DECEMBER 2013

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Rugged data storage

Streaming video, radar, and signals intelligence drive rugged storage media for big data. PAGE 16

Rugged backplanes

Cost takes center stage for embedded computing backplanes and chassis. PAGE 24

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Counterfeit component chaos

Aerospace and defense wrestles with counterfeiting, obsolescence, and ITAR.

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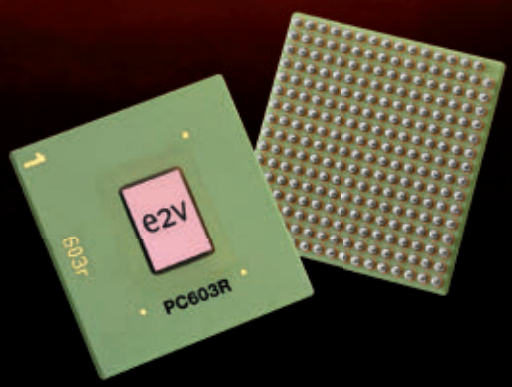

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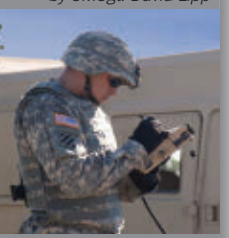
U.S. Air Force photo by SMSgt. David Lipp



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BY **JOHN KELLER**, EDITOR IN CHIEF

The revenge of COTS in an aging commercial technology base

The U.S. military's move to replace custom-designed, mil-spec electronic subsystems and components with commercial off-the-shelf (COTS) electronics was supposed to reduce costs and give the military access to the latest technology. That was the intent, but the stark realities of sequestration, program reductions, and other downward pressures on military spending are creating conditions that not only are far worse than what was expected, but also perhaps even worse than the problems that COTS was supposed to alleviate.

Military program managers and the defense industry face a broadly installed base of COTS electronics with capabilities and supportability that is going obsolete rapidly, and with diminishing prospects for being brought back up to date because of crushing military budget cuts.

The year was 1994 when then-Defense Secretary William Perry ushered in the COTS era when he declared that the U.S. Department of Defense (DOD) should stop inventing its own unique electronics and instead take advantage of advanced developments in a booming commercial electronics sector. Custom-designed, mil-spec electronic components were expensive to build, and often were less capable than their commercial counterparts. The 1990s saw the end of the Cold War, and there was immense pressure at the time to enhance military capability and reduce costs. We had to do more with less...sound familiar?

With various fits and starts, Perry's COTS philosophy took hold, and today is woven tightly into the fabric of the military procurement culture. In many ways, COTS have lived up to its promise of improving access to technology at affordable cost.

The COTS movement has relegated custom-designed, mil-spec components to pariahs of the military procurement world. Once systems designers get used to the capabilities and low costs that COTS provide, they vow never again to go back to the buggy-whip, mil-spec days. In the move to COTS, systems designers and program managers have lost sight of some of the benefits of custom-designed, mil-spec components.

Top among the benefits is longevity. Mil-spec electronics technology was reliable and maintainable, and lasted a long time—perfect attributes for a military that expected to keep military platforms in service for many decades. Even when mil-spec components become obsolete, generally they still are rugged and reliable, and their manufacturers commit to supporting them for as long as the military needs. That's the culture of the custom, mil-spec world.

Before the Pentagon embraced the technology, COTS was criticized for its short shelf life. Rapid obsolescence was one of the chief complaints and one of the most convincing reasons that systems designers gave who were seeking waivers from COTS requirements. The long-term success of COTS-based military design is based on the fundamental assumption that COTS-based systems must be upgraded more rapidly than they were in the mil-spec era.

Military budget cuts are delaying or eliminating scheduled rounds of component upgrades. COTS components that were supposed to be switched out every five years or so are staying in the field longer than ever. The results are predictable—obsolete parts and a complicated logistics chain, which are exactly what we're seeing today as the military adjusts to a rapid downturn in spending. We have electronic components that are going obsolete quickly, with only spotty long-term support. Obsolete COTS technology can be far more problematic than obsolete mil-spec technology.

As defense budgets are cut back even more, the problem only threatens to get worse. The COTS approach works only as long as it gets the support it needs.

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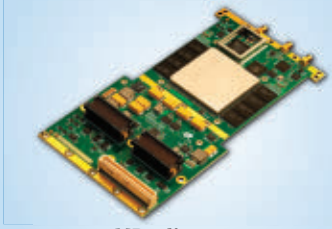

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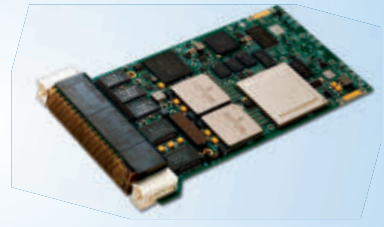

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Air Force eyes modeling software to understand how wind farms create radar dead spots

BY JOHN KELLER

PETERSON AFB, Colo.—U.S. Air Force researchers are asking a Pennsylvania computer simulation company to design modeling software to help radar systems designers compensate for the dead spots that renewable energy wind farms cause in military air-defense radar, commercial air traffic control radar, and weather radar.

Concentrations of wind turbines such as the wind farm shown above can create problems for military, weather, and air traffic control radar by creating large fields of radar clutter.

Officials of the Air Force Space Command at Peterson Air Force Base, Colo., have announced their intention to award a sole-source contract to Analytical Graphics Inc. (AGI) of Exton, Pa., to design a new-generation Radar Obstruction Evaluation Model and Simulator to help experts understand how concentrations of energy-producing wind turbines can interfere with a variety of crucial radar systems.

The upcoming two-year contract, estimated to be worth about half a million dollars, will call for AGI to produce a new version of the company's Radar Obstruction Evaluation Model and Simulator

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IN BRIEF

BAE Systems, Boeing join DARPA program to advance electronics thermal management

Microelectronics experts at the BAE Systems Electronic Systems segment in Merrimack, N.H., and the Boeing Co. Defense, Space & Security segment in El Segundo, Calif., are working with Pentagon researchers to break through design limitations in electronics thermal management, size, weight, and power consumption (SWaP) in military embedded systems and RF MMICs. The companies are working on the ICECool Applications program, a major new electronics cooling initiative of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va. BAE Systems won a $2.4 million contract, and Boeing won a $2.1 million contract. The two companies' involvement in ICECool Applications will be a 30-month effort. The ICECool program seeks to demonstrate advanced electronics cooling techniques for high-performance embedded computing (HPEC) and RF monolithic microwave integrated circuit (MMIC) power amplifiers with convective or evaporative microfluidic cooling built directly into the electronic devices and packaging. ←

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Four research companies pursue artificial intelligence for image intelligence

BY JOHN KELLER

WASHINGTON—Artificial intelligence experts at Teledyne Scientific & Imaging LLC in Thousand Oaks, Calif., are joining those at the Siemens Corp. Corporate Research and Technology Division in Princeton, N.J.; Carnegie Mellon University in Pittsburgh; and HRL Laboratories LLC in Malibu, Calif., on an intelligence research project to unlock secrets in the nature of knowledge in an effort to improve tools and training available to intelligence analysts.

The four companies are working on the Knowledge Representation in Neural Systems (KRNS) program of the Intelligence Advanced Research Projects Agency (IARPA) in Washington.

In November, Teledyne Scientific won an $8.4 million IARPA contract, and Siemens won a $2.2 million contract. Carnegie Mellon, which won a $4.8 million contract, and HRL, which won a $10.3 million contract, received their awards in September before the temporary government shutdown.

Experts from Teledyne Scientific, Siemens, Carnegie Mellon, and HRL will develop new theories that explain how conceptual knowledge is represented in the human brain and test those theories by demonstrating the ability to predict and interpret concept-relate patterns of neural activity measured non-invasively.

Awarding the contracts on behalf of IARPA were officials of the U.S. Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio. IARPA is the research arm of the U.S. Office of the Director of National Intelligence.

KRNS seeks to develop and test theories that explain how the human brain represents diverse types of conceptual knowledge within spatial and changing patterns of neural activity.

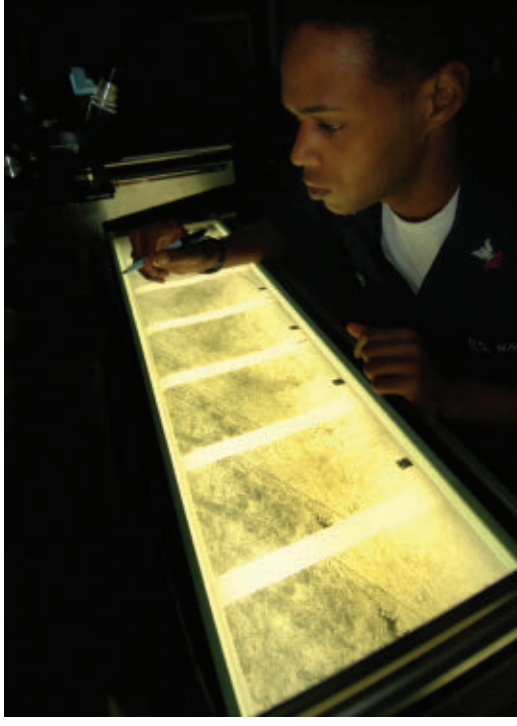
The four companies will develop systems that aim to predict patterns of neural activity associated with particular concepts and that can interpret which concepts are represented within measured patterns of neural activity.

The program will obtain all neural activity data using non-invasive methods such as functional magnetic resonance imaging (FMRI) and magnetoencephalography (MEG).

The program may uncover new ways of helping intelligence analysts probe deeply into images, video, text, and other data sets. When making sense of intelligence data, analysts rely on rich repertoires of conceptual knowledge to resolve ambiguities, make inferences, and draw conclusions.

Conceptual knowledge refers to knowledge about the properties of an entity, as well as its relationships to other entities.

Understanding how the human brain represents conceptual knowledge is a step toward building new analysis tools that acquire, organize and wield knowledge with unprecedented proficiency, officials say. Moreover, such understanding may lead to the development of novel techniques for training intelligence analysts and linguists.



A U.S. Navy intelligence specialist reviews aerial reconnaissance aboard a deployed Navy aircraft carrier. Researchers are trying to refine image analysis skills with artificial intelligence.

The KRNS program consists of two phases: one that seeks to understand how the brain varies its representation of a concept. The second phase of the KRNS program will explore how the brain represents single concepts and combinations of concepts.

Teledyne, Siemens, Carnegie Mellon, and HRL engineers should complete this phase of the KRNS program by November 2016.

FOR MORE INFORMATION visit **Teledyne Scientific & Imaging** online at *www.teledyne-si.com*, **Siemens Corporate Research** at *www.usa.siemens.com/en/about_us/research*, **Carnegie Mellon University** at *www.cmu.edu/research*, **HRL Laboratories** at *www.hrl.com*, and the **Intelligence Advanced Research Projects Agency** (IARPA) at *www.iarpa.gov*.

AIR FORCE CONTINUED FROM PAGE 6

(ROEMS) software, which will be called ROEMS II. The software tool is to be mature and ready for governmental validation at the end of the two-year project, Air Force officials say.

AGI experts will develop a software configuration-control architecture to provide software enhancements for scientific radar analysis capability for the U.S. and Canada.

