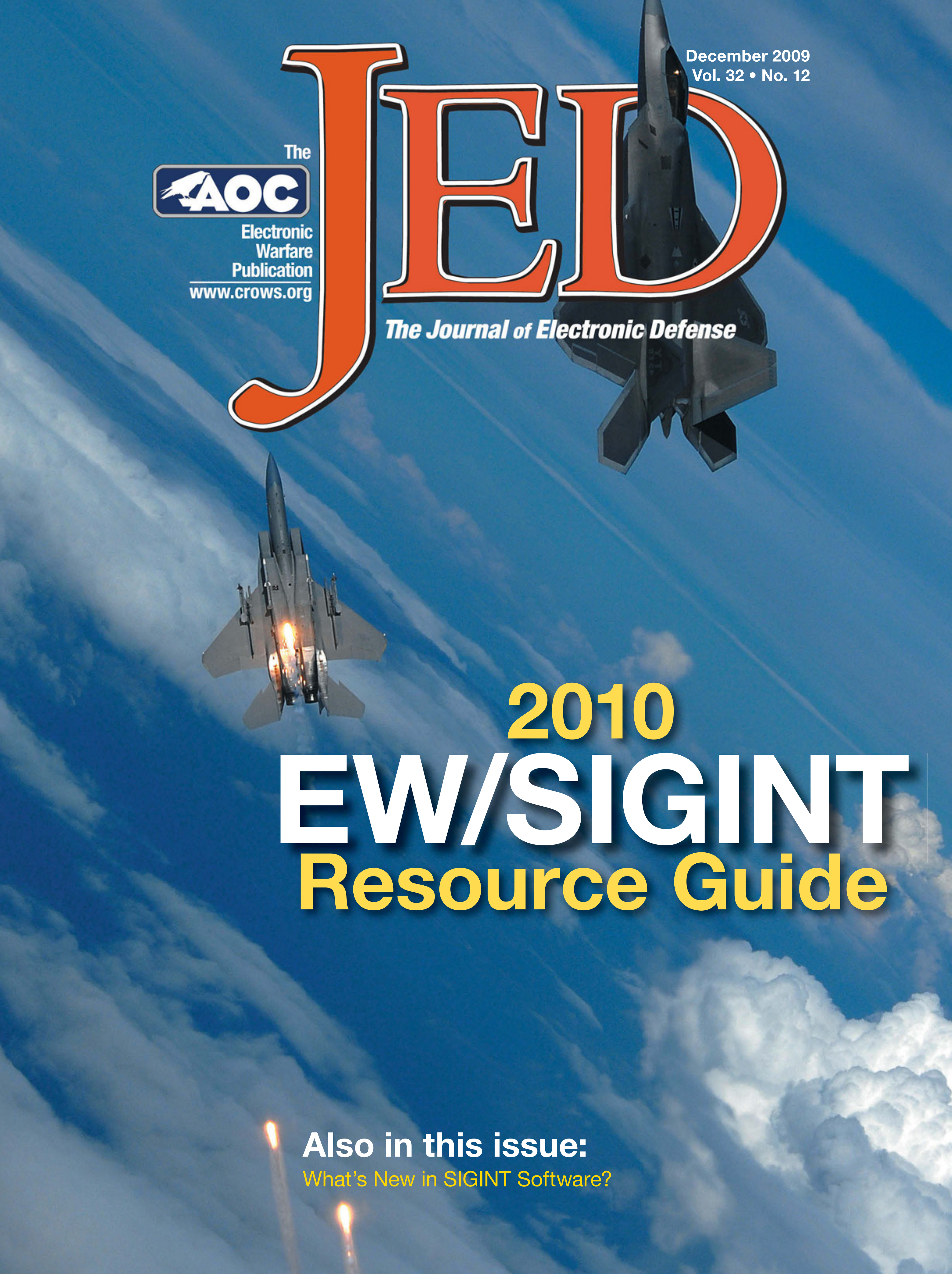

December 2009
Vol. 32 • No. 12

The AOC Electronic Warfare Publication
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JED

The Journal of Electronic Defense

2010 EW/SIGINT Resource Guide

Also in this issue:

What's New in SIGINT Software?

December 2009 • Vol. 32, Issue 12

JED

The Journal of Electronic Defense

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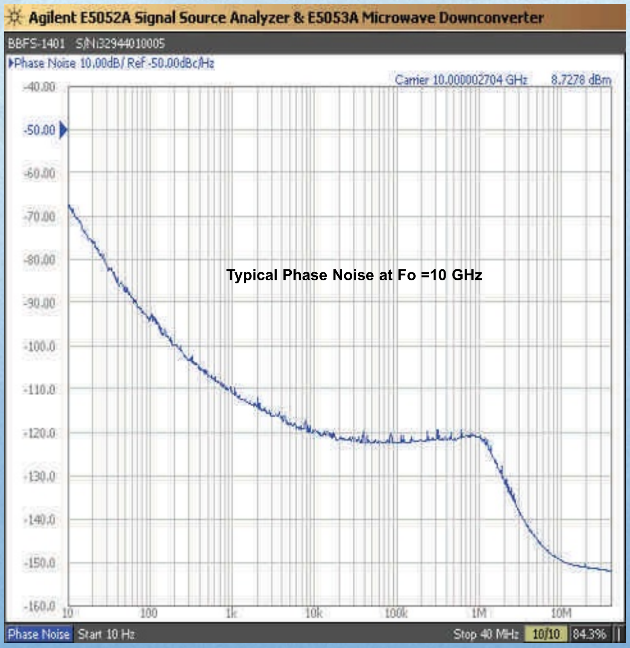

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the view from here

BUILDING YOUR RESOURCES

In this month's *JED*, we have brought back something that we have not published for many years – the EW/SIGINT Resource Guide. You may wonder why the *JED* staff bothered to publish such a resource guide. After all, the Internet can provide information about companies that supply EW and SIGINT products and services. And there are many other military technology resource guides out there. Both of these facts are true. Our goal, however, is to publish a resource guide that is both convenient (try conducting a Google search to find EW antenna manufacturers, for example) and represents the full scope of the EW and SIGINT market.

There are well over 1,000 companies worldwide that are doing business in the EW and SIGINT market. This may seem like a large number, but it is actually quite small when you consider the diversity and technological complexity of EW and SIGINT systems, as well as the variety of specific EW and SIGINT missions that must be supported. In addition, more countries are buying and developing EW and SIGINT capabilities each year, and the industrial base is expanding on a similar scale to support these customers.

Another question you may ask is why the EW and SIGINT market needs a resource guide at all. Most of the companies in this market have traditionally worked with a small number of trusted suppliers. While that may be part of the "culture" of the EW and SIGINT market, there are many evolving trends that challenge that paradigm. Take, for example, the massive DOD effort to develop and field 40,000 IED jammers over the past several years. For the IED systems manufacturers, this acquisition pattern drove major supply chain challenges. This resource guide can help identify potential suppliers, whether you are seeking anything from microwave components, integrated subsystems, software developers or training services.

The 2010 EW/SIGINT Resource Guide represents a humble beginning for a tool that I expect will grow each year in terms of size and complexity. That said, please contact me at editor@crows.org if your company is providing products or services to the EW and SIGINT market, but it was not included in this Resource Guide. In the coming months, the AOC will be introducing an on-line buyers' guide and we will be happy to include your information.

– John Knowles

The AOC Electronic Warfare Publication
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JED
The Journal *of* Electronic Defense

DECEMBER 2009 • Vol. 32, No. 12

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The Journal of Electronic Defense
is published for the AOC by

naylor

Naylor, LLC
5950 NW 1st Place
Gainesville, FL 32607
Phone: (800) 369-6220 • Fax: (352) 331-3525
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PUBLISHED DECEMBER 2009/JED-M1209/8396

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calendar conferences & tradeshows

DECEMBER

Worldwide EW Infrastructure Conference
December 1-3
Atlanta, GA
www.crows.org

EW Symposium
December 2-3
Shrivenham, UK
www.cranfield.ac.uk

AAAA Unmanned Aircraft Symposium
December 9-11
Arlington, VA
www.quad-a.org

JANUARY

AUSA Army Aviation Symposium
January 5-7
Arlington, VA
www.ausa.org

Surface Navy National Symposium
January 12-14
Arlington, VA
www.navysna.org

Net-Centric Operations Conference
January 26-28
Port Mugu, CA
www.crows.org

FEBRUARY

Singapore Airshow
February 2-7
Singapore
www.singaporeairshow.com

EW India 2010
February 9-11
Bangalore, India
www.shephard.co.uk

Air Warfare Symposium
February 18-19
Orlando, FL:
www.afa.org

Cyber and Spectrum Operations Integration Conference
February 23-25
Chantilly, VA
www.crows.org

AUSA Winter Symposium
February 24-26
Fort Lauderdale, FL
www.ausa.org

MARCH

3rd Annual Joint Suppression of Enemy Air Defenses Conference
March 17-18
Las Vegas, NV
www.crows.org

Dixie Crow Symposium
March 21-25
Warner Robins, GA
www.dixiecrow.org

APRIL

Australian EW and IO Convention
April 12-13
Adelaide, SA, Australia
www.oldcrows.org.au

MAY

3rd Annual EW Gaps and Capabilities Conference
May 11-13
Crane, IN
www.crows.org

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

InfowarCon 2010
May 12-13
Washington, DC
www.crows.org

JULY

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

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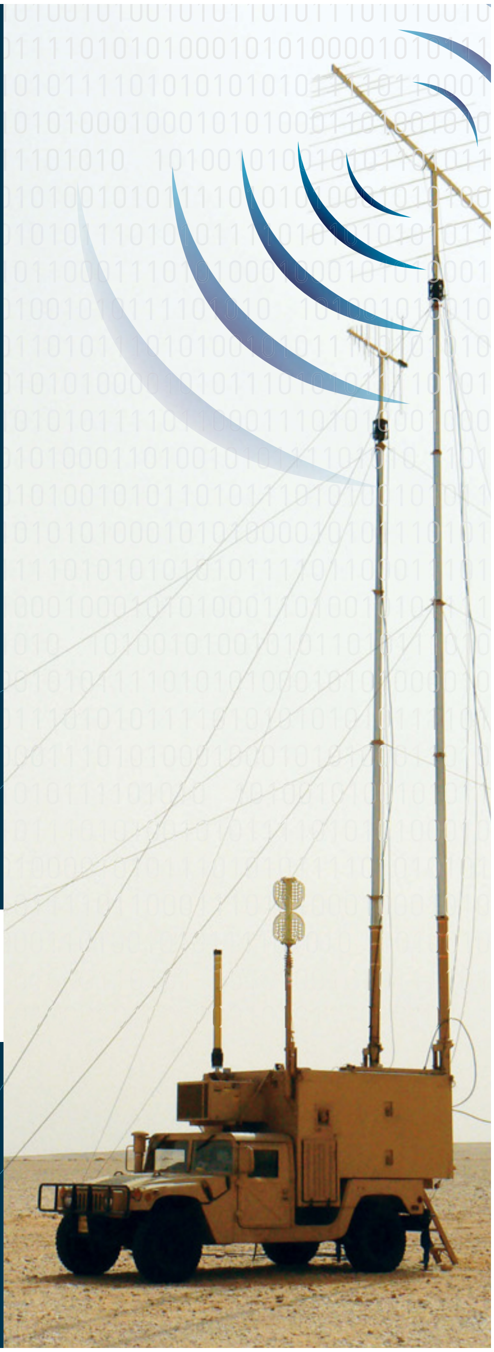


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Dispenser Tester
AN/ALE-47 CMDS
Countermeasures
Dispenser System


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TESTING
SAFETY
TRAINING
RELIABILITY
PERFORMANCE

calendar courses & seminars

DECEMBER

US Intelligence Community Course
December 1-3
Washington, DC
www.afcea.org

IR Countermeasures
December 8-11
Atlanta, GA
www.gtri.gatech.edu

Senior Leader Information Operations Course
December 7-11
Alexandria, VA
www.crows.org

FEBRUARY

Advanced EW Course
February 15-18
Alexandria, VA
www.crows.org

Antennas and Radiowave Propagation Course
February 8-12
Shrivenham, UK
www.cranfield.ac.uk

Cyber Warfare Tutorial
February 22
Washington, DC
www.crows.org

Pyrotechnics Course
February 22-26
Shrivenham, UK
www.cranfield.ac.uk

Digital Radio Frequency Memory (DRFM) Technology
February 23-25
Atlanta, GA
www.gtri.gatech.edu

MARCH

Infrared/Visible Signal Suppression
March 2-5
Atlanta, GA
www.gtri.gatech.edu

ELINT and Modern Signals Course
March 9-12
Alexandria, VA
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March 8-10
Shrivenham, UK
www.cranfield.ac.uk

Radar Cross Section Reduction
March 15-17
Atlanta, GA
www.gtri.gatech.edu

M&S of RF EW Systems
March 23-26
Atlanta, GA
www.gtri.gatech.edu

EMC/EMI for Engineers and Engineering Managers
March 30-April 2
Huntsville, AL
www.gtri.gatech.edu

Adaptive Antennas with Military Applications Course
March 31-April 10
Shrivenham, UK
www.cranfield.ac.uk

APRIL

Radar ESM
April 12-13
Shrivenham, UK
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Radar Countermeasures
April 14-16
Shrivenham, UK
www.cranfield.ac.uk

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

Basic RF EW Concepts
April 20-23
Atlanta, GA
www.gtri.gatech.edu

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message from the president

NEW HORIZONS

For those of you who attended the AOC's International Convention and Symposium this year, you may have heard a low level "buzz" moving through the general sessions and classified session about an emerging doctrinal construct called "Spectrum Warfare." Although it is not an entirely new concept, Spectrum Warfare is beginning to gain momentum in the impressive wake of being created by the Joint Electronic Warfare Center's (JEWC) Electronic Warfare Capabilities-Based Assessment (EW CBA) and the subsequent approval of an EW Initial Capabilities Document (ICD). As a former Joint Staff action officer who was deeply involved in EW and Information Operations (IO) policy and doctrinal issues, I can tell you that the JEWC, USSTRATCOM and the Chairman of the Joint Chiefs of Staff appear to be moving in a doctrinal direction that is conducive to the future health of Electronic Warfare.

By the time you read these words, the JEWC, the EW Service Leads, the Joint Spectrum Center and members of the AOC staff will have met to discuss a lexicon of terms which may help to define a "new horizon" for Electronic Warfare within a Spectrum Warfare construct. And what is this new horizon?

Over the past ten years, EW professionals and advocates within and outside of the Services have highlighted the importance of the electromagnetic spectrum (EMS) to current operations. In fact, the JEWC defines the EMS today as the "oxygen" of joint operations. This basic understanding of the importance of operations within and across the spectrum can only benefit the EW mission area and highlight the necessary resourcing required to ensure our warfighters have the EW capabilities they need to be successful.

Having worked directly on EW and IO doctrinal publications in the past, I can tell you that developing a Spectrum Warfare construct will be a long and difficult process. However, in my discussions with the JEWC and the EW Service leads, I sense a renewed vigor and serious contemplation of how a Spectrum Warfare construct may be developed. In developing a lexicon or terms of reference for Spectrum Warfare, I would remind those involved that the definition of Electronic Warfare within Joint Publication 1-02 (JP 1-02) has remained constant for at least 30 years now.

My opinion is that the definition of EW has stood the test of time and should not be changed. However, the scope of the definition has changed over the years and is most readily apparent in the expanding EMS target sets our warfighters have experienced since the early 1990s. The EW mission area can be a significant component of the Spectrum Warfare construct, along with missions such as spectrum control and management. I applaud the efforts of the JEWC and the Service EW leads. Now let's move forward and explore this further.

– Chris Glaze

EW INFRASTRUCTURE

World Wide EW Infrastructure Conference

December 1-3, 2009
Atlanta, GA

Don't miss this unclassified event, featuring international perspectives on ensuring effective collaboration and discussion on joint issues, gaps and capabilities concerning the current and future infrastructure of the entire spectrum.

Visit **www.crows.org** for more information.

Operationalizing Intelligence in Electronic Warfare for the 21st Century Conference

POSTPONED to Spring 2010
NASIC, Wright Patterson, AFB
Dayton, OH

The conference will address the need to improve the lines of communication between the intelligence and the operational EW communities. This is particularly true for communicating warfighter needs across the electromagnetic spectrum to intel and delivering intel products to the warfighter.

This conference has been postponed until Spring 2010. Visit **www.crows.org** for details on new dates.

Don't Miss These Upcoming AOC Courses:

Senior Leader Information Operations Course
December 7-11

EW Fundamentals Course
January 18-22

Advanced EW Course
February 15-19

Cyber Warfare Tutorial
February 22
Washington, DC

All courses take place at AOC headquarters in Alexandria, VA, unless otherwise noted. Visit **www.crows.org** for more information.

Don't Miss These 2010 AOC Conferences:

Net-Centric Operations Conference
January 26-28 • Pt. Mugu, CA

Cyber and Spectrum Integration Conference
February 23-25 • Chantilly, VA

3rd Joint Suppression of Enemy Air Defenses Conference
March 17-18 • Las Vegas, NV

Passive Covert Radar Conference
July 13-15 • Verona, NY

Space Protection Conference
August 17-19 • Kirtland AFB, NM

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ONR ISSUES JCREW TECHNOLOGY BAA

The US Navy's Office of Naval Research (Arlington, VA) has released a new Broad Agency Announcement (BAA) for the Joint Radio Controlled Improvised Explosive Device Electronic Warfare (JCREW) 3.3 Technologies program. The BAA describes the technologies the Navy wants to develop for the next generation of IED jammers. It also provides some critical insight into the capabilities these systems may provide in the field.

Counter-IED requirements continue to evolve based on operational experience in Iraq and Afghanistan, and the BAA sheds some light on the capabilities desired in future IED jammers. Perhaps the most significant requirement is the ultra-wide frequency coverage described in the BAA. The Navy wants its next generation of IED jammers to defeat RF IED triggers operating from the mid-Low Frequency (LF) to the mid-Extremely High Frequency (EHF) range. The Navy is seeking to develop compact IED jammers that will perform direction finding and geolocation of threats and provide jamming power on the order of "10s of Watts" in dismounted (manpack) configurations and "100s of Watts" in mounted configurations. The IED jammers must be able to communicate with one another and form ad-hoc networks for distributed electronic support and electronic attack coverage. Another goal is to minimize jamming fratricide impact on friendly communications and signals intelligence systems.

The BAA highlights several technology areas that cover nearly all aspects of future CREW systems. In the area of antenna technologies the BAA calls for compact, lightweight, multi-function apertures that feature high efficiencies, low visible signatures and high linearity. The antenna should offer "adaptive, dynamic control of antenna patterns, including gain pattern, directivity and polarization." In addition, "techniques for increasing isolation at the antenna between collocated transmit and receive apertures to support simultaneous transmit and receive (STAR) are also desired."

The BAA also calls for advanced receiver/transmitter technologies that provide extremely broadband coverage, wide instantaneous bandwidth, high dynamic range and small resolution bandwidths. Receivers should be "capable of instantaneous bandwidth on the order of 500 MHz/channel, dynamic range >10 bits, and resolution bandwidth on the order of 1-20 KHz." Transmitters should provide greater than 100 MHz per channel instantaneous bandwidth, efficiencies of greater than 40 percent, high linearity, and multiple signal and frequency simultaneous transmission. "

Future JCREW systems will require signal generation subsystems that can generate "multiple simultaneous and coherent jamming waveforms with low noise" in response to threats. "These jamming responses will require high speed activation at up to GHz bandwidths and digitally controllable parameters and waveform selection to facilitate integration into closed loop architectures," according to the BAA. To meet this need, program officials are interested in direct digital synthesizer (DDS), arbitrary waveform generator (AWG) and digital RF memory (DRFM) technologies or a hybrid approach among them. "Software defined radio (SDR) approaches which support the generation of both EW waveforms and communications from a common waveform generator are of particular interest."

Under the heading, "Comprehensive Spectral Awareness," the BAA describes several specific areas, including spectral mapping, signal assessment system, direction finding and geolocation, as well as "situational awareness data fusion." This last topic calls for capabilities and techniques that can combine off-board information (EO/IR and ISR) and on-board JCREW sensor data to detect, locate and identify possible threats.

Electromagnetic compatibility is also an area of interest, including "JCREW network centric operations." According to the BAA, "The ability for JCREW systems to communicate with one another, as well as to both communicate with other platforms and system in performance of the JCREW mission and transfer pertinent information, would provide a networked approach that maximizes protection capabilities and resources." Network operations could be used for a variety of tasks, including geolocating all JCREW systems in a particular area, change JCREW system operating parameters, or develop a "self-forming network topology or network-based jamming algorithms." In addition, access to event logs, fault logs and other diagnostics can help determine system readiness and maintenance needs, especially for remotely operated systems. "Development of a secure wireless link and associated network is needed to demonstrate this capability," according to the BAA.

Another technology area is packaging and cooling. This is particularly challenging because of the JCREW program's focus on compact size and high-power jamming generated by the power amplifiers. According to the BAA, "Conduction cooling techniques for mounted and dismounted systems are preferred."

The BAA also covers "scalable open architectures." Because JCREW units will perform their missions individually and collectively (depending on the number of available platforms for a given mission) the Navy will develop architectures that are scalable. "In addition, integration of subsystem components from a wide variety of vendors will require that this scalable architecture be open," according to the BAA. The open architecture will support coordination of EW functionality and threat response, closed-loop adaptive parameter control utilizing sub-component to sub-component data exchange and resource control at the sub-system level.

Program officials also are interested in component technologies that support simultaneous transmit and receive. This includes "disruptive" electronics and photonics component technologies that can eliminate the need to blank the receiver while transmitting when using a single aperture for both functions.

With a budget of $12.5 million, program officials anticipate awarding multiple contracts of up to $750,000 each, with performance periods of up to two years. The point of contact at ONR's EW program office is David Tremper, david.tremper@navy.mil. White papers are due January 4 and full proposals are due February 2. ONR is expected to award contracts under this BAA in July 2010. The BAA is available at www.fbo.gov. – *J. Knowles*

LOCKHEED MARTIN REORGANIZES ELECTRONICS UNITS

Lockheed Martin Corporation (Bethesda, MD) has realigned its Electronics Systems business area and appointed new leaders.

The company will realign much of its Systems Integration-Owego business unit (Owego, NY) under its Maritime Systems and Sensors (MS2) division. The reorganization brings Systems Integration-Owego, which is Lockheed's main EW and SIGINT business (manufacturer of airborne ESM and COMINT systems), together with many of Lockheed's other EW businesses, such as Sippican (manufacturer of the EW payload for the Nulka decoy) and MS2-Akron, which develops directed IR countermeasures systems.

Lockheed also announced several management changes. Marilyn Hewson, currently president of Systems Integration-Owego, will become executive vice president of Lockheed's Electronic Systems business area. She will report to Christopher Kubiansk, who was recently appointed president of Electronic Systems. Orlando Carvalho, who is currently vice president and manager of MS2's Moorestown, NJ, operations, will become president of MS2. Also, William L. Graham, 59, will become deputy to Information Systems & Global Services (IS&GS) Executive Vice President Linda Gooden. Among other services, IS&GS provides SIGINT analysis support to the DOD.

All changes and appointments will become effective January 1, according to the company. – *J. Knowles*

AFRL ANNOUNCES FY2010 EW RESEARCH TOPICS

The Air Force Research Laboratory's Sensors Directorate (AFRL/RY) at Wright-Patterson AFB, OH, has announced some of the research topics it plans to address in FY2010 under an amendment to the Sensor Technology Research, Development, Test & Evaluation Open-Ended Broad Agency Announcement (STROEB) II. Among the FY 2010 research topics are two "core technical competencies" (CTCs) with EW applications.

