Satellite Communications

Satellite units offer new capabilities for soldiers.

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The $170 million, five-year award made by USSOCOM in August is expected to yield over 1,000 L-3 Communications GCS Panther Flyaway VSAT Terminals in Ku-, Ka-, and X-band entering service. This program, USSOCOM's Special Operations Forces Deployable Node-Lite (SDN-Lite), represents the state of the art today.

But what is being planned for tomorrow in terms of finding the mobility required for small teams needing communications on the move, at sufficient bandwidth to support the right mix of critical applications that will change from deployment to deployment and mission to mission?

ITT

ITT's most recent embarkation into flexible, mobile satellite communications (SATCOM) gear has been through the Distributed Tactical Communications System (DTCS) program, originating out of Naval Surface Warfare Center Dahlgren. This uses the Low Earth Orbit Iridium satellites for long range beyond-line-of-sight (BLOS) communications using a small, rugged handheld device that is very much a 'military radio' designed from the start for the field, rather than an Iridium phone on steroids. DTCS grew out of the earlier ETCS program, better known as Netted Iridium. To meet the DTCS requirement, ITT worked with Dahlgren to produce the company's RO Tactical Radio now being fielded.

Dario Valli, director, business development at ITT CS Commercial Wireless Solutions, explained, "In the past year, we have gone from productionizing it to building over 6,000 radios in 2010 for U.S. forces in theater."

The battlefield role of DTCS is modest in terms of bandwidth capabilities, but nonetheless significant with the 'swarms' of RO Tactical Radios complementing single, at the halt larger-capacity manpacks or flyaway solutions in the field.

Valli said, "It is in a small, handheld form factor, similar to personal radios that users are operating today but with over-the-horizon capabilities to 100-200 miles. The unique feature of the RO Tactical Radio is that it will provide position locations of that user, if so desired, and then push that up, so high level commanders can actually see the location of forces."

One of the great advantages, according to Valli, is the device's ability to support disadvantaged users such as small units, those who are particularly challenged in terms of the availability of advanced communications capabilities such as high capacity communications at long range.

"We now have small units that have significantly greater areas of operation than have historically been the case," he noted.

"Platoons are operating in very large areas of operations and at … significant distances from their headquarters. Previously they have not had the robust communications in such a small form factor to be able to reliably reach back, particularly if they are on the move. The RO Tactical Radio changes all that."

As the program matured, DTCS responsibility and oversight has naturally switched from Dahlgren to the Defense Information Systems Agency (DISA). DISA has the existing overall responsibility for managing government services on the Iridium DoD gateway. There are two parts to DISA's work; one is developmental—looking at spiral development opportunities—and the second part handles the day-to-day operation and management of the system and the activation of services.

There is no limit on the number of radios on the net. The only limitation is that it is just like any other push-to-talk radio: one person talks and everyone on the network can listen.

Discussing how the radio might be used operationally, Valli said, "In Afghanistan right now, traditional line of sight communications will not provide the kind of communications that units need, whether they want to reach back to a higher headquarters or even within a small platoon that is … starting to move into a valley. You have squads operating independently that can't talk to their buddies on the other side of the ridgeline because of LOS issues. Now they can."

Valli explained that program offices are now looking at the DTCS architecture for inclusion in their long-term plans for C2 architectures. Using the underlying technology, ITT has also created small form factor beacons that push critical information to and from the user.

ITT is finding additional ways to exploit

the capabilities of the radio by listening to initial feedback from users, and then working on design enhancements to exploit its ability to receive and push data.

Raytheon

Raytheon successfully completed integration and government acceptance of Phase 1 Integrated Waveform (IW) on its AN/PSC-5D Multi-Band/Multi-Mission Communication Radio terminal as well as on the AN/PSC-5C Shadowfire man-portable and AN/ARC-231 airborne radio terminals in late 2009. David Libbing, business area manager for multi-band radio systems, part of Raytheon Network Centric Systems, explained that Raytheon is currently about 60 percent through implementing IW Phase 2 in these systems. The company expects to complete government acceptance of IW Phase 2 by early next year.

