October 2009
Vol. 32 • No. 10

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the view from here

THE EMS IS A WARFIGHTING DOMAIN

I don't know if it's me, the approaching AOC Convention, or simply the cycle of events, but this time of year often gets me thinking about some of the larger issues in the EW community. Around this time of year, I like to take a moment and assess where we are and hopefully gain some insight into where we are going.

These are very exciting days for the EW discipline. A lot of changes are occurring all around our community. We are making huge contributions to operations in Iraq and Afghanistan. The senior leadership is recognizing those contributions. And the leaders in our community are working hard to take EW to the next level. By that, I mean EW is on the verge of transforming from a support role to a principal role in future operations. The success of that journey will partly depend on how our own community views itself. We are no longer a small fraternity of "back-seater" EWOs twisting knobs and turning dials, protecting a fighter aircraft or a ship against SAMs or ASCMs. We are a community of professionals that provides a unique and universally needed capability – control of the electromagnetic spectrum (EMS).

This may sound somewhat esoteric, unless you recognize one of the big lessons coming out of Iraq and Afghanistan is the realization that the EMS is a maneuver space – a warfighting domain – on par with air, land, sea, space and cyberspace. The warfighter knows that he cannot fight in any one of these domains without controlling the EMS.

The notion that the EMS is a warfighting domain is a long way from EW's humble beginnings, but it reflects the reality that we have "used up" the EMS. It is no longer an "infinite" resource, and our recent experiences have confirmed that. The warfighter is finding that in order to retain free access to the EMS – while denying the enemy's use of it – he needs to think about the EMS as a maneuver space the same as any other warfighting domain.

What is unique at this moment in EW's 50-year history is that many senior defense leaders understand this problem, too. From the theater combatant commanders to joint staffs and service leaders, they are realizing that they can no longer manage EW on an ad hoc basis and expect to achieve spectrum control in future conflicts.

The transformation toward recognizing the EMS as a warfighting domain has already started. Our leaders in the EW community are making this very point in meetings and briefings, and senior defense leaders are nodding in agreement, or at the very least, acknowledging a viable challenge to long-held assumptions about warfare. For most of us in the EW community, I think the building blocks to this concept have always been there. But now they are coming together and we are using them to construct a new EW paradigm that is both consequential and durable and serves to control the EMS as a warfighting domain.

– John Knowles

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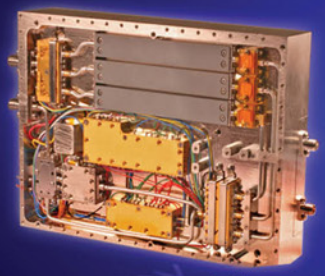

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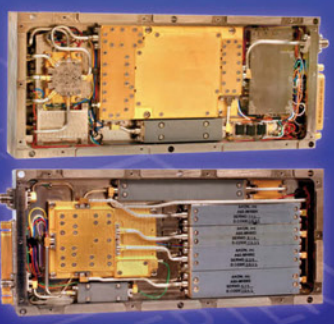

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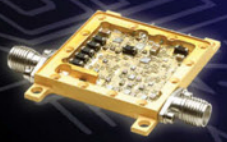

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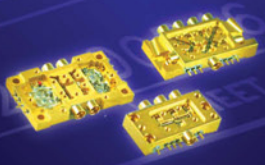

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2009 Combat Vehicles Conference
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46th Annual AOC International Symposium & Convention
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NOVEMBER

12th Annual Directed Energy Symposium
November 2-6
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Aircraft Survivability Symposium 2009
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Monterey, CA
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Defense and Security 2009
November 4-7
Bangkok, Thailand
www.asiandefense.com

AAAA ASE Symposium
November 9-11
Nashville, TN
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Dubai Air Show
November 15-19
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Low Probability of Intercept ELINT/ SIGINT Conference
November 17-19
NPGS, Monterey, CA
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I/ITSEC 2009
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DECEMBER

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Directed Energy Education Workshop
November 6
San Antonio, TX
www.deps.org

Understanding and Engaging "Now Media"
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Military Electronic Warfare Course
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Shrivenham, UK
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TRANSITION WITH CONTINUITY

Kermit Quick

Chris Glaze

This month the AOC Presidency will change hands. Thus we are writing a joint message to mark the change but more importantly, to emphasize that there will be continuity and follow-through of our shared vision and strategic goals for this Association. The AOC has accomplished much in the past two years. We have institutionalized a new strategic plan with prioritized recommendations, revamped and reenergized our conference schedule, embraced Information Operations through the Information Operations Institute (IOI), and begun the journey to improve our educational program with the rollout, this October, of "The Essentials of Electronic Warfare" – a handbook that will act as the basis for our strategic education goals. The Association is well positioned to be the relevant organization to continue this drive into the future and to be the advocate for Electronic Warfare and Information Operations.

Chris and I believe all of us – AOC leadership, AOC staff and the global AOC membership – working together can continue to guide our discipline in the right direction. We want to ensure defense establishments and government leadership understand the force-multiplying benefits that warfighters will attain with enhanced EW/IO capabilities and strategies – and with these in place or on the horizon, control the total electromagnetic spectrum.

As the AOC moves closer to our 50th anniversary, we issue a "call to arms." As an Association of dedicated professionals, we the members represent a critical, but at times overlooked, resource in our nation's security. In some respects, due to the nature of our business, the accomplishments of EW and IO professionals go unnoticed. With that understanding, we charge each of you to actively inform and educate co-workers and government and military officials on the important role EW and IO plays every day in the defense of this nation and its warfighters. All AOC members must get involved with local Chapters and AOC Headquarters. If you are a Chapter Officer, work with your regional directors to educate and enhance your regional members and government officials on the importance of EW and IO.

The AOC Headquarters will support your efforts in every way possible, but as an active AOC member you represent the "last mile" of expertise in our profession and you are the AOC's most valuable resource.

We both look forward to seeing you at the National Convention and Symposium October 18-21, in Washington, DC.

Kermit Quick (outgoing president) and
Chris Glaze (incoming president)

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the monitor news

DOD TO STUDY JOINT EM SPECTRUM ENTERPRISE

The Joint Electronic Warfare Center (San Antonio, TX) has briefed Vice Chairman of the Joint Chiefs of Staff Gen James Cartwright on the results of US Strategic Command's EW Functional Solutions Analysis (FSA).

The outcome of last month's briefing is that General Cartwright has approved a Joint EW Initial Capabilities Document (ICD) that lays the groundwork for substantial improvements in DOD EW in terms of leadership and organization, training and acquisition, and strategic investments. Many of the factors shaping these changes are coming out of lessons learned in current operations in Iraq and Afghanistan.

In those theaters, free access to the Electromagnetic (EM) Spectrum, or EMS – something that had usually been taken for granted by the warfighter – has become a major problem. The operational EW community has seen for the past several years that military and civilian use of the EM Spectrum has increased dramatically, and consistent military access to the EMS is becoming far more difficult to achieve. While current operations have addressed this problem in the short term by deploying hundreds of EWOs to these theaters, the DOD leadership has determined that a more strategic and holistic approach is required in the future.

The Joint EW ICD describes concepts and solutions that provide a better framework to enable the warfighter to consider the EM Spectrum as operational maneuver space, addressing some of the most basic concepts about the EMS. This will lead to inevitable discussions on whether the EMS should be considered a warfighting domain on par with the air, land, sea, space and cyberspace domains.

The EW ICD also addresses the need for a larger, overarching EM battle management (EMBM) strategy that ties together all aspects of electronic protect (or electronic counter-countermeasures), spectrum management, electronic warfare support and electronic attack. Along these lines, the EW ICD also recommends a lexicon change that includes this larger EMBM concept.

The proposed lexicon, EM Spectrum Warfare or simply, "Spectrum Warfare," will not replace EW terminology one-for-one. Rather, it will serve to describe Spectrum Warfare more broadly than its predecessor, "EW." Spectrum Warfare will be the leading component in achieving EM Spectrum Control.

Another major outcome of the ICD is the recognition that EW and its associated organizations and activities need to be organized and managed more effectively within DOD. Because the DOD's EW capabilities and resources are mostly spread among and fragmented within the Services, the ICD recommends the most effective approach to managing EW is to create a Joint EM Spectrum Enterprise. It is not clear at this point what specifically the Joint EM Spectrum Enterprise will entail.

With the Joint EW ICD now approved by the Services and the Joint Staff, the DOD's next move is to commence a 120-day study led by a Federally Funded Research and Development Center (FFRDC) to recommend how the DOD can establish a Joint EM Spectrum Enterprise, what it will comprise, and how its various entities will collaborate to deliver EM Spectrum Control capabilities and resources for the Warfighter. Using the Joint EW ICD as a baseline, US Strategic Command (via the Joint EW Center) and the Joint Forces Command will write the terms of reference (TOR) for the study to help guide the study team.

The gist of all this study work is to look at the EMS in a new light and build a stronger capability to enable the US to fight in the EMS. Although the services are not necessarily keen to abandon their EW concepts and capabilities, the Joint Staff recognizes that the combatant commanders are concerned about achieving spectrum control in future operations. The Joint EM Spectrum Enterprise should address those concerns and reshape, to some degree, how the DOD approaches EM Spectrum Control. – *J. Knowles*

US ARMY EW CONTINUES TO TAKE SHAPE

As the US Army moves forward with its EW plans, re-establishing the discipline by training more than 1,600 EW experts in the coming years, it is also addressing policy issues that will affect how EW evolves within the Service.

The Army's EW capabilities are developing. The Army is currently testing a prototype airborne electronic attack (AEA) capability via the Rapid Equipping Force. The aim is to evaluate the AEA capability and then possibly field additional aircraft in order to take some of the pressure off US Navy and US Marine Corps EA-6B squadrons and US Air Force EC-130H squadrons that have been flying counter IED missions for the past five years. At press time, the Army was evaluating multiple AEA payloads and various aircraft types ranging from

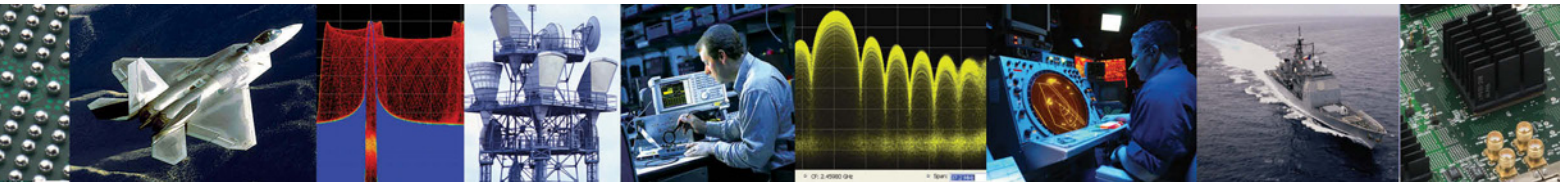
light manned aircraft to UAVs. The AEA capability is scheduled to be available in theater by October 10.

While the Army focuses on deploying the new AEA capability, EA has become the subject of a larger debate within the Army about how to best organize to nurture emerging EW capabilities. The Army's traditional organization around "schoolhouses" and centers creates a materiel landscape that is shaped by Training and Doctrine Command Capabilities Managers (TCMs), who write operational requirements and ensure that systems developed by the acquisition community meet operational needs. Although the Army has conducted very little EA over the past five decades, what ground-based EA capabilities it has owned have resided within the intelligence community, which has been the *de facto* "home" for ground-based EW in the Army for decades. Currently, EA requirements, from special purpose EA systems, like Prophet, to basic EA systems, such as CREW jammers, falls within TCM Ground Sensors located at Fort Huachuca, AZ. However, as the Army's Fires community, based at Fort Sill, OK, takes on greater responsibility for the EA mission, the Army leadership must decide which "schoolhouses, and therefore, which TCMs should be developing which EA capabilities.

Those who want to shift more EW responsibility to the Army Fires community argue that the Army is creating an operational conundrum by allowing the intelligence community to manage EW requirements. "Do I attack or collect?' asked one informed Army official. "Other services that have more experience with EW have already figured this out, and they have aligned EW within their warfighting communities rather than their intelligence communities. So, now the Army is grappling with the question of how to get into electronic attack and we don't have the schoolhouse or a center that is used to building those requirements."

The question carries significant implications for the future of Army EW. The Army leadership has decided not to buy CREW 3.3 system and will instead develop the Integrated EW System (IEWS). The IEWS will be a modular, scalable, open architecture EA system that Army EW officials expect will replace CREW systems. But the system will also feature EA technology that will enable it to perform EW missions well beyond jamming RCIEDs. IEWS will also be interoperable in a joint environment, which means it will address RF fratricide issues that have plagued Army operations in Iraq and Afghanistan. IEWS received a boost last month when the Vice Chairman of the Joint Chiefs of Staff, Gen James Cartwright, approved the Joint EW Initial Capabilities Document (ICD). The Army has aligned its EW needs with the ICD, and an IEWS Annex to the Joint EW ICD has essentially kickstarted the program. The Army will now move ahead with identifying a Materiel Development Authority (MDA), which may be an Army organization or another service if the IEWS gains joint status. The MDA will then conduct an AOA and determine a development strategy.

Despite the Army's success at starting new EW programs, such as the AEA



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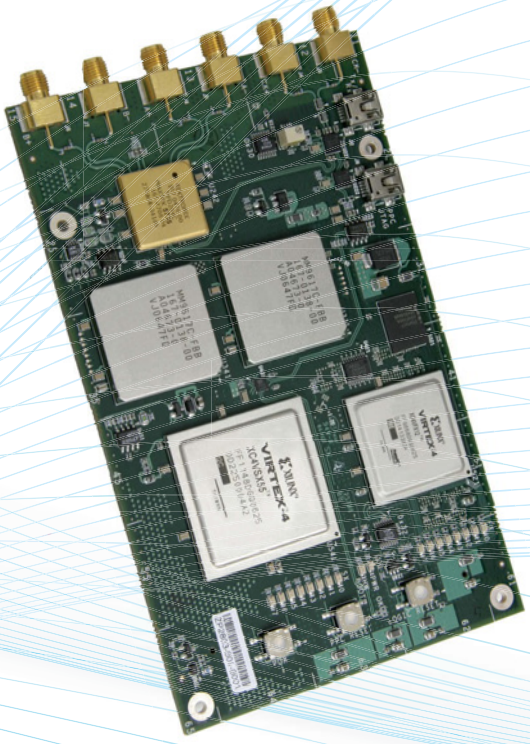

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platform and the IEWS, the Army is still wrestling with how to organize itself to develop its EW capabilities across the board. "How does the Army get into EA when we are not used to developing requirements for EA?" asked the Army official. "We only do SIGINT and collection. So, now that the Army is not going to buy [CREW] 3.3, and the VCJCS has approved the IEWS Annex to the Joint ICD, how do we answer the big question, 'How does the Army fall in line with the Joint Warfighter and place ownership for the new system at the Fires Center at Fort Sill?' Or does it go back to business as usual, and give the capability to the Intel Center at Fort Huachuca? If the system goes back to Huachuca, does the Army get caught up again in the intel gain/loss conundrum?"