One of the projects under CTC1 is titled "The NAVWAR Trinity" (TNT), managed by the RF Sensor Technology Division, Reference Systems Branch (AFRL/RYRN). This effort will focus on navigation warfare (NAVWAR) electronic protect (EP), electronic attack (EA) and electronic support (ES) techniques. The TNT's main thrust will be integrating EP, EA and ES techniques to help perform "cooperative detection, characterization, geolocation and mitigation of GPS threats while denying enemy use of GPS and maintaining full GPS operation across friendly forces." This will involve developing and demonstrating "multi-function capability and integration strategies that implement NAVWAR across distributed DOD platforms." TNT will leverage previous NAVWAR EP, ES and EA research, including the NAVWAR ESM Terminal. The Program manger is Dana Howell, AFRL/RYRN, (937) 255-6127, ext. 4153.

Under CTC3, the Sensor Applications and Demonstrations Division, EW Branch (AFRL/RYZW), will fund a project titled "Distributed EW Development" (DISTEW). As its name implies, this research will "explore and document the anticipated benefits and synergies of distributed electronic warfare," in support of jamming applications. "This distribution can be spatial, temporal, by technique or combinations of these parameters," according to the BAA. The research will apply directly to the Air Force's EW Battle Management research,

US NAVY SEEKS HPM ANTENNA INFO

The Naval Surface Warfare Center, Dahlgren Division (Dahlgren, VA) has issued a request for information (RFI) seeking companies that can demonstrate the performance of a high-power microwave (HPM) antenna.

The Navy is soliciting cost and technical white papers from potential suppliers describing antenna performance, such as constant power density beam profile in terms of radius (particularly for the 1- to 30-meter range); operation at 2.45 GHz, 5.8 GHz and 95 GHz; and pulse width (0.5 seconds or greater). The white paper must also address power input, wait times before another pulse is permitted, as well as other parameters. According to the RFI, the objective is to consider different technical approaches that would enable the Navy to evaluate the HPM antenna for naval warfare applications.

Responses are due by December 3. The program point of contact is Philip Makely, (540) 653-5832, e-mail: philip.makely@navy.mil. – *JED Staff*

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- Chip and Wire or SMT mounting schemes possible
- Designs possible from S to Ku Band

Typical Lowpass Filter
- Low loss in passband [better than 1.0dB]
- Greater than 40dB attenuation in stopband
- Typical size: .4 x .25 x .015 inches
- Chip and Wire or SMT mounting schemes possible
- Designs possible from S to Ku band

Typical Highpass Filter
- Low loss in passband region [better than 2.0dB]
- Greater than 35dB attenuation in stopband
- Typical size: .3 x .2 x .015 inches
- Chip and Wire or SMT mounting schemes possible
- Designs possible from 1GHz to 67GHz

L1/L2 GPS Notch Filter
- Greater than 20dB attenuation typical
- Low loss in passband regions [better than 1.5dB]
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- Includes integral cover
- Chip and Wire or SMT mounting schemes possible

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Dow-Key Microwave CMP · K&L MICROWAVE CMP · NOVACAP CMP · POLE ZERO CMP · SYFER CMP · Voltronics CMP as well as other EA programs. Program officials will draw on three resources for the DISTEW project. The Sensors Directorate will contract with industry; collaborate with other Services, such as the US Navy; and leverage EW research conducted by US allies. The program manager is Jerry Bullmaster, AFRL/RYZW, (937) 904-9361.

AFRL should release specific BAA amendments for these topics in the coming months. – *J. Knowles*

IN BRIEF

CAPT John Green has assumed command of the EA-6B Program Office (PMA-234) at Naval Air Systems Command (NAS Patuxent River, MD). He replaces CAPT Steve Kochman, who has retired from the Navy after 27 years. Captain Green has also joined the *JED* Editorial Advisory Board.

* * *

The US Navy has announced plans to buy additional Handheld Integrated Directional Receiver and Homing (HIDRAH), AR-8200 Receiver Systems from **Radio Reconnaissance Technologies Inc.** (Fredericksburg, MD). The systems, as well as accessories and support, will be procured under a five-year basic ordering agreement.

* * *

The Naval Surface Warfare Center, Crane Division (Crane, IN), has announced plans to award a firm fixed price contract to **L-3 Communications, Electron Devices Division** (San Carlos, CA) for 21-month modernization of the ALQ-99(V)'s Band 5/6 transmitter output traveling wave tube.

* * *

The **Naval Surface Warfare Center, Crane Division** (Crane, IN), has partnered with Johns Hopkins University Applied Physics Laboratory on a cooperative agreement to better transition theory into real-world testing environments and military applications. The three-year partnership will specifically focus on missions in which the two organizations can collaborate on the use of Ultrashort Pulse Lasers (USPLs), high-average power lasers and laser-material interactions for EW applications

* * *

NSWC's Crane Division also is conducting a market survey for a low-cost antenna system for use in an airborne radar jamming application. Program officials are interested in wideband microwave receive and transmit antenna systems with high isolation between the transmit and receive antennas. Antennas must be directional and should be oriented in the “forward and down” directions. The point of contact is Roger Brett, (812) 854-5269, e-mail roger.brett@navy.mil.

* * *

Airborne Tactical Advantage Co. (Newport News, VA) has received a $43.5 million contract from Naval Air Systems Command (NAS Patuxent River, MD) for type III and type IV supersonic aircraft in support of the Commercial Air Services program. The contract is a modification to a previously awarded indefinite delivery, indefinite quantity (IDIQ) contract and includes a variety of airborne threat simulation capabilities to train shipboard and aircraft squadron weapon systems operators and aircrew on countering potential enemy EW and EA operations. Work will be performed at Newport News, VA, Point Mugu, CA, and various other locations outside the US, and is expected to be complete by October 2010.

* * *

Naval Air Warfare Center Weapons Division has announced plans to award a cost-plus fixed fee IDIQ contract with **AAI Corporation** (Hunt Valley, MD). The contract will cover engineering technical services, in support of the organizational level (O-Level) Electronic Warfare Test Program Set (OEWTPS) planning, development and sustainment efforts, as well as lab and field testing for validation of the USM-670 Joint Service Electronic Combat System Tester (JSECST).

* * *

Naval Air Warfare Center Weapons Division (China Lake, CA) has issued a final solicitation for support of the Combat Environment Simulation Division at China Lake and the Airborne Threat Simulation Division at Point Mugu, CA, with the intent to award multiple cost-plus fixed fee, IDIQ contracts. Requirements include design, engineering development, fabrication, procurement, integration, testing and managing multiple radar and pod instrumentation systems, as well as multi-spectral threat simulators. The program's current contractors are Tybrin Corp., Lockheed Martin Services and L-3 Communications. Submissions are due by December 21, and the

point of contact is Bill Monckton, 760-939-8234, e-mail william.monckton@navy.mil.

* * *

Raytheon Missile Systems (Tucson, AZ) has received a $7.5 million modification to a previously awarded contract from Naval Air Systems Command (NAS Patuxent River, MD) to provide control and guidance section repairs for the AGM-88 high speed anti-radiation missile for the Air Force. Work is expected to be complete by May 2011.

* * *

Naval Air Systems Command has announced plans to award a sole-source contract to **Northrop Grumman** (Rolling Meadows, IL) for procurement of 65 RF amplifiers for the ALR-67(V)2 radar warning receivers in support of the Spanish Air Force.

* * *

Air Force Materiel Command has announced plans to award a sole source contract for updating of the ALE-50 to **Raytheon** (Goleta, CA). The contract requires design of an updated integrated solid-state module to deal with obsolescence issues related to Gallium Aresnic Boule (GAB) material. The contract also calls for the use of general technology to improve decoy reliability and performance and for evaluation of alternative manufacturing sources for GAB material in hopes of finding a replacement vendor for the obsolete parts.

* * *

DRS Defense Solutions LLC, Intelligence, Communications and Avionics Solutions operation in Buffalo, NY, has sold it first Joint Man-Portable Air Defense System (JMANPADS) trainer to the US Air National Guard. The system will be used to train C-130 pilots and develop tactics against IR MANPADS attacks.

* * *

Telephonics Corp. (Farmingdale, NY) has received a $45 million follow-on contract from Sierra Nevada Corp. (Reno, NV) to provide manufacturing support for the Counter Radio Frequency Improvised Explosive Device – Electronic Warfare (CREW) 3.1 program. The contract extends delivery of the devices through March 2010.

* * *

John Mikulsky has been named as president and CEO of Endwave Corporation, effective December 1. Mikulsky, currently Endwave's president and chief operating officer, succeeds Ed Keible, who stepped down as the company's vice chairman and CEO.

* * *

Argon ST (Fairfax, VA) has launched a new C4ISR training center. The facility has been created to provide US Navy ISR operators training on ISR system operations, troubleshooting and maintenance, as well as performance-based logistics needed to support the company's deployed systems and sensors. The center includes both actual systems and training aides such as Computer Based Training (CBT) developed by Hybrid Learning Systems and 3-D mission simulation developed by Penn State University Applied Research Laboratory.

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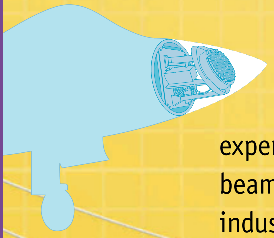

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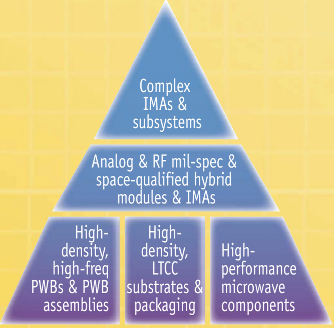

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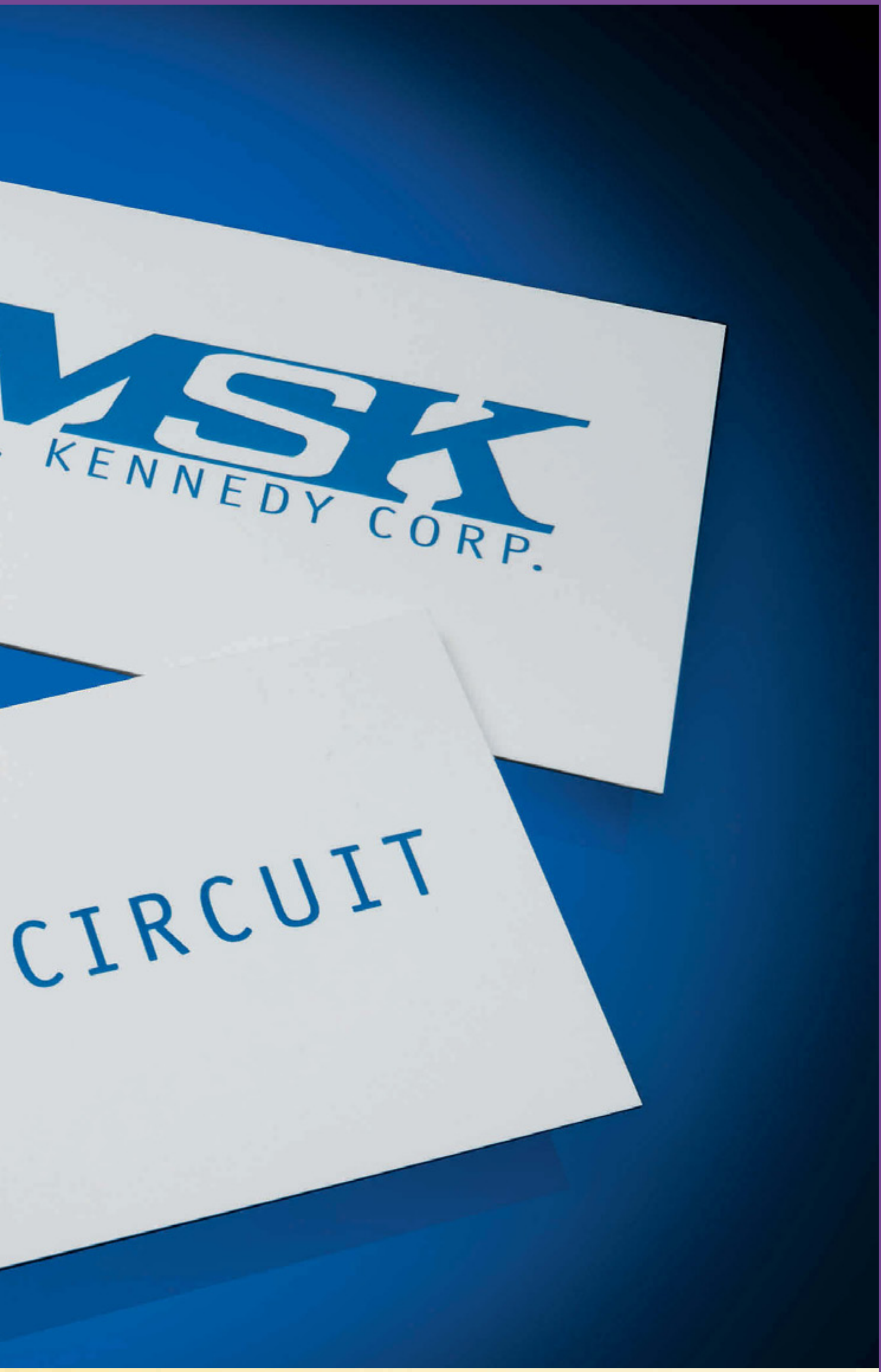
MSK
KENNEDY CORP.
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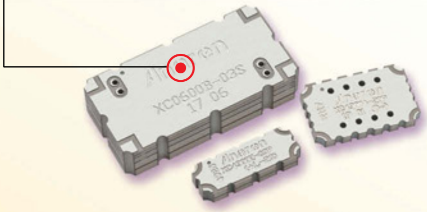
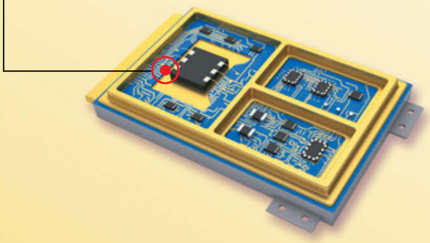
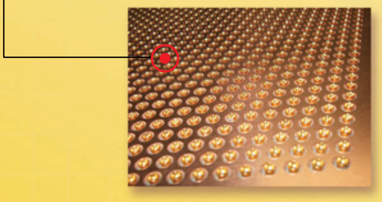






washington report

DOD BOOSTS FOCUS ON IEDS

As NATO continues to strengthen its forces in Afghanistan, improvised explosive devices (IEDs) are emerging as the weapon of choice, according to senior DOD officials. In response, Defense Secretary Robert Gates has ordered the formation of a new task force that will look at ways to enhance the DOD's counter-IED efforts. In 2004, IEDs began to emerge as a strategic weapon in Iraq, and the DOD responded to this new threat by establishing new organizations, funding countermeasures programs, improving training and buying more ISR assets. Now IEDs are becoming more pervasive in Afghanistan, and the DOD is keen to limit their impact.

The task force will be co-chaired by Ashton Carter, undersecretary of defense for acquisition, technology and logistics, and will integrate the efforts of the Joint IED Defeat Organization (JIEDDO) and DOD ISR community. Rather than starting fresh, as the DOD did in 2004-5, the task force will look at ways to ensure that all relevant DOD resources are focused on the IED problem and that no bureaucratic issues or organizational stovepipes are hindering counter-IED efforts in Afghanistan. While the US has been able to reduce the presence of IEDs in Iraq, Afghanistan may impose some unique challenges, according to testimony Lt Gen Thomas Metz gave before a House panel in late October.

Secretary Gates established an ISR task force for Iraq operations, which yielded a new approach that rapidly delivered ISR assets to that theater. The Afghanistan IED task force could have a similar impact on the growing IED problem in that theater. The IED task force will examine the problem over the next several months and report its findings to Secretary Gates in May. – *J. Knowles*

DOD ISSUES OPPORTUNITIES FOR SMALL BUSINESSES

The DOD has issued its first Small Business Innovative Research (SBIR) solicitation of FY2010. Several of the research topics are focused on EW and SIGINT applications.

The Navy is funding several SBIR projects. One, titled "Digital RF Memory Jammer Simulator" (Topic N101-035), aims to begin development of an "open architecture generic threat Digital Radio Frequency Memory (DRFM) jammer simulation and stimulation capability that provides real-time threat emulation (with realistic threat waveforms) and accepts inputs from an intelligence database front end of specified parameters and generic mode description templates." NAVAIR's F-18/EA-18 program office (PMA-265) is managing this project. The program point of contact can be reached at (301) 995-2309.

NAVSEA's Submarine Sensor Systems Programs Office (PMS-435), which manages the BLQ-10 ESM program for the Navy's submarine fleet, is funding a topic titled "Multi-Algorithm Unique Emitter Identification" (Topic N101-061). This project will "develop innovative algorithms and multi-algorithm fusion techniques for submarine EW/ISR system to support unique emitter identification," and reduce operator workload. The point of contact is Steve Henry, (401) 832-7849, e-mail steven.w.henry@navy.mil.

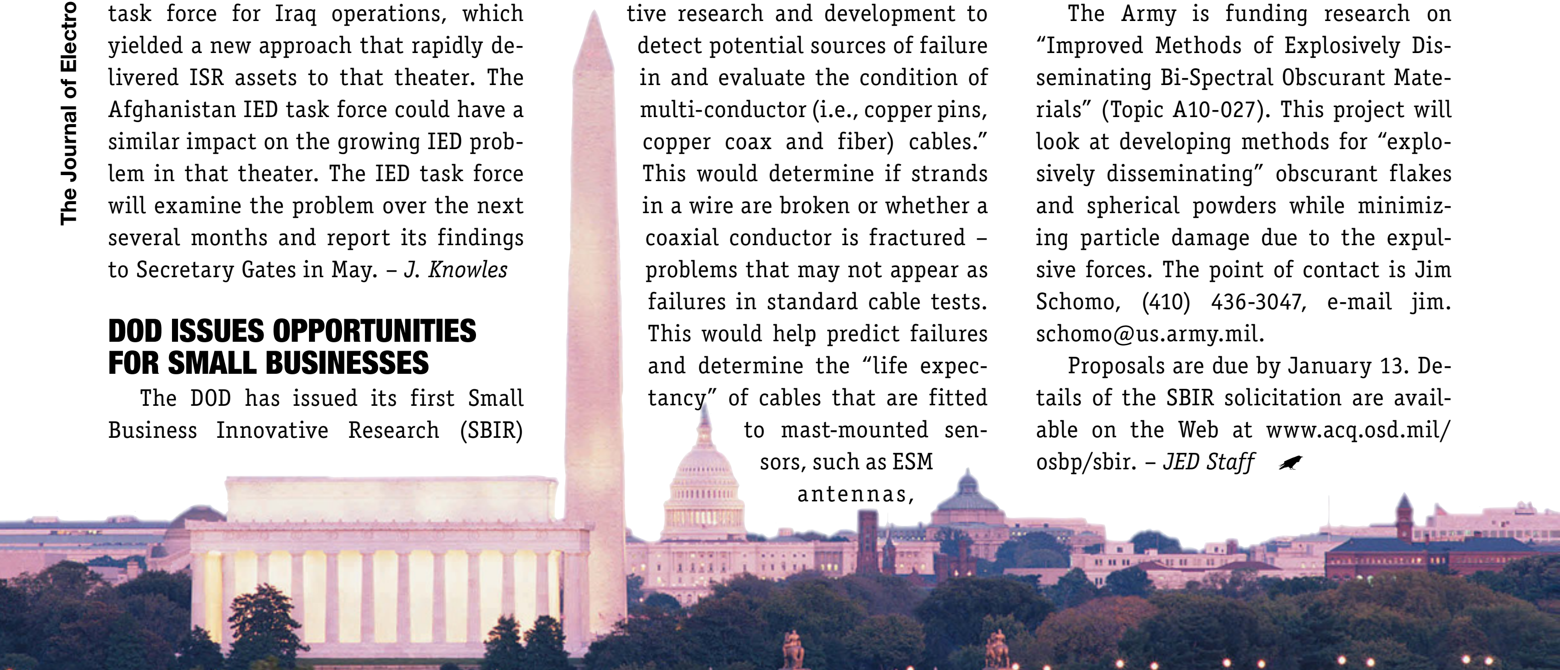
PMS-435 is also funding "Innovative Submersible Outboard Cable Failure Detection and Prediction Device" (Topic N101-057). This research aims to "develop a novel approach using innovative research and development to detect potential sources of failure in and evaluate the condition of multi-conductor (i.e., copper pins, copper coax and fiber) cables." This would determine if strands in a wire are broken or whether a coaxial conductor is fractured – problems that may not appear as failures in standard cable tests. This would help predict failures and determine the "life expectancy" of cables that are fitted to mast-mounted sensors, such as ESM antennas, on submarines. The point of contact is Brian Bradshaw, (410) 832-4109, e-mail brian.r.bradshaw@navy.mil.

NAVSEA's Virginia Class Program Office (PMS-450) is seeking antenna solutions for a topic titled "Innovative Wideband Antenna Technology for Ultimate Consolidated Submarine Mast" (Topic N101-069). This will focus on "wideband antenna design and efficient wideband electronics as a step toward the long-range goal of the development of consolidated, multifunction submarine masts." These multifunction mast apertures would handle communications, radar and EW. The point of contact is Steve Lose, (202) 781-4052, e-mail steven.lose@navy.il.

The Office of Naval Research is funding a project titled "Counter Directed Energy Weapons" (Topic N101-087). This effort will "advance the state-of the-art of counter directed energy weapons technologies and develop countermeasures for high energy lasers and/or high power microwave weapons systems in the future. Specifically, this SBIR seeks to develop specific items for a US Navy weapon system, or systems, to improve their survivability characteristics and maintain established performance capabilities when attacked by High Energy, Directed Energy Weapons (DEW), with minimal cost or system impacts." The program point of contact is Peter Morrison, (703) 696-0553, e-mail peter.a.morrison@navy.mil.

The Army is funding research on "Improved Methods of Explosively Disseminating Bi-Spectral Obscurant Materials" (Topic A10-027). This project will look at developing methods for "explosively disseminating" obscurant flakes and spherical powders while minimizing particle damage due to the expulsive forces. The point of contact is Jim Schomo, (410) 436-3047, e-mail jim.schomo@us.army.mil.

Proposals are due by January 13. Details of the SBIR solicitation are available on the Web at www.acq.osd.mil/osbp/sbir. – *JED Staff*

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DUTCH TO BUY ESM FOR M-CLASS FRIGATES

The Netherlands Ministry of Defence is soliciting tenders for procurement of ESM systems for the Royal Netherlands Navy's two *Karel Doorman*-Class frigates.

Also known as Multipurpose or M-Class frigates (they can be used in anti-submarine, anti-aircraft or surface combat roles), eight ships were built by the De Schelde Group (now part of the Damen Shipyards Group) in Flushing, Netherlands and delivered between 1991 and 1995. The Netherlands has sold six of the M-Class ships to Belgium (two ships in 2005), Chile (two ships in 2004) and Portugal (two ships in 2006). The *HNLMS Van Amstel* and the *HNLMS Van Speijk* have remained in Netherlands service and will receive the ESM upgrade.

The ESM procurement would replace the receiver portion of the APECS II system, which was the original EW system installed on all eight of the M-Class ships. The M-Class frigates' EW suite also includes the Mk 36 Super Rapid Blooming Off-Board Chaff (SRBOC) naval decoy system. ITT RSS (Morgan Hill, CA) is expected to bid for the ESM upgrade, as are Thales, Indra, Rockwell Collins and possibly Elettronica.

The contract may include an option to provide two ESM systems for the M-Class frigates in service with the Belgian Navy – F930 *Leopold I* and F931 *Louise-Marie*.

The program point of contact for the ESM upgrade is CDR T.D. van Hoorn, +31 7 03 16 34 08, e-mail TD.v.Hoorn2@mindef.nl. Submissions are due by February 12, 2009. – *E. Richardson and J. Knowles*

UAE BUYS AEW AIRCRAFT

The United Arab Emirates has selected Saab to provide Airborne Early Warning (AEW) surveillance and reconnaissance aircraft.