The IW is a TDMA (Time Division Multiple Access cell phone technology) waveform, which allows dynamic control of the number and access of circuits on the available channels—creating more efficient use of channel bandwidth as compared to the previous SATCOM fixed circuit channel structure. It allows controllers to tightly load circuits in the SATCOM channels for maximum throughput. This has resulted in as much as a three to four times increase in the number of circuits available on a given SATCOM channel.

The Phase 1 IW implementation supports pre-assigned services, and Phase 2 will extend the services to include demand assigned services. Libbing said, "The way to think about Phase 1 versus Phase 2 is with Phase 1, terminal users need to request SATCOM channel access prior to their mission (pre-assigned service); in Phase 2, terminal users can request channel access on the fly (demand assigned service) if their mission requires it."

The AN/PSC-5D, AN/PSC-5C and AN/ARC-231 radios are a family of terminals known as the Fireseries. Currently all the Fireseries terminals are on a growth path to include crypto-modernization and implementing hardware (HW) and software (SW) to host the Mobile User Objective System (MUOS) UHF SATCOM waveform.

Libbing said, "There are over 12,000 PSC-5D and over 6,000 PSC-5Cs in the field across the various services/commands. We are working closely with those key elements to leverage both government and Raytheon investments to achieve success on a couple of major modernization efforts. Raytheon has ongoing programs that directly affect SATCOM terminal crypto-modernization and MUOS waveform terminal implementation. We are trying to leverage programs of record to reduce the cost and minimize the schedule risk associated with new technology insertion for both the government and Raytheon. This is being achieved through applying common architectural approaches to HW and SW developments to achieve 'technology portability.' Once you have established this portability, leveraging technology insertion across the similarly upgraded modules in Fireseries products is manageable and lower-cost. The 5D and other Fireseries family terminals have shared this common architecture in the past and this will continue in the future. This … approach is key for rapid capability insertion to support the changing user demands in the battle space."

Along with the MUOS and crypto-modernization efforts being worked to deliver secure modern BLOS SATCOM, Raytheon is also actively pursuing pre-planned product improvements (P3I) efforts that are focused on integrating networking (wideband waveforms) and other capabilities into their terminals. These waveforms could be proprietary or ported from government repositories like the Joint Tactical Radio System Joint Program Executive Office SW library.

Libbing acknowledged that there are published schedules for MUOS "capability" fielding, but he believes that there are still considerable challenges that could impact fielding dates. Some questions still exist on the terminal development side with regard to terminals and system configurations and their ability to achieve effective size, weight and power solutions for the warfighter. Some of those details that aren't so clear affect specific form factors or ancillaries targeted for development (handheld, manportable, airborne, etc.). So when will a MUOS capability be sufficiently mature on both the satellite and terminal side to be fielded?

"On that subject, my gut tells me the current projected dates could slide to the right some," Libbing said. "How far schedules may slip will depend on how well information is shared by waveform developers and terminal developers. The challenges with MUOS capability are not just terminal questions. It is a total radio satellite system question. For instance, the MUOS system's full duplex and spectral adaptation requirements drive system level design challenges into everything from amplifiers and filters to the overall system routing approach for antennas, radio frequency (RF) switching, low noise amplifiers and more. All the necessary hardware involved has to go somewhere, and that is the challenge system developers face when trying to minimize the [size and weight] of any unit going to the field."

CapRock

CapRock Government Solutions' X-band man-pack unit is the latest in lightweight SATCOM equipment for highly mobile remote users. As a reseller of the X-Band microsat unit, designed and manufactured by Tampa Microwave, CapRock offers government customers one of the most innovative and user-friendly microsat terminals on the market. The combination of lightweight design, fan-less cooling system, and simple set-up and operation combine to meet the needs of modern-day missions.

Peter Semenach, director of product development, noted that "today's SATCOM users are looking for the next generation systems capable of high bandwidth transmission in a compact form factor. In a soft case configuration, the CapRock Tampa terminal weighs only 31 pounds. This is one of the most compact systems on the market with a tremendous amount of capabilities," Semenach said.

He sees the man-pack as illustrative of the next generation of high capacity terminal designs. "The man-pack terminal is well-suited for highly mobile units such as special operations, as well as conventional forces from various combatant commands," Semenach said.

Perhaps the most significant feature of the terminal is its ability to offer increased reliability through the use of a fan-less design.