Large wind farms have the potential to increase the costs of air travel and delay launching jet fighters on missions to protect the U.S. and Canada from possible enemy attack, radar experts say.

Aviation specialists are raising concerns that large wind turbines are creating blackout zones for military and air traffic control radars, and have the potential to create erroneous weather forecasts by spoofing weather radar systems, according to a story last month in the Ottawa Citizen by David Pugliese entitled Wind farms creating dead zones for military radar, the report warns.

The spinning blades of wind turbines are being detected by the radar, presenting false images or generating so much clutter on radar screens that controllers are losing track of airplanes as they fly near the wind farm sites, the story says.

Wind turbines, furthermore, can interfere with weather radar, U.S. researchers have warned, the story goes on. The rotating blades can show up on radar as incoming weather, such as an area of precipitation.

AGI software developers produced the first version of ROEMS, known as ROEMS I, which was an adjunct program that plugs into AGI's proprietary Systems Tool Kit (STK) modeling program.

ROEMS II is intended to be a specialized expansion of ROEMS I.

FOR MORE INFORMATION visit **Analytical Graphics Inc. (AGI)** online at *www.agi.com*, **Air Force Space Command** at *www.afspc.af.mil*, and the **Ottawa Citizen** at *www.ottawacitizen.com*.

SPECIAL REPORT

Counterfeit component chaos

Aerospace and defense professionals face counterfeiting, parts obsolescence, and ITAR challenges head-on to help ensure system safety and reliability.

BY **Courtney E. Howard**

Aerospace and defense engineers and executives, like the militaries they serve, face adversaries. Certainly, these enemies are of a different nature than those faced by warfighters, but their effect can be just as incapacitating and severe.

Military officials facing tight budgets are opting to extend the life of currently fielded aerospace and defense platforms on the ground, at sea, and in the air. In some cases, lifespans are even being doubled.

Cheap often becomes expensive, however. Leaving an aircraft or ground combat vehicle in service for decades past the end of its original, intended useful life brings with it a number of challenges.

"Programs can run for decades, during which products are expected to deliver long life and reliability," says Michael Flatley, manager, product applications at Microsemi in Aliso Viejo, Calif. "As military programs get pushed out further due to funding issues, obsolescence management becomes even more important. Electronic component obsolescence is a very big challenge in the aerospace and defense market. The best way to combat obsolescence is through design-based techniques that minimize the problem at its genesis, rather than letting it become an ongoing issue that must be managed."

Shrinking market

Many factors can influence the availability of aerospace and defense parts and components. Market consolidation, the result of continued mergers and acquisitions, is but one cause.

"There are currently less U.S.-based manufacturing sources in the electronics space," observes Aram Sarkissian, general manager of microelectronics test and engineering at EAG in Santa Clara, Calif. "Many have closed their doors or no longer support these technologies as the cost has become too prohibitive for them—which creates and exacerbates the obsolescence problem."

Not long ago, a majority of manufacturers catered to the needs of the military market. Times change, however, and a wealth of companies have gone in search of verticals marked by orders with larger quantities, faster turnarounds, less uncertainty or risk of contract cancellation, and greater return on investment.

"One of the reasons obsolescence is such a big problem for military designs is that available electronic components are typically intended for commercial, industrial, and

automotive use," says Microsemi's Flatley. "It is rare for products to be specifically developed for defense applications, so designers must use commercial and industrial temperature-rated parts that aren't necessarily designed, packaged, and screened for military high-reliability use."

The problems is even more severe in the digital world, where generational technology changes such as consumers moving from desktops to laptops and on to tablets have led to semiconductors that are more powerful, yet draw less power, which means performance at temperature extremes is often sacrificed.

"Semiconductor companies have responded to cost pressures through die shrinks, which results in decreased performance and reliability," Flatley says. "These trends accelerate obsolescence in the components' materials and the components' physical characteristics—each of which is critical in the design and development of defense and aerospace products.

"Obsolescence can negatively impact long-term viability of aircraft, missile, C4ISR (command, control, communication, computers, intelligence, surveillance, and reconnaissance), and other systems," Flatley says. "Component obsolescence also makes it hard to increase processing and performance power in applications like missile, ordnance, and aircraft platforms, without increasing electronic component volume."

Limited supply

Aerospace and defense firms, in response to obsolescence pressures, are forced to seek the necessary parts elsewhere—from new and often foreign sources. Expanding the supplier base is no mean feat for providers of mission- and safety-critical military and aerospace solutions. The process must be handled with great care, given that it can open the door to a whole host of problems—not the least of which is counterfeit parts.

"This lack of suppliers has driven a need to relax laws so that oversea suppliers can be considered and utilized," explains EAG's Sarkissian. "This opens the doors for counterfeit devices as the majority comes from overseas, primarily China.

"Counterfeiting poses many significant challenges to aerospace and defense industries, primarily related to the safety of electronics," Sarkissian says. "This is often related to purchasing components from unauthorized distribution sources in the supply chain or when parts are discontinued from the original component manufacturer."

"Obsolescence is a daily struggle," admits Colton Mizen, chief operating officer at Target Corp. in Pleasant Prairie, Wis. "When components are slated to become obsolete or are becoming hard to find, they become very expensive and targets for counterfeiters. Any components which slip through the cracks and are sold to manufacturers with fake certifications not only cost the manufacturer and end user money and down time, but can be a real life safety issue. We supply many items to the government, domestically and for foreign military use. Soldiers rely on these products with their lives and the lives of those they protect."

Unexpected results can be catastrophic. "A simple relay or integrated circuit (IC) could, in theory, bring down a large troop transport jet or cripple the navigation system of a ship," Mizen explains. "Of course, there are redundancies which help to prevent this, but my point is that it shouldn't happen with the safeguards put in place to stop this from happening. With every safeguard, like destructive testing and DNA marking of components, the counterfeiters have a new and better way of producing bad components. The newest way is cloning of components. Even simple resistors and capacitors have started to be cloned."

Older military aircraft are relegated to the Aerospace Maintenance and Regeneration Center, better known as the boneyard, at Davis-Monthan Air Force Base, Ariz.

Rising responsibility

All defense contractors are now responsible under the 2012 National Defense Authorization Act to have a corporate plan to mitigate counterfeits and are responsible to pay for any counterfeit part expense mediation in their products, says R. Dale Lillard, president and owner of aftermarket specialist Lansdale Semiconductor in Phoenix.

"The government will no longer pay to fix or replace equipment [in which] counterfeits were discovered," Lillard cautions. "Under this act, [aerospace and defense contractors] are responsible to purchase from trusted sources, manufacturers, and sales channels.

"Historically, these contractors could go out to the broker market and find products in many cases faster and cheaper than these trusted sources could deliver. Now they must change their purchasing habits, which may require longer lead times and higher prices than in the past. Any mistakes could be very costly to the contractor," Lillard says. "They are establishing new trusted sources for some of these parts they were used to purchasing from brokers."

The first resource for preventing counterfeiting is to buy only from trusted sources, Mizen says. "I get e-mails every day from multiple sources saying they can procure hard-to-find items. If I perform a search for a particular component and all I find are the same old websites offering them like they are no problem, I know there is a problem.

"Using trusted sources which are

A P-51 Mustang and an A-10A turn over the boneyard, where retired or unused military aircraft are stored, preserved, or recycled.

authorized distributors guarantees quality," Mizen adds. A few companies will procure hard-to-find items and run the required testing and anti-counterfeit measures, he says. SMT Corp. in Sandy Hook, Conn., for example, will provide complete traceability and certificate of conformance (C of C), as well as mark them with Target's DNA ink, if required. I feel secure in using them because of the state-of-the-art facility and methods used to prevent counterfeiting."

Legacy equipment

It is important to purchase ICs direct from the manufacturer, licensed aftermarket manufacturer, or their authorized sales channels only, Lansdale's Lillard advises. "Any purchases through sources other than this risk counterfeit product or product that may be mishandled, such as recycle pulls or ESD damages."

Lansdale, since 1964, has manufactured products using the original tooling, process, and test programs licensed to manufacture the same part that was discontinued by companies such as Motorola, Phillips, and Intel, to name a few, Lillard says. "We have over 1,000 QML 38535 integrated circuits qualified and over 2,500 products in our catalog. These products date from the 1960s to the 1990s, such as RTL, DTL, TTL, LS TTL, and analog. We purchased the military products from Motorola and Philips when they exited the military markets." Lansdale, a QML manufacturer of stock class 5962 ICs, is licensed with the original IC manufacturers to produce the products.

Another method is having a robust quality team with 100-percent incoming inspection," Mizen notes. "This is a requirement for military, although we extend this benefit to every customer for whom we build. If every single piece is inspected and meets or exceeds the specifications, as well as has complete documentation, the chance for counterfeiting is nearly eliminated."

Target Corp. uses DNA marking on active components going to the government, Mizen describes. "Since Nov. 2012, the government has mandated that any 5962-type devices being sold as spares or in repairs get marked with a specific DNA ink which is proprietary to the supplier. It ensures that only approved suppliers providing quality components are used. At $50,000 per year to procure the ink, fly-by-night companies looking to make a quick buck and then disappear should be reduced or eliminated.

One other company that specializes in DNA-based marking to help prevent parts counterfeiting is Applied DNA Sciences, Inc. in Stony Brook, N.Y. Applied DNA Sciences is licensed by the U.S. Defense Logistics Agency to provide DNA marking services for the Pentagon's stockpile of electronic components.

"Soon," Mizen says, "this mandate will be extended to 5961 devices and [likely] will be continued down to the hardware level. There is, of course, the human factor and it can never be 100 percent eliminated, but we put as many safeguards in place as reasonably necessary to reduce this risk. Technologies like x-raying components, 100 percent inspection, Flying Probe testing, complete traceability, and making sure who you are dealing with will all help in this ongoing challenge."

Two key players from the Target Corp. team recently traveled to visit not only the company's best customer face to face, but also to visit one of its suppliers to inspect their facility and speak with them directly. "Any company can grab stock images off the Net and build a fancy website luring you into their web. It happens every day, but if you spend a few bucks and go visit with them, it can really put into perspective who you are working with. We were pleasantly surprised and feel at ease placing orders," Mizen explains.

"Do your due diligence," Mizen recommends. "Make sure what you are buying is the real deal. Use the available tools to inspect these items. If your company doesn't have some of the pricier test equipment, send it to someone who does. Include the testing in the quote process; your customers will be glad you did."

Combat counterfeiters

"The underground network of counterfeiters continues to grow steadily and they are developing more sophisticated manufacturing methods. Much of the product they produce is not easy to detect and unfortunately does enter the supply chain," Sarkissian says. "It is important to take a vigilant stand and utilize the expertise of trusted suppliers, such as EAG, to help combat these trends.

EAG staff continue to stay abreast of the technology, understand how the counterfeit suppliers are moving to exploit the market, and develop the right techniques to identify them, Sarkissian says. "To combat obsolescence, we work closely with component manufacturers in the early design, debug, and test phases to insure that components they are re-releasing to the market meet the original manufacturer's specifications. Often these components must adhere to stringent reliability and test standards, and EAG brings a blend of systems and knowledge to test to these standards.