The contract, worth approximately 1.5 billion SEK (roughly US$220 million), calls for two Saab 340 AEW aircraft fitted with the company's Erieye active phased array pulse Doppler radar. The sale includes ground equipment, logistics, spares and support services. The UAE order also is believed to include Saab's HES-21 ESM system, which features digital narrow band and wide band receivers combined with an interferometer antenna array. The basic system covers 2-18 GHz, with options to extend coverage down to 0.7 GHz and up to 40 GHz.

The first aircraft for the UAE would be delivered in late 2010, with the second coming in early 2011. – *E. Richardson*

GERMANY SELECTS ESM FOR FRIGATES

Germany has tapped Rockwell Collins (Richardson, TX) to provide ESM systems for the country's F125 frigates, which are to be used for special operations and stabilization missions around the world. Four frigates are currently on order with the Arge F125 consortium, which comprises German ship builders ThyssenKrupp Marine Systems (including subsidiaries Blohm + Voss and Nordseewerke) and Lurssen Werft. Deliveries are scheduled for 2017-2022.

The F125 frigates will be fitted with Rockwell's CS-3600 radar ESM (R-ESM) system, which includes the CS-300 pulse analyzer unit, CS-5998 wideband tuners, CS-5020 microwave tuners, IFMR-6070 instantaneous frequency measuring receiver and the FS-6090 precision intercept spectral monitoring (PRISM) system. Work will be performed at Rockwell Collins and system deliveries are scheduled from 2010 to 2013. The F-125s will also be fitted with the Multi Ammunition Softkill System (MASS) from Rheinmetall Waffe Munition, with each ship carrying four MASS dispensers. – *E. Richardson and J. Knowles*

In Brief

- **CILAS** (Orleans, France) has delivered a prototype for the compact Mid Infrared Laser for DIRCM Application (MILDA) to the French MOD's Direction Générale de l'Armement (DGA). CILAS was awarded the MILDA development contract two years ago, as a second phase of DGA's CESAM project.
- **Elbit Systems** (Haifa, Israel), has completed acquisition of BVR Systems at a cost of approximately $34 million. BVR develops and produces training, simulation and debriefing systems for air, sea and ground forces. It has been very successful with domestic and international sales of its In Flight EW Simulator (IFEWS).
- **AAI Corp's ESL Defence** unit has sold its 500th Baringa Missile Warning System Test Set. The latest sale was made to the UK Military of Defence. Baringa test sets are used to stimulate multiple types of missile warning systems for test and training applications. It is used by more than 15 countries.
- **Thales Land and Joint Systems** has successfully tested its new IR warner system, being developed in partnership with Australia's Defence Science and Technology Organisation for the Australian Defence Force. The system, based on the company's Elix-IR missile warner, is intended for vehicles and integrated with vehicle-mounted weapons and countermeasures systems to provide warning of anti-tank guided munitions, rocket propelled grenades and small arms fire.

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2010 EW/SIGINT Resource Guide

Welcome to *JED's* 2010 EW/SIGINT Resource Guide. This guide is designed to list companies and organizations that manufacture products or provide services in the areas of electronic warfare (EW) and signals intelligence (SIGINT).

About this Guide

This guide was assembled by our editorial team, in part from responses to our questionnaire distributed during October and early November. Though we have attempted to produce a comprehensive listing, we expect this EW/SIGINT Resource Guide to grow over the next several years. If your company does not appear in this year's guide, please see the note below describing how your company can appear in future editions.

How to Use this Guide

This first section features a "company listing," in which companies are featured in alphabetical order. The second section includes product and service categories-roughly organized by components/subsystems, systems, software and services. Refer back to the company section for website data on listed companies.

Get Your Company Listed

Our next print EW/SIGINT Resource Guide will appear in December 2010, however, the AOC's online buyers' guide is coming in early 2010 and offers the opportunity for online listings. Keep watching *JED* for additional details on this new daily resource.

If your company missed our questionnaire for this year's guide, e-mail **editor@crows.org** to ensure you're on our distribution list for next year's guide.

COMPANY LISTING

A

AAI Corporation
Hunt Valley, MD
www.aaicorp.com

Abacus EW Consultancy Ltd.
Lincoln, UK
www.abacusewc.com

Advanced Control Components Inc.
Eatontown, NJ
www.advanced-control.com

Advanced Electronics Company
Military Systems Business Unit
Riyadh, Saudi Arabia
www.aecl.com

Aeroflex
Microelectronic Systems
www.aeroflex.com

Aeroflex Test Solutions
www.aeroflex.com

Aeronix
www.aeronix.com

Aethercomm
Carlsbad, CA
www.aethercomm.com

Agilent Technologies
Santa Clara, CA
www.agilent.com

Airborne Systems Limited
www.airborne-sys.com

Airborne Tactical Advantage Company
Business Development
Newport News, VA
www.atacusa.com

AIRBUS MILITARY
Blagnac, Cedex, France
http://www.eads.net

AirScan Inc
www.airscan.com

AKON, Inc.
San Jose, CA
www.akoninc.com

Albrecht Telecommunications
Hunenberg, Switzerland
www.albrecht-telcom.ch

Alion Science and Technology
Defense Operations
McLean, VA
www.alionscience.com

ALKAN
Valenton, France
www.alkan.fr

Allen-Vanguard Corporation
Ottawa, Canada
www.allen-vanguard.com

Alloy Surfaces Col., Inc.
Chester Township, PA
www.alloysurfaces.com

Altera Corporation
San Jose, CA
www.altera.com

American Microwave Corporation
Frederick, MD
www.americanmicrowavecorp.com

AMESYS
Boulogne, France
WWW.AMESYS.FR

AMEWAS, Inc
California, MD
www.amewas.com

AML Communications Inc.
Carmarillo, CA
www.amlj.com

Ampex Data Systems
Redwood City, CA
www.ampex.com

Amplifier Solutions Corp
Colmar, PA
www.amplifiersolutions.com

AmpliTech
Holbrook, NY
www.amplitechinc.com

AMT Microwave Corp.

Camarillo, CA
www.amt-microwave.com

Analog Devices Inc
Norwood, MA
www.analog.com

Anaren
Syracuse, NY
www.anaren.com

Anatech Electronics
Garfield, NJ
www.anatechelectronics.com

Annapolis Micro Systems, Inc.
Annapolis, MD
www.annapmicro.com

Anritsu
MMD
Morgan Hill, CA
www.us.anritsu.com

Antenna Research Associates
Beltsville, MD
www.ara-inc.com

Applied EM Inc.
Hampton, VA
www.appliedem.com

Applied Geo Technologies Inc
Choctaw, MS
www.appliedgeotech.com

Applied Signal Technology, Inc.
Sunnyvale, CA
www.appsig.com

ARC Technologies
Amesbury, MA
www.arc-tech.com

Argon ST
Fairfax, VA,
www.argonst.com

Aselsan Inc.
Ankara, Turkey
www.aselsan.com.tr

Association of Old Crows
Alexandria, VA
www.crows.org

Astronics DME Corporation
Orlando, FL
www.astronics.com

ATDI Ltd
West Sussex, UK
www.atdi.co.uk

Avalon Electronics, Inc.
Bartow, FL
www.avalon-electronics.com

ATK Mission Systems
Woodland Hills, CA
www.atk.com

ATK Space Systems
Brigham City, UT
www.atk.com

Avalon Electronics, Inc.
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www.avalon-electronics.com

B

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BAE SYSTEMS Australia
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BARCO
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Barr Associates, Inc.
Westford, MA
www.barrassociates.com

BC Systems, Inc
Setauket, NY
www.bcpowersystems.com

BEL – Bharat Electronics Ltd
Bangalore, India
www.bel-india.com

BittWare
Concord, NH
http://www.bittware.com

Boeing Integrated Defense Systems
St. Louis, MO
www.boeing.com

C

CACI Technologies Inc
Arlington, VA
www.caci.com

CAP Wireless
Newbury Park, CA
www.capwireless.com

Carolina Unmanned Vehicles Inc.
Raleigh, NC
www.carolinaunmanned.com

Ceralta Technologies
Sage Laboratories
Hudson, NH
www.sagelabs.com

Chemring Countermeasures Ltd
Salisbury, UK
www.chemringcm.com

Chemring Energetics Division
Technical Ordnance
Downers Grove, IL
www.scotinc.com

Chengdu SIWI Electronic Co., Ltd
Chengdu, China
www.siwi.com.cn

Chordell Systems Ltd.
Oxford, UK
http://www.chordell.com

Ciao Wireless, Inc.
Camarillo, CA
www.ciaowireless.com

Cobham
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www.avdef.fr

Cobham
FR Aviation
Christchurch, Dorset, UK
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www.colemanmw.com

Concurrent Technologies
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www.cpii.com

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www.csir.co.za

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Sunnyvale, CA
www.cttinc.com

Cubic Defense Systems
San Diego, CA
www.cubic.com

Cuming Microwave Corporation
Avon, MA
www.cumingmw.com

Curtiss-Wright Controls Electronic Systems
Santa Clarita, CA
http://www.cwcelectronicsystems.com

Curtiss-Wright Controls Electronic Systems
Fairborn, OH
www.cwcelectronicsystems.com

Curtiss-Wright Controls Embedded Computing
Leesburg, VA
www.cwcembedded.com

D

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Annapolis, MD
www.d-ta.com

DARE Electronics, Inc
Troy, OH
www.dareelectronics.com

dB Control
Freemont, CA
www.dBControl.com

Defence Research and Development Canada
Ottawa, Ontario, Canada
www.ottawa.drdc-rddc.gc.ca

Defense Research Associates, Inc.
Beavercreek, OH
http://www.dra-inc.net

DELTA MICROWAVE
Oxnard, CA
www.deltamicrowave.com

Diehl BGT Defence GmbH & Co. KG
Überlingen, Germany
www.diehl-bgt-defence.de

Digital Receiver Technology
Germantown, MD
www.drti.com

Dow-Key Microwave
Ventura, CA
www.dowkey.com

DRS C3 Systems, Inc.
Buffalo, NY
www.drs.com

DRS Codem Systems, Inc
Merrimack, NH
DRS-com

DRS Signal Recording Technologies
Columbia, MD
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DRS Sustainment Systems
St. Louis, MO
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Dynamic Analytics & Test, Inc.
Arlington, MA
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Haverhill, MA
www.dynawave.com

Dynetics Inc.
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www.e2v.com

EADS Defence & Security
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www.eads.com

Eclipse Electronic Systems, Inc.
Richardson, TX
www.sigint.com

ElectroOptic Industries Ltd.
Rohovot, Israel
www.el-op.com

Electro-Metrics Corp.
Johnstown, NY
www.electro-metrics.com

EFJohnson Technologies
Irving, TX
www.efjohnsontechnologies.com

Elcom Technologies
Rockleigh, NJ
www.elcom-tech.com

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www.eldes.it

Elettronica SpA
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www.elt-roma.com

Elisra
Bene Beraq, Israel
www.elisra.com

ELTA Systems Ltd
Ashdod, Israel
www.iai.co.il

EM Research
Reno, NV
www.emresearch.com

EMS Technologies, Inc.
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www.emsdss.com

Empower RF Systems, Inc.
Inglewood, CA
www.EmpowerRF.com

Endwave Corp.
San Jose, CA
www.endwave.com

eonic BV
Delft, The Netherlands
www.eonic.com

ESL Defence Limited
Sales & Marketing
Southampton, Hampshire, UK
www.esldefence.co.uk

Esterline Defense Group
Coachella, CA
www.esterline.com

ET Industries
Boonton, NJ
www.etiworld.com

ETS-Lindgren
Cedar Park, TX
www.ets-lindgren.com

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www.etm-inc.com

European Antennas
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EW Defense Systems, Inc
Peyton, CO
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EW Simulation Technology Limited
Farnborough, UK
www.ewst.co.uk

EWA Government Systems, Inc.
Herndon, VA
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F

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Port Murray, NJ
www.flexcomw.com

Foster Miller Inc
Waltham, MA
www.foster-miller.com

Fractal Antenna Systems
Waltham, MA
www.fractenna.com

FS Antennentechnik GmbH
Unterschleissheim, Germany
www.fsant.de

G

GE Fanuc Embedded Systems
Charlottesville, VA
www.gefanuc.com

General Dynamics Advanced Information Systems
Fairfax, VA
www.gd-ais.com

General Dynamics C4 Systems
Scottsdale, AZ
www.gdc4s.com

Genesis EW
Rehovot, Israel
www.EWgenesis.com

Georgia Tech Research Institute
Atlanta, GA
www.gtri.gatech.edu

Giga-tronics Incorporated
San Ramon, CA
http://www.gigatronics.com

Goodrich ISR Systems
Danbury, CT
www.goodrich.com

Goodrich Sensors and Integrated Systems
Digital Data Systems
Monterey Park, CA
www.goodrich.com/sis

Grintek Ewation (Pty) Ltd
Pretoria, South Africa
www.gew.co.za

H

Herley-CTI, Inc
Whippany, NJ
www.herley-cti.com

Herley Farmingdale
Farmingdale, NY
www.herley.com

Herley General Microwave Israel
Jerlem, Israel
www.herley.com

Herley Micro Systems
Fort Walton Beach, FL
www.herley.com

Herley New England
Woburn, MA
www.herley.com

Herley Power Amplifier Systems
Farmingdale, NY
www.herley.com

Herotek, Inc
San Jose, CA
www.herotek.com

Hittite Microwave
Chelmsford, MA
www.hittite.com

Honeywell Aerospace
Plymouth, MN
www.honeywell.com

HUBER+SUHNER
North America
Essex, VT
www.hubersuhner.com

HUBER+SUHNER AG
Herisau, Switzerland
www.hubersuhner.com

I

IFI - Instruments for Industry Inc.
Ronkonkoma, NY UA
www.ifi.com

IMI - Israel Military Industries
Ramat Hasharon, Israel
www.imi-israel.com

INDRA
Alcobendas, Madrid, Spain
www.indracompany.com

Innovative Signals Technology (ISigTech)
Scottsboro, AL
www.isigtech.com

Intersil
Milpitas, CA
www.intersil.com

ITAS A/S
Grenaa, Denmark
www.itas.eu.com

ITCN, Incorporated
Dayton, OH
www.itcninc.com

ITT - Advanced Engineering & Sciences
Engineering and Technical Services
Arlington, VA
www.aes.itt.com

ITT - Advanced Engineering & Sciences
Microwave Systems
Lowell, Ma
www.ittmicrowave.com

ITT Communications Systems
Bohemia, NY
www.cs.itt.com

ITT
CS- Antenna Products & Technologies
Bohemia, NY
http://cs.itt.com/c4products.html

ITT Electronic Systems
Force Protection Systems
Thousand Oaks, CA
www.fps.es.itt.com

ITT Electronic Systems
Integrated EW Systems
Clifton, NJ
www.es.itt.com

ITT Electronic Systems
Reconnaissance and Surveillance Systems
Morgan Hill, CA
http://rss.es.itt.com/

ITT Intelligence & Information Warfare
Nashua, NH
www.iiw.itt.com

iVeia, LLC
Annapolis, MD
www.iveia.com

IW Microwave
Danbury, CT
www.iw-microwave.com

IZT GmbH
Erlangen, Germany
www.izt-labs.de

IZT GmbH
Erlangen, Germany
www.izt-labs.de

J

Jabil Defense and Aerospace Services
St. Petersburg, FL
www.jabil.com

JEM Engineering
Laurel, MD
www.jemengineering.com

Jersey Microwave
Hackettstown, NJ
www.jerseymicrowave.com

Jordan Electronic Logistic Support
Electronic Warfare
Jordan, Amman
www.jels-tech.com

K

K&L Microwave, Inc.
Salisburg, MD
www.klmicrowave.com

Keragis
Poway, CA
www.keragis.com

Kilgore Flares Company, LLC
Toone, TN
www.kilgoreflares.com

KMIC Technology, Inc.
San Jose, CA
www.kmictech.com

KOR
Cypress, CA
www.korelectronics.com

L

L-3 Communications
Applied Signal & Image Technology
Linthicum Heights, MD
www.l-3com.com/asit

L-3 Communications
Applied Technologies
San Diego, CA
www.l-3com.com

L-3 Communications
Cincinnati Electronics
Mason, OH
www.l-3com.com

L-3 Communications
Communication Systems-East
Camden, NJ
www.L-3com.com/ISR

L-3 Communications
Display Systems
Alpharetta, GA
www.l-3com.com

L-3 Communications
Electron Device Division
San Carlos, CA
www.l-3com.com/edd

L-3 Communications
Electron Technologies, Inc.
Torrance, CA
http://www.l-3com.com/eti/

L-3 Communications
Electrodynamics
Rolling Meadows, IL
www.l-3com.com

L-3 Communications
Electronic Systems
Toronto, Ontario Canada
www.l-3com.com

L-3 Communications
ESSCO
Ayer, MA
www.l-3com.com

L-3 Communications
Flight International
Newport News, VA
www.l-3com.com

L-3 Communications
Infrared Products
Dallas, TX
www.l-3com.com

L-3 Communications
Integrated Systems
Greenville, TX
www.l-3com.com

L-3 Communications
Linkabit
San Diego, CA
www.l-3com.com

L-3 Communications
Narda Microwave-East
Happauge, NY
www.l-3com.com

L-3 Communications
Narda Microwave-West
Folsom, CA
www.l-3com.com

L-3 Communications
Randtron Antenna Systems
Menlo Park, CA
www.L-3com.com/randtron

L-3 Communications
Targa Systems
Nepean, Ontario Canada
www.l-3com.com

L-3 Communications
TRL Technology
Tewkesbury Gloucestershire UK
www.trltech.co.uk

LaBarge, Inc
St. Louis, MO
www.labarge.com

Lacroix Defense and Security
Mazeres, France
www.lacroixds.com

Link Microtek
Basingtoke, Hampshire, UK
www.linkmicrotek.com

LNX Corporation
Salem, NH
www.lnxcorp.cpm

Lockheed Martin
INSYS
Ampthill, Bedfordshire UK
www.lockheedmartin.co.uk

Lockheed Martin
IS&GS - Gaithersburg
Githerburg, MD
www.lockheedmartin.com

Lockheed Martin
IS&GS - Littleton
Littleton, CO
www.lockheedmartin.com

Lockheed Martin
Missiles and Fire Control
Orlando, FL
www.lockheedmartin.com

Lockheed Martin
MS2 - Akron
Akron, OH
www.lockheedmartin.com

Lockheed Martin
MS2
Syracuse, NY
lockheedmartin.com/ms2

Lockheed Martin
Systems Integration Owego
Owego, NY
www.lockheedmartin.com

Lockheed Martin Aeronautics
AFEWES-MARS
Fort Worth, TX
www.lockheedmartin.com

Lockheed Martin Aculight
Bothell, WA
www.aculight.com

Lockheed Martin Sippican
Marion, MA
www.sippican.com

Lorch Microwave
Salisbury, MD
www.lorch,com

LS telcom
Lichtenau, Germany
www.LStelcom.com

M

MacAulay-Brown, Inc.
Dayton, OH
www.macb.com

ManTech Real-Time Systems Lab
Sarasota, FL
www.mrsl.com

MANTECH Systems Engineering Corp.
Lexington Park, MD
www.mantech.com

Mass Consultants Limited
Cambridgeshire, UK
www.mass.co.uk

Maxtek
Beaverton, OR
www.maxtek.com

MBDA
Paris, France
www.mbda-systems.com

MC Countermeasures Inc
Kanata, Ontario, Canada
www.mc-cm.com

MECA Electronics
Denville, NJ
www.e-MECA.com

Mectron – Engenharia, Indústria e Comércio
São José dos Campos, SP Brazil
www.mectron.com.br

Medav Gmbh
Uttenreuth, Germany
www.medav.de

MegaPhase RF
Stroupsburg, PA
www.megaphase.com

Meggitt Avionics
Fareham, Hampshire, UK
www.meggitt-avionics.co.uk

Meggitt Defense Systems
Irvine, CA
www.meggittdefense.com

Mercer Engineering Research Center
Warner Robins, GA
www.merc-mercer.org

Mercury Computer Systems
Chelmsford, MA
www.mc.com

MES S.p.A.
Rome, Italy
www.mesroma.it

MESL Microwave
Edinburgh, Scotland
www.meslmicrowave.com

Mica Microwave
a division of Micronetics, Inc.
Manteca, CA
www.mica-mw.com

Micro Lambda Wireless, Inc.
Fremont, CA
www.microlambdawireless.com

Micro-Coax, Inc
Pottstown, PA
www.micro-coax.com

Micronetics, Inc
Hudson, NH
www.micronetics.com

Micronetics, Inc.
Noise and Test Division
Hudson, NH
www.micronetics.com

Micronetics, Inc.
VCO Division
Hudson, NH
www.micronetics.com

Micronetixx, P.A.
Lewiston, ME
www.micronetixx.com

MicroPhase Corp
Norwalk, CT
www.microphase.com

Microsemi Corporaion
RF Integrated Solutions
www.microsemi-rfis.com

Microsemi Corporation
www.microsemi.com

Microwave Communications Laboratories
St. Petersburg, FL
www.mcli.com

Microwave Concepts (Micro-Con)
a division of Micronetics, Inc.
Fairfield, NJ
www.micro-con.com

Microwave Engineering Corp.
North Andover, MA
www.microwaveeng.com

Mid-Atlantic RF Systems
Forest Hill, MD
www.midatlanticrf.com

MiKES Microwave Electronics Systems Inc.
Ankara, Turkey
www.mikes.com.tr

MITEQ
Hauppage, NY
www.miteq.com

MRCM GmbH
Ulm, Germany
www.mrcm.net

My-konsult
Sundbyberg, Sweden
www.mykonsult.com

N

Nallatech, Inc.
Camarillo, CA
www.nallatech.com

National Instruments Corp.
Austin, TX
www.ni.com

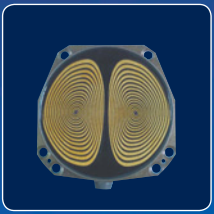
National Semiconductor
Santa Clara, CA
www.national.com

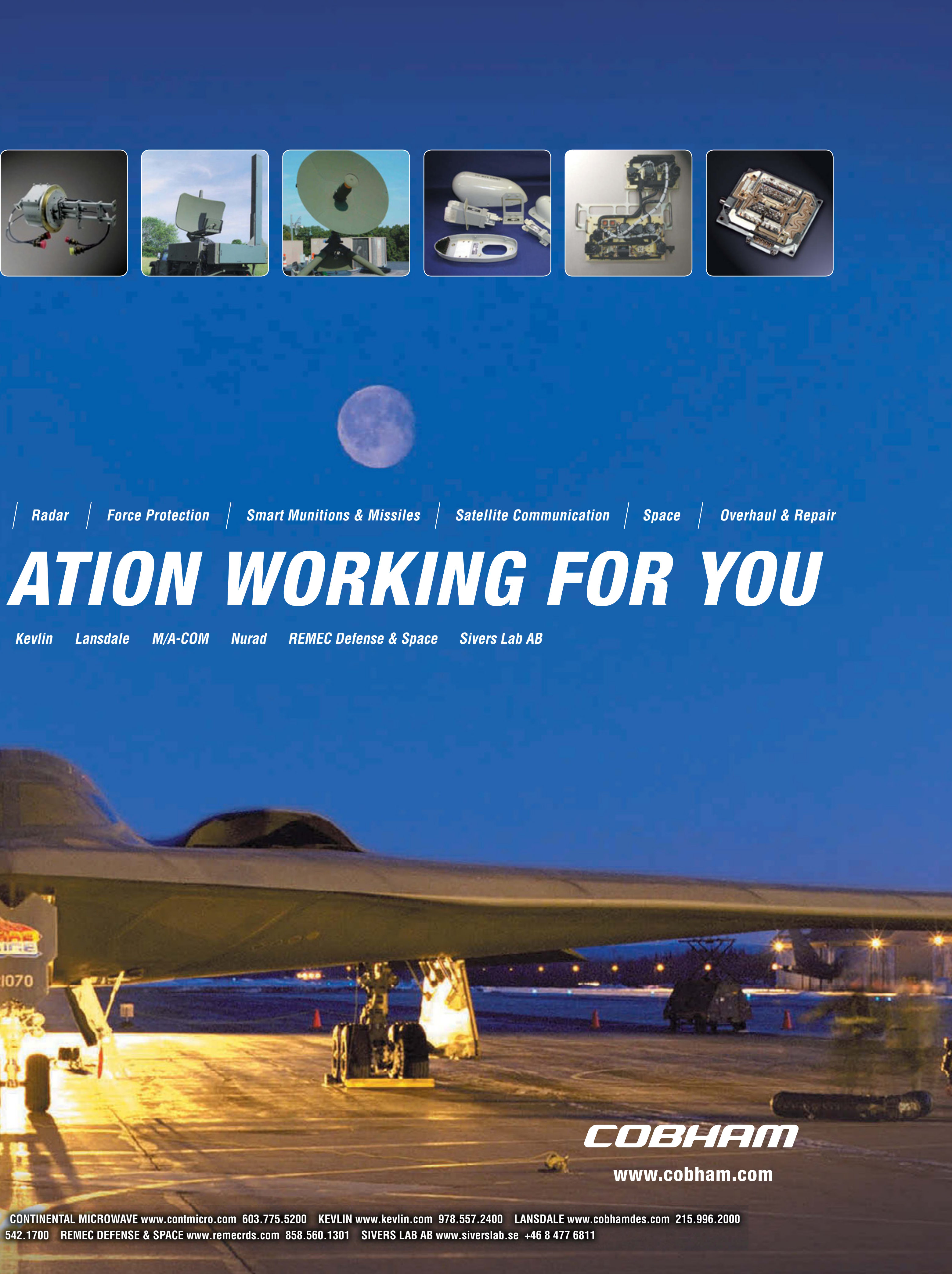
NEC Microwave Tube, Ltd.
Tokyo, Japan
www.nec-mwt.com

