# Radios Shrink In Size, Not In Power

**Radios for tactical and non-tactical military applications are getting smaller with a growing number of functions in support of portable voice, data, and video communications.**

MILITARY RADIOS were once associated with large backpacks full of heavy electronic equipment, all of which yielded limited operating functionality and reliability. But as wireless communications has advanced in the form of lightweight cellular telephones for civilians, it has also evolved into compact, highly reliable and secure portable radios for the battlefield—whether said battlefield happens to be on land, at sea, or in the air.

Tactical radios have incorporated antijamming functions, frequency hopping, software-defined-radio (SDR) technologies, and various battery/power technologies to enhance usability and reliability. What follows is a sampling of some of the newer portable and man-pack radios for tactical use and other critical applications, such as search-and-rescue (SAR) operations, along with some of the technologies supporting these radios.

A firm long synonymous with tactical portable radios (as well as the cellular telephone), Motorola, has helped push the evolution of battlefield radios as much as any company. At present, Motorola Solutions USA (www.motorolasolutions.com) is encouraging its radio designers to make use of commercial-off-the-shelf (COTS) components in their radio products to achieve performance and reliability levels needed for the battlefield at reduced costs.

As an example, the SRX 2200 combat radio is built for the battlefield with COTS components but is also backwards- and forwards-compatible with all of the firm's mission-critical radio systems. It also meets the latest Project 25 (P25) standards (www.p25.com) for interoperability. P25 is a suite of standards for digital radio communications in North America that allows different government agencies to communicate. It is somewhat similar, although not interoperable, with the European Terrestrial Trunked Radio (TETRA) protocol used in Europe.

Using COTS components and technology, the SRX 2200 *(Fig. 1)* is designed for use in the harshest environments. It includes a receiver with 80-dB dynamic range, is compliant with US Department of Defense (DoD) standards for APCO waveforms and encryption, and meets Federal Information Processing Standard (FIPS) 140-2 Level 3 security for use in the most sensitive environments. The radio offers a full suite of communications-ready features and applications, such as secure encrypted voice and text messaging and over the air programming (OTAP), a tactical over-the-air-rekey (OTAR) function, and individual location information (ILI). It meets MIL-810 specifications and



1. The model SRX 2200 combat radio is built for the battlefield with COTS components. [Photo courtesy of Motorola Solutions (www.motorolasolutions.com)]

exceeds the IP67 submersion specification (allowing it to be submerged under 2 m of water for 2 hours).

Another name strongly connected with tactical radios is Harris Corp. (www.harris.com). The firm recently received orders from the US Air Force for Falcon III AN/PRC-117G multiband man-pack and AN/PRC-152A multiband handheld tactical radio systems *(Fig. 2)*. These wideband radios will help provide wideband networking capabilities to a wide range of US Air Force users.

Both radios are equipped with the Harris Adaptive Networking Wideband Waveform, which is designed for interoperability among a wide range of radio systems and software applications. The radios are also certified to operate with the Joint Tactical Radio System (JTRS) waveform and can also work with SINCGARS, HAVEQUICK, and P25 waveforms for secure tactical use.

The AN/PRC-152A is truly a multiband radio, with traditional amplitude-modulation (AM) and frequency-modulation (FM) coverage from 30 to 512 MHz (12.5 to 25.0 kHz for narrow band) and 1.2 MHz for wideband operation with networking waveforms from 225 to 450 MHz. It uses 5-W transmit power for line-of-sight (LOS) use and 10-W transmit power when working in satellite-communications (satcom) mode. The radio can also test signals from 762 to 870 MHz with 10-Hz tuning resolution across all of the frequency ranges.

George Helm, president

of Harris' US Department of Defense business unit, elaborates: "Harris' Falcon III radios provide secure voice communications and enable operators to send and receive images, video, e-mails, text messages, and even participate in teleconferences." He adds: "The Air Force is deploying our JTRS-certified radios to provide two-channel communication capabilities. JTRS-certified wideband networking allows users to connect seamlessly to the Global Information Grid, a secure, classified version of the Internet." The company has shipped more than 40,000 AN/PRC-117G and AN/PRC-152A radios to all branches of the US military and to more than 15 allied nations.

Boeing (www.boeing.com) has worked closely with the US Air Force to support its combat survivor evader location (CSEL) program, with a new multifunction handheld radio designated the AN/PRQ-7. It transmits on at least 121.5, 243.0, and 406.025 MHz (the COSPAS-SARSAT satellite tracking SAR system). The radio system also receives Global-Positioning-System (GPS) signals. The radio is designed to securely communicate position and text messages via a data link through the CSEL UHF SATCOM network.

The AN/PRQ-7 portable radio is software programmable and upgradable and can receive over-the-horizon (OTH) waypoints and text messages. It includes NSA-certified encryption and decryption of LOS and OTH messages. The radio, which works with a wideband flat blade antenna, is rated to withstand 10-m liquid submersion and operating temperatures from −20 to +55°C. It is tested to MIL-STD-810 requirements and weighs only 32 oz. with its rechargeable battery. It includes four UHF/VHF guard channels for voice transmissions.

The US Army recently designated the two-channel AN/PRC-155 man-pack tactical radios for inclusion in its Capability Set (CS) 14, a package of radios, satcom systems, software, and

2. The AN/PRC-152A is truly a multiband radio, with total frequency range extending from sections of 30 to 870 MHz. [Photo courtesy of Harris Corp. (www.harris.com)]

portable electronic devices for network communications.