The Army is debating these EW issues at its most senior levels. It is not clear when these issues will be resolved, but the nascent Army EW community is slowly finding its feet and weighing in on its future. – *J. Knowles*

JOINT DIRCM PROGRAM NEARING RFP STAGE

The US Army's nascent Common Infrared Countermeasure (CIRCM) program is moving forward and earning significant interest from industry. Under the CIRCM program, the Army aims to develop a lightweight, laser-based, directed IRCM (DIRCM) system for Army rotary- and fixed-wing aircraft and Navy, Marine Corps and Air Force rotary-wing aircraft. The focus of the program is on reducing the size of the DIRCM pointer-tracker turret or jam head, which directs the laser beam at incoming IR-guided missiles, so it can fit on small helicopters. The Army issued a request for information in July, asking respondents to provide comments on the CIRCM (pronounced "kerkum") Draft System Performance Specification, Draft Interface Control Document, and Draft Program Schedule.

The proposed CIRCM system solution must use a Modular Open Systems Approach (MOSA) to enable it to interface with, and be cued by, future missile warning systems such as the Navy's Joint and Allied Threat Awareness System (JATAS). The Marine Corps' MV-22 Osprey tilt-rotor aircraft will be the lead platform for JATAS and will be fitted with CIRCM once it becomes available.

BG Thomas Cole, who heads the Program Executive Office for Intelligence, Electronic Warfare and Sensors (PEO-IEW&S), noted the significant industry investments made in miniaturizing DIRCM jam heads. As a result, he told *JED*, the technology is already at a "prototype/preliminary design system-level" stage mature enough to allow the Army potentially to skip the standard Technology Development phase [with two competing contractors] and move straight into Engineering and Manufacturing Development [with a single contractor] early next year. Reliability and

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jam-head tracking capability testing are planned in the meantime to confirm that technological maturity, he said.

Several EW companies are expected to pursue the CIRCM program. ATIRCM manufacturer BAE Systems is following the program, as are LAIRCM manufacturers Northrop Grumman and Selex Galileo, which announced their CIRCM team last month. Raytheon Missile Systems, which has developed the Quiet Eyes system, and ITT Electronic Systems, which has conducted flight demonstrations of its DIRCM system, are also expected to bid for the program.

The Army's Communications-Electronics Life-Cycle Management Command Acquisition Center (Ft. Monmouth, NJ) released the RFI on behalf of the Program Director for Aircraft Survivability Equipment under PEO-IEW&S. Program officials are scheduled to release an RFP in the next few months and hope to achieve Milestone B approval in June 2010. If the schedule holds, the Army would award a 21-month engineering and manufacturing development contract shortly after Milestone B approval. The CIRCM technical point of contact is Darrell Quarles at (256) 955-0304, e-mail darrell.quarles@us.army.mil – *G. Goodman and J. Knowles*

US NAVY ISSUES NEXT-GENERATION JAMMER BAA

On September 15, the US Navy's EA-6B/Airborne Electronic Attack Program Office (PMA-234) at Naval Air Systems Command (NAS Patuxent River, MD) released the final Broad Agency Announcement (BAA) for Technology Maturation contracts under the Next-Generation Jammer (NGJ) program (see p. 34). Bidders' proposals are due on October 15. PMA-234 plans to select up to four companies to receive 10-14 month contracts valued at $15-$30 million by March 31.

The program's aim is to provide a replacement around 2018 for the venerable ALQ-99 external jamming pods currently used on the EA-6B Prowler and on the new EA-18G Growler aircraft that has begun to replace it. It is expected that the NGJ program will produce new pods that will be integrated onto the Growler and possibly the F-35 Joint Strike Fighter. However, an ongoing Analysis of Alternatives (AoA), slated for completion next April, will determine the preferred NGJ solution(s), which could include putting the capability on unmanned aircraft.

The Technology Maturation contracts will have two objectives: The first calls for each contractor to propose a preliminary design of a system-level Concept Demonstrator that integrates NGJ Critical Technology Elements (CTEs). The second objective is for each company to mature the CTEs to Technology Readiness Levels of 6 or higher. That work will feed into a follow-on Technology Development phase, which will demonstrate technology maturity through a series

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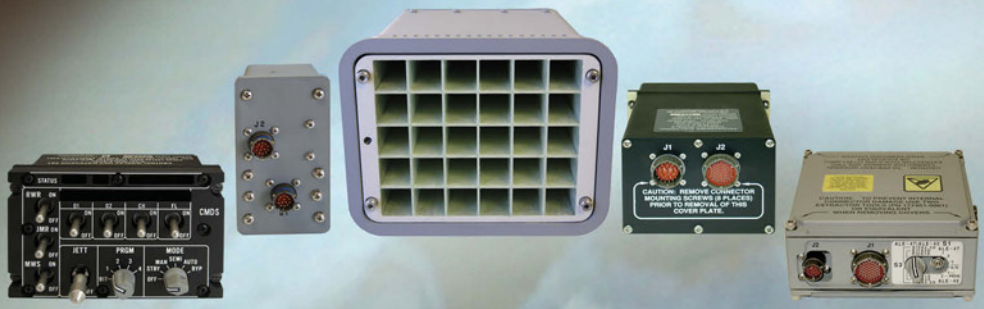

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of laboratory demonstrations and flight tests aboard contractor test aircraft on a Government range. The two phases, the BAA states, will "facilitate a smooth transition of the key technologies into future DOD EW capabilities, such as the EA-18G, F-35 and unmanned aircraft."

The NGJ BAA solicitation number is N00019-09-0238. The contracting point of contact is Ms. Robyn Warner, Robyn.Warner@navy.mil. – *G. Goodman*

LAIRCM FIELDING CONTINUES ON USAF TRANSPORTS

The US Air Force continues to field the laser-based Large Aircraft Infrared Countermeasures (LAIRCM) system in large numbers on Air Mobility Command's C-17 and C-130 transport aircraft to protect them from shoulder-launched, IR-guided, surface-to-air missiles. Transport aircraft are vulnerable to the heat-seeking missiles during takeoffs, landings and air drops. Over the past six years, the Air Force has procured 132 LAIRCM systems to date for its 210 funded C-17s and 174 of the systems for its more than 400 C-130s, according to USAF FY10 budget documents. In addition, the service began LAIRCM purchases for its 100+ C-5 transports in 2008, ordering 13 to date.

The AAQ-24 LAIRCM, produced by Northrop Grumman (Rolling Meadows, IL), automatically detects and tracks an incoming threat missile. It then directs a high-intensity modulated laser beam – from a swiveling pointer-tracker turret – at the missile's IR seeker to defeat it. C-17s and C-130s typically are fitted with two LAIRCM turrets, with one on each side of the aircraft. The system is fully automatic following power-up.

A separate passive missile warning system (MWS), composed of five or six sensors installed externally around the aircraft's fuselage to provide full spatial coverage, cues the turrets to the direction of arrival of the IR missile. LAIRCM has used Northrop Grumman's AAR-54 ultra violet-based MWS, but it will be replaced by a more advanced Next-Generation (NexGen) two-color IR-based MWS developed by the company. NexGen entered low-rate initial production for the Air Force a year ago.

The Air Force initiated the LAIRCM program in 2001, leveraging Northrop Grumman's earlier-generation AAQ-24 directable lamp-based Nemesis system that had been jointly developed by US Special Operations Command and the UK during the 1990s. After the September 11 attacks that year, the LAIRCM program became a major Air Force priority. The service began installing the system on its C-17s and C-130s in 2003.

LAIRCM's original pointer-tracker turret, called the Small Laser Transmitter Assembly (SLTA), is being replaced with the smaller and lighter Guardian LTA. Northrop Grumman began delivering the Guardian turrets to the Air Force in the summer of 2008. The service plans to ret-

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rofit them on the existing LAIRCM systems on its C-17s. Lt Col William Kelleher, Business and Integration Flight Lead in the 654th Aeronautical Systems Squadron (LAIRCM) at Wright-Patterson AFB, OH, told *JED* that the displaced SLTAs will be moved over to C-130s to increase the number of those aircraft fitted with LAIRCM. The LAIRCM turrets are permanently installed on the C-17 aircraft, but are often rotated among C-130s.

"Our intent is to field LAIRCM on as many C-17s as possible," Kelleher said. "Our goal is 190+." LAIRCM procurements take a holiday in the USAF FY10 budget request, but Kelleher said that amounts to a pause while the service awaits budget direction from the Obama Administration. – *G. Goodman*

CORRECTION

The article, "The Top 20 EW Programs," in the August 2009 *JED*, contained an error. The estimated five-year value of the

TSP FACES OFF WITH ASIP

The US Army plans to integrate the Tactical Signals-Intelligence Payload (TSP), under development by BAE Systems (Nashua, NH) since 2004, on its Extended-Range Multipurpose (ERMP) unmanned aircraft system (a Predator variant formerly called Sky Warrior). However, the Air Force has developed a different SIGINT payload for its Predator UAS – a scaled-down variant of Northrop Grumman's Airborne SIGINT Payload (ASIP) going on the Air Force's larger Global Hawk UAS.

The Office of the Secretary of Defense, questioning the need for funding two different Predator SIGINT payloads, initiated a study that could lead to a fly-off between the two systems over the next year or so. Subject to the outcome of OSD's action, the Army is moving ahead with plans to compete its TSP procurement (as the "Enhanced TSP"), with a low-rate production decision scheduled in the third quarter of FY2010. Northrop Grumman could compete against BAE Systems for that contract with an ASIP variant. – *G. Goodman*

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EuroDASS program should have been stated as $1.8 billion rather than $1.18 billion. Its ranking in second position on the list was correct. *JED* regrets the error.

IN BRIEF

SRCTec (Syracuse, NY) has received a five-year indefinite delivery/indefinite quantity (IDIQ) contract valued at up to $700 million to upgrade thousands of CREW Duke systems to the V2 configuration. The initial order is for $188 million.

The Airborne Electronic Attack Division of NSWC Crane recently conducted a flight demonstration of the Communications Electronic Attack with Surveillance and Reconnaissance (CEASAR) system prototype. The testing was conducted in August at Camp Atterbury Joint Maneuver Training Center, with the CEASAR prototype integrated on a Hawker Beechcraft King Air 100 aircraft. During this time, CEASAR's ability to detect and jam a variety of commercial and military communication systems was demonstrated in a sparse urban environment. Varying threat geometries, jammer techniques, and system employment methods were evaluated as part of the test. The demonstration prototype utilizes a modified version of the AN/ALQ-227 Communication Countermeasures System (CCS), developed by Raytheon (Ft Wayne, IN) for the EA-18G program. The CCS is integrated in a small electronics pod built by Zivco Engineering and approved for flight on the Predator A Unmanned Air System (UAS). Other key components within the pod include Aethercomm solid state amplifiers, a Raytheon Microlite data link, Zeli GPS, and NSWC Crane designs for the payload controller, EA antennas and antenna interface assembly. SAIC developed and integrated the CEASAR control software, including data link control and operator controls and displays.

Raytheon has announced that Roy Azevedo has been promoted to the role of vice president for Advanced Concepts and Technology. He will report to Jon Jones, President of Raytheon's Space and Airborne Systems (SAS) business. Previously, Azevedo had been Deputy Vice President for Tactical Airborne Systems and the product line director for EW.

DRS Technologies (Parsippany, NJ) has completed its acquisition of Soneticom (Melbourne, FL), which provides software, hardware and digital signal processing solutions for EW and COMINT customers. Soneticom now operates as part of DRS Signal Solutions (Gaithersburg, MD).

The US Navy's **AGM-88E Advanced Anti-Radiation Guided Missile (AARGM)** program successfully completed its eighth and final live fire test as part of its system design and development phase. Launched from an F-18C, the test evaluated the AARGM's ability to detect, identify and locate an enemy air defense system using its anti-radiation homing receiver. In the terminal phase, AARGM used its multi-mode sensor suite to overcome advanced target countermeasures and directly hit the target.

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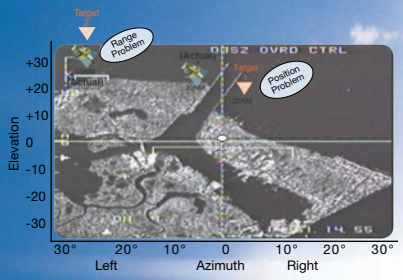

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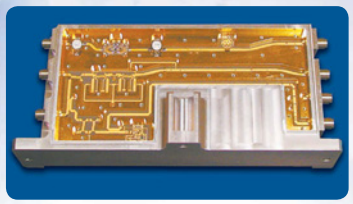

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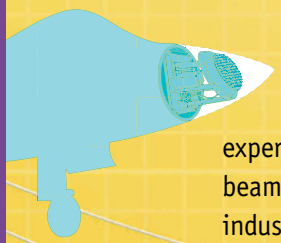

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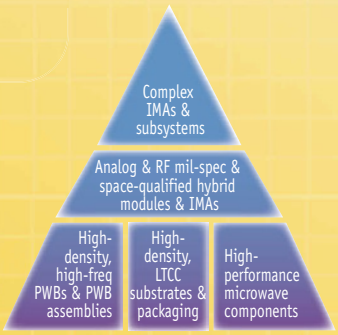

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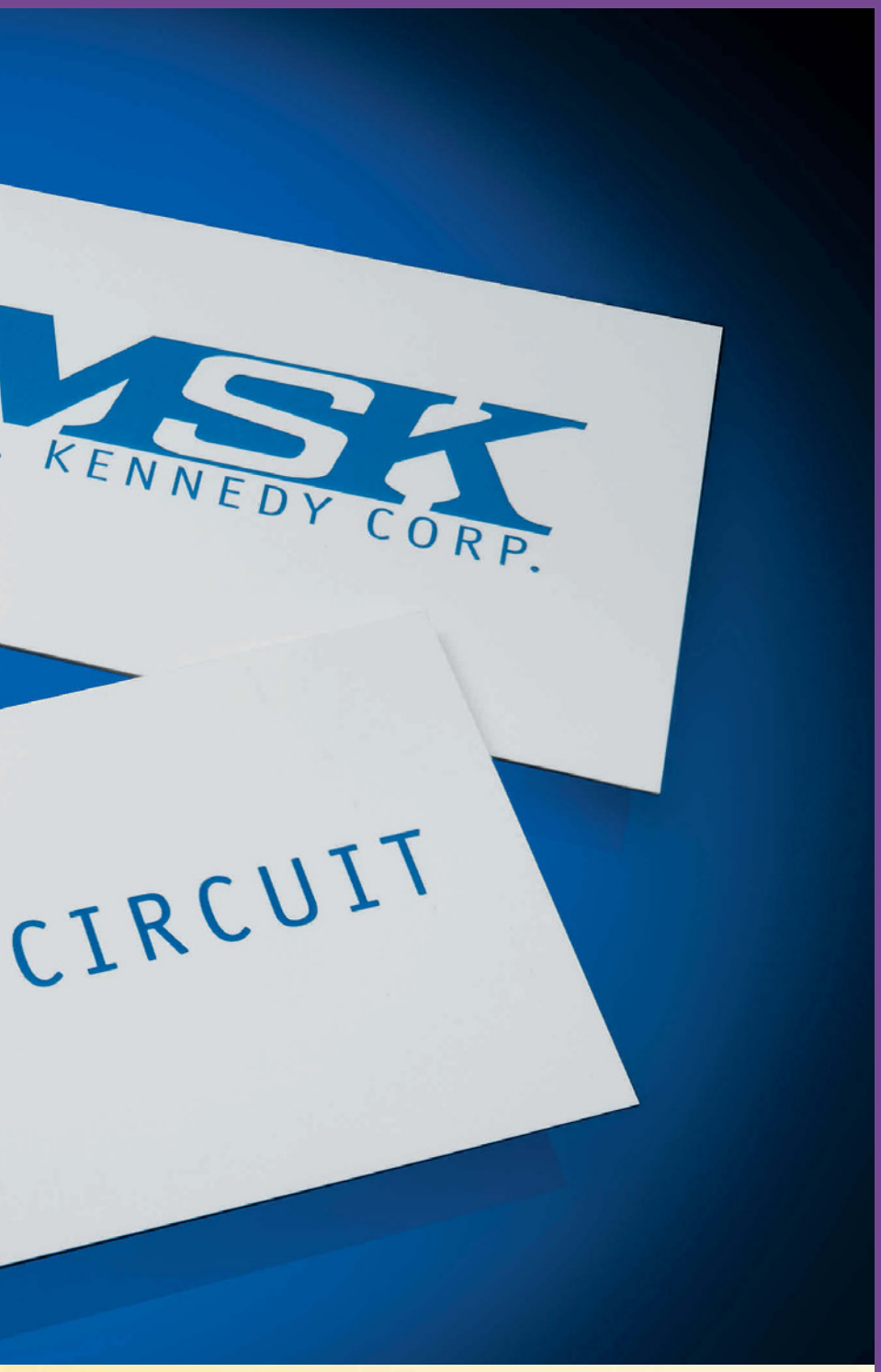

