APRIL 2010
Vol. 33, No. 4

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the view from here

THE EMS PARADOX

In my job, I spend a fair amount of time thinking about the future of EW. Where is it going? How will it evolve? And while I am often impatient about the lack of advocacy and awareness that EW receives, I take comfort in the fact that many of the long-range indicators for EW are excellent. Since World War II, control of and access to the electromagnetic spectrum (EMS) has become an increasingly important factor in military operations, and that trend will continue to grow as we continue building our net-centric forces in the coming decades. Fuelled by an innovative and robust electronics industry, there are simply more users –military, government and commercial – using more of the EMS every day. This creates more EW challenges and opportunities for combatant commanders.

I find it ironic that the commercial world, which has less "life and death" dependence on the EMS than military forces, should do such a good job of managing use of the EMS. Companies that make commercial electronics devices often get together, agree on IEEE standards, and follow them very well, in order to ensure that their electronic devices work as they should. Those problems that do arise are often tackled quickly and efficiently, because at the end of the day the company's profits depend on universal access to the EMS. Somewhere in these companies, the leaders are listening to their engineers about the standards and procedures they must follow on order to ensure everyone's use of the EMS, including their own. Obviously, government broadcasting and telecommunications agencies certainly play their roles in regulating use of the EMS, too.

More importantly, however, the commercial world sees the EMS as a resource that it must preserve if their customers are to continue using it and companies are to continue profiting from that use. Companies spend millions (and probably billions) of dollars on research and development each year to create new electronic devices that offer more capability and, at the same time, use the EMS more efficiently. (Our adversaries leverage this investment every time they buy IED triggers from their local electronics shop.) Even military systems, such as the Global Positioning System, have strong support and interest from the commercial world, which fully understands how dependent it is on this satellite constellation.

How is it possible that the commercial world, which is inherently competitive and self-interested, should be capable of taking a longer, more strategic view of the EMS than our better organized and highly EMS-dependent military organizations? Aside from the under-resourced EW community, it seems as though the only other military professionals who regularly think about access to the EMS are those from the cyber community. Where is the broad understanding among senior leaders who fight in the air, land sea and space domains? Where is the corporate long-range planning at the Joint and coalition levels?

I don't see much of this today. But as I said, I'm optimistic that EMS awareness and the concept of spectrum control will grow in the future. Our military organizations will either figure out how to organize and fight in the EMS before a military disaster occurs, or we will continue to risk costly and humiliating lessons from weaker, but smarter adversaries.

– John Knowles

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www.oldcrows.org.au

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Fort Worth, TX
www.quad-a.org

Spring 2010 EWIIP
April 20-11
Little Creek, VA
www.crows.org

MAY

Navy League Sea-Air-Space Expo
May 3-5
Washington, DC
www.seairspace.org

AOC/Shephard EW 2010
May 11-12
Berlin, Germany
www.shephard.co.uk

3rd Annual EW Gaps and Capabilities Conference
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InfowarCon 2010
May 12-14
Washington, DC
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International Microwave Symposium
May 23-28
Anaheim, CA
www.ims2010.org

37th Annual Naval Aviation EW Symposium
May 25-27
Whidbey Island, WA
www.whidbeycrows.org

JUNE

Kittyhawk Week
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Wright-Patterson AFB, OH
www.crows.org

Eurosatory 2010
June 14-18
Paris, France
www.eurosatory.com

JULY

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Passive Covert Radar Conference
July 13-15
Verona, NY
www.crows.org

Farnborough International Airshow
July 19-25
Farnborough, Hampshire, UK
www.farnborough.com

AUGUST

Space Protection Conference
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Kirtland AFB, NM
www.crows.org

Unmanned Systems North America
August 24-27
Denver, CO
www.auvsi.org

SEPTEMBER

AFA Annual Air and Space Conference
September 13-15
Washington, DC
www.afa.org

OCTOBER

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Fundamentals of Airborne EC T&E
April 19-23
Washington, DC
www.gtri.gatech.edu

Advanced EW
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Alexandria, VA
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Atlanta, GA
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EW – A DIFFERENT TYPE OF BRACKET BUSTER

As I write this article, I am watching a number of basketball games in my own attempt to participate in the NCAA's "March Madness." I like pulling for the underdogs. They always seem to play with a determined spirit, even though the odds are against them and their athleticism may not meet the level of higher-seeded teams. In some sense, I think about the Electronic Warfare mission area in the same way. In the 30 years I have been associated with EW, the mission area has consistently been described as an "enabler" or "force multiplier." These terms have essentially put our mission area "on the bubble" of those operational capabilities that always seem to get higher seeding when it comes to training, material and funding.

However, over the last two years the playing field has shifted decidedly in favor of EW. It began with the Joint Electronic Warfare Directorate's emphasis on the importance of the Electromagnetic Spectrum (EMS) to today's military operations, and it has expanded to the realization that the EMS is in fact a maneuver space whose availability is critical to our national security.

Today, our Diplomatic, Informational, Military, Economic & Law Enforcement (DIME-LE) elements of national power operate in a global environment characterized by interdependence, uncertainty, complexity and continual change. In this environment, the prosperity and security our Nation relies on use of the EMS to achieve strategic advantage and strengthen the instruments of national power. Because the EMS reaches across geopolitical boundaries, its use and availability must also be considered in the conduct of national commerce, governance, and security. Therefore, EMS practitioners must be prepared to provide flexible, secure options involving use of electromagnetic spectrum to their national command authorities. This will require the deliberate integration of electronic warfare, cyber and spectrum management activities in all warfighting domains and across all operating environments.

This requirement will necessarily drive EW training, material and funding into a higher seeding. In effect, a mindset change within the Department of Defense that recognizes the "spirit and athleticism" of a mission area that has consistently ranked low. So, as you enjoy March Madness, remember EW is no longer "on the bubble" but is rapidly becoming a "bracket buster."

– Chris "Bulldog" Glaze

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US ARMY CIRCM RFP NEARS RELEASE

The US Army is in the final stages of preparing a request for proposals (RFP) for its Common IR Countermeasures (CIRCM) Technology Demonstration (TD). The RFP will call for a lightweight, laser-based DIRCM system for use on Army helicopters, such as the AH-64 and UH-60.

For the past several years, the Army and Navy have sponsored demonstrations of advanced directed IR countermeasures (DIRCM) technologies and systems from BAE Systems, Northrop Grumman, Raytheon and ITT. Those demonstrations have provided the Army with confidence that the required technology is sufficiently mature to proceed with CIRCM system development.

Meeting the Army's weight requirements will be important. The Army's RFP is expected to call for CIRCM "prototype B kits" weighing 85 lbs or less. A-kits must be 35 lbs or less for small rotary wing platforms and 70 lbs or less for larger helicopters.

The 21-month TD phase will require the selected contractor to deliver 12 CIRCM prototypes (six units within nine months and the remaining six units 10 months after award). The TD phase will conclude with a preliminary design review that will shape a follow-on engineering and manufacturing development phase of the program.

At press time, the Army was expected to release a draft RFP before April 1, followed by the announcement of a CIRCM industry day. The contracting point of contact is Ms. Eddie Whitfield (256) 955-6299, eddie.whitfield@us.army.mil. – *J. Knowles*

USMC CORPORAL PROJECT ADVANCES

A two-year electronic warfare-related Joint Capabilities Technology Demonstration (JCTD), being conducted by the US Marine Corps with Army participation, completed a key two-day field test with positive results during the second week of March at the Navy test range at China Lake, CA. The system concept, involving integration of existing technologies, is called CORPORAL (Collaborative Online Reconnaissance Provider/Operationally Responsive Attack Link). It aims to provide an infantry squad leader on the ground for the first time with networked access to intelligence, surveillance and reconnaissance (ISR) imagery, as well as communications-jamming support.

An electronic warfare requirements officer at HQ Marine Corps, told *JED* that the Technical Demonstration 1A "definitely proved the concept and demonstrated a capability we haven't seen provided yet to the warfighter."

CORPORAL would allow a squad leader to use his existing radios to request ISR still imagery of, say, enemy positions or an assault objective. The collaborative network would use the electro-optical/infrared cameras on a UAV or in the Litening targeting pod on a manned tactical aircraft to acquire that imagery.

During the field test, imagery from a Scan Eagle UAV was transmitted to a ground station and then shared in near real time across the CORPORAL network, which included an AV-8B Harrier and an F/A-18 Hornet, both fitted with a Litening pod. The ISR imagery was accessible to different network nodes on the ground and in the air, including dismounted and vehicle-mounted infantry.

The CORPORAL project also involves adding a small communications jammer to a UAV in the future, likely the Shadow 200 initially. During the test, a surrogate jammer payload on the ground was used to fulfill a request from Marines on the ground for communications-jamming support. Such jamming could be desired at a particular location and time – just prior to an assault – to disrupt insurgent communications.

The collaborative network would assign an available UAV or EA-6B Prowler support jamming aircraft to provide it. Marine Prowlers also carry the Litening pod and offer extended "on-station time" – the ability to loiter over the battlefield at a safe stand-off altitude and spot enemy activity with the pod's long-range high-resolution cameras. The Litening pod is built jointly by Northrop Grumman (Rolling Meadows, IL) and RAFAEL (Haifa, Israel).

The JCTD began in FY2008 and will be completed in the summer of 2011. – *G. Goodman*

ARMY TO RELEASE EMARSS RFP

On March 30, the US Army is expected to release a solicitation for the engineering and manufacturing development (EMD) phase of the Enhanced Medium Altitude Reconnaissance and Surveillance Systems (EMARSS), a manned ISR aircraft that will feature COMINT and EO/IR sensors, a SATCOM system and a self-protection suite.

The contractor will deliver four EMARSS systems (including aircraft and ground stations) during the EMD phase of the program. The aircraft must be capable of providing at least five hours of mission time. It will carry two pilots and two sensor operators and will send collected intelligence to a Distributed Common Ground System-Army for processing and dissemination.

Previous EMARSS discussion had focused mostly on the selection of a commercial derivative aircraft, with many in industry expecting the Army to provide the COMINT and EO/IR sensors as government furnished equipment (GFE). However, the upcoming solicitation is expected to direct the contractor to select the aircraft, as well as the sensor systems. The Army is expected to provide the Nebula Aerial Precision Guidance system as GFE.

The EMARSS aircraft will also be equipped with a self-protection suite that includes the APR-39B(V)2 radar warning receiver, the AAR-57 Common Missile Warning System (CMWS) and three ALE-47 countermeasures dispensing systems.