"In the fight against counterfeits, we developed a number of both simple screening and deep dive analysis techniques that can help minimize the amount of counterfeit electronics entering the supply chain," Sarkissian describes. "These can include physical inspection and deeper electrical testing of semiconductors and ICs, as well as verification and authentication of device marking, die inspection, circuit extraction, electrical functionality, and performance against reliability specs."

EAG operates a large lab with a range of tools in microelectronics test and engineering and materials characterization. "By taking a multidisciplinary approach, we can design the right methodology to meet customers' needs and investigate devices in a comprehensive and holistic way. Our install base of tools gives us the bandwidth to take a range of project sizes and scale to meet any burst need clients have," Sarkissian says. "An ITAR-registered organization, EAG understands the challenges aerospace and defense customers face and has the size and scale to be a true extension of their resources and a ready partner to support them."

Rugged data storage goes mobile

Demand is growing quickly for military streaming video, advanced radar, signals intelligence, and other data-intensive applications, which places a growing burden on rugged storage media for big data.

BY **J.R. Wilson**

Increasingly massive amounts of data are overwhelming battlespace bandwidth, storage capacity, and end users. It has led to multiple efforts to resolve what military commanders of previous generations never would have thought possible: too much information.

As the need for data storage and network connectivity has grown almost exponentially, so has the need to ensure such systems can withstand the extreme environments of combat. Achieving rugged information storage for avionics, vetronics, and other combat applications, however, involves more than improved media; size, weight, and power (SWaP), reliable interconnects, and the ability to "go mobile" securely all are part of the equation.

On the 21st-century battlefield, secure and rugged fixed and platform-based systems rapidly are being seen as inadequate if infantry warriors cannot take the data and network connectivity they need with them. That requires lightweight tablet computers that also meet all military specifications for security and ruggedization. In addition, all must be common systems that meet the variable needs of all services and coalition partners.

It requires a blend of standardized and custom approaches, continued migration to solid-state storage media for vibration resistance and miniaturization, high-cycle connectors, and Gigabit Ethernet, says Gregory Powers, business development manager at TE Connectivity Global Aerospace, Defense & Marine in Harrisburg, Pa. This, in turn, must combine with existing and trending technologies and components.

"The state-of-the-art in backplane pluggable/removable storage, which could be used for an unmanned aerial vehicle (UAV) or similar environment, is the standard packaging format, such as VPX, and non-standard, which is similar but uses a different board-level connector that might be smaller or more rugged," Powers says. "It's a bit of a Swiss Army Knife."

Standard or custom designs often depend on the application. "Sometimes people like standards because there is a large user base, making it a good ecosystem to step into, but others like custom architectures because that gives them the ultimate in creativity and innovation," Powers says. "There also are tethered approaches, using USB or rugged 10-Gigabit Ethernet. For the ultimate in speed and security, there's fiber optics, typically used in avionics or high-end capital ground systems."

Solid-state drives

Military and commercial users have been turning to solid-state media, which has been highly engineered in recent years to be corrosion resistant, using gold on the contacts, and to enhance durability in mating and unmating. End users want military connectors rated to 10,000 cycles and an extra level of redundancy, Powers says. While many commercial USB connectors are rated to 10,000 cycles, they only have a single point of contact. "If it gets fouled, they're out," Powers says. But military connectors have multiple points of contact, so losing one leaves three or more others to keep functioning.

"If you look at SATA or even Ethernet, actually very few lines [are] dedicated to high-speed data. With SATA, you have just two differential

The rugged tablet computer is a cornerstone of the U.S. Army Mounted Family of Computer Systems (MFoCS) for armored combat vehicles.

pair, the balance of the contacts go to power and logic. With Ethernet you have four pair, eight lines; from a connector standpoint, that is a relatively low pin count," Powers says.

"Overall, I would say the interconnect world is pretty well staged for this explosion. I see the modularity and signal integrity of modern connectors, to handle up to 10 gigabytes per second per pair, as well-placed in terms of scalability to enable that data throughput," Powers says. "The challenges in media are read/write speeds, temperature variations, shock, vibration, radiation, and so on. Depending on the application, the ultimate trump card is optical media—EMI immune, virtually distance immune, extraordinarily high density. Most of the media guys are sticking with copper right now."

Connectors and backplanes are electromechanical building blocks enabling high speed and scalability, but are only part of the multiple components comprising a rugged, secure system.

"A lot of the real paradigm shifting involves protocols and where information will be stored," Powers says. "Speaking to some of the storage guys at MILCOM [November 2013], they expect to get away from SATA and go with 10-Gigabit Ethernet devices on the network, which has benefits in terms of scalability,

redundancy, and connectivity, depending on local storage or remote through a network."

Cloud computing also is being considered for data storage. "So there probably will be increasing utilization of the cloud concept, depending on the security of the network," Powers says. "The entire military thrust these days is network-centric; if you have a really secure network, some crucial files still would be kept locally, but the majority will be out on the network."

Military, contractor, and academic labs are working on a wide range of future technologies for rugged, secure, and SWaP-efficient combat computing. A leader at the fundamental research level is the National Science Foundation (NSF), which is about to launch the NSF Cloud, an infrastructure all researchers can use as a testbed for evolving communications, security, and information exploitation technologies in a real cloud environment.

NSF officials also are heavily involved in developing technologies for network processors that interact with the physical environment. That includes information exploitation algorithms, data mining, wireless networking, and new protocols for the Next-Generation Internet. Some of those include adding and designing new levels of security, highly efficient routing, and forwarding of packet algorithms, says David Corman, NSF program director for cyber physical systems.

"Our focus is foundational research that goes into developing capabilities, not necessarily applicable to a single domain, but across multiple domains, from unmanned systems to the individual warfighter," Corman says. "We don't develop products at TRL 9 [Technology Readiness Level 9, the highest stage], but do early research more at TRL 1-to-4 [on] the innate foundation storage and processing technologies that transition into those systems, with a typical horizon of 10-to-20 years," he says, adding NSF hopes to reduce that transition time to less than 10 years, given the speed of new technology and capability development.

"At the individual warfighter level, we are looking at how to secure the devices he might carry to interact with his environment and network information out, how to make them more resilient, able to work in the face of cyber threats, and operate in a more fault-intolerant world," Corman says. "That includes funding the development of a large set of cooperative control algorithms that essentially provide interaction among vehicles and humans, optimizing whatever network, and overall processing resources are available."

Commercial technology

Many new technologies will begin as commercial products, with the military keeping a close eye on their development, in some cases, even contributing to make the end result more combat-useful. High-end commercial image and video editing and transmission keep pushing civilian bandwidth solutions, which the military is transitioning to handle the escalating use of video on the battlefield—not necessarily to process it on a field platform, but to pull, rather than push, tailored information requiring less bandwidth.

"I think you can expect to see improvements in processing and energy efficiency, greater levels of security in routing information to and from and more intelligent exploitation algorithms for fusing information, and presenting it in a form the user can understand," Corman says.

The Mounted Family of Computer Systems (MFoCS) program will build rugged computers for land vehicles, which subject data storage to massive amounts of shock and vibration.

"The question in my mind is, will we see great advances in bandwidth, he adds. "Readily available comm links in the military generally have lagged behind the commercial world, so I'm not sure we will see advances in orders of magnitude down to the individual warfighter level. But we will see better exploitation of available information, better utilization of cloud resources, and better management algorithms for the overall available bandwidth."

Creating advanced capabilities while ensuring they meet the real-world needs of commanders, and warfighters in the field has been an increasingly cooperative effort by the military, industry, and academia.

"The Army and Marines have been working to address ruggedization and security constraints. The JBC-P addresses a lot of those concerns—it delivers a big, secure pipe, and enhanced computer storage on

the platform," says Bill Guyan, vice president of strategy at DRS Tactical Systems in Melbourne, Fla. Unlike many past efforts to take computers and networks into combat, he added, future systems will not try to cobble together existing, independently developed military and commercial components to achieve their goals.

"The most important consideration is taking a systems engineering approach to the design," Guyan says. "You don't focus on any single aspect, but start with a good and full understanding of the CONOPS [concept of operations] and the environment in which the system is likely to be used. In our case, that's anywhere our troops have to fight, so it has to include all the hazards of warfare—humidity, high and low temperatures, vibration, etc.

"We design from scratch rather than trying to ruggedize commercial components, taking into account all the demands of the system," Guyan continues. "Vibration is a major requirement, but there also are limitations when it comes to performance in extreme temperatures. So you have to bundle the environmental factors that drive performance of the hard drive with those that drive the performance of the processor and the memory supporting it and, in the case of a dismountable element, batteries, and their performance in those environments."

MFoCS vetronics computers

For the remainder of this decade and into the 2020s, the Mounted Family of Computer Systems (MFoCS) will be a significant advance in that arena, Guyan adds, breaking new ground at all levels of combat computing, whether in compliance with the Army's VICTORY (Vehicular

Integration for C4ISR/EW Interoperability) initiative or security or ruggedization. In all those domains, MFoCS is designed to push the leading edge of technology from inception to retirement.

The Army awarded the MFoCS contract to DRS last summer in a potential $455 million deal. The contract calls for DRS to build a variety of vehicle-mounted command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) equipment. The MFoCS hardware is for the Army Mounted Common Operating Environment.

DRS is building rugged computers, displays, radio controls, and on-board sensors to help alleviate growing SWaP concerns of C4ISR equipment in command and control vehicles. DRS Tactical Systems will carry out the contract requirements in a series of separate orders.

"The foundational element of the program is the rugged tablet, which is the cornerstone of all the different capability sets," Guyan explains. "It provides resilient and dismountable computing capability, no longer hostage to the vehicle, which is a big leap for our soldiers. Many commanders have voiced frustration that they could not share with dismounted soldiers what they were seeing on their screens. Now a commander can work on a tablet in a tank or Bradley, take it into a command post and dock it.

"Security risks mean thumb drives are not available in the field," Guyan continues. "The challenge is making a computer that is light enough to be considered a tablet but also rugged enough to survive vehicle movement and vibration, all the temperature ranges in which we operate and even being dropped."

MFoCS, managed by Program Manager-JBC-P, is designed to deliver capabilities that support not only JBC-P, but also platform-based computing needs across the services.

"Unfortunately, most computers fielded in the past were single-application platforms—as if in an office you had different computers to run PowerPoint, Excel, word processing, and connect to the Internet. But now we are enabling multiple simultaneous applications on the same piece of hardware; using virtual machine capability, you can even run multiple operating systems," Guyan says.

"As it is fielded in the next five to 10 years, MFoCS will free up space, save power and weight, reduce heat inside the vehicle, and allow the sharing of data across applications and inside the vehicle in ways not currently possible," Guyan says. "It also enables the Army's vision for a mounted COE, an open-architecture solution allowing for commonality of interfaces in the mounted computing environment."

Dominic Satili, the Army's deputy product manager for Blue Force Tracking,assigned to PM JBC-P, says that approach also will benefit the warfighters who will use MFoCS. "The vision here is to have a single tactical computer for Army vehicles that will run multiple applications. This standardizes the type of computer and at the same time creates a family of different sizes that adjusts to the mission," he says. "By offering basic through advanced computing and display capabilities, we can satisfy the needs of several mission command applications while eliminating the burden of operating different computers in the same vehicle. The soldier only has to learn how to operate one computer."