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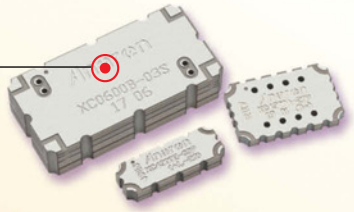

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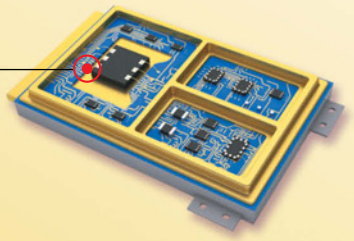

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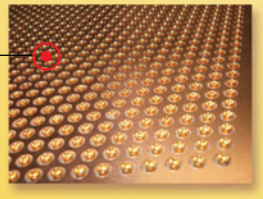

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washington report

SENATE PASSES DEFENSE APPROPRIATIONS BILL

The US Senate has passed its version of the FY2010 Defense Appropriations Bill. The bill provides $625 billion in funding, which is only $22 million less than the House version of the bill.

The committee report accompanying the bill details many funding adds and cuts in defense programs, including EW and SIGINT programs.

In the procurement lines, the Senate:

- added $1.5 million for the Navy's Crane IDECM capability;
- cut $16 million from the Navy's Shipboard IW Exploit Line for Ships Signals Exploitation Equipment Increment F slow production ramp-up;
- added $3 million to buy the BLQ-10A(V) Wideband Signal Processor for use on Navy submarines;
- cut $9.8 million from the Navy's Ammunition Procurement Line due to termination of the MJU-55 flare acquisition;
- added $2 million to buy more Miniature Air-Launched Decoys; and
- added $3 million for Unmanned threat Emitter (UMTE) modernization.

The Senate also made several changes to EW and SIGINT research and development (R&D) lines. In this section of the bill, the Senate:

- cut $35 million from the Army's EW Development line due to "excessive CIRCM management services";
- added $2 million to Army EW Development for hostile fire indicator EMD;
- cut $13 million from the Navy's Tactical Aircraft DIRCM program due to delays;
- cut $35 million for the JCREW 3.3 program due to contract delays;
- added $1 million to the Navy's EW Development line for development of a "small survivable jammer";
- added $4 million to the Navy's EW Development line for F/A-18 countermeasures improvement;
- added $1 million to the Air Force's applied research line for mid-IR laser materials;
- cut $17 million from the Air Force's MALD-J development program;
- cut $10 million from the Air Force's Airborne SIGINT Enterprise line due to RQ-4 Airborne SIGINT Payload program delays.
- cut $5 million from the Air Force's Large Aircraft IRCM program for "program underexecution";
- added $4 million to the Central T&E Investment Development line for advanced SAM hardware simulator development;
- added $5 million to the Special Operations Technology Development line for EC-130J multi-mission upgrades; and
- added $4 million to the Special Operations Technology Development line for "Picocepter and processor for man-portable threat warning."

The report also goes into detail about some EW- and SIGINT-related programs. With regard to UAV SIGINT payloads, the report states: "The Committee is aware that the Army and Air Force have parallel development programs underway to fulfill similar requirements for signals intelligence payloads capable of flying on small unmanned aerial vehicles, but have thus far proceeded with separate acquisition strategies. In order to ensure the Department of Defense is fulfilling operational requirements for this capability and that continued development provides the best value for the warfighter and the taxpayer, the Committee directs the Under Secretary of Defense for Acquisition, Technology and Logistics to submit a report to the congressional defense committees no later than March 15, 2010, that details the preferred acquisition strategy for UAV-based signals intelligence capabilities across the military services."

With regard to the Aerial Common Sensor, the Committee cut all funding and stated, "The fiscal year 2010 budget request includes $210,035,000 for the development of the aerial common sensor [ACS]. The Committee notes that despite several program delays, a significant adjustment to the originally proposed hardware solution and a modification to the initial acquisition strategy, an ACS requirement has not been validated. The Committee further notes that the fiscal year 2010 budget request includes funds to integrate multiple intelligence capabilities onto medium altitude aircraft which will provide the Army with an enhanced medium altitude reconnaissance and surveillance capability. Therefore, the Committee provides no funds for ACS."

The Senate version of the bill also includes a number of funding differences compared with the House version of the Bill. Some of the procurement funding that will need to be resolved in conference includes SLQ-32 upgrades, HARM modifications and anti-ship missile decoys. In the R&D lines, the House and Senate will need to resolve funding for Army EW Technology, EA-18G, Next Generation Jammer, Navy tactical cryptologic systems, Navy threat simulator development and Air Force electronic combat technology. At press time, House and Senate conferees were expected to soon to forge a final defense appropriations bill that would be sent for the President. – *JED* Staff

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world report

UAE SELECTS EW FOR NEW ASW CORVETTE

The UAE Navy's recently ordered *Abu Dhabi*-Class corvette will be equipped with the same EW systems already being procured for the Navy's *Baynunah* corvette class and the retrofit programs of the in-service *Mubarraz* fast attack craft and *Muray Jib* corvette class vessels. The new 1,650-ton ASW vessel is based on the *Comandanti*-class vessels built for Italian Navy. However, the *Abu Dhabi*-Class will feature additional radar cross section reduction, and a rear flight deck with a retractable hangar able to accommodate a helicopter, and an evolved combat management system with an enriched sensor and weapon systems suite.

The latter is mainly provided by Finmeccanica companies, including Selex Sistemi Integrati for the CMS and sensors suite based on Kronos 3D multifunctional radar, Oto Melara for the main and secondary armament and WASS together with Thales Underwater Systems for the ASW suite. The vessel's EW suite will be based on Elettronica's SEAL-H ESM system and a pair of Rheinmetall MASS chaff and flare decoy launchers. The UAE Navy will provide the EW systems to Finmeccanica for integration into the combat system. Both systems also form the heart of the EW suite being installed on board the Navy's *Baynunah*-Class corvettes, which was launched in June at Constructions Mécaniques de Normandie shipyard in Cherbourg, France. Delivery to the UAE Navy is scheduled for 2010.

The *Abu Dhabi*-Class corvette will be built and delivered at group facilities in Italy in early 2011. The contract also includes logistic support, crew training and an option for a second ship, which according to industry sources, is to be exercised within the next year. – *L. Peruzzi*

AUSTRALIAN DOD RETHINKS ECHIDNA

Citing concerns regarding delayed aircraft availability, the Australian DOD released a statement last month announcing that the government had agreed to reduce the scope of Project Echidna, which would provide EW self protection for rotary wing aircraft.

The prime contractor, BAE Systems Australia, had met all requirements, said Greg Combet, Minister for Defence Personnel, Materiel and Science. However, the country had determined that continuing advanced EW suite plans for Black Hawk helicopters would be unjustified, given their life span. In addition, given the Black Hawks' workload, there was concern about how continuing the program would impact the aircraft's availability to fulfill vital functions.

Combet said modifications to 12 Black Hawk helicopters – providing a basic level of EW self protection – will be completed; however, they will discontinue work on a more advanced suite of self-protection equipment that was set to include a domestically developed ALR-2002 radar warning receiver.

Under Project Echidna, Australia has already added enhanced protection to its Chinook fleet operating in Afghanistan and has modified their 12 C-130H aircraft to include missile warning, radar warning and countermeasures dispensing capabilities. The move will result in A$50 in savings. – *E. Richardson*

SAAB FORMS ELECTRONIC DEFENSE DIVISION

Swedish aerospace giant Saab AB announced last month that it has created a new operating and management structure to create a better market-oriented company that can compete more effectively on the world market. The company will operate under five business areas: Aeronautics, Dynamics, Security and Defence Solutions, Support and Services and Electronic Defence Systems.

The Electronic Defense Systems division is formed by merging Saab's premier radar business, Microwave Systems, and the company's EW business, Saab Avitronics. This new business will be led by Micael Johansson, who was previously president of Saab Avitronics. In 2008, the business units comprising Electronic Defence Systems represented approximately SEK 4.5 billion ($575 million) in sales or about 19 percent of the company's revenue. From a technology perspective, the move to combine radar and EW businesses is similar to other major defense electronics companies, such as Thales, Selex, ITT, Raytheon and Northrop Grumman. It also positions Saab to better explore future integration of EW and radar systems within the company and with international partners. The reorganization will become effective January 10.

In other Saab news, the company received a €14 million integration and production contract for the BOL dispenser system on Finnish Air Force F-18s. The program is part of the Hornet Mid Life Upgrade 2 (MLU2) program. Work will begin in 2009 and be completed by the end of 2011.

Saab has also delivered the first of its new BOZ enhanced capability (EC) pods to the company's launch customer, the Italian Air Force. The BOZ-EC pods are being installed no Italian Tornados. – *J. Knowles*

IN BRIEF

- The UK MOD has awarded a contract to Roke Manor Research Ltd (Hampshire, UK) to provide its RESOLVE EW manpack for British land forces under Project SEER. The RESOLVE manpack provides electronic surveillance and electronic attack (EA) capabilities. Roke's partners include Selex UK (for EA hardware) Thales UK and Frazer Nash Consultants. The systems will be delivered during the first quarter of 2010.

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Shaping the AEA

Future of

By CAPT Steven Kochman and Tom Dalheim

The venerable ALQ-99 Tactical Jamming System (TJS), used by the Department of the Navy's EA-6B Prowler and EA-18G Growler airborne electronic attack (AEA) aircraft, will be 54 years by the time it could be fully retired in 2025. The AEA mission, enabled in large part by the ALQ-99, has evolved beyond the traditional Suppression of Enemy Air Defenses role. Today the ALQ-99 provides a wide range of jamming support to ground forces and others for Irregular Warfare (IW) missions, significantly increasing the demand for the aging weapon.

The ALQ-99's degrading maintainability, increasing cost to operate and limited growth capacity prompted the Department of Defense to direct the US Navy to initiate a technology maturation phase leading to its replacement.

The Next-Generation Jammer (NGJ) development effort, still in its early stages, is proceeding at a measured pace across several parallel fronts designed to help ensure its success. NGJ's aim is to provide a replacement beginning in 2018 for the ALQ-99 TJS.

ALQ-99 Background

The ALQ-99 TJS is a pod-mounted weapon system. It synthesizes, amplifies and radiates multiple, simultaneous jamming techniques across a very broad frequency range of the electromagnetic spectrum. The EA-6B and EA-18G typically carry three ALQ-99 TJS pods, mounted on their centerline and two wing store stations. Within each pod, there is a techniques generator and two high-power amplifier/antenna assemblies, called Transmitters (XMTR). The pods are configurable to meet specific mission needs from among 11 unique XMTR configurations that cover the ALQ-99's full frequency range.

The only ALQ-99 XMTR in active production is the Low-Band Transmitter (LBT), developed and produced by Cobham Sensor and Antenna Systems (Lansdale, PA). The LBT replaces four legacy configurations of low-frequency XMTRs, reducing the number of unique configurations to seven. The LBT utilizes solid-state amplifier technology and has demonstrated a tenfold improvement in reliability in the field compared with the legacy low-band XMTRs. All of the ALQ-99's high-band XMTR configurations utilize traveling wave tubes for jamming technique amplification, with only the newer Band 9/10 XMTR employing multiple, lower-power radio-frequency chains to provide graceful degradation of the amplifier performance if failures occur. The ALQ-99 XMTRs all employ high-power transmit antennas to radiate jamming.

Another key feature of the ALQ-99 TJS pods is that they are self-powered by a Ram Air Turbine (RAT). While the RAT imparts a significant aerodynamic drag on the aircraft while operating, it eliminates a significant demand for electrical prime power that would otherwise be placed upon aircraft engine generators. It also eliminates the need for large, heavy gauge wiring running from the engine generators to the store stations.

The ALQ-99 was originally designed in the 1960s and was first fielded in 1971. Since that time, the Navy has executed a number of upgrade programs to improve ALQ-99 capabilities, availability and ownership cost. Even with these upgrades, the ALQ-99 still contains an overwhelming percentage of legacy

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technologies that constantly erode the system's availability for meeting mission needs.

While upgrades have managed to keep pace against advancing threats over the years, the system's architecture and fundamental component technologies limit the return on investment to be gained from future upgrades, both in terms of capability and life-cycle cost. This comes at a time when digital and solid-state technologies have yielded dramatic improvements to air defense radars and communications/data links.

Adversary nations around the globe now have access to state-of-the-art Integrated Air Defense capabilities that potentially limit our ability to access and gain control of airspace. Of equal importance has been the explosion in the availability and use of commercial wireless technologies. In this age of IW ushered in since 9/11, our forces confront enemies that employ a wide range of wireless technologies to provide an asymmetric advantage on the battlefield and avoid direct engagement.

AEA has shown it can greatly disrupt the enemy's use of the electromagnetic spectrum. Thus the EA-6B and its ALQ-99 are now a key component of our IW capabilities. This driving force of increased demand for AEA capability, coupled with the limitations of the ALQ-99's age and its architecture, form the fundamental need for the NGJ.

Although the Navy has upgraded the ALQ-99 piecemeal over the years, its reliability and maintainability are deteriorating and its performance capabilities relative to advancing air defense threat radars are projected to degrade over time.

OSD directed the AoA team to address specific NGJ alternatives related to the EA-18G and the F-35 Joint Strike Fighter as candidate platforms, as well as other options, in both major combat operations and irregular warfare.

Another key shortfall of the ALQ-99 system is that its pods, with their mechanically steered antennas, can jam only a limited number of targets simultaneously. An increase in the number of concurrent jamming beams is needed to handle greater threat densities in the future.

A new airborne tactical jamming system with greater effective radiated power is needed to counter longer-range radars and surface-to-air missiles from increased stand-off ranges. Several high-level DOD analytical studies have validated the NGJ requirement, which is acknowledged by the Department's senior leadership. The NGJ is deemed crucial to retaining access to enemy airspace in the future.

The EA-6B/AEA Program Office (PMA-234) at Naval Air Systems Command (NAVAIR), NAS Patuxent River, MD, is managing the NGJ program.