Following release of the RFP, the Army will evaluate proposals and plans to award a 42-month EMD contract in late June. The contractor will be required to deliver four EMARSS Systems within 18 months. Another four systems will be delivered during low-rate initial production and a further 28 systems will be delivered during full-rate production. The program point of contact is Peter Taylor, (410) 306-3523, peter.taylor7@us.army.mil. – *J. Knowles*

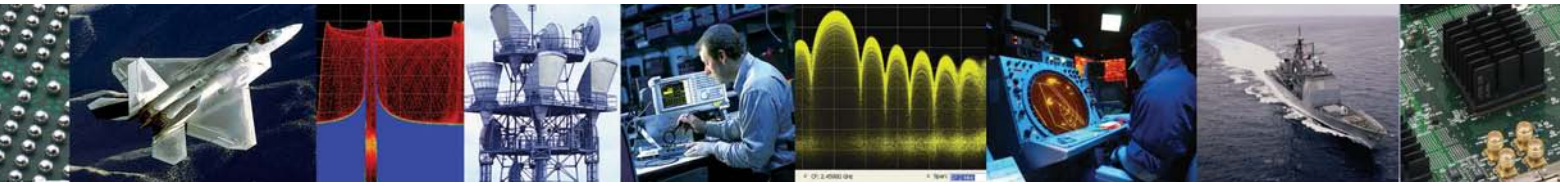
USMC PONDERS CESAS SUCCESSOR

The US Marine Corps has issued a request for information for its Next Generation Marine Corps Ground EA System (NGMCGEAS), which will serve as a possible replacement for its ULQ-30 Communication Emitter Sensing and Attacking System (CESAS).

According to a recently published draft performance specification, the Marine Corps is seeking a vehicle-mounted system that can operate from 20 MHz to 8 GHz, providing stationary and on-the-move electronic support (ES) and electronic attack (EA) in support of the Marine Air-Ground Task Force (MAGTF) Commander. In the future, the goal is to eventually extend coverage up to 18 GHz.

The performance specification cites a typical mission duration of 16 hours, during which the system shall be capable of constantly transmitting up to 10 hours, with an objective "constant transmit" capability of 24 hours. It must operate from standard 24VDC vehicle power, with a maximum power draw of 3KW. And it must convert between stationary and on-the-move modes within 20 minutes.

The Marines want the NGMCGEAS to feature an open architecture and utilize off-the-shelf components. It must also share voice and data with other USMC SIGINT/EA assets, such as the Mobile Electronic Warfare Support System (MEWSS), Radio Reconnaissance Equipment Program (RREP) and the Team Portable Collection System Multi-Platform Capable (TPCS-MPC), as well as the Technical Control and Analysis Center (TCAC). The system must allow



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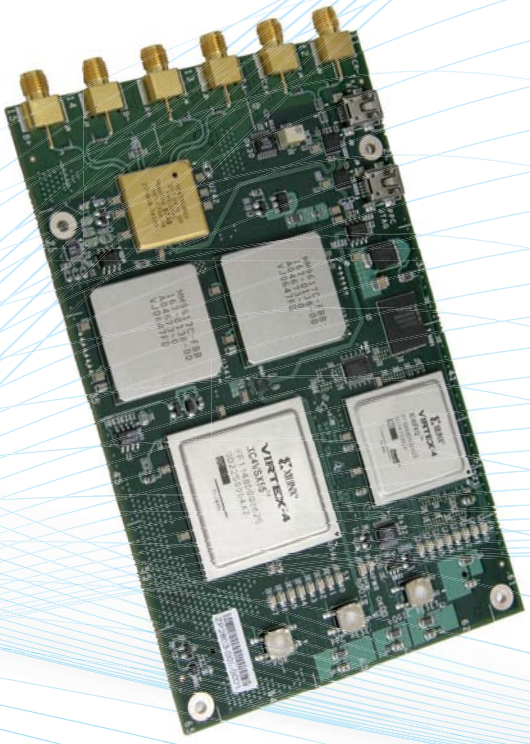

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operators to program at least 20 signals of interest (SOIs) and provide automatic notification upon detection. The EA system will disrupt all programmed SOIs, with 30 percent effectiveness against SOIs in the 20- to 30-MHz range and 80 percent effectiveness in the 31-MHz to 8-GHz range. Another required feature is a "stop buzzer" mode, in which remote shutdown can be performed to prevent jamming fratricide of friendly communications.

The Marines are seeking this capability not as a single "box" but as a family of systems capable of being integrated onto a variety of ground vehicles. The program point of contact is Sonia Guerrero, sonia.guerrero@usmc.mil. – *JED Staff*

US NAVY PLANS DIRCM UPGRADES

The Navy is planning a series of upgrades and improvements for the AAQ-24 Large Aircraft IR Countermeasures (LAIRCM) it is installing on its large rotary-wing platforms.

The Navy began operational use of the AAQ-24(V)25 Department of Navy LAIRCM (DoN LAIRCM) system on its CH-53Es in January 2009. Earlier this year, the program achieved full-rate production, which will cover the CH-53D and CH-46E, as well. With production now in full gear, the Navy is looking at system upgrades and enhancements.

One DoN LAIRCM upgrade of interest to the Navy is the addition of a hostile fire indication (HFI) capability. Rotary-wing HFI is a top priority for Marine Corps and Navy aircrews in Iraq and Afghanistan. In order to evaluate HFI on DoN LAIRCM, the Navy wants to procure

five 2-color IR missile warning systems from prime contractor Northrop Grumman (Rolling Meadows, IL). The missile warners will be upgraded with an HFI capability and evaluated using a Mid-Wave IR data collection system.

In another DoN LAIRCM effort, the Navy has announced plans to upgrade the missile warning sensors and processors with a laser warning capability. The Navy has a requirement to procure 385 laser warning sensors and integrate them into the 2-color IR missile warning sensors. In addition, the Navy will buy 77 two-color missile warning system processors upgraded with the laser warning capability. The Navy is expected to award a contract to Northrop Grumman for this work. – *J. Knowles*

US NAVY AWARDS DRFM CONTRACT

The US Navy has awarded a $44.4 million contract to KOR Electronics (Cypress, CA) for delivery of up to 200 miniature I/J-Band digital RF memory (DRFM) units.

The Navy's Airborne Threat Simulation Organization (ATSO) in Point Mugu, CA, will install the DRFMs in ULQ-21(V) countermeasures sets. The ULQ-21 is integrated onto supersonic aerial targets, pods and internal bays on aircraft. The DRFMs enable these platforms to appear as anti-ship cruise missiles, aerial threats and radar jammers for test and training purposes.

The contract follows earlier ATSO orders for I/J band DRFMs that were also awarded to KOR. – *J. Knowles*

NASIC SEEKS SIGINT ENGINEERING SUPPORT SERVICES

The US Air Force has issued a sources sought synopsis for the SIGINT Engineering Support Services II (SESSI II) program to determine which firms are capable of supporting this effort. The SESS II contractor will support the National Air and Space Intelligence Center (NASIC) at Wright-Patterson AFB, OH, with "Signals Intelligence (SIGINT) processing, exploitation, data management, analysis, dissemination and reporting," according to the synopsis. "SIGINT analysis is conducted by NASIC analysts to determine the performance characteristics of systems of interest. The results of this analysis are incorporated into all-source threat assessments, used to construct engineering models and provided directly to intelligence end-users."

NASIC is seeking information from companies that can provide Top secret/SCI-cleared personnel with expertise in technical electronic intelligence (Tech ELINT), foreign instrumentation intelligence (FISINT), C3 datalinks, modeling/digital simulation development, system operations and support and SIGINT techniques implementation.

NASIC's budget for this effort is $24 million, and it plans to award one or two contracts by November. A formal request for proposals is expected in the next few months. – *JED Staff*

US ARMY SEEKS INFO ON VEHICULAR SIGINT SYSTEMS

The US Army's Intelligence and Information Warfare Directorate (I2WD) has issued a request for information (RFI) for wideband SIGINT systems to be integrated onto a ground vehicle. The system will be procured via Foreign Military Sales channels and fielded by a coalition partner country.

The I2WD is interested in receiving responses describing commercial-off-the-shelf SIGINT systems covering the HF, VHF and UHF frequencies. The Army will supply the vehicle, the power subsystem, a 10-meter integrated extendable mast, equipment racks, two operator workstations and associated cabling. In addition to the SIGINT system, the contractor will be responsible for antennas, system cabling, laptops and dedicated displays. The Army will perform system integration on the vehicle, which will be evaluated in the end user's country. The contractor will also provide operator and maintenance training to the end user.

The program point of contact is to Chad Mocik, (732) 427-7097, chad.mocik@us.army.mil. – *JED Staff*

IN BRIEF

Alliant Techsystems (Minneapolis, MN) has announced a company-wide reorganization, realigning its businesses into four operating Groups as of April 1. Blake Larson leads the newly formed Aerospace Group, which has capabilities in solid rocket propulsion systems, advanced materials, launch structures, next-generation commercial and military aircraft structures, satellite structures and small satellite systems. Karen Davies now manages the Armament Systems Group. Bart Olson leads the newly formed Missile Systems Group, which includes the AGM-88E Advanced Anti-Radiation Guided Missile (AARGM) program, the AAR-47 and JATAS missile warning programs, as well as special mission aircraft integration. Ron Johnson heads the company's newly formed Security and Sporting Group.

The US Navy has exercised a $12.1 million contract option with **L-3 Communications Flight International** (Newport News, VA) for commercial air services, military operations support. The company will provide airborne threat simulation, including electronic attack, for shipboard and aircraft squadron weapons system operators in the EW environment. The contract will run through October.

The US Army has awarded a $13.9 million contract to **Alloy Surfaces Co.** (Chester, PA) for production of M211 special materials decoys for its rotary-wing aircraft. Deliveries will be completed in May 2011.

Argon ST (Fairfax, VA) has received a $17 million contract from the US Army to provide advanced development services in airborne SIGINT. The company will provide "platform enablers" via its Lighthouse/Prism products to ensure easier upgrade of Army SIGINT systems.

US Air Force Special Operations Command (Hurlburt Field, FL) has announced plans to award a sole-source contract to **S&K Technologies** (Warner Robins, GA) for upgraded IR Suppressor Systems (IRSS) for its AC-130 aircraft


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under the Tubs/Rails Improvement Program (TRIP). A single TRIP kit consists of four IRSS assemblies (also referred to as Tubs), which are installed on each of the AC-130's four engines. AFSOC's total requirement is for 27 kits (17 for the basic requirement and an option for 10 additional kits). Deliveries meeting the basic requirement are scheduled to be completed by December 2011.

The Naval Research Lab (Washington, DC) is soliciting proposals for engineering and technical support in IR and EO EW technologies. The contractor will perform tasks divided under six major technical areas: (1) Electro-Optical/Infrared (E-O/IR) Hardware Development and Evaluation, (2) E-O/IR Countermeasure/Low Observable Studies, (3) Radio Frequency (RF) Countermeasure Studies, (4) Directed Energy Studies, (5) Computer Engineering, and, (6) Program Documentation. The base contract will run for one year, to be followed by four option years. The incumbent contractor is Envisioneering (Alexandria, VA). The program point of contact is Jerry Riles, (202) 767-0667, jerry.riles@nrl.navy.mil.

The Naval Research Lab is planning to issue a solicitation for software development services in support of Multifunction Electronic Warfare (MFEW) Advanced Demonstrator Model (ADM) integration with Advanced Multifunction RF Concept (AMRFC) test-bed. The software to be transitioned includes core infrastructure, resource allocation management, electronic warfare, radar, communications and utility software. This software will be a common component of several multifunction RF systems that will be developed as part of the Navy's Integrated Topside (InTop) program and will provide a framework for integrating these systems together and dynamically allocating their resources to multiple functions such as radar, electronic warfare and communications. The solicitation is expected in the coming months. The contracting point of contact is Grace A. Pennington, (202) 767-0682, grace.pennington@nrl.navy.mil.

