

JUNE 2015

Military & Aerospace Electronics®

ENABLING TECHNOLOGIES
FOR NATIONAL DEFENSE

Quiet unmanned aircraft

Distributed electric propulsion could be key to ultra-quiet UAVs. **PAGE 4**

Rugged connectors

Connector industry balancing speed, cost, and performance. **PAGE 20**

militaryaerospace.com

Hunting down roadside bombs

Countering terrorist bombs adapts to sophisticated improvised explosives. **PAGE 10**

PennWell

POWER YOUR CRITICAL MISSION

Introducing the VXR Series High-Reliability COTS DC-DC Converters

- 7 to 100 Watts
- 9 to 60 Volt Input
- 55°C to +105°C
- 2 to 20 Amp EMI Filters

Utilizing VPT's Advanced Packaging Technology

- ✓ Integral EMI Shield
- ✓ Dual-Sided Thermal Conduction
- ✓ Chemical & Solvent Resistant



VPT®

Power Your Critical Mission Today

www.vptpower.com

2 TRENDS

4 NEWS

4 IN BRIEF

COVER STORY >

10 SPECIAL REPORT

IED hunters adapt to sophisticated threats

Improvised explosive devices have been the most lethal enemy threat to U.S. forces during military operations in Southwest Asia. Counter-IED technologies are adapting to ever-more-sophisticated IED threats.

20 TECHNOLOGY FOCUS

Connector industry balancing speed, cost, and performance

Interconnect designers confront system demands for blindingly fast speeds and small, lightweight connector products that work in rugged operating conditions.

28 RF & MICROWAVE

30 UNMANNED VEHICLES

32 ELECTRO-OPTICS WATCH

34 PRODUCT APPLICATIONS

37 NEW PRODUCTS

Space Grade DC-DC Converters for 120V Input



M3G120 Series of 40W DC-DC Converters are developed specifically for 120V standard power bus for International Space Station and NASA's Orion MPCV (Multi-Purpose Crew Vehicle) programs

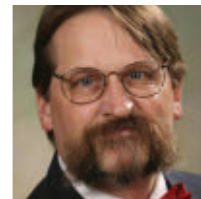
Features:

- Total Dose > 200k rad(Si)
- SEE > 83 MeV•cm²/mg
- Class K hybrid per MIL-PRF-38534
- 95 to 140V DC input, up to 160V input transients
- 40W maximum output power
- Integrated input EMI filter
- Meets derating requirements of NASA EEE-INST-002 and MIL-STD-1547B
- Size: 3.5"L x 2.5"W x 0.475"H
- 110 gram maximum

For more information call 1.800.981.8699
or visit www.irf.com

International
IOR Rectifier
THE POWER MANAGEMENT LEADER

MILITARY & AEROSPACE ELECTRONICS ©2015 (ISSN-1046-9079) is published monthly by PennWell Corp., 1421 S. Sheridan, Tulsa, OK 74112. Periodicals postage paid at Tulsa, OK 74101 and additional mailing offices. Editorial offices are located at 98 Spit Brook Road, Nashua, NH 03062-5737. Subscription Prices: Free to qualified subscribers in North America. Other subscribers in U.S.A.: \$175.00 one year; \$309.00 two years; \$440.00 three years. Other subscribers in Canada: \$270.00 one year; \$465.00 two years; \$600.00 three years. All other international: \$325.00 one year; \$620.00 two years; \$810.00 three years. Digital edition \$70.00 yr. Call (847) 763-9540 for subscription information. We make portions of our subscriber list available to carefully screened companies that offer products and services that may be important for your work. If you do not want to receive those offers and/or information, please let us know by contacting us at List Services, Military & Aerospace Electronics, 98 Spit Brook Road, Nashua, NH 03062. POSTMASTER: Send change of address form to MILITARY & AEROSPACE ELECTRONICS Subscription Services, PO Box 3425, Northbrook, IL 60065. All rights reserved. No material may be reprinted without permission from the publisher. Back issues of Military & Aerospace electronics may be purchased at a cost of \$16.00 each in the U.S., \$22.00 Canada, and \$27.00 elsewhere. Printed in the USA / GST NO. 126813153 / Publications Mail Agreement No. 875376



Embedded computing leaps forward with Intel Xeon D processor

Designers of high-performance embedded computing (HPEC) for demanding aerospace and defense applications like radar processing, signals intelligence (SIGINT), and electronic warfare (EW) are flexing their muscles after introduction earlier this spring of the Intel Xeon D.

This processor — a rugged mobile version of the Intel Xeon server-class chip — is bringing unprecedented digital signal processing (DSP) power to embedded computing and represents a big leap ahead of the latest Intel Core i7 processors that have become an embedded computing staple over the past several years.

The Xeon D is a mini server small enough to fit on a 3U embedded computing board, or even on a COM Express mezzanine card. Think of a computer server the size of a deck of playing cards and you get the idea of what the Xeon D brings to the table.

So what's the big deal, you might be thinking. The Xeon processor is nothing new; it's been part of those big server farms we have read about for quite a long time. The difference is the Xeon D's suitability to rugged embedded computing applications. Embedded systems designers need ball grid array (BGA) packaging in their processors for mobile rugged uses, and the Xeon offered only land grid array (LGA) packaging until the

Xeon D burst on the scene.

The conventional Xeon processor also consumes too much power and runs too hot for all but the most complex embedded computing applications. The traditional Xeon chip starts to throttle back its performance when its temperature reaches 50 to 120 watts. This throttle-back mechanism is called thermal design power, or TDP for short.

"They are hot," says Ajit Patel, business development manager at Intel Corp. in Chandler, Ariz. The Xeon D, however, offers a TDP rating of 15 to 45 watts, which is manageable for many high-end embedded computing applications.

While BGA packaging and manageable heat are big advantages for embedded computing, there's more in store. Intel engineers are planning for extended-temperature support for the Xeon D of -40 to 85 degrees Celsius, which puts it right in the wheel house for rugged mobile embedded computing. Okay, so the Xeon D is rugged. What about its performance? Compare it to the Intel Core i7: the Xeon D chip has 4 to 16 separate processing units, which are called cores. The Intel Core i7 has four cores.

The Core i7 offers an operating temperature range of 0 to 70 degrees C, which can complicate embedded computing

thermal management. The extended-temperature Xeon D could be appropriate for a wider variety of embedded computing environments.

Despite its advantages in raw processing power, the Xeon D is not for everyone. The processor does not offer graphics support like the Core i7 does. "Some applications that were using the Core i7 just for computing purposes might be able to use the Xeon D," Patel says. "If you don't need a display, the Xeon D is perfect."

The Xeon D also will offer HPEC systems designers some interesting new options — particularly for those who blend general-purpose processors like the Core i7 together with general-purpose graphics processing units (GPGPUs) for parallel processing applications. With as many as 16 computing cores, the Xeon D is a formidable embedded parallel processing engine on its own, and could offer alternatives to the GPGPU for signal processing in applications like radar, sonar, and lidar processing, as well as EW and SIGINT.

Many of the major embedded computing supplies either are gearing up for Xeon D-based products, or already have Xeon D boards on the market. It's not hard to see that the new powerful chip is going to send the high-end embedded computing market in new directions. ↙



Welcome to our Satellite Office

**With hundreds of space missions under our belt,
Coilcraft CPS is well positioned for all your aerospace applications**

Space is no place for commercial-grade components. That's why leading aerospace companies rely on Coilcraft CPS for proven RF and power magnetics featuring:

- Custom termination plating including Sn/Pb and Gold
- Extended temperature ranges (-55°C to +300°C)
- Vibration testing to 80 G / shock testing to 1000 G
- Low outgassing to NASA specifications

We also offer comprehensive product testing and validation services in accordance with established industry standards, as well as custom screening to your electrical and physical specifications.

Learn more about how our deep space experience can help your design take flight. Call or visit **coilcraft-cps.com** today!



* Coilcraft CPS parts are available with or without ITAR compliance.

800.981.0363 847.639.6400 www.coilcraft-cps.com

NASA-developed distributed electric propulsion could be key to future ultra-quiet UAV

BY JOHN KELLER

ATLANTA—U.S. government researchers are applying precise digital engine control in what could be the key to ultra-quiet unmanned aircraft for a wide variety of uses, ranging from covert military surveillance and reconnaissance to package deliveries that don't annoy the neighbors.



NASA scientists are using the GL-10 demonstrator, shown above, to create ultra-quiet propulsion for unmanned aircraft that could be inaudible from altitudes as low as 100 feet.

Researchers at the National Aeronautics and Space Administration (NASA) have developed a scale model of what they call distributed electric propulsion, and now are moving to general aviation-scale prototype aircraft with this ultra-quiet UAV propulsion technology.

The test bed for distributed electric propulsion is called the GL-10 — short for Greased Lightning — a 10-motor small unmanned aerial vehicle (UAV) with low-speed, 18-inch

propellers that developers say is inaudible to human ears when operating at altitudes as low as 100 feet above the ground.

Developing distributed electric propulsion technology are aviation researchers at the NASA Langley Research Center in Hampton, Va.

They showed the GL-10 demonstrator UAV last month at the Association for Unmanned Vehicle Systems International (AUUVSI) 2015 conference and trade show in Atlanta.

The GL-10 prototype has ten 8-horsepower electric motors — eight on the wings and two on the tail. The next project involving distributed electric propulsion will be a 3,000-pound, four-passenger aircraft with a 31-foot wing span, says Mark Moore, the GL-10's project lead

at NASA Langley.

Standard fast-moving propellers on most small UAVs like the ubiquitous quadcopter generate harmonics that translate into relatively loud noise — even if the drone's propellers and air frames generate little if any noise. The movement of air is the source of the unwanted sound.

Distributed electric propulsion on the GL-10, however, uses relatively

IN BRIEF

► Harris acquires Exelis, forming \$8 billion combined company

The acquisition of defense electronics specialist Exelis Inc. by Harris Corp. cleared one of its final hurdles in late May when Exelis shareholders approved the merger agreement. Harris and Exelis executives announced a \$4.75 billion deal last February for Harris to acquire Exelis in a cash and stock transaction. The acquisition closed in late May. Based on the agreement, Harris shareholders own about 85 percent of the combined company, and Exelis shareholders own about 15 percent. The combined company will be called Harris, but it is not clear if the company's headquarters will remain in Melbourne, Fla., or be relocated to the Washington, D.C., area. The Exelis headquarters has been in McLean, Va. The combined company would have had more than \$8 billion in revenue and about 23,000 employees globally in 2014, including 9,000 engineers and scientists.

FOR MORE INFORMATION

visit **Harris Corp.** online at <http://harris.com>, and **Exelis** online at www.exelisinc.com.

CONTINUED ON PAGE 7 ➔

CONTINUED ON PAGE 9 ➔

Defense industry concerned about cyber security; not sure where to turn for help

BY JOHN KELLER

NASHUA, N.H.—The vast majority of those in the aerospace and defense electronics industry are deeply concerned with the susceptibility of



their data and systems to cyber attack, yet they are not investing in cyber security tools because of perceived high costs and lack of customer cyber security requirements.

That's the conclusion of an industry survey *Military & Aerospace Electronics* and *Intelligent Aerospace* conducted in April and May on how important cyber security is to the aerospace and defense electronics industry and how cyber security will influence this industry in the future.

The survey tested opinions of 571 readers of *Military & Aerospace Electronics* and *Intelligent Aerospace* in an eight-question survey. Three out of four say they are very concerned or extremely concerned about the vulnerability of their data and systems to cyber attack.

Of responders, 85 percent say they expect the need for cyber security, information security, and cyber warfare to change how they do their jobs over the next one

to three years. At the same time, however, the survey indicates that aerospace and defense electronics experts are unclear about how to deal with cyber security issues, and on the companies to turn to for help with cyber security tools and advice.

Of those responding, 48 percent indicate they are not sure of specific companies they would approach as cyber security providers. Of those responders who were specific about companies they would approach for cyber security products, the companies they mentioned include:

- Advanced Technical Intelligence Center (ATIC) in Beavercreek, Ohio;
- AlienVault Inc. in San Mateo, Calif.;
- Apple Inc. in Cupertino, Calif.;
- Aspect Security Inc. in Columbia, Md.;
- Boeing Defense, Space & Security in St. Louis;
- Check Point Software Technologies Ltd. in Tel Aviv, Israel;
- Cigital Inc. in Dulles, Va.;
- Cisco Systems Inc. in San Jose, Calif.;
- Comodo Group in Clifton, N.J.;
- Cybernet Systems Corp. in Ann Arbor, Mich.;
- Dell in Round Rock, Texas;
- FireEye Inc. in Milpitas, Calif.;
- General Dynamics Information Technology in Fairfax, Va.;
- Google in Mountain View, Calif.;
- IBM Corp. in Armonk, N.Y.;

CONTINUED ON PAGE 8 ➔

High Quality, Rugged Microwave & Power Products



The Crane Advantage

- Efficient, reliable, clean power conversion
- High performance subsystem integration using Multi-Mix® leading technology
- Specialized products for Airborne Systems, Radar & Electronic Warfare, Flight & Mission Control Systems and Space

When failure is NOT an option,
rely on Crane for your
Mission Critical needs



Microwave Solutions
MERRIMAC® • SIGNAL TECHNOLOGY

Power Solutions
ELDEC® • INTERPOINT® • KELTEC®
www.craneae.com

Visit us at the NSREC
Booth #39 • Boston, MA

MIKEL helping Navy improve submarine warfighting capabilities

BY JOHN KELLER

WASHINGTON—A Massachusetts research company is moving forward on a U.S. Navy project to design futuristic submarine combat system technologies involving machine automation and reduced manning requirements.

Officials of the Naval Sea Systems Command awarded a \$6.7 million contract modification to MIKEL Inc. in Fall River, Mass., for research and combat system development and processing for Navy submarines.

MIKEL engineers will build on research they have been doing over the past five years to improve submarine automation, reduce manning requirements, and improve human system integration over current submarine combat systems.

MIKEL, an undersea warfare systems specialist, is focusing on automation and data fusion, target motion analysis, weapon employment tactical decision aids, tactical combat and surveillance system algorithms for sonar, combat control, weapons, communications, command and control, and navigation for future Navy submarines.

The most recent contract continues MIKEL efforts that began in late 2010 and have involved contracts and orders worth \$42.5 million on advanced submarine combat system and surveillance research.

The original contract, for \$9.1 million, was awarded on 30 Dec.

2010, and was followed by contract modifications involving a \$9.1 million order in January 2012, an \$8.9 million order in September 2012, a \$6.7 million order in March 2014, and the \$6.7 million in May.

MIKEL has expertise in acoustic tracking and navigation, combat systems, and performance as-

determine the 3D position to detected submarine active emissions at long ranges using existing submarine sonar systems for torpedo evasion and collision avoidance.

The company's Submarine Acoustic Navigation System (SANS) calculates the position of a submerged submarine or un-



MIKEL Inc. is helping the U.S. Navy develop efficient new warfighting technologies for fast attack submarines.

essment. The company develops algorithms that process data, and delivers software and hardware systems for submarine and other military combat systems.