Netline Communications Technologies
Tel Aviv, Israel
www.netline.co.il

Nitronex
Durham, NC
www.nitronex.com

Northrop Grumman Corporation
Aerospace Systems
Bethpage, NY
www.northropgrumman.com





Northrop Grumman Corporation
Defensive Systems Division
Rolling Meadows, IL
www.es.northropgrumman.com

Northrop Grumman Corporation
Information Systems
San Jose, CA
www.is.northropgrumman.com

Nova Defence
Edinburgh, SA Australia
www.novadefence.com.au

Novatech Instruments
Seattle, WA
www.novatech-instr.com

Nuvotronics LLC
Radford, VA
www.nuvotronics.com

O

Ocean Microwave Corp.
Beijing, China
www.oceanmicrowave.com

OEwaves
Pasadena, CA
www.oewaves.com

OPHIR RF
Los Angeles, CA
www.ophirrf.com

Orbit Communication Systems, Inc.
City of Industry, CA
www.orbit-cs.com

Overlook Systems Technologies, Inc.
Vienna, VA
www.overlooksys.com

Overwatch
Austin, TX
www.tactical.overwatch.com

P

PA&E
Wenatchee, WA
www.pacaero.com

Pascall Electronics Limited
Ryde, Isle of Wight, UK
www.pascall.co.uk

Patria Aviation Oy
Systems
Tampere, Finland
www.patria.fi

PCTEL Inc.
Antenna Products
Bloomingdale, IL
antenna.pctel.com

Pharad, LLC
Glen Burnie, MD
www.pharad.com

Pentek
Upper Saddle River, NJ
www.pentek.com

Pharad LLC
Glen Burnie, MD
www.pharad.com

Phase Matrix
San Jose, CA
www.phasematrix.com

Phoenix Air
Cartersville, GA
www.phoenixair.com

Picosecond Pulse Labs
Boulder, CO
www.picosecond.com

Planar Electronics Technology
Frederick, MD
www.planarelec.com

Planar Monolithics
Frederick, MD
www.pmi-rf.com

PLATH GmbH
Hamburg, Germany
www.plath.de

Plextek Ltd
Great Chesterford, Essex, UK
www.plextek.com

Pole/Zero Corporation
West Chester, OH
www.polezero.com

Poynting Antennas (Pty) Ltd.
Wendywood, South Africa
www.poynting.co.za

Precision Connector
Franklin, IN
www.precisionconnector.com

Precision Display Technologies
Reno, NV
www.pdt-usa.com

Protium Technologies, Inc.
Northboro, MA
www.protiumtechnologies.com

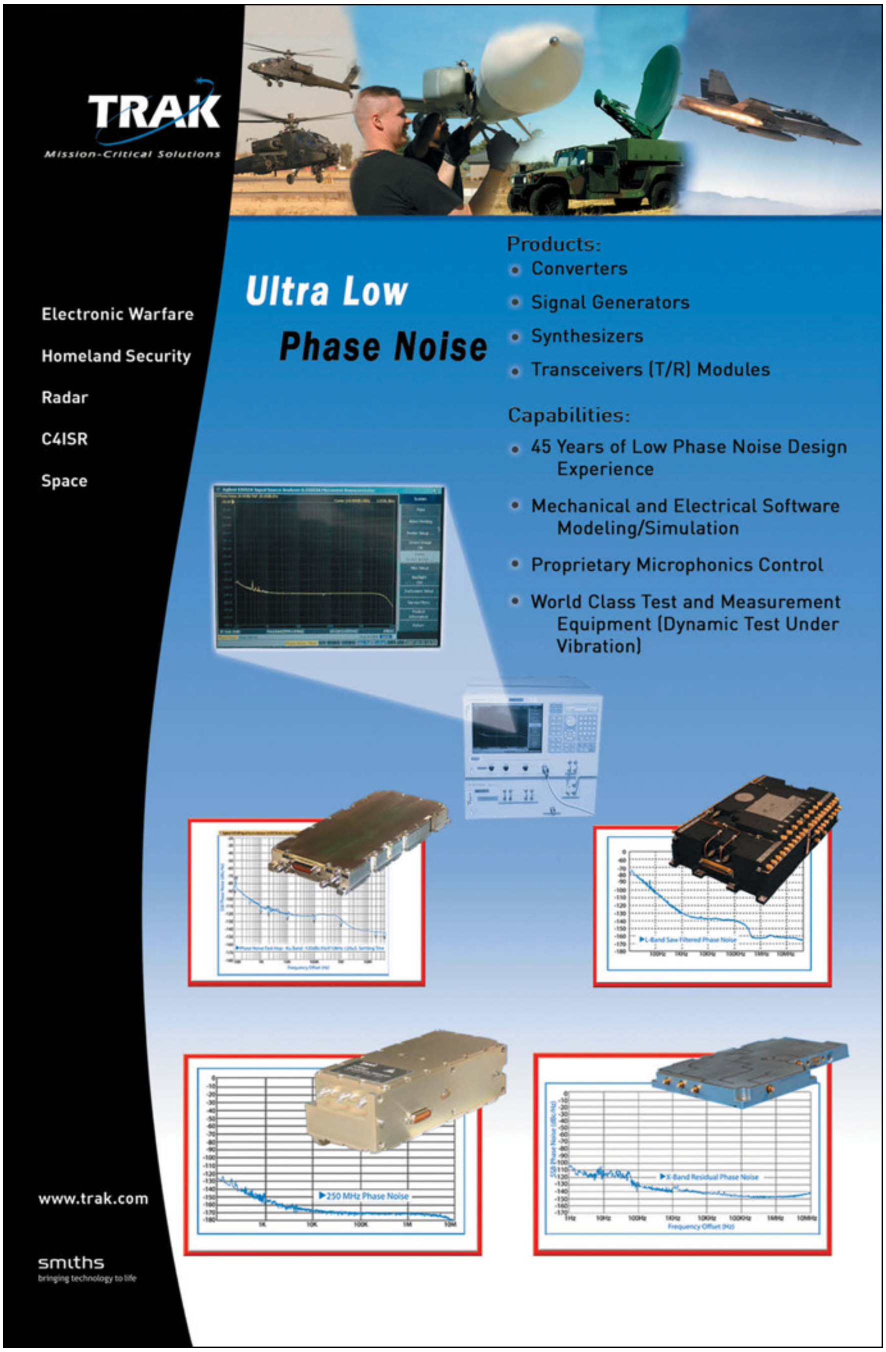
Q

QinetiQ Ltd
Worcestershire, UK
www.QinetiQ.com

Q-par Angus Ltd
Leominster, Herefordshire, UK
www.q-par.com

QRC Technologies
Stafford, VA
http://qrctech.com

Quarterwave Corp.
Rohnert Park, CA
www.quarterwave.com



QuinStar Technology, Inc.
Torrance, CA
www.quinstar.com

R

Radio Reconnaissance Technologies
Fredericksburg, VA
www.radiorecon.com

Rafael - Systems Division
Haifa, Israel
www.rafael.co.il

RAS - Research Associates of Syracuse
East Syracuse, NY
www.ras.com

Raven Research
Reading, Berkshire, UK
www.raven-research.com

Raytheon
Electronic Warfare Systems
Goleta, CA
http://www.raytheon.com

Raytheon
Intelligence and Information Systems
Falls Church, VA
www.raytheon.com

Raytheon Missile Systems
Air Warfare Systems (Product Line)
Tuscon, AZ
www.raytheon.com

Red Rapids
Richardson, TX
www.redrapids.com

Renaissance Electronics Corporation
Harvard, MA
www.rec-usa.com

RF Engines Ltd
Newport, Isle of Wight, UK
www.rfel.com

RF Industries
San Diego, CA
www.rfindustries.com

RF Logic
Hudson, NH
www.rflogic.net

RF Micro Devices
Greensboro, NC
www.rfmd.com

RFCore Co, Ltd.
Seongnam-si, Gyeonggi-do, South Korea
www.rfcore.com

RH Laboratories
Nashua, NH
www.rh-labs.com

Rheinmetall Defence
Protection Systems division
Germany
www.rheinmetall-defence.com

Rising Edge Technologies
Herndon, VA
www.risingedge.com

Rockwell Collins
Electronic Warfare and Intelligence Solutions
Richardson, TX
www.rockwellcollins.com/ewsigint

Rodale Electronics Inc
Hauppage, NY
www.rodaleelectronics.com

Rodelco Electronics Corp.
Ronkonkoma, NY
www.rodelco-usa.com

Rohde & Schwarz GmbH Ko KG
Muenchen, Germany
www.rohde-schwarz.com

ROKE MANOR RESEARCH LTD
Hampshire, UK
http://www.roke.co.uk/electronic-warfare

RUAG
Aerospace
Bern, Switzerland
www.ruag.com

S

Saab
Saab Avitronics
Järfälla, Sweden and Centurion, South Africa
www.saabgroup.com

Sage Laboratories
Hudson, NH
www.sagelabs.com

Sagem Defense Securite
Paris, France
www.sagem-ds.com

SAIC
McLean, VA
www.saic.com

SAT Corp.
Sunnyvale, CA
www.sat.com

Scientific Research Corporation
Integrated Systems and Solutions
Atlanta, GA
www.scires.com

Scientific Research Corporation
Simulation, Test and Instrumentation
Atlanta, GA
www.scires.com

SELEX Galileo
Luton, Bedfordshire, UK
www.selexgalileo.com

SELEX Galileo
Edinburgh, Scotland
www.selexgalileo.com

SELEX Sistemi Integrati
Rome, Italy
www.selex-si.com

SensorCom Inc.
Annapolis, MD
www.sensorcominc.com

Shogi Communications Ltd.
Noida, UP India
www.shoghi.co.in

Sierra Nevada Corp
ISR Systems
Sparks, NV
www.sncorp.com

Sierra Nevada Corp.
Sensor Systems & Technologies
Dayton, OH
www.sncorp.com

Signami-DCS
EW/Range
Rancho Cordova, CA
www.sncorp.com

Signatec
Newport Beach, CA
www.signatec.com

Simulation Technologies
Huntsville, AL
www.simtechinc.com

Sivers IMA AB
Stockholm, Sweden
www.siversima.com

SKY Computers Inc.
Chelmsford, MA
www.skycomputers.com

Southwest Microwave
Tempe, AZ
www.southwestmicrowave.com

Southwest Research Institute
San Antonio, TX
www.swri.org

SprayCool
Liberty Lake, WA
www.spraycool.com

Spectrum Signal Processing
Burnaby, BC, Canada
www.spectrumsignal.com

SpectrumControl, Inc.
Spectrum Microwave, Inc.
Philadephia, PA
www.spectrummicrowave.com

SRC/SRCTec
Syracuse, NY
www.srcinc.com

Stealth Microwave
a division of Micronetics, Inc.
Trenton, NJ
www.steatlhmicrowave.com

Stealth Microwave, Inc
Ewing, NJ
www.stealthmicrowave.com

SURVICE Engineering Co.
Belcamp, MD
www.survice.com

Superconductor Technologies Inc.
Santa Barbara, CA
www.suptech.com

Symetrics Industries
Melbourne, FL
www.symetrics.com

Synectics Surveillance Technology
Tewkesbury, Gloucestershire, UK
www.synx.com

Sypris Data Systems
Centennial, CO
www.sypris.com

System Planning Corporation
Arlington, VA
www.sysplan.com

Systems & Processes Engineering Corp
Austin, TX
www.spec.com

Systematic
Sleaford, Lincolnshire, UK
www.systematic.com

SystemWare Inc.
Thousand Oaks, CA
www.sysware.com

T

Tactical Technologies Inc
Ottawa, Ontario, Canada
www.tti-ecm.com

Tampa Microwave
Tampa, FL
www.tampamicrowave.com

Tata Advanced Systems Limited (TASL)
New Delhi, India
www.tataadvancedsystems.com

Tata Power Strategic Electronics Division
Bangalore, India
www.tatapowersed.com

TCI International
Freemont, CA
www.tcibr.com

Tech Resources, Inc.
Milford, NH
http://www.tri-milford.com/

Technograph Microcircuits Ltd
Portsmouth, Hampshire UK
www.technographmicro.com

TECOM Industries
Thousand Oaks, CA
www.tecom-ind.com

TEK Microsystems, Inc.
Chelmsford, MA
http://www.tekmicro.com

Tektronix Inc.
Beaverton, OR
www.tek.com

Teledyne Cougar
Sunnyvale, CA
www.cougarcorp.com

Teledyne Defence Limited
Yorkshire, UK
www.teledynedefence.co.uk

Teledyne Electronic Manufacturing Services
Lewisburg, TN
www.teledynelewisburg.com

Teledyne KW Microwave
Poway, CA
www.teledynekwmicrowave.com

Teledyne MEC
Rancho Cordova, CA
www.teledyne-mec.com

Teledyne Microelectronic Technologies
Los Angeles, CA
www.teledynemicro.com

Teledyne Microwave
Mountain View, CA
www.teledynemicrowave.com

Teledyne Relays
Hawthorne, CA
www.teledynerelays.com

Teledyne Reynolds
Los Angeles, CA
www.teledynereynolds.com

Teledyne Scientific and Imaging
Thousand Oaks, CA
www.teledyne-si.com

Teledyne Solutions
Huntsville, AL
www.teledynesolutions.com

Teledyne Storm Products
Woodridge, IL
www.stormproducts.com

Teleplan AS
Lysaker, Norway
www.teleplan.no

COMPANY LISTING

TERMA A/S
Lystrup, Denmark
www.terma.com

Textron Defense Systems
Wilmington, MA
www.textrondefense.com

Thales Aerospace
Elancourt, France
www.thalesgroup.com

Thales Electron Devices
Velizy Villaoublay, France
www.thalesgroup.com

Thales Land & Joint Systems
Paris, France
www.thalesgroup.com

Thermacore
Lancaster, PA
www.thermacore.com

THERMAX
Indianapolis, IN
www.thermaxcdt.com

TIL Defense Systems
Ptakh Kitva, Israel
www.til.co.il

Times Microwave Systems
Wallingford, CT
www.timesmicrowave.com

TINEX AS
Haslum, Norway
www.tinex.no

TMD Technologies Ltd
Hayes, Middlesex, UK
www.tmd.co.uk

Top Aces
Point Claire, Quebec, Canada
www.topaces.ca

Total Aircraft Services, Inc. An IKHANA Group Company
Van Nuys, CA
www.tasaircraft.com

TRAK Microwave
Tampa, FL
www.trak.com

Toyon Research Corporation
Goleta, CA
www.toyon.com

Triasys Technologies
Chelmsford, MA
www.triasystech.com

TriQuint Semiconductor, Inc.
Hillsboro, OR
www.triquint.com

Triton Services Inc.
Electron Technology Division
Easton, PA
www.tritonetd.com

Trival Antene D.O.O.
Kamnik, Slovenia
www.trival-antennas-masts.com

TRU Corporation
Peabody, MA
www.trucorporation.com

U

UB Corp.
Tampa, FL
www.ubcorp.com

Ultra Electronics
Avalon Systems
Maswon Lakes, SA Australia
www.avalon.com.au

Ultra Electronics Telemus
Ottawa, Ontario, Canada
www.ultra-telemus.com

U.S. Dynamics Corporation
Amityville, NY
http://usdynamicscorp.com

V

Varilog Research, Inc
Beltsville, MD
www.varilog.com

Viasat
Carlsbad, CA
www.viasat.com

Vicor Corporation
Andover, MA
vicorpower.com

Virtualabs srl
Rome, Italy
www.virtualabs.it

W

Wallop Defence Systems Ltd.
Middle Wallop, Hampshire, UK
www.wallopdefence.co.uk

Wang Electro-Opto Corp.
Marietta, GA
www.weo.com

Wavepoint Research, Inc.
Newburgh, IN
www.wavepointresearch.com

Werlatone, Inc.
Brewster, NY
www.werlatone.com

Wide Band Systems Inc.
Rockaway, NJ
widebandsystems.com

Wideband Systems Inc.
Data Recorders
Silver Spring, MD
www.wideband-sys.com

Wyle Laboratories, Inc.
Aerospace Group
Lexington, MD
www.wylelabs.com

X

X-COM Systems, LLC
Reston, VA
www.xcomsystems.com

Z

Z Microsystems, Inc.
San Diego, CA
www.zmicro.com

Zeta Associates
Support to Military Operations
Fairfax, VA
www.zetamilops.com

CATEGORY INDEX

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RF MICROWAVE COMPONENTS & SUBSYSTEMS

Antennas/Arrays

AMT Microwave Corp.
Applied EM Inc.
Chengdu SIWI Electronic Co., Ltd
Cobham Antenna Systems - Marlow, Chelton Ltd.
Cobham Sensor Systems - Baltimore, Nurad Technologies
Cobham Sensor Systems - Bolton, Atlantic Microwave
Cobham Sensor Systems - Exeter, Continental Microwave
Cobham Sensor Systems - Lansdale, Sensor and Antenna Systems
Cobham Sensor Systems - Lowell, M/A COM
Defence Research and Development Canada
DRS Codem System, Inc
Elisra
ET Industries
ETS-Lindgren
European Antennas
First RF Corp
Fractal Antenna Systems
FS Antennentechnik GmbH
HUBER+SUHNER – North America
HUBER+SUHNER AG
IFI - Instruments for Industry Inc.
ITAS A/S
ITT Antenna Products and Technologies
ITT Communications Systems
ITT Corporation – Reconnaissance and Surveillance Systems
ITT Corporation, CS – Antenna Products & Technologies
ITT Electronic Systems - Reconnaissance and Surveillance Systems
JEM Engineering
L-3 Communications – Randtron Antenna Systems
L-3 Communications, ESSCO
L-3 Communications, Linkabit
L-3 Communications, Narda Microwave-East
Link Microtek
Lockheed Martin, MS2
Medav Gmbh
Micronetixx, P.A.
Microsemi Corporation
Microwave Engineering Corp.
Nuvotronics LLC
Ocean Microwave Corp.
Orbit Communication Systems, Inc.
PCTEL Inc., Antenna Products
Pharad, LLC
PLATH GmbH
Poynting Antennas (Pty) Ltd.
Q-par Angus Ltd
QuinStar Technology, Inc.
Radio Reconnaissance Technologies
Raven Research
RFCore Co, Ltd.
Rohde & Schwarz GmbH Ko KG
ROKE MANOR RESEARCH LTD
Saab Avitronics
SKY Computers Inc.
Southwest Research Institute
TCI International
TECOM Industries
Trival Antene D.O.O.
UB Corp.
Wang Electro-Opto Corp.

Antenna Mounts/ Support Structures

HUBER+SUHNER – North America
ITT Corporation, CS – Antenna Products & Technologies
L-3 Communications – Randtron Antenna Systems
SKY Computers Inc.
TECOM Industries
Total Aircraft Services, Inc. An IKHANA Group Company

Antenna Radomes

Cobham Antenna Systems - Marlow, Chelton Ltd.
Cobham Sensor Systems - Baltimore, Nurad Technologies
Cobham Sensor Systems - Lansdale, Sensor and Antenna Systems
HUBER+SUHNER – North America
HUBER+SUHNER AG
ITT Corporation, CS – Antenna Products & Technologies
L-3 Communications – Randtron Antenna Systems
L-3 Communications, ESSCO
Orbit Communication Systems, Inc.
Q-par Angus Ltd
SKY Computers Inc.
TECOM Industries
Total Aircraft Services, Inc. An IKHANA Group Company

Active RF Components

Advanced Control Components Inc.
Aeroflex, Microelectronic Systems
Aeroflex Test Solutions
Anaren
CAP Wireless
Ceralta Technologies – Sage Laboratories
Cobham Sensor Systems - Lansdale, Sensor and Antenna Systems
Crane Aerospace & Electronics
DELTA MICROWAVE
EM Research
ET Industries
Hittite Microwave
IZT GmbH
Jabil Defense and Aerospace Services
Jersey Microwave
KOR
L-3 Communications, Electron Technologies, Inc.
LNX Corporation
Lockheed Martin, MS2
Mica Microwave
Microsemi Corporation
MITEQ
Pole/Zero Corporation
Protium Technologies, Inc.
Rodelco Electronics Corp.
ROKE MANOR RESEARCH LTD
TEK Microsystems, Inc.
Teledyne Cougar
Times Microwave Systems
TRAK Microwave
U.S. Dynamics Corporation

Analog-to-Digital Converters

Analog Devices Inc
Curtiss-Wright Controls Embedded Computing
Digital-to-Analog Converters
Intersil
iVeia, LLC
KOR
Lockheed Martin, MS2
Mercury Computing Systems
Microwave Concepts (Micro-Con)
National Semiconductor
Pentek
Protium Technologies, Inc.
Red Rapids
SpectrumControl, Inc. - Spectrum Microwave, Inc.
TEK Microsystems, Inc.
X-COM Systems, LLC

Digital-to-Analog Converters

Analog Devices Inc
Crane Aerospace & Electronics
Curtiss-Wright Controls Embedded Computing
iVeia, LLC
KOR
Lockheed Martin, MS2
Microwave Concepts (Micro-Con)
Pentek
Protium Technologies, Inc.
Red Rapids
SpectrumControl, Inc. - Spectrum Microwave, Inc.
TEK Microsystems, Inc.
X-COM Systems, LLC

Semiconductor Integrated Circuits

Crane Aerospace & Electronics
Hittite Microwave

Digital Signal Processors

Altera Corporation
Analog Devices Inc
BittWare
Curtiss-Wright Controls Embedded Computing
Eclipse Electronic Systems, Inc.
ITAS A/S
iVeia, LLC
Pentek
Protium Technologies, Inc.
RF Engines Ltd
ROKE MANOR RESEARCH LTD
Signatec
SKY Computers Inc.
TEK Microsystems, Inc.

ASICs

LNX Corporation
Roke Manor Research Ltd

FPGAs

Altera Corporation
BittWare
Eclipse Electronic Systems, Inc.
iVeia
iVeia, LLC
KOR
Nallatech, Inc.
Red Rapids
ROKE MANOR RESEARCH LTD
TEK Microsystems, Inc.