Military forces are increasing their use of laptop computers, yet data from the field is precious and calls for rugged data storage.

Rugged data systems

MFoCS, currently under a three-year, indefinite-delivery/indefinite-quantity contract with DRS for production and development, arose from a 2011 Army Directed Requirement to converge separate computing environments onto a single architecture. It is taking a building block approach with three models: basic, intermediate, and advanced.

The tablet constitutes the basic configuration, while the intermediate, platform-based model adds a processing unit with a 12-, 15- or 17-inch display. The advanced model brings tablets together with two intermediate units to create three workstations. All three models will be interchangeable and easily mission-customized.

In addition to bringing interoperability to tactical computers, the Army estimates MFoCS will reduce the cost of the basic configuration computer by as much as 36 percent, while boosting performance by more than 350 percent.

Lockheed Martin Corp. is involved in a wide range of ruggedized military data systems, including the Navy COMBATSS-21 total ship combat management system; Command, Control, Battle Management & Communications (C2BMC) for national missile defense; air/ground Expeditionary Ground Control System and the Common Cockpit avionics suite for Navy helicopters. The company's Information Systems & Global Solutions component is involved with advanced data technologies across a broad spectrum of domains.

"We work intelligence processing, which for DOD means the DCGS family. That means a mix of sites, from fixed large core sites to supported locations generally well below the brigade combat team," says John Beck, business development manager at the Lockheed Martin Information Systems & Global Solutions segment. A key focus has been making software and other developments inherently bandwidth-aware, capable of autonomously tailoring data exchanges based on available bandwidth, storage capacity, and need.

"When someone logs in from a location, the enterprise will acknowledge not just their role—and we do a lot of role-based security—but also communications [capability]," Beck says. "If you are dealing with a brigade combat team with only JTRS [Joint Tactical Radio System], the enterprise will move data to them one way, but may use a different way with a fixed station with greater bandwidth."

In an increasingly complex environment of network-centric battlespace communications, advanced avionics and vetronics, sensor processing, and high-density data storage at all levels, creating systems rugged enough to function with full reliability in all physical and threat environments, secure against threats and failures at every component, and meeting other military requirements means ruggedization, security, and SWaP not only are of equal importance, but must be built in together, from initial design to fielding to future technology insertion.

"When you talk about ruggedization on a platform or a warfighter's back, it has to be small; SWaP is precious and user interface is key real estate. With a SWaP-limited environment, regarding ruggedization, you can't assume unlimited bandwidth and small monitors," says John Murphy, Lockheed Martin's IS&GS Tactical Intelligence Capability manager.

Demands of video

The fast-growing use of full-motion video in combat requires systems that not only are rugged and secure, but also smart.

"You need analytics to get the right data there at the right time—often advanced analytics, where [the enterprise] knows you care about activity in a given location and your mission and objectives, which helps identify relevant data," Murphy says. "And if it knows you are on a comm that is intermittently connected, with low bandwidth, which will determine the way data is presented to you, reducing resolution or frame rate in full motion video, for example. So if data is automatically provided, you get what you need in a useful way from a bandwidth perspective. The system also might tell you data is available, but not send it unless you want to prioritize your bandwidth to pull it."

Following two decades of increasing reliance on commercial-off-the-shelf (COTS) technologies, DOD now is looking to leverage open source, as well, raising some of the same concerns as COTS: If technologies are openly available, doesn't that raise the risk of adversaries, including non-state players, matching new developments and thus reducing America's combat technology edge?

"Actually, it is very, very difficult to do that; you can't just throw code into the baseline. In addition, the peer review process is phenomenal and there are so many eyes on that code nothing malicious could survive," says Andy Goodson, IS&GS program manager for Distributed Data Framework, which uses open source software to support data sources, transformation services, and user interfaces into the DIB.

Many observers see MFoCS as the SOTA platform computing system for the Army and Marine Corps through at least the next decade.

"The MFoCS features a number of different form factors for displays and network computers as part of a secure system. The security aspect is hardware and software-based, from the BIOS to the storage medium and application level," says DRS's Guyan. "The unique thing about this program is it is a combination of custom computing architecture and information assurance capabilities that are software-based and paired with encryption-capable hard drives," he says. "Going forward, we believe the joint forces will be able to avail themselves of the latest technologies in computing and security, modularity, and SWaP functionality."

Navigating through the data-storage acronyms

Current research, development, and implementation of state-of-the-art (SOTA) and next-generation technologies have become a puzzle box of program and component acronyms, including:

C3-T—Command, Control, and Communications-Tactical
CISE—Computer Information Science & Engineering
CNS—Compact Network Storage
COE—Common Operating Environment
DAS—Direct-Attached Storage
DCGS—Distributed Common Ground System
DDF—Distributed Data Framework
DIB—DCGS Integration Backbone
eMLC—enterprise Multi-Level Cell
FIPS—Federal Information Processing Standard 140-2
FMS—Flash Storage Module
GEDR—Gigabit Ethernet Data Recorder
JBC-P—Joint Battle Command Platform
MCE—Mounted Computing Environment
MFoCS—Mounted Family of Computing Systems
MLC—Multi-Level Cell
MMCM—Molded Multi-Component Modules
NAS—Network-Attached Storage
NSC—Near Sensor Computing
PED—Processing, Exploitation, and Dissemination
POET—Protocol Offload Engine Technology
RITE—Relevant Intelligence to the Edge (aka, Relevant ISR to the Edge)
SATC—Secure And Trustworthy Computing
SFPDP—Serial Front Panel Data Port
SLC—Single-Level Cell
SSD—solid-state Disk
SWaP—Size, Weight, and Power
UCNS—Ultra-Compact Network Storage
VPX—Virtual Path Cross-Connect
WET—Weapons, Environment & Technology

There also is a growing plethora of cutting-edge (most still in the lab) technologies with potential applications to the rugged data storage requirement. Those include:

Hybrid Memory Cubes
Quantum Computing
Atomic-scale Magnetic Memory
DNA Storage
Magnetoelectric Random Access Memory (MeRAM)
NAND multi-level cell memory
Nanotech-based components
Thermally Assisted Magnetic Recording (TAMR)
Off-Site Cloud Computing
Enhanced Flash
Holographic Memory

Shielding challenges

Rugged systems no longer can rely on heavy, inert shielding or cushioning. At the same time, they must incorporate not only the latest security technologies, but allow for future technology insertion against evolving threats without needing to replace major components, much less entire systems. Operating at the forward edge of combat, they also must be able to provide full performance capability at the lowest bandwidth.

"While large amounts of data may be pushed upward or pulled down from higher-level commands, the size of the pipe limits what can efficiently be transmitted. When you add the security overhead, it further slows down data transmission," Guyan says. "At the command post and vehicle level, you have to insert some kind of filter to limit what gets sent and what is held locally, perhaps for later transmission or when it can be plugged in for downloads.

"We are looking at requests for mission recording for later playback for the purpose of after-action review or lessons-learned capture, which will drive up the amount of data that needs to be stored locally," Guyan adds. "Increasing levels of ISR data being pushed down to the platform require larger drives, to host maps and other mission-critical information."

Another factor is the small number of field commanders and intel analysts, who also are time-limited, creating major task saturation.

"Storage is moving forward rapidly to provide huge capability in a much smaller package that is also rugged. But the enterprise also is developing more and more tools to optimize the available time of the person in a tactical unit, immediately pointing them to [intel derived from large video or photo files], such as recently disturbed earth or changes seen by UAV surveillance. That also optimizes limited bandwidth when working with big data," says Lockheed Martin's Beck. "What you're seeing is the ability to have distributed capabilities across the

battlefield that rival or outpace what we had with fixed sites before and what kind of improvements can be made in point-to-point area communications or even beyond line-of-sight that give you much more assured comms that support and lessen the intermittent, latent environment. Those are the big moves that are really changing things. In the past 12 years, there have been incredible advances in processing power and analytical products they have been able to put into lower echelons, moving things much more out of fixed sites."

While MFoCS is intended to meet ground combat requirements for at least the next quarter century, what follows it will depend on how well that design works, as well as what is expected in technology evolution and revolution—the unexpected.

"I expect it to continue for some time, with enhancements of new technologies, such as a secure wireless connectivity between the vehicle and the tablet. There also are likely to be new form factors required by other users. You will see a widening of product range and a deepening of its capabilities in terms of security and reliability," Guyan predicts.

"From a system design standpoint, we're always looking at the roadmaps from our partners in the commercial computing world—hard drives, memory, processors, etc.—which allow us visibility into the latest technologies and the ability to work with the developers," Guyan says. "That gives us a head start on employing new technologies before they are even released."

Cloud computing

Of all the new technologies under development, the one already being heavily employed, by government edict, is cloud computing. While there are severe limitations—especially bandwidth "at the edge" and security—to using clouds in a combat environment, it would reduce field SWaP requirements, which in turn would enable greater emphasis on ruggedization. Near-term applications will be largely limited to fixed command posts, even without the bandwidth and reliable connectivity available to commercial users.

The rugged RPC24 4000 information storage system from Phoenix International is for bandwidth-intensive data recording.

As with all military programs—especially those still in their infancy or relying on future R&D—ever-tighter DOD budgets and sequestration, along with an increasingly fragile civilian economy, have cast a shadow over future expenditures. Ironically, however, many of the initiatives being taken to ensure combat forces have more rugged, reliable, secure, and capable computing and data storage actually may benefit from budget-driven cost-cutting.

For example, the NSF's Corman says he has not seen any appreciable limitations in recent budgeting for NSF through a number of federal agencies that cooperatively fund the Foundation. An NSF spokesman says the FY2014 budget actually reflects a 7.3 percent increase from the previous year. NSF does little in-house, instead providing grants to research institutions for technologies it wants to pursue, which may help entities deal with internal loss of funding.

Overall, the drive for greater commonality, modularity, and multi-purpose, easily upgradable field computing is seen as a way not only to reduce acquisition costs, but also lifecycle maintenance and user training, while increasing service life and enhancing capabilities and interoperability well into the future. Once systems such as MFoCS are fielded, the Army plans to start removing single-purpose, high-maintenance legacy components from vehicles, at the same time expanding rugged and secure data storage and processing out to the individual warfighter.

"The military IT user often is referred to as a disadvantaged user, without the unlimited power and bandwidth or line-of-sight connectivity you have in a fixed location. Adoption of the latest commercial technologies for the military is not just a cut-and-paste exercise; there are differences based on military missions that drive their requirements," Guyan says. "But the drive for commonality and standards will make it easier to take advantage of future solutions.

"We will continue to get new capabilities to soldiers and vehicles at the edge of the battlefield. [Contractor] engineers are staying in touch with and, in some cases, supporting advanced developments, from DNA storage to quantum computing to nanotech," Guyan says. "We're in the pragmatic domain of delivering capability today that is dependable for tomorrow's fight and expandable to allow near- and mid-term upgrades." ←

Cost quickly becoming a central concern for embedded computing backplanes and chassis

BY **John Keller**

There was a time not long ago when embedded computing industry-standard form factors really mattered. It was the dawn of the COTS era, when commercial off-the-shelf components, boards, and chassis had to adhere to specific and widely accepted industry standards, like VME, OpenVPX, PCI Express, and CompactPCI.