Examples of MIKEL's expertise include the company's Automated Contact Management System (ACMS), a new approach to generating the tactical picture from the raw acoustic data from submarine sensors. This approach eliminates the need for traditional dot stacks, company officials say.

The MIKEL Active Intercept and Ranging System (AIRS) seeks to

manned underwater vehicle (UUV) in real time using one bottom-mounted beacon emitting a synchronized coded ping.

This technology is for affordable submarine and UUV navigation, waypoint position updates, correcting the accumulated errors of onboard inertial navigation systems, and for exercise reconstruction. ◀

FOR MORE INFORMATION

visit **MIKEL Inc.** online at www.mikelinc.com, and **Naval Sea Systems Command** at www.navsea.navy.mil.

NASA CONTINUED FROM PAGE 4

slow-moving props with digital control that spin at slightly different RPMs to break up the big harmonics of standard propellers. This approach creates a lot of different harmonics spread over all the motors, Moore says.

Digitally controlled motors moving at slightly different speeds is called speed frequency shifting, Moore says. "We can fly this over at 100 feet without being able to hear it on the ground," he says. "We're targeting package delivery and privacy, and no-noise-nuisance applications."

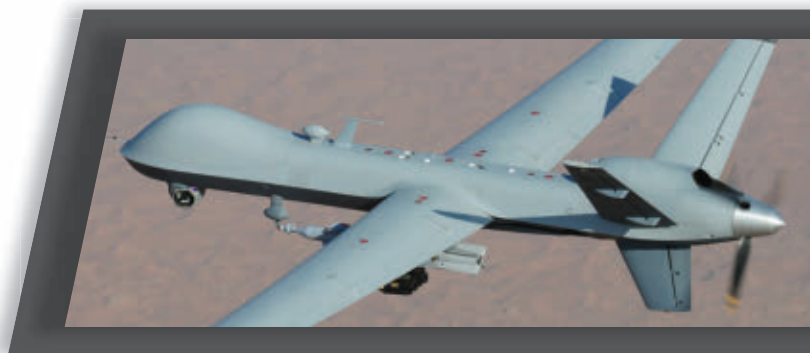
The basis for ultra-quiet aircraft propulsion like the GL-10's distributed electric propulsion is not new, Moore says. It came from Vietnam War-era research that led to the YO-3A Quiet Star aircraft, developed by Lockheed Corp. in the late 1960s for covert battlefield observation — particularly at night, Moore says. The manned YO-3A aircraft reportedly was inaudible from the ground when flying at altitudes as low as 1,200 feet. The last YO-3A was sold at auction in the early 2000s, but not before being used by the Louisiana Department of Fish and Game to help catch poachers.

Ultimately, this approach could lead to reduced-annoyance UAVs that can operate unobtrusively in densely populated areas, as well as provide the propulsion technology for covert and stealthy reconnaissance and surveillance UAVs. ←

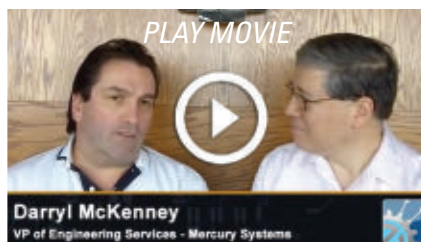
FOR MORE INFORMATION visit NASA Langley Research Center online at www.nasa.gov/langley.

Innovation That Cools.

MERCURY OFFERS INDUSTRY-LEADING INNOVATIONS IN THERMAL MANAGEMENT FOR AIR, CONDUCTION AND LIQUID -COOLED VITA 48 CHASSIS. OUR SOLUTIONS, SUCH AS THE NEW AIR FLOW-BY™ AND LIQUID FLOW-BY™, TRANSFER MASSIVE AMOUNTS OF THERMAL ENERGY AT THE INDIVIDUAL COMPONENT, MODULE AND SUBSYSTEM LEVEL WHILE STILL OVERCOMING THE MOST CHALLENGING SWAP REQUIREMENTS FOR THE OVERALL SOLUTION. NOW CUSTOMERS CAN TAKE FULL ADVANTAGE OF THE HIGHEST-POWER PROCESSING TECHNOLOGIES AVAILABLE FOR THE SENSOR CHAIN.



INNOVATION THAT MATTERS™



Visit mrcy.com/MAE and download our whitepaper:
Innovations in Thermal Management

Copyright © 2015 Mercury Systems and Innovation That Matters are trademarks of Mercury Systems, Inc. - 3129

DEFENSE CONTINUED FROM PAGE 5

- Intel Security Group (formerly McAfee Inc.) in Santa Clara, Calif.;
- Juniper Networks in Sunnyvale, Calif.;
- Kapersky Lab in Woburn, Mass.;
- L-3 TRL Technology in Tewkesbury, England;
- Lancope Inc. in Alpharetta, Ga.;
- Lockheed Martin Information Technology in Denver;
- Microsoft Corp. in Redmond, Wash.;
- National Instruments in Austin, Texas;

- Norse Corp. in San Mateo, Calif.;
- Northrop Grumman Information Systems in McLean, Va.;
- Palo Alto Networks Inc. in Santa Clara, Calif.;
- Raytheon Co. in Waltham, Mass.;
- RSA Advanced Cyber Defense in Hopkinton, Mass.;
- Symantec Corp. in Mountain View, Calif.;
- Trend Micro Inc. in Irving, Texas; and
- Trustwave in Chicago.

The wave of cyber security is near at hand, survey responders say. More than 95 percent say they expect future aerospace and defense programs and contracts to require proof of cyber security and cyber protection. Less than three percent don't expect these kinds of future cyber security requirements.

The majority of responders perceive the threat of cyber security to be elevated, high, or severe in mission- and life-critical aerospace and defense applications like avionics and vetronics, air traffic control, satellites and manned spacecraft, embedded systems, unmanned vehicles, and command, control, communications, computers, surveillance, and reconnaissance (C4ISR).

Survey responders say they protect their information and systems from cyber attack — or will in the future — with software, hardware, education, physical security, and virtual and cloud computing.

Despite the critical need for cyber security that responders perceive, nearly 59 percent say they haven't adopted cyber security tools yet because of costs. Twenty-nine percent say they haven't



With 16,535 available models

we already have a proven DC-DC converter that meets your requirements. (If not, we can build it.)

From standard models with built-in EMI filtering and low voltage outputs to semi-custom designs, our robust state-of-the-art converters meet the unique power requirements of your program.

100K+® Proton Rad Hard



For satellite applications

For example, the 5193SE-T05XF 100K+® Proton Rad Hard 28VDC input has outputs of 5V@3A and +/- 5VDC@450mA, each designed for satellite applications serving 5V logic loads and supplemental operational amplifiers. A chassis

mountable hermetic steel package attaches directly to satellite frame or system housing. Available in popular satellite bus inputs of 50, 70, and 100V, other mounting options and single and dual output combinations.

To find the converter you need, contact our responsive support team at sales@mdipower.com or telephone 1 631 345 3100 today

VISIT US AT NSREC BOOTH 24

MODULAR DEVICES, INC.

www.mdipower.com

An ISO 9001:2008 registered company

100K+ is a registered trademark of Modular Devices, Inc.

because of a lack of requirements, 25 percent say there is no return on investment for buying cyber security tools, 21 percent say cyber security is not required by clients, and 20 percent say they have not purchased cyber security tools because of a low threat level.

Those responding to the survey primarily are — or would be — buyers and specifiers of cyber security tools. Sixty percent say they expect to be involved in their company decision to buy, recommend, or specify cyber security, information security, or cyber warfare protection tools in coming years. Just 39 percent say they don't expect to be involved in cyber security purchasing decisions. ◀

IN BRIEF

► Navy and Boeing prepare to build nine new Poseidon military planes

U.S. Navy aviation authorities are giving the green light to the Boeing Co. to start building nine new P-8A Poseidon military planes under terms of a \$21.3 million contract. Officials of the Naval Air Systems Command at Patuxent River Naval Air Station, Md., are asking the Boeing Defense, Space & Security segment in Seattle acquire long-lead items for the manufacture and delivery of nine full-rate production Lot II P-8A maritime patrol and

anti-submarine warfare (ASW) aircraft for the Navy. The P-8A is a specially hardened and reinforced version of the Boeing 737 passenger jet, and is designed to operate either at extremely low altitudes or at high altitudes over the ocean to search for potentially hostile submarines. The P-8A is designed to withstand the rigors of low-altitude turbulence and exposure to salt spray. ◀

FOR MORE INFORMATION visit Boeing Defense, Space & Security online at www.boeing.com/defense, and Naval Air Systems Command at www.navair.navy.mil.



Optimizing SWaP is our passion.

MEET A BRAND NEW CES AT CES-SWAP.COM

THE SWISS **RUGGED** COMPUTERS COMPANY HAS A **NEW LOOK!**

We design and manufacture rugged embedded computers engineered to meet the most demanding performance requirements with optimal Size, Weight and Power (SWaP) considerations.

**ces**

IED hunters adapt to sophisticated threats

Improvised explosive devices have been the most lethal enemy threat to U.S. forces during military operations in Southwest Asia. Counter-IED technologies are adapting to ever-more-sophisticated IED threats.

BY J.R. Wilson

Improvised Explosive Devices (IEDs) have been the enemy's signature weapons in Southwest Asia for more than a decade of war. But IEDs actually have been in use for at least 500 years, although the term itself was not invented until the 1970s, when the British Army used it to identify remote-controlled or booby trap Provisional Irish Republican Army (IRA) bombs made from fertilizer and Semtex smuggled from Libya.

They also were widely used in World War II to cover retreating German Army troops and by resistance groups fighting the Nazis. The Vietnam War in the 1960s also saw IED use against U.S. infantry.

But it was not until Iraq and Afghanistan that IEDs became the single most important weapon in an ongoing war — responsible for roughly two-thirds of all coalition casualties in Southwest Asia, beginning with the first confirmed death in the spring of 2003 in Afghanistan.

Many people are misled by the word “improvised,” believing it means amateurish or substandard, both of which are far from the case. The typical IED comprises five primary elements: a switch or activator, an initiator or fuse, a container, an explosive and a power

Georgian soldiers search for simulated improvised explosive devices during a mission rehearsal exercise (MRE) in Germany last summer. (Army photo.)

source. An amateur bomb maker or one using substandard parts is more likely to blow himself up before he does anyone else.

IEDs intended to penetrate armor use a shaped charge; anti-personnel IEDs typically include nails, ball bearings, rocks or other fragmentation items to extend damage beyond the blast itself. Triggers include cell phones, garage door openers and other remote-control devices; washing machine timers, infrared or magnetic sensors, pressure bars, or trip wires. Those planting IEDs also can link them in a daisy chain spread out along a runway, roadway, or street to attack an aircraft, vehicles or foot soldiers.

Their “success” — aided by readily available bomb-making instructions on the Internet — has made IEDs the fastest growing type of weapon used by insurgents and terrorists worldwide, with hundreds of attacks now recorded every month in some 100 nations, according to the U.S. Department of Defense (DOD). As if that weren’t enough, now there is growing evidence they have been adopted by some nation-states for use in urban warfare environments.

The global IED threat

Last year alone, the DOD’s Joint Improvised Explosive Device Defeat Organization (JIEDDO) reported more than 27,000 IED incidents around the world that caused more than 56,000 casualties.

As the war in Southwest Asia progressed, IEDs became more powerful and sophisticated, as designers crafted each new generation to circumvent the latest Coalition detection and disposal technologies. As with most weapons in history,

each advance by one side led to counter advances by the other. Thus battlefield changes drove requirements and forced accelerated research into new technologies.

“Innovative enemy tactics have forced innovation by the U.S. and

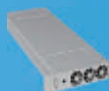
its allies. JIEDDO identified new solutions or adaptive ways to use existing technologies. For Radio-Controlled IEDs (RCIEDs), CREW [Counter RCIED Electronic Warfare] jammers will remain the primary method of defeating threat

SCALE UP AND SCALE OUT RES HIGH-DENSITY (HD) SERVERS

Suited for computing environments where server Size, Weight, and Power (SWAP) is important, Themis RES HD servers deliver high performance processing power, double compute density, enable a 50% rack space savings with per server weights as low as seven pounds, and reduce total system weight by almost 50%. For more information, go to www.themis.com/hd.



- SWAP-C Ready
- 2RU or 3RU Chassis Options
- Intel® Xeon® E5-2660 v3 Series processors, and Supermicro X9DRT-IBFF motherboards
- Supports up to three 56 Gb/sec Infiniband (IB) or 40 Gbm Ethernet ports to provide industry leading I/O bandwidth
- Maximum system configuration and expansion flexibility with processor, storage, high-speed switch, and system management modules options
- Enhanced reliability for shock, vibration, and extended temperature
- 0° C to 55° C operating temperature range
- 8% to 90% operating humidity (non-condensing)
- Operating vibration: 4.76 Grms, 5Hz to 2000Hz (SSD)
- MIL-STD 810F, EN60000, CE Mark



RES-HDC
Processor
Module



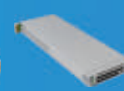
RES-HDS and
RES-HDS8
Storage Modules



RES-HDS8
Storage
Expansion Module



RES-HDFS
Storage
Module



RES-Switch
Module
(Mellanox-based)



RES-TMS System
Management
Module



47200 Bayside Parkway, Fremont CA 94538 | 510-252-0870 | www.themis.com

©2015 Themis Computer. All rights reserved. Themis and the Themis logo are trademarks or registered trademarks of Themis Computer. All other trademarks are the property of their respective owners.



A U.S. Marine checks for improvised explosive devices while leading a patrol during a training exercise in Kuwait last winter. (Marine Corps photo.)

devices,” says Patrick McKinney, JIEDDO’s program integrator for rapid capability delivery. “In a threat environment as dynamic as RCIEDs, a defeat mechanism must be as dynamic as the threat base.

“CREW systems, tailorable to the predominant threats, are continually updated based on intelligence from the battlefield,” McKinney continues. “JIEDDO, in conjunction with the CREW community of interest, remains vigilant in ensuring CIED systems remain effective, relevant and ahead of the enemy. Training and CIED awareness remain the primary mitigation measure for low-tech IEDs of the command- or victim-initiated variety. JIEDDO works extensively with theater and combatant commands [COCOMs] to develop programs that enhance awareness, train best practices and protect the force.”

The end of U.S. ground combat operations in Southwest Asia has seen an increase in IED attacks in Afghanistan and especially by ISIS in Iraq. An increasingly popular new version introduced by ISIS is the House-Borne IED (HBIED), where an entire house is rigged to detonate

and collapse shortly after a military squad has entered the building on a house-clearing mission.

“The IED threat is global, enduring and spreading. We will continue to see tactics, techniques and procedures [TTPs] proliferate, [with] a marked rise of IED use in conflicts around the globe, complicated by the rise of technology-enabled warfare,” McKinney says. “The IED is used with strategic effect not only against our deployed forces, but also in our homeland. Today’s most experienced extremists can share their lessons learned with the newest generation of extremists without the risk of face-to-face contact or travel. Violent extremists will adopt sophisticated technology limited only by the builder’s imagination.