"Many competitors' products in the man-pack market all have cooling fans, while the CapRock terminal boasts a fan-less active cooling system," Semenach said. "This increases the overall reliability of the unit while eliminating any noise associated with other systems. The terminal is also fully sealed to ensure that the key components are isolated from any harsh environmental conditions."

The user interface to set up and operate the terminal also is designed for nontechnical, incidental users rather than trained satellite technicians.

"Some units on the market offer fully motorized auto-acquire systems. These systems add weight, complexity, and multiply the number of systems that could fail in the field," Semenach explained.

"The Tampa unit has a very simple-to-use interface that guides incidental operators through the set-up and pointing of the terminal. This is accomplished using a clever and well thought out software interface designed by Tampa Microwave." When the terminal is powered up, the software immediately guides a nontechnical user through the steps needed to get the terminal operational.

CapRock is currently offering the Tampa microsat terminal as part of its CommandAccess service. "We provide X-band subscription services using commercial X-band satellite providers, coupled with innovative field terminals such as the one designed by Tampa Microwave. The final service package is a fully engineered end-to-end solution for the customer," Semenach said.

Semenach was eager to partner with Tampa Microwave because of the company's expertise. The core of its business has traditionally been manufacturing specialty radio frequency components. "It's one of the keys to what they do best. They don't just buy off-the-shelf components and stuff them in a small box. This terminal is a highly engineered system, including the RF. I have seen it on the inside and it is a very impressive piece of engineering," Semenach said.

The terminal uses an iDirect modem as standard, and has been designed from inception to be a modular system. It consists of two units, the modem unit as well as an RF unit. The iDirect modem is specifically designed for small form factor man-pack solution and the RF unit can be decoupled from the modem.

Future developments for the microsat terminal include an expansion to have multi-band RF capabilities in Ku and Ka-band in addition to the current X-Band offering.

Rockwell Collins

Rockwell Collins received a follow-on order from a SOF element for their miSAT-X man-pack terminal in late 2010. First deliveries of the briefcase-sized unit—which is capable of 1.5-2Mbps, enabling links to networks such as NIPRnet and SIPRnet as well as supporting full motion video transmission—have recently begun.

Keith Gammon, principal product line manager for satcom systems, explained, "It is one of the new generation of man-pack terminals that is ultraportable but also allows you to hit high data rates. It is something that can be taken on SOF-type missions by small, two to four man teams."

This solution is distinguished from others in Rockwell Collins' Flyaway line by the decision not to include the use of the company's CommuniCase modular architecture, which, for example, uses a powered auto alignment system. In contrast, the miSAT-X uses manual alignment. Gammon said, "Because of the size of the terminal, we came up with a manual point system. This allows you to align it in azimuth and elevation easily and within five minutes you can be online. Our CCT-90 and 120 CommuniCase terminal uses auto-acquisition, since trying to point the larger antennas manually would be a bit problematic."

Gammon commented that the use of small teams over a widely dispersed tactical area, hitherto associated almost exclusively with SOF, is becoming more prevalent, with a resulting increase in demand for this type of system

In the Flyaway arena, the CCT-120 and -90 terminals represent the current state of the art for the company. Rockwell Collins has recently received Intelsat and Eutelsat type approval for use with the CCT-120 terminal. Gammon added they are also in the final stages of X-Band certification for use with WGS [wideband global SATCOM], with Ka-band certification close behind.

Current modems supported by both systems include iDirect's Infinity and Evolution, ViaSat's LinkWay S2 and Advantec's Satnet DVB-S2 modem. The addition of the ND Satcom SkyWAN module is also imminent. Conversion between the modems takes a matter of minutes

A systemized solution, built around a 1.2 m Flyaway SATCOM is the recently delivered Joint Incident Site Communications Capability (JISCC), designed to provide a rapidly established and interoperable communications hub for operational use by non-expert users. The trailerized solution, originally developed by Rockwell Collins for the Utah National Guard, is now being used more widely and provides a hub that both links to the various agencies' IT and communications networks used by first responders and related agencies, as well as reaching back to headquarters via SATCOM. JISCC also uses MaxView software to provide a means for remote control and automation for the system using its SATCOM feed.

Gammon said, "With MaxView, people with expertise back at the headquarters can see any errors and trends that might be in the equipment and make the changes necessary directly over the air or tell the people on the ground that they might need to physically swap out a module." ✭

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