The two-channel AN/PRC-155 radios from General Dynamics C4 Systems (www.gdc4s.com) and Rockwell Collins (www.rockwellcollins.com) will provide wireless connections to the Soldier's Network, which includes a Warfighter Information Network-Tactical (WIN-T) link and other capabilities. The radio is part of the US Army's modernization plan and will provide secure network communications in ground-based and airborne vehicles.

The Army is also in the process of making a transition from its former SINCGARS radio technology to JTRS radios, such as the widely fielded PRC-148 multiband inter/intra team radio (MBITR) tactical radio from Thales Communications (www.thalescomminc.com). Operating from 30 to 512 MHz, this compact radio system hosts all modern tactical core waveforms and is certified by the NSA to protect the confidentiality of voice and data up through the Top Secret level. The JTRS-

approved radio features programmable INFOSEC interoperability with a wide range of legacy radio systems. It is upgradable by means of software and is also available in a vehicle-mounted version.

Some radios for tactical and government are designed for use outside of the normal frequency bands and are targeted for integration within larger systems, such as the Spartan M13 Series of data-communications board-level radios from FreeWave Technologies (www.freewave.com). They are as small as 106.7 × 50.8 ×14.1 mm for a serial board-level radio and designed for use at operating temperatures from −40 to +75°C. These compact radios (Fig. 3) work from 1.350 to 1.390 GHz with user-selectable data rates of 115 or 153 kb/s. They offer transmit power levels from 20 mW to 1 W and can achieve LOS communications at distances to 60 miles.

The board-level radios offer seven user-selectable frequency-hopping bands and operate with occupied bandwidth of 230
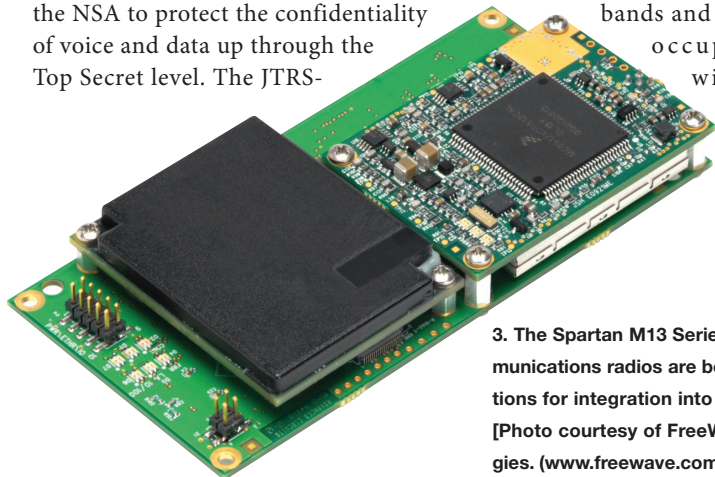


3. The Spartan M13 Series of data-communications radios are board-level solutions for integration into larger systems [Photo courtesy of FreeWave Technologies. (www.freewave.com)]
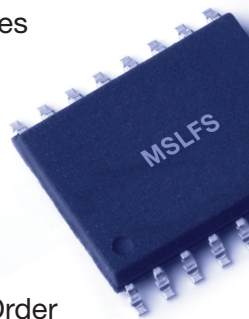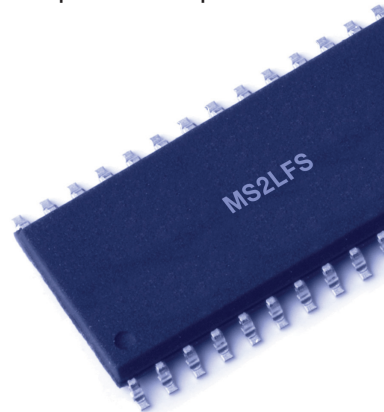
kHz. With their small size, they are ideally suited for applications in unmanned aerial vehicles (UAVs) and unmanned ground vehicles (UGVs) where saving size and power are concerns. They include 32-b cyclic-redundancy-check (CRC) error detection for reliable data transmissions and FIPS 140-2 Level 2 encryption.

At lower frequencies, the Centaur Light Weight VHF Portable (LWVP) Radio from Excelis Inc. (www.excelisinc. com) is a lightweight tactical radio that operates within the 30- to 88-MHz band and is backwards compatible with existing analog radios. It measures a mere 44 × 94 × 194 mm and weighs just 0.9 kg, but can handle voice and data communications at rates to 16 kb/s. It achieves transmit power levels to 5 W, is resistant to jamming and interference, and includes an embedded GPS receiver and IP router. It is designed for operating temperatures from −40 to +71°C.

Some secure radio solutions are meant for applications outside of the battlefield, such as the VHF (112 to 156 MHz) and UHF (225 to 400 MHz) R&S Series 4200 SDRs from the Radiocommunications Systems Division of Rohde & Schwarz (www.rohde-schwarz. com), which target military and civilian air-traffic-control (ATC) systems. Both radio lines provide as much as 50-W output power.

The radios operate with 8.33- or 25.0-kHz channel spacing at VHF and 8.33-, 12.50-, and 25.00-kHz channel spacing at UHF. They include receivers with the capability of detecting simultaneous transmissions to alert an air traffic controller. These radios allow as many as seven Voice-over-Internet-Protocol (VoIP) sessions to be established within the receiver or transmitter, and the radio can be connected to as many as two VoIP voice recorders simultaneously.

These radio systems provide the security required for battlefield operations, but not always associated with applications such as air control. With growing concerns about civilian air-traffic control integrity, they provide numerous "fail-safe" features that prevent signal jamming and interception.

While these are radios that are extremely helpful to military users, they are also reminders that military radios find uses in many applications above and beyond the battlefield and that current trends for improving reliability, economy, and interoperability for different types of military radios will serve many difference branches of the military in many different applications. **de**