“Threat networks are actively recruiting and trying to attract white-collar professionals, such as chemists, physicists and engineers, to help support their tactical and strategic efforts,” McKinney continues. “Combined, threat network capabilities mirror that of an iterative industrial complex for IEDs and we are seeing examples of this today in various IED switches. And

experienced enemy combatants are returning to their countries of origin with increased knowledge of irregular warfare tactics and IED construction TTPs.”

IED use in the United States has included the backpack pressure cooker bombs used by the Boston Marathon bombers on 15 April 2013 and the Vehicle IED (VIED) used by Timothy McVeigh against the Murrah Federal Building in Oklahoma City in 1995.

In Boston, two bombs exploded 13 seconds and about one block apart near the race finish line. Three spectators were killed and 264 others injured, including 14 who required amputations or lost limbs as a direct result of the blasts. Investigators learned the bombs, containing nails and ball bearings for maximum damage, had been manufactured by two fanatical Muslim brothers using instructions posted online by al-Qaida.

The Oklahoma City bombing, a \$652 million act of domestic terrorism by two anti-government extremists, killed 168 people, injured more than 680 others, destroyed or damaged 324 buildings and 86 vehicles within a 16-block radius and shattered glass in 258 nearby buildings. Using a 4800 pound mixture of ammonium nitrate fertilizer, nitro methane and diesel fuel packed into a rental truck parked in front of the building, McVeigh’s VIED created a blast equivalent to more than 2.5 tons of TNT that could be heard up to 55 miles away and registered approximately 3.0 on the Richter scale.

In areas where the primary insurgents and terrorists are Islamic fanatics, suicide bombers have

grown from explosive-laden vests to Suicide VIEDs (SVIEDs) they drive up to a target and detonate while still inside.

Multinational counter-IED force

Government instability and military actions by rebels, army deserters and al-Qaida-linked Islamic terrorist groups led to the creation of the United Nations Multidimensional Integrated Stabilization Mission in Mali (MINUSMA) in 2013. Comprising more than 11,500 uniformed personnel (military and police) from 50 nations, along with more than 1000 local and international civilians and 125 UN volunteers, MINUS-



A Marine Corps infantryman watches as a Georgian soldier uses a sickle to identify possible improvised explosive devices.

MA has focused on ensuring security, stabilization and protection of civilians; supporting national political dialogue and reconciliation; assisting the reestablishment of state authority; rebuilding of the security sector and the promotion and protection of human rights in Mali.

As of 31 March 2015, 49 MINUSMA troops had died in action and more than 100 more were injured, with IEDs being the principal cause of all casualties.

“With its network of bases and

its extended movements, MINUSMA has become their [the extremists] primary target,” according to a December 2014 report by the UN Secretary General. “Improvised explosive devices and anti-vehicle mines placed along routes used by MINUSMA

severely hindered its operations.”

While the report said MINUSMA has accelerated its counter-IED program, including acquisition of mine-protected vehicles and more training for its personnel, it also noted the African contingents

**Classic Designs
Are Timeless®**

**Just like the
legendary Ford Built
GT500 Mustang classic design...**

Lansdale Semiconductor still manufactures some of the most popular... and timeless commercial wireless, telecommunications, military and aerospace integrated circuits (ICs) classic designs.

As a global pioneer in IC products life cycle management, Lansdale manufactures over 3,000 classic design ICs in the original package, exactly as they were created and produced by AMD, Farchild, Freescale Semiconductor, Harris, Intel, Motorola, National, Philips (formerly Signetics), and Raytheon.

Our exclusive life cycle management program assures you of a dependable, continuous, cost effective, and high quality source of classic designed ICs today... and tomorrow!

This means Lansdale eliminates the need to go to the time or expense of designing in a replacement part or even doing a complete product redesign – not when we still make 'em... exactly like they used to.

Log on to our Web site at www.lansdale.com to review our up-to-date product listings and data sheets.

LANSDALE
Semiconductor, Inc.



Contact Sandi@Lansdale.com today.
5245 South 39th Street
Phoenix, AZ 85040-9008
Phone: 602.438.0123 • Fax: 602.438.0138

comprising most of the mission's forces are highly vulnerable to IEDs, lacking the equipment and self-sustainment capability required for UN peacekeeping.

IEDs also have become a growing threat in India, where insurgent organizations such as the United National Liberation Front (UNLF) have planted what the Indian military described as "powerful IEDs" along roadways used by security forces in the northeast Indian state of Manipur, which has seen continuous anti-government activities for more than half a century.

In February 2015, an Irish Army Bomb Disposal Team responded to an IED alert at a private residence in Cork City. A controlled explosion was carried out at the scene to render the device safe and the remains were moved to a military location for further testing. It was the first viable device of the year in Ireland, but the fifth call-out received by the Army bomb disposal unit in 2015. In 2014, there were 141 call-outs; 52 of those were viable devices.

The scope of the problem has led to an increasing number of U.S. EOD teams training host nation militaries and police in Counter-IED methods and technology, such as Marine Corps Special Marine Air/Ground Task Force (SPMAGTF) Crisis Response-Africa efforts in Uganda and Burundi, multinational European exercises focusing on manual neutralization of IEDs and U.S. and Dutch navy EOD technicians working together in an exercise in support of the 14-nation littoral warfare exercise Bold

Alligator in November 2014.

"When you look at the global trends, it is clear these weapons are not just a facet of our fights in Iraq and Afghanistan, but an aspect of the world we now live in and will operate in for the foreseeable future," says JEIDDO's director, Lt. Gen. John. D. Johnson.

Counter-IED state-of-the-art

The sophistication of an IED depends on the skills and experience of its bomb-maker and the materials available to him, from scavenged military explosives to fertilizer to industrial dynamite, along with easily obtainable electronic devices to use as triggers.



Two U.S. Army Humvee vehicle-mounted mine detection systems use ground-penetrating radar to detect IEDs. (Army photo.)

The technologies being used for detection and defeat of IEDs include ground-penetrating radar (GPR), handheld metal detectors, and explosive trace detection systems. Among the most widely used counter-IED technologies in Iraq and Afghanistan were small robots, such as iRobot's PackBot and QinetiQ North America's TALON, which could remotely examine suspect vehicles, packages, buildings, and tunnels. Such robots are expected

to remain a keystone in counter-IED efforts long into the future, albeit with increasing sophistication and capability.

And an "old" technology that originally gave U.S. ground forces control of the night has evolved to help counter the growing threat. The Night Vision & Electronic Sensors Directorate (NVESD) of the U.S. Army Communications-Electronics Research, Development, and Engineering Center at Fort Belvoir, Va., has been at the forefront of that effort.

"As the threat facing our soldiers evolves, night vision continues to develop technologies to meet these changing threats," says Rich

Nabors, deputy director of NVESD's operations division. "Extensive, long-term NVESD work in this area has taught our scientists of the need for multifunction detection devices that offer soldiers multiple capabilities in single technology packages; sensors with multifunction capabilities are essential to limiting the soldier's need to carry several detection devices.

"Additionally, NVESD is conducting research of sensors to relieve the cognitive burden required by legacy detection systems," Nabors continues. "NVESD is performing world-class research in-house in the development of techniques to improve the U.S. Army's Humvee Mounted Detection System (HMDS). These improvements provide an advanced LIDAR profilometry with forward-looking and downward-looking GPR to help eliminate ground

bounce and surface clutter. Technical expertise in laser and countermining component technology development continues to improve the forward-looking dual-band GPR for buried threat detection.”

In June 2014, the Sandia National Laboratories in Albuquerque, N.M., transferred to the U.S. Army for ground troop use a breakthrough IED detection capability — the Cop-perhead Synthetic Aperture Radar (SAR), a highly modified MiniSAR system that has been used on unmanned aerial vehicles (UAVs) in Southwest Asia since 2009. Cop-perhead detects disturbances in the earth such as those made when IEDs are buried, day or night, and in



Soldiers use the iRobot 510 PackBot to identify and disarm a simulated improvised explosive device at the Robotics lane at Fort Irwin, Calif. (Army photo.)

many weather conditions, including fog and dust storms.

In the early years of the wars in Southwest Asia, U.S. and Coalition troops were unprepared for the types and level of IEDs they were

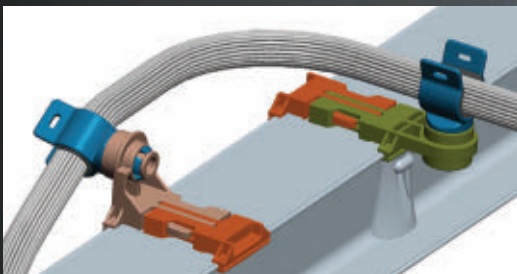
facing. The military responded by providing ground forces with whatever off-the-shelf equipment they had that might offer even a little assistance. Meanwhile, military and contractor labs worked overtime to develop new and better ways to detect and dispose of IEDs, even as the enemy worked equally hard to stay ahead of the curve.

In February 2006, DOD also created JIEDDO to, according to its mission statement, “focus (lead, advocate, coordinate) all Department of Defense actions in support of the Combatant Commanders and their respective Joint task forces’ efforts to defeat IEDs as weapons of strategic influence”. The

Commercial Aerospace

TAKE CHARGE OF LIGHTNING STRIKES

EVERY CONNECTION COUNTS



TE Connectivity (TE)... Your Partner for the Design and Build of Grounding and Bonding Systems for Composite Airframes

- Space-saving, weight-reducing systems
- For traditional metal and CFRP airframes
- Lightning-, fault- and EMI-protection
- Flexible, modular cable management
- Quick installation, easy maintenance

te.com/CommAero

TE Components... TE Technology... TE Know-how...

AMP | Agastat | CII | Hartman | Kilovac | Microdot | Nanonics | Polamco | Raychem | Rochester | DEUTSCH
SEACON Phoenix | L.L. Rowe | Phoenix Optix | SEACON

Organization seeks to accomplish its mission through three primary lines of operation: attacking the enemy's network, defeating the device and training the force.

Johnson, who became JIEDDO's fifth director in 2013, told the second annual Explosives Ordnance Disposal, Improvised Explosive Device and Countermining Symposium in 2014 the transnational nature of threat networks, terrorists and crime organizations now incorporating IEDs as a weapon of choice mean they are likely to be part of any future battlefield, regardless of the enemy.

"One of the keys to fighting this networked, global enemy is the ability to know who the enemy is," he said. "We have put a huge emphasis on forensics. Soldiers treat an IED site like a crime scene. We figure out a bomb-maker's signature and track how they operate and share knowhow around the globe.

Disruptive technology

"IEDs are a manifestation of a bigger problem — disruptive technology. The enemy has figured out how to arrest our technological advantage on a localized or temporal basis. Their combination of local attacks gives them potential for strategic advantage."

The FBI's Terrorist Explosive Device Analytical Center has become a key forensics game-changer, analyzing IED components and information from 38 countries to identify their origin and commonalities, as well as what new technologies may be involved in their construction and use. That also assists JIEDDO's fourth priority — anticipating

future developments.

"I don't want us to be so focused on the IED that we miss the 'next IED'. The enemy is creative and adaptive and we have to be equally so," Johnson warned. "The enemy adapts to any measures we take. We have to be constantly on our toes to the changes we see these threat networks making.

"We must make some tough choices about what we keep, what we idle and what we set aside. In the short term, we have to anticipate future threats and do our best to gear up for it. And if we can't anticipate the threat, we have to be able to react rapidly."

Next-generation counter-IED

As IEDs, whether developed and employed by terrorists or nation-states, are becoming more and more sophisticated, so too are the technologies under development to counter them.

For example, the Haptics-based

Immersive Tele-robotic System (HITS) employs a touch-sensitive robotic interface containing an immersive telepresence environment for a remotely-controlled three-articulated-robotic-arm system, according to a paper presented at the SPIE Unmanned Systems Technology XVI conference in June 2014. The four Canadian-based authors — David Erickson from Defence research Canada and Hervé Lacheray, Gilbert Lai and Amir Haddadi from Quanser Inc. — said the project demonstrates that a two-armed anthropomorphic EOD robot interface can use complex neutralization techniques against realistic IEDs without exposing the operator to danger.

"While the haptic feedback enhances the operator's perception of the remote environment, a third teleoperated dexterous arm, equipped with multiple vision sensors and cameras, provides stereo vision with proper



A U.S. Army Buffalo explosive device detection vehicle digs up an improvised explosive device during route clearance operations at McCrady Training Center, Eastover, S.C. (National Guard photo.)

visual cues and a 3D photo-realistic model of the potential IED,” they wrote. “This decentralized system combines various capabilities, including stable and scaled motion, singularity avoidance, cross-coupled hybrid control, active collision detection and avoidance, compliance control and constrained motion, to provide a safe and intuitive control environment for the operators.”

To counter what is expected to be a new front in the IED war, the Department of Homeland Security has contracted Saab, in cooperation with DHS’ Technical Support Working Group, to develop a Water-Borne IED Remotely Operated Vehicle (WBIEDROV) to detect and defeat underwater IEDs in U.S. domestic waters.

“We hope to follow the huge strides that have been made on land in the area of Remote IED disposal over the past 10 years and to address the problem of underwater security,” Agneta Kammeby, head of Saab’s Underwater Systems business unit, said when the contract was announced at the Euronaval 2014 exhibition in France in late October 2014.

Operated by the DHS Underwater Hazardous Device Team, the WBIEDROV, based on Saab’s Double Eagle Subrov, is being designed to detect, manipulate and defeat IEDs and limpet mines in the challenging underwater environment of ship hulls and jetty searches while maintaining station in a current.

Scientists at the U.S. Defense Advanced Research Projects Agency (DARPA) are working on a compact, configurable, real-time infrared



A Marine Corps dog searches for explosives during a patrol near Patrol Base Boldak in Helmand province, Afghanistan. (Marine Corps photo.)

hyperspectral imaging (HSI) system to detect and identify chemical and explosive threat materials in a variety of complex, high variable background conditions. Existing HSI systems are large, costly to field, operate and support and generally do not operate in real time, while those that do are limited in the number of spectral bands, image definition or targets being detected.

According to DARPA’s three-phase request for proposals to industry, “what is needed is an IR hyperspectral imaging and sensing capability with the following characteristics:

1. rapidly field-configurable operation to adapt to different targets or operating conditions;

A Single Board Computer (SBC) from
a Proven IC and Service Provider

COBHAM

The most important thing we build is trust



**GEN 6 LEON 3FT
Single Board Computer (SBC)**

World Class CCA facility..Bill of Materials (BOM)
with Cobham IC Content

Standard, Readily Available SBC

***Flight Ready TRL-6 SBC, Designed for
LEO, GEO and Planetary Missions***

Cobham Semiconductor Solutions’ (formerly Aeroflex) Off-the-Shelf Solution for Command and Control Applications.

- Flexible Architecture
- Core LEON 3FTs - UT699, UT699E, UT700
- Up to 95 Dhrystone MIPS performance with 132MHz System Clock
- 64MB of SRAM Memory
- 32MB of NV Memory
- Two cPCI bus I/F connectors (Hypertronics)
- Two SpW connectors and front panel test connector

The GEN 6 SBC is available now for your missions.

800-645-8862
www.aeroflex.com/SBC

2. real-time, target on-the-move operation, ideally at the frame rate of the focal plane array camera;
3. real-time automated target signature detection, performed within the system to dramatically reduce data bandwidth, downlink transmission bandwidth requirements and post-processing;
4. significantly reduced cost, size and weight; and
5. imaging operation with minimal support infrastructure.