Agilent Technologies (Englewood, CO) has received a $158,226 contract from the US Air Force (Wright-Patterson AFB, OH) for a four-channel high-frequency direction finding (HFDF) receiver to be used in conjunction with the Air Force Institute of Technology's RF Signal and Intercept Collection System (RFSICS), which was supplied by the company in 2006.

The **US Air Force** has issued a request for information (RFI) calling for companies that can provide sustainment services and program depot maintenance of the AN/TPT-Ti(V) Unmanned Threat Emitter (UMTE). Responses are due April 19. The contracting point of contact is Christopher Neering, (801) 586-6016, christopher.neering@hill.af.mil.

The US Strategic Command has announced plans to award a 60-day contract to the **Center for International**

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and Strategic Studies to manage the USSTRATCOM Electromagnetic Spectrum Organizational Study and to lead command-directed special analysis in support of a JROCM requirement. The nature of this work requires the contractor to convene an optimal group of subject matter experts at the 3- and 4-Star level to address organizational analysis issues. It also requires industry leaders, active duty and retired military leaders, current and former policy officials and scientific organizations and experts, all of whom will be called upon to make crucial contributions to the analysis. The study support will conclude on May 31.

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The Naval Research Lab has awarded a pair of contracts for engineering support. **Global Strategies Group** (Crofton, MD) has won a $10.4 million contract ($2 million base, plus $8 million in options) for engineering support in the area of advanced electronic attack technologies and concepts for the Lab's Tactical Electronic Warfare Division. The company will focus on four major task areas: TASK 1: Electronic Countermeasures Techniques; TASK 2: Artificial Intelligence; TASK 3: Command & Control System Development; TASK 4: Unmanned Aerial Vehicles (UAV) Design and Development. **CACI CMS Information Systems** has received a $21 million contract ($4 million base and $17 million in options) for research, design, development, installation and maintenance of advanced electronic warfare and information warfare systems on Navy ships and aircraft.

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The Office of Naval Research will hold a classified SECRET workshop entitled Multi-Function Communications and Electronic Warfare (EW) for Counter Radio-Controlled Improvised Explosive Devices (C-RCIED), May 11-13, 2010, in the greater Washington, DC area. The workshop will focus on the application of multi-function communication and EW technologies toward C-RCIED operations. All industry participants will be required to: 1) hold a GENSER SECRET clearance, 2) be experts in the implementation of multi-function communication and EW concepts and 3) provide a technical presentation on their experiences with the application of multi-function communication and EW systems during the workshop. Due to limited space, industry representation will be limited to two technical experts per organization and one 20-minute PowerPoint technical presentation per organization. Please contact ONR EW Program Officer David Tremper, david.tremper@navy.mil no later than April 21.

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Herley New England (Woburn, MA), a division of Herley Industries, has received an $11.7 million contract for microwave assemblies for a US Navy support jamming aircraft program. The company's Simulation Systems Group in Irvine, CA, also received a $1.3 million contract to supply a dual-channel digital RF memory (DRFM)-based target and EW simulator to support radar testing operations in the US Navy.

Monitor photos courtesy US Air Force, US Navy

washington report

JIEDDO DIRECTOR PROVIDES IED UPDATE

Last month, LTGEN Michael Oates, director of the Joint IED Defeat Organization, participated in a "DoDLive Bloggers Roundtable" with reporters on March 12. The following excerpts from that event provide some excellent insight into the latest developments in IEDs and the DOD's strategy to defeat them.

In response to a question about the difference between the IED threat in Afghanistan today versus the earlier fight against IEDs in Iraq, General Oates said, "The current situation in Iraq – of course, you know, the volume and the effectiveness of IEDs have dropped significantly in the last year. So the first thing is the Iraq that many of you remember from a couple of years ago has very much changed. The type of IED and the volume of IED in Iraq from the really bad days of '06, '07, early '08 is very different than what we see in Afghanistan. Specifically, in Iraq we saw proliferation of military-grade explosives and projectiles as the primary explosive and a varying degree of sophisticated detonation capability, some of which was supplied by third countries. In Afghanistan, the threat is expanding. That is, it's almost doubled the number in volume of IEDs in the last year. The number of casualties has reflected that this last year. The quality and type of IED is very different in Afghanistan: largely homemade explosive centered around two dominant types of fertilizer, potassium chlorate and ammonium nitrate and a very rudimentary detonation capability, the majority of which is what we called victim-operated – that is pressure plate or trip wire – followed by some command wire-detonated and, a third, remote control. So, to summarize, the difference of IEDs between Iraq and Afghanistan – declining in Iraq, significantly increasing in Afghanistan. Degree of sophistication in Iraq high, degree of sophistication in Afghanistan low. Effectiveness good in both. That is we still see EFPs in Iraq, which are effective. And the fertilizer bombs because of the unimproved roads present a unique challenge for detection."

Another question focused on the IED Task Force for Afghanistan and what it has produced to date. General Oates responded, "The first thing was to synthesize all the urgent needs that were required from the Central Command and from Afghanistan. We've got all those aboard now, at least on most of them. We have already processed those requirements, and the – and the first group of requirements has already been obligated. I am spending out most of my budget that's remaining to meet these surge requirements, and that capability is already moving into theater. It will flow in over about the next three to four months, and some will be longer term, because there are block increments associated with some of these technologies to meet some of the commander's requirements over there."

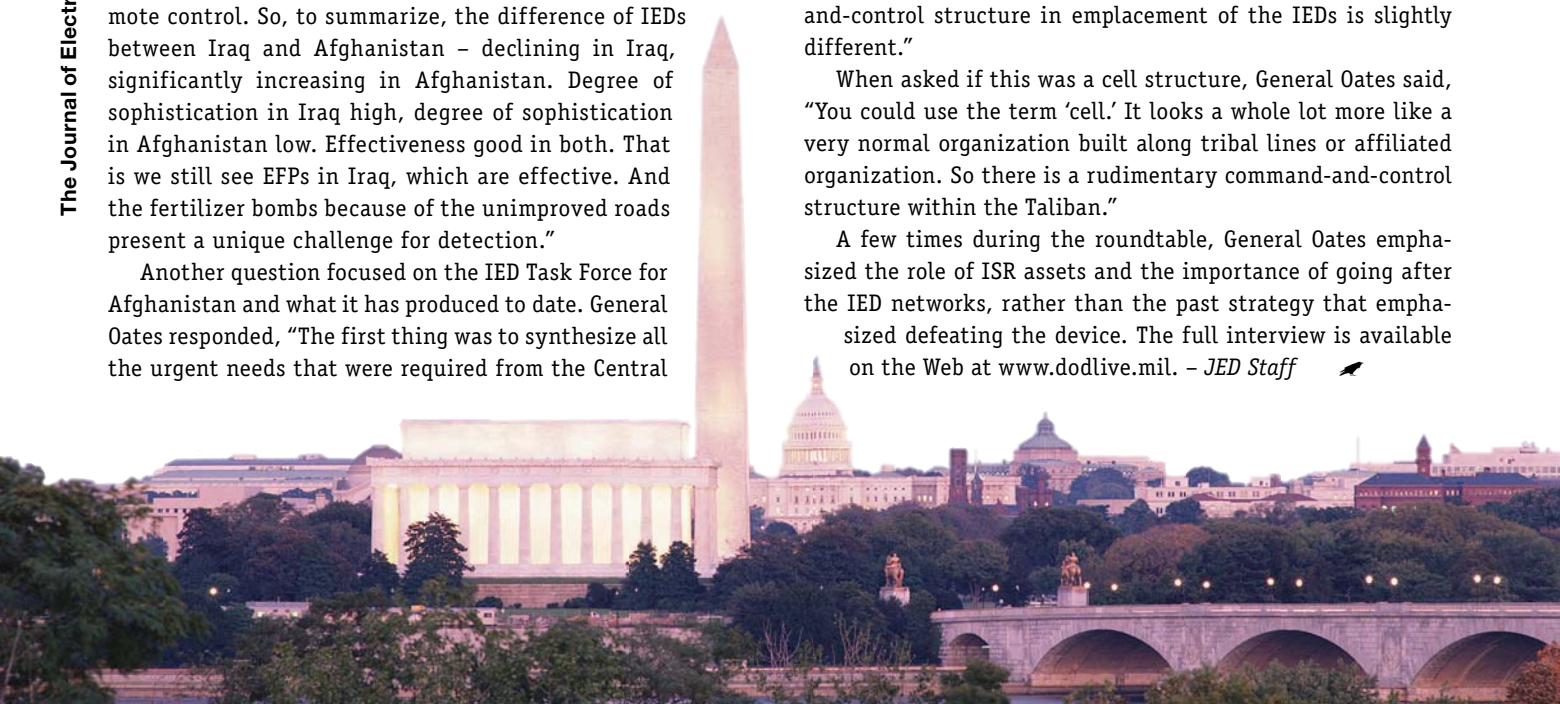
One reporter asked how IED networks in Afghanistan differ from those in Iraq. General Oates said, "There are some similarities, but I'll try and highlight the differences. The actual networks in Iraq were largely financed by al Qaeda or Sunni rejectionists who received other financing. The emplacers of the IEDs in Iraq were largely disaffected, disenchanted, unemployed Sunni males. Now, what we have – and, of course, Shi'a militia groups in the south, obviously, account for a number of the EFPs in the south.

"In Afghanistan, though, the Taliban is very much in control locally, and they have almost a military-style organizational structure, and their fighters are the ones that do the emplacement. And so there is a chain of command, if you will, within the Taliban, and they seek to use the IED's mobility and prevent us from interacting with the population to preserve their own criminal enterprise and certainly to harm or kill our soldiers.

"So there are some similarities, but the actual command-and-control structure in emplacement of the IEDs is slightly different."

When asked if this was a cell structure, General Oates said, "You could use the term 'cell.' It looks a whole lot more like a very normal organization built along tribal lines or affiliated organization. So there is a rudimentary command-and-control structure within the Taliban."

A few times during the roundtable, General Oates emphasized the role of ISR assets and the importance of going after the IED networks, rather than the past strategy that emphasized defeating the device. The full interview is available on the Web at www.dodlive.mil. – *JED Staff*



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world report

UK SELECTS CDAS DEVELOPER

The UK MOD has awarded a contract to Selex Galileo (Luton, UK) for the Common Defensive Aids System Technology Demonstrator Programme (CDAS TDP). The goal of CDAS is to integrate a family of existing and future DAS components for installation across multiple aircraft types.

