March 2009
Vol. 32 • No. 3

JED

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A MAJOR ACHIEVEMENT

In late January, the US Army formally established an EW career field for its officers, warrant officers and enlisted personnel. Over the coming months and years, it will build a community of nearly 1,600 dedicated EW personnel who can work in the EW discipline throughout their service careers. Eventually, the total may grow well beyond 1,600.

Just getting to this point is a remarkable achievement for the Army. Back in early 2006, when the Army began to move in this direction, I heard from several skeptics inside and outside the Washington, DC, beltway who did not think the Army would see this plan through. Some of them dismissed the Army's renewed interest in EW as a politically calibrated response to the growing number of losses from IEDs in Iraq and Afghanistan. But, in this case, the skeptics were proven wrong, as the Army demonstrated that its EW initiative was far more serious than mere political window dressing. The entire Army obviously has learned some tough and enduring lessons in Iraq and Afghanistan. The enemy has spent thousands to the Army's billions and has used RF-controlled IEDs and Vietnam-era shoulder-launched MANPADS to attack lines of communication and supply on the ground and in the air. Current and future adversaries (large and small) will continue to challenge the Army's ability to achieve spectrum control in future operations. And without spectrum control, the Army knows it cannot perform its mission.

I should note that Army EW obviously is not a blank slate. Throughout the Cold War and up through the Global War on Terror, the Army has always nurtured EW expertise in the aviation and intelligence communities. That said, I am very interested to see how Army EW takes shape and what changes will occur from the future influx of EW thinking across the service. Which Army commands will stand up EW offices? Will there eventually be a program executive office just for EW? Will TACOM take a fresh look at integrated multispectral EW suites for its ground vehicles now that IED jammers have proved their value in combat?

Another interesting question is, How will Army EW evolve in the joint world? In fact, when you consider the history of Joint CREW Composite Squadron – One (JCCS-1), it is fair to say that some aspects of Army EW have evolved *from within* the joint world. The Army has learned and will continue to learn a lot about EW from the other services. What is important to keep in mind, however, is that Army EW is not Air Force EW or Navy EW. It has a lot in common with Marine Corps EW, but the two are not the same, either. Generally speaking, the Army's EW target set is different from that of the other services. The Army is very focused on attacking an adversary's command and control networks, and I think this fact will drive a lot of synergy between EW and cyber in Army operations. Additionally, the Army's core focus is at the brigade level. I think this will dictate a lot of the thinking in terms of how Army EW evolves and how it is integrated within the service.

I would like to wrap this up by heaping some kudos on the people, like COL Laurie Buckhout and LTC Chip Bircher, whose leadership and vision have helped to open a new chapter for Army EW. Well done!

– John Knowles

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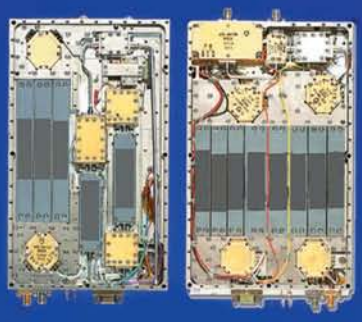

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www.deps.org

Avalon 2009
March 10-15
Geelong, Victoria, Australia
www.airshow.net.au/avalon2009

34th Dixie Crow Symposium
March 22-26
Warner Robins, GA
www.dixiecrow.org

APRIL

Directed Energy Systems Symposium
April 6-10
Monterey, CA
www.deps.org

Emerging EW Technologies Conference
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www.myaoc.org

Latin America Aero & Defence (LAAD) 09
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www.laadexpo.com

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Washington, DC
www.infowarcon.com

MAY

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www.seaairspace.org

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May 5-7
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Joint Warfighting Conference and Exposition
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Virginia Beach, VA
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AOC/Shephard EW 2009
May 13-15
London, UK
www.shephard.co.uk

JUNE

NSA SIGINT Development Conference
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www.fbcinc.com

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Le Bourget, France
www.paris-air-show.com

55th MSS Tri-Service Radar Symposium
June 22-26
Boulder, CO
www.gatech.edu

AOC Kittyhawk Week
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MARCH

RF Directed Energy Effects
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www.cranfield.ac.uk

Modeling & Simulation of RF EW Systems
March 24-27
Atlanta, GA
www.pe.gatech.edu

Radar ESM
March 30-31
Shrivenham, Swindon, UK
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Radar EW
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www.cranfield.ac.uk

High-Energy Laser Weapons Systems Short Course (on-line)
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www.deps.org

APRIL

Radar Countermeasures
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Directed Energy 101
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Monterey, CA
www.deps.org

Laser-Induced Sensor Effects
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Directed IR Countermeasures: Technology, Modeling and Testing
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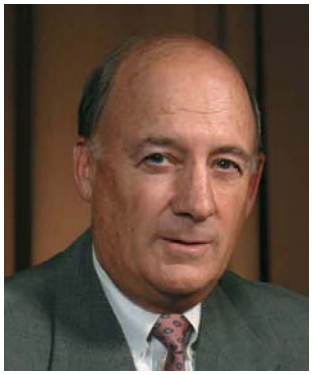

BECOMING A SMART EW CUSTOMER

This month, I would like to delve into a topic that is near and dear to me, and one that I have engaged in for the past 25 years of my career in EW: the complexity of buying (and selling) EW systems and capabilities on the international market. To say the least, I have enjoyed an interesting career working in the world of Foreign Military Sales (FMS) programs of the US Defense Department and direct commercials sale (DCS) programs of US industry. I also have participated in my share of EW systems exports and I have seen different governments employ many strategies in their quest to understand and manage EW acquisitions in an increasingly complex export arena.

A savvy customer understands his specific EW technical and operational requirements, is knowledgeable about current and emerging EW technologies and capabilities and understands the intricate supply "tail" required to support these systems over the long-term. On the other hand, customers who do not fully comprehend these issues risk being disappointed to some degree with their acquisition.

EW technology has changed substantially over the past decade, and it will continue to develop rapidly for years to come. The pace of evolving EW technology poses a significant challenge for all EW professionals who must endeavor to stay current on the latest radar warning receivers (RWRs), radio frequency (RF) jammers, missile warners, laser warners, directed infrared countermeasures (DIRCM) systems, flares, etc. It can be especially daunting for customer nations that are entering the global EW market for the first time. They must develop and sustain a knowledgeable corps of EW experts who need to understand and navigate the bureaucracies that manage defense exports in various supplier nations.

The role in selecting and acquiring EW systems, however, is only the first step in the process. It is quickly followed by managing the support process, training EW users and maintainers and planning and managing sustainment of the EW systems throughout their lifecycle. One might say (and I would agree) that "acquiring" the EW system is the easy part in an overall EW program.

My point here is that it takes a knowledgeable military customer to buy sophisticated EW systems that will meet defined operational requirements. Precious EW knowledge is not gained overnight, nor is it acquired in isolation. However, there is a vast pool of EW knowledge that can be learned for very little money, time and commitment. The process for gaining this advanced level of understanding could begin with a membership in this international association. Those interested in EW instantly will be connected with the global EW community and be given the opportunity to learn their trade alongside other EW professionals. The AOC stands ready to educate future EW experts and provide valuable knowledge that could go a long way in guaranteeing successes in the intricate world of EW systems' acquisition, management and sustainment.

– Kermit Quick

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JAMMER'S EARLY DEVELOPMENT IN HIGH GEAR

An Analysis of Alternatives (AoA), a mandatory step in the Department of Defense (DOD) acquisition process, is well underway for the US Navy's Next-Generation Jammer (NGJ) program**.** The program aims to provide a replacement for the ALQ-99 Tactical Jamming System employed by the Navy's venerable EA-6B Prowlers and set to transition to new EA-18G Growlers that will replace them. The service first fielded the ALQ-99 in 1971 and has upgraded most of its components and subsystems several times over the ensuing decades. The NGJ is slated to become operational in 2018 and provide a significant enhancement to the EA-18G's jamming capabilities at a reduced operations and sustainment cost. The program is managed by the EA-6B/Airborne Electronic Attack (AEA) Program Office (PMA-234) at Naval Air Systems Command (NAS Patuxent River, MD).

John Young, the Under Secretary of Defense for Acquisition, Technology and Logistics, approved the formal start of the AoA in December. The AoA, being conducted by a government-industry Integrated Product Team, will perform a detailed evaluation of options to meet the NGJ requirements, including upgrading the existing ALQ-99 jamming pods rather than developing an entirely new replacement for them. Completion of the AoA in FY2010 will lead to a Milestone A decision for the program to enter the Technology Development phase. This phase will see the award of multiple 24- to 30-month contracts to demonstrate mature NGJ technologies in system-level prototypes. A Milestone B decision to enter an Engineering and Manufacturing Development phase with a single contractor would follow in FY2013.

Ray Coutley, the leader of the AoA government team, said in a statement, "The NGJ AoA will evaluate alternative systems in various warfare scenarios, based on expected threats, concept of operations and cost/capability trade-offs. Our goal is to give decision-makers the best information available, based on quantifiable data." Industry AoA team members include representatives from the companies Dynamic Analytics and Test (Arlington, VA) and Systems Performance and Analysis (SPA) in Alexandria, VA, and from the Johns Hopkins University Applied Physics Laboratory in Laurel, MD. The AoA reports to an Executive Steering Committee, co-chaired by RADM Joseph Aucoin, the Deputy Di-

rector for Air Warfare on the Navy staff; and Thomas Laux, Deputy Assistant Secretary of the Navy for Air Warfare.

On January 15, NAVAIR released a request for information soliciting industry technical input to the AoA in the form of potential system concepts relevant to one of the following AoA alternatives: incremental modernization of the ALQ-99, starting with the oldest or most critical bands (such as Bands 4 and 5/6); fielding of a new jamming system with subsystems and components at a Technology Readiness Level (TRL) of 5 or 6 and incorporating commercial off-

JATAS BIDS DUE THIS MONTH

Later this month, US Navy officials are expected to begin reviewing industry proposals to develop a new missile warning system for Navy and Marine Corps rotary wing aircraft.

Bids for the Joint Aircraft Threat Awareness System (JATAS) program are due March 13, and at least three offers are anticipated. Northrop Grumman's Defensive Systems Division (Rolling Meadows, IL), which already is delivering missile warning systems to the Navy and Marine Corps under the Department of the Navy Large Aircraft Infrared Countermeasures (DoN LAIRCM) program, is responding to the request for proposals (RFP). Another bid will be submitted by Alliant Techsystems Mission Systems (Woodland Hills, CA) and BAE Systems IE&S (Nashua, NH), known collectively as Team Argus. The third and final proposal will be submitted by Lockheed Martin Missiles and Fire Control (Orlando, FL). After initially showing some interest in the program, Raytheon and ITT each have decided not to submit proposals.

The Naval Air Systems Command's Advanced Tactical Aircraft Protection Systems (ATAPS) program office (PMA-272) is managing the JATAS program. After reviewing the bids, it plans to award a pair of technology demonstration contracts later this year.