“The resulting system should be able to support one or more of the following missions: counter IED detection, IFF, bio/chemical WMD detection and tag, track and locate (TTL) missions,” DARPA said. “The military utility of the data and intelligence that is generated by the current large and costly systems has been demonstrated.

SWaP and costs

“Driving the SWaP and cost down such that the system can be used by a dismount or on a small UAV will enable proliferation of the capability in the same way that night vision goggles or cell phones have become an integral part of the soldier’s arsenal. Requiring the system to be compatible with existing systems and data formats will help ensure more rapid acceptance and use.”

DARPA’s compact HSI effort would be applicable to finding ways to detect next-generation IEDs that are not “visible” to existing systems due to the use of non-metallic cases and components and new types of explosives. Given the need to make detectors multifunctional and of common distribution across



A Marine searches for improvised explosive device indicators with a Holley stick during a counter IED course held at the Marine Corps Engineer School’s Home Station Training Lanes in Holly Ridge, N.C.

multiple forces worldwide, that has led to a growing emphasis on Smart Multi-sensor Counter-IEDs.

One such is an advanced Counter IED and Mine Suite (CIMS or ELI-3375) being developed by Israel Aerospace Industries (IAI) for route clearance to protect lead combat maneuver forces operating in areas known or suspected to be IED- or mine-infested.

CIMS is designed to detect surface and underground IEDs, mines and roadside bombs using an integrated suite of sensors, processing and decision support tools — an Above-surface Detection System (ADS) incorporating an advanced side-looking SAR, high-resolution optical detection system and infrared multispectral investigation system and an underground Mine and IED Detection System (MIDS) comprising a GPR and a magnetic detector. It also performs automatic cuing of sensors and complimentary countermeasure systems, including

IED neutralization and hard kill, to autonomously and remotely defeat or destroy suspected IEDs.

The European Defense Agency (EDA), meanwhile, has announced plans for five IED projects, to begin by the end of 2015 and run through 2018. Those will involve one UAV-based and one UGV-based (unmanned ground vehicle) early warning project, one UGV-based stand-off detection system, a “confirmation and identification” capability and a multi-sensor urban distributed ISR demonstrator.

Another technology with future potential, being developed by Phoenix Nuclear Labs (PNL) in partnership with the U.S. Army, uses a compact, high-yield neutron source for IED detection. Called NEMESIS (neutron emitting mobile explosives sensing and identification system), it is based on a neutron generator 1000 times stronger than conventional accelerator-based neutron generators and has demonstrated a standoff distance up to 100 feet, with a high degree of accuracy, according to PNL President Ross Radel.

Generating a steady state production of as many as 10¹⁴ neutrons per second, the NEMESIS broad energy spectrum can detect all key nuclear elemental signatures: nitrogen, hydrogen, oxygen, carbon, silicon, and iron. It also can significantly reduce false-positive responses to silicon, wet soil conditions, and background nitrogen in air. According to Radel, by directly detecting the explosive material itself, rather than metallic bomb components, so-called “detection-proof” bombs made without metal, wires or electronic triggering

mechanisms “are as easy to detect as any other bomb.”

“We’ve known for some time that certain types of IEDs can potentially go undetected through existing scanners that use X-rays,” Radel told the American Society of Mechanical Engineers. “The beauty of our system is that it can detect unconventional explosives, such as homemade explosives, that might not be caught by existing security infrastructure.”

In February 2015, the U.S. Army issued a solicitation to industry for a lightweight handheld device with a user-friendly interface that can collect data from several sensors to help dismounted warfighters detect metallic and non-metallic IEDs and land mines. It also must present the user with 2D and 3D visual representations on a display that is either integrated or mounted on the detector.

No silver bullet

“There is no silver bullet to this problem; it’s using multiple capabilities to maximize results. Threat networks are learning organizations, more agile and flatter than we are. They operate seamlessly and virtually using social media and the Internet to communicate, raise funds and share intelligence,” JIEDDO’s McKinney says. “We, too, must become equally adaptable, agile and flexible. The enemy is a master of off-the-shelf and dual-use components, using ordinary containers, commercial fertilizer, wire, discarded batteries and scraps of wood to construct their devices. We must figure out how to counter this threat.

“One of the lessons re-learned is the value of training. Training must

accompany innovation. Our best Counter-IED weapon will always be a well-trained soldier. We must identify and continue to invest in capabilities to counter the evolving IED threat.”

Some had expected JIEDDO to disband when U.S. troops left Afghanistan; instead, it was permanently re-aligned in March 2015 as a combat support agency under the Defense Undersecretary for Acquisition, Technology and Logistics. In that role, Johnson vowed, it will be at the forefront of tracking and responding to current use and future evolutions of IEDs.

“We track IEDs around the world and... anywhere U.S. troops deploy, they are going to be at risk of IEDs. The enemies are very innovative and they share their ideas and innovations. If we see IEDs that have success in one place, we can guarantee you we’re likely to see it elsewhere,” Johnson said in announcing the organization’s new status. “Now we’re back helping the Iraqis with the problems there — and our enemies are using IEDs in greater numbers all the time.”

Calling U.S. warfighters “the most trained, most capable weapon” against IEDs, Johnson added JIEDDO will continue to “provide counter-IED capabilities that allow [warfighters] to adapt and be that number one weapon on the battlefield.”

The challenge JIEDDO and others face in dealing with future IEDs and counter-IED efforts was summed up precisely by an Iraqi colonel fighting ISIS: “When you beat them today, they will think of a way to build an even more sophisticated bomb, so you won’t beat them again.” ◀



MISSION CRITICAL DEVICES



DC-DC Converters

AC-DC Power Supplies





- Expanded Operating Temperatures **-55 to +85C**
- Vibration, **Method 204, Cond. D**
- Shock, **Method 213, Cond. I**
- Altitude, **Method 105, Cond. D**
- Environmental Screening
- Specification Review
- Custom Models Available
- 400 Hz and Now - **800 Hz AC-DC Models**

Thousands of Standard Models 2V to 10,000 VDC
Outputs - 0.75 to 2,000 Watts

PICO Electronics, Inc.

143 Sparks Ave, Pelham, NY 10803-1837
E-Mail: info@picoelectronics.com
www.picoelectronics.com





See full Catalog immediately
www.picoelectronics.com

Connector industry balancing speed, cost, and performance

Interconnect designers confront system demands for blindingly fast speeds and small, lightweight connector products that work in rugged operating conditions.

BY John Keller

At no other time in the history of electronics have demands been greater on signal and power interconnects. Systems designers want the smallest connectors possible to handle applications like robotics and wearable electronics, yet they require signal and power throughput that was unimaginable only a few years ago.

As it is for most aerospace and defense electronics these days, the need to reduce size, weight, and power (SWaP) is perhaps the primary design factor driving military and aerospace connectors, their designs, and their applications.

Besides SWaP, other trends in military and aerospace connectors involve increasing data throughput—particularly when it involves the question of when to move to optical interconnects over copper—as well as new generations of hybrid connector designs to reduce cost,

Omnetics Connector Corp. specializes in nano- and miniature circular connectors for a variety of aerospace and defense applications.

size, and weight, as well as to enhance performance.

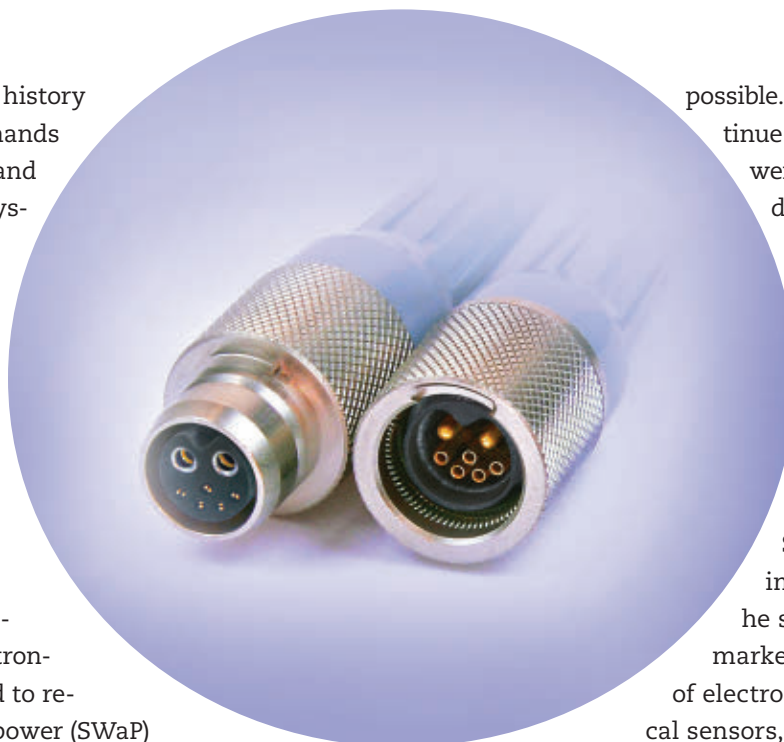
Reducing SWaP

Of utmost concern in aerospace and defense connector design is reducing SWaP so connectors are as small, lightweight, and power-efficient as

possible. “Connectors will continue to shrink in size and weight,” says Bob Stanton, director of technology at Omnetics Connector Corp. in Minneapolis.

“Our customers want connectors that are smaller, more rugged, more portable, and as rapidly available as possible,” Stanton says. The most important design drivers he sees in the connector market are the growing use of electronic and electro-optical sensors, the broad use of high-speed Ethernet in aerospace and defense applications, and the growing use of robotics.

As other electronic components shrink in size and weight, the pressure grows on connector designers to keep pace with these design trends. “We are trying to take these massive storage units that we used to see in buildings and make them portable for small units out in the field,” Stanton says.



"We want to make the weight lower, but make the processing more," Stanton says. "Systems designers want higher power, higher capacity, and still have the ability to handle all this stuff. We want this capability on a hip pack on a soldier, when it used to be a refrigerator size in a building, and the connectors have to handle that."

Consider the growing use of sensors on platforms ranging from ships and aircraft, to the rifle sights on infantry weapons. "A high-volume driving trend is looking at things through different forms of surveillance, ranging from satellites to UAVs [unmanned aerial vehicles], to personal equipment, to roving vehicles on the ground," Stanton says. "There is more surveillance data than ever before."

Take robotics, for example. This technology area is helping drive the need for reduced size, weight, and power consumption, as well as driving demands for increased connector throughput.

"Chips are moving from the big box and into modules, and into the point of access or actuation," Stanton says. "Designers want sensors, detectors, transducers, and processors out in the hand of the robot, and we are moving the processing power out there to the hand, rather than the shoulder. We need some sort of connector that handles multiple signals," he says.

Omnetics specializes in micro-miniature and nano-miniature high-reliability electronic connectors for aerospace, defense, medical, instrumentation, and other high-reliability applications. The company uses a proprietary flex pin contact system for micro and nano connectors,

which are QPL approved to MIL-DTL-32139 & MIL-DTL-83513.

Omnetics offers micro and nano strip connectors; micro circular connectors; a squeeze-latching nano-connector; nano-circular connectors; and polarized nano-connectors.

Demands for throughput

Not only must connectors today and in the future be small and lightweight, but they also must be able to handle the data throughput of modern high-resolution sensors, as well as provide the power necessary for



PIC Wire and Cable® has been making customers' jobs easier for over 40 years by helping to improve platform and system performance, reduce development and manufacturing schedules and lower total costs. Our PICMATES® family of cables, connectors and cable assemblies is advancing interconnect technology for network/communications, data transfer and high frequency/microwave specifications.

Applications

- **Communications / SATCOM**
- **TCAS/ Navigation**
- **ADS-B**
- **GPS**
- **Cockpit Instrumentation**
- **Broadband Networks**

PIC Programs

- **Chinook Helicopter Glass Cockpit Upgrade**
- **Hunter UAV**
- **Joint Primary Aircraft Training System (JPATS)**
- **T-38 Retrofit**
- **Blue Force Tracker**
- **Secure Border Initiative**

PICMATES®
INTERCONNECT PRODUCTS



RF



Video



Data



Micro

800.742.3191 • WWW.PICWIRE.COM/MILAERO

AIRCRAFT / GROUND VEHICLES / TRANSPORTABLE SHELTERS

these sensors, actuators, and other electrical subsystems.

This pushes the need for a growing number of pins in increasingly small connector housings, with increased care necessary to preserve the ruggedness of connectors in field applications, avionics, and other areas where shock, vibration, and temperature extremes are common.

"The biggest trend we see in the connector industry is higher and higher speed in digital signal integrity. Signals are moving faster and faster," Stanton says. These needs are forcing connector designers to take ever-more care in how they craft interconnects to enhance data throughput, improve signal



Aerospace and defense applications are demanding high-performance connectors that are small and rugged enough for wearable devices and other ruggedized uses.

integrity, and reduce size and weight.

"We are seeing rapid change in the quality of surveillance, with high-performance CMOS, and the chips that run on lower and lower voltages and currents," Stanton says. "We can get massively improved imaging today even over what they got five years ago."

Chip designs for sensors and sensor processing have changed dramatically in recent years with demand for lower voltages, lower current flows, and higher speeds for digital signals, Stanton explains.

These reduced-voltage components can place limitations on the lengths of cables and cable runs, as well as reductions in the capacities of cable so as to preserve signal integrity. These conditions make it increasingly important to match the impedance of cables of connectors, Stanton says. "When you see a change from lower-power signals running 1 to 3 gigabits per second, you see different demands on connectors and cables.

"Minding the combination of the cable and the connectors is making the evolution of high-speed differential signal management such a big trend," Stanton says. "We are sometimes running 90 to 100 Ohms impedance, so impedance matching is becoming more and more critical."

As a side note, the high throughput demands placed on connectors and cable today may be spelling the end of coaxial cable and coaxial connectors for data in most modern designs. "There are more wires per circuit, and the circuit is handling more and more data than it used to," Stanton says. "With digital moving rapidly, we see less demand for everyday coax. Coax has its place in RF and microwave, but it doesn't bear on digital."

Many connector manufacturers are finding similar conditions in the market. "There is a steady creep involving data rates and in voltages to minimize SWaP," says Greg Powers, business development manager at TE Connectivity in Harrisburg, Pa. "If there is any design shift, it is in the data portion, where it might be more impedance matched, or involve a block of

Molded Cable Assemblies



Cables with molded connector strain reliefs and junctions provide superior reliability to shrinkable boots and mechanical backshells. Molded assemblies are sealed for life and provide excellent strain relief, environmental protection, abrasion protection, shock and impact resistance, most often at lower cost. Benefits include ability to custom fit into tight spaces, allow cables to exit connectors at any angle, and excellent aesthetics. Moldings do not utilize shrink boot adhesives that break apart in the cold or with age. Cables with moldings do not pullout due to cold flow as can happen in a cable clamp or grommet.

Nortech Systems
WE THRIVE ON HELPING OUR CUSTOMERS SUCCEED
www.nortechsys.com



High-throughput USB 3.0 interconnects, developed originally for commercial applications, are being ruggedized for industrial and military uses.

dielectric.”