TECHNOLOGY DEVELOPMENT STRATEGY

In late 2008, the Office of the Secretary of Defense (OSD) directed PMA-234

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to undertake an NGJ technology maturation effort designed to support a DOD Milestone A decision in early FY11. The first step was to award six-month trade-study contracts in January 2009 to four companies – BAE Systems, ITT, Northrop Grumman and Raytheon. We provided the contractors performance objectives, and they investigated the range of alternative NGJ technology solutions at the system level.

The next step in our competitive development strategy will be to select up to four companies to receive 10-14 month Technology Maturation contracts starting in March 2010 that will have two objectives. The first calls for each contractor to do a preliminary design of a system-level Concept Demonstrator that integrates Critical Technology Elements (CTEs). The second objective is for each company to mature the CTEs.

The five major CTEs that were previously identified and validated during the initial trade studies for NGJ are its power generation, exciters, beam formers, radio-frequency (RF) power amplifiers and antenna arrays. Volume constraints and waste heat dissipation are key technology challenges across these CTEs. Most of the CTEs are at a Technology Readiness Level (TRL) of less than 6. Maturing the CTEs to TRL 6 or higher as early as possible and integrating them into a functional system are critical to the NGJ program's success by reducing future development risk.

Following a Milestone A approval, the program will enter an 18-24 month Technology Development phase with a minimum of two contractors. Each will build a prototype of its system-level Concept Demonstrator, which will undergo flight testing aboard a surrogate test bed aircraft in addition to ground testing. Our objective is to mature the CTEs to a TRL of 6 or higher by the end of the Technology Development phase. Following a Milestone B decision in early FY13, we plan to select a single contractor to conduct an Engineering and Manufacturing Development (EMD) phase over four years.

PARALLEL EFFORTS

Complementing PMA-234's Technology Maturation activities are two other

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ongoing NGJ-related efforts. The first is an Analysis of Alternatives (AoA); the second involves the Next-Generation Airborne Electronic Attack (NGAEA) Enabling Capability program, managed by the Office of Naval Research (ONR) EW Program Manager.

Completion of the AoA is required prior to the NGJ program's Milestone A decision. The 15-month study, led by NAVAIR with joint service participation and OSD oversight, entails a detailed assessment of options to meet the NGJ requirements. OSD directed the AoA study team to address potential system concepts relevant to one of the following alternatives: incremental modernization of the ALQ-99; development of a new tactical jamming system with subsystems and components at a TRL of 5 or 6; development of a new jamming system based on lower TRLs that could be developed further; and non-US technologies.

Using technical inputs from industry, the AoA team is evaluating alternative system solutions in various warfare scenarios, based on expected threats, concepts of operation and cost/capability trade-offs. OSD directed the AoA team to address specific NGJ alternatives related to the EA-18G and the F-35 Joint Strike Fighter as candidate platforms, as well as other options, in both major combat operations and irregular warfare. The AoA will determine the preferred NGJ solution.

Because we won't know which aircraft will employ NGJ until after the AoA is completed in April 2010, our Technology Maturation efforts will remain "platform-independent." We have told our industry contactors not to expend any effort related to NGJ integration on a specific aircraft, which won't occur until EMD. However, we have directed them to focus on how their CTEs will be "packaged" -- integrated to work together in a particular "form factor" or volume, notionally a pod on the EA-18G Growler, to meet our NGJ performance objectives.

The objective of ONR's NGAEA project, which is part of the Future Naval Capabilities program, is to develop and transition advanced technologies capable of bringing about an NGJ system with improved levels of performance and/or reduce demands for size, weight, prime power and cost. NGAEA is focused on component-level technologies within all of the NGJ CTEs except prime power generation. Since the NGJ Technology Maturation and Technology Development schedule will limit the consideration of component technologies to those at higher TRLs (i.e., 5/6), NGAEA will take on development of higher-risk, higher pay-off technologies currently at lower TRLs (i.e., 3/4).

The NGAEA schedule calls for TRL 6 demonstrations of advanced components, capable of integration into NGJ sub-systems, by the end of FY12, which aligns with the NGJ program transition from Technology Development to EMD.

NGAEA began in November 2007, prior to the NGJ Milestone A decision but far enough along in the evolution of the NGJ program that ONR, the Office of the Chief of Naval Operations and PMA-234 made it a priority. Ten companies were awarded initial one-year Phase 0 study contracts to help conceptualize early NGJ system concepts and study key technology needs.

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Technology maturation plans and component research study reports were delivered.

Following this study phase, NGAEA entered into Phase 1, which calls for the initial design of TRL 4 (i.e., breadboard) components. In August of this year, the Naval Surface Warfare Center Crane Division awarded four Phase 1 task orders to teams led by Cobham-Sparta (BAE partner for NGJ technology maturation trade study), ITT, Northrop Grumman and Raytheon.

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The component technologies being pursued include an ultra high-speed direct digital synthesizer; both photonic and digital beam forming circuits; families of gallium-nitride based RF power amplifier modules; and broad-band, high-power antenna array elements. Phase 1 designs are projected to be completed in the March-April 2010 time frame and will be followed by Phase 2 awards for fabrication and demonstration of TRL 4 components.

Additional phases of development for design iteration to TRL 6 (Phase 3) and fabrication and demonstration of component prototypes (Phase 4) are planned across FY11 and FY12. Since the four companies awarded Phase 1 task orders are also competing for NGJ Technology Maturation and Technology Development contracts, there is strong linkage between NGAEA and NGJ. The companies have a clear understanding of how the advanced technologies they are pursuing under NGAEA would integrate into the NGJ system concepts they developed under their Technology Maturation trade study contracts.

OPEN ARCHITECTURE

A key NGJ requirement is that it must be designed with a modular, scalable, open-system architecture. This will facilitate the rapid insertion of new capabilities, such as higher-performance power amplifiers, or software changes to meet changing threat requirements. Scalability also will ensure that the NGJ can be adapted for use on different large or small aircraft with varying effective radiated power requirements. Consideration of open architecture even extends to the NGAEA components technologies, helping to ensure that high pay-off components not developed by the eventual NGJ EMD contractor can be integrated into the final NGJ system.

We are emphasizing the Navy's well developed Modular Open Systems Approach (MOSA) in designing NGJ's architecture, and will implement MOSA attributes early in the program during the Technology Development phase.

COMPELLING NEED

The ALQ-99 system will have been in service for more than 50 years by 2025. The system's limitations, in terms of deteriorating sustainability and projected capability gaps, are widely acknowledged. The Department of Defense's senior leadership has endorsed the compelling need for a Next-Generation Jammer to replace the ALQ-99 pods with enhanced AEA capabilities at a reduced operations and sustainment cost.

Our target date for initial fielding is 2018. Technology readiness underpins our NGJ development strategy. We are emphasizing the early maturation of Critical Technology Elements to high Technology Readiness Levels. We plan to validate the maturity of the CTEs through the flight testing of Concept Demonstrators during the Technology Development phase, mitigating technical, cost and schedule risk prior to the start of EMD, which will be able to focus on platform integration.

CAPT Steven Kochman is the EA-6B Program Manager at Naval Air Systems Command (NAS Patuxent River, NJ).

Tom Dalheim is the Chief Engineer, Airborne Electronic Attack, in the Spectrum Warfare Division of Naval Surface Warfare Center-Crane.

EW Operational Data Support to Frontline Forces

(A User Perspective)

By Chris Howe MBE

Military organizations world wide have a duty to ensure that Electronic Warfare (EW) systems used by front line forces are correctly programmed with accurate, relevant and up-to-date EW information at all times. To accomplish this vital task, a facility like an Electronic Warfare Operational Support Center (EWOSC) is essential, in order to facilitate the minute-to-minute management and subsequent dissemination of the relative EW data in support of operational units. One such typical task is to provide geographic, mission-tailored, equipment-specific EW data libraries for use in operationally deployed front-line EW Units. The main aim is to provide the EW operator with a fundamental aid to intercept identification/classification through the use of onboard radar descriptive libraries that are constantly being parsed via Radar Classification Algorithms (RCAs) embedded within the EW (ESM/ECM) system.

OVERVIEW

A growing number of both advanced and developing nations use expensive and often extremely complex EW systems. These EW systems quite naturally have an insatiable thirst for high quality data. Hence, there is a vital need to source, validate, process and subsequently maintain a considerable amount of relevant, accurate and readily available EW information. This essential information is then utilized in the assessment and validation of "other nation's" Electronic Order of Battle (EOB), which is considered to be vital knowledge when building EW threat libraries. In order to discharge this task, both accurately and efficiently, it is necessary to introduce a set of strict working practices for use within the EWOSC environment. These working practices will allow the research, validation, analysis and consolidation of all EW related information from all obtainable sources. It is this area of EW database support that this article is intended to cover; the content will range from the original sources through to the production of the front-line end user product as an EW output. It should be remembered that this practical introduction to EW databases is purposely written from the user perspective and is not intended to represent a technical design requirement document for a fully developed EW relational database management and library generation system.

DATA SUPPORT TASKS

In general terms, the following high-level tasks provide the basis for any EW support activity:

- maintain database on a Multi-Service basis but always meeting Single-Service requirements;
- research, validate, analyze and consolidate EW information from all available sources;
- update EW Master Database to reflect global changes to the data;
- rapidly disseminate "significant" database changes to front-line units;
- maintain a customer support cell to facilitate liaison with the producers and users of EW information;
- react positively and promptly to all customer feedback; and
- provide specialist advice on front-line EW support issues as and when required.

The overall aim must always be to "provide a process from which a change in the EW environment is recognized, analyzed and reacted to in the fastest possible time." Remember – the clock is always running!

EW DATA SOURCES

An EWOSC could not function effectively without source material. Source information can, of course, come in many varied shapes and sizes and can have countless different origins. Generally speaking though, and in this article, EW sources are broken down into two distinct categories, namely classified and unclassified. The latter often are generated from "open sources," although it must be stated that unclassified sources can frequently still have some form of "commercially sensitive" caveat attached to them that may restrict their use.

CLASSIFIED SOURCES

Classified sources are the much preferred type of information that can be used within an EWOSC. The actual classification can, of course, vary from a simple "Restricted" up to something much higher, such as "Secret" and even "Secret Codeword," in UK parlance. Quite simply, there has to be an accepted level of trust and confidence when using this type of EW data; the providers of such a level of classified data will most certainly have an in-built vetting system. By default, this system, if observed to the letter of the law, ensures a high degree of both physical and documentary security within not only the personnel but the entire organization in general. Secondly, data provided from a classified supplier (source) would normally dictate that the receiving EWOSC staffs have an acceptable working knowledge of the quality-control procedures applied to the actual data being provided. This is a very important and fundamental issue when relying on sources from a "Third party and Friend." In addition, the ability to openly question the provider of such source information often proves

to be a vital factor within the integral quality assurance procedures in place within the EWOSC organization.

Typical Classified sources can include:

Nationally owned radar parametric data: This type of information will often come from the national defense industry product manufacturers. For example, radar or weapon system providers and associated Ministry/Department of Defense research organizations. In addition to this, there will always be a relevant Government Project Manager who will have overall responsibility to oversee the development, production and through-life support of any emitter or weapon system.

Nationally observed (intercepted) data: This data serves several important purposes and will be further explained in a later paragraph; however, one main benefit of an intercept is that it will often provide a vital clue to an analyst by allowing an accurate picture and understanding of how an emitter operates in the live environment. Subsequently, it will then assist with the generic description for input to the Master Emitter Database. However, it should be remembered that intercepts are only indicative of the mode being transmitted at that particular point of time or period. It is not always the "whole story." The majority of today's modern radars are multi-moded and therefore often complex; consequently, it should be realized that each mode in turn can also have its own specific function. For example; Early Warning, Target Tracker, Target Indication, Target Acquisition and Missile Guidance can all be incorporated within a multi-element weapon system.

Bi/multi-lateral Memorandum Of Understanding (MOU): This information is another extremely accurate and useful source of EW data. Unfortunately it can often come at a price. Needless to say, the very existence of bi-lateral or multi-lateral agreements between nations, while often being invaluable, is a highly sensitive and well protected arrangement.

UNCLASSIFIED SOURCES

Unclassified sources are very often referred to as "open sources." This readily available source can provide a whole host of information about who has what capability, when did they or will they buy and so forth. Nevertheless, some of it comes with a price tag and can be an additional cost and therefore a burden. This does not have to be the case though, as so often this type of non-parametric information can easily be gleaned from the open press, magazines, manufacturers marketing literature and, of course, the World Wide Web. Defence industry exhibitions and symposiums are often a prolific source of gratuitous EW information and often lead to information beyond the glossy.

General:

However, it certainly needs to be pointed out that both these categories have inherent problems and do not come trouble free. In the case of classified sources, consideration must be given to the implications if information that has been derived from a Memorandum Of Understanding (MOU) with a "friendly nation" should go astray. Once this type of information has found its way into the EWOSC Master database, it would be extremely wise to have some form of audit trail that provides a history of the origins and ownership of that data. This will generally involve a form of multi-level security and/or source tagging to the individual fields and records held on the database. Imagine the embarrassment should this type of data be inadvertently given away to another third party under another MOU, thereby violating the agreements set down in any bilateral agreement!

In the case of unclassified sources the age-old problem of misinformation unfortunately exists; this is undoubtedly the main area of concern when using this specific type of information. Falling foul from misinformation is usually the result of a general lack of knowledge regarding the original source or the providing organization in question. This scenario is a totally realistic prospect and can cause untold damage if not discovered at an early stage during internal quality control procedures. All possible steps should be taken to allow an education to take place that provides an understanding of the sources in use and a reasonable knowledge of the working practices of the organization producing/providing them.

EW MASTER DATABASE CONTENT

The EW Master Database should be recognized as the repository for all source information once it has been through the complete cycle of research, validation, analysis and consolidation by means of internal quality assurance/quality control procedures. This formatted data will typically be held and managed in a modern Relational Database Management System (RDBMS), e.g., Oracle, Sybase, MS SQL server or Informix, although there are certainly other options or indeed a combination of object oriented solutions. As a minimum, the main types of data held within this structured system are:

- emitter descriptions (generic/global);
- platforms (land fixed, land mobile and all air and sea mobiles);
- weapons; and
- intercepts.

Emitters:

Emitters are the most comprehensive type of data to be described within an EWOSC and the residing Master Database. If there is a generic/global requirement for the storage of emitter (radar/laser) characteristics, the number of individual parametric field descriptors contained within the emitter data model can range from 25 to several thousands. This level of complexity is, of course, dependent on the specific EW equipment data requirements. It is due to this level of complexity that the emitters section is the most challenging activity within any EWOSC type facility.

In an ideal world the analyst should also be qualified within the general field of EW, including front-line experience and knowledge of operating EW systems in a real-time tactical environment.

One of the essential aims within an emitter analysis section is to review each and every emitter (all modes) as accurately and as often as possible. This review process must also include thorough use of internal quality assurance/quality control rules and procedures. When considering that thousands of different emitters (represented by many tens of thousands of modes) can exist within a truly global EW database, the task of prioritizing "throughput" is an extremely difficult one to manage effectively. There will always be an arbitrary number of emitters that are considered to be a very

high priority. Consequently this category will demand constant attention and update from all available sources. The existence of high priority emitters will often be dictated by the current operational (political) situation at any particular instance in time and will of course be subject to constant change and review. Nevertheless, a word of warning; these higher priority emitters will very easily dominate analytical procedures and order of review unless some form of emitter management prioritization schedule is agreed and adhered to. It is only with the strict adherence to such a procedure that the other "not so important" emitters will ever be reviewed and updated. Of course there are no black and white solutions to this age-old dilemma; each and every situation must be addressed on its unique merits and operational circumstances.