The initial cost of the components was secondary to the perceived need for a wide variety of vendors, relatively easy technology refresh and systems upgrades, and the ability for the military to dip into the well of commercially developed technology.

That was then, however. Today ever-tightening military technology budgets and the imperative to do more with less are encouraging military electronic systems designers to put their priorities on functionality and cost, and leave architectural choices as secondary considerations.

This is not to say that architectural considerations in specifying rugged military backplanes and chassis no longer matter—far from it. In fact, new developments in chassis and backplane connectors, signal integrity, cooling, and small form factors are more important than ever in today's age of high-throughput electronics that must make the most of size, weight, and power (SWaP).

"Forced-air convection cooling has been popular for a long time, as has conduction cooling," explains Marc Couture, director of product management at Mercury Systems in Chelmsford, Mass. Despite the popularity of these thermal-management techniques, today's demands for high-power microprocessors are forcing systems designers to rethink embedded systems cooling.

"With some of these processing technologies such as Intel Xeon server technologies, standard air- and conduction cooling starts to fall apart at 200 watts," Couture says. Nevertheless, chassis and backplane designers are meeting the challenge of today's high-performance microprocessors with new standard and custom architectures.

"The VITA 48.7 is an air-flow-by technique like a clamshell," Couture says. Essentially this approach uses a sealed enclosure containing the system's sensitive components, and then uses blown air and fins to remove heat. "It's a hybrid of conduction and convection cooling," Couture says. "It has better efficiencies than air cooling, and you can throw dirty air at it," which can be a big benefit when operating in dusty environments, such as the Middle East.

Liquid flow-by thermal management for high-power electronic subsystems still is a viable option whenever necessary, but like its predecessors, it still has disadvantages. "Liquid leaks," Couture says. Still, Couture and his colleagues say they are starting to see contractual requirements for liquid quick disconnects on the backplane.

Other notable trends in electronics chassis and backplanes involve an increasing use of optical fiber, and enhanced board-to-backplane connectors that enhance ruggedness and signal integrity. Some of these connectors are affording reliable throughput to 40 gigabits per second.

Embedded computing experts say cost is starting to be a bigger consideration—particularly in today's shrinking Pentagon budgets, sequestration, and other financial pressures. Where systems integrators used to specify standard board and enclosure form factors for easy integration and upgrades, today systems designers are showing growing interest in complete subsystems that come ready to install at affordable costs.

"Customers are looking for application-ready platforms, where it is a little bit higher level of integration, rather than a chassis and a few flavors of boards," says Justin Moll, director of marketing at VadaTech Inc. in Henderson, Nev. Customers are looking for a specific type of application and the boards that are best suited for that application. "This can be an easier first step, rather than the customer putting this all together. They want a preconfigured baseline to start from, and some one-stop shopping."

On one hand, it can be beneficial

COMPANY INFO

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Rittal Corp.
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SIE Computing Solutions
http://sie-cs.com

Tracewell Systems
www.tracewellsystems.com

VadaTech Inc.
www.vadatech.com/

Vector Electronics & Technology Inc.
www.vectorelect.com

to embedded computing providers, because as military budgets shrink, prime contractors are willing to contract out increasing amounts of electronic system work in efforts to attack costs. On the other end, embedded computing suppliers are under more pressure to keep costs low than ever before. This can lead them to unconventional approaches that are less expensive than standard favorites like VME, VPX, and OpenVPX.

Cost pressures are causing systems designers to take a second look at MicroTCA as an alternative to VPX and OpenVPX. "Sequestration helped MicroTCA," Moll says. "Its value proposition is it can do everything VPX can do and more, but it is 30 percent cheaper." ←

Hydroid asked to repair and upgrade Navy's fleet of MK 18 unmanned underwater vehicles

U.S. Navy officials are asking Hydroid in Pocasset, Mass., to repair and upgrade the Navy's fleet of MK 18 Kingfish unmanned underwater vehicles (UUVs), as well as to help train Navy personnel to use the unmanned submersibles. Officials of the Naval Surface Warfare Center (NSWC) Indian Head Explosive Ordnance Disposal Technology Division in Indian Head, Md., are awarding Hydroid a $26.2 million contract. The Navy's MK 18 UUV is a variant of the Hydroid REMUS 600, which Hydroid originally developed through funding from the Office of Naval Research (ONR) in Arlington, Va., to support the Navy's UUVs with extended endurance, increased payload capacity, and greater operating depth. The REMUS 600 can dive to depths of nearly 2,000 feet and can operate on one battery charge for up to 24 hours for mine countermeasures, harbor security, debris field mapping, search and salvage, scientific sampling and mapping, hydrographic surveys, environmental monitoring, and more. REMUS is short for Remote Environmental Measuring Units.

FOR MORE INFORMATION
visit **Hydroid** online at *www.km.kongsberg.com/hydroid*.

Army asks Norwegian company to design Black Hornet pocket UAV helicopter for foot soldiers

NATICK, Mass.—U.S. Army researchers are asking a Norwegian company to develop a pocket-sized helicopter drone to provide a personal reconnaissance unmanned aerial vehicle (UAV) for infantrymen and Special Forces warfighters.

Officials of the Army Contracting Command in Natick, Mass., are awarding a $2.5 million contract to Prox Dynamics AS of Nesbru, Norway, to develop the Black Hornet Personal Reconnaissance System (PRS)—a one-pound, force-protection micro UAV for soldiers and small infantry units.

The Army Contracting Command is awarding the contract for the Black Hornet pocket UAV on behalf of the Army Natick Soldier Systems Center as part of the Army Rapid Innovation Fund (RIF) for the transition of technologies developed by small businesses to solve immediate defense needs.

Prox Dynamics researchers will base the Black Hornet pocket UAV on the company's PD-100 personal reconnaissance system, a mobile unmanned helicopter designed to provide infantry soldiers with immediate intelligence, surveillance, and reconnaissance (ISR) capability.

The Prox Dynamics PD-100 PRS consists of the PD-100 nanocopter UAV and base station. The entire package weighs less than two pounds, excluding display, and measures 8 by 3.5 by 2 inches.

The PD-100 micro UAV system is for applications such as search and rescue; reconnaissance in confined areas; look behind, between, and below obstacles; birds-eye view for situational awareness; object identification; proximity surveillance; crowd control; nuclear installation inspection; and checking chemical plants after incidents and accidents.

The Black Hornet UAV, shown above, weighs less than an ounce and is extremely quiet, which enables infantrymen to observe enemy movements.

The complete system fits inside a pocket; can be airborne within one minute; operates in confined areas and outdoors; is small and silent; requires little training and no pilot experience; represents no risks to other aircraft or personnel; and reusable or expendable, Prox Dynamics officials say.

The PD-100 UAV offers a rotor diameter of less than five inches, weighs less than an ounce including camera, and flies as fast as 32 feet per minute on missions lasting as

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DARPA asks Boston Dynamics to build enhanced version of legged infantry-support robot

BY **John Keller**

ARLINGTON, Va.—A U.S. military project to develop a donkey-sized legged robot to help infantry warfighters haul ammunition, food, and other gear through rugged terrain is moving ahead.

Robotics experts at Boston Dynamics in Waltham, Mass., will develop an enhanced version of the company's Legged Squad Support System (LS3) robot under terms of a $10 million contract by unmanned vehicles scientists at the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va.

Boston Dynamics is developing the four-legged LS3 to help Army and Marine Corps infantry carry as much as 400 pounds of a squad's load, follow squad members through rugged terrain, and interact with troops in a natural way, similar to a trained animal and its handler.

The semi-autonomous LS3 eventually could go through the same terrain the squad goes through without hindering the squad's mission. The robot also could serve as a mobile auxiliary power source to the squad, so troops can recharge batteries for radios and handheld devices while on patrol.

The legged robot first was demonstrated outdoors in January 2012 by climbing and descending a hill and exercising its perception capabilities. In the second phase of the LS3 program, robotics experts at Boston Dynamics will develop an enhanced version of the LS3 system with increased reliability and usability, enhanced survivability against small arms fire, and a quiet power supply to support stealthy tactical operations.

Today's infantry warfighter can be saddled with more than 100 pounds of gear, resulting in physical strain, fatigue, and degraded performance, DARPA researchers point out. The Army has identified physical overburden as one of its top five science and technology challenges.

The latest contract to Boston Dynamics is part of a two-year effort expected to culminate in the LS3 robot's participation in a planned military exercise. Boston Dynamics is working with the Army and Marine Corps to provide the LS3 with a suite of autonomy settings, including leader-follower tight, leader-follower corridor, and go-to-waypoint.

DARPA is sponsoring development of an advanced version of the Legged Squad Support System (LS3) robot, shown above.

Leader-follower tight has the LS3 follow as closely as possible to the path its leader takes. Leader-follower corridor has the robot stick to the leader but gives it freedom to make local path decisions. Go-to-waypoint, meanwhile, has the robot use its local perception to avoid obstacles on its way to a designated GPS coordinate. Boston Dynamics experts also are working to enable squad members to speak commands to LS3.

Boston Dynamics staff will do the work in Waltham, Mass., and should be finished by 31 March 2015.

FOR MORE INFORMATION visit **Boston Dynamics** online at *www.bostondynamics.com*.

UAV CONTINUED FROM PAGE 26

long as 25 minutes. The micro UAV has a digital data link with a range as far as 3,200 feet line of sight, GPS or visual navigation through video, autopilot with autonomous and directed modes, and can hover and stare, search patterns automatically, or fly preplanned routes.

The tiny helicopter UAV's sensor payload has a steerable electro-optical camera with pan-and-tilt capability to provide live video and snapshot images.

The PD-100 base station provides mission planning, execution and analyses; display connections, functions, and system controls; storage of mission data, including video and images; and provides connections to PC, network, and other peripherals.

FOR MORE INFORMATION visit **Prox Dynamics** online at *www.proxdynamics.com*, or the **Army Natick Soldier Systems Center** at *www.army.mil*.

Thermal infrared imaging camera core introduced by Sofradir

Sofradir EC in Fairfield, N.J., has introduced the ATOM80 low-cost thermal infrared imaging camera core for low-cost thermal imaging, building energy efficiency management, advanced presence detection including access control and people counting, thermography, and automotive safety sensing. The ATOM80 electro-optical sensor consists of a microbolometer array with 80 by 80 pixels with high infrared sensitivity. The camera core is based on a ULIS Micro80P microbolometer. The thermal sensor camera core bridges the applications gap for which single-, quad-, or multi-element thermal detectors do not have sufficient sensitivity or resolution and where large-format imaging arrays outperform the application needs and costs.

FOR MORE INFORMATION visit **Sofradir EC** at *www.sofradir-ec.com*.

Lockheed Martin to upgrade obsolete data and graphics processors in C-130 aircraft displays

U.S. Air Force avionics experts are working with Lockheed Martin Corp. to upgrade embedded computers in primary flight displays aboard C-130J Super Hercules aircraft to improve capability and stave-off component obsolescence. Officials of the Air Force Life Cycle Management Center at Wright-Patterson Air Force Base, Ohio, awarded a $21.6 million

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Companies to develop synthetic-vision to operate helicopters in blinding dust

BY **John Keller**

FORT EUSTIS, Va.—Three U.S. defense contractors are developing synthetic-vision helicopter avionics that capitalizes on data from existing onboard sensors to help U.S. Special Operations helicopter pilots deal with brownout conditions and other degraded visual environments (DVE) during challenging missions.