The TDP will run for approximately four years. During that time, the company will lead the CDAS effort to develop a suite architecture that enables easy integration of various sensor and countermeasures systems from different manufacturers. The DAS controller and architecture will be developed from Selex's Helicopter Integrated Defensive Aids System (HIDAS) and other helicopter DAS solutions developed by the company. Other components will include a passive missile warning system, such as the AAR-57 from BAE Systems or the Elix-IR from Thales, a hostile fire indicator, expendables dispensers and a directed IR countermeasures (DIRCM) system. With regard to the DIRCM system, Selex has been tapped to provide its ECLIPSE Pointer-Tracker and Type 160 Infrared Counter Measure (IRCM) laser, which were developed as part of a miniature DIRCM jam head in partnership with Northrop Grumman.

In a press release, Selex said, "The CDAS TDP will develop an architecture that can easily integrate the different sensors and effectors that may be required for a given platform and role. A flexible, open-architecture approach with standardised interfaces will be developed, together with a common approach to programming. The outcome will be a coordinated, optimized response to threats based on the various sensor and effector capabilities fitted to the platform." – *J. Knowles*

DSTL TO LEAD DEFENSE S&T

Beginning April 1, the UK's Defence Science and Technology Laboratory (DSTL) will take over responsibility for leading the MOD's science and technology (S&T) research program.

Frustrated by the pace of technology development and the slow transition of that technology to the operational user, the MOD decided earlier this year to close its Defence Technology and Innovation Centre and move S&T management responsibility to Dstl. The MOD has replaced the Science Innovation Technology organization with a smaller team inside the MOD.

In the EW area, Dstl is the MOD's primary technology lab, developing sensor and net-centric technologies and concepts in partnership with industry.

In a press statement, Dstl Chief Executive Dr. Frances Saunders said, "These changes will increase our ability to bring together the users of S&T in the MOD with the suppliers in industry and academia, with the aim of reducing the time it takes for pull-through of advances into service." Dr. Saunders added, "We are now the single point of contact, with science and technology research funding coming through Dstl to the widest possible variety of suppliers. We will set the parameters and work with suppliers to get the best possible results for government and our Armed Forces." – *JED Staff*

In Brief

- **TMD Technologies** (Hayes, Middlesex, UK) has named David Pike to the newly created position of Operations Director. This follows recent appointments of new managers for both its Tubes and Equipment Divisions.
- The Kingdom of **Saudi Arabia** is considering the acquisition of Russian S-300 PMU and S-400 air defense systems, according to a report from UPI. The acquisition is being proposed in an effort to exert political influence on Russia and prevent deliveries of Russian advanced air defense systems to Iran, according to some analysts. However, the sale of S-300/-400 systems to Saudi Arabia is likely to drive new EW requirements in the region, as well.
- The **Malaysian Air Force** has scrapped plans to retire its MiG-29N this year, according to a report from Forecast International. It will continue to operate 10 of its 16 MiG-29N aircraft until 2015. The retirement date was extended because government funding shortfalls will delay acquisition of new fighter aircraft.
- **Saab** has reported that its Gripen NG flight tests continue, with evaluation of all tactical systems on the aircraft. Last month the company said it was testing the aircraft's AESA radar and a new communications system. The company has completed and verified the performance of the missile warning system.
- **UK Minister of Defense** Bob Ainsworth said in a written statement to the House of Commons last month that the UK and US governments have reached an agreement under which the UK will acquire three RC-135 Rivet JOINT SIGINT aircraft and associated ground systems. The Foreign Military Sale was proposed in 2008. The RAF will retire its two remaining Nimrod R1 SIGINT aircraft in March 2011. The RC-135s will be delivered in 2014.

MASTER IN STRATEGY

The New

Face of Airborne Electronic Attack

By Glenn Goodman

Complementary Family of US Navy, Marine Corps and Air Force Jamming Aircraft Takes Shape

With the release of the Defense Department's FY2011 budget request in February, the pieces of a long-sought executable blueprint for the joint-services' airborne electronic attack (AEA) systems finally fell into place. Faced with a pending AEA shortfall and demands from the US regional combatant commanders for more jamming aircraft in their overseas theaters, senior DOD officials directed the Navy to buy additional new EA-18G Growler aircraft. They will be used to recapitalize the Navy's three land-based EA-6B Prowler "expeditionary" squadrons, which have supported Air Force and Army missions and were scheduled to be deactivated.

Pentagon officials approved the AEA modernization blueprint back in 2002. It aimed to fill the shortfall in radar-jamming capability that would be created with the retirement of all of the Navy's venerable aircraft carrier- and land-based EA-6Bs, which began last year. The DOD was entirely dependent on Navy and Marine Corps Prowlers to provide support jamming to counter the radars of a modern integrated air defense system (IADS) in a major combat operation – the most stressing scenario – to allow US attack aircraft to reach their targets.

The AEA modernization scheme called for fielding not just a Prowler replacement (the Growler), but a family of complementary Navy, Marine Corps and Air Force manned and unmanned jamming aircraft – a joint AEA "system of systems."

Of particular importance, the Air Force committed itself to provide a manned high-power stand-off jamming aircraft and focused on a B-52 bomber-based solution. However, due to budget constraints, the service struggled to find the money to fund it. Following two aborted efforts over five years to define requirements and begin a B-52 jammer program, the Air Force essentially defaulted on its commitment early last year, leaving the DOD's AEA modernization plan in disarray.

On the positive side, Air Force development of a low-cost, expendable, cruise missile-like Miniature Air-Launched Decoy-Jammer (MALD-J), another piece of the AEA plan, has moved forward and is entering engineering and manufacturing development by Raytheon Missile Systems. It is scheduled to begin providing autonomous "stand-in" jamming close to enemy air defense radars – a unique new capability – in late 2012.

The Air Force also has pushed its workhorse EC-130H Compass Call communications-jamming aircraft to the fore as a new pillar of the AEA architecture. The service has added some radar-jamming capability to the turboprop aircraft.

In addition, the Air Force says the combination of on-board EW and the low-observable stealth characteristics of its new fifth-generation fighters – the F-22 and the planned F-35 Joint Strike Fighter – will allow them to defeat enemy air defenses and strike targets. Advanced air defense radars can operate at lower frequencies and may be able to detect and track some low-observable aircraft. The Air Force is focusing its AEA programs to handle those low-band threats. MALD-J

likely could be used to jam those low-frequency radars preemptively. Moreover, US long-range precision air-to-surface stand-off weapons and supersonic anti-radiation homing missiles, not always given sufficient weight in AEA discussions, could destroy the radars if they remain stationary for too long.

Col Stephen Brown, the Air Force's chief of electronic warfare requirements, told *JED*, "We studied the B-52 stand-off jamming concept and concluded that a system of systems comprised of stand-off communications jamming from our EC-130H, stand-off weapons, stealth and stand-in jamming with MALD-J was a more cost-effective approach."

US military officials have acknowledged publicly that advanced active electronically scanned array (AESA) radars installed on fighter aircraft can provide some spot jamming capability against threat radars. Those type of radars are used on the F-22 and F-35 (and on non-stealthy fighters such as F/A-18E/Fs, EA-18Gs and some F-15s). However, electronic warfare experts counter that an AESA radar's jamming capability is limited to a very specific and narrow frequency range in which the radar typically operates. By comparison, support jammers cover a wide range of frequencies across which many types of radar (early warning, acquisition, tracking and fire control) operate.

Brown's predecessor, Col Robert Schwarze, told *JED* in 2007, "The idea behind the AEA system of systems is a layered approach. It's not a single system that is going to save your aircraft but a combination of capabilities, such as stealth, self-protection systems, escort jamming, stand-off jamming and stand-in jamming, not all of which will always be available. They complement each other and give our aircraft the best chance of survivability in any scenario." He added, "When you start pulling out pieces of the system of systems, "you leave holes where you increase your risk in those areas."

US NAVY AND USMC AEA PLANS

The Boeing EA-18G Growler is a variant of the Navy's two-seat F/A-18F Super Hornet. It carries the same ALQ-99 system with external high- and low-band jamming pods as the Prowler. The

"We studied the B-52 stand-off jamming concept and concluded that a system of systems comprised of stand-off communications jamming from our EC-130H, stand-off weapons, stealth and stand-in jamming with MALD-J was a more cost-effective approach."

Navy's original plan called for acquiring only enough new Growlers (88) to outfit a squadron with five operational aircraft in each of its 10 carrier air wings for fleet missions and deactivating its three land-based EA-6B expeditionary squadrons and single land-based reserve squadron. The latter were created following the retirement in 1998 of USAF's EF-111 Raven AEA aircraft fleet. They have primarily supported penetration of defended airspace by Air Force non-stealthy fighters and bombers, the role intended for the cancelled B-52 stand-off jamming aircraft.

DOD officials said February 1 that the Navy will now acquire an additional 26 Growlers – two in FY2011 and 24 in FY2012 – beyond the final 10 of 88 it had planned to order in FY2011. Those extra EA-18Gs will allow the Navy to keep three expeditionary squadrons operational. In addition, the single Naval Reserve EA-6B squadron, VAQ-209 at Andrews AFB, MD, will transition to Growlers and serve as a fourth expeditionary AEA squadron. All Growler squadrons will have five operational aircraft instead of the four in the EA-6B squadrons.

The Navy's first squadron to complete the transition from Prowler to Growler aircraft became operational last September. CAPT John Springett, the AEA Requirements Officer in the Navy's Air

Warfare Division (N88), told *JED* that his service will operate EA-6B squadrons in its carrier air wings until they have completed transitioning to EA-18Gs by the end of FY2014.

The Navy had planned to deploy its first Growler squadron (VAQ-132) with the air wing on the aircraft carrier *USS Carl Vinson*. However, the squadron instead will deploy overseas to serve in the expeditionary role. Springett noted, "The Navy has prioritized the expeditionary transition to EA-18Gs in response to combatant commanders' urgent requests for

airborne electronic attack support. Three of the first four squadrons to transition to the EA-18G will be expeditionary squadrons."

The Marine Corps opted to keep operating its four land-based EA-6B squadrons (VMAQ-1 through VMAQ-4) and transition them to the latest Improved Capabilities (ICAP) III Prowler configuration instead of buying the Navy's new Growler. The Marines will wait "to make the next leap in AEA technology with a potent combination of the [planned] Next-Generation Jammer and the F-35B short-take-off-and-vertical-landing variant of the Joint Strike Fighter" the Corps is acquiring, said Maj Adam Musoff, an EW requirements officer at HQ Marine Corps Aviation. The Corps also is interested in fielding unmanned aerial vehicles (UAVs) with electronic attack payloads in the future.

As Marine Corps Lt Gen Duane Thiessen, deputy commandant for programs and resources, told an *Aviation Week* conference in February, "Our intention is to shift EA to the JSF; and where there is opportunity [for EA payloads] in unmanned aircraft systems, we will take advantage of that."

Naval Air Systems Command is developing the Next-Generation Jammer (NGJ) to replace the ALQ-99 system on the Growlers around 2018. USMC Lt Gen George Trautman, deputy commandant for aviation, told *JED* last spring, "What we have pressed for is that the planned NGJ not be built strictly as external pods for the Navy's EA-18G Growler. We would envision flying a mix of very low-observable F-35Bs and not-very-low-observable F-35s equipped with NGJ pods, and [the latter] would be 'when and if needed.' When and if we needed the capability resident in the NGJ, we could put them on the F-35 and go."