Release of the JATAS RFP was delayed for several months while the services and John Young, the Under Secretary of Defense for Acquisition, Technology and Logistics, formed an aircraft survivability equipment (ASE) joint analysis team (JAT) to help establish a plan to modernize the infrared countermeasures (IRCM) capabilities across the Department of Defense's (DOD) fixed- and rotary-wing fleets. One of the indirect outcomes of the ASE JAT is a draft acquisition decision memorandum (ADM) currently in the approval cycle that outlines how the Army and the Navy would divide responsibility for future IRCM development. Under this new plan, the Navy would have responsibility for rotary-wing missile warning development programs and the Army will retain similar authority for directed infrared countermeasures (DIRCM) programs. The DOD is expected to formally approve this ADM in the coming months. – *J. Knowles*

the-shelf technology; or exploration of the costs and benefits of a new jamming system based on a lower TRL that initially can address the core requirement currently filled by the ALQ-99.

The solicitation number is AIR410-NGJ-RFI. The technical point of contact is Tom Dalheim, the NGJ AoA Technical IPT Leader at the Naval Surface Weapon Center-Crane Division (Crane, IN), at (812) 854-4886, e-mail thomas.dalheim@navy.mil.

Under Secretary Young made a favorable Material Development Decision – the first step in the new DOD acquisition process allowing early development work – late last fall. He directed the Navy to accelerate and fund NGJ technology maturation efforts. This led to the award last month of six-month, $5.5 to $6 million trade study contracts to four companies – BAE Systems (Nashua, NH), ITT (Clifton, NJ), Northrop Grumman (Bethpage, NY) and Raytheon (Goleta, CA) – for "research support in developing innovative concept solutions at the system level that address NGJ requirements."

The contracts were solicited under a Broad Agency Announcement (BAA). As the BAA stated, "PMA-234 is seeking industry engagement to develop innovative ways to perform tactical jamming within the context of current and future threats using the EA-18G as its target platform for technology maturation. From a system-level perspective, the goal of this BAA is to investigate the effectiveness of alternative solutions for the NGJ system, select and define a solution, define its subsystems, allocate requirements, identify any needed technology developments and establish initial project planning documentation."

The NGJ program will benefit from other ongoing technology maturation programs. The Office of Naval Research (ONR), under its five-year Next-Generation AEA (NGAEA) Enabling Capability project in support of the NGJ program, awarded 10 companies initial one-year Phase 0 study contracts in November 2007 to identify the critical NGJ technologies requiring further development. The remaining four years of the NGAEA project will develop component technologies that can be integrated into NGJ subsystem designs and provide

improved performance or reduced cost, size, weight and power consumption.

"Next-Generation Jammer is the most important AEA effort since the initial deployment of the EA-6B and ALQ-99," said CDR John Springett, EA-6B/EA-18G requirements officer on the Navy staff, in a statement. "Although we have continually upgraded the Prowler, we now have the opportunity to take advantage of current and emergent technologies to greatly enhance our electronic attack capability and achieve spectrum dominance to protect our aircraft, ships and soldiers, airmen and Marines on the ground." – *G. Goodman*

FLEDGLING B-52 JAMMER DEVELOPMENT CANCELED

The US Air Force revealed in recent weeks that its leadership had decided not to pursue a stand-off jamming capability using the B-52 platform, bringing an end to the service's prospective B-52 Core Component Jammer (CCJ) development program. The concept called for the use of two large 40-foot underwing pods on the B-52H bomber to house high-power, low- and mid-band transmitting arrays and advanced exciters. The Air Force Research Laboratory (AFRL) at Wright-Patterson AFB, OH, had kick-started the program last June by awarding a number of three-year B-52 CCJ technology maturation contracts. If these efforts had met their goals, AFRL planned a two-year follow-on effort in 2011 to 2012 to build the arrays and exciters and demonstrate them in flight tests to assess the potential utility of the B-52 CCJ. The Air Force now has zeroed funding for the B-52 CCJ in its spending plans, and any technology maturation work related specifically to the B-52 CCJ will not be funded beyond the current fiscal year.

The decision leaves a stand-off jamming void for the Air Force. Beginning later this year, the Navy plans to retire all of its EA-6B Prowler jamming aircraft, which also have supported penetration of defended airspace by Air Force fighters and bombers, and to replace them by the end of 2012 only with enough new EA-18G Growlers for Navy fleet missions.

The Air Force is counting on a jamming variant of its expendable, cruise missile-like Miniature Air-Launched Decoy, called MALD-J, to help fill the void by providing "stand-in" low-power jamming in proximity to enemy air defense radars. It is slated for initial fielding in 2012. The basic MALD entered low-rate initial production by Raytheon Missile Systems (Tucson, AZ) last June. The Air Force awarded Raytheon a two-year $80 million risk-reduction contract in April 2008 for MALD-J. This past January, the Air Force awarded the company a contract modification to study increasing the radiated power of MALD-J's jamming payload and adding a data link to the decoy. With more power, MALD-J could stand off a little farther from air defenses and thus jam a larger target set.

Another platform that will help fill the void in some scenarios is the Air Force's turboprop EC-130H Compass Call communications-jamming aircraft, to which a radar jamming capability is being added. The aircraft are being modified to carry two high-power Special

ONR ISSUES EW BAA

The Office of Naval Research (ONR) released a Broad Agency Announcement (BAA) soliciting industry proposals for its FY2010 EW Discovery & Invention program and held an Industry Day January 16. The research program's aim is to invest in science and technology initiatives that will provide Navy and Marine Corps forces with "next-generation components and systems enabling improvements in threat warning systems, electronic warfare support, decoys and electronic attack countermeasures, as well as communication and navigation countermeasures." ONR plans to fund one- to three-year contracts ranging from $100,000 to $750,000 per year beginning October 30 of this year.

The primary emphasis of the BAA is on technologies to detect and defeat imaging infrared (IR) and multimode threats. Proposed efforts are to focus on developing technology and techniques to detect or counter advanced threat tracking systems, missiles and other precision-guided munitions that employ imaging IR sensors or multiple passive or active modes of tracking and guidance that can operate sequentially or simultaneously during weapon engagement to negate the effectiveness of single-mode countermeasures.

White papers were due last month and full proposals are due May 12. The point of contact at ONR is Dr. Peter Craig, e-mail peter.craig@navy.mil, or fax (703) 696-1331. – *G. Goodman*

Emitter Array (SPEAR) pods, built by BAE Systems, on outboard wing stations. – *G. Goodman*

RFP FOR INTEGRATED TOPSIDE DEVELOPMENT RELEASED

The Office of Naval Research (ONR) released a request for proposals (RFP) in January for its Integrated Topside (InTop) technology project, one of the research efforts under the Navy's Innovative Naval Prototype program. Responses were due March 2, and multiple five-year indefinite delivery-indefinite quantity (ID/IQ) task order contracts will be awarded June 2.

ONR aims to reduce the number of topside apertures present on Navy ships through the use of integrated, multifunction, multi-beam arrays. As stated in the solicitation notice, "The InTop Program is to address the current condition where US Navy surface combatants are increasingly employing large numbers of federated radio-frequency (RF) apertures to perform electronic warfare, communication and radar functions; each function (and hence system) historically has its own aperture, electronics, operator and logistics/maintenance tail. This classic stand-alone RF systems approach results in electromagnetic interference/compatibility problems that degrade system performance and increase lifecycle cost of the ship. Ship RF signature and radar cross section are also difficult to reduce when restricted to stand-alone RF aperture/antenna approaches."

Last fall, ONR completed its Advanced Multi-function RF Concept (AMRFC) Test Bed proof-of-principal program, which

developed and demonstrated technology for EW, radar and RF communications functions to share receive and transmit antenna arrays and integrate with a common resource allocation manager. AMRFC and subsequently a Multi-Function Electronic Warfare (MFEW) advanced development model (ADM) were installed and tested at the Naval Research Laboratory's Chesapeake Bay Detachment (MD) site.

Under the InTop ID/IQ awards, contractors will receive task orders to investigate and adapt new technologies supporting affordable multifunction capabilities and will build ADMs to test and demonstrate the new capabilities. The RFP included six sample task orders; bidders must articulate their capabilities for addressing one or more of them. The first of these is a Surface Ship EW/Communication System study, which will be the initial task order that ONR plans to award under the ID/IQ contracts. It calls for identifying issues associated with developing a combined surface ship EW/communication system that would provide both an electronic attack capability and line-of-sight communications (via the Tactical Common Data Link) and could be integrated with the electronic support system on new and existing Navy surface ships. It would operate from the H through K EW frequency bands.

The InTop solicitation number is N00014-09-R-0002, and the ONR point of contact is Lynn Christian at (703) 696-1575, e-mail lynn.christian@navy.mil. – *G. Goodman*

GROWLER MAINTENANCE TRAINER

Boeing (St. Louis, MO) revealed that it had delivered the first maintenance trainer for its new US Navy EA-18G Growler jamming aircraft to the Navy's Whidbey Island Naval Air Station, WA, November 21, two weeks ahead of schedule. Boeing delivered the first EA-18G fleet aircraft and first aircrew trainer to Whidbey last June. The maintenance trainer is a set of three devices. Two of them are mockups of aircraft hardware, one representing the gun bay and pallet and the other a wingtip pod. The mockups are used to train maintenance crews in installation and removal procedures.

The third device in the set, the Visual Environment Maintenance Trainer, consists of a fully replicated cockpit, an instructor/operator station and two touch-screen displays that provide graphical representations of the aircraft and support equipment. The student interacts with the trainer via the cockpit and displays to test and troubleshoot. The trainer simulates a variety of maintenance situations and provides realistic feedback to students' actions. The Navy plans to retire its aircraft carrier-based EA-6B Prowler jamming aircraft and buy 88 Growlers to replace them, enough to outfit 10 five-aircraft squadrons. The EA-18G is on track to achieve an Initial Operational Capability in September. – *G. Goodman*

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NORTHROP GRUMMAN EMPLOYEES DIE IN PLANE CRASH

Four employees of Northrop Grumman Amherst Systems (Buffalo, NY) died tragically February 12 when the aircraft they were traveling in crashed as it approached the airport near Buffalo. The four coworkers were flying home from Newark airport after a one-day business trip. The victims were Steve Johnson, Jerome "Jerry" Krasuski, Darren Tolsma and Ernest "Ernie" West, according to friends and media reports.

Steve Johnson, 52, was a program manager who joined Northrop Grumman several years ago after a long career at CALSPAN Corp. Jerry Krasuski, 53, was a program manager at Northrop Grumman, where he had worked for more than 20 years. Darren Tolsma, 45, was an engineer at the company for nearly 25 years. Ernie West, 54, was the deputy director for business development. He joined Northrop Grumman several years ago after 22 years at Sierra Research Corp. West, who traveled around the world and was known to many in the EW community, was president of the AOC's Niagara Frontier Chapter in 2003 and 2004.