Officials of the Technical Applications Contracting Office at Fort Eustis, Va., are awarding the contracts on behalf of U.S. Special Operations Command (SOCOM) at MacDill Air Force Base in Tampa, Fla. Contract winners are: Rockwell Collins in Cedar Rapids, Iowa; the Boeing Co. Defense, Space & Security segment in Philadelphia; and Sierra Nevada Corp. in Sparks, Nev.

Engineers from Rockwell Collins, Boeing, and Sierra Nevada will develop the DVE System for Special Operations Command. The system will integrate information from aircraft sensors to increase situational awareness for MH-47 and MH-60 helicopter aircrews. The contracts

Landing helicopters in thick dust can blind and disorient pilots and crew members. Three companies are developing synthetic vision technology to alleviate the problem.

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Northrop Grumman, Lockheed Martin to develop pod-mounted aircraft and UAV laser defenses

BY **John Keller**

ARLINGTON, Va.—U.S. military researchers are hiring two defense companies to develop technology for pod-mounted laser weapons to protect manned aircraft and unmanned aerial vehicles (UAVs) from electro-optical and infrared (EO/IR)-guided surface-to-air missiles.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) are choosing the Northrop Grumman Corp. Aerospace Systems segment in Redondo Beach, Calif., and the Lockheed Martin Mission Systems and Training segment in Akron, Ohio, for Project Endurance to develop laser weapons to defend aircraft from missiles.

Northrop Grumman is receiving a $14.6 million contract, and Lockheed Martin is receiving $11.4 million for the Endurance program. Project Endurance, previous-

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DUST CONTINUED FROM PAGE 28

were announced in late September.

Rockwell Collins won a $22.4 million contract, Boeing won a $23 million contract; and Sierra Nevada won a $22.6 million contract to develop the DVE System.

Based on the wording of the contracts, the companies will not develop new sensors for coping with helicopter DVE, but instead will consolidate data from existing sensors onboard the MH-47 and MH-60 helicopters into a system to enhance pilot situational awareness.

Spatial disorientation (SD) describes flight incidents where the pilot fails to sense correctly the position, motion, or attitude of the aircraft as he loses sight of the ground, buildings, trees, helicopters close by, and other outside visual cues in dust, snow, fog, smoke, or other obscurants.

Helicopters operating in dusty conditions, such as those in the Middle East and Southwest Asia, are particularly susceptible to DVE because the aircraft rotors kick up dense, choking clouds of dust so thick that pilots often cannot see beyond their own windshields. This condition is called brownout.

In the 15 years from 1990 to 2005, SD crashes in the U.S. Air Force amounted to 11 percent of all crashes, according to the NATO Research and Technology Organization (RTO) report, "Spatial Disorientation Training–Demonstration and Avoidance."

In helicopters, the problem is even worse. The U.S. Naval Aviation Center for Rotorcraft Advancement reports that three out of four helicopter accidents in Iraq and Afghanistan have been attributed to brownout conditions, and that more helicopters are lost to degraded visual environment (DVE) than to enemy fire. DVE accidents have cost the U.S. armed forces more than $100 million annually, officials say.

Special Operations helicopters are especially vulnerable to DVE because they typically operate at night, and rarely have the option of cancelling crucial missions due to bad weather or other degraded-visibility conditions.

The awards to Rockwell Collins, Boeing, and Sierra Nevada are for technology demonstrations to run for five years. After that, SOCOM officials may decide to pursue the program and choose one of the three contractors to develop a DVE-prevention system for deployment.

SOCOM issued a request for information (H92241-12-R-0018) last December for the Degraded Visual Environment Pilotage System (DVE-PS) program, which was to result in a multiple award cost plus fixed fee contract. On these contracts, Rockwell Collins will do the work in Cedar Rapids, Iowa; Boeing will do the work in Philadelphia; and Sierra Nevada will do the work in Sparks, Nev. All contractors will be finished by the end of 2017. ←

FOR MORE INFORMATION visit **Rockwell Collins** online at *www.rockwellcollins.com*, **Boeing Defense, Space & Security** at *www.boeing.com/boeing/bds*, **Sierra Nevada Corp.** at *www.sncorp.com*, and **SOCOM** at *www.socom.mil*.

UAV CONTINUED FROM PAGE 28

ly part of the DARPA Excalibur laser weapons program, focuses on miniaturizing component technologies, developing high-precision target tracking, identification, and lightweight agile beam control to support target engagement. The program also focuses on the phenomenology of laser-target interactions and related threat vulnerabilities. Ultimately, the program seeks to develop pod-mounted lasers for drones and planes.

Among the Endurance program's goals are to design a miniaturized, flight-traceable, low-maintenance laser with an output beam strong enough to defeat incoming enemy missiles. The program also seeks to design a lightweight agile beam director and beam control technology to support coarse and fine tracking of moving targets.

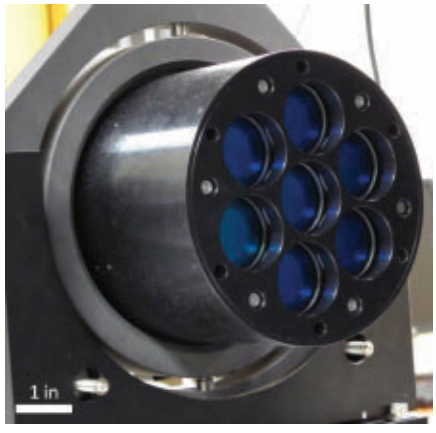
DARPA researchers are interested in laser pods also capable of target-identification and target-engagement, and that can accommodate additional functions such as intelligence, surveillance, and reconnaissance (ISR) and target designation.

Also part of the DARPA Endurance program is the design of a high-precision coarse-to-fine-track and target identification subsystem, as well as test plans for laser effects testing. Later, the program will design and test miniaturized airborne defense laser weapons, laser effects testing, and estimate the vulnerabilities of enemy anti-air missiles to specific laser power levels.

The Endurance program emerged from the DARPA Excalibur program, which sought to develop coherent optical phased array technologies to enable scalable laser weapons that are 10 times lighter and more compact than high-power chemical laser systems.

The laser phased arrays developed in the Excalibur program were to combine low-power electrically driven lasers, such as diode lasers and fiber laser amplifiers, in a coherent way. The program also focused on laser beam-steering technologies to make laser arrays conformal with aircraft.

On the current contracts, Northrop Grumman will do the work in Redondo Beach, Calif.; Rolling Meadows, Ill.; Linthicum, Md.; Oxford, Mass.; and Pittsburgh, Pa. Lockheed Martin will do the work in Akron, Ohio; Orlando, Fla.; Sunnyvale, Calif.; and Palmdale, Calif. The companies should be finished with this phase of the Endurance program by December 2016.



The DARPA Endurance program, previously part of the Excalibur laser weapons program, depicted above, focuses on miniaturizing laser weapons components small enough to fit on unmanned aerial vehicles.

FOR MORE INFORMATION visit **Northrop Grumman Aerospace** online at *www.northropgrumman.com*, **Lockheed Martin Mission Systems and Training** at *www.lockheedmartin.com/us/mst*, and **DARPA** at *www.darpa.mil*.

BRIEFS CONTINUED FROM PAGE 28

contract to the Lockheed Martin Aeronautics segment in Marietta, Ga., for avionics display work on the C-130J. The contract is for the diminishing manufacturing sources solution for CMDUs and MFCUs aboard the C-130J. The contract modification redesign effort for the CMDU and MFCD is to replace the display's obsolete common central processor and graphics processor chip sets.

FOR MORE INFORMATION visit **Lockheed Martin Aeronautics** at *www.lockheedmartin.com*.

Raytheon to provide UAV electro-optical targeting systems

U.S. Air Force officials needed electro-optical targeting systems for the General Atomics MQ-9 Reaper hunter-killer unmanned aerial vehicle (UAV), as well as for manned helicopters and fixed-wing aircraft. They found their solution from the Raytheon Co. Space and Airborne Systems segment in McKinney, Texas. Officials of the Air Force Life Cycle Management Center Medium Altitude Unmanned Aircraft Systems office at Wright-Patterson Air Force Base, Ohio, awarded Raytheon a $50.2 million contract to provide the Multispectral Targeting System (MTS)-B for the Reaper UAV and for other aircraft. Raytheon will provide MTS-B turret units, 37 MTS HD electronics units, containers, spare parts, and support equipment.

FOR MORE INFORMATION visit **Raytheon Space and Airborne Systems** at *www.raytheon.com*.

PRODUCT applications

BOARD PRODUCTS

Navy underwater warfare experts choose legacy memory PMC cards from GE for torpedo research

U.S. Navy underwater warfare experts needed legacy CompactFLASH memory adaptor circuit cards to support underwater testing of torpedoes and other undersea weapons. They found their solution from GE Intelligent Platforms in Huntsville, Ala.

Officials of the Naval Undersea Warfare Center (NUWC) in Newport, R.I., have announced their intention to award a sole-source contract to GE for 20 of the company's PMCF2 PCI mezzanine card (PMC) for embedded computing necessary for underwater testing.

The PMCF2 is the only supported device that meets the Navy's interface requirement, Navy officials say. Acquisition is time-critical to support efforts related to in-water runs. Any other circuit card board will not be compatible with the current torpedo software, officials say.

NUWC Newport is the Navy's primary center for research in submarine warfare systems and undersea warfare. The major thrust of NUWC Newport is applied research and system development. The organization operates detachments at West Palm Beach, Fla., and Andros Island in the Bahamas, and remote test facilities at Seneca Lake and Fisher's Island, N.Y., and at Dodge Pond, Conn.

Using any memory-based PMC other than GE PMCF2 would require an extensive weapon software redevelopment plan that would span several years and cost the Navy millions of dollars, officials say. GE is the sole manufacturer and sole retailer of these cards.

FOR MORE INFORMATION visit **GE Intelligent Platforms** online at *www.ge-ip.com*, and **NUWC Newport** at *www.navsea.navy.mil/nuwc/newport*.

RUGGED COMPUTERS

DRS to provide vetronics rugged computers for Army FBCB2 program

U.S. Army leaders needed rugged computers and displays to support the Force Battle Command Brigade and Below (FBCB2) program. They found their solution from DRS Tactical Systems in Melbourne, Fla.

The Defense Logistics Agency Land and Maritime segment at Aberdeen Proving Ground, Md., has announced a $61.6 million five-year contract to DRS for FBCB2 vetronics equipment. DRS has been providing FBCB2 equipment to the Army since 1998. DRS in 1998 won a production contract to supply prime contractor Northrop Grumman Corp. with nearly 2,000 RVS-330 Appliqué V4 rugged vehicle systems for FBCB2. The RVS-330 has helped digitize several U.S. Army brigades and divisions.

Among the FBCB2 equipment that DRS provides to the Army is the JV-5 block 2 rugged vehicle computer system, which uses off-the-shelf components. It has a customizable expansion bay, two 3U CompactPCI expansion slots, and sunlight-readable display.