He also cited the Marine Corps' planned use in the future of UAVs with jamming payloads. [Our desire] is "to create a distributed approach to AEA whose capabilities will far exceed anything we have today."

Musoff elaborated: "EW is growing in the Marine Corps. No longer will we have only a single platform to do the mission. We plan to expand our EW capabilities and distribute them among our F-35s and unmanned aircraft systems."

The Corps is procuring upgraded Intrepid Tiger jamming pods, which are currently flown on its F/A-18 Hornets and AV-8B Harriers. The new ALQ-231 Intrepid Tiger II pods feature a new techniques generator, new antennas and an enhanced networking capability that will enable off-board operators to access and control the pod, Musoff said. "Our intent is to procure additional pods to add the capability to our H-series helicopters, ensuring that all of our Marine Expeditionary Units will have organic EW assets."

In addition, the service will expand the ground-based EW capabilities resident in its radio battalions and CREW (counter radio-controlled improvised explosive device EW) jamming systems. "The key will be to tie all of these systems together in a network that we are calling EW battle management," Musoff said.

DOD officials said February 1 that the Navy will now acquire an additional 26 Growlers – two in FY2011 and 24 in FY2012 – beyond the final 10 of 88 it had planned to order in FY2011.

The Marine Corps has the option to increase the number of operational EA-6B Prowlers in its four squadrons as the Navy draws down its EA-6B force, and plans to fly them until 2019, Musoff said. The 20 Marine Prowlers are of the (still formidable) ICAP II configuration introduced by the Navy in 1984. They began transitioning to ICAP III as this issue went to press. Congress funded 16 ICAP III conversion kits for the Corps' ICAP II Prowlers in 2007-2008. And the Navy is going to transfer its 16 ICAP III aircraft – it limited ICAP III production to shift to the Growler – to the Marine Corps instead of retiring them.

AEA IN IRREGULAR WARFARE

The 2002 AEA blueprint focused on countering IADS radars. As a result of the wars in Iraq and Afghanistan, the scope of key AEA requirements has broadened, with communications jamming becoming a key tool in meeting the irregular warfare needs of combatant commanders.

It's well known that EA-6B Prowler and EC-130H Compass Call missions in Iraq and Afghanistan have involved supporting Army and Marine ground forces with preemptive communications jamming, particularly during flights along convoy routes to neutralize the radio-frequency activation devices of


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improvised explosive devices (IEDs) planted by insurgents. The jamming also has supported US ground assault operations by preventing insurgent communications. In fact, communications jamming has been the predominant AEA mission carried out in support of US Central Command's operational requirements.

The Navy's three EA-6B expeditionary squadrons and the four Marine Corps EA-6B squadrons have borne the brunt of the heavy Prowler tasking from CENTCOM in Iraq and Afghanistan over the past several years. Those squadrons have operated at many times their normal utilization rate.

The Air Force's EC-130H Compass Call aircraft also have done yeoman's work over Iraq and Afghanistan, completing more than 5,500 combat missions while operating at two and a half times their planned usage rate, Col Brown said. "Compass Call is our only dedicated irregular warfare AEA aircraft."

The service has just 14 of the specially modified C-130 transports, and only 10 are operationally available at any time. To bolster its Compass Call fleet, the Air Force plans to convert a WC-130H aircraft into a 15th EC-130H over the period FY2011-2013.

The traditional mission of the air-refuelable EC-130H, flying in a stand-off orbit, is to disrupt voice and data communications essential to command and control of enemy forces, particular coordination within IADS networks during tactical air operations. It performed this traditional mission very effectively during every major conflict dating back to 1989.

The latest Block 35 configuration of the EC-130H, developed by BAE Systems, features a radar-jamming capability, a new mission for the Compass Call aircraft, now the Air Force's primary AEA platform. The service previously modified the EC-130Hs to carry high-power, directional, Special Emitter Array (SPEAR) pods on outboard wing stations (two per aircraft). They were designed to provide more precise, longer-range communications jamming than the aircraft's other onboard transmitters. BAE Systems engineers later extended the frequency range of the SPEAR pods and upgraded their onboard jamming technique-generation hardware and software. The SPEAR pods on the Block 35 aircraft reportedly have some capability to jam low-frequency air defense early-warning and acquisition radars.

Air Force officials, concerned about the flight hours being racked up by the Compass Call aircraft in executing non-primary counter-IED jamming missions for Army and Marine forces, plan to initiate a new-start program in FY2011 for an airborne "Electronic Attack Pod." Explaining the requirement for the pod, an Air Force FY2011 budget document states, "Recent events have led to an increased focus on an advanced electronic attack capability for use in irregular warfare scenarios against non-IADS targets such as communications networks and remote-controlled IEDs."

The low-cost, off-the-shelf communications-jamming pod would be carried externally on an undetermined UAV or existing fighter, bomber or transport aircraft. It could become operational as early as 2012. Brown said the Air Force has allocated $344 million over the next five years for the pod program. "Compass Call was not really designed for the high operational tempo it has faced in Iraq and Afghanistan," he said.

The Air Force recently conducted a several-month fleet viability board review of the Compass Call airframe's structural integrity due to its heavy usage, Brown said, but the results of the review were not yet available.

The increased importance of AEA capabilities today was highlighted during the Congressional debate last July over the issue of whether the Air Force should be allowed to buy more than the planned 187 F-22 fighters. USMC Gen James Cartwright, vice chairman of the Joint Chiefs of Staff, revealed in testimony that US regional combatant commanders' concerns about the lack of sufficient joint AEA capabilities in the future were a significant factor in the Pentagon's decision not to buy additional F-22s but to spend the money instead on additional Navy EA-18G Growlers.

Photos courtesy US Air Force, Boeing and Raytheon.

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The global electronic warfare conference and exhibition

Electronic Warfare is held in collaboration with the Association of Old Crows, and is strongly supported by European and international industry.

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Analysis of operational lessons and recognition of the need for new concepts are raising new possibilities and requirements for EW around the globe. Lessons about the importance of EW once forgotten have been relearned, but at great cost. To ensure an enduring EW capability, leaders are now looking to develop and implement EW strategies to ensure preparedness in future.

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NATO and many nations around the world are beginning to understand how the electromagnetic operational environment or EW domain, including EW, is critical to operations in all the warfare domains that are as effective – and safe - as possible. Experimentation and force development have demonstrated how this electromagnetic environment, and within it EW, work with the other operational environments of the land, sea, air and space, and the information environment.

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Venue Information

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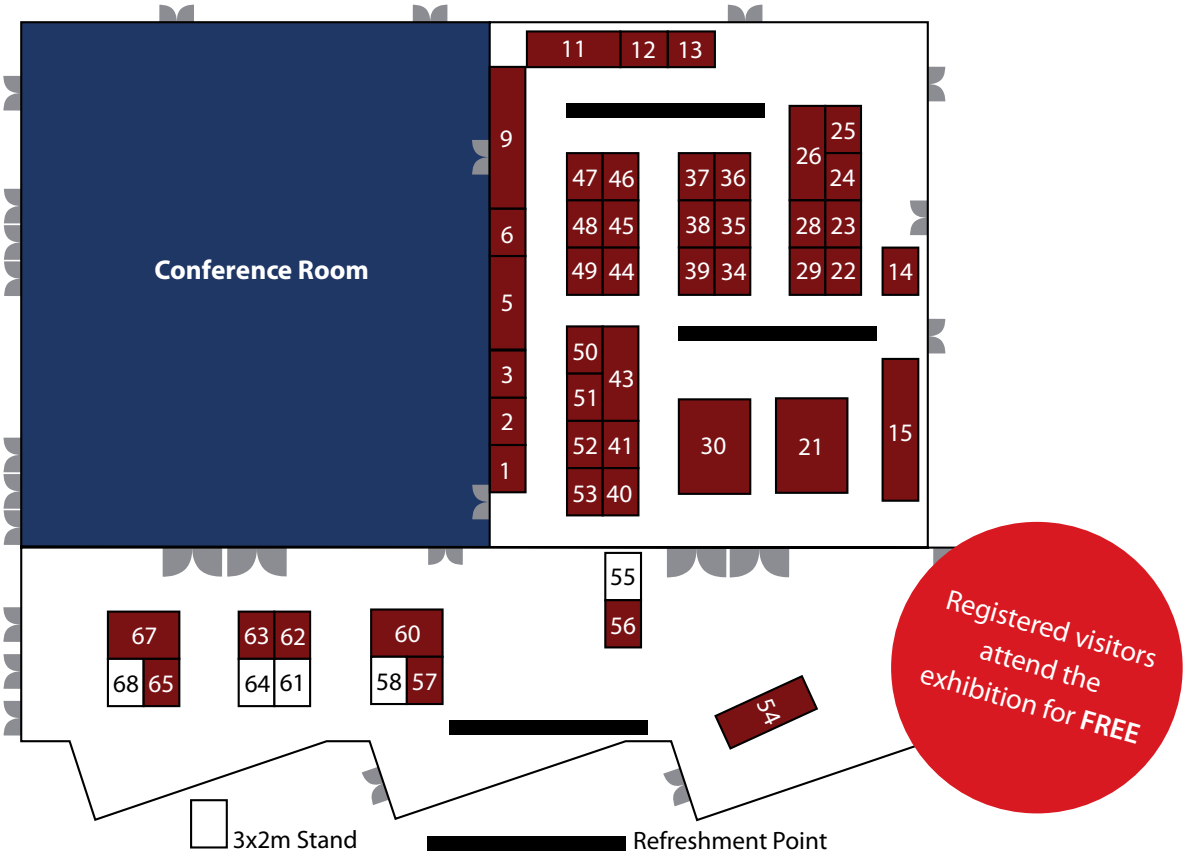

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Programme day one – Tuesday 11 May 2010

THE GLOBAL EW CONFERENCE
SHAPING THE FUTURE OF EW

08.00 - 09.00 – REFRESHMENTS AND EXHIBITION

SESSION ONE – WELCOME – EW IN THE 21ST CENTURY

09.00	**CHAIRMAN'S OPENING REMARKS** **Air Marshal Philip Sturley** RAF (Ret'd), Senior Military Advisor, The Shephard Group, UK
09.05	**WELCOME** **Colonel Chris "Bulldog" Glaze**, USAF (Ret'd), President of the International AOC, Washington DC **Kapitän zur See Reiner Puschies**, German Navy President, Red Baron Roost of the AOC, Germany **Alexander Giles**, CEO, The Shephard Group, UK
09.20	**KEYNOTE ADDRESS** **Lieutenant General Friedrich Wilhelm Ploeger**, German Air Force, Commander German Air Force Air Operations Command, Commander CAOC 2, Executive Director Joint Air Power Competence Centre (JAPCC), Germany
09.45	**OPENING ADDRESS** **Brigadier General Reinhard Wolski**, German Army Chief Army Aviation Corps and Commander Army Aviation School Germany