Frequency Converters

Anaren
Cobham Sensor Systems – Defense Systems
Crane Aerospace & Electronics
DELTA MICROWAVE
DRS Technologies
Elcom Technologies
EM Research
Herley-CTI, Inc
IZT GmbH
Jersey Microwave
K&L Microwave, Inc.
KMIC Technology, Inc.
LNX Corporation
Microwave Concepts (Micro-Con)
MITEQ
Planar Electronics Technology
Protium Technologies, Inc.
Red Rapids
TRAK Microwave

Frequency Synthesizers

AAI Corporation
Aeroflex Test Solutions
Analog Devices Inc
Anritsu
Cobham Sensor Systems - Lowell, M/A COM
DRS Technologies
Elcom Technologies
EM Research
Herley General Microwave Israel
Herley-CTI, Inc
ITT - Advanced Engineering & Sciences, Microwave Systems
IZT GmbH
LNX Corporation
MITEQ
Novatech Instruments
Phase Matrix
Planar Electronics Technology
Protium Technologies, Inc.
RFCore Co, Ltd.
Rodelco Electronics Corp.
Sivers IMA AB
Teledyne Microwave
TRAK Microwave
Wide Band Systems Inc.

Oscillators

Analog Devices Inc
Cobham Sensor Systems - Lowell, M/A COM
Communications & Power Industries, Inc (CPI), Beverly Microwave Division
Crane Aerospace & Electronics
EM Research
Giga-tronics Incorporated
Herley Farmingdale
Herley General Microwave Israel
Herley-CTI, Inc
Hittite Microwave
IZT GmbH
Jersey Microwave
Micronetics, Inc., VCO Division
Microsemi Corporation
MITEQ
OEwaves
Pascall Electronics Limited
Phase Matrix
Protium Technologies, Inc.
QuinStar Technology, Inc.
RF Micro Devices
RFCore Co, Ltd.
Sivers IMA AB
SpectrumControl, Inc. - Spectrum Microwave, Inc.
TRAK Microwave

Low Noise Amplifiers

Aethercomm
AML Communications Inc.
Amplifier Solutions Corp
AmpliTech
CAP Wireless
Ciao Wireless, Inc.
Cobham Sensor Systems - Lowell, M/A COM
Communications & Power Industries, Inc (CPI), Beverly Microwave Division
CTT, Inc.
Curtiss-Wright Controls Electronic Systems

- DELTA MICROWAVE
- Endwave Corp.
- Giga-tronics Incorporated
- Herotek, Inc
- Hittite Microwave
- Jersey Microwave
- K&L Microwave, Inc.
- Keragis
- KMIC Technology, Inc.
- L-3 Communications, Narda Microwave-West
- Microsemi Corporation
- Microwave Communications Laboratories
- Microwave Concepts (Micro-Con)
- MITEQ
- Pascall Electronics Limited
- Planar Electronics Technology
- Planar Monolithics
- Pole/Zero Corporation
- Protium Technologies, Inc.
- QuinStar Technology, Inc.
- RF Micro Devices
- Rodelco Electronics Corp.
- ROKE MANOR RESEARCH LTD
- SpectrumControl, Inc. - Spectrum Microwave, Inc.
- Teledyne Cougar
- Teledyne KW Microwave
- Teledyne Microwave
- TRAK Microwave
- TriQuint Semiconductor, Inc.
- U.S. Dynamics Corporation

Passive RF Components

- Aeroflex, Microelectronic Systems
- Aeroflex Test Solutions
- AKON, Inc.
- American Microwave Corporation
- Analog Devices Inc
- Anaren
- Anritsu
- Ceralta Technologies – Sage Laboratories
- Cobham Sensor Systems - Exeter, Continental Microwave
- Cobham Sensor Systems - Lowell, M/A COM
- Cobham Sensor Systems - San Diego, Remec Defense and Space
- Coleman Microwave Company
- DELTA MICROWAVE
- Dow-Key Microwave
- Ducommun Technologies
- Endwave Corp.
- ET Industries
- Herley Farmingdale
- Herley New England
- Herotek, Inc
- Hittite Microwave
- Honeywell Aerospace
- HUBER+SUHNER – North America
- HUBER+SUHNER AG
- Jabil Defense and Aerospace Services
- K&L Microwave, Inc.
- L-3 Communications, Narda Microwave-East
- L-3 Communications, Narda Microwave-West
- Link Microtek
- LNX Corporation
- Lockheed Martin, MS2
- Lorch Microwave
- MECA Electronics
- MegaPhase RF
- MESL Microwave
- Mica Microwave
- Micronetics, Inc., Noise and Test Division
- MicroPhase Corp
- Microsemi Corporation
- Microwave Communications Laboratories
- Microwave Engineering Corp.
- MITEQ
- Nuvotronics LLC
- PA&E
- Pascall Electronics Limited
- Picosecond Pulse Labs
- Planar Monolithics
- QuinStar Technology, Inc.
- Raven Research
- Renaissance Electronics Corporation
- RF Micro Devices
- RH Laboratories
- Rodelco Electronics Corp.
- ROKE MANOR RESEARCH LTD
- SpectrumControl, Inc. - Spectrum Microwave, Inc.
- Superconductor Technologies Inc.
- Teledyne Cougar
- Teledyne KW Microwave
- Teledyne Microwave
- Teledyne Relays
- U.S. Dynamics Corporation

Converters and Mixers

- Anaren
- Anritsu
- CAP Wireless
- Ceralta Technologies – Sage Laboratories
- Cobham Sensor Systems - Lowell, M/A COM
- Communications & Power Industries, Inc (CPI), Beverly Microwave Division
- DELTA MICROWAVE
- EM Research
- Hittite Microwave
- Jersey Microwave
- KMIC Technology, Inc.
- LNX Corporation
- Mica Microwave
- Microsemi Corporation
- MITEQ
- Protium Technologies, Inc.
- QuinStar Technology, Inc.
- RH Laboratories
- Rodelco Electronics Corp.
- Teledyne Cougar

Couplers

- Anaren
- Ceralta Technologies – Sage Laboratories
- Cobham Sensor Systems - Lowell, M/A COM
- Cobham Sensor Systems - San Diego, Remec Defense and Space
- DELTA MICROWAVE
- DynaWave Inc
- ET Industries
- HUBER+SUHNER AG
- K&L Microwave, Inc.
- L-3 Communications, Narda Microwave-East
- MECA Electronics
- MESL Microwave
- Microwave Communications Laboratories
- Microwave Engineering Corp.
- MITEQ
- Nuvotronics LLC
- Planar Monolithics
- Precision Connector
- Raven Research
- RF Industries
- RF Micro Devices
- Southwest Microwave
- Werlatone, Inc.

Fiber-Optic Cable

- HUBER+SUHNER AG

Fiber-Optic Connectors

- HUBER+SUHNER – North America
- HUBER+SUHNER AG
- PA&E

Filters and Diplexers

- AKON, Inc.
- Anatech Electronics
- Ceralta Technologies – Sage Laboratories
- Cobham Sensor Systems - San Diego, Remec Defense and Space
- Coleman Microwave Company
- DELTA MICROWAVE
- Endwave Corp.
- ET Industries
- HUBER+SUHNER AG
- KMIC Technology, Inc.
- L-3 Communications, Narda Microwave-West
- Link Microtek
- Lorch Microwave
- MECA Electronics
- MESL Microwave
- Micronetixx, P.A.
- MicroPhase Corp
- Microwave Communications Laboratories
- Microwave Engineering Corp.
- Nuvotronics LLC
- OEwaves
- Picosecond Pulse Labs
- Pole/Zero Corporation
- Power Dividers/Combiners
- QuinStar Technology, Inc.
- Raven Research
- Rodelco Electronics Corp.
- Superconductor Technologies Inc.
- Teledyne KW Microwave
- Teledyne Microwave

Power Dividers/Combiners

- AKON, Inc.
- Anaren
- Anatech Electronics
- Ceralta Technologies – Sage Laboratories
- Cobham Sensor Systems - Lowell, M/A COM
- DELTA MICROWAVE
- Empower RF Systems, Inc.
- ET Industries
- HUBER+SUHNER – North America
- HUBER+SUHNER AG
- K&L Microwave, Inc.
- L-3 Communications, Narda Microwave-East
- L-3 Communications, Narda Microwave-West
- LNX Corporation
- MECA Electronics
- Micronetixx, P.A.
- Microwave Communications Laboratories
- Microwave Concepts (Micro-Con)
- Microwave Engineering Corp.
- MITEQ
- Nuvotronics LLC
- Planar Monolithics
- Renaissance Electronics Corporation
- Teledyne Cougar
- Werlatone, Inc.

RF Absorptive Materials/ Shielding

- ARC Technologies
- Cuming Microwave Corporation
- ETS-Lindgren

RF Cables/Cable Assemblies

- Anatech Electronics
- Ceralta Technologies – Sage Laboratories
- FLEXCO Microwave
- HUBER+SUHNER – North America
- HUBER+SUHNER AG
- IW Microwave
- MECA Electronics
- MegaPhase, LLC
- Micro-Coax, Inc
- RF Industries
- RF Logic
- Teledyne Reynolds
- Teledyne Storm Products
- THERMAX
- Times Microwave Systems
- TRU Corporation

Thermal Management Solutions

- PA&E
- SprayCool
- Thermacore

Waveguides

- Anatech Electronics
- Cobham Sensor Systems - Exeter, Continental Microwave
- Dow-Key Microwave
- HUBER+SUHNER – North America
- HUBER+SUHNER AG
- K&L Microwave, Inc.
- Keragis
- L-3 Communications, Narda Microwave-East
- Link Microtek
- MESL Microwave
- Micronetixx, P.A.
- Microwave Communications Laboratories
- Microwave Engineering Corp.
- Nuvotronics LLC
- PA&E

Digital Frequency Discriminators

- AKON, Inc.
- Anaren
- Ceralta Technologies – Sage Laboratories
- CSIR – DPSS
- LNX Corporation
- MITEQ
- Protium Technologies, Inc.
- RFCore Co, Ltd.
- ROKE MANOR RESEARCH LTD
- Teledyne Defence Limited
- Wide Band Systems Inc.

Digital RF Memories

- Anaren
- CSIR – DPSS
- Herley Micro Systems
- Jordan Electronic Logistic Support – Electronic Warfare
- KOR
- LNX Corporation
- MC Countermeasures Inc
- Saab Avitronics
- Systems & Processes Engineering Corp.
- TEK Microsystems, Inc.
- X-COM Systems, LLC

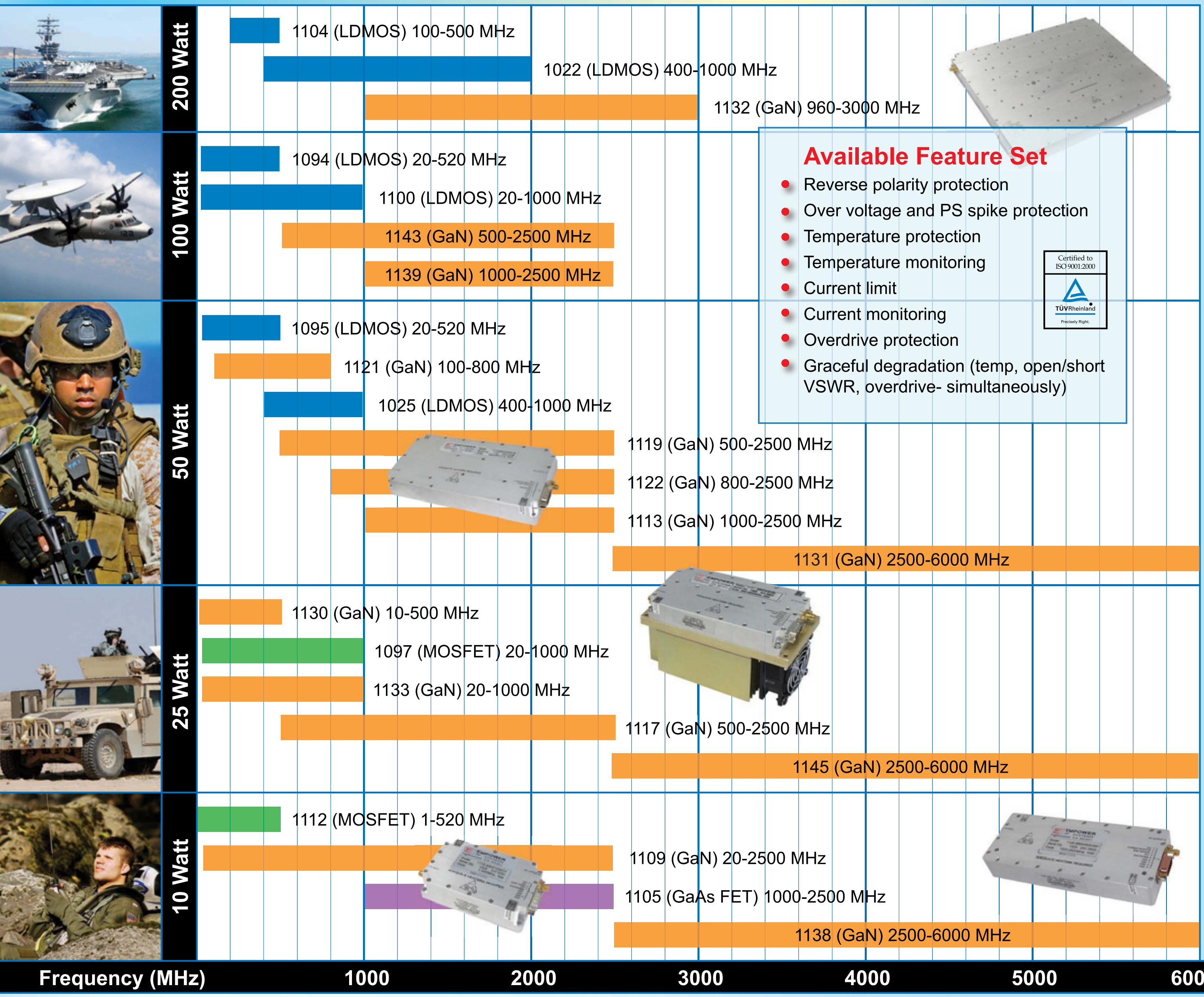
Integrated Microwave Assemblies

- AML Communications Inc.
- Cobham Sensor Systems - San Diego, Remec Defense and Space
- Endwave Corp.
- Herley Farmingdale
- Herley General Microwave Israel
- Herley New England
- ITT - Advanced Engineering & Sciences, Microwave Systems
- Jabil Defense and Aerospace Services
- LaBarge, Inc
- Lorch Microwave
- Maxtek
- MicroPhase Corp
- Microsemi Corporation

Sentry Series PA Module Selection Guide

Broadband Defense Applications

GaN 🟧
LDMOS 🟦
MOSFET 🟩
GaAs FET 🟪



Available Feature Set

- Reverse polarity protection
- Over voltage and PS spike protection
- Temperature protection
- Temperature monitoring
- Current limit
- Current monitoring
- Overdrive protection
- Graceful degradation (temp, open/short VSWR, overdrive- simultaneously)

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- Rack mount amplifiers
- Multi-function PA assemblies

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Planar Monolithics
RFCore Co, Ltd.
Rodelco Electronics Corp.
Saab Avitronics
SpectrumControl, Inc. - Spectrum Microwave, Inc.
Technograph Microcircuits Ltd
Teledyne Cougar
Teledyne Electronic Manufacturing Services
Teledyne Microelectronic Technologies
Teledyne Microwave
U.S. Dynamics Corporation

RF Receivers

Agilent Technologies
AKON, Inc.
AMESYS
Argon ST
BEL - Bharat Electronics Ltd
Cobham Sensor Systems – Defense Systems
Cobham Sensor Systems - Lansdale, Sensor and Antenna Systems
Communications & Power Industries, Inc (CPI), Beverly Microwave Division
Communications Audit UK Limited
Cubic Defense Systems
Digital Receiver Technology
DRS Technologies
D-TA Systems
Eclipse Electronic Systems, Inc.
Elcom Technologies
GE Fanuc Embedded Systems
ITAS A/S
ITT Electronic Systems, Integrated EW Systems
IZT GmbH
Jersey Microwave
L-3 Communications, Linkabit
LNX Corporation
MC Countermeasures Inc
Medav Gmbh
Mercury Computer Systems
Microwave Concepts (Micro-Con)
Mid-Atlantic RF Systems
MITEQ
OEwaves
PLATH GmbH
Plextek Ltd
Protium Technologies, Inc.
Radio Reconnaissance Technologies
Raven Research
Red Rapids
RF Engines Ltd
RFCore Co, Ltd.
Rohde & Schwarz GmbH Ko KG
ROKE MANOR RESEARCH LTD
Saab Avitronics
Spectrum Signal Processing
Tampa Microwave
TCI International
Teledyne Defence Limited
Teledyne Microwave
Wide Band Systems Inc.
X-COM Systems, LLC

RF Tuners

Agilent Technologies
AKON, Inc.
Cobham Sensor Systems – Defense Systems
Communications Audit UK Limited
DRS Technologies
Eclipse Electronic Systems, Inc.
Elcom Technologies
FS Antennentechnik GmbH
ITAS A/S
IZT GmbH
LNX Corporation
Medav Gmbh
Mid-Atlantic RF Systems
MITEQ
PLATH GmbH
Protium Technologies, Inc.
Raven Research
Red Rapids
Rockwell Collins – Electronic Warfare and Intelligence Solutions
ROKE MANOR RESEARCH LTD
Teledyne Defence Limited

Signal Conditioners

Curtiss-Wright Controls Electronic Systems
DRS Technologies
LNX Corporation
Pole/Zero Corporation
Protium Technologies, Inc.
Teledyne Defence Limited

Displays

BARCO
Curtiss-Wright Controls Electronic Systems
L-3 Communications, Display Systems
L-3 Communications, Electronic Systems
Lockheed Martin, Systems Integration Owego
Meggitt Avionics
Overwatch
Precision Display Technologies
Z Microsystems, Inc. - Aerospace Group

Power Amplifiers

Aethercomm
AML Communications Inc.
BC Systems, Inc
CAP Wireless
Cobham Sensor Systems - Lansdale, Sensor and Antenna Systems
Comtech Telecommunications – Comtech PST
CTT, Inc.
Curtiss-Wright Controls Electronic Systems
dB Control
Empower RF Systems, Inc.
ETM Electromatic Inc.
Herley Power Amplifier Systems
IFI - Instruments for Industry Inc.
IZT GmbH
Keragis
KMIC Technology, Inc.
L-3 Communications, Applied Technologies
L-3 Communications, Electron Device Division
L-3 Communications, Electron Technologies, Inc.
L-3 Communications, Narda Microwave-West
LNX Corporation
Microsemi Corporation
Mid-Atlantic RF Systems
MITEQ
NEC Microwave Tube, Ltd.
Nuvotronics LLC
OPHIR RF
Planar Monolithics
Pole/Zero Corporation
Protium Technologies, Inc.
Quarterwave Corp.
RFCore Co, Ltd.
Rodelco Electronics Corp.
ROKE MANOR RESEARCH LTD
Stealth Microwave, Inc
Teledyne Microwave
Thales Electron Devices
TMD Technologies Ltd
TriQuint Semiconductor, Inc.

TWTs

Communications & Power Industries, Inc (CPI), Microwave Power Products
dB Control
e2v – Defence
L-3 Communications, Electron Device Division
L-3 Communications, Electron Technologies, Inc.
MITEQ
NEC Microwave Tube, Ltd.
Stealth Microwave, Inc
Teledyne MEC
Thales Electron Devices
TMD Technologies Ltd
Triton Services Inc. – Electron Technology Division

TWT Assemblies

Cobham Sensor Systems - Lansdale, Sensor and Antenna Systems
Communications & Power Industries, Inc (CPI), Beverly Microwave Division
Communications & Power Industries, Inc (CPI), Microwave Power Products
dB Control
e2v – Defence
ETM Electromatic Inc.
IFI - Instruments for Industry Inc.
L-3 Communications, Electron Device Division
L-3 Communications, Electron Technologies, Inc.
MITEQ
NEC Microwave Tube, Ltd.
Quarterwave Corp.
Teledyne MEC
Thales Electron Devices
TMD Technologies Ltd
Triton Services Inc. – Electron Technology Division

MPM Modules

Communications & Power Industries, Inc (CPI), Beverly Microwave Division
dB Control
e2v – Defence
L-3 Communications, Electron Device Division
L-3 Communications, Electron Technologies, Inc.
NEC Microwave Tube, Ltd.
Stealth Microwave, Inc
Thales Electron Devices
TMD Technologies Ltd
Triton Services Inc. – Electron Technology Division

GaN Power Amplifiers

Aethercomm
BC Systems, Inc
CAP Wireless
Comtech Telecommunications – Comtech PST
Empower RF Systems, Inc.
Keragis
KMIC Technology, Inc.
L-3 Communications, Electron Device Division
Nitronex
OPHIR RF
RFCore Co, Ltd.
Stealth Microwave, Inc
TriQuint Semiconductor, Inc.

Power Supplies

BC Systems, Inc

Data Recorders

Agilent Technologies
Ampex Data Systems
Annapolis Micro Systems, Inc.
Avalon Electronics, Inc.
Avalon Electronics, Inc.
Curtiss-Wright Controls Electronic Systems
DRS Signal Recording Technologies
DRS Technologies
DSPCon, Inc.
eonic B.V
Goodrich Corp. - Sensors and Integrated Systems
Goodrich Sensors and Integrated Systems – Digital Data Systems
IZT GmbH
L-3 Communications, Communication Systems-East
L-3 Communications, Electrodynamics
L-3 Communications, Targa Systems
Rising Edge Technologies
ROKE MANOR RESEARCH LTD
Scientific Research Corporation - Integrated Systems and Solutions
Shogi Communications Ltd.
Signatec
Sypris Data Systems
TEK Microsystems, Inc.
Wideband Systems Inc. (Data Recorders)
X-COM Systems, LLC

Signal Analysis Systems

Agilent Technologies
Annapolis Micro Systems, Inc.
Cobham Sensor Systems – Defense Systems
Crane Aerospace & Electronics
Curtiss-Wright Controls Electronic Systems
DRS Technologies
Innovative Signals Technology (ISigTech)
ITAS A/S
IZT GmbH
Overwatch
ROKE MANOR RESEARCH LTD
SKY Computers Inc.
Southwest Research Institute
TEK Microsystems, Inc
X-COM Systems, LLC

TEST EQUIPMENT

Oscilloscopes

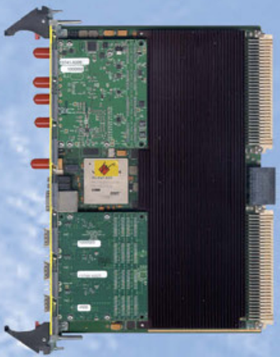
Agilent Technologies
Giga-tronics Incorporated
Tektronix Inc.

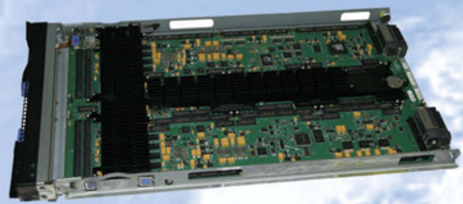
Signal Generators

Aeroflex Test Solutions
Agilent Technologies
Anritsu
Giga-tronics Incorporated
Hittite Microwave
IZT GmbH
Micronetics, Inc., Noise and Test Division
Novatech Instruments
Phase Matrix
Tektronix Inc.
Tektronix Inc.
Varilog Research, Inc

Spectrum Analyzers

Aeroflex Test Solutions
Agilent Technologies
Anritsu
DSPCon, Inc.
Giga-tronics Incorporated
IZT GmbH
RF Engines Ltd
Tektronix Inc.





Power Meters

Aeroflex Test Solutions
Agilent Technologies
Anritsu
Giga-tronics Incorporated
L-3 Communications, Narda Microwave-East
Micronetics, Inc., Noise and Test Division

Network Analyzers

Agilent Technologies
Anritsu
Giga-tronics Incorporated

Automatic Test Equipment

AAI Corporation
Aeroflex Test Solutions
Agilent Technologies
Astronics DME Corporation
Chemring Energetics Division – Technical Ordinance
Curtiss-Wright Controls Electronic Systems
ETM Electromatic Inc.
Giga-tronics Incorporated
HUBER+SUHNER AG
INDRA
IZT GmbH
Mass Consultants Limited
MES S.p.A.
Patria Aviation Oy
Rodale Electronics Inc
RUAG – Aerospace
Viasat

EO/IR COMPONENTS AND SUBSYSTEMS

IR Detectors

L-3 Communications, Infrared Products
Lockheed Martin, MS2
Teledyne Scientific and Imaging

Optical Filters

Barr Associates, Inc.