DRS also provides the Joint Platform Tablet (JPT) for the FBCB2 program, an all-in-one rugged computer tablet for space-constrained vehicle applications. The JPT has a military-grade aluminum case, dual-core processor, 128 gigabytes of solid-state removable hard-drive storage, and a 10.4-inch XGA display with five-wire touchscreen display.

The JPT meets MIL-STD-810G, MIL-STD-461F and has embedded MIL-STD-1275 power conditioning. It can be hard-mounted into a vehicle without an additional vibration isolation kit. JPT systems provide for future CPU upgrades to processors and enhanced 2 gigabytes of RAM expandable to 4 gigabytes.

On this contract DRS will do the work in Melbourne, Fla., and should be finished by August 2018.

FOR MORE INFORMATION visit **DRS Tactical Systems** online at *www.drs-ts.com*, and the **Defense Logistics Agency Land and Maritime segment** at *www.landandmaritime.dla.mil*.

EMBEDDED COMPUTING

Air Force cryptography experts look to Mercury for embedded computing digital receivers

U.S. Air Force cryptography experts needed a field-programmable gate array (FPGA)-based channelizer to support a broad range of digital receiver applications. They found their solution from Mercury Systems in Chelmsford, Mass.

Officials of the Air Force Life Cycle Management Center, Cryptologic Systems Contracting Division (AFLCMC/HNCK) at Hanscom Air Force Base, Mass., have announced their intention to award a sole-source contract to Mercury for several pieces of digital receiver embedded computing equipment.

Air Force contracting officials are asking Mercury to supply five of the company's Echotek series DCM-V5-6416-PCI Express digital receiver, a 16-bit PCI Express long-format FPGA-based channelizer. The Air Force also is buying one PCI Express to PCI-eXtended (PCI-X) expansion chassis from Mercury.

The receiver channel synchronization of the DCM-V5-6416 enables users to synchronize all important receiver functions on one DCM-V5-6416-PCI Express or across several boards, Mercury officials say. The board combines high-speed and high-resolution analog-to-digital (A/D) conversion with digital receiver processing. This device it is suitable for narrowband down-conversion and filtering for applications such as direction finding (DF), geolocation, and commercial wireless communications, officials say.

When the 32-channel receiver mezzanine with additional FPGA resources is installed on the baseboard, the entire module has 64 channels, while using one PCI Express slot.

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

DIGITAL SIGNAL PROCESSING

Northrop Grumman orders airborne radar signal processors from Curtiss-Wright for Joint STARS

Aircraft surveillance experts from the Northrop Grumman Corp. Aerospace Systems segment in Melbourne, Fla., needed radar processing technology for the Joint Surveillance and Target Attack Radar System (Joint STARS) aircraft. They found their solution from Curtiss-Wright Controls Defense Solutions in Santa Clarita, Calif.

Northrop Grumman has awarded an $8 million follow-on production contract to Curtiss-Wright to provide an upgraded digital signal processing (DSP) system for the Joint STARS program. The estimated value of this follow-on embedded computing order over the lifetime of the program is $22 million, Curtiss-Wright officials say.

Joint STARS is an airborne command, control, intelligence, surveillance, and reconnaissance (C2ISR) aircraft for the U.S. Air Force's air-to-ground battle management and surveillance operations. The Air Force's Radar Airborne Signal Processor (RASP) system performs the radar signal processing capabilities of the Joint STARS aircraft, enabling its ability to process data to locate and track ground targets.

The contract is part of a larger upgrade to the RASP system used in Joint STARS. The radar signal processors represent one of two subsystems that Curtiss-Wright supplies on the Joint STARS aircraft. The award began in November 2012. The program is expected to continue through 2015.

FOR MORE INFORMATION visit **Curtiss-Wright Controls Defense Solutions** online at *www.cwcdefense.com*, and **Northrop Grumman Aerospace Systems** at *www.northropgrumman.com/AboutUs/BusinessSectors/AerospaceSystems*.

RADIO COMMUNICATIONS

Army chooses Harris to provide voice, data, and video networking to the battlefield front lines

U.S. Army military communications experts needed multichannel tactical radios for military vehicles to extend voice, data, and imagery services from brigade and battalion radio networks to companies and platoons operating in the field. They found their solution from the Harris Corp. RF Communications segment in Rochester, N.Y.

Officials of the Army Contracting Command at Aberdeen Proving Ground, Md., are awarding a potential $140.7 million contract to Harris RF to design and build the Mid-Tier Networking Vehicular (MNVR) radio, which will host Joint Tactical Networking Center (JTNC) waveforms and fulfill the Army's need for a tactical radio networking bridge to connect upper-level commanders with fighting forces on the forward edge of the battlefield.

The two-channel MNVR solution is based on the Harris Falcon III AN/PRC-117G multiband networking radio. The MNVR system provides an extension of data services from the upper tactical network at brigade and battalion to the lower tactical network at company and platoon echelons.

The advanced network waveforms distribute data and imagery with information assurance protection and automatic routing across complex terrain, according to Army officials.

The MNVR capability consists of modular radios capable of running software-defined waveforms, which operate as nodes in a network to ensure secure wireless communication and networking services for mobile and stationary forces.

This supports mission command, sensor-to-shooter, sustainment and survivability applications on military combat vehicles and other tactical platforms.

FOR MORE INFORMATION visit **Harris RF Communications** online at *http://rf.harris.com*, and the **Army Contracting Command** at *www.army.mil/acc*.

SATELLITE ANTENNAS

Army looks to GATR for lightweight, quick-setup inflatable SATCOM antennas

U.S. Army network-centric warfare experts needed portable, lightweight, inflatable satellite communications (SATCOM) antennas for the Warfighter Information Network–Tactical (WIN-T). They found their solution from GATR Technologies in Huntsville, Ala.

Officials of the Army Contracting Command at Picatinny Arsenal, Ala., have awarded GATR a $440 million contract for different size inflatable satellite antennas. GATR inflatable SATCOM antennas are designed for ground use, particularly useful in military situations in remote areas, quick deploys, or in bad weather.

GATR inflatable SATCOM antennas are for deployments where the movement and installation of 2+ meter class standard deployable rigid satellite antennas is challenging, GATR officials say. The design combines the transmission power advantages of a large antenna with the low weight and portability of a small aperture antenna.

The GATR 2.4 meter inflatable antenna system packs in as few as two cases that weigh less than 99 pounds for a single-band, versus more than eight cases for traditional rigid antennas, reducing size and weight by 50 to 80 percent over rigid satellite antennas, company officials say.

The GATR inflatable satellite antennas, moreover, are reliable in extreme environments, are stable in high winds, and perform well in extreme heat and cold. The antennas can be set up in 30 minutes or less.

GATR also provides a 1.2 meter backpackable antenna for high-bandwidth communications for transmission of secure and non-secure data, voice, and video in a compact package. All components fit in a backpack that weighs less than 50 pounds.

The Army Contracting Command awarded the contract to GATR on behalf of the Army's program executive officer for WIN-T at Aberdeen Proving Ground, Md.

FOR MORE INFORMATION visit **GATR Technology** online at *www.gatr.com,* and the **Army PEO WIN-T** office at *http://peoc3t.army.mil/wint*.

RACKMOUNT COMPUTERS

Lockheed Martin to upgrade computers in Marine Corps TPS-59 deployable air search radar

U.S. Marine Corps leaders needed upgraded computers for the AN/TPS-59A(V)3 military radar system. They found their solution from the Lockheed Martin Corp. Mission Systems and Training segment in Syracuse, N.Y.

Officials of the Marine Corps Systems Command at Quantico Marine Corps base, Va., awarded a $7.5 million contract to Lockheed Martin for technical refresh and integration of TPS-59 radar computers.

Fielded in 1985, the AN/TPS-59A(V)3 is a long-range 3-D ground-based air surveillance radar. The system is for anti-air warfare to a maximum range of 300 nautical miles, and tactical ballistic missile surveillance to a range of 400 nautical miles.

The contract calls for Lockheed Martin to upgrade the radar system's obsolete Oracle Sun Netra T5220 carrier-grade ruggedized computer servers, the operations console computers, and re-integrate the system's proprietary software.

Lockheed Martin signal processing experts will replace the Oracle Sun Netra T5220 rugged server with the Oracle Sun Netra T4-1 carrier-grade server, which the Marine Corps will procure through the Marine Corps Common Hardware Suite (MCCHS) and provide to Lockheed Martin as government-furnished property.

The Netra SPARC T4-1 server is powered by the eight-core and four-core SPARC T4 processor with integrated on-chip cryptographic support for wire-speed encryption capabilities.

This server offers 16 DIMM slots, which can support 256 gigabytes of memory, four hot-pluggable 2.5-inch drives plus DVD, integrated 10 Gigabit Ethernet networking, and built-in PCI Express Generation 2 expansion. The server runs the Oracle Solaris operating system and virtualization software such as the Oracle Solaris Zones and Oracle VM Server for SPARC technology.

FOR MORE INFORMATION visit **Lockheed Martin Mission Systems and Training** online at *www.lockheedmartin.com/us/mst*, and **Marine Corps Systems Command** at *www.marcorsyscom.marines.mil*.

NETWORKING EQUIPMENT

Navy chooses NTDS networking gear from X-COM for land-based Aegis weapon test sites

U.S. Navy surface warfare experts needed Naval Tactical Data System (NTDS) shipboard networking components to support the Aegis shipboard combat system at land-based test sites. They found their solution from X-COM Systems in Reston, Va.

Officials of the Naval Surface Warfare Center Dahlgren Division in Dahlgren, Va., have announced plans to award an estimated $6 million contract to X-COM for NTDS digital switching, fiber-optic extender assemblies, and subassemblies for Aegis system testing and support.

X-COM will provide its XPS-32 32-port switch, XPS-CPU-M CPU card for multiple-chassis networking, XPS-CMS-A NTDS Type A channel line card and connector module, XPS-CMS-B NTDS Type B channel line card and connector module, MPS-32 32-port low-level serial switch, MPS-CPU-M CPU card for multiple-chassis networking, and NN-CAB-19 rack cabinet under terms of the contract.

The contract will call for X-COM to provide as many as 16 XPS-32 units, 16 XPS-CPU-M units, 20 XPS-CMS-A units, 40 XPS-CMS-B units, 16 MPS-32 units, 16 MPS-CPU-M units, and 10 NN-CAB-19 units. This equipment will support existing X-COM switching hardware, including parallel and serial switches and parallel and serial fiber-optic interface extenders for NTDS electrical interfaces for Aegis support.

Navy officials are choosing X-COM gear sole-source to support interchangeability with existing in-line hardware components at different land-based test sites, Navy officials say. The necessary equipment is not available from any other source.

The Navy has been using this kind of X-COM equipment since 1998, the company uses proprietary technology for fiber-optic conversion and multiplexing, and this kind of technology is being phased out of use, which leaves limited motivation for outside competition, officials say.

FOR MORE INFORMATION visit **X-COM** at *www.xcomsystems.com*, and Naval **Surface Warfare Center Dahlgren** at *www.navsea.navy.mil/nswc/dahlgren*.

new PRODUCTS

To submit new products for consideration, contact John Keller at jkeller@pennwell.com.