Northrop Grumman said in a statement, "All of us at Northrop Grumman are deeply saddened to learn of this tragedy and the loss of our four colleagues and we extend our heartfelt sympathy to the families during this most difficult time."

At a meeting last month, the AOC Niagara Frontier Chapter named its four scholarships in memory of Johnson, Krasuski, Tolsma and West. Donations to the scholarship fund can be sent in any of their names to the Association of Old Crows, Niagara Frontier Chapter, PO Box 1493, Amherst, NY 14226-7493. – *J. Knowles*

Clarification: The article, "USMC Helicopters Outfitted with DIRCM," on Page 15 of the February 2009 *JED* issue was accompanied by a photo of a directed infrared countermeasures (DIRCM) system installed on a Dutch AH-64 Apache in the Apache Modular Survivability Equipment (AMASE) configuration. The photo was intended to highlight the DIRCM system and was not meant to represent the specific DIRCM installation on the CH-53E or CH-46E platforms. *JED* regrets any confusion this may have caused.

Correction: The article, "Morocco Selects F-16 EW Suite" (*JED*, January 2009, Page 24), erroneously identified a subsystem of the Advanced Countermeasures Electronic System (ACES) sold to the government of Morocco. Morocco bought an ACES comprising the ALR-93 radar warning receiver (rather than the ALR-69A, which was erroneously reported in the article), ALQ-187(V) jammer and the ALE-47 countermeasures dispenser. In a subsequent quarterly financial report, Raytheon indicated that the ACES contract with Morocco is valued at $127 million. Future versions of ACES are expected to feature the ALR-69A.

IN BRIEF

Marine Corps Systems Command, on January 30, solicited bids for a Product Support Integrator and Contractor Logistics Support for the service's CREW (Counter Radio-Controlled Improvised Explosive Device Electronic War-

fare) jammers. The bids are due March 20. The solicitation said the Marine Corps has 10,089 Hunter and Chameleon CREW 2.0 systems and will transition from these to 2.1 CREW Vehicle Receiver Jammer (CVRJ) systems by the end of 2010. The solicitation number is M6785409R7005 and the point of contact is Albert Whitley at (703) 432-3186, e-mail albert.whitley@usmc.mil.

✪ ✪ ✪

The US Air Force Research Laboratory, Space Vehicles Directorate (Kirtland AFB, NM), has awarded a $6 million technology development contract to BAE Systems EI&S (Nashua, NH) for an onboard RF threat detection and space warning receiver system for low-earth orbit and geosynchronous earth orbit satellites. The program will run for three years.

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LaBarge, Inc. (St. Louis, MO) was awarded a $1.6 million contract from Northrop Grumman in February to continue to produce electronic equipment for Northrop's AAQ-24(V) Directional Infrared Countermeasure (DIRCM) system. LaBarge has worked on the program for nearly a decade.

✪ ✪ ✪

ITT Electronic Systems (Clifton, NJ) announced February 4 that it plans to establish a new 15,000-square-foot defense avionics repair and testing facility at the Crane (IN) Naval Surface Warfare Center. The company said it will begin hiring engineers, technical support staff and managers next month and it plans to begin operations at the center by August. The facility will provide services related to the evaluation and component repair of EW equipment for the Department of Defense (DOD).

✪ ✪ ✪

Northrop Grumman Electronic Systems (Linthicum Heights, MD) was awarded a $10.5 million contract by Naval Air Systems Command for spares, repairs, upgrades or modifications and engineering services in support of shop-repairable assemblies and antenna units for the EA-6B Prowler aircraft's ALQ-218(V)1 jamming system receiver.

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Jacobs Engineering Group (Pasadena, CA) announced January 20 that it had received a US Navy contract to continue supporting the Airborne Threat Simulation Organization (ATSO) at Pt. Mugu, CA. The contract, with a total maximum value of $43.8 million, consists of a one-year base period and four one-year options and runs through December 2013. The company has supported the Navy in this work for the past 12 years. The Jacobs team, which includes subcontractors Aegir, SA-TECH and TESSADA, is performing the task order work via the SeaPort Enhanced contract vehicle.

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NanoDynamics (Buffalo, NY) announced its receipt of a two-year, $733,000 Phase II Small Business Innovative Research grant from the US Army to continue development of nanoscale materials for use in defensive obscurants. The grant specifically will fund second-stage activities in the development and fabrication of highly conductive, high-aspect-ratio nanomaterials for military infrared (IR) obscurants. With an end goal of producing materials with an ideal size and shape for use in advanced IR countermeasure devices, the project is slated to continue through 2010.

✪ ✪ ✪

Kilgore Flares Co. (Toone, TN) was awarded a $22.8 million contract by the US Army Field Support Command (Rock Island, IL) January 30 for 225,800 M206 and 488,580 MJU-7A/B infrared countermeasure flares. **Armtec Countermeasures Co.** (East Camden, AR), a division of Esterline Technologies, was awarded a $20 million contract by the Army command for 184,800 M206 and 399,720 MJU-7A/B flares.

✪ ✪ ✪

Applied Signal Technology (AST) (Sunnyvale, CA) said it had successfully completed a flight test demonstration of its Model 570X SIREN, a miniature airborne tactical signals intelligence (SIGINT) payload for intelligence, surveillance and reconnaissance platforms. AST's Intelligence and EW Division said ground and flight tests of the Model 570X were conducted aboard a Piper Seneca airplane, as well as on a hand-launched tactical unmanned aerial vehicle (UAV), in California and Maryland and that excellent collection and geolocation results were achieved in identifying and locating emitters.

✪ ✪ ✪

Boeing (St. Louis, MO) said January 26 that, in a test at the White Sands Missile Range, NM, in December, it had acquired, tracked and shot down an unmanned aerial vehicle (UAV) with a laser mounted on the US Army Humvee-based Avenger air defense system it produces – a world's first for a combat vehicle. The Laser Avenger can fire its laser beam without creating missile exhaust or gun flashes that would reveal its position.

✪ ✪ ✪

Raytheon's Laser Centurion Demonstrator is being tested as an air defense weapon by the Army at the White Sands Missile Range, NM, under the service's Laser Area Defense Systems program. The trailer-mounted, high-powered, solid-state laser works in conjunction with a radar-based threat-detection system. Initial tests with the demonstrator have been positive, the Army said January 30, with the laser showing that it can rapidly penetrate armor plating even when not at full power. It will be tested against mortar rounds in the coming weeks. The Laser Centurion also could be used against artillery and rocket rounds, missiles and unmanned aerial vehicles (UAVs). Unlike a gun, it won't run out of ammunition and fires quietly. The Navy also is participating in the program to provide a replacement for the 20-mm Gatling gun on its shipboard Phalanx system.

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washington report

ARMY ESTABLISHES EW OFFICER CAREER FIELD

The US Army approved establishing a new electronic warfare (EW) 29-series career field for officers, warrant officers and enlisted personnel February 6. The new career field eventually will give the Army the largest EW manpower force of all the services. Nearly 1,600 EW personnel, serving at every level of command, will be added to the Army over the next three years. The Army also is considering adding an additional 2,300 personnel to the career field in the near future as personnel become available, officials said.

Approval for the career field was based on an extensive study conducted by the Combined Arms Center at Fort Leavenworth, KS. The study concluded that Army EW expertise is not only necessary for counterinsurgency efforts such as Operations Iraqi Freedom and Enduring Freedom, but against the full range of potential adversaries and should therefore be institutionalized as an enduring core competency.

Col Laurie Buckhout, chief of the Army's EW division, said the service's EW personnel will be experts not only in fighting the threat of improvised explosive devices (IEDs), but also will provide commanders and their staffs with guidance on how the electromagnetic spectrum can impact operations, and how friendly EW can be used to gain an advantage in support of tactical and operational objectives across the full spectrum of operations. She noted, "The Army is leaning forward now to address the very complex challenge of controlling the electromagnetic environment in land warfare. The creation of a large cadre of full-time EW specialists is a critical step in the right direction."

Gen Peter W. Chiarelli, the Army's vice chief of staff, said, "One of the enduring features of any future battlefield will be determined [by] resourceful enemies attempting to undermine our will by leveraging the electronic spectrum. Building an EW structure within the Army will greatly enhance our ability to proactively counter these threats. A commitment to EW allows us to tightly integrate non-kinetic and kinetic capabilities across the Army and as part of joint operations."

The Army is conducting a series of pilot EW officer qualification courses at Fort Sill, OK. Warrant officer and enlisted pilot courses are expected to begin this spring. Its career management field identifiers will be Functional Area 29 for officers, Military Occupational Specialty 290A for warrant officers and Military Occupational Specialty 29E for enlisted personnel.

The US Army's Computer Network Operations and Electronic Warfare Proponent (USACEWP) at the Combined Arms Center (CAC), Fort Leavenworth, KS, is responsible for providing EW doctrinal guidance and structure. It was set to release Field Manual 3-36, Electronic Warfare in Operations, in late February. Lt Col John Bircher, USACEWP's Deputy Director for Futures, said FM 3-36 is the Army's first keystone EW document of its kind, noting that previous EW doctrine was localized to divisions and corps and above or was technically-oriented. The new doctrine is the first effort to build an overarching concept of EW operations that is nested in overall operational Army doctrine as described in FM 3-0, Operations.

In 2007, the Army authorized the merging of the CAC's Computer Network Operations (CNO) function with the EW function and formed what is now the USACEWP. The joining of the two disciplines grew from the Army's increasing need to understand, operate in and manipulate cyberspace. "In the operational environment, the lines between CNO and EW are blurred," Bircher said. "We can use EW to disable our enemies' cellular phone device or we can use CNO to deny the device's access to its network. Do we use CNO or EW to deny our adversary, and does it matter to the tactical commander? In our conceptual research, we found that it didn't matter. What's important is controlling the data, the bandwidth and the electromagnetic spectrum."