Platforms:

Typical examples of platforms include aircraft, space vehicles, surface ships and submarines, as well as land vehicles and fixed ground installations. Unlike emitters, the level of platform knowledge and comprehensiveness of platform description does not receive a high priority when assigning internal manpower and resources. It should be noted, however, that the platform does provide the vital link for the association of emitters, weapons and intercepted/observed data.

Weapons systems:

Weapon system descriptions are often a bone of contention within the EWOSC environment when it comes to the specific descriptive attributes and the level of data model required describing weapon system characteristics. There has been a continual conflict over which community should be the lead/provider of such data, namely the Intelligence or the EW community. However, there is no desire, and it is certainly not intended, to make the argument in this article. A weapon system description should at least reflect the minimum amount of information required in order to allow the relationship between a weapon system, emitter, platform and an intercept to be a true and meaningful one, and of use within the overall EW data support requirements.

Intercepts:

Intercepts are an important source of data and provide a vital contribution to any EWOSC facility. Not only do they confirm a level of emitter and platform identity (albeit the latter on a sliding scale), but they are also a "controlled source" for the emitter analysts to use during the constant emitter review process. Large numbers of intercepts, built up and stored over a period of time, form parametric histogram information. The histogram statistics can then be used in the development of Radar Classification Algorithms (RCAs) and in the population of Equipment Specific DataBase (ESDB) libraries. Intercepts of own units can also provide other useful indicators, such as an observation of a friendly radar malfunction. These observations can in turn lead to an investigation, and subsequently an early rectification of the problem can be achieved by the original transmitting unit.

GENERIC DATA TO EQUIPMENT SPECIFIC & MISSION SPECIFIC DATA

The Master Database will generally hold data in a generic nature, initially. The term generic will usually refer to the emitter parametric descriptions contained within the master emitter data model. It is this data model that accommodates fields (at-

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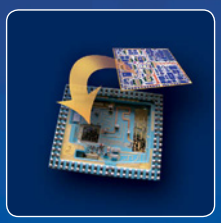

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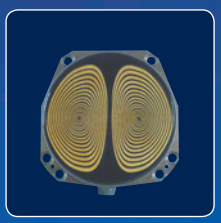

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tributes) to describe radars, mode by mode, in a globally representative format. It is from the Master Database that the ESDB formats will be generated. These ESDBs are essential for the programming of the individual front-line EW equipment; both passive and active systems. It is in this process that the generic data is transformed.

The generic-to-ESDB transformation can be achieved in several ways:

- a software interface (use of run-time mapping scripts) into the ESDB formats;
- a manual process performed by an experienced EW analyst who has a high level of user
- knowledge specific to the EW equipment in question; and
- a combination of both, for example, when a "fudge factor" is used.

The combination method may be applicable in some less complex EW systems in order to achieve an acceptable solution. As a result this will reduce emitter identification ambiguity and avoid undesirable false alarm rates, which can result in the unnecessary expenditure of expensive off board decoys such as chaff and flares.

In an ideal world the ultimate EW equipment library would contain only those threat modes expected within a particular area of operation, thus negating any potential for ambiguity during the intercept identification process. Unfortunately, this situation is very rarely achieved.

In summary, this process takes into consideration the capability and limitation of each piece of EW equipment, ESM or ECM. These ESDBs are tailored to meet the specific threat known to exist within the designated area of operation. This step produces the Mission Specific or Theater Specific view. As previously mentioned, it is during this process that accurate and timely knowledge of the enemy Order of Battle (OOB) and Electronic Order of Battle (EOB) are essential. The main aim of this activity is ambiguity reduction, leading to rapid identification of friendly, neutral or potentially hostile platforms.

EW DATABASE STRUCTURES – WHERE DO THEY COME FROM?

Many nations now use EW equipment of one type or another and therefore must have some degree of an EW support requirement. However, few have implemented the full capability of a traditional EWOSC-type activity. EW databases designed to support a typical EWOSC activity are rarely built from new, that is, there are very few organizations that can afford to start from scratch to build an in-house bespoke system. To be realistic and cost effective, it is considered best practice to seek out specialist software companies who offer a commercial-off-the-shelf (COTS) product that, with some customization, will achieve a workable solution to meet the EWOSC requirement. However, regardless of how an EWOSC data management solution requirement is met, without the experience and input from the recognized EW user community the end product (system) will not function correctly. Therefore, the main aims of the EWOSC will simply not be met.

DATABASE DESIGN ISSUES

As discussed earlier, the traditional EW database can be built within any one of a number of available Relational Database

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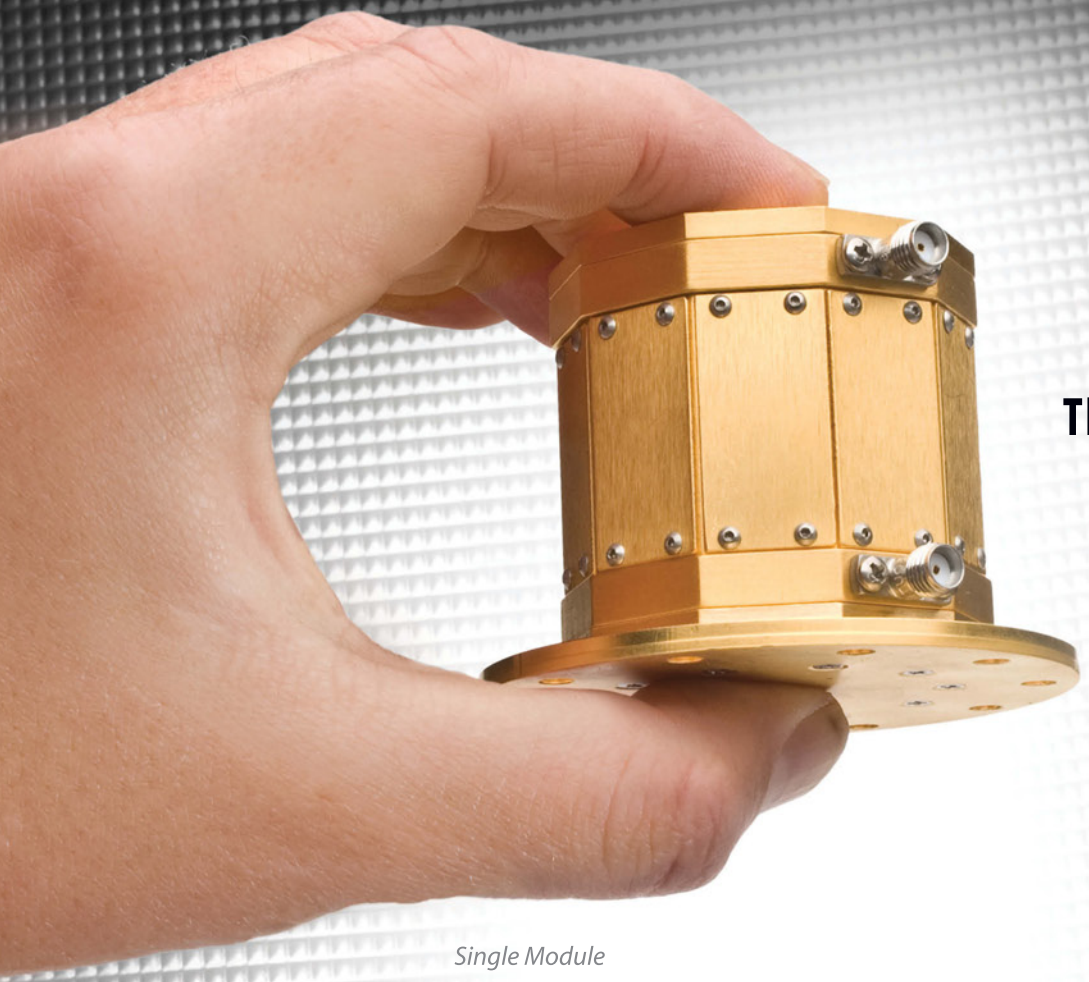

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Management Systems, or indeed a combination of Object and Relational. Therefore, there are important issues to be considered during the decision making process to determine which one to choose. All of the RDBMS mentioned earlier will provide the structure for an effective system. However, as discussed in the following sections, the dilemmas occur when security, flexibility, development and of course financial issues are considered in depth.

Security: It may be that security is a major concern, and of course the nature of EW business will often dictate that security is a driving factor. If this is a mandate then the choice could be made for you, or at least narrowed down. The rationale behind this being that some RDBMS are particularly strong at providing a "trusted" and secure system. Naturally, security is of paramount importance when handling data provided from a third party (Bi-Lat), especially if it is possible that specific outputs from the EW database are destined for a different friendly nation under completely separate MOUs or bi-lateral agreements. However, security should not be allowed to be the dominant and overriding decision maker. There is certainly no point in having a first-rate secure system if many of the other areas of functionality do not perform at the required level.

Flexibility & Development: When discussing flexibility we are often talking about development issues. The flexibility of any system design is dictated by the associated software tools chosen and the ability to interface with third-party packages. The software tools are often known as "Development Tools." These tools are used within a large number of areas within the actual database system design.

Some of these tools are listed here, and it should be noted that the list is by no means exhaustive:

- compilers (various);
- graphical user interface (GUI) builders;
- browsers;
- emulator software (various);
- operating system software; and
- report writers.

Financial Considerations: Another significant design issue is the cost involved in designing, developing, testing, providing and running an operational database. For example, runtime license costs will always be a strong consideration depending on the number of simultaneous site users (clients) and servers involved in the particular project. All of the above development tools are likely to have an associated cost either initially or as a runtime cost. There are considerable savings to be made if a solution can be found that involves an element of COTS philosophy in the first instance.

Sourcing high-quality EW database software in a mature stage of development, perhaps even in use with other organizations, will negate the need to go through the complete development phase that is starting with a blank piece of paper. Unfortunately, when taking this approach there is often the "not invented here" syndrome to contend with. This argument, in this context, is entirely without foundation, as any EW database will need some level of internal customization. This is due to the fact that all organizations will have unique EW support requirements; therefore commercial off the shelf (COTS) is a very cost-effective way to proceed and should at least be

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afforded due consideration prior to deciding on any design, development and procurement strategy.

Having considered all of these issues, there will invariably be a need for a compromise to be reached prior to deciding on the RDBMS to be employed. Nevertheless, a system that can provide 85% to 90% of the required specification and requirement would generally be an acceptable compromise situation.

As an aid to reaching a final decision, there are general rules and factors that should be considered and discussed at some length. It is essential that a comprehensive set of business rules are defined at the earliest possible stage of any database design activity. For example:

- Structure of the data model: Are all current and near future (planned) EW equipment specific requirements covered?
- What level of validation and security is required: field level, record level or even multi level?
- Relevant prompts to assist with input errors;
- Ability to amend, archive, transfer or delete content;
- Choice of RDBMS: does the choice meet the national IT regulations?
- Level of quality assurance: How much is automated? How much must rely on manual quality control?
- Changes to the data model: downstream effects of changes to the hard code;
- System administration: control of individual user access rights and privileges;
- Data release considerations; and
- Manpower: Are experienced EW analysts/users available, what training courses are required and who will provide them?

These are just some of the typical user considerations; of course the list is by no means exhaustive and would be dictated by specific requirements. Nevertheless, the suggestions are certainly thought-provoking and should be considered by the discerning user during the initial procurement stages of any database design process. Given the appropriate level of technical assistance, combined with the experience of EW equipment users, the end results should be favorable.

OUTPUTS

Having discussed and considered the expenses incurred when designing and implementing an EWOSC, coupled with the day to day running costs of keeping such an enterprise going, there is obviously going to be an output requirement. Typical output formats are as follows:

- formatted, equipment-specific library magnetic media;
- hard copy (perhaps), containing textual support to amplify content of EW equipment libraries;
- theater maps – mission specific data support displaying land, EOB/MOB, etc.;
- electronic versions of data libraries and maps, e.g. laptops; and
- EW training systems.

Once again this list is by no means exhaustive and is merely representative of the standard type of EW output to the typical EWOSC customer.

EWOSC MANNING CONSIDERATIONS

Manning an EWOSC with the appropriate personnel can in itself be a difficult task, to say the least. In my experience, there are no specifically

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trained EW analysts that will meet the typical job description(s) relating to *all* of the various tasks within an EW support activity. There are, however, two distinct categories of personnel that should be considered when defining the manning levels for an EWOSC. These are the EW equipment users and the radar technicians; personnel trained in these specific areas have experience and professional skills that are appropriate to many tasks within EW support.

Individual experiences will probably have been gained from the accumulative time in service, and will of course be different from person to person. The combination of these relative skills within the working environment has a proven track record, with the balance probably towards technical dominance combined with a sound knowledge of EW. However, it must be stated that the experiences of the EW user/analyst provide an invaluable input to any EW support activity and should always be considered as a vital ingredient to the EWOSC manning requirement. Front line experiences and feedback can often resolve some of the internal support issues that have to be routinely dealt with on a daily basis.

The previous paragraph is generally aimed at the actual emitter analyst post. The point is made due to the technical nature of an emitter description and the ability of the analyst to understand the terminology involved when handling comprehensive technical sources of this nature. It would be considered a waste of expertise and professional skills to put radar technicians in a position that simply required them to input very basic platform details copied from source material straight into the database. Alternatively, it would be totally unrealistic to expect a person who is not trained in EW or radar to work in the emitter analysis area. The latter would certainly not be a productive concept and would undoubtedly lead to unacceptable errors being created within the database. Subsequently, this would have a serious and detrimental knock-on effect on the quality of front-line EW support which in turn could "cost lives."

DEVELOPING ISSUES

All areas of EW are subject to continuous development programs, either within the defense industry using research and development (R&D) programs, or within military organizations with the aid of supporting defense research establishments. Accepting that there is a vital need for R&D at all levels, the following areas will most certainly need to be addressed and, in some cases, have been for some years:

- accurate data to support EO/IR systems;
- collection, analysis, storage and output of Specific Emitter Identification (SEI) Data (in addition to – not replacing – the traditional RF, PRI, PW and Scan);
- object-oriented design in conjunction with the traditional RDBMS;
- full integration to third party software such as geographical information systems;
- rapid reaction facilities to provide a "push – pull" capability to pass mission critical data to and from front line EW units;
- clever parsing software that will compare new structured source data with current baseline descriptions. This will save valuable time and decrease the stale time factor; and
- the accurate programming of modern defensive aid suites.

FUTURE EWOSC CONSIDERATIONS

In addition to the storage and maintenance of the traditional EW paramet-

ric data used for target recognition, several other areas will also need to be addressed at some stage in the future. Under the heading of "Non-Cooperative Target Recognition (NCTR)" we can find a few more pieces of the platform classification jigsaw puzzle that should enhance our target identification probability considerably. The next couple of paragraphs provide a brief introduction to this technology.

Jet Engine Modulation (JEM): Already in use within some countries, put simply, JEM theory is based on observing, measuring and identifying the characteristics reflected from the jet engine of an aircraft. Traditionally, a radar user is concerned with the size or type of echo and speed of an aircraft. The speed is often measured from the Doppler shift; however, the Doppler shift of the rotating parts of an engine will also reflect energy back to the radar. JEM looks specifically at these Doppler changes.