Fine-Track Sensors

Defense Research Associates, Inc.
ElectroOptic Industries Ltd.
General Dynamics, Advanced Information Systems
SKY Computers Inc.

Lasers (IR Countermeasures)

ElectroOptic Industries Ltd.
Lockheed Martin Aculight
Teledyne Microelectronic Technologies

IRCM Transmitter Assemblies

ElectroOptic Industries Ltd.
ETM Electromatic Inc.
SELEX Galileo

EW/SIGINT SYSTEMS

Radar Warning Receivers

AKON, Inc.
BAE SYSTEMS Australia
BAE Systems, Electronics, Intelligence & Support (EIS)
BEL - Bharat Electronics Ltd
DRS Technologies
EADS Defence & Security – Defense Electronics – Protection
Elcom Technologies
Elettronica SpA
ELTA Systems Ltd
INDRA
ITT Electronic Systems, Integrated EW Systems
Lockheed Martin, MS2
Lockheed Martin, Systems Integration Owego
MIKES Microwave Electronics Systems Inc.
My-konsult
Northrop Grumman Corporation - Defensive Systems Division
OEwaves
Rafael - Systems Division
Raytheon – Electronic Warfare Systems
Saab Avitronics
SELEX Galileo
SRC/SRCTec
Tata Power Strategic Electronics Division
Teledyne Defence Limited
Thales Aerospace

ESM Systems

Aeronix
Airborne Tactical Advantage Company
AMESYS
Argon ST
BAE SYSTEMS Australia
BAE Systems, Electronics, Intelligence & Support (EIS)
BEL - Bharat Electronics Ltd
Defence Research and Development Canada
DRS Technologies
EADS Defence & Security – Defense Electronics – Protection
Eclipse Electronic Systems, Inc.
Elettronica SpA
General Dynamics, Advanced Information Systems
Genesis EW
INDRA
ITT Corporation – Reconnaissance and Surveillance Systems
ITT Electronic Systems, Integrated EW Systems
ITT Electronic Systems, Reconnaissance and Surveillance Systems
Lockheed Martin, IS&GS - Gaithersburg
Lockheed Martin, MS2
Lockheed Martin, Systems Integration Owego
MIKES Microwave Electronics Systems Inc.
My-konsult
Northrop Grumman Corporation - Defensive Systems Division
Northrop Grumman Corporation, Aerospace Systems
Rafael - Systems Division
Raytheon – Electronic Warfare Systems
Rheinmetall Defence
ROKE MANOR RESEARCH LTD
Saab Avitronics
SELEX Galileo
Sierra Nevada Corp. - Sensor Systems & Technologies
Tata Power Strategic Electronics Division
Teledyne Defence Limited
Thales Aerospace
Ultra Electronics - Avalon Systems
Ultra Electronics Telemus
Virtualabs srl

The perfect synthesis of low noise, speed, and wide bandwidth

- Wide bandwidth:
  10 MHz to 40.96 GHz
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- 1-Hz full-band coherent switching
- Low phase noise:
  -120 dBc/Hz, typical at 10-kHz offset at 10 GHz
- Harmonic filters
- 200-ns switching speed available
- Industry-standard BCD programming
- Locks to an external or internal reference
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  FM, Pulse, I&Q
- Four FM modes
- Digital frequency sweep
- Digital attenuator option
- Touch screen front-panel display
- Low-profile chassis or compact modular package configurations
- 2U height configurations available
- IEEE-488, GPIB & Ethernet capability
- Universal AC Supply

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Series DS Direct Synthesizer

With ultra-low phase noise that rivals premium fixed-frequency sources, the DS Series offers very fast switching, extremely broad bandwidth in a single unit, and step sizes down to 1 Hz. Get the performance, speed, and flexibility you need for radar, RCS, EW, simulators, automatic test equipment, and frequency-agile equipment. Plus, 1-Hz coherent switching allows improved signature measurements.

For direct synthesizers, count on Herley for performance, reliability, service, and delivery.

For more information or to speak to a marketing representative, call 973-884-2580. Or e-mail us at sales@herley-cti.com.

Frequency Range (MHz)	Phase Noise (dBc/Hz)				
	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
10 GHz	-90	-110	-120	-120	-130
18 GHz	-84	-104	-114	-114	-124
40 GHz	-77	-97	-107	-107	-117

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Radar Jammers

Airborne Tactical Advantage Company
ATK Mission Systems
BAE Systems, Electronics, Intelligence & Support (EIS)
BEL - Bharat Electronics Ltd
Comtech Telecommunications – Comtech PST
EADS Defence & Security – Defense Electronics – Protection
Elettronica SpA
ELTA Systems Ltd
ETM Electromatic Inc.
INDRA
ITT Corporation – Reconnaissance and Surveillance Systems
ITT Electronic Systems, Integrated EW Systems
ITT Electronic Systems, Reconnaissance and Surveillance Systems
Lockheed Martin, MS2
MC Countermeasures Inc
MIKES Microwave Electronics Systems Inc.
My-konsult
Northrop Grumman Corporation - Defensive Systems Division
Northrop Grumman Corporation, Aerospace Systems
QinetiQ Ltd
Rafael - Systems Division
Raytheon – Electronic Warfare Systems
Rodale Electronics Inc
ROKE MANOR RESEARCH LTD
Saab Avitronics
SELEX Galileo
Tata Power Strategic Electronics Division
Thales Aerospace
Ultra Electronics Telemus
Virtualabs srl

RF Towed Decoys

BAE Systems, Electronics, Intelligence & Support (EIS)
EADS Defence & Security – Defense Electronics – Protection
Rafael - Systems Division
Raytheon – Electronic Warfare Systems
SELEX Galileo
Thales Aerospace

EW Suite Managers/Controllers

TERMA A/S
Selex Galileo

Maneuvering Air Launched Decoys

IMI - Israel Military Industries
Raytheon Missile Systems

Passive Missile Warning Systems

ATK Mission Systems
BAE Systems, Electronics, Intelligence & Support (EIS)
DRS Technologies
EADS Defence & Security – Defense Electronics – Protection
L-3 Communications, Cincinnati Electronics
Lockheed Martin, Missiles and Fire Control
MBDA
Northrop Grumman Corporation - Defensive Systems Division
Raytheon – Electronic Warfare Systems
Saab Avitronics

Active (Pulse Doppler) Missile Warning Systems

ELTA Systems Ltd
SELEX Galileo
Thales Aerospace

Laser Warning Systems

EADS Defence & Security – Defense Electronics – Protection
ELTA Systems Ltd
Goodrich ISR Systems
Rheinmetall Defence
Saab Avitronics
SELEX Galileo

EO/IR Jammers

BAE Systems, Electronics, Intelligence & Support (EIS)
Diehl BGT Defence GmbH & Co. KG
EADS Defence & Security – Defense Electronics – Protection
ElectroOptic Industries Ltd.
INDRA
ITT Electronic Systems, Integrated EW Systems
Lockheed Martin, MS2 - Akron
Northrop Grumman Corporation - Defensive Systems Division
Rafael - Systems Division
Raytheon Missile Systems
SELEX Galileo

Airborne Decoy Dispensers

BAE Systems, Electronics, Intelligence & Support (EIS)
Chemring Energetics Division – Technical Ordinance
EADS Defence & Security – Defense Electronics – Protection
IMI - Israel Military Industries
Lockheed Martin, MS2
MBDA
Meggitt Defense Systems
Raytheon – Electronic Warfare Systems
Rodale Electronics Inc
Saab Avitronics
SELEX Galileo
Symetrics Industries
TERMA A/S

Naval Decoy Dispensers

Airborne Systems Limited
BAE SYSTEMS Australia
Chemring Energetics Division – Technical Ordinance
EADS Defence & Security – Defense Electronics – Protection
Lacroix Defense and Security
Lockheed Martin, MS2
Rafael - Systems Division
Rheinmetall Defence
Sagem Defense Securite
SELEX Sistemi Integrati
TERMA A/S
Wallop Defence Systems Ltd.

Airborne Chaff Countermeasures

Chemring Countermeasures Ltd
Chemring Energetics Division – Technical Ordinance
EADS Defence & Security – Defense Electronics – Protection
Esterline Defense Group
IMI - Israel Military Industries
Kilgore Flares Company, LLC
Lacroix Defense and Security
MES S.p.A.
Rheinmetall Defence – Protection Systems Division
Wallop Defence Systems Ltd.

Naval Chaff Countermeasures

Chemring Countermeasures Ltd
Chemring Energetics Division – Technical Ordinance
Kilgore Flares Company, LLC
Lacroix Defense and Security
Rheinmetall Defence
Wallop Defence Systems Ltd.

Airborne IR Decoys/ Countermeasures Flares

Alloy Surfaces, Inc.
ATK Space Systems
Chemring Countermeasures Ltd
Chemring Energetics Division – Technical Ordinance
EADS Defence & Security – Defense Electronics – Protection
Esterline Defense Group
IMI - Israel Military Industries
Kilgore Flares Company, LLC
Lacroix Defense and Security
MBDA
MES S.p.A.
Raytheon – Electronic Warfare Systems
Rheinmetall Defence – Protection Systems Division
Wallop Defence Systems Ltd.

Naval IR Decoys

Chemring Countermeasures Ltd
Chemring Energetics Division – Technical Ordinance
Kilgore Flares Company, LLC
Lacroix Defense and Security
Rheinmetall Defence
Wallop Defence Systems Ltd.

Naval RF Reflector Decoys

Airborne Systems Limited
Rafael - Systems Division

Active RF Naval Decoys

BAE SYSTEMS Australia
Lockheed Martin Sippican
Rafael - Systems Division
SELEX Galileo
Thales Aerospace

Multispectral Obscurants/ Smoke

Kilgore Flares Company, LLC
L-3 Communications, Linkabit
Lacroix Defense and Security
Rheinmetall Defence – Protection Systems Division
Wallop Defence Systems Ltd.

Communications ESM Systems

AMESYS
Aselsan Inc.
BAE Systems, Electronics, Intelligence & Support (EIS)
Comtech Telecommunications – Comtech PST
Defence Research and Development Canada
Digital Receiver Technology
DRS Technologies
EADS Defence & Security – Defense Electronics – Protection
Eclipse Electronic Systems, Inc.
ETM Electromatic Inc.
General Dynamics, Advanced Information Systems
Genesis EW
Grintek Ewation (Pty) Ltd
INDRA
ITAS A/S
ITT Intelligence & Information Warfare
IZT GmbH
L-3 Communications, Applied Signal & Image Technology
L-3 Communications, TRL Technology
Lockheed Martin, MS2
Medav Gmbh
MRCM GmbH
Netline Communications Technologies
Northrop Grumman Corporation, Aerospace Systems
RFCore Co, Ltd.
Rohde & Schwarz GmbH Ko KG
ROKE MANOR RESEARCH LTD
SAT Corp.
SELEX Galileo
Shogi Communications Ltd.
Sierra Nevada Corp. - Sensor Systems & Technologies
Signami-DCS - EW/Range
SKY Computers Inc.
Southwest Research Institute
Synectics Surveillance Technology
Tata Advanced Systems Limited (TASL)
Tata Power Strategic Electronics Division
Thales Land & Joint Systems

Communications Jammers

Albrecht Telecommunications
Allen-Vanguard Corporation
Aselsan Inc.
Comtech Telecommunications – Comtech PST
DRS Technologies
EADS Defence & Security – Defense Electronics – Protection
ETM Electromatic Inc.
Foster Miller Inc
Grintek Ewation (Pty) Ltd
INDRA
ITT Electronic Systems, Force Protection Systems
ITT Intelligence & Information Warfare
IZT GmbH
Jordan Electronic Logistic Support – Electronic Warfare
L-3 Communications, TRL Technology
Lockheed Martin, MS2
MRCM GmbH
My-konsult
Netline Communications Technologies
RFCore Co, Ltd.
Rockwell Collins – Electronic Warfare and Intelligence Solutions
Rohde & Schwarz GmbH Ko KG
ROKE MANOR RESEARCH LTD
SELEX Galileo
Shogi Communications Ltd.
Signami-DCS - EW/Range
SRC/SRCTec
Synectics Surveillance Technology
Tata Advanced Systems Limited (TASL)
Tata Power Strategic Electronics Division
TECOM Industries
Thales Land & Joint Systems
Ultra Electronics Telemus

GPS Jammers

Defence Research and Development Canada
DRS Technologies
EADS Defence & Security – Defense Electronics – Protection
Jordan Electronic Logistic Support – Electronic Warfare
L-3 Communications, TRL Technology

MRCM GmbH
ROKE MANOR RESEARCH LTD
Scientific Research Corporation - Integrated Systems and Solutions
SELEX Galileo
Signami-DCS - EW/Range
Synectics Surveillance Technology
Tata Power Strategic Electronics Division
Thales Land & Joint Systems

Anti-Radiation Homing Missiles

ATK Mission Systems
ELTA Systems Ltd
Mectron - Engenharia, Indústria e Comércio
Raytheon Missile Systems

ELINT Systems

Aeronix
AMESYS
Annapolis Micro Systems, Inc.
Applied Signal Technology, Inc.
Avalon Electronics, Inc.
BAE Systems, Electronics, Intelligence & Support (EIS)
BEL - Bharat Electronics Ltd
Chordell Systems Ltd.
DRS Technologies
EADS Defence & Security – Defense Electronics – Protection
Elettronica SpA
eonic BV
Genesis EW
INDRA
ITT Corporation – Reconnaissance and Surveillance Systems
ITT Electronic Systems, Reconnaissance and Surveillance Systems
Jordan Electronic Logistic Support – Electronic Warfare
L-3 Communications, Communication Systems-East
Lockheed Martin, MS2
Lockheed Martin, Systems Integration Owego
MRCM GmbH
Northrop Grumman Corporation - Information Systems
Northrop Grumman Corporation, Aerospace Systems
OEwaves
Overwatch
Patria Aviation Oy
QinetiQ Ltd
Rafael - Systems Division
Rockwell Collins – Electronic Warfare and Intelligence Solutions
ROKE MANOR RESEARCH LTD
Saab Avitronics
Sierra Nevada Corp. - Sensor Systems & Technologies
SKY Computers Inc.
TECOM Industries
Thales Aerospace
Ultra Electronics - Avalon Systems
Ultra Electronics Telemus
Zeta Associates – Support to Military Operations

COMINT Systems

Agilent Technologies
AMESYS
Annapolis Micro Systems, Inc.
Applied Signal Technology, Inc.
Argon ST
Avalon Electronics, Inc.
BAE Systems, Electronics, Intelligence & Support (EIS)
Chordell Systems Ltd.
Cobham Sensor Systems – Defense Systems
Communications Audit UK Limited
Cubic Defense Systems
Digital Receiver Technology
DRS Technologies
EADS Defence & Security – Defense Electronics – Protection
Eclipse Electronic Systems, Inc.
eonic B.V
Genesis EW
Grintek Ewation (Pty) Ltd
Innovative Signals Technology (ISigTech)
ITAS A/S
IZT GmbH
Jordan Electronic Logistic Support – Electronic Warfare
L-3 Communications, Applied Signal & Image Technology
L-3 Communications, Communication Systems-East
L-3 Communications, Linkabit
L-3 Communications, TRL Technology
Lockheed Martin, MS2
Medav Gmbh
MRCM GmbH
Northrop Grumman Corporation - Information Systems
Northrop Grumman Corporation, Aerospace Systems
OEwaves
Overwatch
PLATH GmbH
Pole/Zero Corporation
QinetiQ Ltd
Radio Reconnaissance Technologies
Raytheon - Intelligence and Information Systems
Rockwell Collins – Electronic Warfare and Intelligence Solutions
Rohde & Schwarz GmbH Ko KG
ROKE MANOR RESEARCH LTD
Sierra Nevada Corp. - Sensor Systems & Technologies
SKY Computers Inc.
Southwest Research Institute
Synectics Surveillance Technology
SystemWare Inc.
Tata Advanced Systems Limited (TASL)
TCI International
Thales Land & Joint Systems
Ultra Electronics Telemus
Zeta Associates – Support to Military Operations

Direction Finding Systems

Agilent Technologies
AMESYS
Argon ST

Aselsan Inc.
BAE Systems, Electronics, Intelligence & Support (EIS)
Communications Audit UK Limited
Cubic Defense Systems
DRS Codem System, Inc
DRS Technologies
EADS Defence & Security – Defense Electronics – Protection
Eclipse Electronic Systems, Inc.
Genesis EW
Grintek Ewation (Pty) Ltd
INDRA
ITT Corporation – Reconnaissance and Surveillance Systems
IZT GmbH
L-3 Communications, Applied Signal & Image Technology
L-3 Communications, Linkabit
L-3 Communications, TRL Technology
Lockheed Martin, MS2
Medav Gmbh
MRCM GmbH
Overwatch
PLATH GmbH
QinetiQ Ltd
QRC Technologies
Radio Reconnaissance Technologies
Raven Research
Rohde & Schwarz GmbH Ko KG
ROKE MANOR RESEARCH LTD
SAT Corp.
Shogi Communications Ltd.
Southwest Research Institute
Synectics Surveillance Technology
Tata Advanced Systems Limited (TASL)
TCI International
TECOM Industries
Thales Land & Joint Systems
Ultra Electronics Telemus
Zeta Associates – Support to Military Operations

EW SIMULATORS

Flightline RF EW Testers

AAI Corporation
DRS Sustainment Systems
ELDES srl, Radar Division
ESL Defence Limited
EW Simulation Technology Limited
Herley Micro Systems
INDRA
ITCN, Incorporated
ITT Electronic Systems, Integrated EW Systems
My-konsult
Patria Aviation Oy
RUAG – Aerospace
Thales Aerospace

EW Antenna Couplers

DRS Sustainment Systems
Tech Resources, Inc.

EO/IR Stimulators

AAI Corporation
Defense Research Associates, Inc.
ESL Defence Limited
EW Simulation Technology Limited
RUAG – Aerospace
Scientific Research Corporation – Simulation, Test and Instrumentation

Laboratory EW Simulators

AAI Corporation
Applied Geo Technologies Inc
CSIR – DPSS
Defense Research Associates, Inc.
DRS C3 Systems, Inc.
ELDES srl, Radar Division
ESL Defence Limited
ETM Electromatic Inc.
EW Simulation Technology Limited
Genesis EW
Herley Micro Systems
INDRA
IZT GmbH
KOR
Lockheed Martin Aeronautics, AFEWEW-MARS
MC Countermeasures Inc
Northrop Grumman Corporation - Defensive Systems Division
Overwatch
Rafael - Systems Division
RUAG – Aerospace
Scientific Research Corporation - Simulation, Test and Instrumentation
Simulation Technologies
Tactical Technologies Inc
Thales Aerospace
Ultra Electronics Telemus
Varilog Research, Inc
Viasat

RF Range Threat Simulators

AAI Corporation
Chemring Countermeasures Ltd
dB Control
Defense Research Associates, Inc.
DRS C3 Systems, Inc.
ELDES srl, Radar Division
ESL Defence Limited
ETM Electromatic Inc.
EW Simulation Technology Limited
Herley Micro Systems
INDRA
IZT GmbH
KOR
Lockheed Martin Aeronautics, AFEWEW-MARS
Northrop Grumman Corporation - Defensive Systems Division
RUAG – Aerospace
Signami-DCS - EW/Range
SRC/SRCTec
Thales Aerospace

IR Range Threat Simulators

AAI Corporation
Chemring Countermeasures Ltd
ESL Defence Limited
EW Simulation Technology Limited
Lockheed Martin Aeronautics, AFEWEW-MARS

Scientific Research Corporation
 - Simulation, Test and Instrumentation

EW/SIGINT SERVICES

EW System Integration Services

Abacus EW Consultancy Ltd.
AIRBUS MILITARY
AMESYS
Aselsan Inc.
ATDI Ltd
BAE SYSTEMS Australia
BAE Systems, Electronics, Intelligence & Support (EIS)
Boeing Integrated Defense Systems
Defense Research Associates, Inc.
DRS Codem System, Inc
EADS Defence & Security – Defense Electronics – Protection
ETM Electromatic Inc.
General Dynamics, Advanced Information Systems
Genesis EW
INDRA
ITT Electronic Systems, Integrated EW Systems
Jordan Electronic Logistic Support – Electronic Warfare
Lockheed Martin, MS2
Lockheed Martin, MS2 - Akron
Lockheed Martin, Systems Integration Owego
LS telcom
Mass Consultants Limited
Mercer Engineering Research Center
MIKES Microwave Electronics Systems Inc.
Northrop Grumman Corporation - Defensive Systems Division
Patria Aviation Oy
RF Engines Ltd
RFCore Co, Ltd.
Rockwell Collins – Electronic Warfare and Intelligence Solutions
ROKE MANOR RESEARCH LTD
RUAG – Aerospace
Saab Avitronics
Scientific Research Corporation - Integrated Systems and Solutions
SELEX Galileo
Sierra Nevada Corp. - ISR Systems
Sierra Nevada Corp. - Sensor Systems & Technologies
Signami-DCS - EW/Range
SKY Computers Inc.
SRC/SRCTec
Thales Aerospace
TINEX AS
Total Aircraft Services, Inc. An IKHANA Group Company
Wavepoint Research, Inc.

SIGINT System Integration Services

Agilent Technologies
AIRBUS MILITARY
AirScan Inc
AMESYS
Applied Signal Technology, Inc.
Argon ST
BAE Systems, Electronics, Intelligence & Support (EIS)
Boeing Integrated Defense Systems
CACI Technologies Inc
Chordell Systems Ltd.
Communications Audit UK Limited
DRS Codem System, Inc
DSPCon, Inc.
EADS Defence & Security – Defense Electronics – Protection
General Dynamics C4 Systems
General Dynamics, Advanced Information Systems
Genesis EW
Grintek Ewation (Pty) Ltd
INDRA
Innovative Signals Technology (ISigTech)
L-3 Communications, Applied Signal & Image Technology
L-3 Communications, Integrated Systems
L-3 Communications, Linkabit
L-3 Communications, TRL Technology
Lockheed Martin, INSYS
Lockheed Martin, IS&GS - Littleton
Lockheed Martin, MS2
Medav Gmbh
MRCM GmbH
Northrop Grumman Corporation – Information Systems
Patria Aviation Oy
PLATH GmbH
Radio Reconnaissance Technologies
Raytheon - Intelligence and Information Systems
RF Engines Ltd
Rising Edge Technologies
ROKE MANOR RESEARCH LTD
Scientific Research Corporation - Integrated Systems and Solutions
Sierra Nevada Corp. - ISR Systems
SKY Computers Inc.
Synectics Surveillance Technology
Thales Aerospace
Thales Land & Joint Systems
TINEX AS
Total Aircraft Services, Inc. An IKHANA Group Company
Ultra Electronics Telemus

EW Design Engineering Services

Alion Science and Technology – Defense Operations
AMESYS
AMEWAS, Inc
BEL - Bharat Electronics Ltd
CACI Technologies Inc
Concurrent Technologies
Defence Research and Development Canada
Defense Research Associates
Defense Research Associates, Inc.