USACEWP will continue to lead the Army's CNO and EW doctrine and development but was recently renamed Training & Doctrine Command's Capabilities Manager for CNO and EW as part of an internal refinement of the Combined Arms Center-Capability Development Integration Directorate (CAC-CDID) at Fort Leavenworth to which it belongs. This refinement will distribute CNO and EW expertise, previously restricted just to the USACEWP, throughout the entire CAC-CDID organization, thus making the overall development process more efficient, Bircher said. – *G. Goodman*

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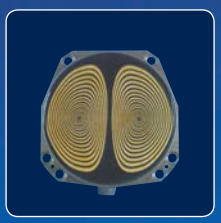

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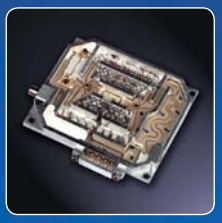

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world report

ROK SELECTS EW SUITE FOR F/A-50

Elisra Electronic Systems Ltd. of Israel announced February 9 that it was awarded an initial $7 million contract to supply airborne electronic warfare (EW) systems to Korean Aerospace Industries (KAI) for use on the F/A-50 attack jet that KAI is developing for the Republic of Korea Air Force. The contract calls for Elisra to develop and build prototypes of the EW system to be supplied to KAI over the next two years. The F/A-50 is a strike variant of the KAI/Lockheed Martin T-50 advanced jet trainer. The South Korean company received state funding earlier this year worth more than $300 million to build four prototypes of the F/A-50 to be delivered by 2012, and believes the air force will place an initial order for 60 production aircraft to begin replacing its oldest F-5 fighters. Elisra is held 70 percent by Elbit Systems Ltd. and 30 percent by Elta, a subsidiary of Israel Aerospace Industries. – *G. Goodman*

SELEX GALILEO AND BHARAT SIGN EW MOU

SELEX Galileo, a subsidiary of Italy's Finmeccanica, and Bharat Electronics Limited (BEL) of Hyderabad, India, signed a memorandum of understanding (MOU) to jointly explore potential opportunities in the field of EW in the Indian market, including offset requirements and contract manufacturing for export markets. Current opportunities include offset requirements in Indian programs such as the Medium Multi-Role Combat Aircraft (MMRCA) fighter procurement, in which SELEX Galileo is participating through global aircraft manufacturers.

The new partnership between SELEX Galileo and BEL, a key developer and manufacturer of EW equipment for the Indian armed forces, is expected to provide significant market opportunities for both companies. SELEX Galileo supplies EW systems for aircraft around the world, including the Eurofighter Typhoon fighter and the AgustaWestland AW101 and Boeing AH-64D Apache Longbow helicopters. SELEX Galileo is the name adopted by Galileo Avionica SpA and SELEX Sensors and Airborne Systems Ltd., both Finmeccanica companies, to present a common identity to the market. BEL is a government-owned company with coveted Navratna status. – *G. Goodman*

ISRAELI JSF NEGOTIATIONS

Israel had made little or no headway with its request to install its own EW, radar, munitions and command-and-control systems in the Joint Strike Fighters (JSFs) it plans to purchase through the US Department of Defense, *The Jerusalem Post* reported February 16. The target date for delivery of the Lockheed Martin aircraft to Israel is 2014, but this could slip as a result of the American position, senior Israeli defense officials told the newspaper. Negotiations are continuing, but US DOD officials have stated that Israel will not be allowed to install its own hardware boxes on the JSFs and that Israeli customization of the aircraft will be limited to software. Israeli defense firms Elbit, Israel Aerospace Industries' Elta and Rafael have protested the American stand through the Israeli Defense Ministry. Israel and the United States are scheduled to sign a purchase agreement by the end of this year. – *G. Goodman*

IN BRIEF

- Three member's of the British Army's 14 Signal Regiment (Electronic Warfare) were killed in an auto accident not far from the Regiment's barracks in Brawdy, Pembrokshire, Wales. Killed were Cpl Dan Ginty, 26; LCpl. Chris Beckett, 25; and Cpl Jimmy Luton, 24. Between them, the men had completed five tours of duty in Afghanistan. Corporal Ginty was scheduled to return to Afghanistan this month.
- **Allen-Vanguard Corp.** (Ottawa, Canada) and Tailwind Financial Inc. (Toronto, Canada) announced January 26 that they plan to merge. The name of the merged entity will be Allen-Vanguard Corp. Allen-Vanguard builds counter radio-controlled improvised explosive device (RCIED) jammers and other equipment providing protection against hazardous materials.
- **Saab Avitronics** (Järfälla, Sweden) was selected by the Italian Air Force to provide its BOZ-EC (enhanced capability) countermeasures dispensing pod for use on the country's Tornado aircraft. The dispenser uses the company's Compact Integrated Defence Aids Suite (CIDAS) installed in a standard BOZ pod and adds missile warning, an EW controller and pyrotechnic countermeasures dispensing.
- **Lockheed Martin** selected Raytheon to supply the integrated EW suite for the F-16IN Super Viper it is bidding for the Indian Air Force's MMRCA fighter competition. Raytheon is offering the Advanced Countermeasures Electronic System (ACES). The company also is offering the ALR-67(V)3 RWR on Boeing's F-18E/F bid to India.

AOC Award Nominations Due April 15

Any AOC Member can nominate an individual or organization for the AOC Annual Awards. AOC Awards recognize excellence in the EW community and are presented during the AOC Annual Convention, October 18-22 in Washington, DC.

Nominations are being accepted for the following awards. For a nomination form and other details, visit **www.myaoc.org.**

AOC Gold Medal Logistics Award

Stanley Hall Business Development Award

Clark Fiester C2 Warfare Award

Communications Award

Directed Energy Warfare Award

EO/IR Award Offensive

Executive Management Award

Information Operations Award

Integrated Product Team Award

John Marks ISR Award

International Achievement Award

Joint Service Award (multiple)

Joseph W. Kearney Pioneer Award

Training Award

Maintenance Award

Program Management Award

Business Management Award

Defensive Information Warfare Award

Modeling and Simulation Award

Navigation Warfare Award

Information Warfare Award

Operations Award

Psychological Operations Award

Radio Frequency Award

Research and Development Award

Technical Analyst Award

Technical Intelligence Analyst Award

A.C. McMullin Test and Evaluation Award

EW Across the

Europe's northern states rely on EW to multiply their forces

By Marianne Kunkel and John Knowles

For decades, Europe's northern states, Denmark, Finland, Norway and Sweden, have been important players in the global electronic warfare (EW) market – well out of proportion to their size. Home to less than 25 million people, with fewer than 120,000 active duty soldiers between them, these Nordic countries have managed to build modern defense forces that employ a complete range of advanced EW capabilities. The region also is home to some of the leading EW companies in the global market. This month, *JED* is taking a closer look at what makes the Nordic region such an important player in the EW market.

THE ELUSIVE NORDIC DEFENSE ALLIANCE

Shortly after World War II, the governments of the Nordic region were widely expected to create a strong defense alliance. These plans were soon overtaken by events, however, as the Cold War emerged and Europe found itself on the front line facing the Soviet Union. When NATO was established to counter the Soviet threat, it satisfied many of the regional security needs for Norway and Denmark. While Sweden and Finland have remained outside NATO, defense trade relationships with Europe and the United States have been strong.

In the post-Cold War era, the governments in the region have seen another opportunity to forge a Nordic defense alliance. NATO aside, this is not without its challenges. Perhaps the most important hurdle is the differing security objectives of the various governments within the region. Norway and Finland, for example, are strongly focused on territorial defense. Norway must monitor a 2,500-km coastline that extends from the Olsofjord in the south to the Barents Sea in the north. Finland shares a 1,300-km border with Russia, which it is keen to monitor and protect. Over the past decade, Sweden has been tailoring its military into more of an expeditionary force to support out-of-country peacekeeping missions. Denmark already has done the same.

Despite these differences, the push toward a Nordic defense alliance continues. Last month, a prominent Norwegian politician (the former minister of defense and of foreign affairs) made headlines in the region when he proposed a Nordic alliance aimed at protecting the region's interests in the arctic. The proposed alliance also would participate in other major military operations and peacekeeping missions outside the region. Another interesting development was the establishment of the Swedish-led Nordic Battle Group in 2008, which comprises 2,800 soldiers. This is one of 18 European Union battlegroups that has been stood up over the past several years. Such developments could shape EW requirements for the region, drive greater EW spending and influence relationships with EW suppliers.

BUYING WEAPONS SYSTEMS AS A BLOC

While the establishment of a broad defense alliance so far has been elusive for the Nordic countries, the region has had

Nordic Region

more success working together on defense procurements.

In 1994, Denmark, Finland, Norway and Sweden began laying the foundation of what was to become the Nordic Armaments Cooperation (NORDAC). Its first major procurement was the Nordic Standard Helicopter Program (NSHP), under which the four countries sought to buy a single type of helicopter in the 9- to 15-ton class. The combined requirement was for 100 helicopters, and the NSHP drew bids from helicopter manufacturers in Europe and the United States.

The NSHP has been something of a mixed success. In 2001, Finland, Sweden and Norway selected the NH90 from Eurocopter. So far, the countries have ordered a total of 52 NH90s both in the NATO Frigate Helicopter (NFH) and Tactical Transport Helicopter (TTH) variants. However, each of the three countries has bought a different EW suite for the helos. Finland, which bought 20 TTHs for search and rescue (SAR) missions, opted for the NH90's standard EW suite. This comprises the AAR-60 missile warning system from EADS, the Threat Warning Equipment (TWE) radar warning receiver (RWR) from Thales Airborne Systems, and the Saphir-M countermeasures dispenser from MBDA. Norway, which will use its 14 NFHs for anti-surface warfare and coast guard roles, selected the ALQ-211(V)5 from ITT Electronic Systems, as well as the AAR-60 and Saphir-M. Sweden will use its 18 TTHs for troop transport and SAR missions. Its helicopters are fitted with Saab Avitronics' Integrated Defensive Aids Suite (IDAS), which features laser, radar and missile warning systems, as well as a countermeasures dispenser. Denmark eventually dropped out of the NSHP and opted for the AgustaWestland EH101, eventually procuring 14 Merlins for SAR and troop transport duties. These were equipped with an EW suite that includes the Kestrel ESM system from Thales. Despite the variation in EW suites, the NSHP has been somewhat successful, considering that it was the first major effort toward common procurement within the region, and the cooperation within the program continues in the form of common training and sustainment.

Sweden hopes that the lessons from the NSHP can be applied to a Nordic fighter program, as it promotes Saab's

JAS 39 Gripen to Norway and Denmark. Norway recently disappointed Sweden when it announced that it would pursue the acquisition of 48 F-35 Lightening II Joint Strike Fighters instead of buying the Gripen as a replacement for its F-16s. Denmark, which has been a major participant in the JSF program, has not made a final determination yet, and it is expected to name its choice in the coming months. Even if Sweden is disappointed again, it is not likely to give up on Denmark and Norway until contracts are signed. Sweden also is focusing on Finland, which in the next few years is expected to begin planning a replacement for its F-18s. Finland is not expected to retire its F-18s until 2030, however.

FINLAND: SMALL COUNTRY WITH A LARGE NEIGHBOR

Since the end of World War II, Finland has followed a policy rooted in neutrality. Despite being a western democracy, it did not join NATO and it was careful to split its defense purchases between the Soviet Union and the West. The collapse of the Soviet Union substantially changed Finland's defense procurement policy, and it has been gradually retiring Soviet equipment from its inventory ever since. In 1994, it replaced its MiG-21bis and Saab 35 Draken fighters with 64 F-18C/D aircraft, most of which were built under license by Patria. The F-18s are equipped with Northrop Grumman's ALR-67(V)2 RWR, ITT's ALQ-165 airborne self-protection jammer (ASPJ) and ALE-47 chaff and flare dispensers.