10.15 - 10.45 – REFRESHMENTS AND EXHIBITION

SESSION TWO – EW AND LAND/AIR WARFARE

10.45	**OPERATIONAL EXPERIENCE OF ELECTRONIC WARFARE** TBC
11.10	**THE INFLUENCE OF EW ON CURRENT OPERATIONS** **Dr Richard Wittstruck PhD**, Chief Systems Engineer, Program Executive Office/Intelligence, Electronic Warfare and Sensors, US Army, USA
11.35	**EM SPECTRUM MANOEUVRE – THE FUTURE OF ARMY EW** **Colonel Laurie Buckhout**, Chief, Electronic Warfare Division, Army Staff, US Army, USA
12.00	**LAND/AIR EW INTEGRATION – COORDINATING EW** **Lieutenant Colonel Chris Wellborn**, EW Program Manager Counter-IED and Chief, Command Advanced Programs Branch, US Air Force, USA

12.30 - 14.00 – LUNCH AND EXHIBITION

SESSION THREE – EW AND THE INTERNATIONAL ARENA

14.00	**NATO JOINT EW CORE STAFF** **Captain Peter Kenward RN**, Director NATO Joint Electronic Warfare Core Staff (JEWCS), UK
14.25	**EVOLUTION OF EW IN AIR POWER OPERATIONS** **Colonel Sandro Sampaoli**, C4ISTAR Planning Branch, Italian Air Force, Italy
14.50	**EXPERIMENTATION AND NATO TRANSFORMATION – DEFENCE AGAINST TERRORISM** **Hauptmann Herbert Hopp**, Chairman, NATO SIGINT/EW Working Group, German Air Force, Germany
15.15	**EW RESEARCH AND DEVELOPMENT IN INDIA** TBC

15.40 - 16.10 – REFRESHMENTS AND EXHIBITION

SESSION FOUR – EW DEVELOPMENTS

16.10	**DEVELOPMENTS IN NETWORK-ENABLED EW** **Steve Roberts**, SELEX Galileo, UK
16.35	**CHALLENGES OF 21ST CENTURY EW TRAINING** **Dr Colin Hamilton PhD**, VP Microwave Systems, Operations, Defence Electronics, EADS, Germany
17.00	**MODERN CONCEPT OF AIRBORNE INTEGRATED SIGINT SYSTEMS** **Gadi Singal**, ELTA Systems, Israel
17.25	**DAY 1 CLOSING REMARKS Chairman**

17.30 - 19.00 – DRINKS RECEPTION

Programme day two – Wednesday 12 May 2010

THE GLOBAL EW CONFERENCE
SHAPING THE FUTURE OF EW

	08.00 - 09.00 – REFRESHMENTS AND EXHIBITION
	SESSION FIVE – FUTURE DIRECTION OF EW
09.00	**CHAIRMAN'S OPENING REMARKS** **Colonel Chris "Bulldog" Glaze**, USAF (Ret'd), President of the International AOC, Washington DC
09.10	**KEYNOTE ADDRESS – FUTURE DIRECTION OF EW** **Lieutenant General Robert J (Bob) Elder**, USAF (Ret'd), Former Commander, 8th Air Force; Research Professor, George Mason University, USA
09.35	**FUTURE EW REQUIREMENTS IN A COMPLEX WORLD** **Wing Commander Dave Appleby**, RAF, Ministry of Defence, Joint Capability Joint Strike EW1, UK
09.50	**MARITIME EW – THE US PERSPECTIVE** **Captain Paul Overstreet** US Navy, Program Manager PMA-272, Advanced Tactical Aircraft Protection Systems, USA
	10.15 - 10.45 – REFRESHMENTS AND EXHIBITION
	SESSION SIX – CAPABILITY DEVELOPMENT
10.45	**EVOLUTION OF JOINT EW CAPABILITY** **Ronald D "Fog" Hahn**, Acting Director, Joint EW Center, Lackland Air Force Base, USA
11.10	**AIR COMBAT COMMAND EW VISION AND TRANSFORMATION EFFORTS** **Colonel Joseph M Skaja Jr**, Chief EW/IO/DE HQ ACC, Langley Air Force Base, USA
11.35	**JIEDDO BRIEF** TBC
12.00	**COUNTER-IED OPERATIONS - A NEW DIMENSION IN EW** **Major General Anukul Chandra AVSM, Indian** Army (Ret'd), Former Additional Director General Equipment Management, Indian Army, India
	12.30 - 14.00 – LUNCH AND EXHIBITION
	SESSION SEVEN – THE ELECTROMAGNETIC ENVIRONMENT
14.00	**SECURING EW FOR 21st CENTURY OPERATIONS** TBC
14.25	**LASER PROTECTION FOR HELICOPTER AIRCREW** **Lieutenant Colonel Horst Rieker**, S3 EW Officer, German Air Force, Germany
14.45	**TITLE TBC** **Lieutenant Colonel Johannes Naumann**, GAF (Ret'd), Germany
	15.10 - 15.40 – REFRESHMENTS AND EXHIBITION
	SESSION EIGHT – GLOBAL INDUSTRY PERSPECTIVE
15.40	**GAZING INTO THE EW CRYSTAL BALL** **Jack Pledger**, Director IRCM Business Development, Defensive Systems Division, Northrop Grumman, US
16.00	TBC
16.20	**EW TESTING – TRUST OR DOUBT** **Kurt Bosshard,** RUAG Avionics**,** Switzerland
16.40	**FAREWELL REMARKS** **AOC** **Shephard Group** **Appreciation** **INVITATION TO EW 2011 AOC/SHEPHARD EW CONFERENCE** **"EW Challenges – a Decade into the 21st Century"**
	17.00 – CONFERENCE CLOSE

How Cool is That?
Thermal Management in EW Systems

By Barry Manz

Reducing the size, weight and power of EW and SIGINT systems, while increasing overall performance, is a tall order. But trying to keep the system cool – even though its functional density is greater, it may use high-power-density gallium-nitride (GaN) or silicon carbide (SiC) transistors and it may reside in a size-, weight- and power- (SWaP) constrained environment (such as a UAV) – makes the job a lot tougher. Without question, it's time SWaP became SWaP™, holding thermal management on high, where it belongs.

In addition to removing heat at the chassis and system levels using conduction, convection and liquid cooling, designers are looking further into the box to remove heat at the device level where it is created. The target devices include traveling wave tube amplifiers (TWTAs) – the all-time heat-generating champion – and newer rivals for the title, such as dual- and quad-core processors, feverishly powerful graphics engines and most recently GaN and SiC transistors used for RF power generation and DC power, respectively. The latter devices bring unprecedented levels of power density to their intended applications – with a commensurate increase in heat dissipation.

STAY COOL, LIVE LONGER

High heat levels are recognized as the best (or worst) way to shorten the operating life of electronic systems from components on up the food chain, at a lifetime reduction rate of 50 percent per 10 degrees Celsius increase in operating temperature. An RF power transistor, for example, will not only live longer if its junction temperature is reduced, but it can potentially be driven harder to deliver more power at its specified junction temperature, as well. Consequently, focusing on thermal management at the device level makes sense, and the range of cooling methods being explored to address it range from the traditional approaches to emerging technologies.

Within the EW market, one of the leading drivers for this new-found interest in device-level cooling is the US Navy's Next-Generation Jammer (NGJ) program. The goal of the program is to replace the aging ALQ-99 tactical jammer developed in the 1960s and first deployed with the then-new EA-6B in 1971. NGJ will replace the ALQ-99 on the EA-6B Prowler and EA-18G Growler and possibly be deployed on other aircraft including the F-35 and UAVs. It will make extensive use of solid-state RF power generation rather than the ALQ-99's TWTAs. Not surprisingly, there is fierce competition among prime contractors for this program, because it potentially offers the winning contractor a strategic advantage in offering solid-state technology in future EW programs. NGJ's use of solid-state RF power devices, as well as its scalable, easily-reconfigurable, state-of-the-art signal processing system, translate into a need for new cooling requirements and fresh concepts for addressing them.

HOT NEW APPROACHES

One of the most promising methods for device-level cooling – aluminum diamond – is also one that might cause industry veterans to yawn. This technology seems to have been dormant ever since advances were announced in the early 1990s, and it then appeared to have great promise for device packaging as diamond's thermal conductivity is at least 900 W/m-K (Watts per Kelvin per meter).

The development of diamond as a packaging material has since claimed most of its champions thanks to the difficulty in solving the problems inherent in bringing it from scientific curiosity to viable commercial product. However, Nano Materials International Corp. (NMIC), a joint venture between Materials and Electrochemical Research (MER) Corp. (Tucson, AZ) and Mitsubishi Corp. of Japan, is not only still standing, but ready to introduce aluminum diamond composites for packaging applications for the first time.

The attention diamond has received is directly related to its ability (if made commercially viable) to reduce the problems associated with the increased heat generated by devices made with GaN and SiC (or GaN using SiC as a substrate material), creating a new standard for the thermal performance of transistor packaging. "We see our materials making inroads with manufacturers of MMICs and amplifiers for T/R modules," says Kevin Loutfy, NMIC's president, "because the introduction of SiC and GaN devices is increasing power density per unit area from 1500 W/cm2 to 8000 W/cm2."

The company's aluminum-diamond matrix composites have thermal conductivity greater than 500 W/m-K compared with the average of 200 W/m-K for conventional materials such as copper-tungsten or copper-moly-copper, which averages about 200 W/m-K). It can be used as a heat spreader that attaches to the die or to replace the base plate in the package. The composite encapsulates industrial-grade diamond particles in aluminum, the diamond providing exceptional thermal conductivity and the aluminum providing structure as well as a very smooth surface on the top and bottom that serves as the attach face.

"Some people might look at aluminum diamond and say 'I heard about this years ago, and they had the same roadmap in the '90s – so what's new?" says Dr. Raouf Loutfy, NMIC's chief technical officer. "Our answer is that over this time we worked on aluminum diamond for NASA, DOD and others and supplied samples, but there was always some problem like surface finish, cleanness of the edge or plating. It wasn't until 2007 when we formed the joint venture between MER and Mitsubishi

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to form NMIC that we could address real customer needs. We've made huge improvements since then and now that we have a production partner we're working to gain design wins with a production-ready technology."

The problems with aluminum diamond have historically been related to the interface between the diamond and aluminum. Loufty and his team developed technology to convert the surface of the diamond to silicon carbide, which is what enabled the high levels of thermal conductivity to be achieved, according to Loutfy. "Adding a 'nano' layer of SiC matched the properties of aluminum so we patented it," says Loutfy. "In addition, when you add thermal-cycle diamond composites, its thermal conductivity decreases. We thought the interface between the matrix materials was breaking and might be the cause, and our conversion to SiC showed that no degradation of material occurs as you temperature cycle it. This is a big improvement over what has been done before."

GETTING TO THE CORE

One of the "thermal core"-type solutions that has been used for larger areas than required for device-level cooling is the Thermally-Annealed Pyrolytic Graphite (TPG) manufactured by Momentive Performance Materials (Albany, NY). TPG is similar in name only to the substance used in pencils, being created by thermally decomposing hydrocarbon gas in a high-temperature chemical vapor deposition process. The resulting deposit has a uniformly-aligned crystalline structure parallel "in plane," and thermal conductivity in this plane averages about 1500 W/m-K, in contrast to copper's 400 W/m-K, and aluminum's 250 W/m-K, making it an appealing heat-transfer medium.