High Range Resolution (HRR): HRR provides thousands of one-dimensional images of a platform that in turn can be utilized for classification of a potential target. This activity can take place at long ranges and any aspect angle of the platform. Unlike a normal single radar echo, HRR detects the many different much smaller combinations of echo return. Each of these smaller echoes is reflected from a different part of the target platform. For instance: the engine, tail or wing of an aircraft; the funnel, mast, bridge of a ship. These profiles are therefore very sensitive to platform orientation (various aspects), which unfortunately means a very large database is required in support of a deployable HRR target identification system.

Without doubt there are many advantages of considering the combined use of NCTR concepts. The research and development of these techniques will most certainly lead to an urgent need to collect, analyze, store and maintain the necessary data within the traditional EWOSC environment, already an uphill struggle.

MISSION CRITICAL

It is simply unthinkable for any nation investing in expensive EW assets, to be deployed with front-line units, to operate without the full support of an EWOSC type facility. Without such support these mission-critical EW systems will simply not provide the vital service or the operational effectiveness needed and, indeed, expected of them. To invest such large sums of money in EW equipment without this crucial support is risking the loss of even more expensive resources, namely ships, aircraft and land units and of course, human life. While being a somewhat dramatic statement to make, historical events speak for themselves. When mission-critical EW data support is not forthcoming at the appropriate stage of any exercise or operation, the consequences can rapidly rise to an unacceptable and most regrettable level.

The lack of validated, accurate and timely EW support data will not only have detrimental effects on operational effectiveness but has strong potential to sadly result in target misidentification leading to "blue-on-blue" fratricide!

Chris Howe MBE, is the Senior Manager, EW at Systematic. He has 37 years of experience in EW, 19 of which he has spent in EW operational support. He joined the Royal Navy in 1972 and trained as a Communications and EW specialist and has 26 years active service to his name, including as EW Director on HMS Coventry during the 1982 Falkland Islands conflict. Chris's final appointment was Royal Navy Operations Officer RNEWOS where he was instrumental in the formation of the tri-service UK DEWC, Waddington.

ModSim conference a success

From July 27-29, the AOC facilitated the first annual EW Modeling and Simulation (Mod/Sim) Conference in Las Vegas, NV. Mod/Sim is a critical capability that presents future threats and warfighting challenges to help our warfighters effectively train for combat. It injects a degree of measurable predictability into an uncertain future.

Keynote Speaker RADM Mark Emerson, Commander, Naval Strike Warfare Center, opened the conference by saying, "From a training perspective, I am a big proponent of live training – getting our forces ready to deploy. We will have a false sense of security if we do not do those things [live training] from time to time … however, you cannot do that every day." He discussed how Northern Edge, a joint-service exercise that integrated live training and Mod/Sim, provided our warfighters with valuable and robust exposure to future threats and improved interoperability by adding Live-Virtual-Constructive (LCV) operations. This allowed training sessions that simulated full-scale operations that would have been otherwise logistically impossible, melding live and virtual data.

The conference covered a variety of topics, including training range limitations and frequency encroachment to solutions and development processes necessary to close existing gaps in training. Col Rob Vanderberry, USAF, the Conference Technical Program Advisor, expressed that EW training must be joint and imitate real scenarios that our warfighters must plan to face. Unfortunately, our community has not done a good job of comprehensively pursuing, and more importantly, sharing solutions that exist in various stages today. A solution to this problem and the underlying theme of the conference is the need to create a LCV modeling and simulation environment, which allows our warfighters to experience aspects of training that they cannot experience in the real world due to encroachment on training space and operational risks.

Furthermore, most warfighters lack experience against, and even exposure to, most threats. Training devices need to ensure that they are representative of most threats. This requires improving a process of verification, validation and accreditation that looks beyond simply threat components in and of themselves, but considers these components as a threat "system" that truly represents the real-world threats our warfighters may face in combat.

Dr. Dr. George Ka'iliwai, the Conference Chairman and Director for the Resources and Assessment Directorate (J8), US Pacific Command (PACOM), expressed, "The threat is continuously evolving, so we need to have high-fidelity models to know what the threat is. The bad news is that the threat is constantly changing . . . [Our near-peer competitors] are rapidly modernizing their forces and they are rapidly modernizing their air defense systems. And once again we find ourselves in a catch-up mode. So what we need [is a capability that allows] us to cover the entire spectrum. The part that is uncomfortable is when we talk about the way forward."

Dr. Ka'iliwai believes we have "a window of opportunity in which the environment appears to be correct to fix those things that ail us. But we have to react quickly. Because if we don't do it right [the window of opportunity] will close, and it will close, in my opinion, for several decades. We cannot afford for that to happen."

The interplay between live training and Mod/Sim – and the need for each part to inform the other – is critical to success in future combat and the protection of our warfighters. The AOC will continue to facilitate progress on this critical issue. Look for the next Mod/Sim Conference in November 2010. – *AOC Staff*

AOC sends letter to Congress, supports EW amendment

On September 22, the AOC sent a letter to the leaders of the Senate Armed Services Committee and the leaders of the House Armed Services Committee expressing strong support for an amendment and report language in the House version of the FY2010 National Defense Authorization Act. The amendment, which was passed by voice vote, calls for the Secretary of Defense to submit an annual report on DOD EW Strategy. The House and Senate will reconcile the differing versions of their defense policy bills in a conference session. The AOC is urging the conferees to retain the EW strategy report language in the final version of the bill. The full text of the letter is available at www.crows.org.

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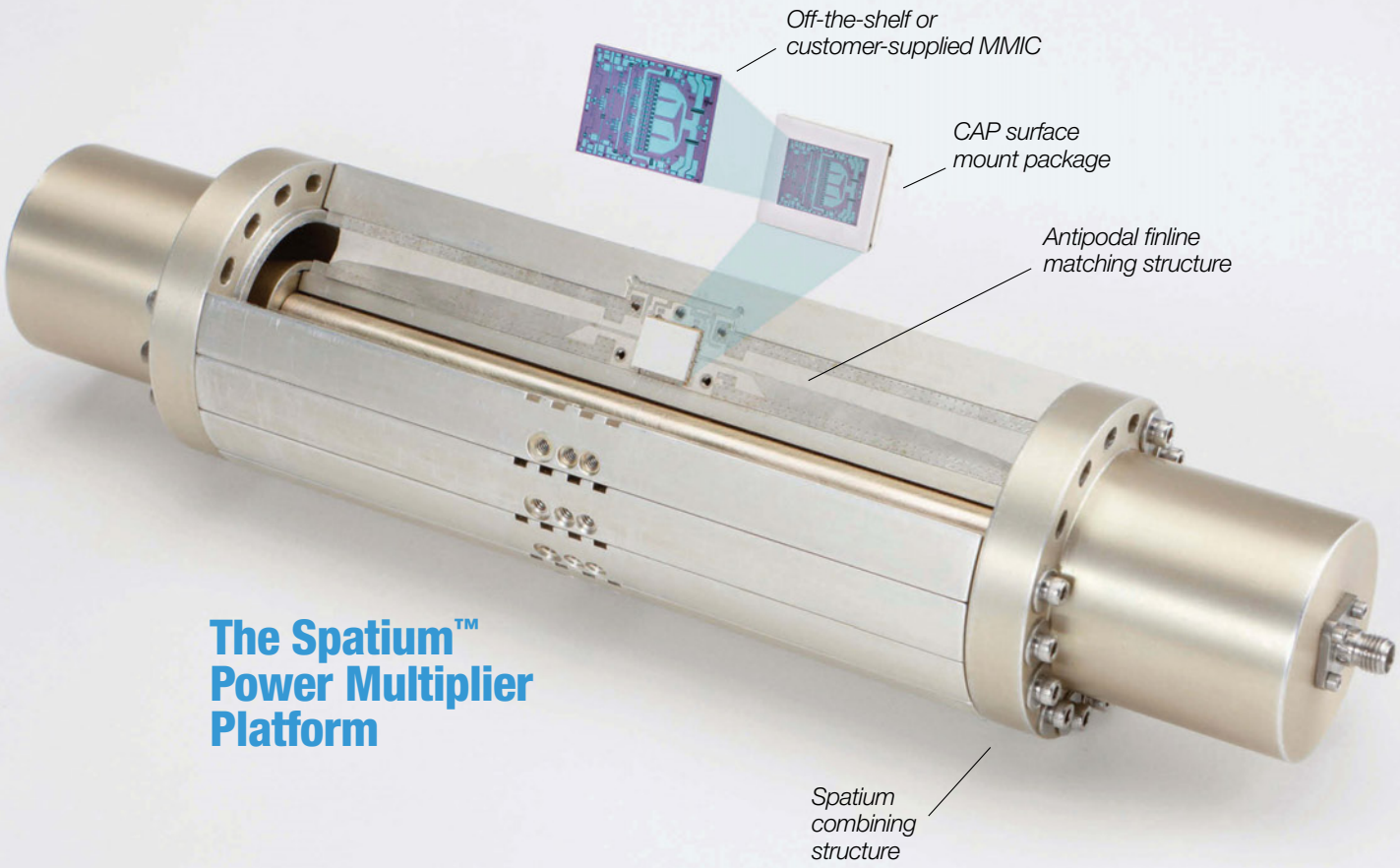

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Jamming Direct Sequence Spread Spectrum Signals

By Dave Adamy

DSSS Signal Structure

Direct Sequence Spread Spectrum (DSSS) signals are digital signals that are spread in frequency by application of a secondary digital modulation. Digital signals have spectral characteristics as shown in **Figure 1**, with the typical null-to-null bandwidth equal to twice the bit rate of the modulation. **Figure 2a** shows the spectrum of the signal when only the information modulation is present. **Figure 2b** shows the spectrum when the higher bit rate spreading modulation has been applied. The bits in the spreading modulation are called "chips." This figure is unrealistic in that the spreading modulation chip rate is only shown as five times the information modulation rate; actually the spreading modulation is normally of the order of 100 to 1,000 times the information bit rate to provide adequate processing gain.

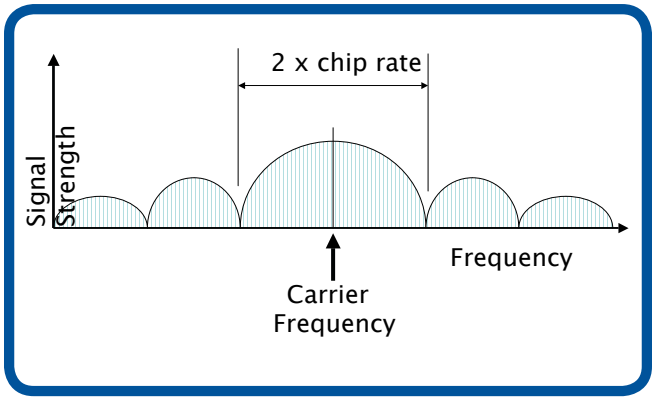

Figure 1: DSSS signals, like any digital signals, distribute energy over a spectrum dependent on the bit rate.

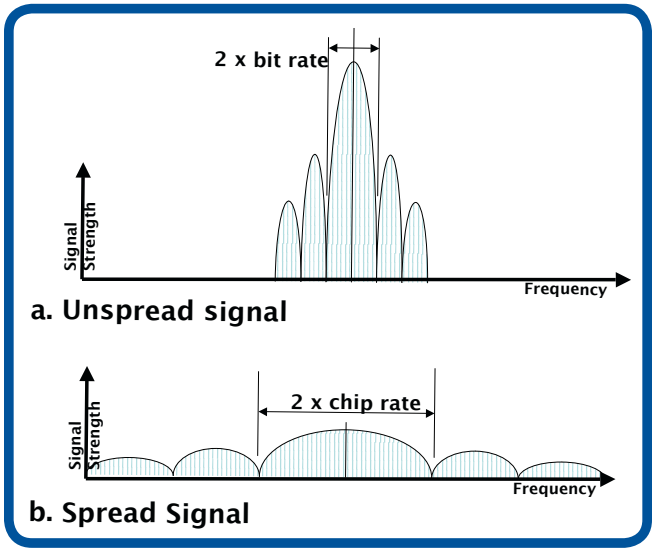

Figure 2: Applying a second, wider digital modulation to a digital signal spreads its spectrum and reduces its signal strength density.

As shown in **Figure 3**, a de-spreading modulation is applied to the received signal to remove the spreading modulation, thus de-spreading the signal and increasing its signal strength vs. frequency by the spreading factor. For example: 30 dB if the spreading modulation chip rate is 1,000 times the information bit rate. This is a processing gain that applies only to signals the receiver is designed to receive

The spreading modulation is a pseudo-random code. The "de-spreader" shown in **Figure 4**, is the spreading demodulator in the block diagram of **Figure 3.** It applies the same modulation that was placed on the signal in the transmitter. This has the effect of removing the spreading modulation from the signal, thus restoring the original information signal. If the code applied in the receiver is different than that in the transmitter, the signal is not de-spread and thus remains at its low (spread) signal strength. Note that because the de-spreading

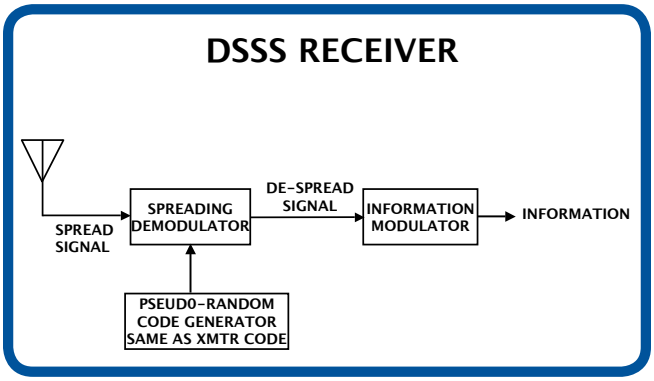

Figure 3: A DSSS receiver applies the same code used to spread the signal, thereby removing the spreading modulation.

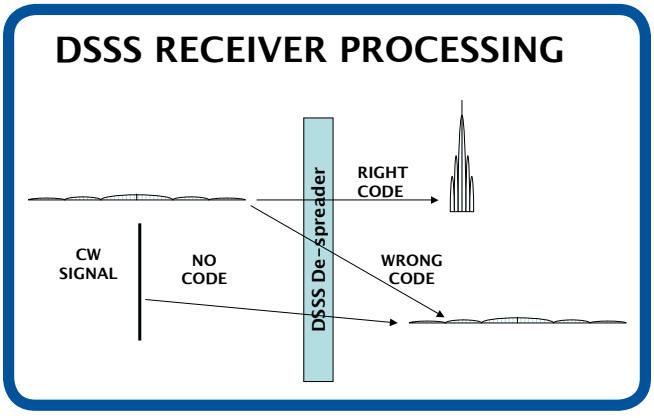

Figure 4: The de-spreading process also spreads and reduces signals that are not modulated with the matching code.

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process is identical to the spreading process, a non-spread signal input to the receiver will be spread, and thus reduced by the spreading factor. This provides the anti-jam performance of the DSSS LPI approach.

Jamming DSSS Receivers

If the spreading code is known, as it might be in commercial systems, the jamming signal can be appropriately modulated and pass through the receiver enhanced by the processing gain. However, in military applications, the code will not be known, so the J/S can be expected to be reduced by the spreading factor.