Looking forward, Finland is trying to establish a plan to upgrade the EW on its Hornets. The US Navy has been slow to upgrade the EW on its F-18C/Ds and this has left countries like Finland seeking an affordable upgrade path. Because the Finnish Air Force did not install ASPJs on all of its F-18s during the original procurement in the mid-1990s, it considered a plan a few years ago to complete ASPJ installation across the fleet. By that time, however, the ASPJ was out of production and the cost associated with restarting the ASPJ production line was not affordable.

The Finnish Air Force then decided to look at a more comprehensive EW upgrade program for its Hornets that was based around the US Navy's Integrated Defensive Electronic Countermeasures (IDECM) Block II configuration. This would have replaced the ALR-67(V)2 and ASPJ with the ALR-67(V)3 RWR from Raytheon and the ALQ-214(V)2 RF countermeasures system from ITT. About a year ago, however, Finland determined that it could not obtain releasability for all of the EW capabilities it wanted and it learned the cost of integrating the ALQ-214 onto the C/D model was not affordable. If the US Navy proceeds with an IDECM block II upgrade on its Hornets, as has been discussed in the FY10 budget planning process, Finland's interest could revive. In the meantime, Finland has settled on a minor upgrade to its ALR-67(V)2 RWRs.

Another major EW user in the Finnish Defense Forces is the Navy. The Navy's Hamina- and Rauma-class missile patrol craft are fitted with the Shipborne Integrated EW System (SIEWS) from Thales and the Common Opto-electronic Laser Detection System Next-Generation (COLDS NG) from EADS. The Hamina-class vessels also feature Rheinmetall Waffe Munition's Multi-Ammunition Softkill System (MASS), which is installed on the Navy's pair of Hameenmaa-class mine layers.

Finland buys most of its EW and SIGINT systems from abroad. The country's major defense manufacturer, Patria, has in the past performed a substantial amount of EW platform integration and sustainment for some of the Finnish Defence Force's EW and SIGINT programs. Recently, the company's Aviation Division in Tampere (about 100 miles north of Helsinki) has begun marketing a digital wideband ELINT receiver. The Finnish Air Force operates a Fokker F-27 100 modified for SIGINT missions, and the ELINT receiver may have originated with this program. The company also is developing a similar receiver for COMINT applications.

NORWAY: STAUNCH NATO ALLY

Norway, like Finland, has a very small EW industry, but its military maintains substantial EW requirements. As such, it imports all of its EW equipment from the United States and Europe. Its largest program to date is the EW suite for its F-16A/B aircraft. These are fitted with ALR-69 RWRs, ALQ-131 external jamming pods, ALQ-162 Shadowbox II jammers and ALE-40 chaff/flare dispensers. The suite is controlled by Terma's ALQ-213 EW Management System (EWMS). About 10 years ago, Norway had been considering an EW upgrade program for its F-16s but scrapped it in favor of buying a new fighter, the F-35, which it selected late last year. If the F-35 program should encounter more substantial delays or if the unit cost grows too much, Norway could dust off its plans for F-16 EW upgrades until a longer-term solution is identified.

Norway also is investing in several naval EW programs. In June 2000, the Royal Norwegian Navy acquired five Firdtjof Nansen-class ships as part of its Norwegian Frigate Program and outfitted them with ITT RSS's CS-3701 ESM system and Terma's Soft Kill Weapon Systems (SKWS). Four years later, Norway procured six ES 3701 ESM systems from ITT and MASS decoy launchers for its Skjold-class

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patrol vessels. Later this year, the Navy is expected to select a new ESM system for its Ula-Class submarines. This could draw bids from EADS, ITT RSS and Thales. The Norwegian Intelligence Service operates a SIGINT ship, the F/S Marjata, along its northern coast. It monitors Russian naval activity in the Barents Sea and reportedly was nearby collecting signals from a Russian naval exercise when the Russian submarine Kursk tragically sank in August 2000.

Norway's EW industry is mainly concentrated in two companies. Tinex AS in Haslum (located about 10 miles east of Oslo) integrates EW systems onto ground vehicles, such as the fleet for six P6-300M vehicles that are equipped with the SGS 2000 Hummel communications jammer from EADS Ewation. Another company is Teleplan AS in Lysaker (also outside of Oslo), which integrates SIGINT systems and has developed the CORVUS family of software tools for logging, analysis and reporting systems for SIGINT and EW applications.

SELF-SUFFICIENT SWEDEN

Sweden is the largest EW developer and user in the region. It began to pursue EW programs in the early 1960s at its National Defence Research Establishment (FOA). In 2001, FOA merged with another state research agency to form the Swedish Defence Research Agency (Totalförsvarets Forskningsinstitut – FOI). Today, FOI researchers delve into a variety of areas from radar and low-observable technology to medicine and protection from chemical/biological weapons. FOI's EW research areas include RF countermeasures, ESM and SIGINT, IR countermeasures and high-power microwave technology. Many of Sweden's EW programs begin at FOI in support of the Swedish Armed Forces, the Swedish Defence Materiel Administration (Forsvarets Materielverk – FMV) and the National Defence Radio Establishment (Försvarets Radioanstalt – FRA).

FRA is Sweden's military SIGINT agency. It provides SIGINT personnel for collection platforms such as the Orion SIGINT ship (operated by the Swedish Navy) and a pair of S-102B Korpen (Raven) aircraft. The S-102Bs are modified Gulfstream IV aircraft. They are nicknamed Huginn (thought) and Muninn (memory) after Odin's two intelligence-gathering ravens. The HMS Orion soon will be replaced by the HMS Carlskrona, which is being outfitted for SIGINT missions. The Orion was well-suited to territorial waters, but the larger Carlskrona is better suited to supporting expeditionary missions.

Much of Sweden's EW is manufactured by Saab Avitronics, which is headquartered in Järfälla. The company's history stretches back 50 years to the early days of Swedish EW. Over the past decade, Saab has grown its EW capability by acquiring EW manufacturers in Sweden and South Africa. In 1999, Saab bought Sweden-based CelsiusTech Electronics, which at the time was the country's leading EW manufacturer. In 2006, it bought Eriksson Microwave Systems, another Swedish company that made radar and sensor systems. With these acquisitions, the company consolidated Sweden's EW industry. Another important acquisition was the purchase of South Africa's Grintek Avitronics in

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2000. In 2005, Saab bought a majority stake in the Grintek Group, which gave it ownership of Grintek Ewation, a division that manufactures communications intelligence (COMINT) and communications jamming equipment, as well as the S/UME-100/200 tactical ESM/ELINT system and chaff launchers for ships and submarines.

A decade ago, the future of Sweden's EW industry was uncertain. Today, however, Saab Avitronics is one of the largest EW companies in the market. It manufactures EW systems for fighter aircraft, helicopters and transports, as well as ships, submarines and ground vehicles. Its biggest EW program is the Gripen's self-protection suite, EWS 39. With Gripen sales to Sweden, South Africa, the Czech Republic, Hungary and Thailand, Saab Avitronics has been able to re-invest sales revenue into a healthy EW research and development program. The result has been a new suite, the EWS39/2, for the Gripen NG demonstration program.

Said Anna Bergenlid, head of communications and public relations at Saab, of EW capabilities on the Gripen NG, "The aircraft will be designed to operate in threat scenarios beyond 2020, featuring increased frequency ranges, improved jamming capabilities, precision direction-finding [DF], full 3D coverage, a MWS [missile warning system]/LWS, etc. The system will be based on a multi-function architecture, which provides seamless integration of radar, communication and EW."

For the rest of its EW product line, Saab is honing in on international customers. "We have the majority of our EW business outside Sweden," said Bergenlid, "and this is where we see the markets growing." Demand for ESM systems on maritime patrol aircraft (MPA), surveillance and Airborne Early Warning and Control (AEW&C) systems has fueled interest in Saab's HES-21 suite, which features an RWR/ESM system, a laser warning system, a missile warner and BOP-L and BOL countermeasures dispensers. BOL has been another successful product for Saab. First produced in 1993, it has been installed on US Air Force's F-15 Eagle, Australia's F/A-18C/D Hornet, both the UK's Harrier GR7 and Tornado, the Eurofighter Typhoon and the Gripen.

Saab has overseen deliveries of its Integrated Defensive Aids Suite (IDAS), a self-protection system encompassing radar, laser, UV missile approach warning and countermeasures dispenser functions, to Spain, Switzerland, South Africa, India, the UAE and Swedish Defense Forces (SDF). Malaysia has bought IDAS for its Su-30MKM fighter aircraft. Saab also offers a Civil Aircraft Missile Protection System (CAMPS), anti-Man Portable Air Defense System (MANPADS) technology that combines an MAW-300 MWS and BOA countermeasure dispensing system. Designed for civil aircraft, it can be installed on military aircraft as well.

For ground vehicle self-protection, Saab produces the Land Electronic Defense System (LEDS), which features softkill and hardkill capabilities. LEDS currently is used by the Dutch army and is being considered by other countries. Saab's close relationship with Germany's Howaldtswerke-Deutsche Werft (HDW) shipyard has led to sales of naval ESM systems to Germany and, in 2008, the company was contracted by Germany's Rheinmetall Waffe Munitions to supply ESM and LWS systems for the German Navy's mine countermeasure vessels (MCMVs).

Although Saab has met most of Sweden's EW needs, the Swedish Defence Forces have occasionally imported EW technology. In fact, the basis for ITT RSS's (then EDO Corp.) ES-3701 ESM system came from a request by Sweden in the mid-1990s to create a replacement ESM system for its Gothenburg and A-17 submarines, and the system was soon after put on the Swedish Navy's Visby-class corvettes.

DENMARK: EXPEDITIONARY OUTLOOK

Arguably the most well-connected country in the Nordic region, Denmark is a very supportive NATO member that has maintained strong relationships with both The Netherlands and Germany. It has played a behind-the-scenes role buying EW products from the United States and integrating them onto NATO aircraft in support of the Global War on Terror (GWOT).

Like Norway, Denmark operates a fleet of early model F-16 fighters that were acquired in the late 1970s. These F-16s, which have been modernized over the years with indigenous and US equipment, remain the Royal Danish Air Force's primary aircraft. They are in the middle of a program under which they will be outfitted with EADS' AAR-60(V)2 MILDS-F missile warning system, which is integrated into a pylon and linked to the aircraft's existing ALQ-213(V) EWMS. Denmark also has been seeking an RWR upgrade for its F-16s for more than a decade. The aircraft currently use the ALR-69. If the program moves forward, Raytheon's ALR-69A(V) is a strong contender.

The Royal Danish Navy, which frequently supports operations outside its home waters, also has bought EW suites that combine local EW systems with imported equipment. In September 2005, Denmark selected ITT RSS's (then EDO

Corp.) ES-3701 ESM system for its pair of Absalon-class flexible support ships. The ships also were outfitted with four DL-12T and two DL-6T decoy launchers made by Terma.

