
- VHF FM becomes the dominant field-radio technology.