However, to make it useful for defense radar and EW applications, the granular TPG must be diffusion-bonded to an aluminum shell and the enclosure is hermetically sealed to form a 3-mm sandwich that consists of 0.5-mm-thick aluminum plates on the top and bottom and 2 mm of TPG in the middle. This product, called TC1050, has lower thermal conductivity than the raw TPG (about 1050 W/m-K) but it is still far higher than copper. The TC1050 panels are typically mounted to PC boards placed in liquid-cooled chassis, providing a thermal short between the two.

Obvious applications for TC1050 include tower- or mast-top environments, where removing weight is paramount and the product can potentially solve a given heat-transfer problem using a fraction of the weight and material of a copper-base solution. A TC1050 panel also continues to function if damaged while heat pipes and other more complex cooling schemes will not.

With NGJ and other programs in mind, the company is looking hard at how to get TPG into form factors smaller than the transmit-receive module, where the company has had considerable success. Possibilities include encapsulating TPG into other materials that could potentially make the material viable for incorporation in and around packages.

REFOCUSING THE SPRAY

Ten years ago, "spray cooling" was relatively unknown, but today in many cases it is vying for "mainstream" status. SprayCool just became part of the Gas Turbine Fuel Systems Division of Parker Aerospace, which should not only remove any "small company" stigma but provide a nice complement to Parker's airframe manufacturer customer base, as SprayCool addresses the cooling of payloads rather than complete aircraft. EW is one of SprayCool's target markets going forward, according to Dan Kinney, director of business development. "We think there are benefits in cooling individual devices, such as T/R modules, EW amplifiers, and IGBTs for power electronics – the really high power density applications," says Kinney. "So we're targeting NGJ, where the benefit is to reject at least 65 kW of heat. On NGJ you need to both acquire the heat and reject it with ram air exchangers or skin heat exchangers where you can get the heat out through the skin of the pod. The closer you can get to where the heat is generated the better the SWaP."

"While we currently cool cards directly, we can also cool from the card edges as liquid is flowing through the sidewalls of the chassis," Kinney added. "Our job is to make the thermal management system in the pod much smaller, and the combined capabilities of SprayCool and Parker should offer an excellent solution."

Going deeper into the device domain, Kinney said that in addition to cooling signal processing cards, the company is cooling the devices in radars that generate the most power, primarily T/R modules and IGBTs in the power supplies. "We can spray devices directly within the enclosure or we can cool the enclosure through a cold plate to which the device is mounted. That is, spraying the plate where liquid is circulated to reach where the fluid is vaporizing to get the benefits of two-phase heat transfer – liquid to vapor and back to liquid."

KEEPING IT COOL

It seems unlikely there will be a day anytime soon when thermal management concerns have been satisfied, and EW system designers can breathe a sigh of relief. The increasing replacement of vacuum tubes with solid-state devices in the amplifiers of EW systems simply replaces one set of thermal management challenges with another. That is, high-voltage TWTAs may generate lots of heat, but so do massive banks of the lower-power GaN devices required to generate the same amount of power. Signal processing systems, general-purpose processors and graphics engines deliver spectacular computational ability – but they create lots and lots of heat to get the job done. And so on, generation after generation, as each new device operates at higher speeds, and has higher functional density.

The answer will in part be provided by looking at device-level heat generation more closely than ever and using multiple cooling technologies in more applications. The NGJ program alone provides the incentive for manufacturers to come to grips with the upcoming thermal management challenges presented by this system, which will probably be in service for a quarter century. Many other programs will benefit from the advances in cooling capabilities revealed in NGJ, and they won't come a moment too soon.

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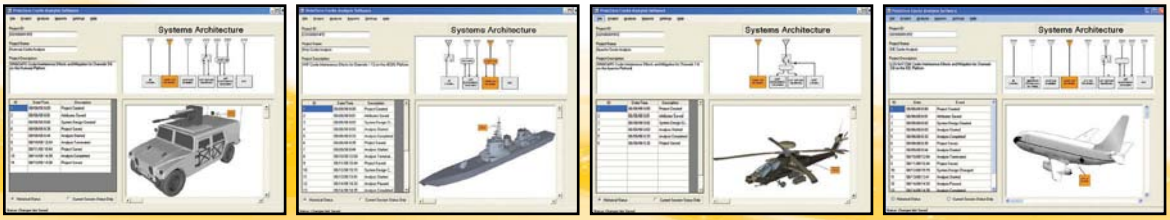

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EW Against Modern Radars – Part 5

Cross-Polarization and Cross-Eye Jamming

Two very effective mono-pulse jamming techniques are Cross-polarization and Cross-eye jamming.

Cross-Polarization Jamming

If a parabolic radar antenna reflector has significant forward geometry, it will have small lobes (called Condon lobes), which are cross polarized to the main antenna feed. In general, the greater the curvature of the antenna, the larger the Condon lobes will be. As shown in **Figure 1**, these lobes can become dominant if the radar is illuminated by a very strong jamming signal cross polarized to the primary radar signal.

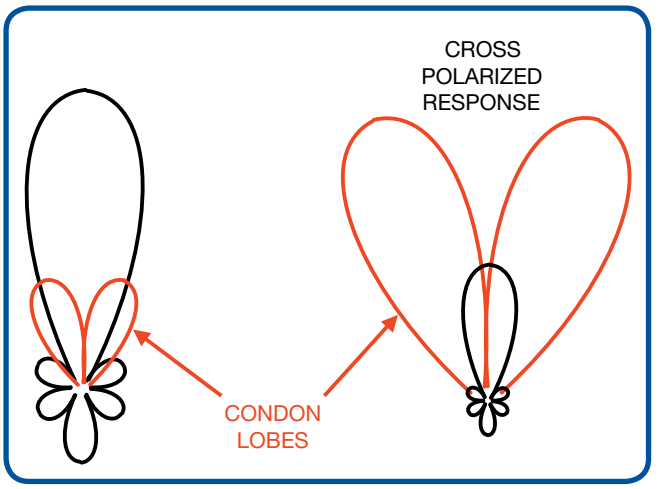

Figure 1: Some radar antennas have cross-polarized lobes oriented away from the co-polarized bore sight.

Figure 2 shows the operation of a cross-polarization (Cross-pol) jammer. It receives the radar signal in two antennas, which are orthogonally polarized. In this figure, one is vertically polarized and the other is horizontally polarized. The signal received by the vertically polarized antenna is rebroadcast with horizontal polarization and the signal received by the horizontally polarized antenna is rebroadcast with vertical polarization. This causes the jammer to produce a signal that is cross polarized to the received signal regardless of the received signal polarization. The jamming signal thus produced is amplified by a large enough factor to produce a J/S ratio of 20 to 40 dB.

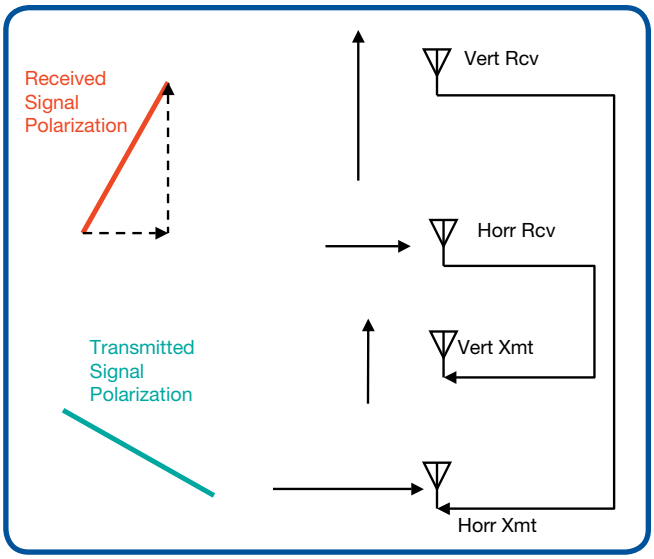

Figure 2: Cross-pol jamming generates a strong cross polarized return signal, which causes the radar to track the target in one of its Condon lobes.

When the strong cross-polarized signal reaches the radar, it will capture one of the Condon lobes. The radar will then move its antenna so that the captured Condon lobe is aimed at the target. This causes the radar to lose its track on the target.

In general, this type of jamming is not effective against radars that have flat plate phased array antennas, because they do not have the forward geometry to produce Condon lobes. However, if the phased array has significant beam shaping from variable illumination, it may have Condon lobes.

If the radar antenna is protected by a polarization filter, it will be immune to cross-pol jamming.

Cross-Eye Jamming

The configuration of a cross-eye jammer is shown in **Figure 3.** The signal received by an antenna at point A is amplified 20 to 40 dB and rebroadcast from an antenna at point B. Likewise, signals received by an antenna at point B are amplified and rebroadcast from an antenna at point A, but there is a 180° phase shift in this circuit. In order for the jammer to be effective, these two signal paths must be exactly the same length. Because points A and B must have significant spacing for the jamming to be effective, the cables are long. It is extremely

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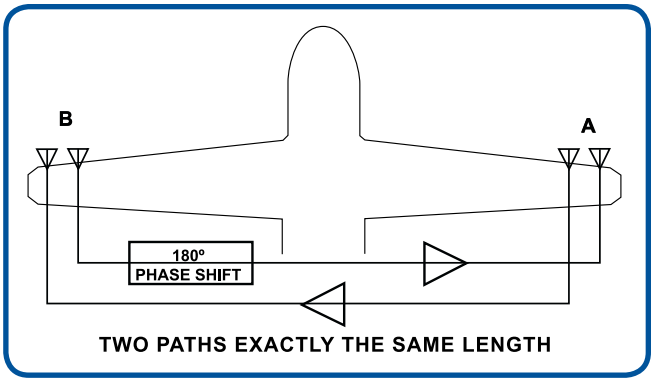

Figure 3: Cross-eye jamming broadcasts the radar signal received at location A from location B and simultaneously broadcasts the signal received at location B from location A with a 180° phase shift.

difficult to maintain adequate balance in these two sets of cables over variations of temperature and frequency. The two cable paths must maintain the 180° relationship within an electrical degree or two for effective jamming. This is a differential electrical length of the order of a tenth of a millimeter.

To mitigate this problem, the system can be configured as shown in **Figure 4**. Nanosecond switches allow a single cable to be used from a single antenna at each of the two locations, and it is easy to maintain phase matching within the (quite small) box. The switches alternate the signal path between the phase shifted and non-shifted branches many times during reception of each radar pulse. Because the radar receiver must be optimized to receive the radar's pulse, it will average the square waves shown below the pulse in the figure. Thus, the signals from the two jammer antennas will be seen by the radar as two simultaneous pulses that are 180° apart in phase.