Terma A/S – Denmark's main indigenous EW supplier – is one of only two major foreign EW suppliers to the United States (Saab Avitronics, with its BOL dispenser system, is the other). Terma started its EW business 25 years ago by providing EW support to Denmark and other European F-16 operators. Following the Gulf War in the early 1990s, the US Air Force took a closer look at the company's ALQ-213(V) EWMS technology as a solution for avoiding a whole-system replacement on its F-16 fleet. After running the system through foreign comparative testing, the United States began placing orders for the system in 1997.

Its breakthrough as a global EW supplier, combined with its business focus as an EW system integrator for various aircraft, has brought worldwide attention to Terma. Not only is it contracted regionally, but Terma has established a US subsidiary in Warner Robins, GA, to supply its US market and also deliver EW systems internationally through US Foreign Military Sale (FMS) channels.

Currently, Terma is developing a new version of the ALQ-213 for The Netherlands' CH-47 Chinook helicopters. The ALQ-213A will be a smaller system that combines multiple units into a single box, according to Steen M. Lynenskjold, Terma's senior vice president of airborne systems. "We're also separating the controller from the display so that it can either work with a display that we provide or fully integrate into a glass cockpit if that's required," he said. Looking ahead, Terma expects to take on greater integration responsibility, performing more cross-fleet installations and high-level incorporation of its technology with that of other EW manufacturers.

BUILDING STRENGTH

With Russia's government taking a more aggressive stance in recent years, Denmark, Finland, Norway and Sweden are taking steps to reenergize their collective security commitment to the Nordic region. While Saab and Terma continue to build their presence in the global EW market, EW manufacturers in Europe and North America will continue to look for opportunities in the Nordic region.

In addition, the region's efforts to build a comprehensive defense alliance will be closely watched. An important sign of collaboration came January 21, when a new Nordic defense cooperation agency called Nordic Supportive Defence Structures (NORDSUP) held its first meeting in Helsinki, Finland. Based on an initiative drafted by Finnish, Swedish and Norwegian officials and later signed by Denmark and Iceland, the meeting facilitated pledges to cooperate as a regional body in 2009 in areas including land, naval and air forces; personnel and education; material development and procurement; logistics; and research and development. The vision of a Nordic defense defense alliance, proposed more than 60 years ago, may eventually become a reality.

Photos courtesy Gripen International, Kokums AB, NHIndustries, Saab the S Department of Defense.

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Case Study:

EW Sustainment

The complicated story of the ALQ-99 Band 4 transmitter upgrade demonstrates many of the unique and ongoing challenges faced in the EW sustainment world

By Elaine Richardson

When the ALQ-99 tactical jamming system began flying aboard US Navy and Marine Corps EA-6B Prowlers in 1971, it was the first fully integrated, computer-controlled radar jamming system. Developed in the previous decade, the system featured all of the design and sophistication of the 1960s – jammer pods outfitted with an exciter and two transmitters organized by frequency bands. And with a series of upgrades to its low- and high-level bands, the system has remained viable from the 1970s through today.

In the early 1980s, however, the Navy supply system began to notice that the -99's Band 4 transmitter output traveling wave tube (OTWT) was a fairly difficult component to manufacture. And although it wasn't necessarily news – the production line for the Band 4 OTWT had always yielded fairly low numbers of usable units – it was the first inkling of what would become an increasingly difficult sustainment challenge.

"We kept the production line going as long as possible, even though the yield was very low on the production side. You can live with that for awhile," said CAPT Steven Kochman, program manager for the Airborne Electronic Attack/EA-6B Program Office (PMA-234) at Naval Air Systems Command. By the mid-1990s, though, things got much worse when the Navy went from having a hot, albeit low, yield production line to no production at all.

So how was the production line allowed to stop completely? After the completion of the initial production run, there was a natural production break. Then, the Navy went back to its original supplier, L-3 Communications Electron Devices (San Carlos, CA), to restart the production line. However, L-3 had some issues recreating the technology. "A lot of science goes into these tubes, but a little bit of alchemy, too. They just kind of lost the formula," Kochman said. "It was never very producible, which is why production yield was so low from the beginning."

L-3 struggled with the outdated technology and, between 1995 and 2002, no tubes actually were produced. As a stopgap, the Navy went to the boneyard at Davis-Monthan AFB, AZ, to pick through the systems left on the Air Force's retired EF-111 Ravens.

Kochman, who arrived at PMA-234 in 2003, recognized the need to deal with a critical supply issue. "For 14 to 15 years, we saw this problem and didn't address it [from the supply or user side]," Kochman said. "We never did much to address any of the issues on the user side. If we were doing things through use or maintenance that contributed to the failure rate, we never addressed it because we had a fairly consistent failure rate."

But then this steady failure rate started to increase as missions accelerated and the ALQ-99 usage rate increased, not to mention the system was being used in conditions never before seen. An inability to collect maintenance-related data about the basic ALQ-99 design meant that the service had little information to tell it exactly why the failure rate was so significant.

"On the supply side, we needed to take stock of the fact that the supply system can't buy what's not producible. You have to develop things for the supply system to buy," Kochman said. "Fortunately, through congressionally-directed funding, L-3 had done some analysis on modernizing the tube. About the same time, Teledyne MEC (Rancho Cordova, CA) said that it could develop a solid-state amplifier replacement for this vacuum device. We went to the Office of Naval Research (ONR) to request some funding."

By 2004, PMA-234 was developing a multi-pronged approach to attack Band 4 readiness decline – trying to recreate a consistent production level for the original tube, funding tube modernization with L-3 and working with Teledyne on a solid-state replacement solution. "We recognized back in 2004 that if these initiatives don't yield something, we're really in trouble," Kochman said. "We're getting ready to integrate ALQ-99 on EA-18G and the supply of that one component was completely broken. It was really important that we fix this situation." But PMA-234 needed to ensure that the Navy wouldn't end up back in the same situation with low production yields. A veteran panel put together by ONR's Manufacturing Technology Program, industry, NAVAIR and the American Competitiveness Institute studied how the Band 4 TWT actually could be produced in terms of the original and modernized configurations and what the chokepoints might be on the production line at L-3.

"L-3 production was roughly five tubes a month among four critical tubes in the Band 4 and Band 5/6 transmitters," Kochman said. "Some test equipment was an absolute chokepoint. We were able to reduce time on those pieces of equipment, increase the amount of equipment inventory and decrease those chokepoints. Between 2004 and 2008, we were able to facilitate L-3 to the point where it can now produce 16 to 20 tubes a month."

But the years of delay had a significant impact on the situation. The development process ended up taking one year longer than expected. Then, in 2007, the low-band transmitter was introduced and, some time after this addition, the Band 4 transmitter suffered a spike in failure rate that may or may not have been related to the introduction of the new transmitter. A paucity of documentation has delayed detailed engineering analysis, but this is now underway. Two steps forward, one step back.

Kochman credits industry for working with the Navy on this process. "L-3, Teledyne and Triton are the primary traveling wave tube producers in the United States. I'm extremely pleased with how quickly they stepped up and wanted to help," Kochman said. "It was impressive to see industry step up with energy and innovation to do this. L-3, in particular, was able to really do a remarkable redesign – not only is it more producible and more reliable, it's also a better-performing tube. We currently have a steady production line for the original Band 4 OTWT that nearly meets fleet needs, but not enough to replenish severely depleted supply lines." The modernized tube is scheduled for production in late 2009 and should arrive in the fleet by the end of the year. Kochman anticipates running two production lines for awhile – one for the original and one for the modernized tubes – as the Navy builds up its supply. The Navy also is continuing to pursue the Teledyne solid-state replacement option for the Band 4 TWT.

THE NEXT CHALLENGE

The Band 4 OTWT was the pacing item for ALQ-99 readiness for so many years that now other components are starting to catch up to it, Kochman explained. PMA-234 now is focusing on driver TWTs.

"For Band 4, it took us roughly 14 years to really solve the OTWT issue," Kochman said, noting that the Navy started working on making the driver tube producible in 2007. But, like the output tube, the driver tube had not been in production for a number of years. "We were able to make it producible by the end of last year, so with lessons learned from the output tube, it took only two years to solve the driver TWT issue and have a production line up and running."

The exciter also needs attention, Kochman noted. "It has an obsolete component in it – so does the test equipment for the exciter and some of the transmitters," he said. "The good news is, for the first time, there's recognition in the program funding system to help us address these things in a proactive way. We can put things in place in time so we can stave off a crisis."

LESSONS LEARNED

Going through the process on the ALQ-99, both from the user side and the supply side, there are lessons for others dealing with sustainment challenges. "You have to take a multifaceted approach and you can't ignore the warning signs," Kochman said. "The tremendous 'Aha!' moment for me was when I stepped in – I went right to our supply guys to ask, 'Why aren't you putting them on contract?' What I learned was that we failed to make the investment, so there was nothing to buy."

"Once I asked for help, there was plenty to be had," Kochman said. "I went to ONR one day and said, 'I need money to modernize tubes.' I went back a week or two later and said, 'I need money to fund a solid-state amplifier.' ONR was willing to help out. Without the Navy supply system and ONR's willingness to help, this wouldn't have been done."

"With the benefit of hindsight, I'd conclude that with aging avionics like this, if you have a shortcoming on the supply side, you can't overestimate how hard it's going to be to solve any problem," Kochman said. "Take every step on the supply side and on the user side to actively address it or you're going to find yourself far behind. I continue to believe that we need to work harder on our user side. If you don't take warning signs seriously when you first notice them, again, it's very easy to find yourself in crisis response mode as we were in 2004. If we had taken things more seriously and dealt with the user side problems earlier, we might have been able to prevent some of the failures (i.e., pressure on the supply side) we've seen."

For example, Kochman noted that operators often simply get used to dealing with certain things over time, like not running the built-in test because doing so actually can create additional problems. "Operators and maintainers learn how to make equipment work. It's something you live with and it's possible we contributed to some of these hardware failures by just living with these problems for so long."

One key thing Kochman noted is that components become outdated all of the time, but there are avenues to provide funding that might address the shortcomings of small components. In the case of the ALQ-99 Band 4 transmitter OTWT, where the production formula effectively was lost, the situation became more serious. Someone decades earlier should have started asking questions about acceptable standards. "They should have been looking at the fact that they only had 25 to 30 percent yield from the very beginning. Maybe we shouldn't be accepting that as a yield. We had a bad design and we knew it was a bad design," Kochman said. "If the customer is paying for it, accepting it and you're producing three [units] to achieve one [usable unit]… you need to take those warning signs seriously when you encounter them early."

The lessons learned on the ALQ-99 upgrade process also will aid the Navy as it undertakes the -99's replacement, the Next-Generation Jammer (NGJ).

"On the -99, we never had any way of recording usage data, so we have no idea how old these components are," Kochman said. "We know when they were manufactured, but we have no idea how much they have been used. It's difficult to track usage data when things fail. We know how much time a plane has flown, or how much time a pod has flown, but we don't know how much time a transmitter or exciter was operated or even how much time it was powered up. This is problematic from the perspective of data programming use requirements."

It's a lesson learned well, as the NGJ will build in usage and performance data recording that can be used on the maintenance and logistics support side. "We're cognizant of the data issues we had on the -99 and we won't repeat that," said Kochman.