PORTABLE COMPUTING

AMREL announces major upgrades to line of ROCKY DR10 and ROCKY DK10 rugged tablets

Rugged computer specialist American Reliance Inc. (AMREL) in El Monte, Calif., is introducing major upgrades for its line of rugged tablet computers, which make the ROCKY DR10 8.4-inch and ROCKY DK10 12.1-inch tablets faster, brighter, and tougher, company officials say. The ROCKY DR10 and DK10 rugged tablets are for applications that demand portability, capability, and ruggedness, such as operator control, communication management, avionics testing, data acquisition and control, supply chain logistics, field data collection, homeland security and law enforcement, as well as geological and scientific field research. For the ROCKY DR10 8.4-inch rugged tablet, AMREL has added an Intel Core i7 processor, brighter display, improved memory, and longer-lasting battery.

FOR MORE INFORMATION visit **AMREL** online at *http://computers.amrel.com*.

CHASSIS AND ENCLOSURES

8U MicroTCA.4 chassis for applications that require rear I/O introduced by VadaTech

VadaTech Inc. in Henderson, Nev., is introducing the VT811 8U MicroTCA.4 chassis for applications that require rear I/O. The embedded computing chassis has redundancy, including dual fan trays, dual MicroTCA Carrier Hub (MCH) slots, and quad Power Module (PM) slots. The VadaTech VT811 chassis has a lightweight aluminum construction with integrated cable ducts below the card cage to enable systems designers to protect the cables and route them to the rear of the chassis. The fan trays use Teflon strips which make insertion and extraction smoother and easier. Plus, the trays have shrouded blind-mate connectors for the male and female ends. The VT811 chassis has a 30-layer impedance controlled backplane with slots for 12 double-wide AMC modules in the mid-size, plus 2 MCHs and 4 PMs. The clock traces are laid out to give equal track length from MCH to each AMC slot, easing latency equalization.

FOR MORE INFORMATION visit **VadaTech** at *www.vadatech.com*.

RUGGED COMPUTING

Rugged computer able to combine classified and non-classified data introduced by GMS

General Micro Systems (GMS) in Rancho Cucamonga, Calif., is introducing the SB1002R-MD Golden Eye ultra-small, secure, ultra-rugged, multi-domain computer workstation that combines two isolated systems—one operating in the black (classified) domain and the other in the red (non-secure) domain—in one unit. What makes this possible is Golden Eye's advanced design and NSA-approved architecture, GMS officials say. The SB1002R-MD rugged computer houses an independent computer for each side (red/black) in the same enclosure—sharing only the secure internal DC power—and uses a proprietary mechanical system to isolate red from black domains electrically and from any electromagnetic force (EMF). No radiation crosses between the two. The same system to be used in several military programs with varying needs and applications. Once the secure black domain is NSA-certified, reconfiguration and software modification of the non-secure red domain—changing I/O to meet the

needs of a certain vehicle, for example—can be completed without recertification.

FOR MORE INFORMATION visit **General Micro Systems** online at *www.gms4sbc.com*.

IMAGING

Small rugged video tracker and image stabilizer for unmanned vehicles introduced by GE

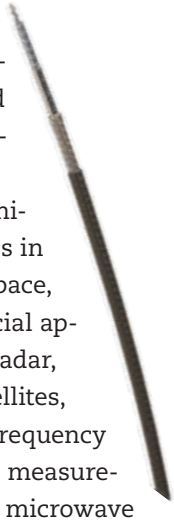
GE Intelligent Platforms in Huntsville, Ala., is introducing the ADEPT3100 rugged miniature automatic video tracker and image stabilizer for environments in which size, weight, and power are severely constrained, such as small unmanned vehicles and man-portable devices. The ADEPT3000 combines video

tracking and image stabilization in one device to improve tracking performance and image quality, and reduce cost. It is rugged, enabling the ADEPT3100 to survive the harshest commercial and military deployments. The device measures 34 by 24 millimeters—about the size of a microprocessor, and can operate with PAL or NTSC analog video signals, and incorporates on-board serial links to interface to most platforms. The ADEPT3100 weighs six grams and consumes 1.5 watts of power. "The ADEPT3100 addresses the continual pressure on autonomous vehicle manufacturers to increase endurance," says Chris Jobling, product manager of applied image processing at GE.

FOR MORE INFORMATION visit **GE Intelligent Platforms** online at *http://defense.ge-ip.com*.

CABLING AND WIRING

Rugged coax cable for radar, military vehicles, missiles, and space introduced by Molex



Molex Inc. in Lisle, Ill., is introducing rugged Temp-Flex RF and microwave coaxial cables for device manufacturers specifying microwave coaxial cables in high frequency aerospace, defense and commercial applications, including radar, military vehicles, satellites, space, missile, radio frequency (RF) ablation, test and measurement equipment. The microwave cable assemblies uses the Molex Temp-Flex air-dielectric ultra-low-loss flexible microwave coaxial cables with dual monofilament air-enhanced design and a helically wrapped shield. The Temp-Flex coaxial cables achieve 85 to 88 percent velocity of propagation (VOP) for increased signal speed, Molex officials say. Molex coax cables provide extremely stable electrical performance with minimal impedance and insertion loss variation in dynamic applications.

FOR MORE INFORMATION visit **Molex** online at *www.molex.com*.

SIGNAL PROCESSING

FPGA XMC digital I/O module for coding, encryption, and decryption introduced by Pentek

Pentek Inc. in Upper Saddle River, N.J., is introducing the 71610 XMC digital I/O module with low-voltage differential signaling (LVDS) I/O connected to a Virtex-6 field-programmable gate array (FPGA) for encoding/decoding, modulation/demodulation, encryption/decryption and channelization of signals between transmission and reception. The embedded computing module provides 32 LVDS differential input or output pairs plus LVDS clock, data valid and flow control signals via an easy access front panel 80-pin connector routed to the Virtex-6 FPGA. LVDS is a general-purpose digital interface operating at high speeds over inexpensive twisted-pair or flat ribbon copper cables. It is popular for common control or data capture applications, such as high-speed video, graphics, video camera data transfers and general-purpose computer buses.

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

POWER CONTROL

Rugged solid-state power controller for aircraft and military applications introduced by DDC

Data Device Corp. (DDC) in Bohemia, N.Y, is introducing the RP-2032151XD0 32-channel, lightweight solid-state power controller (SSPC) for aircraft and other space-conscious aerospace and defense applications. The power electronics device provides a total continuous current output capacity of 120 amps at 28 volts DC in a 3-pound box, along with a high channel count and advanced programmability. The RP-2032 product family offers users

significant size, weight, power and cost (SWaP-C) savings in addition to improved reliability and smart power control. DDC's SSPCs support real-time digital status reporting and computer control, and are equipped with instant trip, and true I²T wire protection, rated to 300 amps continuous, and multi-channel boards that are rated to 25 amps continuous per channel.

FOR MORE INFORMATION visit **DDC** online at *www.ddc-web.com*.

RUGGED COMPUTERS

Rugged thin clients for virtualizing desktop computers introduced by Crystal Group

Crystal Group Inc. in Hiawatha, Iowa, is introducing the RTCZ90 rugged Thin Client and the RZCP25 rugged Zero Client for rugged computer applications that call for virtualizing desktop computers. "These Virtual Desktop Infrastructure (VDI) solutions go into environments that standard Thin and Zero Clients simply cannot go," says Chip Thurston, Crystal's technical director. These products are able to perform at wide temperature extremes, resulting in a cool run time. The Zero Client allows virtualization in many workstations off a combined storage and processing appliance, while not storing any data on the local machine. This results in a deployed multi-user compute lab that can be set up in minutes, company officials say. Zero Clients do not store local data, allowing a room of data to be sanitized by removing the centralized storage in seconds, if needed. Pair the Thin and Zero Clients with the RS347L26 Rugged 3U Quad Server for maximum output and usage.

FOR MORE INFORMATION visit **Crystal Group** online at *www.crystalrugged.com*.

TEST AND MEASUREMENT

Mixed-signal oscilloscope for test and debug of analog and digital signals offered by Rigol

Rigol Technologies Inc. in Oakwood Village, Ohio, is introducing the MSO4000 series mixed-signal oscilloscope for signal analysis and digital decoding for testing and debugging of analog and digital signals. The test & measurement scope has 16 digital and as many as four analog channels at bandwidths ranging from 100 to 500 MHz. The MSO4000 has 28 megapoints per channel memory depth in each digital channel and 140 megapoints per channel in analog channels. The device delivers sample rates of 1 gigasample per second digital and 4 gigasamples per second analog, and has a digital waveform capture rate of 85,000 waveform captures per second. Rigol's UltraVision technology allows for real-time waveform recording, replay, and analysis of as many as 200,000 frames (64,000 frames with digital), as well as a low noise floor with minimum analog vertical sensitivity measuring 1mV/div. MSO4000 series supports serial bus triggers (standard) and decoding (optional) for analog and digital channels. The RPL2316 has a logic probe adaptor for high-speed digital measurements, and supports several logic levels.

FOR MORE INFORMATION visit **Rigol Technologies** online at *www.rigolna.com*.

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Great aerospace minds are partnering to propel unmanned aircraft systems (UAS) and aerospace technologies and applications forward.

Why are regions such as Oklahoma taking a proactive approach to UAS, with academia, government, and technology firms joining forces?

A statewide initiative was natural because the state's main industry sectors (oil & gas, aerospace, agriculture, defense, and security) will all directly benefit from development of the UAS industry. The benefits of this approach are that the UAS industry segments in Oklahoma, that otherwise may not have collaborated, are now working in partnership. Funding goals are prioritized, and UAS has become a state priority at multiple levels, including state politics, the private sector, and the education and research sectors.

Several major aerospace corporations have recently located here or are in discussions about partnering, expanding or locating in Oklahoma. The Department of Homeland Security (DHS) and Department of Defense (DOD) have strong, continuing programs within the state for test and evaluation purposes. Economic developers are being attracted to this market segment and investors are likewise paying attention to what is happening in the state.

What segments are increasing the adoption of UAS?

Current activities include UAS application in: fire and rescue, disaster response, precision agriculture, power line inspections, oil & gas pipeline inspection, severe weather studies, homeland security research & development (including test & evaluation of existing technology and development of new technology for first responders and border patrol), defense and military test & evaluation (also including the development of new technology), research into platform design, autonomous systems, telemetry, sense and avoid, radars, and, of course, education.

Current Oklahoma attentions with respect to applications are in agriculture, oil & gas, utility power lines, and severe storm studies. Other ongoing efforts are in radar development, platform design for specialist operations (e.g. long endurance, silent flight), autonomous systems, and aeronautical education with a specialty is UAS design. The most immediate niches and early adopters of this technology will be in first response and agriculture, with the energy industry not far behind.

What advice would you offer related to current and future UAS?

For students considering UAS as a career, take as many science and math courses as you can. At university, enter a program in which there is direct hands-on experience with building and operating UAS. Choose established university programs, and not some of the newer, online programs. For the business sector, be on the look-out for the utility of UAS for your businesses. This technology is transformational in that it will allow businesses to do things safer, cheaper, and faster, with less overall risk. ←

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