With high pressure for performance and aerospace and defense systems, as well as demand to control costs, sometimes systems designers who are used to strict military standards must find a way to compromise.

“We are seeing increasing downward cost pressure,” says Jay Sandidge, international marketing director at Positronic in Springfield, Mo. “This has impact on product selection and may have require the use of a COTS [commercial off-the-shelf] part that is less expensive. No doubt there has been an uptick in the number of times we have to confront cost decreases.”

The tradeoff of COTS versus mil-spec connectors can be tricky, he says. “Is a ruggedized commercial

solution okay for military applications? Sometimes it is,” Sandidge says. “On the one hand you pay so much for mil-spec part, yet you might be able to get the mechanical equivalent without a mil-spec part number, but it may have some cost options for the customer.”

Sometimes this might require changes in how military applications allow for reducing the power ratings of connectors, which often is referred to as derating. “One trend I have seen is maybe the military gets more performance by loosening their mandate in how they derate,” Sandidge says.

“You could buy yourself more performance by derating—maybe not to the edge, but farther than they have in the past.” While admitting that systems designers and

CONNECTORS FOR HARSH ENVIRONMENTS



Push-Pull and Ratchet Connectors:

- Rugged
- Watertight
- Stainless Steel
- Aluminum Shell
- Hybrid Configurations
- Vibration Resistance
- Cable Assembly
- Compact for Reduced Space



LEMO USA, Inc.
800-444-5366
info@lemousa.com
www.lemo.com



NORTHWIRE is a LEMO Group Company

component manufacturers may be taking on added risk by connector derating, the tradeoff of risk for performance may be worth it in certain applications.

"Anytime you move away from being more conservative in derating, you would think statistically that you are opening yourself up to more failures," Sandidge says. "It could be one in a million or two in a million."

The solution might be small tweaks in test procedures to ensure connector reliability for specific applications, Sandidge says. "I've never really seen customers who rely on the supplier to provide every last little fact on testing. If a designer will do more derating, then our customers might do more rigorous reliability testing."

Changes like this could become commonplace in the aerospace and defense industry as pressures mount to keep performance high and costs down. "This is coming in the connector industry," Sandidge says. "If a prime contractor selects a connector to put on a system, once all those parts are selected, those things get tested and beat to death in the lab."

Positronic designs high-reliability electronic connectors and build-to-print cable assemblies for military, space, commercial aerospace, medical, industrial, test, rail and other high-reliability applications. Key products include high power, D-sub, rectangular, modular and circular connectors with mixed density, blind mating, optical, waterproof (IP67), hermetic, thermocouple, spaceflight, mil-spec, solder/wire/press-fit terminations and various

accessories. Connector types include options for free cable, PCB mount and panel mount.

Demands for small size and weight in connectors are driving innovations in small wire sizes and non-traditional voltages to accommodate industry needs.

Power and performance

While data throughput is of critical importance in the connector industry, the need to provide efficiently conditioned power remains undiminished. "Power is a necessary evil, just like batteries," says TE Connectivity's Powers. "It's where people wish there were more convenient ways to do it."

Combining the needs for power, data throughput, and SWaP often encourages connector designers to combine data and power in the same connector in several different hybrid design approaches.

"Data is easy, but power comes down to heavy copper," Powers explains. "The evolutions in power are in contact density and contact efficiency, and people are looking at dual-use where COTS connectors are up to performing in rugged applications."

TE Connectivity designs

connectivity and sensor solutions for a variety of industries including aerospace, defense, automotive, industrial equipment, energy, sub-sea communications, oil and gas, and consumer electronics.

The company changed its name to TE Connectivity from Tyco Electronics in 2011 to reflect its position as a connectivity and sensor component manufacturer. The company

centers its interconnect products on four sectors: transportation, industrial, network, and consumer.

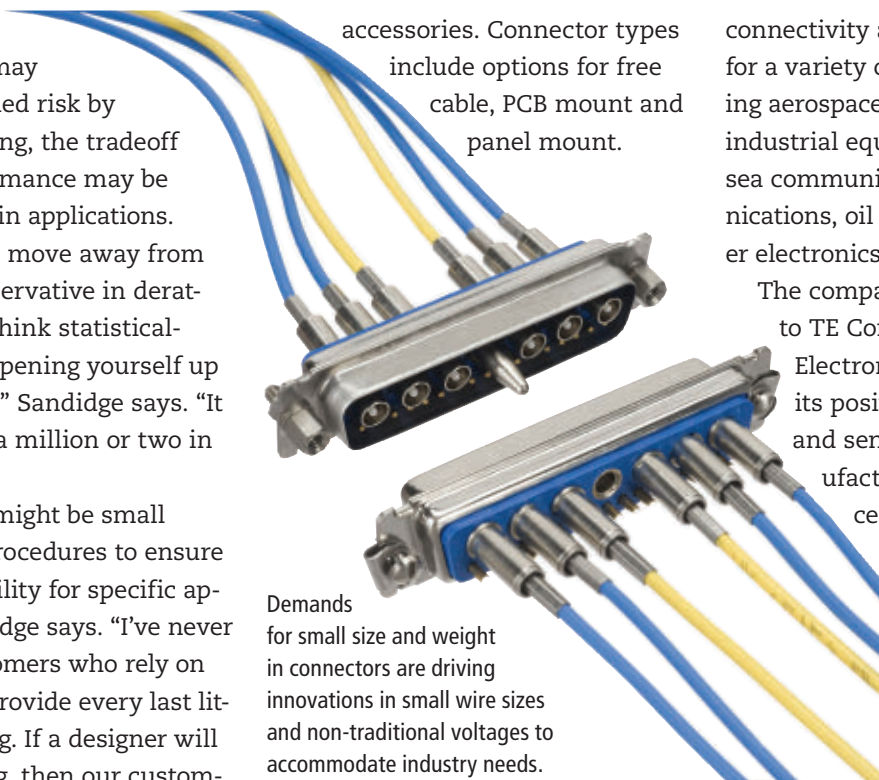
Sometimes reducing size, weight, and power efficiency in power connectors

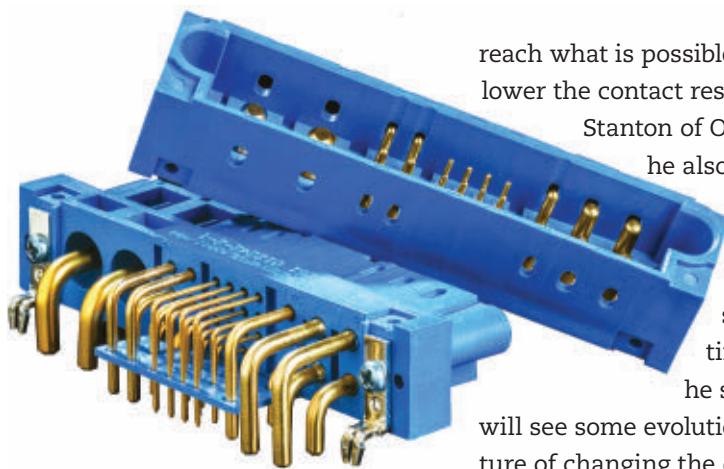
can encourage designers to increase voltages and use smaller wires, "and the connectors need to be compatible as well," Powers says.

There is not clear consensus among systems designers of whether to combine data and power in the same connector, Powers says. "Some people are okay with hybridizing connectors, and others like to maintain them as discreet; there is not complete rationale between the two," Powers says.

The issue of combining power and data in the same connector becomes more complicated when fiber optic interconnects are involved. "If there is the ability to rationalize why you might mix power and data it will be with copper, but not power and data fiber," Powers says.

Although there is some combining of power and fiber data throughput in the same connector in specialized applications like undersea





The Positronic Scorpion connectors is optimized for small size and weight, and can accommodate power, signaling, or a combination of the two.

and some avionics applications, often the design solution involves adjacent modules to reduce complexity. "I do think that power and data will always be hybridized, but if you have them in adjacent modules it does allow segregation of the media with discrete wire and fiber bundles," Powers says.

"There are other things coming, like carbon nanotube technology that is being investigated for things like MIL-STD-1553; it is very good for that, and will have a significant impact on SWaP," Powers says.

At some stage, however, some connector de-

signers fear that the industry could be reaching the point where small connector sizes prevent additional combining of data and power. "We may be reaching the limits of physics," says Positronic's Sandidge. "At some point you

reach what is possible; you can only lower the contact resistance so far."

Stanton of Omnetics says

he also sees limitations on the horizon.

"Higher densities will continue to a point,"

he says. "We

will see some evolution in the future of changing the dielectric constant of the insulator. If speed continues, the only solutions are lower capacitances."

Optical interconnects

Although connector and cable designers will continue to push the bounds of copper interconnects, at some stage systems designers must consider optical fiber and fiber-optic connectors if they continue to push the bounds of data throughput. "With the general concept of we want as much throughput as we can get, then you have to use an optical interface," says Positronic's Sandidge. "If the bandwidth appetite progresses as it has, then designers will have to confront that."

"Right now a lot of the connector



These Positronic D-Sub connectors are designed to withstand the shock, vibration, and radiation conditions of space applications.

KEEP COOL

with high-efficiency power and signal connectors



Scorpion Connector

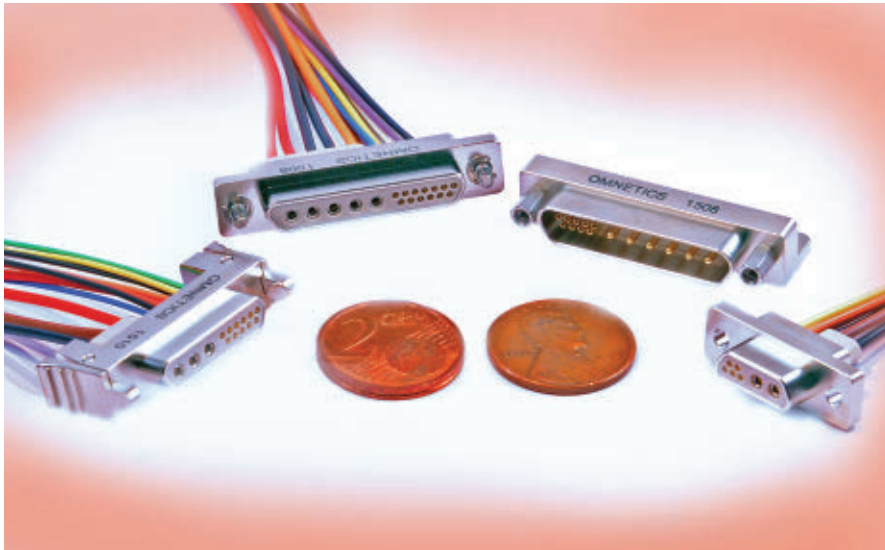


- Sub-milliohm resistances generate minimal heat
- Machined contacts for rugged applications
- Modular options for design flexibility
- Leading linear current density
- Blind mating and press-fit options
- Cooling provisions (biplanar)



Positronic®

connectpositronic.com



Demands for small, lightweight connectors are encouraging hybrid approaches that combine power and data on the same interconnect.

community is looking at holding ground in design practices with some of the higher-speed copper connectors, and then in migrating to ultra-high-speed fiber,” says TE Connectivity’s Powers. Driving this approach are applications in radar, signals intelligence (SIGINT), video processing, and communications hubs, he says.

“There will always be a place for copper-based connector products; it’s a mechanical thing,” Sandidge says. With that in mind, many connector manufacturers and systems integrators remain in their copper comfort zone, but at some time many of them must confront the challenges and complexity of fiber interconnects, which can be daunting for aerospace and defense applications.

When it comes to optical fiber interconnects, it’s a continuing challenge to fabricate these devices that are rugged enough for many aerospace and defense applications. “Some commercial connectors are touted as 25 gigabits per second, but those are not

really found in the rugged world yet,” Powers says.

The question of when and where to make the jump from copper to optical fiber continues to confound the experts. The downside of making the move too quickly is that “any time you introduce optics, it complicates the whole picture,” Sandidge says. Make the jump too late and systems designers risk being overtaken by their competition.

“How do you jump to optical, and when do you make the jump? I don’t have any knowledge of where that is,” Sandidge admits. “There is some copper stuff that moves data as fast as 50 gigabits per second, but there are so many caveats.”

One of the most formidable hurdles to converting from electrical fiber to optical fiber and optical interconnects is the design complexity of converting electrons to photons, and photons back into electrons. It probably will be a long time before all-optical systems are common in aerospace and defense applications, so electrical-to-optical conversion

will be a necessity for the foreseeable future.

RF and microwave applications like radar and SIGINT, moreover, are likely always to involve electronic components close to the antenna, so an all-optical system always may remain in the theoretical.

Still, the potential benefits of optical fiber and optical interconnects is a big attraction for data-hungry applications. “Fiber carries signals eight times fast than wire,” says Omnetics’s Stanton. “The reason fiber hasn’t exploded is it is hard to convert photons to electrons.”

Moving to optical fiber and interconnects, moreover, never may be feasible for compact applications like wearable computing. Converters that switch signals from electricity to light and back again take space, weight, and power, and for SWaP-sensitive applications it might never make sense. “A compact system probably isn’t worth going to fiber because of the conversion needs,” Stanton says.

Cost also is a big factor concerning a move to optical interconnects. “With mixed signals we want to go more and more with standard products, and we want to control our costs,” Stanton says. “That’s what the government says it wants.

These needs are driving connector manufacturers and systems integrators to using standard products that are adapted to individual needs—as long as adaptations are affordable. The challenge is to balance reliability, performance, and design risk where changes are made. “One by one every company tries to offer standard products and rapid adaptations for special needs,” Stanton says. ◀

Military & Aerospace Electronics®

Mobile Your Way



Read it Anytime
Take it Anywhere
Share with Anyone

Take *Military & Aerospace Electronics* on the go and stay connected. From breaking news to videos to the mobile web, there's a way to connect from your mobile device.

Now Available

- iPhone
- iPad
- Mobile Site
- RSS
- Android

Scan the QR code at the right with a barcode-scanning app on your phone.



Download and go mobile with
Military & Aerospace Electronics today.

<http://www.militaryaerospace.com/mobile.html>

► Air Force to speed M-Code GPS receivers to warfighters

Satellite navigation experts at L-3 Interstate Electronics Corp. (IEC) in Anaheim, Calif., are developing anti-jam Global Positioning System (GPS) receivers with special M-code GPS capability for military operations. Officials of the U.S. Air Force Space and Missile Systems Center at Los Angeles Air Force Base, Calif., announced an \$18.2 million contract modification to L-3 IEC as part of the Military GPS User Equipment (MGUE) program. The deal calls for L-3 IEC to accelerate the MGUE program by providing additional pre-prototype receiver cards and test support to speed the fielding of M-Code capable GPS receivers.