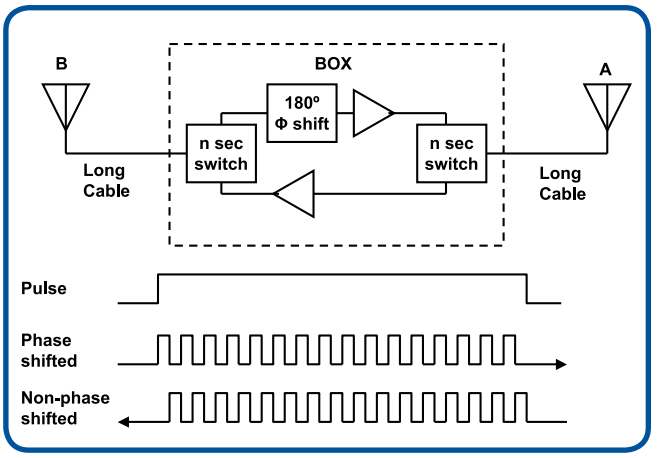

Figure 4: Nanosecond switches allow single cables from each of the antennas to time share signals in both directions, eliminating critical cable length matching.

The path from the radar to antenna A to antenna B and back is exactly the same length as the path from the radar to antenna B to antenna A and back. This does not require that the A-B baseline be perpendicular to the path from jammer to radar. Thus, the radar will receive two signals 180° out of phase. As shown in **Figure 5**, this will cause a null at the radar's sensors. The result will be that the sum response will be below the difference response, which will change the sign of the "difference – sum equation." This will cause the radar to correct its tracking angle away from the target rather than toward the target.

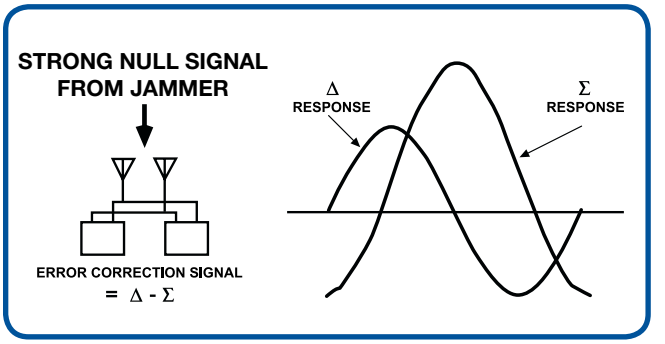

Figure 5: The null from the cross-eye jammer makes the sum response less than the difference response, reversing the direction of the mono-pulse tracking response.

When a video camera has been co-bore-sighted with a mono-pulse radar, it shows the target moving out of the picture at a high rate of speed when cross-eye jamming is applied. This is, of course, the result of the mono-pulse radar being forced rapidly away from its intended target.

The effect of the cross-eye jammer is often described in literature as a distortion of the wave-front of the skin return signal as shown in **Figure 6**.

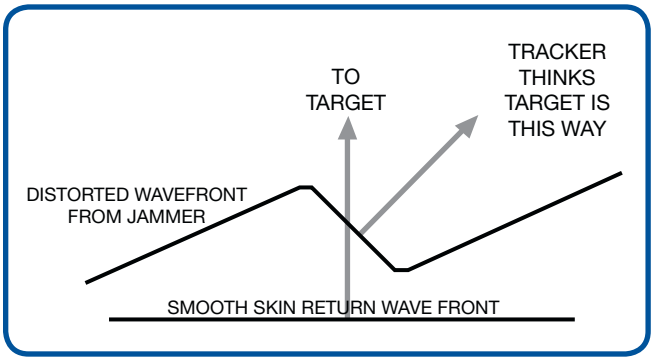

Figure 6: Because the phase-shifted and non-phase-shifted signal arrive at the mono-pulse tracking sensors at the same time, they cause a null, which forces the tracker away from the target.

What's Next

Next month, and for the next few months, we will discuss electronic protection techniques in modern radars. For your comments and suggestions, Dave Adamy can be reached at dave@lynxpub.com.

association news

AOC 2010 ELECTION NOMINATIONS DUE BY APRIL 21

Each year the AOC membership helps determine the future direction of the AOC by electing representatives to its Board of Directors. Nominations for the 2010 election are now being accepted through close of business on April 21, 2010.

This year's election slate will include the position of President, who will serve as Vice President in 2011 and as President in 2012. The AOC President appoints the Association's Secretary and Treasurer, presides over the Board of Directors and Executive Committee and appoints committee chairs. The President is also the AOC's primary spokesperson, visiting AOC chapters across the world and meeting with leaders in the Electronic Warfare community. This is a significant but rewarding commitment.

The 2010 election slate will also include three At Large Director positions. At Large Directors serve a three-year term. In addition, Regional Directors will be elected for three-year terms from the International I and International II Regions. Nomination forms are available on the AOC website at www.crows.org or by contacting Carole Vann at the AOC at vann@crows.org.

For any questions or assistance, please contact:
Carole Vann, AOC Election Coordinator
Office: (703) 549-1600
Fax: (703) 549-3279
E-mail: vann@crows.org

AOC AWARD NOMINATIONS DUE APRIL 19

It's not too late to nominate an individual or unit for the 2010 AOC Awards. Visit **www.crows.org** or see the eCrow newsletter for a nomination form and return it by April 19.

PIKES ROOST MARCH LUNCHEON

The Pikes Roost hosted Professor Scott Trimboli, Director of the Center for Space Studies at the University of Colorado at Colorado Springs and Associate Dean of the College of Engineering and Applied Science, at its March lunheon. Dr. Trimboli has extensive military and commercial space experience and currently directs masters' degree programs in Space Operation, Systems Engineering and Engineering Management. He is also on the board of directors for eSpace, the Center for Space Entrepreneurship, located in Colorado.

Dr Trimboli gave an outstanding briefing on critical national security-related research and education in cyber security, space operations, engineering and other important areas performed at the University of Colorado at Colorado Springs.

PLAN TO ATTEND AOC KITTYHAWK WEEK

Come join us June 7-10 for the 38th Sensors/AOC Kittyhawk Week in Fairborn, OH. Kittyhawk Week will provide operating command representatives and DOD acquisition organizations with the most current information on exploratory/advanced development efforts, technology trends, transition status, and investment strategy and opportunities within AFRL Sensors Directorate portfolio. All sessions will be at the **SECRET//NOFORN** level at the AT&T Conference Center (2940 Presidential Drive, Suite 390, Fairborn, OH 45424).

Registration fees: $15 Government/Military Employees; $500 AOC Members; and $545 for Non-AOC members.

TOP-LEVEL AGENDA

Monday, 7 June: Scholarship Golf Outing; NCR Country Club; 0900 Shotgun Start

Tuesday, 8 June: Senior Leader Perspectives; Threats & Technologies; Reception

Wednesday, 9 June: Operator Requirements; EW Focus Areas; Panel Discussion

Thursday, 10 June: Current/Planned Programs

For more information, visit **www.kittyhawkaoc.org.**

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SMALL (10-49 Employees)	$500	10
CONSULTANT (1-9 Employees)	$300	5

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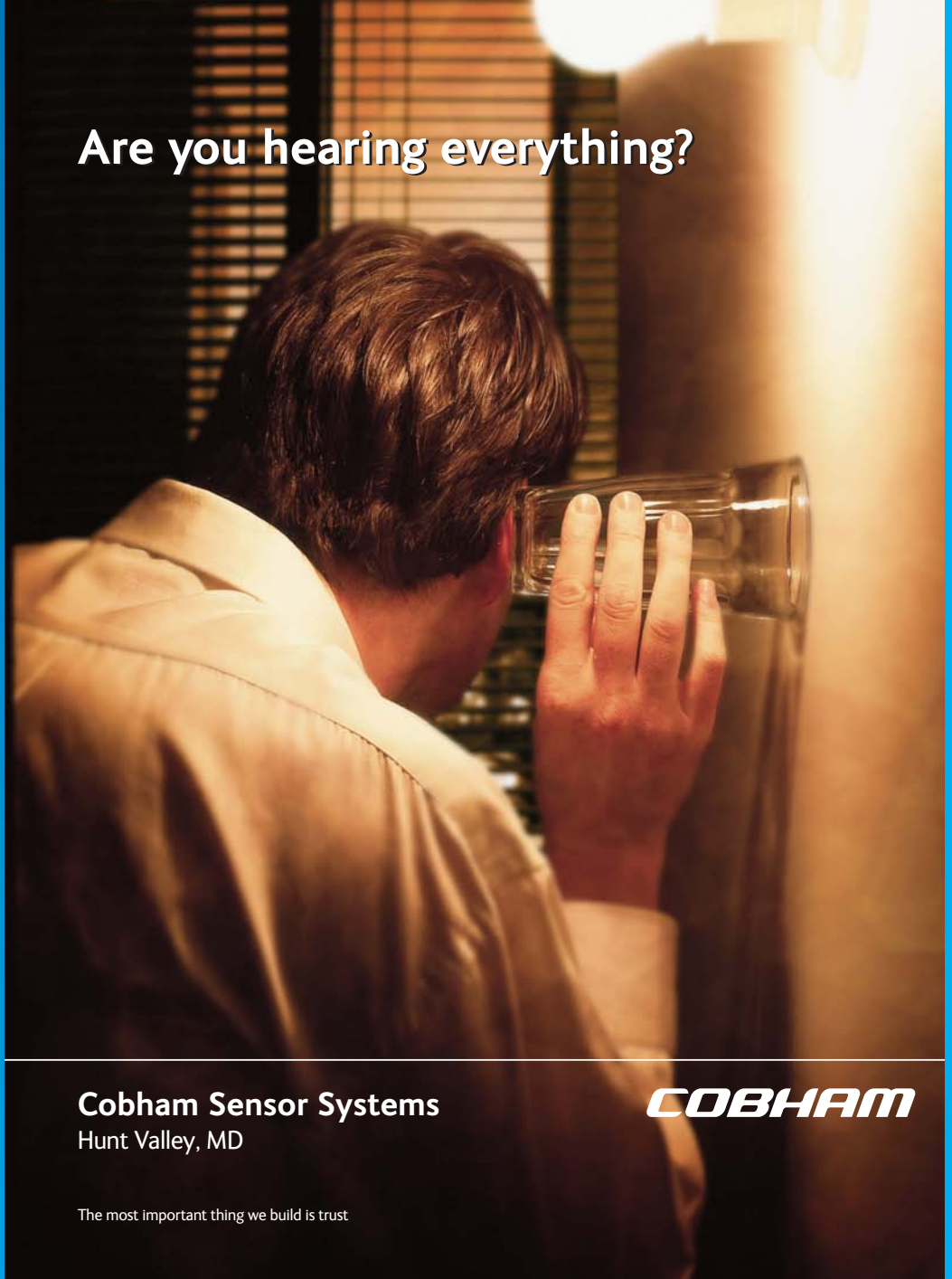

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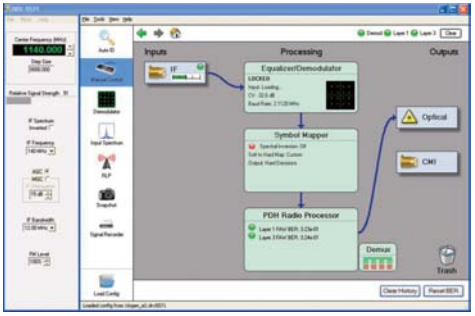

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