"I expect, in a year from now, the Band 4 transmitter readiness won't be discussed by anyone for the first time in many years. We expect to really see a turnaround in coming months," Kochman said. "We're moving ahead."

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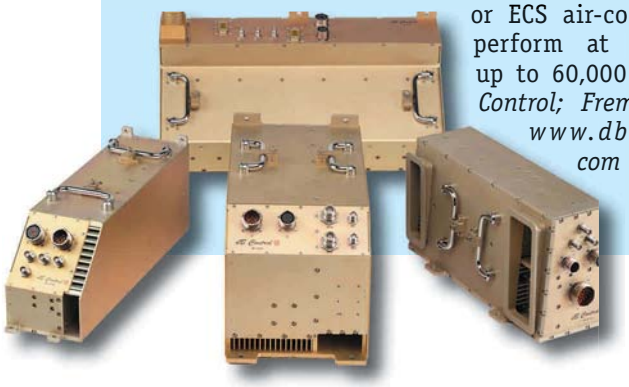

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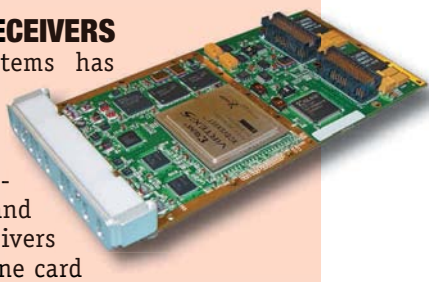
The Picoceptor™ is DRS Technologies' newest series of miniature portable receivers. Measuring 13 cubic inches and requiring 1 Watt of power, the receiver is designed for portable SIGINT and other software-definable radio applications. The receiver features an FPGA architecture and a built-in Web-based USB 2.0 graphical user interface that attaches to thumb drives, Ethernet devices, GPS receivers and Bluetooth modules and connects to a personal computer (PC) or laptop. Its RAM and flash memory support Linux OS software. Its file transfer protocol (FTP) and telecommunications network (telnet) protocol capability make it well-suited for complex digital signal processing. *DRS Signal Solutions Inc., Gaithersburg, MD; www.drs-ss.com*

18-40 GHz MILLIMETER-WAVE SDLVAs

Link Microtek has introduced a line of millimeter-wave successive detection log video amplifiers (SDLVAs) manufactured by Endwave Corporation and designed for electronic intelligence (ELINT) receivers, as well as radar and missile-guidance systems. The SDVLAs come in three types, the 18- to 40-GHz ASDA-81840, the 18- to 26-GHz ASDA-81826 and the 26- to 40-GHz ASDA-82640. With a typical signal sensitivity of -65 dBm at 85 degrees Celsius and a typical dynamic range exceeding 69 dB, the amplifiers have a +/- 1.0 dB log linearity and +/-1.5 dB frequency flatness. Hermetically sealed, they can operate in temperatures ranging from -45 to 85 degrees Celsius. *Link Microtek; Basingstoke, Hampshire, UK; www.linkmicrotek.com*

FPGA-BASED DIGITAL RECEIVERS

Mercury Computer Systems has introduced the DCM-V5-XMC Echotek® series of digital receivers based on Virtex™-5 FPGA architecture. Ideal for COMINT and ELINT applications, the receivers are packaged in a mezzanine card format and have two 14-bit analog-to-digital converters (ADCs) at up to 250 mega samples per second (MSPS) and one 12-bit digital-to-analog (DAC) converter at up to 2.3 giga samples per second (GSPS). The units are available either with a Virtex-5 SX95T or LX155T FPGA and each comes with QDR-II-SRAM and DDR-II-SDRAM memory chips, the latter using a 312.5-MHz, 32-bit-wide link to the FPGA for a 2.5-GB/s bandwidth. The convection-cooled receivers include two high-speed serial XMC connectors and can be used in temperatures ranging from 0 to 40 degrees Celsius. *Mercury Computer Systems; Chelmsford, MA; www.mc.com*



Communications EW – Part 22

Communication Jamming *(continued)*

By Dave Adamy

JAMMING CELL PHONES

This month and next, we will discuss the jamming of cell phone links. First, we will discuss how various types of cell phone systems work, and then we will consider a few jamming situations.

CELL PHONE SYSTEMS

Figure 1 shows a typical cell phone system. A number of towers are connected to a mobile switching center (MSC) that controls the whole process. The MSC also is connected to a public switched telephone network so that cell phones can be connected to regular wired telephones.

Cell phone systems can be either analog or digital. This refers to the way that communication signals pass between the cell towers and cell phones. In analog systems, the communication channels are analog (frequency modulated), but there also are control channels, which are digital. Digital systems use digital channels for both control and communication. Each frequency in a digital cell system has multiple communication channels. We will consider two important digital systems (GSM and CDMA) as typical.

ANALOG SYSTEMS

In analog cell phone systems, duplex operation is provided by the assignment of two radio frequency (RF) channels to each cell phone, one from the tower to the phone (the downlink) and one from the phone to the tower (the uplink). One user continuously occupies two RF channels during a call. Each channel carries the transmitted signal most of the time, but interrupts this signal for short periods to send digital control data. In some systems, the control data is modulated onto the voice signal so that no interruption is required. **Figure 2** shows the way signals are carried in analog cell phone channels for a typical system. A few of the RF channels carry digital signals

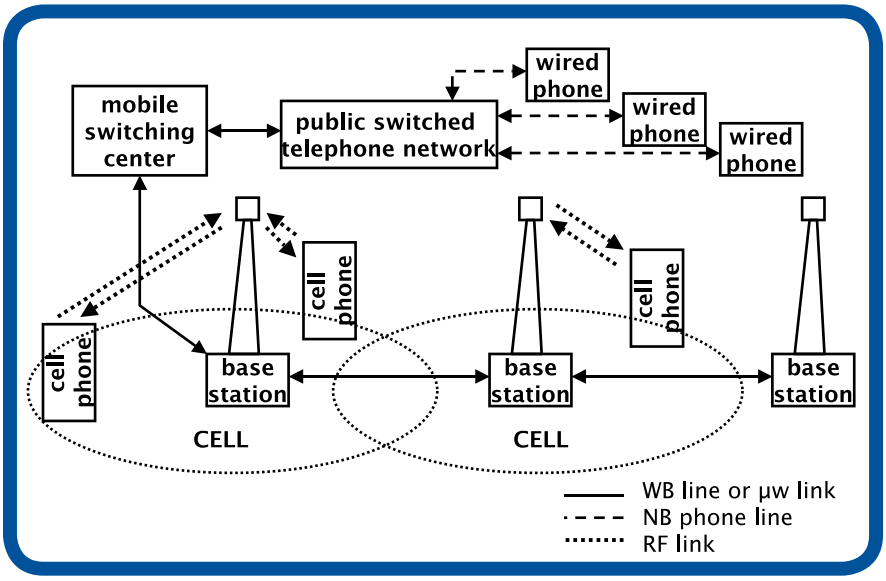


Figure 1: A cell phone system comprises several towers that are connected to a mobile switching center, which also connects to a public switched telephone network.

for access and control functions, and these are called control channels.

When a cell phone is activated, it searches control channels to find the strongest tower signal (i.e., the closest cell tower). After the cell system validates the cell phone as an authorized user, the cell phone enters the "idle" mode, monitoring the control channel for incoming calls. When the cell phone is called, the tower sends a control message assigning a pair of RF channels. When the cell phone initiates a call, the tower sends a control message to assign the RF channels. When

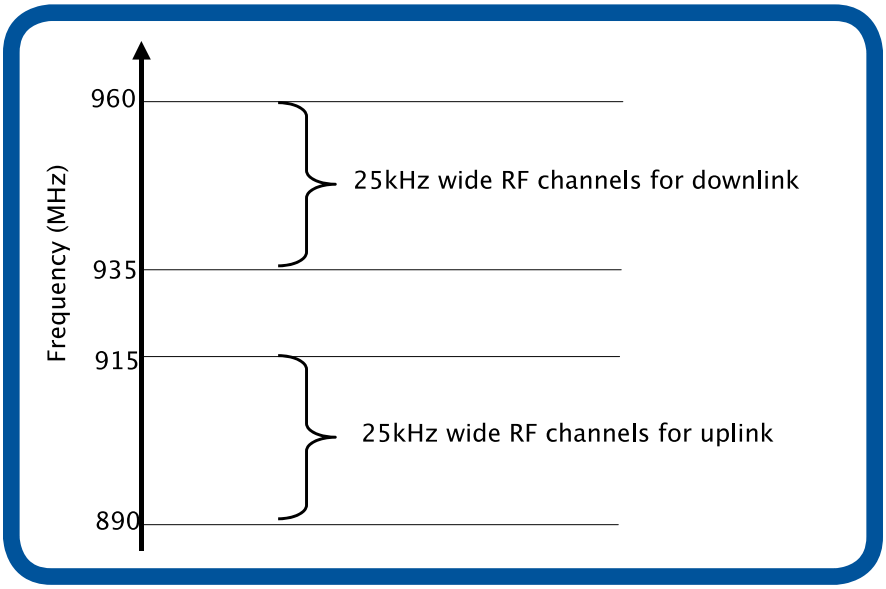


Figure 2: An analog cell phone system carries one conversation per RF channel. Up and down link channels for one phone are 45 MHz apart.

no channels are available, the system delays by a randomized period before retrying. To prolong cell phone battery life, the cell phone transmitter is turned off when the user is not talking. The digital control signals in the voice channels allow the system to change the RF channel assignment and to turn down the transmit power from the cell phone to the minimum acceptable level (to further prolong battery life).

Analog cell systems typically operate at about 900 MHz and can have up to 50 Watts of transmit power on each RF channel from the cell towers. Cell phones have a maximum transmit power of 0.6 to 15 Watts, but are turned down to a minimum required power by command from the tower. Minimum cell phone transmit power is usually 6 milliwatts.

Some of the user time slots in the cell system are occupied by control channels for paging and assignment of RF channels and time slots.

Operation is very similar to that of analog cell systems. When a cell phone is activated, it searches control channels to find the strongest tower signal and, after authorization, enters the idle mode, monitoring the control channel for incoming calls. When the cell phone is called or initiates a call, the tower sends a control message assigning a pair of RF channels (one each for uplink and downlink). However, in a GSM system, it also assigns a time slot in each assigned RF channel.

The randomized delay before retry when no channel/time slot is available and the control of cell phone transmitter power to maximize battery life are the same as described above for analog systems.

GSM systems operate at 900; 1,800; and 1,900 MHz. Separate RF channels are used for the uplink and downlink to each cell phone for full duplex operation. Note that different time slots are used for the uplink and downlink so that a cell phone is not transmitting and receiving at the same time. The transmitted power from cell phones and towers is similar to that in analog systems.