► Mercury Systems to provide electronic spare parts for shipboard EW

U.S. Navy shipboard electronics experts needed electronic spare parts for the Navy's AN/SLQ-32(V)6 ship-mounted electronic warfare (EW) system. They found their solution at Mercury Systems in Chelmsford, Mass. Officials of the Naval Surface Warfare Center in Crane, Ind., announced a potential \$7.3 million contract to Mercury to provide ARC bus controllers, PDF synthesizers, PDF tuners, 8-channel digital receivers, 4-channel digital receivers, and clock generator VME cards for the AN/SLQ-32(V)6. ◀

Army awards contracts for Rifleman infantry software-defined radio

BY John Keller

ABERDEEN PROVING GROUND, Md.—U.S. Army radio communications experts are moving forward with mass production of the Rifleman software-defined radio for handheld use by infantry warfighters with substantial contracts to two manufacturers.

Officials of the Army Contracting Command at Aberdeen Proving Ground, Md., announced a potential \$3.9 billion contract with options to Harris RF Communications in Rochester, N.Y., and to Thales Defense & Security Inc. in Clarksburg, Md., to produce Rifleman radios.

The two companies will compete for Rifleman radio orders over the next 10 years to provide infantry soldiers with voice, text, and imagery over handheld software-defined radios.

The Rifleman software-defined radio is more like a communications computer than a traditional handheld radio. It uses software applications called waveforms to change functionality and operating bands.

Thales offers the AN/PRC-154 Rifleman radio, which delivers networked communications and situational awareness. It enables self-forming, self-healing, ad-hoc, simultaneous voice and data networks, provides software-defined capability for upgradeability and interoperability, provides low-cost Joint Tactical Radio System (JTRS) networking, integrates embedded encryption and GPS, and provides



Harris and Thales are competing for software-defined radio orders worth as much as \$3.9 billion over 10 years.

networked voice and data communications for foot soldiers.

The Harris Rifleman radio is the RF-330E-TR wideband team radio, which provides a long-lasting, lightweight, handheld connection to the wideband network—including secret and below information. It provides a low-cost way for warfighters at the tactical edge to get the wideband communications capability.

The Thales AN/PRC-154 Rifleman radio is a low-cost, lightweight, body-worn radio that transmits voice and data simultaneously with the Soldier Radio Waveform (SRW). It brings secure Type 2 squad-level communications to the soldier at the tactical edge of the battlefield network.

The radio enables team leaders at the tactical level to track individual soldier position location information, providing situational awareness. It is a core component of the Army's soldier modernization program and has been proven in Afghanistan.

The Harris RF-330E-TR radio offers share and access Type 1 secret and below, stays connected during mission while minimizing weight. Its battery life is as long as 20 hours, and it is designed to enhance situational awareness for every squad member with simultaneous voice, high-speed data, and position location information.

The Thales AN/PRC-154 Rifleman radio offers continuous transmission of position location information for situational awareness and blue-force tracking, supports hands-free display and external computer interface, has audio indicators for preset, GPS position, and battery status, participates in one voice talk call group while simultaneously monitoring other talk groups, is software programmable and upgradeable, and operates with standard USB and RS-232 devices for display use and radio control.

The Harris RF-330E-TR Rifleman radio offers dashboard display,

push-button view of battery life and network status, 30-40-second time to readiness to form or join a network and 3 minutes from cold start, and is interoperable with all Soldier Radio Waveform devices.

On this contract, funding and work location will be determined with each order with an estimated completion date of April 2025. ◀

FOR MORE INFORMATION visit **Thales Defense & Security** online at www.thalescomminc.com, **Harris RF Communications** at <http://rf.harris.com>, or the **Army Contracting Command-Aberdeen** at <http://acc.army.mil/contractingcenters/acc-apg>.

Air Force wants ideas for high-power directed-energy weapons

BY **John Keller**

KIRTLAND AIR FORCE BASE, N.M.—U.S. Air Force researchers are asking for industry's help in advancing the state of the art in high-power electromagnetics technologies for directed-energy weapons and a variety of other aerospace and defense uses.

Air Force Research Laboratory officials at Kirtland Air Force Base, N.M., released a broad agency announcement (BAA-RVKD-2014-0003) for the High-Powered Electromagnetics (HPEM) Research Program, which seeks to develop HPEM technology for directed-energy weapons, cyber warfare, electronic warfare, electronics-killing weapons, power electronics, and antennas.

The program, sponsored by the High-Powered Electromagnetics Division of the AFRL Directed Energy Directorate at Kirtland Air Force Base, will be open for five years and will be worth about \$140 million.

Air Force researchers plan to

award one contract for each of six technical areas: HPEM Transition; HPEM Cyber/Electronic Warfare Applications; HPEM Effects; Electromagnetics Weapons Technology; Numerical Simulation; and NextGen HPEM. HPEM Transition will develop concepts for HPEM systems, components, and information, including the feasibility of integration and development of HPEM technology into a platform. HPEM Cyber/Electronic Warfare Applications will identify and develop HPEM technologies for the cyber and electronic warfare communities. HPEM Effects will investigate the effects of HPEM against a broad range of electronics, and develop predictive models for HPEM battle damage.

Electromagnetics Weapons Technology will move new HPEM technologies into pulsed-power weapons. Numerical Simulation will develop simulation to help develop modern HPEM systems and the Improved



Air Force researchers want industry ideas on developing high-power microwave and other directed-energy weapons. (Photo by B.E. Meyers & Co., www.bemeyers.com.)

Concurrent Electromagnetic Particle-in-Cell software. NextGen HPEM will develop the source and antenna technologies for HPEM weapons, including broadband high power amplifiers, tunable high power oscillators, and broadband antennas RF effects weapons that work over a broad range of frequencies, pulse lengths, pulse repetition frequencies, and power densities.

For technical questions, contact the Air Force's Tyrone Tran at tyrone.tran@us.af.mil. For contracting questions, contact Katy Florez at katy.florez@us.af.mil. ◀

MORE INFORMATION IS online at <http://1.usa.gov/1J8i6Ix>.



UNMANNED vehicles

Air Force orders eight MQ-9 Block 5 Reaper attack drones

U.S. Air Force unmanned systems experts are ordering eight MQ-9 Reaper Block 5 attack drones from General Atomics Aeronautical Systems in Poway, Calif. Officials of the Air Force Life Cycle Management Center at Wright-Patterson Air Force Base, Ohio, announced a \$72.1 million order for Reaper armed unmanned aerial vehicles. Reaper is a variation of the General Atomics MQ-1 Predator that is designed for surveillance and attack missions using a suite of airborne sensors and the AGM-114 Hellfire air-to-ground missile.

Antenna to link UAVs and military ground vehicles introduced by CPI

Communications & Power Industries (CPI) in Camarillo, Calif., is introducing the GMA-100QB antenna system for communications on military ground vehicles. The GMA-100QB provides on-the-move line of sight bi-directional communications capability to link military vehicles to unmanned aerial vehicles in L, S, C, and Ku-bands. Capable of Churchville B OTM performance, the GMA-100QB is equipped to handle high dynamic loads. With a built-in received signal strength indicator, the antenna can scan the sky rapidly for available signals and point to the desired airborne asset. ←

General Atomics to provide radar for Air Force Reaper hunter-killer drone

BY John Keller

WRIGHT-PATTERSON AFB, Ohio — Unmanned aerial vehicle (UAV) experts at the General Atomics Aeronautical Systems Inc. (GA-ASI) in Poway, Calif., will provide the U.S. Air Force with ad-

vanced radar UAV sensor payloads under a \$23.1 million contract.

Officials of the Air Force Life Cycle Management Center at Wright-Patterson Air Force Base, Ohio, are ordering 72 MQ-9 Block 20A Lynx SAR retrofit kits for the Reaper hunter-killer drone. General Atomics makes the Reaper UAV as well as the Lynx radar.

The General Atomics Lynx multi-mode radar provides high-resolution, photographic-quality radar imagery through clouds, rain, dust, smoke, and fog. The radar consumes minimal size, weight, and power (SWaP) while delivering precision air-to-surface targeting accuracy and superb wide-area search capabilities.

Lynx offers synthetic aperture radar (SAR), ground/dismount moving target indicator (GMTI/DMTI), and maritime wide area search (MWAS) modes. Lynx's search modes provide wide-area coverage and allow for cross-cue to a narrow field-of-view electro-optical/infrared sensor.

Lynx includes two spotlight and two stripmap SAR modes. Spotlight



General Atomics is providing advanced radar for the Air Force Reaper hunter-killer unmanned aircraft.

mode produces high-resolution imagery on a defined point. Stripmap mode mosaics several spot images together to form one large image.

Using SAR imagery, subtle changes in the scene are detected by overlaying two images taken at different times.

Coherent change detection (CCD), amplitude change detection (ACD), and automated man-made object detection (AMMOD) algorithms highlight differences between the first and second SAR image for analysis.

GMTI mode helps locate moving vehicles, while DMTI enables operators to detect very slow moving vehicles and people on foot. Operators can select a GMTI/DMTI target and automatically cross-cue to the EO/IR sensor in narrow FOV for visual identification of the target. Lynx's MWAS mode detects ship and boat traffic in various sea state conditions; it also integrates automated identification system (AIS) information for target correlation and identification. MWAS is suitable for coastal surveillance, drug interdiction, long-range surveillance, small target detection, and search and rescue operations.

General Atomics will build the radar systems in Poway, Calif., and should be finished by May 2017. ←

FOR MORE INFORMATION visit GA-ASI online at www.ga-asi.com.

Strike or surveillance: GAO says Navy needs to settle on role of future combat drone

BY John Keller

WASHINGTON—The role of a future U.S. Navy aircraft carrier-based combat drone remains unclear, which leaves Navy leaders uncertain of the program's long-term costs, congressional investigators have found.

Navy leaders have not settled on whether the future Unmanned Carrier-Launched Airborne Surveillance and Strike (UCLASS) unmanned aerial vehicle (UAV) system will be for surveillance with limited strike in lightly contested environments, or for strike with limited surveillance in highly contested environments, the U.S. General Accountability Office (GAO) reported.

This lack of resolution on the UCLASS unmanned aircraft program's future leaves Navy leaders with no clear idea on how much the program will cost over the long term, and no clear idea how to proceed with development, GAO investigators say.

The UCLASS unmanned aircraft is being designed to take off and land from deployed Navy aircraft carriers, as well as refuel in flight.

Four companies are coming up with preliminary UCLASS designs: the Boeing Co. Defense, Space & Security segment in St. Louis; the Lockheed Martin Corp. Skunk Works in Palmdale, Calif.; General Atomics Aeronautical Systems Inc. in Poway, Calif.; and the Northrop Grumman Corp. Aerospace Systems segment in Redondo Beach, Calif.

GAO officials outlined their findings in a report entitled "Unmanned Carrier-Based Aircraft System: Navy Needs to Demonstrate Match between Its Requirements and Available Resources." The GAO, headquartered in Washington, is the investigative arm of Congress, and reports to Congress each year on the UCLASS program's progress.

"Congress has raised concerns about whether UCLASS will be armed and survivable enough to support U.S. power projection in areas in which access and freedom to operate are challenged," the report states, pointing out concerns about the UCLASS ability to help counter enemy defenses.

"The resolution of the debate over UCLASS requirements could have significant design and cost implications, which will determine the resources the Navy needs and how much knowledge from the Navy's previous assessments and estimates can still be applied," the GAO report says.

Early operational UCLASS capability is not expected before 2022, and could occur as late as 2023, GAO investigators say. This delay leaves the Navy without a viable business case to move the program forward,

"If the final UCLASS requirements emphasize a strike role with limited surveillance, the Navy will likely need to revisit its understanding of available resources in the areas of design knowledge, funding,



U.S. Navy leaders are uncertain about the role of a future carrier-based unmanned aerial vehicle.

and technologies before awarding an air system development contract," the report says.

Navy leaders expect to have spent at least \$3 billion on UCLASS development through 2020 in the development of UCLASS to enhance the intelligence, surveillance, reconnaissance, targeting, and strike capabilities of the Navy's aircraft carrier fleet.

In August 2013, the Navy awarded contracts worth \$15 million each to the four competing contractors to develop preliminary designs for the air system, which were assessed by the Navy in May 2014. A development contract is expected in 2017, and the first UCLASS-equipped aircraft carrier is expected to deploy in 2022.

The full GAO UCLASS report is online at www.gao.gov/assets/680/670010.pdf. ←

FOR MORE INFORMATION visit the GAO online at www.gao.gov, or Naval Air Systems Command at www.navair.navy.mil.

► Army eyes quick-turnaround night vision sensor development

U.S. Army night-vision experts plan to invest as much as \$192 million in an effort to speed the design, development, and deployment of electro-optical sensors and weapon sights that help U.S. and allied warfighters operate effectively at night and in bad weather. Officials of the Army Night Vision and Electronic Sensors Directorate at Fort Belvoir, Va., plan to issue a solicitation for the Rapid Acquisition of Materials for Prototyping (RAMP) program (W909MY-15-R-E001). RAMP seeks the rapid development, design, and testing of night vision sensor technologies. E-mail Charlene Buduo at charlene.a.buduo.civ@mail.mil or Ofelia Rivera at ofelia.p.rivera.civ@mail.mil.

► Marine Corps looks to Kollsman for helicopter infrared surveillance

Military electro-optics experts at Kollsman Inc. in Merrimack, N.H., will provide night vision and targeting equipment for U.S. Marine Corps attack helicopters under terms of a \$43 million contract. Officials of the Naval Surface Warfare Center in Crane, Ind., are asking Kollsman to provide Night Targeting Systems Upgrade (NTSU) equipment and support for Marine Corps AH-1 Cobra attack helicopters. The NTSU electro-optical, forward-looking infrared, turreted sensor package improves the tracking and attack capabilities of the AH-1 family of helicopters. ◀

Navy developing electro-optical ship defense against missiles, boats, and UAVs

BY John Keller

STENNIS SPACE CENTER, Miss.—U.S. Navy researchers are ready to launch a program to develop an electro-optical shipboard defense system to protect surface warships from anti-ship missiles, fast attack craft, fast in-shore attack craft, and unmanned aerial vehicles (UAVs).

The Office of Naval Research (ONR) laboratory at Stennis Space Center, Miss., issued a presolicitation (N00173-15-R-SE04) for the Combined EO/IR Surveillance and Response System (CESARS) program. CESARS combines two research initiatives: Shipboard Panoramic EO/IR Cueing and Surveillance System (SPECSS); and Multispectral EO/IR Countermeasures for Advanced Threats (MEIRCAT). Together these two technology capabilities are intended to provide comprehensive shipboard defense against optically guided anti-ship missiles, attack boats, and attack drones.

SPECSS includes an enhanced electro-optical and infrared (EO/IR) countermeasure and situational awareness capability. It performs wide field-of-view target detection and tracking, and cues MEIRCAT high-resolution sensors. MEIRCAT, meanwhile, performs target re-acquisition, tracking, classification, identification, 3D ranging, threat assessment, countermeasures execution, and countermeasures effectiveness monitoring (CMEM). It will offer multi-band capability against many

different targets in one engagement.

The combined CESARS program will use modular, open-systems hardware and software architectures that are scalable to different platforms. Its interface specifications, data formats, and source code will be non-proprietary and govern-



The U.S. Navy is reaching out to industry to develop an electro-optical ship defense capability against missiles, boats, and UAVs.

ment owned. With this in mind, the overall system design approach will capitalize on common imaging components and technologies in a flexible design expected to reduce maintenance and repair costs, as well as to provide a simple and effective approach to upgrade the system as newer technologies become available.