As discussed in the May 2009 "EW 101" column, a digital signal is best jammed by the creation of bit errors and J/S of 0 dB creates close to 50 percent bit errors (the maximum bit error rate). More jamming power has very little effect on the receiver. DSSS signals are digital, so 0 dB J/S (after the receiver processing) is adequate. Remember the processing gain for the desired signal.

Because any received jamming signal will be reduced by the same amount, it makes sense to use a simple continuous wave (CW) signal near the center frequency of the DSSS transmitter.

Barrage Jamming

Barrage jamming can be used against the DSSS signal, but remember that the J/S will be reduced by the receiver's processing gain, and a CW signal would be just as effective (and much easier to generate).

A barrage jammer has the advantage of simplicity of operation. No look-through is required. Thus, this type of jamming is highly compatible with simple remote jammers like those on UAVs, emplaced by artillery, or hand emplaced.

Pulse Jamming

Because the digital DSSS signal can be made unintelligible by a 33 percent bit error rate (or less under some circumstances), the jamming can have significantly less than 100 percent duty cycle. It is usually possible to transmit significantly higher peak power in a pulse jammer than in a continuous jammer.

Note that if the target communication system uses error correcting codes with interleaving, it may not be practical to use pulse jamming.

Stand-in Jamming

Going back to the basic J/S formulas in the December 2008 "EW 101" column, you see that the J/S is strongly influenced by the range between the jammer and the target receiver. If line-of-sight propagation applies, the jammer power into the receiver (and thus the J/S) reduces by the square of the jammer to receiver range. Thus J/S will be increased by the square of reducing range. If 2-ray propagation applies, the J/S will increase by the fourth power of reducing range.

Stand-in jamming involves placing the jammer near the target receiver using remote jammers that may be turned on by command or by automatic timing. They might be barrage jammers or use some other broad spectrum jamming waveform. Ideally, stand-in jammers will be far enough from friendly communication to avoid fratricide (more on this next month).

DSSS + Frequency Hop

Figure 5 is a block diagram of a hopped DSSS transmitter. The information signal will be digital, and the direct sequence modulator will typically add a higher bit-rate digital signal to the information signal. The result will be a digital signal at the higher bit rate.

Figure 6 shows the spectrum of a hopped DSSS signal. Each of the "humps" in the spectrum is the central main lobe of a typical digital spectrum as shown in **Figure 1**. The hop frequencies will typically be picked so that the main lobes of the digital spectra overlap. For example if the spreading chip rate were 5 Mbps, the null-to-null bandwidth of the digital spectrum would be 10 MHz. The hop frequencies might then be chosen about 6 MHz apart.

To jam this type of signal, it is necessary to place the jamming signal near the hop frequency. If, for example, pulse jamming is used, it must either be applied to each hop frequency or applied to the active hop after its frequency is detected by the jammer.

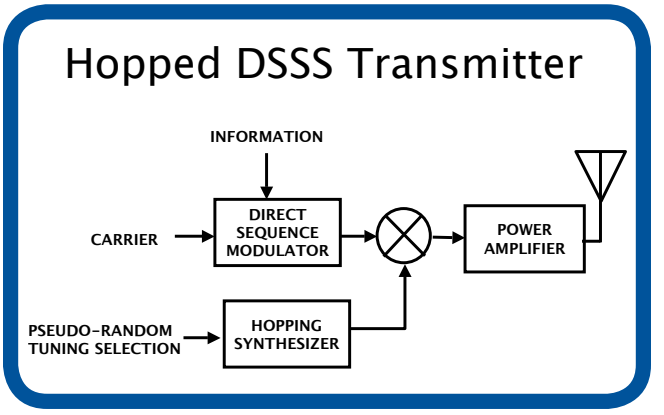

Figure 5: A hopped DSSS transmitter applies frequency hopping modulation to the digitally spread signal.

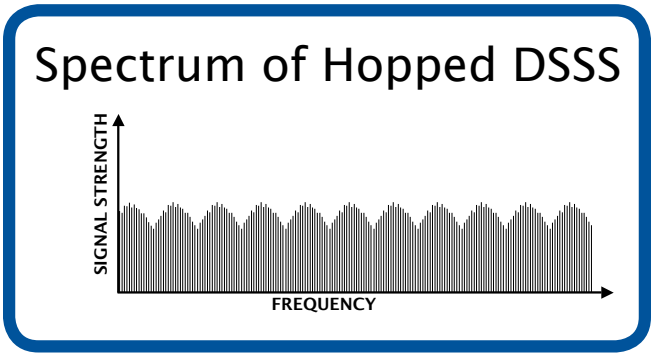

Figure 6: A signal with both DSSS and frequency hop has overlapping digital spectra centered on the hop frequencies.

What's Next

Next month, we will complete this series on communications electronic warfare with a discussion of fratricide. For your comments and suggestions, Dave Adamy can be reached at dave@lynxpub.com.

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Classified Session

Don't miss the Classified Session on Thursday, October 22. During this Secret, U.S.-Only session you will hear senior leader perspectives on how the DOD should lead, advocate, organize and conduct "Spectrum warfare" in order to achieve EMS control, in addition to perspectives on implementation challenges and the way ahead.

Register online at www.crows.org by Oct. 6

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AOC 46th Annual Convention & Symposium

Schedule of Events

Schedule is current as of Sept. 7 2009 and subject to change. Check www.crows.org, or on-site materials for the most up-to-date information

Tuesday, October 13 – Friday, October 16

9:00 a.m. - 5:00 p.m.	Tactical Battlefield Communications Electronic Warfare Course

Saturday, October 17

9:00 a.m. - 5:00 p.m.	Refresher on Electronic Warfare Course

Sunday, October 18

9:00 a.m. - 3:00 p.m.	Refresher on Electronic Warfare Course
1:00 p.m. - 5:00 p.m.	AOC Central Open (includes Registration, AOC Membership Booth and Internet Café)
3:00 p.m. - 7:00 p.m.	Cyber Warfare Tutorial
6:30 p.m. - 9:30 p.m.	Welcome Reception *sponsored with BAE*

Monday, October 19

7:00 a.m. - 7:00 p.m.	AOC Central Open
7:30 a.m. - 9:30 a.m.	Continental Breakfast
8:45 a.m. - 11:00 a.m.	Opening Session – Awards Ceremony and Keynote Speaker
11:15 a.m. - 1:15 p.m.	Symposium – Panel Discussion ***Session 1*** *– Are We Joint Yet?*
2:00 p.m. - 4:00 p.m.	Symposium – Concurrent Sessions ***Session 2*** *– Advanced Technologies I* ***Session 3*** *– International EW – A U.S. Perspective*
4:00 p.m. - 7:30 p.m.	Exhibit Hall Open
6:00 p.m. - 7:30 p.m.	Reception in Exhibit Hall
7:30 p.m. - 11:00 p.m.	ITT Roost

Tuesday, October 20

7:00 a.m. - 5:30 p.m.	AOC Central Open
7:30 a.m. - 9:30 a.m.	Continental Breakfast
8:00 a.m. - 10:00 a.m.	Symposium – Panel Discussion ***Session 4*** *– Cost vs. Capability – A Worldwide Industry View*
10:15 a.m. - 10:45 a.m.	General Session and Keynote Speaker
11:00 a.m. - 1:00 p.m.	Symposium – Concurrent Sessions ***Session 5*** *– IO and EW: Simply Siblings or Conjoined Twins* ***Session 6*** *– Institutionalizing Irregular Warfare*
11:00 a.m. - 6:00 p.m.	Exhibit Hall Open
1:00 p.m. - 2:30 p.m.	Networking Lunch in Exhibit Hall
1:30 p.m. - 4:30 p.m.	Chapter Presidents' Meeting
2:00 p.m. - 6:00 p.m.	EW Project Management Course
4:30 p.m. - 6:00 p.m.	Reception in Exhibit Hall
6:00 p.m. - 9:00 p.m.	Multi-National Forum Reception

Wednesday, October 21

7:00 a.m. - 4:00 p.m.	AOC Central Open
7:30 a.m. - 9:30 a.m.	Continental Breakfast
8:00 a.m. - 10:00 a.m.	Symposium – Panel Discussion ***Session 7*** *– Congressional and Government Leadership for the Future of EW*
10:15 a.m. - 10:45 a.m.	General Session and Keynote Speaker
11:00 a.m. - 3:00 p.m.	Exhibit Hall Open
11:00 a.m. - 1:00 p.m.	Symposium – Concurrent Sessions ***Session 8*** *– Advanced Technologies II* ***Session 9*** *– EW in 2030*
1:00 p.m. - 3:00 p.m.	AOC Annual Awards Luncheon (Open to all Full Symposium attendees)
3:00 p.m. - 5:00 p.m.	AOC Annual Awards Dessert Reception in Exhibit Hall

Thursday, October 22

8:00 a.m. - 5:00 p.m.	Classified Session
9:00 a.m. - 5:00 p.m.	Low Probability of Intercept (LPI) Radar Course

Friday, October 23

9:00 a.m. - 5:00 p.m.	Operations Research for IO and Cyber Analysis Course

AOC 46th Annual Convention & Symposium

Symposium Agenda

Schedule is current as of Sept. 23, 2009 and subject to change. Consult www.crows.org or on-site materials for the most up-to-date information.

Convention Chair

Mr. David Hime, Division Technical Advisor,
Air Force Research Laboratory

Keynote Speakers

LTG Stephen M. Speakes, *Deputy Chief of Staff, G-8, USA*

Maj Gen David J. Scott, *Director, Operational Capability Requirements, DCS, Operations, Plans and Requirements, USAF*

Mr. Itzchak Gat, *CEO, Elisra*

Monday, October 19

9:00 a.m. - 11:00 a.m.
Opening Session

Session 1
11:15 a.m. – 1:15 p.m.
Are We Joint Yet?
Session Chair: Col Marshall Denny, III, USSTRATCOM/JIOWC

No one is more concerned about success on the battlefield then the Soldiers, Marines, Sailors and Airman making it happen every single day. Training together, deploying together, and fighting together - every warrior focused on doing their best and supporting one another. But as threats evolve across the electro-magnetic spectrum (EMS); is the US truly prepared and preparing successfully for joint EMS operations? As resources get tighter, and equipment more specialized and expensive are our services developing a comprehensive and coherent joint EMS strategy or do we continue to leave it up to the operator in the field to make things right? When and how will the gaps between service EMS strategies and resourcing be addressed across the entire DOTMLPF process?

This session facilitated by the Joint Electronic Warfare Center will bring together service leaders to address the significant changes we need to make for future success.

Session 2
2:00 p.m. - 4:00 p.m.
Advanced Technologies I
Session Chair: LtCol William D. Bailey, AFRL/RYZ

EW Self Protection and Accelerating the Kill Chain: *Mr. Daniel Bairey, Elisra Electronic Systems*

Aerostat Systems... Filling the Gaps for Information Operations: *Mr. Rick Osmun, Col (Ret) USAF, Sierra Nevada Corporation*

Affordable High Energy Scanning Multi-Beam Transmitter-Antenna System: *Mr. Chae K. Chong, L-3 Communications Electron Technologies, Inc.*

Balancing EW/ECM System Cost & Capabaility Starts with Modern High-Power Transmitter Design: *Mr. Meppalli Shandas, dB Control*

Session 3
2:00 p.m. - 4:00 p.m.
International EW – A U.S. Perspective
Session Chair: Mr. Kermit Quick, AOC President

This session will present an overview of EW programs and related concepts of DOD EW programs in the international marketplace. Concepts such as in-country reprogramming, multi-mission data file requirements and foreign military sales (FMS) database support will be discussed. This session will also cover the major differences in FMS and direct commercial sales (DCS) of EW systems. Finally, there will be a discussion of the need for EW interoperability among allies and coalition partners. The session is tailored to international and US industry members interested in development, sales and sustainment of EW systems in the world marketplace.

Tuesday, October 20

Session 4
8:00 a.m. - 10:00 a.m.
Costs vs. Capability – A Worldwide Industry View
Session Chair: Mr. John Knowles, Editor, "Journal of Electronic Defense" (JED)

As control of the electromagnetic spectrum becomes increasingly more difficult, the challenges for the defense industry also become more complex. Will sufficient investments be maintained for research and development?

Can we leverage dual-use technologies before an adversary does? Will we be able to share information and integrate effectively across coalition members? Senior defense industry members from European and American industries will present their perspectives in this session.

10:15 a.m. - 10:45 a.m.
GENERAL SESSION

Session 5
11:00 a.m. - 1:00 p.m.
IO and EW: Simply Siblings or Conjoined Twins
Session Chair: CAPT Gregg K. Smith, Naval IO Command Norfolk

Since Information Operations was defined to include Electronic Warfare, the merit of that inclusion has been debated. Initiatives at a myriad of levels and agencies, with varying degrees of formality and support, have attempted to separate EW from IO. The panel will discuss some of the previous initiatives and the catalyst for them while considering what the future might hold and the risks/rewards of a continued "integrated" partnership versus a more separate "disintegrated" relationship.

Session 6
11:00 a.m. - 1:00 p.m.
Institutionalizing Irregular Warfare
Session Chair: Mr. Anthony Lisuzzo, Intelligence and Information Warfare Directorate

Operations Enduring Freedom and Iraqi Freedom clearly showed that America's adversaries will continue to use the electromagnetic spectrum to create asymmetric threats. Secretary of Defense Gates thus challenged the department to institutionalize irregular warfare. This panel will address what needs to change to ensure that spectrum control is integrated into service approaches to irregular warfare. Topics discussed will include how all facets of the Doctrine, Organization, Training, Material, Leadership, Personnel and Facilities will need to change, including acquisition and SAP processes, and how to ensure integration with our allies?

Wednesday, October 21

Session 7
8:00 a.m. - 10:00 a.m.
Congressional and Government Leadership for the Future of EW
Honorary Session Chair: The Honorable Joseph R. Pitts, US House of Representatives (PA-16)

This session brings together leaders and decision-makers from Congress, the Defense Department, and related federal agencies to discuss the challenges and opportunities in securing a comprehensive and coherent electronic warfare acquisition and implementation strategy. Representative Joseph R. Pitts is the founder and co-chair of the Congressional EW Working Group (EWWG). The session begins with a congressional perspective on EW from various key members of the EWWG, including a status and discussion of EW programs and provisions in the FY 2010 defense budget and EW issues for the current and next Congress. The session also provides a panel discussion of experts from defense research, budget, and oversight agencies throughout the federal government. Discussion topics include: the defense budget, EW acquisition strategy, leadership, investment, and readiness and training of EW Warfighters.

10:15 a.m. – 10:45 a.m.
GENERAL SESSION

Session 8
11:00 a.m. - 1:00 p.m.
Advanced Technologies II
Session Chair: Dr. Karl Dahlhauser, OSD/DDR&E

The Software Protection Initiative: Protecting the Defense Industrial Base: *Lt Col Kenneth Edge, AFRL/RYT*

Spectral Correlation Function: A New Signal Classification Technique: *Mr. Darren McCarthy, Tektronix*

ISR Operations and Network Centric Warfare in EW with Limited Bandwidth Availability - Study of the Needs and Suggested Solutions: *LtCol Johannes Naumann, JoNa Systeme*

Design Approach Towards Common Electronic Warfare Circuit and System Architectures: *Dr. Wesley A. Gee, Scientific Research Corporation*

Session 9
11:00 a.m. - 1:00 p.m.
EW in 2030
Session Chair: Col Chris Glaze, USAF, (Ret), L-3 Command and Control Systems & Software

The future battle space (2030) will be formed and driven by trans-political and socioeconomic pressures requiring a different operational and technological approach to warfare. These changes will require significant changes in how we plan and prepare for the future warrior's successful use of the electromagnetic spectrum. This session will examine the future of warfare, the operating constraints and freedoms of a 2030 battle space environment and the emerging technologies and their effects on the 2030 battle space environment.