DRS Technologies
Dynetics Inc.
EADS Defence & Security – Defense Electronics – Protection
EMS Technologies, Inc., Defense and Space
Genesis EW
Georgia Tech Research Institute
ITT - Advanced Engineering & Sciences, Engineering and Technical Services
ITT Electronic Systems, Integrated EW Systems
IZT GmbH
Lockheed Martin, MS2
Lockheed Martin, Systems Integration Owego
LS telcom
MacAulay-Brown, Inc.
Mass Consultants Limited
Maxtek
Mercer Engineering Research Center
MIKES Microwave Electronics Systems Inc.
Northrop Grumman Corporation - Defensive Systems Division
Overlook Systems Technologies, Inc.
RAS - Research Associates of Syracuse
RF Engines Ltd
RFCore Co, Ltd.
Rodale Electronics Inc
ROKE MANOR RESEARCH LTD
RUAG – Aerospace
Saab Avitronics
SAIC
Scientific Research Corporation - Integrated Systems and Solutions
SELEX Galileo
Sierra Nevada Corp. - Sensor Systems & Technologies
Signami-DCS - EW/Range
SKY Computers Inc.
SRC/SRCTec
System Planning Corporation
Teledyne Solutions
Textron Defense Systems
Total Aircraft Services, Inc. An IKHANA Group Company
Ultra Electronics - Avalon Systems
Varilog Research, Inc
Virtualabs srl
Wavepoint Research, Inc.
Wyle Laboratories, Inc.

SIGINT Design Engineering Services

AirScan Inc
AMESYS
AMEWAS, Inc
Applied Signal Technology, Inc.
Argon ST
BEL - Bharat Electronics Ltd
CACI Technologies Inc
Chordell Systems Ltd.
Cobham Sensor Systems – Defense Systems
Concurrent Technologies
Defense Research Associates
Digital Receiver Technology
DRS Technologies
EADS Defence & Security – Defense Electronics – Protection
Genesis EW
Grintek Ewation (Pty) Ltd
Innovative Signals Technology (ISigTech)
ITT - Advanced Engineering & Sciences, Engineering and Technical Services
iVeia, LLC
IZT GmbH
L-3 Communications, Applied Signal & Image Technology
L-3 Communications, Communication Systems-East
L-3 Communications, Integrated Systems
L-3 Communications, TRL Technology
Lockheed Martin, MS2
MacAulay-Brown, Inc.
MANTECH Systems Engineering Corp.
Maxtek
MRCM GmbH
Northrop Grumman Corporation - Information Systems
Overwatch
PLATH GmbH
RAS - Research Associates of Syracuse
Raven Research
Raytheon - Intelligence and Information Systems
RF Engines Ltd
Rising Edge Technologies
ROKE MANOR RESEARCH LTD
SensorCom Inc.
Shogi Communications Ltd.
SKY Computers Inc.
Spectrum Signal Processing
Synectics Surveillance Technology
Teledyne Solutions
Thales Land & Joint Systems
Ultra Electronics - Avalon Systems
Ultra Electronics Telemus
Varilog Research, Inc
Zeta Associates – Support to Military Operations

EW Consulting Services

Abacus EW Consultancy Ltd.
AIRBUS MILITARY
Alion Science and Technology - Defense Operations
AMESYS
ATDI Ltd
CSIR – DPSS
Defense Research Associates
Defense Research Associates, Inc.
Dynamic Analytics & Test, Inc.
Dynetics Inc.
Genesis EW
Georgia Tech Research Institute
ITT - Advanced Engineering & Sciences, Engineering and Technical Services
IZT GmbH
Lockheed Martin, Systems Integration Owego
LS telcom
MacAulay-Brown, Inc.
Mass Consultants Limited
Maxtek
MC Countermeasures Inc
Mercer Engineering Research Center
Micronetixx, P.A.
My-konsult
Overlook Systems Technologies, Inc.
Patria Aviation Oy
RAS - Research Associates of Syracuse
RF Engines Ltd
ROKE MANOR RESEARCH LTD
RUAG – Aerospace
SAIC
System Planning Corporation
Systematic
Teledyne Solutions
Virtualabs srl
Wavepoint Research, Inc.

SIGINT Consulting Services

Abacus EW Consultancy Ltd.
Agilent Technologies
AIRBUS MILITARY
AMESYS
Chordell Systems Ltd.
Defense Research Associates
Digital Receiver Technology
Genesis EW
Grintek Ewation (Pty) Ltd
Innovative Signals Technology (ISigTech)
ITAS A/S
ITT - Advanced Engineering & Sciences, Engineering and Technical Services
MacAulay-Brown, Inc.
MANTECH Systems Engineering Corp.
Maxtek
Overwatch
Patria Aviation Oy
PLATH GmbH
QinetiQ Ltd
RAS - Research Associates of Syracuse
Raven Research
RF Engines Ltd
ROKE MANOR RESEARCH LTD
SensorCom Inc.
Shogi Communications Ltd.
Synectics Surveillance Technology
Teledyne Solutions
Teleplan AS

EW Database Development

AIRBUS MILITARY
AMESYS
Dynetics Inc.
EADS Defence & Security – Defense Electronics – Protection
EW Defense Systems, Inc
Genesis EW
Georgia Tech Research Institute
Grintek Ewation (Pty) Ltd
ITAS A/S
IZT GmbH
Lockheed Martin, MS2
Lockheed Martin, Systems Integration Owego
LS telcom
Mass Consultants Limited
Mercer Engineering Research Center
RAS - Research Associates of Syracuse
ROKE MANOR RESEARCH LTD
Systematic
Thales Aerospace
Wavepoint Research, Inc.

EW Software Development

AIRBUS MILITARY
AMESYS
ATDI Ltd
BEL - Bharat Electronics Ltd
Concurrent Technologies
CSIR – DPSS
Defense Research Associates, Inc.
DRS Technologies
Dynamic Analytics & Test, Inc.
Dynetics Inc.
EADS Defence & Security – Defense Electronics – Protection
Elettronica SpA
EW Defense Systems, Inc
Genesis EW
Georgia Tech Research Institute
ITAS A/S
ITT Electronic Systems, Integrated EW Systems
Lockheed Martin, MS2
Lockheed Martin, Systems Integration Owego
LS telcom
MacAulay-Brown, Inc.
Mass Consultants Limited
Mercer Engineering Research Center
MIKES Microwave Electronics Systems Inc.
Northrop Grumman Corporation - Defensive Systems Division
RAS - Research Associates of Syracuse
RF Engines Ltd
RFCore Co, Ltd.
Rodale Electronics Inc
ROKE MANOR RESEARCH LTD
RUAG – Aerospace
Saab Avitronics
Scientific Research Corporation - Simulation, Test and Instrumentation
SELEX Galileo
Sierra Nevada Corp. - Sensor Systems & Technologies
SRC/SRCTec
SURVICE Engineering Co.
Virtualabs srl
Wavepoint Research, Inc.

SIGINT Software Development

Agilent Technologies
AIRBUS MILITARY
AMESYS
AMEWAS, Inc
Applied Signal Technology, Inc.
Argon ST
BEL - Bharat Electronics Ltd
Chordell Systems Ltd.
Communications Audit UK Limited
Concurrent Technologies
Cubic Defense Systems
DRS Technologies
EADS Defence & Security – Defense Electronics – Protection
General Dynamics C4 Systems
Genesis EW
Georgia Tech Research Institute
Grintek Ewation (Pty) Ltd
Innovative Signals Technology (ISigTech)
ITAS A/S
IZT GmbH
Jordan Electronic Logistic Support – Electronic Warfare
L-3 Communications, Applied Signal & Image Technology
L-3 Communications, Communication Systems-East
L-3 Communications, Integrated Systems
L-3 Communications, Linkabit
Lockheed Martin, INSYS
Lockheed Martin, IS&GS - Littleton
Lockheed Martin, MS2
MacAulay-Brown, Inc.
ManTech Real-Time Systems Lab
Medav Gmbh
MRCM GmbH
Northrop Grumman Corporation - Information Systems
Overwatch
PLATH GmbH
QinetiQ Ltd
QRC Technologies
Radio Reconnaissance Technologies
RAS - Research Associates of Syracuse
Raven Research
Raytheon - Intelligence and Information Systems
RF Engines Ltd
Rising Edge Technologies
ROKE MANOR RESEARCH LTD
SAIC
Scientific Research Corporation - Integrated Systems and Solutions
SensorCom Inc.
Shogi Communications Ltd.
Sierra Nevada Corp. - ISR Systems

Southwest Research Institute
Spectrum Signal Processing
Synectics Surveillance Technology
SystemWare Inc.
Teleplan AS
Thales Land & Joint Systems
Triasys Technologies
Ultra Electronics Telemus
Zeta Associates – Support to Military Operations

EW/SIGINT Mission Planning Software

Sagem Defense Securite
SAT Corp.
Scientific Research Corporation - Simulation, Test and Instrumentation
SELEX Galileo
Sierra Nevada Corp. - ISR Systems
Teleplan AS
Thales Land & Joint Systems
TIL Defense Systems

Operational EW Training Software

Abacus EW Consultancy Ltd.
AIRBUS MILITARY
AMESYS
CACI Technologies Inc
Diehl BGT Defence GmbH & Co. KG
DRS C3 Systems, Inc.
DRS Codem System, Inc
General Dynamics, Advanced Information Systems
Genesis EW
INDRA
Lockheed Martin, MS2
Lockheed Martin, Systems Integration Owego
Raven Research
ROKE MANOR RESEARCH LTD
SAIC
Scientific Research Corporation - Integrated Systems and Solutions
Systematic
Thales Land & Joint Systems
Ultra Electronics - Avalon Systems
Virtualabs srl

Operational EW Training Services

Abacus EW Consultancy Ltd.
Airborne Tactical Advantage Company
AMESYS
CACI Technologies Inc
Cobham, Aviation Defence Service (AVdef)
Cobham, FR Aviation
Defence Research and Development Canada
DRS Codem System, Inc
EADS Defence & Security – Defense Electronics – Protection
EW Defense Systems, Inc
Genesis EW
Grintek Ewation (Pty) Ltd
INDRA
ITAS A/S
L-3 Communications, Flight International
L-3 Communications, TRL Technology
Lockheed Martin, MS2
Lockheed Martin, Systems Integration Owego
Mass Consultants Limited
My-konsult
Phoenix Air
ROKE MANOR RESEARCH LTD
RUAG – Aerospace
Scientific Research Corporation - Integrated Systems and Solutions
Symetrics Industries
Systematic
Thales Aerospace
Thales Land & Joint Systems
Top Aces
Ultra Electronics - Avalon Systems

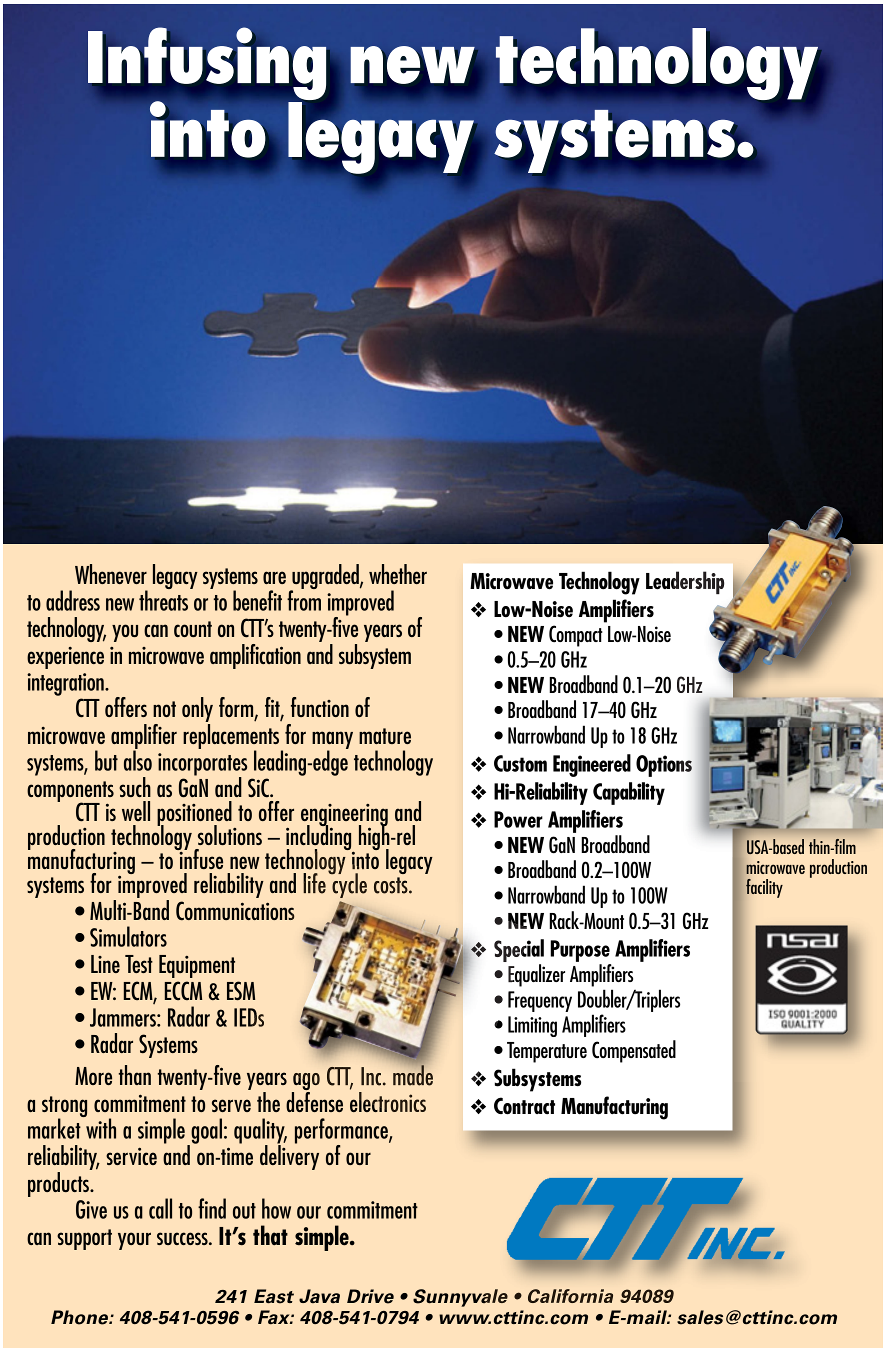
EW Testing Services

Airborne Tactical Advantage Company
AMESYS
Cobham, FR Aviation
dB Control
Defense Research Associates
Defense Research Associates, Inc.
Dynamic Analytics & Test, Inc.
Dynetics Inc.
EADS Defence & Security – Defense Electronics – Protection
EW Defense Systems, Inc
EW Simulation Technology Limited
Genesis EW
INDRA
L-3 Communications, Flight International
Lockheed Martin Aeronautics, AFEWEW-MARS
Lockheed Martin, Systems Integration Owego
Mass Consultants Limited
MegaPhase RF
Overlook Systems Technologies, Inc.
Phoenix Air
ROKE MANOR RESEARCH LTD
RUAG – Aerospace
Scientific Research Corporation - Simulation, Test and Instrumentation
SELEX Galileo
SURVICE Engineering Co.
Teledyne Solutions
Toyon Research Corporation
Varilog Research, Inc
Wyle Laboratories, Inc.

Professional Development Courses and Seminars

Abacus EW Consultancy Ltd.
AirScan Inc
Association of Old Crows
CACI Technologies Inc
CSIR – DPSS

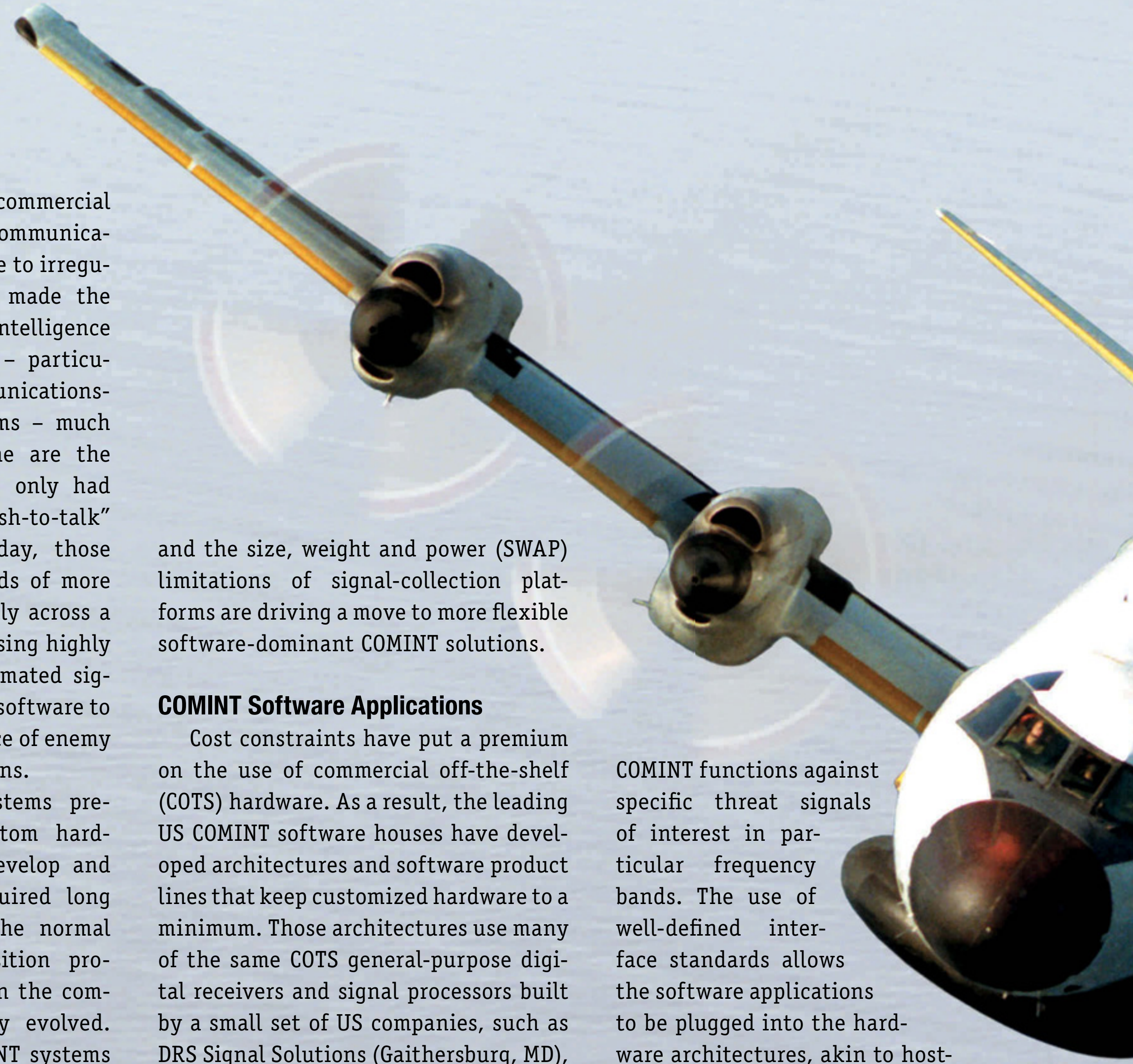
Ensure your company is listed in the 2011 EW/SIGINT Resource Guide. Send your category details and contact information to JED at editor@crows.org.



What's New in S

Communications-Intelligence Systems

By Glenn Goodman



The global proliferation of commercial mobile wireless cellular communications devices readily available to irregular warfare insurgents has made the job of US military signals-intelligence (SIGINT) collection systems – particularly tactical airborne communications-intelligence (COMINT) systems – much more demanding. Long gone are the days when COMINT systems only had to detect conventional "push-to-talk" VHF/UHF radio signals. Today, those systems must filter thousands of more complex digital signals rapidly across a wider frequency spectrum, using highly sophisticated and fully automated signal-processing hardware and software to intercept and locate the source of enemy voice and data communications.

US military COMINT systems predominantly have been custom hardware-based, expensive to develop and proprietary. They have required long development times under the normal Defense Department acquisition process, while the technology in the communications systems rapidly evolved. This often meant that COMINT systems would fall behind the user's operational requirements even before they became operational. As a result, many COMINT systems have been fielded initially on an accelerated schedule by the military services as a Quick-Reaction Capability (QRC) product – a stand-alone set of hardware answering an urgent operational need to address a specific new emitter or set of signals.

Defense Department budget constraints, the need to respond faster in addressing emerging new signal types, and the size, weight and power (SWAP) limitations of signal-collection platforms are driving a move to more flexible software-dominant COMINT solutions.

COMINT Software Applications

Cost constraints have put a premium on the use of commercial off-the-shelf (COTS) hardware. As a result, the leading US COMINT software houses have developed architectures and software product lines that keep customized hardware to a minimum. Those architectures use many of the same COTS general-purpose digital receivers and signal processors built by a small set of US companies, such as DRS Signal Solutions (Gaithersburg, MD), Eclipse Electronic Systems (Richardson, TX), Boeing's Digital Receiver Technology (Germantown, MD) and Cobham's M/A-COM SIGINT Products business (Hunt Valley, MD).

More importantly, the military services are moving away from proprietary SIGINT solutions that require adding dedicated hardware to detect each new type of threat signal and toward non-proprietary open-system hardware architectures. These can host different software applications to perform COMINT functions against specific threat signals of interest in particular frequency bands. The use of well-defined interface standards allows the software applications to be plugged into the hardware architectures, akin to hosting Microsoft Word or Adobe Acrobat on the Microsoft Windows XP operating system of a personal computer.

As a result of the more dense signal environment and the growing types of threat signals that have to be detected and exploited, US tactical airborne COMINT systems today are always going to be SWAP-limited, Scott Francis, Group Director for Support to Military Operations at Zeta Associates (Fairfax, VA), told *JED*. "You can't have rack after rack of hardware. We have to get away

IGINT Software?

Evolve to Cope With New Threat Signals

from the mentality that says, ‘This box does this signal, and this box does this other signal. With the software-based approach, it’s the software applications that are signal-specific, and multiple COMINT applications can run on a single set of hardware. It gives you the ability to add new capabilities to a platform in a hurry to respond to new threats without changing the existing hardware.”

The software-based approach also offers great mission flexibility, he said. “It allows you to reconfigure the software between missions, and even during the same mission, to focus on a different signal of interest.”

The Army’s Prophet wheeled vehicle-mounted tactical COMINT system is an example of the move to software-adaptable systems. The Army curtailed production of its Prophet Spiral 1 system and shifted to procurement last February of an improved follow-on from General Dynamics C4 Systems (Scottsdale, AZ) called Prophet Enhanced. It features an open-system architecture that can be adapted to keep pace with rapidly evolving threat signals by adding new software applications, rather than by strapping another stand-alone hardware “black box” and antenna to the SWAP-constrained Prophet vehicle.

“With this kind of open-system integrated approach, when you add new capabilities it’s only at the weight of software,” noted an industry representative. He added, “When you have a stand-alone black box on a SIGINT aircraft, when you aren’t using it during a particular mission, it’s just taking up space.”

On the other hand, the black box approach, often the product of a QRC project, can meet urgent operational needs fairly quickly. Because the Army’s Prophet Spiral 1 COMINT system wasn’t ready for fielding in 2007-2008, a National Security Agency (NSA)-built substitute with a number of stand-alone COMINT boxes called TRITON was rapidly put into service in Iraq under a QRC effort.

The Army procured Prophet Enhanced as a COTS system with mature technology that General Dynamics could begin delivering six-to-12 months after contract award. Its development essentially was paid for by industry. The baseline for Prophet Enhanced is the Prophet Spiral 1 capability integrated with the QRC capabilities developed for TRITON, according to the Army. (It’s not clear whether that integration will occur via software applications or by moving the TRITON black boxes onto the Prophet vehicle.)

Use of the open-system integrated approach gives the military customer the ability to take third-party software applications developed by different industry vendors or by NSA that provide an effective solution against a particular signal set and readily incorporate them into the open architecture.

The software-based approach to COMINT systems also lends itself to scalable hardware solutions for signal-collection platforms with varying performance requirements and SWAP constraints, from surface ships to large manned SIGINT aircraft like the Air Force RC-135 Rivet Joint and Navy EP-3E to unmanned aerial vehicles (UAVs). Each variable-size set of common modular hardware boxes – from four-to-five full 19-inch racks on a ship down to a single box for a UAV, for example – can run the same baseline software and software applications.

The common hardware typically amounts to multiple increments of the same receiver and processor units based on the platform's available SWAP. Typically, the larger the hardware set, the more signals the COMINT system can process at the same time. Tactical unmanned systems are the most SWAP-constrained platforms. In some examples now offered by industry, UAVs carry a single cube-like COMINT box.