The overall CESARS system also will provide: video data acquisition, dissemination, recording, processing, and display; high-resolution classification, identification, and tracking in several optical wavebands; integrated, precise, and real-time active and passive fine tracking and rang-

CONTINUED ON PAGE 33 ➔

Boeing to provide fiber-optic networking for three new Navy destroyers

BY John Keller

WASHINGTON—Military communications experts at the Boeing Co. will provide high-speed, fiber-optic shipboard networking for three U.S. Navy Arleigh Burke-class guided missile destroyers under terms of an \$11.1 million order.

Officials of the Naval Sea Systems Command in Washington are asking the Boeing Defense, Space & Security segment in Huntington Beach, Calif., to build and maintain the fiber-optic AN/USQ-82(V) Gigabit Ethernet Data Multiplex System (GEDMS) for the destroyer USS

Delbert D. Black (DDG 119), as well as for two yet-unnamed destroyers (DDG 120 and DDG 121). Burke-class destroyers are designed to engage enemy aircraft, surface ships, and submarines.

The GEDMS is designed to transfer data via a redundant, mission-critical network backbone aboard Navy surface warships. It is the most recent upgrade to the Navy's Data Multiplex System (DMS) networks, and offers enhanced network communication capabilities by providing an IP-based backbone that supports multimedia services, such as video and data.

The Delbert D. Black is under construction at Huntington Ingalls Industries Inc.'s Ingalls Shipbuilding yard in Pascagoula, Miss. The ship, named for Master Chief Petty Officer Delbert D. Black, is expected to be commissioned in 2018.

GEDMS increases a surface ship's capacity to support data transfer for the upgraded hull, mechanical, and electrical systems introduced into the fleet with DDG 111. Additional benefits include manpower reduction and increased crew safety by using video and sensors for monitoring of remote or confined spaces, Boeing officials say.

Of the other two unnamed Burke-class destroyers for which Boeing will provide GEDMS shipboard networking capability, one will be built at Ingalls Shipbuilding, and one will be built at the General Dynamics Corp. Bath Iron Works shipyard in Bath, Me.

In September 1989, Boeing de-



Boeing will build fiber-optic networking for three new Navy Arleigh Burke-class destroyers.

livered the first DMS system to the Navy for installation aboard the USS Arleigh Burke, the namesake for the DDG 51 class destroyer. As the DDG new ship construction continued, the DMS was upgraded to a Fiber Optic Data Multiplex System (FODMS) to support evolving needs.

In August 2010, the Navy replaced the copper-based DMS systems installed on the Arleigh Burke and the USS John Paul Jones (DDG 53) with the high-performance fiber-optic GEDMS, the latest variant in the DMS family of networks.

The manufacturer of the GEDMS fiber-optic shipboard network is Argon ST, a wholly owned subsidiary of Boeing. Boeing acquired Argon ST in 2010 as part of the company's strategy to expand its capabilities to address the C4ISR, cyber security, and intelligence applications. Argon ST is a division of Boeing Network & Space Systems, a business of the Boeing Defense, Space & Security operating unit. ◀

FOR MORE INFORMATION visit Boeing Defense, Space & Security online at www.boeing.com/company/about-bds, Argon ST at www.argonst.com, and Naval Sea Systems Command at www.navsea.navy.mil.

NAVY CONTINUED FROM PAGE 32

ing in several wavebands; enhanced countermeasures capability; and provide precise 3D ranging and countermeasures monitoring to the shipboard combat system. The CESARS program calls for industry contractors to develop the SPECSS and MEIRCAT systems independently. The Navy will handle integrating the two. Non-proprietary hardware and data interchange standards will help exchange data among the two systems.

The upcoming solicitation will ask industry to develop five separate products: the SPECSS camera; SPECSS processing; MEIRCAT high-resolution cameras; laser sources; and MEIRCAT hardware, software, integration, and testing. One more 33- to-45-month, cost plus fixed-fee completion-type contracts will be awarded next fall. ◀

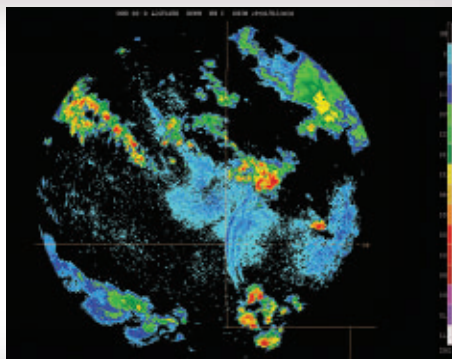
MORE INFORMATION IS online at <http://1.usa.gov/1QeeiED>.

PRODUCT applications

SIGNAL PROCESSING

BCI to extract weather radar data from tactical ship- and land-based radar

U.S. Navy weather experts needed a way to extract weather radar information from shipboard and land-based radar systems normally used to detect potentially hostile aircraft and other incoming threats. They found their solution from Basic Commerce & Industries Inc. (BCI) in Moorestown, N.J.



Officials of the Space and Naval Warfare (SPAWAR) Systems Center Pacific in San Diego announced a five-year \$10.9 million contract to BCI to build, install, and support Weather Radar Through-The-Sensor systems.

Many naval vessels at sea, and military detachments deployed around the globe,

often lack organic weather radar information, BCI officials explain. Although satellite sensors and receivers can provide near-real-time weather information, this data often is not continuously available.

Weather Radar Through-The-Sensor involves a real-time adjunct weather processor that converts tactical radar returns into meaningful weather radar information. The passive interface from the radar to the weather extractor computer (WEC) has no bad influences on the tactical operation of the radar, company officials say.

The WEC is based on commercial off-the-shelf (COTS) PC server technology and adheres to the US Navy's Open Architecture guidelines. Weather information updates come at intervals as frequent as once per minute.

Weather products are available from the WEC via standard Ethernet connection to external networks like IT-21 and ISIS, or via closed-circuit video like 23-TV.

FOR MORE INFORMATION visit **Basic Commerce & Industries** online at www.bcisse.com; **BCI Sensor Systems** at <http://bcisensors.com>, or the **SPAWAR Systems Center Pacific** at www.spawar.navy.mil/sandiego.

RF AND MICROWAVE

Marines look to ViaSat for hatch-mount SATCOM antenna on KC-130J

U.S. Marine Corps aviation experts needed hatch-mount satellite communications (SATCOM) antennas for the KC-130J Super Hercules utility turboprop aircraft. They found their solution from ViaSat Inc. in Carlsbad, Calif.

Officials of the Marine Corps Systems Command at Quantico Marine Base, Va., have announced their intention to award a \$6.90 million contract to ViaSat for a hatch-mounted satellite antenna for the KC-130J four-engine cargo and utility aircraft.

The contract, which has yet to be officially awarded, calls for ViaSat to provide SATCOM antennas for the KC-130J, as well as ViaSat's Yonder SATCOM network access, ancillary equipment, and sustainment.



ViaSat produces the VMT-1220HM two-way broadband Ku- and Ka-band antenna that can provide the Marine Corps KC-130J with real-time video and SATCOM on the move on intelligence, surveillance, and reconnaissance (ISR) missions.

The Lockheed Martin KC-130J provides the Marine Corps with global reach and rapid deployability. It helps the Marines deliver infantry warfighters, fuel, and cargo, where needed.

The ViaSat VMT-1220HM SATCOM antenna is a self-contained airborne satellite terminal for

high-speed Internet-protocol communications-on-the-move. The antenna and ViaSat's Yonder mobile broadband service can enable KC-130J operators to send live, full-motion high-definition video over the horizon, make phone calls, conduct video conferences, access classified networks, and perform mission-critical communications while in flight.

FOR MORE INFORMATION visit **ViaSat** online at www.viasat.com, or the **Marine Corps Systems Command** at www.marcorsyscom.marines.mil.

TEST AND MEASUREMENT

Lockheed Martin Space Systems chooses Marvin's GENASYS for satellite test

Engineers at the Lockheed Martin Space Systems segment in Denver needed performance-testing equipment for high-reliability space electronics designs. They found their solution from Marvin Test Solutions in Irvine, Calif.

Lockheed Martin is using the Marvin TS-323 GENASYS test equipment to ensure the reliability of space launch and orbiting satellite equipment. GENASYS is a PXI-based test & measurement system for mission-critical applications that require performance functional testing.

GENASYS features a high-density, multiplexed switching subsystem with any-pin-to-any-resource architecture and switch management software that provides



automated, end-to-end signal routing, Marvin officials say. Lockheed Martin will use the system to test satellite systems and subsystems.

The PXI digital subsystem addresses a range of avionics data bus test requirements, including 1553, 429, RS-232, and custom or parallel digital buses. In addition, the multiplexed pin architecture of the GENASYS supports more than 6,000 UUT pin connections. With hybrid pin capability, both analog and digital tests can be performed at the pin level.

The test equipment is for high-value, mission-critical electronics applications at the board, box, or system level. Applications include testing for satellite payloads, platform management systems, armament electronics, and flight management.

FOR MORE INFORMATION visit **Marvin Test Systems** online at www.marvintest.com, or **Lockheed Martin Space Systems** at www.lockheedmartin.com/us/ssc.

ANTENNAS

Textron to provide directional antennas for UAV imagery and video

U.S. Army surveillance experts needed directional antennas to help warfighters in the field access reconnaissance imagery and video from unmanned aerial vehicles (UAVs) and manned surveillance aircraft. They found their solution from Textron Systems Corp. in Hunt Valley, Md.

Officials of the Army Contracting Command at Redstone Arsenal, Ala., announced a \$6.6 million contract to Textron for 104 mobile directional antenna systems in support of Textron's One System Remote Video



Terminal (OSRVT).

The Textron OSRVT is a modular video and data system that enables warfighters to downlink live surveillance images and critical geospatial data remotely from joint operations tactical UAVs and manned aircraft.

OSRVT provides data and telemetry from UAVs like the Textron Shadow drone, yet its common software also can integrate with tracked and wheeled ground vehicles to enhance warfighter situational awareness on the battlefield.

The OSRVT's graphical user interface delivers battlespace information in live video or annotated map views, and enables users to save, export, and analyze data.

The OSRVT delivers real-time situational awareness with a modular hardware design that can be configured for manpack, mounted, stationary, airborne, and maritime applications.

Upgrades to the OSRVT with bi-directional capabilities also will enable users to control the electro-optical and infrared sensor payloads on a variety of UAVs.

FOR MORE INFORMATION visit **Textron Systems** online at www.textronsystems.com.

DATA HANDLING

Boeing looks to Curtiss-Wright to provide data-handling space avionics
Spacecraft designers at the Boeing Co. needed data-handling avionics



for the Crew Space Transportation (CST)-100 spacecraft that Boeing is building for NASA. They found their solution from the Curtiss-Wright Corp. Defense Solutions division in Ashburn, Va.

Officials of the Boeing Defense, Space & Security segment in Houston are asking Curtiss-Wright to provide data-handling equipment to gather data from critical vehicle sensors used by the on-board computers to make decisions during flight.

The Boeing CST-100 spacecraft will provide transportation for as many as seven passengers or a mix of crew and cargo to low-Earth orbit destinations such as the International Space Station (ISS) and the Bigelow planned station. Curtiss-Wright also provides data handling systems for payload applications on the ISS.

Curtiss-Wright finished the first phase of the data-handling job last summer, and now will complete development, qualification, and certification of the data handling avionics system along with delivery of the first production units.

The shipments of flight models will begin in 2015 and the CST-100 is scheduled to undergo orbital test flights in 2017. Curtiss-Wright will provide Boeing with the CST-100's

remote analog interface unit (RAIU) based on the company's Acra KAM-500 data handling avionics equipment.

The RAIU will gather data on the status and health of critical spacecraft systems during all phases of

the mission. Curtiss-Wright's Avionics & Electronics business unit in Dublin, Ireland is designing and manufacturing the products covered by this agreement.

FOR MORE INFORMATION visit **Curtiss-Wright Defense Solutions** online at www.cwcdefense.com, or **Boeing Defense, Space & Security** at www.boeing.com/space.

SIMULATION AND TRAINING

Air Force picks Avarint to upgrade electronic warfare simulation

U.S. Air Force test experts needed technology upgrades to enhance integrated electronic warfare (EW) test



capability at Edwards Air Force Base, Calif. They found their solution from Avarint LLC in Buffalo, N.Y.

Officials of the Electronic Warfare Group of the Air Force 412th Test Wing at Edwards announced a \$83.7 million contract to Avarint

for the Virtual Integrated Electronic Warfare Simulations (VIEWS) II program.

VIEWS II seeks to enhance Air Force integrated EW test and measurement capability through the Air Force Digital Integrated Air Defense System (DIADS) Upgrades and the Advanced Warfare Test and Evaluation Capability (AWTEC) programs at the 412th Test Wing.

Avarint experts will support DIADS Upgrades efforts, as well as continue integration efforts for the AWTEC program. The DIADS and AWTEC programs, together, provide an integrated EW test capability.

The contract will provide for various engineering services, including support for continued development and enhancement activities supporting the DIADS and AWTEC programs.

Avarint engineers will provide increased threat simulator fidelity and threat signal density, and improve efficiencies in real-time test execution; environment monitoring techniques; and data capture, processing, and initial analysis, Air Force officials say.

The contract was awarded to Avarint sole-source because the company is the only one qualified for VIEWS II efforts. Avarint was the prime contract on the original VIEWS program and was considered the incumbent for VIEWS II. Ten other

companies expressed interest in the VIEWS II program, Air Force officials say. 

FOR MORE INFORMATION visit **Avarint** online at www.avarint.com, or the **Air Force's 412th Test Wing** at www.edwards.af.mil.



C4ISR

Communications on-the-move antenna for military ground vehicles introduced by CPI

Communications & Power Industries (CPI) in Camarillo, Calif., is introducing the GMA-100QB antenna system for communications on-the-move antenna applications on military ground vehicles. The GMA-100QB provides on-the-move (OTM) line of sight (LOS) bi-directional communications capability to link military vehicles to unmanned ae-



rial vehicles (UAVs) in L, S, C, and Ku-bands. Capable of Churchville B OTM performance, the GMA-100QB is equipped with high-performance motors and drives on both axes to handle high dynamic loads. The antenna is stabilized by internal AHRS, allowing independence from vehicle data. The receiver with built-in received signal strength indicator (RSSI) enables the antenna to scan the sky rapidly for available signals and point to the desired airborne asset, eliminating the delay of external modem decoding of the signal. The GMA-100QB includes a compact multiband high-gain directional antenna array, enabling long-range

LOS datalinks, and a broadband omnidirectional antenna for close-in/overhead communications.

FOR MORE INFORMATION visit the **CPI Malibu Division** online at www.cpii.com.

TEST AND MEASUREMENT

ATC/DME test set for engineering and validation introduced by Cobham AvComm

Cobham Avionics and Communications (AvComm) in Wichita, Kan., formerly the Aeroflex AvComm business unit, is introducing the ATC-5000NG NextGen ATC/DME test & measurement set for engineering development, design validation, manufacturing, and return-to-service test applications. The ATC-5000NG is the replacement product for the legacy SDX-2000 and ATC-1400A/S-1403DL. The software-defined radio architecture supports



more transponder RTCA DO-181E test capability than the legacy products did and has new capability needed to support the FAA NextGen test requirements, including ADS-B (RTCA DO-260B) and UAT (RTCA DO-282).