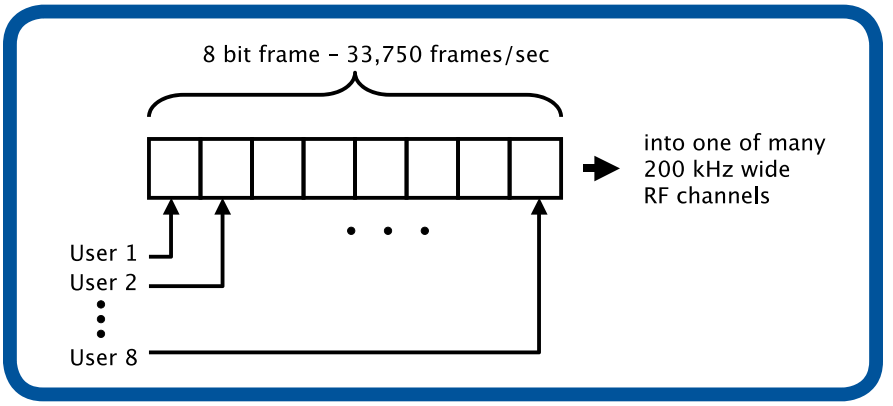


Figure 3: GSM cell phones carry digital user data in one RF channel for the uplink and another RF channel for the downlink.

GSM SYSTEMS

The Global System for Mobile Communication (GSM) has eight time slots per 200-MHz-wide RF band, allowing eight users to share the same RF band. A system will have many RF bands. Digitized voice data from each user is carried in one bit per frame as shown in **Figure 3**. The frame repeats at 33,750 frames per second for a total bit rate per RF channel of 270 kbps. Some systems operate in half rate mode, in which each user occupies the assigned bit in every second frame, so that 16 users share each frequency band. At the receiver, the bits in one time slot are passed through a digital to analog converter (DAC) to reproduce the signal that was digitized at the transmitter.

CDMA SYSTEMS

Code division multiple access (CDMA) cell phone systems use direct sequence spread spectrum (DSSS) modulation as described in the August 1998 "EW 101" column. Each user voice input signal is digitized. A high-rate digital modulation carrying a pseudo-random code is applied to each digitized user voice signal in the transmitter. This spreads the signal power over a wide frequency spectrum, thereby reducing its power density. When the same pseudo-random code is applied to the received signal at the receiver, the signal is returned to its original form. When passed through a DAC, the signal can be heard by the user for whom it is intended. If the correct code is not applied to the received signal, it remains so faint that it cannot even be detected by a listener. By using 64 different codes, which have been selected for optimum signal isolation, voice signals from 64 different users can be carried on the same 1.23 MHz wide RF channel as shown in **Figure 4**. A CDMA cell system has multiple RF channels. Some of the access channels (code and RF channel) in the system are used for control functions.

Operation is very similar to that of GSM cell systems as described above. However, the control signals to cell phones assign spreading codes rather than time slots. The IS-95 CDMA system operates throughout the United States at 1,900 MHz using tower and cell phone transmit powers like those described above for analog cell phone systems.

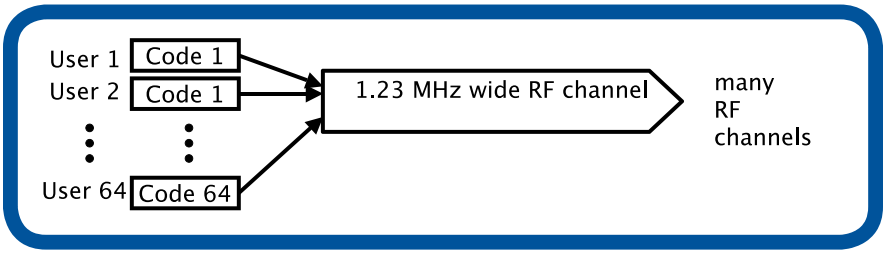


Figure 4: CDMA cell phones carry up to 64 digital user signals, each using a different spreading code, on each RF channel.

WHAT'S NEXT

Next month, we will continue our discussion of jamming cell phones. For your comments and suggestions, Dave Adamy can be reached at dave@lynxpub.com.

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AOC association news

AOC AWARD NOMINATIONS DUE APRIL 15

AOC is taking nominations for its annual awards. See the ad on Page 31 for a list of awards.

For more information and a nomination form, visit www.myaoc.org.

ONR EW PROGRAM MANAGER VISITS CHESAPEAKE BAY ROOST

Dr. Peter Craig, Program Manager for Electronic Warfare at the Office of Naval Research (ONR), was the guest speaker at the Chesapeake Bay Roost's (CBR) Roost January Luncheon, held January 15 in the Pioneer Hall of the National Electronics Museum in Linthicum, MD.

ONR sponsors scientific research and technology that pursue revolutionary capabilities for future naval forces and mature transitional science and technology (S&T) advances to improve naval capabilities, respond to current critical needs and maintain broad technology investments.

Dr. Craig discussed the ONR Electronic Warfare S&T area objectives and challenges. He placed particular emphasis on the ONR Broad Agency Announcement (BAA) posted January 8 titled "Electronic Warfare Discovery and Invention (D&I)" (ONR BAA 09-014). This BAA is seeking white paper submissions on technologies to defect and defeat imaging infrared (IR) and multi-mode threats.

For more information about CBR and its activities, contact John Hawkins at (410) 551-0620.

REPRESENTATIVE VISITS CRANE ROOST

In December, US Rep. Brad Ellsworth (D-8, Indiana) took a break from his pre-holiday schedule at the Naval Surface Warfare Center Crane Division to have lunch with the Crane Roost. Jimmy Hearn, president of the Crane Roost, briefed Rep. Ellsworth and his legislative director, Jed D'Ercole, on the Association of Old Crows (AOC) and the Crane Roost. Rep. Ellsworth is a member of the Congressional Electronic Warfare (EW) Working Group and is concerned with capability gaps in EW. Following the luncheon, Hearn said, "It is fantastic for EW to be receiving this degree of congressional interest and support!"

Rep. Ellsworth was visiting the Naval Surface Warfare Center in southern Indiana to gather information on the Naval Electronic Warfare Technical Integration Center (NEWTIC) and related EW efforts at Crane. Morning sessions were devoted to unclassified briefings by NEWTIC Director Erika White. The remainder of the day was devoted to classified briefings provided by EW Director Don Schulte and the Crane staff.

From left to right: US Rep. Brad Ellsworth, Crane Roost Vice President Carl Lohkamp and Crane Roost President Jimmy Hearn.

Director White said, "NEWTIC is part of the renaissance in EW. We will be the catalyst for EW technology transition and application Navy-wide." NEWTIC will provide the Navy with technology transition and integration into current and future EW requirements. This will be accomplished through an analysis of current and projected multispectral, multi-domain and multi-mission EW needs.

HELP DETERMINE THE AOC'S FUTURE

AOC is taking nominations for the 2009 Annual Election. Positions include President, who will service as Vice President in 2010 and President in 2011, along with three At-Large director positions and regional directors from the Central, Mid-Atlantic and Pacific Regions.

Nomination forms are available on the AOC website at www.myaoc.org or by contacting Carol Vann at the AOC. Nominations must be submitted to Ms. Vann by close of business on April 10, 2009.

For any questions or assistance, please contact:

Carole Vann, AOC Election Coordinator
Office: (703) 549-1600
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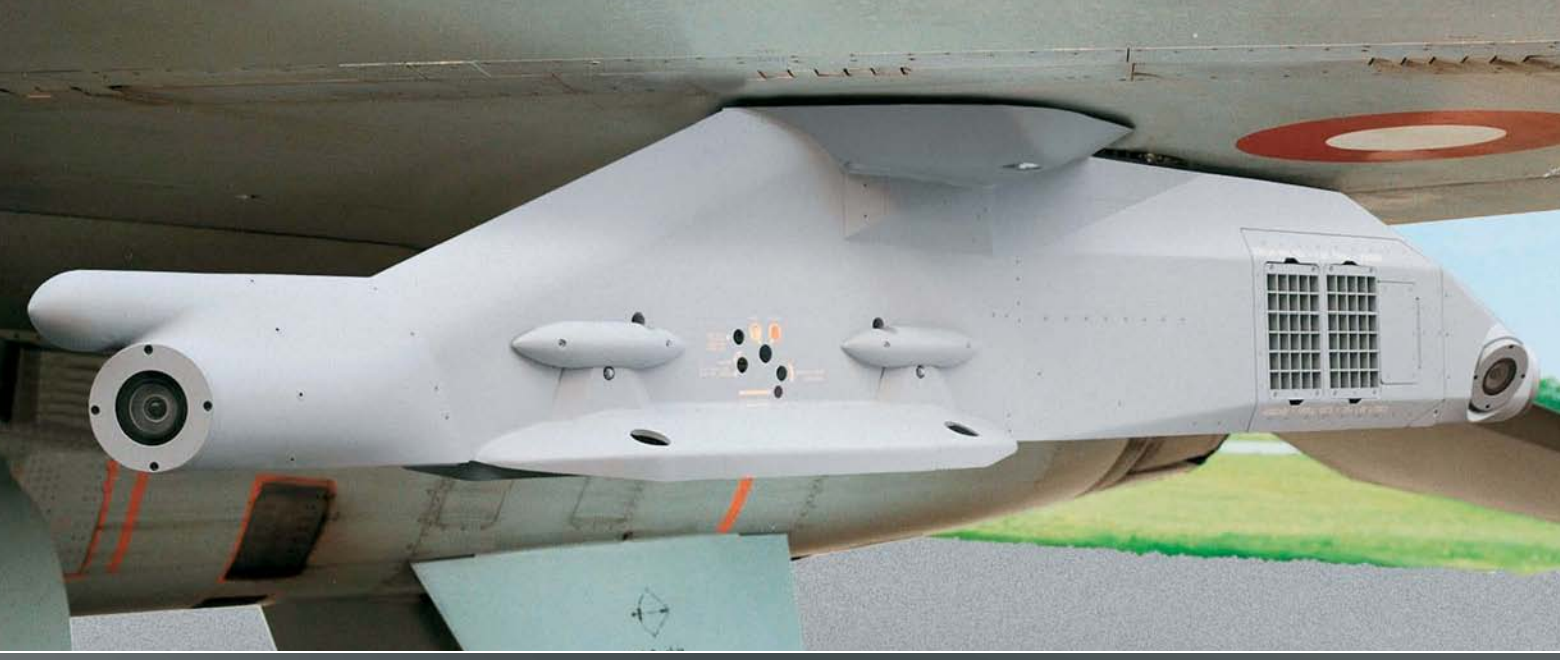

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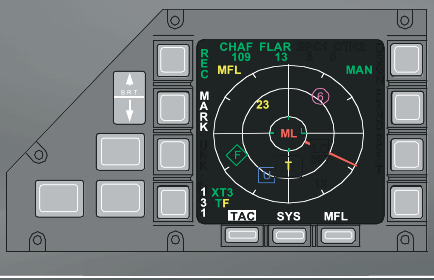

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