1:00 p.m. - 3:00 p.m.
AOC Annual Awards Luncheon
Open to full symposium attendees

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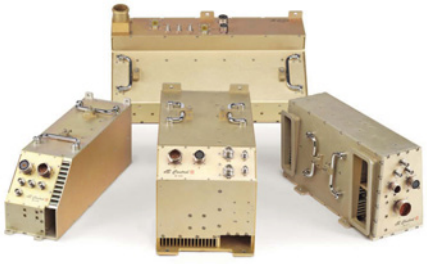

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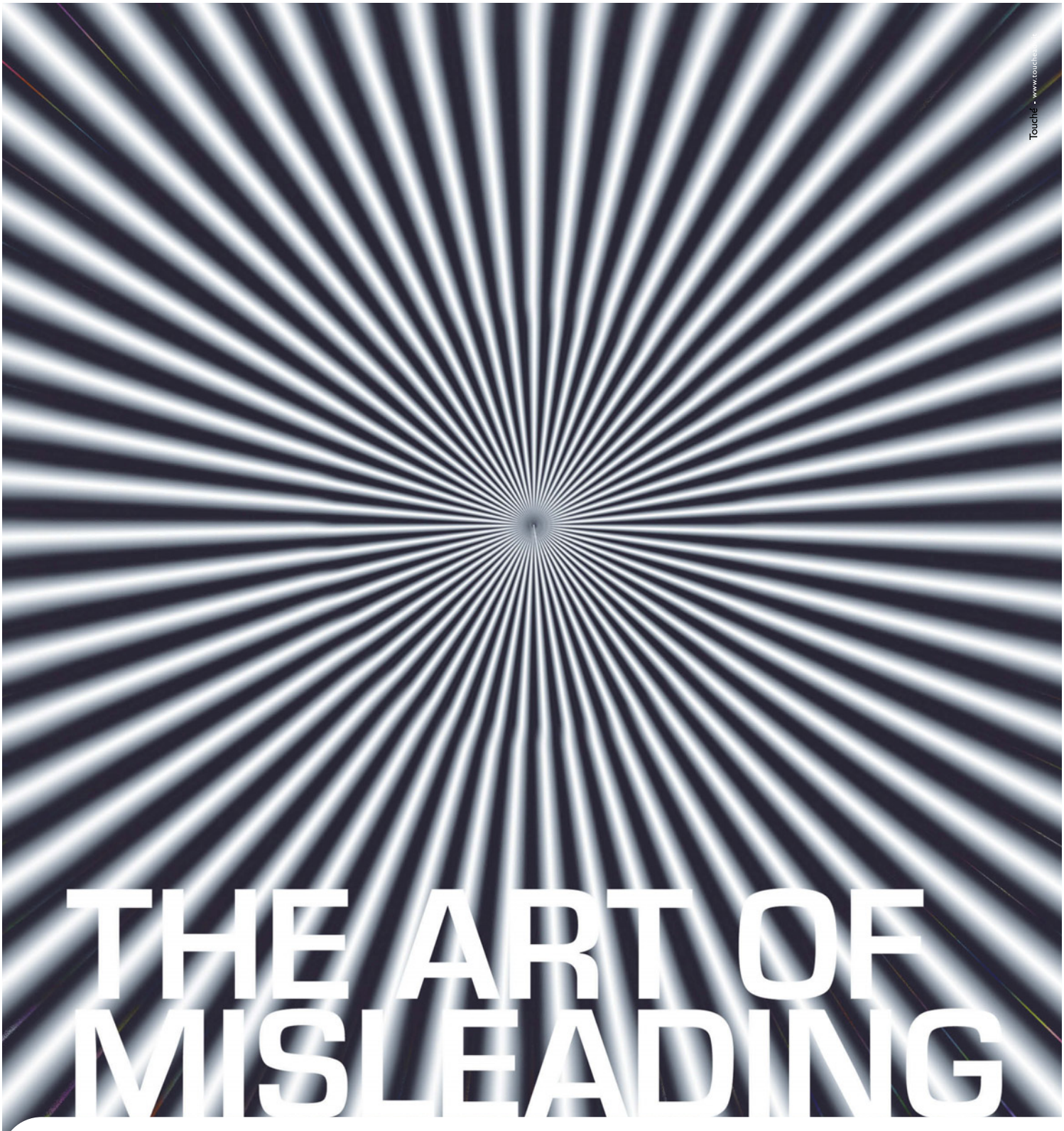

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The Journal of Electronic Defense

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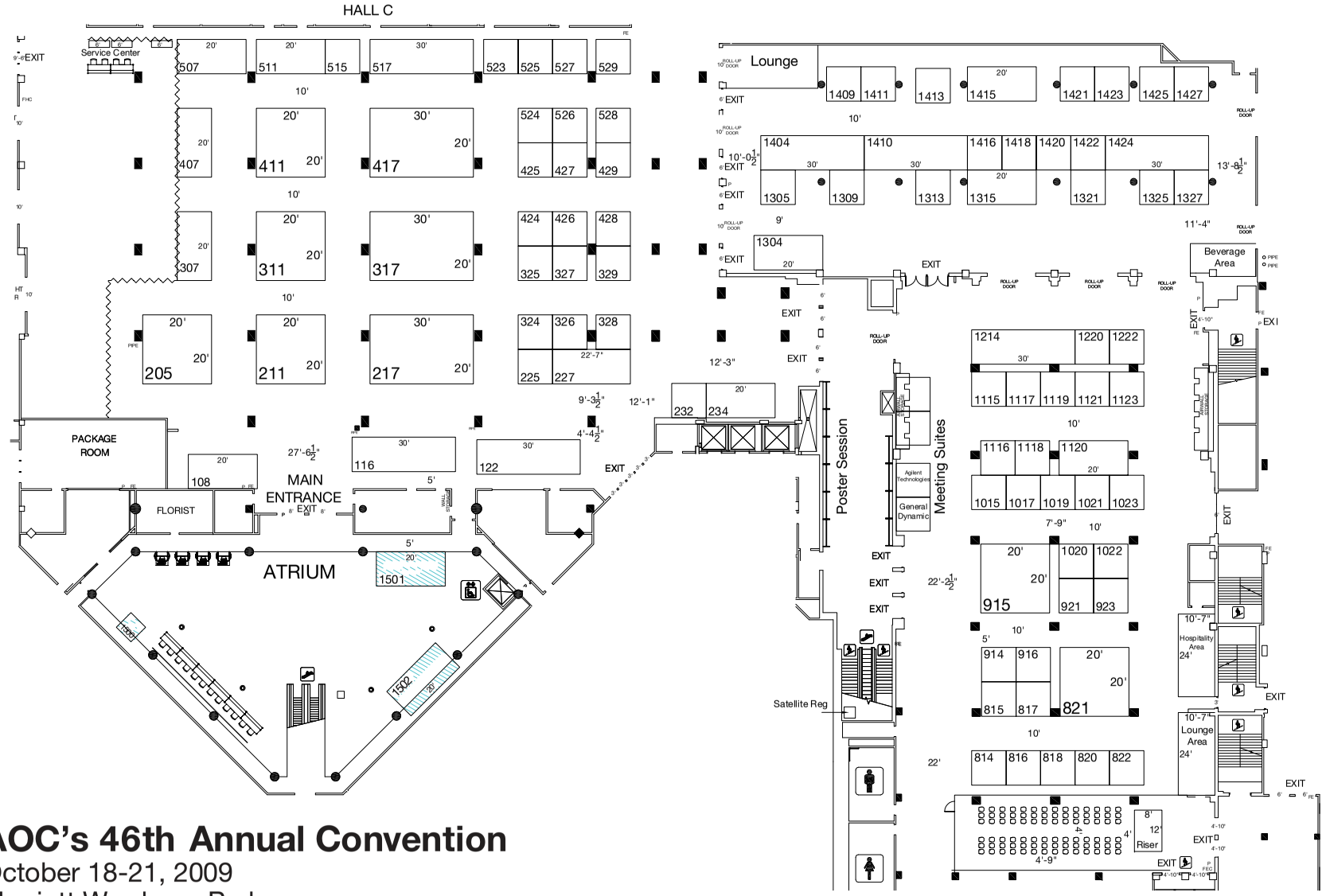

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Marriott Wardman Park
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Exhibit Hall B & C

AOC 46th Annual Convention & Symposium

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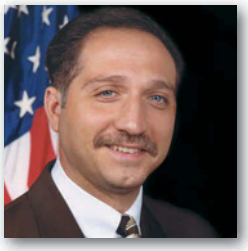

Mr. Anthony Lisuzzo

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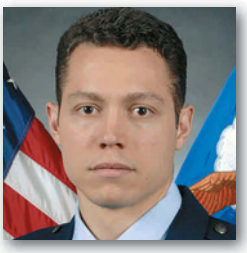
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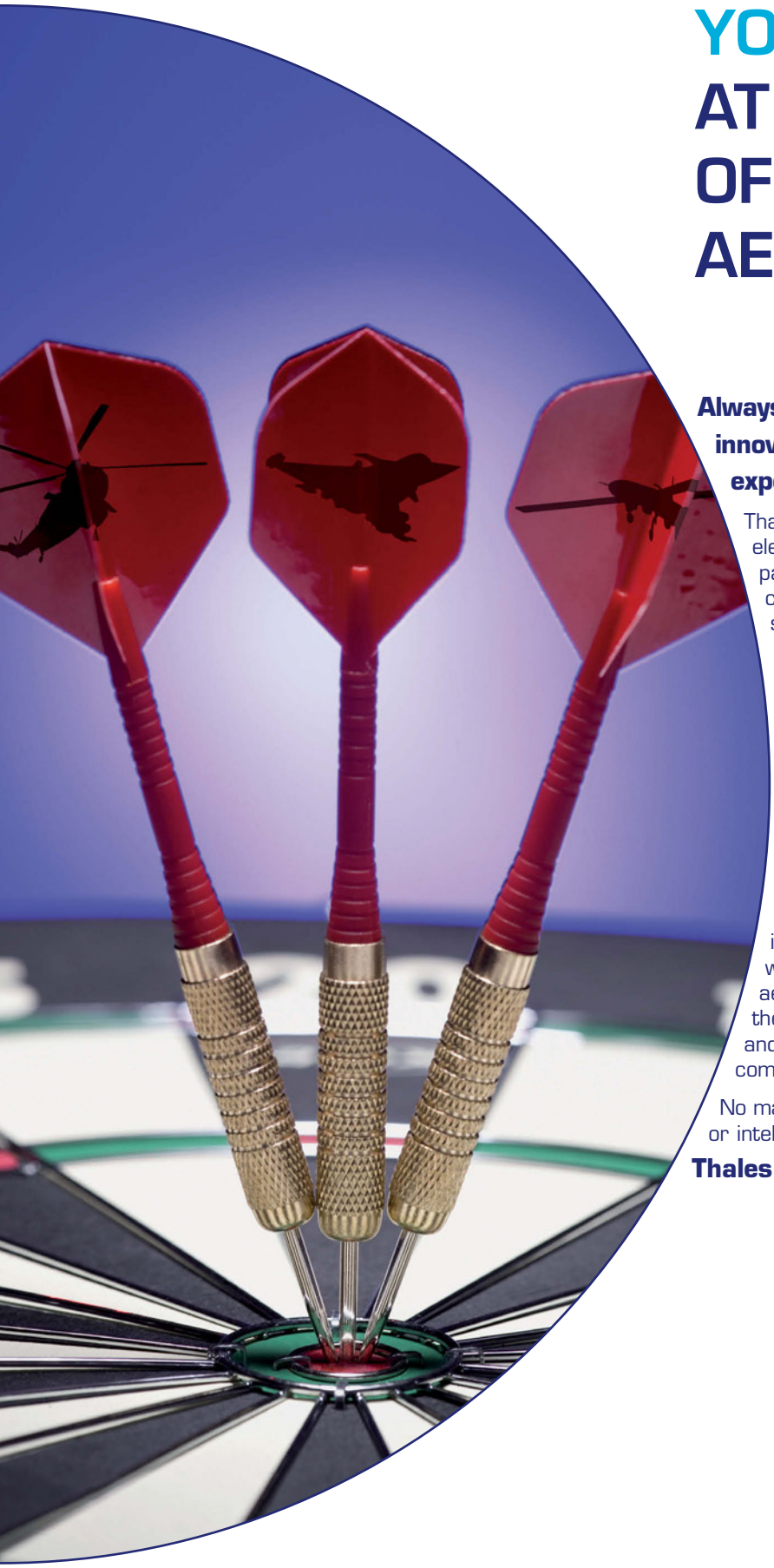

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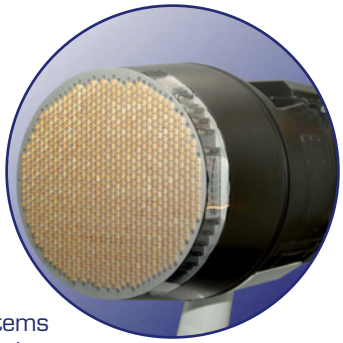

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November 3-5, 2009
Little Creek Naval Station
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Conference Chairman: **CAPT Brian Hinkley**
Last year this was a very successful conference with direct impact on Navy programs. Sign-up early so you don't miss your chance to take part in the discussions!

Operationalizing Intelligence in Electronic Warfare for the 21st Century Conference

December 1-3
NASIC, Wright Patterson, AFB
Dayton, OH

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Call for Papers
Previously unpublished contributions across a broad range of topics in intelligence support across the electromagnetic spectrum are solicited.

Upcoming AOC Conferences:

AOC
Low Probability of Intercept, ELINT/SIGINT
Naval Post Graduate School, Monterey, CA
November 17-19, 2009

Low Probability of Intercept, ELINT/SIGINT Conference

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November 17-19
Naval Post Graduate School, Monterey, CA

Keynote Speaker: Dr. Ted Roberts (NRL/TEWD)
Sessions will concentrate in areas that form the core of LPI radar and counter-LPI radar theory, technologies, and operations. There will be one session on ELINT/SIGINT at a higher classification level (please see crows.org for more details). Also embedded in the conference are tours of the ITT Morgan Hill Technology facility and tours of the NPS Technology Laboratories. Interested in Golfing in this famous golf region? Sign-up to play at the recently renovated Golf Course on NPS!

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f. Total Distribution *(Sum of 15c and e)* ▶			13,776	14,520
g. Copies not Distributed *(See Instructions to Publishers #4, (page #3))* ▶			319	249
h. Total *(Sum of 15f and g)*			14,095	14,769
i. Percent Paid and/or Requested Circulation *(15c divided by f times 100)* ▶			97.52%	96.07%

16. Publication of Statement of Ownership for a Requester Publication is required and will be printed in the October 2009 issue of this publication.

17. Signature and Title of Editor, Publisher, Business Manager, or Owner — Date

Elaine Richardson — Digitally signed by Elaine Richardson DN: cn=Elaine Richardson, o=Naylor, LLC, ou, email=elaine@naylor.com, c=US Date: 2009.09.24 15:29:40 -04'00' — 9/24/2009

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).

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