FOR MORE INFORMATION visit **Cobham AvComm** online at <http://ats.aeroflex.com/contact/businesses>.

SPACE ELECTRONICS

Rad-tolerant FPGAs for space and high-altitude aviation introduced by Microsemi

Microsemi Corp. in Aliso Viejo, Calif., is introducing the RTG4 radiation-tolerant, high-speed field-programmable gate array (FPGA) family for manned spacecraft and satellites. The RTG4's reprogrammable flash technology offers immunity to radiation-induced configuration upsets in radiation environments, requiring no configuration scrubbing. RTG4 supports space and high-altitude avia-



tion applications requiring as many as 150,000 logic elements and as much as 300 MHz of system performance. Typical uses for RTG4 include remote sensing space payloads like radar, imaging, and spectrometry in civilian, scientific, and commercial applications for weather forecasting and climate research, land use, astronomy and astrophysics, planetary exploration, and Earth sciences.

FOR MORE INFORMATION visit **Microsemi** online at www.microsemi.com.

DATA CONNECTORS

Rugged connectors for military field use introduced by ODU

ODU USA Inc. in Camarillo, Calif., is introducing the ODU AMC high-density connectors for harsh-



environment military and aerospace applications like field radios, portable computers, night vision, and digital scopes. The rugged miniature ODU AMC connector offers shell diameters as small as 10 millimeters to 18.5 millimeters and provides as many as 40 contacts. The connector includes several high-density signal configurations and tailored versions for power to 15 amps and data transfer via USB 3.0 with 5 amps of power. The shells are keyed and color-coded, and include watertight protection class IP 68, 5000 mating cycles durability, a break-away



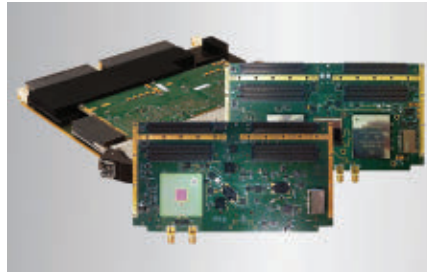
function for maximum safety, rugged and non-reflective surfaces, salt spray resistance, and an operating temperature range of -51 to 125 degrees Celsius.

FOR MORE INFORMATION visit **ODU USA** online at www.odu-usa.com.

DATA CONVERSION

Embedded computing boards with high-speed A/D and D/A conversion introduced by Curtiss-Wright

The Curtiss-Wright Defense Solutions division in Ashburn, Va., is introducing the OpenVPX embedded computing boards with high-speed A/D and D/A conversion. The company's CHAMP-WB boards offer sampling rates from 12.5 to 25 gigasamples per second at 8-bits A/D



and 10 bits D/A. The CHAMP-WB is for demanding wide-spectrum communications applications. The boards enable direct RF sampling of bandwidths to 15 GHz using open-architecture COTS modules. The boards speed and simplify the design of very high-performance wideband SIGINT, EW, and SATCOM applications for deployed platforms such as manned and unmanned aircraft, ground vehicles, ships, and base stations. These open-architecture receiver and transmitter products are the latest ISR and EW solutions resulting from Curtiss-Wright's technology and marketing partnership with Tektronix Component Solutions.

FOR MORE INFORMATION visit **Curtiss-Wright Defense Solutions** online at www.cwcddefense.com.

SIGNAL PROCESSING

Adaptive IF relay XMC for military embedded computing introduced by Pentek

Pentek Inc. in Upper Saddle River, N.J., is introducing the model 71624 dual-channel, 34 signal, adaptive IF (Intermediate Frequency) relay XMC



switched mezzanine card for military and commercial embedded computing applications. Targeted applications include signal monitoring, signal jamming, channel security, countermeasures, beamforming, and radar applications. The 71624 supports signal drop/add/replace, frequency shifting and hopping, amplitude equalization, and bandwidth consolidation. Part of the Pentek Cobalt line of XMCs, the model 71624 comes with a Virtex-6 field-programmable gate array (FPGA). As an IF relay, it accepts two IF analog input channels, modifies as many as 34 signals, and then delivers them to two analog IF outputs.

FOR MORE INFORMATION visit **Pentek** online at www.pentek.com.

SOFTWARE DEVELOPMENT

Software development toolkit for FPGA boards introduced by BittWare

BittWare Inc. in Concord, N.H., is introducing version 1.8 of its BittWorks II software development toolkit for the company's Arria V, Stra-



ti V, and soon-to-be released Arria 10 field-programmable gate array (FPGA)-based embedded computing boards. Designed to make developing and debugging applications for BittWare's boards easy and efficient, the toolkit is a collection of libraries and applications that provides the glue between the host application



and the hardware. The latest release of BittWorks II provides an upgrade to BittWare's Linux PCI driver, BwPCI. Distributed with complete source code, BwPCI enables systems designers to modify kernel-level code to optimize their application performance. Users can create their own interrupt service routine for lower latency transactions without the need to create their own driver entirely. BwPCI includes installation scripts for RedHat and Debian Linux and is compatible with any PCI Express Vendor ID or Device ID.

FOR MORE INFORMATION visit **BittWare** online at www.bittware.com.

EMBEDDED COMPUTING

Secure AdvancedTCA modules for military uses introduced by Mercury Mercury Systems Inc. in Chelmsford, Mass., is introducing the secure AdvancedTCA (ATCA) Ensemble server-class compute modules to help bring ATCA embedded computing technology to the tactical edge in military applications. Mercury's secure ATCA Ensemble building blocks capitalize on OpenVPX processing densities and the company's fourth-generation, server-class thermal management technologies. The first versions of Mercury's secure ATCA processing building blocks include the Ensemble HDS8613 dual Intel Xeon server-class processor blade and the Ensemble SFM8104 40 gigabits per second Ethernet/InfiniBand switch. The HDS8613 high



density server (HDS) blade's dual 12-core processors with Advanced Vector Extensions 2 (AVX2) and Intel QuickPath Interconnect (QPI) are supported with up to 128-gigabyte DDR4-2133 SDRAM to deliver a combined 1.38 trillion floating point operations per second of general-purpose processing power. The blade has an AMC mezzanine site.

FOR MORE INFORMATION visit **Mercury Systems** online at www.mrcy.com/ATCA.

BOARD PRODUCTS

Rugged 6U VME and VPX single-board computers introduced by Aitech Aitech Defense Systems Inc. in Chatsworth, Calif., is introducing the enhanced C111 and C112 Freescale T4-based single-slot 6U VME and VPX single-board computers for military, industrial, and high-end com-



mercial applications. The embedded computing boards have the new low-power, multi-core, multi-processor T4080 QorIQ with Altivec technology, which enhances computing performance and optimizes energy efficiency for lower power, high-end, floating point computing applications. Like the 12-core T4240 and eight-core T4160 also available on the computer boards, the four-core T4080 QorIQ processor features on-chip, high-speed L1 and L2 caches as well as an integrated bus, a high-speed memory switch fabric, and

I/O controllers. The boards are available in conduction- and air-cooled versions, and provide four gigabytes of high-speed DDR3 SDRAM divided into two separate memory channels for processor-to-memory or memory-to-memory message passing and data transfers. ◀

FOR MORE INFORMATION visit **Aitech** online at www.rugged.com.

POWER CONNECTORS

Power electronics connectors for military and aerospace offered by TE TE Connectivity in Harrisburg, Pa., is introducing the AS81714 Series II



DEUTSCH CTJ connector modules that are customizable for military and commercial aerospace applications. The DEUTSCH CTJ series modules are made up of a system of wires and components that are interconnected to one another by a standard Mil AS39029 socket contact. The military qualification allows them to be used in either market, giving them the ability to turn around a change in design. The DEUTSCH CTJ series modules have a 360 degree dielectric contact retention designed single pin power electronics bus bar feature that provides easy "pin and socket" mating. Its modules can be mounted in rails, into chassis, or onto circuit boards.

FOR MORE INFORMATION visit **TE Connectivity** online at www.deutsch.net.

PRODUCT & LITERATURE SHOWCASE



ST-9020 rugged computer system with 20" display, MIL STD shock & vibration qualified



DU-19/U rugged monitor

For full line of rugged systems contact:

IBI SYSTEMS, INC.
6842 NW 20TH AVE, FORT LAUDERDALE, FL 33309
PHONE: 954-978-9225, WEB: www.ibi-systems.com

CAN YOUR EPOXY ADHESIVE GO LOW?

Epoxy System EP42HT-2LTE

Features an ultra low coefficient of thermal expansion

CTE $9-12 \times 10^{-6}$ in/in/°C

LOW SHRINKAGE UPON CURE

Linear <0.01%
Volumetric <0.1%

Elongation <5%

HIGH DIMENSIONAL STABILITY

From -60 to +300°F



MASTERBOND®
ADHESIVES | SEALANTS | COATINGS

Hackensack, NJ 07601, USA • +1.201.343.8983 • main@masterbond.com

www.masterbond.com

SITUATIONAL AWARENESS

SENSOR, VIDEO & COMPUTER SIGNALS ON A SINGLE SCREEN



SuperView® multiviewers display up to 12 real time visuals on a single screen for viewing and analysis.

Any signal type - ultra high resolution graphics, HD, radar, sonar, FLIR and video.

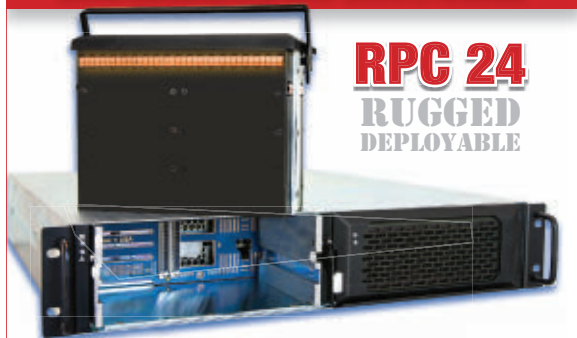
Position and scale images any size, anywhere . . . even pan and zoom within images.



SPECTRUM®
decision support systems™

(510) 814-7000 sales@rgb.com www.rgb.com

AIRBORNE, SHIPBOARD, GROUND MOBILE DATA RECORDING AND DATA STORAGE



RPC 24
RUGGED
DEPLOYABLE

**Magazine Based
High Performance
RAID Storage**

- **24 Solid State or Hard Disk Drives**
- in only 2U of panel height
- **Two Quickly Removable Storage Magazines**
- each containing up to 12 HDDs or SSDs each
- **Fault Tolerant, Hot Swap Components**
- no single point of failure
- **Sustained Read and Write Data Transfer Rates**
- of over 5000 MB/sec and 3000 MB/sec respectively
- **MIL-STD-810G, MIL-STD-461E Certified**



www.phenixint.com 714-283-4800

Military & Aerospace Electronics

GROUP PUBLISHER Alan Bergstein
603 891-9447 / alanb@pennwell.com

EDITOR-IN-CHIEF John Keller
603 891-9117 / jkeller@pennwell.com

EXECUTIVE EDITOR Courtney E. Howard
509 413-1522 / courtney@pennwell.com

CONTRIBUTING EDITOR
WESTERN BUREAU J. R. Wilson
702 434-3903 / jrwilson@pennwell.com

EDITORIAL ART DIRECTOR Cindy Chamberlin

PRODUCTION MANAGER Sheila Ward

SENIOR ILLUSTRATOR Chris Hipp

AUDIENCE DEVELOPMENT MANAGER Debbie Bouley
603 891-9372 / debbieb@pennwell.com

AD SERVICES MANAGER Glenda Van Duyne
918 831-9473 / glendav@pennwell.com

MARKETING MANAGER Gillian Hinkle
603 891-9126 / gilliah@pennwell.com

SUBSCRIPTION INQUIRIES

Phone: 847 763-9541 • Fax: 847 763-9607

E-mail: mae@halldata.com

Web: <http://www.militaryaerospace.com/subscribe.html> or

http://www.sub-forms.com/dragon/init.do?site=PNW20_MFcontact



Editorial offices

PennWell Corporation,
Military & Aerospace Electronics
98 Spit Brook Road LL-1, Nashua, NH 03062-5737
603 891-0123 • FAX 603 891-0514 • www.milaero.com

Sales offices

EASTERN US & EASTERN CANADA & UK

Bob Collopy, Sales Manager
603 891-9398 / Cell 603 233-7698
FAX 603 686-7580 / bobc@pennwell.com

WESTERN CANADA & WEST OF MISSISSIPPI

Jay Mendelson, Sales Manager
4957 Chiles Drive, San Jose, CA 95136
408 221-2828 / jaym@pennwell.com

REPRINTS

Jeanine Pranses
717 505-9701 x344 / jeanine.pranses@theygsgroup.com

DIRECTOR LIST RENTAL

Kelli Berry
918 831-9782 / kelli@pennwell.com

Corporate Officers

CHAIRMAN Frank T. Lauinger

PRESIDENT/CHIEF EXECUTIVE OFFICER Robert F. Biolchini

CHIEF FINANCIAL OFFICER/SENIOR VICE PRESIDENT Mark C. Wilmoth

Technology Group

SENIOR VICE PRESIDENT/PUBLISHING DIRECTOR Christine Shaw

ADVERTISERS INDEX

ADVERTISER

PAGE

| | |
|---|----|
| CES Creative Electronic Systems SA..... | 9 |
| Cobham Semiconductor Solutions..... | 17 |
| Coilcraft..... | 3 |
| Crane Aerospace & Electronics..... | 5 |
| Dawn VME..... | C4 |
| IBI Systems Inc. | 40 |
| International Rectifier | 1 |
| Lansdale Semiconductor..... | 13 |
| Lemo USA Inc..... | 23 |
| Master Bond Inc..... | 40 |
| Mercury Systems | 7 |
| Modular Devices Inc..... | 8 |
| Nortech Systems..... | 22 |
| Phoenix International | 41 |
| PIC Wire & Cable..... | 21 |
| Pico Electronics Inc..... | 19 |
| Positronic | 25 |
| RGB Spectrum..... | 40 |
| TE Connectivity..... | 15 |
| Themis Computer | 11 |
| VPT Inc. | C2 |

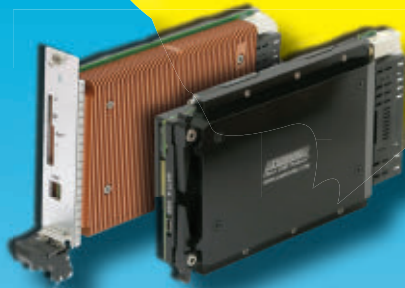
www.militaryaerospace.com



Rugged, Reliable and Ready



Our designer friendly and flexible technology can solve many of your application problems in the design phase.



Contact Dawn to ease the design- to-production transition and reduce deployment time to enable high performance, mission critical systems. We look forward to speaking with you soon.

Dawn's advanced backplane topology customization tools now feature OpenVPX Fabric Mapping Modules.

You need it right. You want Dawn.

DAWN
Dawn VME Products®

(510) 657-4444

dawnvme.com