In addition to SWAP limitations, the amount of hardware required for a COMINT system will be determined by the desired performance requirements. These include the amount of bandwidth covered at any given time, the number and types of signals of interest to be prosecuted simultaneously, a signal direction-finding capability, an emitter geo-location capability, etc.

At least one US industry COMINT software company has even developed digital narrow-band receiver-tuners that exist only in software, with hundreds of them "sitting behind" a front-end wideband digital hardware receiver.

Federated Guardrail COMINT

The COMINT portion of the Army's RC-12 Guardrail Modernization program uses a federated approach – what might be seen as a middle ground between the integrated and black box QRC models – largely by default. The Army undertook the extensive upgrade program for its twin-turboprop Guardrail aircraft about two years ago instead of retiring them as a result of a lengthy delay in acquiring a planned new Aerial Common Sensor (ACS) SIGINT aircraft. Because of the need to field improved airborne COMINT capabilities on an accelerated schedule, the Army chose to reduce technical and schedule risk by leveraging proven COMINT systems with high Technology Readiness Levels for Guardrail without trying to bring them under a software-based integrated model.

In addition to extending the service lives of 36 operational RC-12s by up to eight years or more and standardizing their configurations, the Guardrail Modernization program is providing a suite of federated COMINT payloads with increased capability against the irregular warfare threat with reduced weight. The first unit of upgraded RC-12s, which transmit their processed COMINT data directly to an Army ground station, will enter service next fall.

Northrop Grumman Information Systems' ESL (Sacramento, CA) is the Army's system integrator for Guardrail Modernization. The core of the new Guardrail COMINT suite is Northrop's Enhanced Situational Awareness (ESA) system, a derivative of the Airborne SIGINT Payload (ASIP) developed for the Air Force's high altitude U-2 reconnaissance aircraft and large Global Hawk unmanned aerial vehicle. The Guardrail Modernization mission payload consists of two ESA COMINT chassis in a federated configuration with other industry COMINT products. There also is an ESA server in the ground station.

ESA provides COMINT search, intercept and direction-finding capabilities as well as the infrastructure services, e.g., system timing and navigation accuracy, for the other mission payloads. The Guardrail Modernization mission system integrates five other federated standalone COMINT subsystems, each with their own hardware and software applications. Those subsystems are: the Communications High-Accuracy Location System-Compact (CHALS-C) from Lockheed Martin (Owego, NY), which can pinpoint the location of a signal emitter using two RC-12s; a Special Signals exploitation capability developed by Zeta Associates using the non-proprietary X-MIDAS software environment and hosted on their compact V3 hardware suite; a "High-Band COMINT" system from Argon ST (Fairfax, VA); and two other classified systems.

The ESA component of Guardrail Modernization provides an open architecture that can host software applications from an outside vendor if it complies with specified interface requirements; if it doesn't, Northrop Grumman says it can provide a middleware "wrapper" to make the application fit into the infrastructure. If time and budget permitted, some or all of the five Guardrail COMINT subsystems could be integrated into a single hardware suite. CHALS-C could be the first to do so under a future experiment the Army plans to conduct.

Software Re-Use

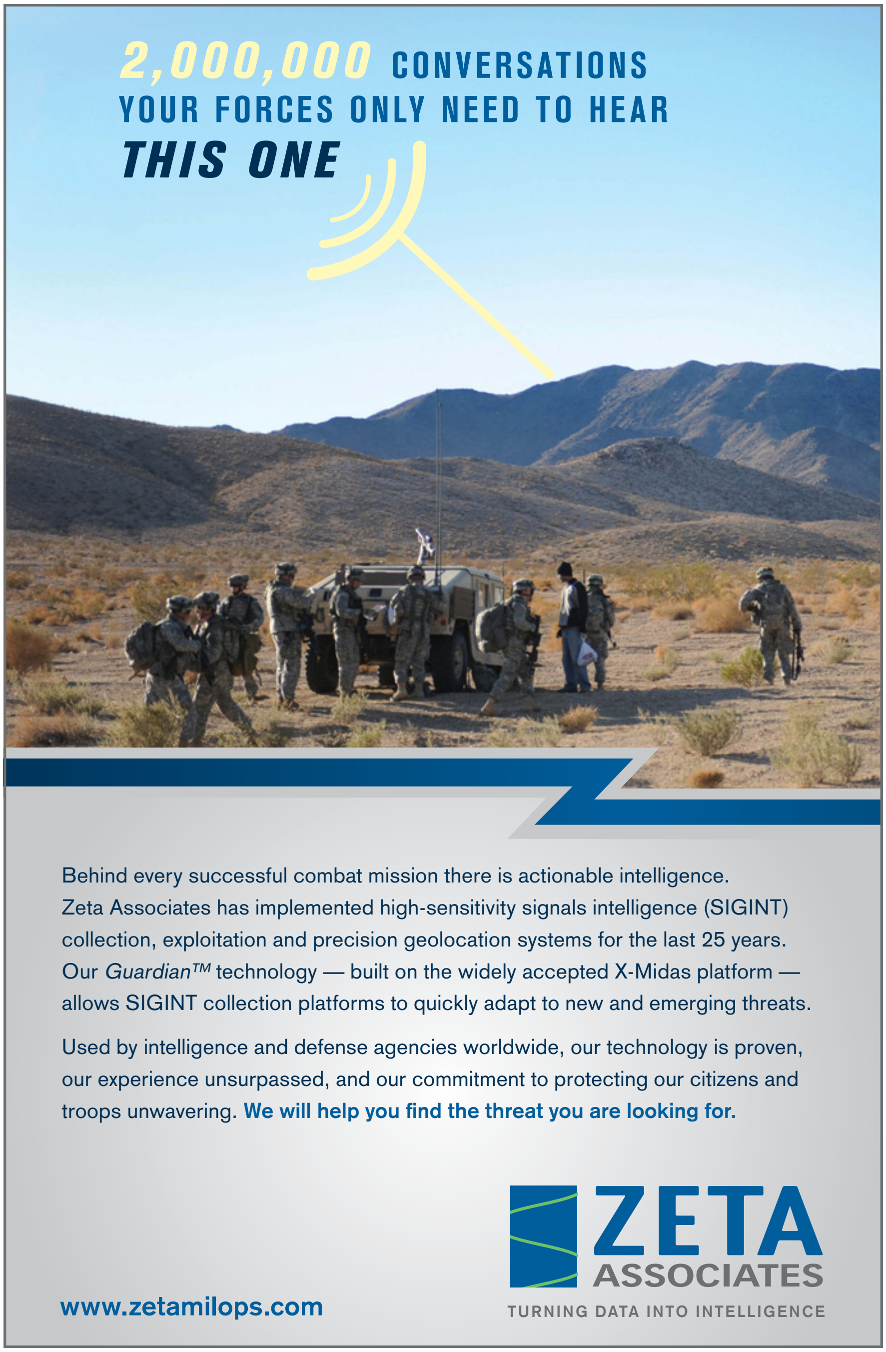
Another key to reducing the costs of developing new COMINT capabilities that US military customers are embracing is software re-use – leveraging software developed previously under other government programs to reduce the new investment dollars and time required.

As an example, the US Navy's nascent EPX acquisition program for a new airborne SIGINT aircraft to replace its EP-3E will likely benefit not only from the service's investment to date in EP-3E COMINT software but also from its past or ongoing investments in COMINT software for submarine and surface ship applications.

This re-use practice was often resisted in the past, particularly when it spanned parallel ongoing programs, because acquisition officials avoided dependencies between their programs and other external programs so that they could control the path to their objectives. Thus, historically, most SIGINT capabilities were developed in isolation from each other as point solutions.

Industry was the first to come around to the new mindset, with companies such as Argon ST, BAE Systems, Northrop Grumman and Zeta Associates each developing evolving COMINT architectures and software product lines that emphasize the re-use principle and build on earlier software development. This includes drawing on government-owned SIGINT software, even signal-exploitation algorithms developed for the national intelligence community.

Kerry Rowe, Argon ST's President and Chief Operating Officer, noted that with software re-use, a military customer also benefits from the extensive testing of the leveraged software that has already occurred. In fact, the software product line approach offers tremendous cost savings to its customers by optimizing non-recurring engineering, testing, training and logistics. As Rowe told *JED*, "If a customer has a requirement to prosecute a particular signal set following an already developed CONOP [concept of operations],



then that customer only has to pay the integration cost of that software capability onto the target platform."

In order for the re-use model to produce the maximum cost savings across DOD development programs, government programs cooperate and commit to "give something back" to the product line. Rowe noted, "Designing software for re-use is incrementally more expensive than designing hardware and/or platform-specific software. However, the one-time cost of developing each capability in the product line is far less than if multiple customers paid to develop the same software."

Business Case

The move to software-based, nonproprietary, open-architecture COMINT solutions raises a key issue for industry and for military and DOD officials: How can contractors make money in the future if the government only buys their COMINT software applications and no hardware to go with them?

This issue was raised by representatives of several COMINT system developers. As one of them noted, "We're used to selling hardware. How do you value the software? There's not a good business case for us in industry to develop only software for specific applications if we can't recover our investment."

Another representative said industry firms will be reluctant to focus their business base around selling software applications. "It's the government's desire to emulate the modern computer marketplace, wherein software applications and upgrades are easily applied to multiple hardware platforms. The sale of tens of thousands of software licenses provides a business case for those companies that provide product applications. Applying this same paradigm to DOD procurements, however, does not yield a viable business case for industry. The government pays industry to develop signal-exploitation algorithms, but once developed there is no long-term licensing potential for industry with only a very limited number of potential sales of these applications."

He added, "Perhaps the best example is the government's establishment of an X-MIDAS-based special signal application library. While it's available to properly cleared customers for their use, industry still pursues hardware solutions using these 'off-the-shelf' applications. Why? Because hardware sales is a business case and selling 10 or a 100 licenses is not."

Another company representative was more circumspect: "While the government is very interested in an [iPhone-like] 'App Store' approach to SIGINT systems, it's still very early in the process wherein the government and industry jointly define and agree on a viable business model for this approach."

Photos: RC-135 Rivet Joint and EP-3E courtesy US Department of Defense. Photo of US Army RC-12 Guardrail (below) by James Gordon.

EW Against Modern Radars – Part 1

Radar Jamming Equations

For the next few months, we will be discussing modern radars from an EW point of view. A part of this discussion is, of course, the vulnerability of these radars to electronic attack (EA), and their electronic protection (EP) features.

Radar jamming was initially covered in the May 1996 to April 1997 "EW 101" columns, and radars were covered in the May 2000 to February 2001 "EW 101" columns. We will begin this series with a brief review of some of the important issues raised in these earlier columns.

RADAR JAMMING

Radar jamming approaches are differentiated by geometry and by techniques. First we will cover the geometric considerations: self protection and remote jamming. This includes dB formulas for the jammer to signal ratio (J/S) and burn-through range associated with both types of jamming. In the following discussion, "log" is the logarithm to the base 10, all jamming power is assumed to be within the radar receiver's bandwidth, and the radar is assumed to use a single antenna for transmit and receive. More complex cases will be considered later in this series. You will note that each of the dB formulas in this series includes a number (for example -103). This number combines conversion factors allowing values to be input in the most convenient units. The rather large resulting number is converted to dB form. A very important consideration in the use of all dB formulas is that ***the input values must be entered in the specified units to get the correct answer.***

First, consider the power a radar receiver receives from the skin return from a target. As shown in **Figure 1**, the transmitted power is focused toward the target by the radar's antenna. The effective radiated power (in dB form) is the transmitter power increased by the main beam bore-sight gain. Because a typical radar uses a directional antenna to transmit and receive signals, the propagation mode is line of sight (see the July 2007 "EW 101" column). The skin return power in the radar receiver is called "S" and is given (in dBm) by the formula:

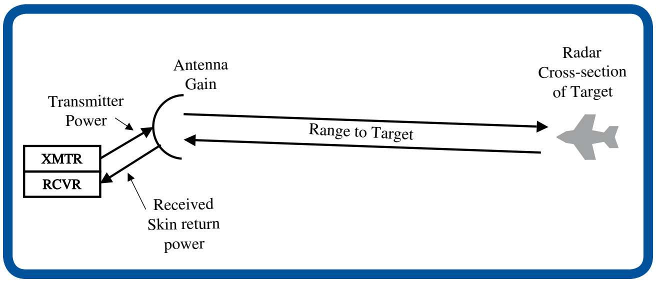


Figure 1: Radar skin return power is calculated from the radar transmitter power and antenna gain, the range to the target, and the target radar cross section.

$$S = -103 + ERP_R - 40 \log R - 20 \log F + 10 \log \sigma + G$$

Where: ERPR is the radar effective radiated power toward the target in dBm
R is the range from the radar to the target in km
F is the radar's transmitting frequency in MHz
σ is the radar cross section of the target in square meters
G is the main beam boresight gain of the radar antenna in dB

The power received by the radar from the jammer is called "J" and is given (in dBm) by the formula:

$$J = -32 + ERP_J - 20 \log R_J - 20 \log F + G_{RJ}$$

Where: ERPJ is the jammer effective radiated power toward the radar in dBm
RJ is the range from the jammer to the radar in km
F is the jammer's transmitting frequency in MHz
GRJ is the gain of the radar's antenna (in dB) in the direction toward the jammer

SELF PROTECTION JAMMING

As shown in **Figure 2**, a self protection jammer is located on the target being detected or tracked by a radar. This means that the distance from the jammer to the radar is "R" and the gain of the radar antenna toward the jammer and the target are the same (we will call this gain "G"). By subtracting the expression for "S" from the expression for "J" and simplifying, we get the following formula for the J/S produced by a self protection jammer:

$$J/S = 71 + ERP_J - ERP_R + 20 \log R - 10 \log \sigma$$

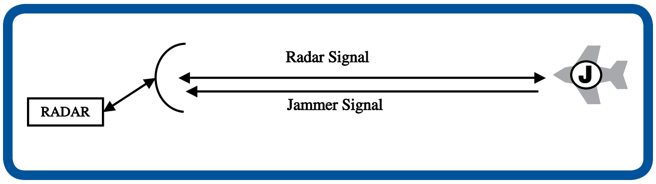


Figure 2: Self Protection Jamming protects a target by use of an on-board jammer.

REMOTE JAMMING

In remote jamming, the jammer is not located at the target. The classical case of remote jamming is stand-off jamming as shown in **Figure 3**. The jammer (typically in a special jamming aircraft) is beyond the lethal range of the weapon controlled by a tracking radar. The jammer protects target aircraft that are within that lethal range. The stand-off jammer typically protects multiple targets from acquisition by multiple radars.

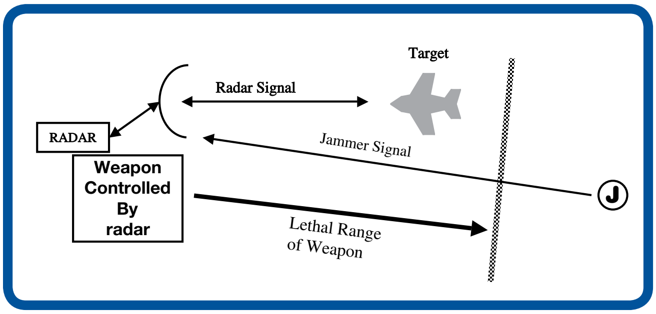


Figure 3: Standoff Jamming protects a target within the lethal range of a radar controlled weapon using a jammer located beyond the lethal range.

This means that the jammer cannot be in the main beam of all of the radars – hence it is assumed to be broadcasting into the side lobes of all hostile radars.

Figure 4 shows another case of remote jamming. This is stand-in jamming, in which the jammer is placed closer to the hostile radar than the target aircraft it is protecting. This jammer is also assumed to be broadcasting into the side lobes of the hostile radar.

All types of remote jammers will produce jamming to signal ratios according to the following formula:

$$J/S = 71 + ERP_J - ERP_R - 40 \log R_T - 20 \log R_J + G_S - G_M - 10 \log \sigma$$

Where: RT is the range from the radar to the target in km
RJ is the range from the jammer to the radar in km
GS is the radar side lobe gain (redefined from GRJ above) in dB
GM is the radar main beam boresight gain in dB

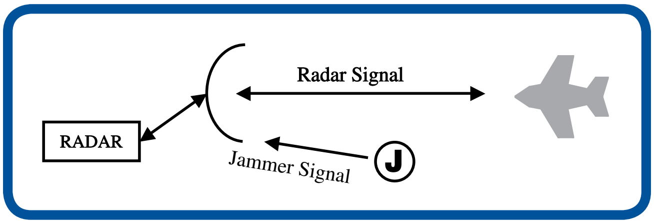


Figure 4: Stand-in jamming protects a target using a jammer located closer to the radar.

BURN THROUGH

In both of the above equations, J/S is a positive function of range from the radar to the target. Thus, as the target approaches the radar, the J/S is reduced. When J/S is small enough, the jammed radar can reacquire the target. It is common practice to determine some J/S value at which reacquisition might occur and define the range from the target at which this J/S occurs as the "burn-through range." This is illustrated in **Figure 5** for self protection jamming. Note that the radar skin return power increases as the fourth power of reducing range, while the received jammer power increases only as the square of reducing range. The equation for self protection burn-through range is derived from the self protection J/S formula as follows:

$$20 \log R_{BT} = -71 + ERP_R - ERP_J + 10 \log \sigma + J/S \text{ Rqd}$$

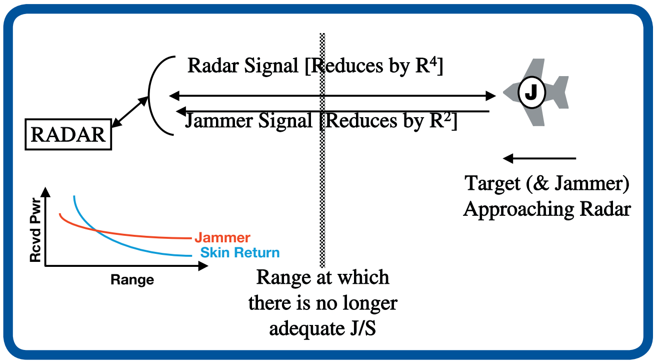


Figure 5: Self protection burn through occurs when the target is close enough to the radar that the radar can reacquire the target.

Where: R_{BT} is the burn through range in km
J/S Rqd is the J/S value at which jammer reacquisition may take place

The burn through range in km is found from the value of 20 log R_{BT} as:

$$R_{BT} = \text{antilog}[(20 \log R_{BT})/20]$$

Figure 6 illustrates burn-through for any type of remote jamming. Note that it is common practice to assume that the stand-off or stand-in jammer does not move while the target approaches the radar. Thus the received jammer power remains constant while the received skin return power increases by the fourth power of reducing range. Thus, the burn-through range refers only to the range from the radar to the target.

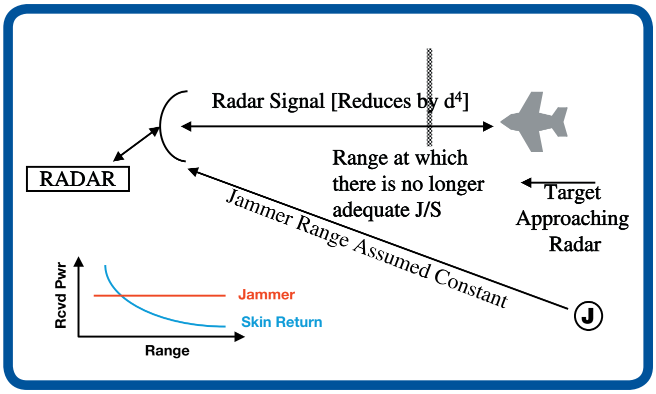


Figure 6: Remote jammer burn through occurs when the target is close enough to the radar that the radar can reacquire the target.

The formula for any kind of remote jamming burn-through is derived from the remote jamming J/S formula as:

$$40 \log R_{BT} = -71 + ERP_R - ERP_J + 20 \log R_J + G_M - G_S + 10 \log \sigma + J/S \text{ Rqd}$$

The burn-through range in km is found from the value of 40 log R_{BT} as:

$$R_{BT} = \text{antilog}[(40 \log R_{BT})/40]$$

What's Next

Next month, we will discuss jamming techniques. For your comments and suggestions, Dave Adamy can be reached at dave@lynxpub.com.

association news

ANTHONY VOZZA, AOC AND EW LEADER, PASSES

Services were held for Anthony Vozza, 82, of Tyler TX, on Friday, October 30. Tony was a dedicated professional in EW and the AOC for many decades.

He was born on October 8, 1927 in Bergenfield, NJ. After high school, he proudly served his country during World War II in the United States Navy, where he was awarded the World War II Victory Medal. He attended college at Newark College of Engineering, where he obtained a bachelors degree in electrical engineering. He worked for more than 30 years in Electronic Warfare in Long Island, NY, for Grumman Aerospace Corp, and helped stand-up the local New York Metropolitan chapter and served as its first chapter president.

He was one of the original designers of the jamming system on the EA-6B Prowler, which is still in use today. His daughter, Arlene, is also an electrical engineer and is following in his footsteps by continuing in electronic warfare and flying the EA-6B as a naval officer. Those left to cherish his memory are his wife of 43 years, Marian Vozza; his daughters, Arlene Camp, Brenda Vozza-Zeid, and Cindy Klein; and his son, Philip Vozza.

CRANE ROOST AWARDS SCHOLARSHIPS

Through partnering with AOC national on their conferences, as well as and a generous donation from the Teledyne office in Bloomington, IN, the Crane Roost was able to award two $2,500 scholarships. The first went to Beverly Crosby, an IUPUI student, and the other to Matthew Cherry, a student at Purdue. Both individuals have done internships at NSWC Crane in the maritime EW division and the CH-53 group, respectively, and are excited about working at Crane in the field of Electronic Warfare when they graduate.

NSWC Crane's Commanding Officer, Captain Chuck Lasota, presented the scholarships to the recipients. The Crane Roost gave half as much as all of the other area professional organizations at NSWC Crane combined. It is an excellent public relations initiative and worthy of finding ways to grow.

If you are a member of the AOC and live in NSWC Crane region, the Crane Roost encourages you to become active in our efforts. If you are not member, please join today and help the Roost support our present and future warfighters! Contact Dave Jenkins at (812) 854-4136, e-mail: dave.g.jenkins@navy.mil.

UK CHAPTER LOOKS BACK AT SUCCESSFUL YEAR

The UK Chapter can look back on 2009 as a year of active participation in a variety of events. We started the year with our Annual General Meeting where we welcomed our new President, John Clifford. We were superbly hosted during three industry visits – to Chemring Countermeasures, SELEX Galileo and Abacus EW Consultancy – and have been directly involved in the organization and presentation of three EW conferences.

We prepared the speaker program and chaired the AOC/Shephard EW Conference in London; we joined the UK Defence Electronics History Society at an autumn symposium for a historical look at EW and joined the UK Defence Academy for the annual joint classified EW Symposium. We are now preparing for the AOC/Shephard EW 2010 Conference and Exhibition in Berlin.

All this points to a thriving and energetic Chapter and details of all our activities can be readily viewed on our web site www.ukaoc.org. We have recently taken over full management control of our website, which also contains our regular UK Chapter Newsletters, and would encourage you to drop in for a look. Any Old Crows visiting the UK would be made most welcome at any of our events but in the meantime we send our Season's Greetings to all fellow Crows.

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(Company size determines fee except for sustaining members)

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CONSULTANT (1-9 Employees)	$300	5

JED, The Journal of Electronic Defense (ISSN 0192-429X), is published monthly by Naylor, LLC, for the Association of Old Crows, 1000 N. Payne St., Ste. 300, Alexandria, VA 22314-1652.

Periodicals postage paid at Alexandria, VA, and additional mailing offices. Subscriptions: *JED, The Journal of Electronic Defense*, is sent to AOC members and subscribers only. Subscription rates for paid subscribers are $160 per year in the US, $240 per year elsewhere; single copies and back issues (if available) $12 each in the US; $25 elsewhere.

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