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Image: Elbit Systems

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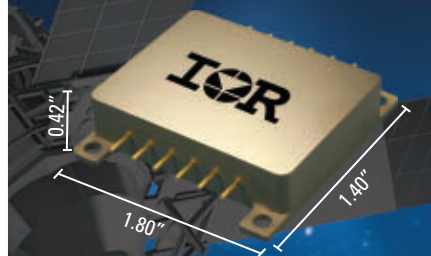
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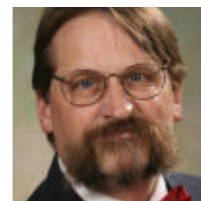


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A risky legacy for manned combat vehicle programs

Defense electronics suppliers must be getting a little gun-shy these days about participating in U.S. military armored combat vehicle programs.

At one time new manned combat vehicle programs were a good bet as long-term revenue streams for suppliers of vetronics and other subsystems. Today... not so much.

Since at least the mid-1980s signing on to new U.S. armored combat vehicle programs has been a crapshoot at best because of the threat these programs face of cancellation.

One of the latest victims in the funeral march of U.S. manned armored vehicles was the U.S. Army Ground Combat Vehicle (GCV), which was to be a heavyweight armored personnel carrier to replace and augment the M2A3 Bradley Fighting Vehicle. The 70-ton GCV—about the size of an M1A2 main battle tank—was cancelled last February amid concerns for the program's cost, and calls for armored fighting vehicles that weigh no more than 30 tons to suit anticipated urban warfare of the future.

The GCV program emerged from the ashes of another major armored combat vehicle program called Future Combat Systems (FCS), which ran from 2003 to 2009 and was to develop families of manned ground vehicles, utility vehicles, unmanned ground vehicles, and unmanned

aerial vehicles. All FCS vehicles were to be linked on a tactical network.

The U.S. Marine Corps has not been immune from seeing its armored vehicle programs fall by the wayside. Among the latest Marine vehicle casualties was the Expeditionary Fighting Vehicle, an armed amphibious personnel carrier. That program was cancelled in 2011 due to high costs.

Armored vehicle cancellations go back decades, to the ill-fated M247 Sergeant York Division Air Defense self-propelled anti-aircraft gun, which was cancelled in 1985 amid rising costs and reliability concerns.

Today's military armored vehicle fleet, meanwhile, is getting long in the tooth. One of the most modern systems, the Stryker family of eight-wheeled combat vehicles, has been in service since 2002—just a puppy by today's standards. The front-line M1 Abrams main battle tank is far older. This cold War-era behemoth has been in the inventory since 1980, but it has gone through several rounds of systems upgrades and technology insertion. Despite its age, the M1 Abrams remains one of the most capable main battle tanks in the world.

The Bradley Fighting Vehicle—the system that GCV was intended to replace—has been in service since 1981, although the Bradley has

undergone technology upgrades and improvements. The Army's M109 self-propelled howitzer has an even longer legacy. This 155-millimeter artillery system first was fielded in the early 1960s. Its latest iteration, the M109A6 Paladin, has been in the inventory since the late 1990s.

None of this is to suggest a lack of contracting opportunities for armored combat vehicles. Today's aging platforms still are being upgraded with modern electronics and other subsystems. Vehicle networking is a hot technology right now. Existing vehicles are not the problem, however. It's the new programs that have been so risky.

Armored vehicle designers in the Pentagon are still trying. From this bleak landscape is emerging one of the latest concepts for a brand new armored combat vehicle: the Future Fighting Vehicle (FFV). The FFV concept is emerging from the cancelled GCV, whose designers—BAE Systems Land & Armaments LP and General Dynamics Land Systems—have begun work on recycling appropriate technologies from the GCV program that might be appropriate for the FFV.

My only question is: Are there still electronics subsystem suppliers with the nerve and risk-taking chutzpah to give today's armored combat vehicle market another shot? ⬅

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Textron to start building one of first LCAC replacement vessels

BY JOHN KELLER

WASHINGTON—U.S. Navy shipbuilding experts are authorizing construction of one of the first vessels that will replace the Navy's fleet of fast air-cushioned hovercraft designed to transport Marines, soldiers, combat vehicles, and other equipment ashore during land invasions.

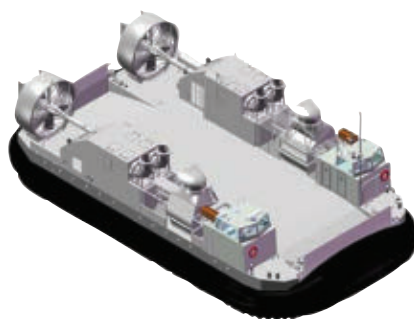
Officials of the Naval Sea Systems Command in Washington announced a \$21.9 million contract modification to the Textron Inc. Marine & Land Systems segment in New Orleans to build Landing Craft, Air Cushion (LCAC) 101 of the ship-to-shore connector (SSC) program.

The LCAC is designed to move weapons, armored combat vehicles, equipment, cargo, infantry, and other military personnel to invasion beaches from amphibious assault ships offshore.

The specialized landing craft skims across the surface of the ocean on an air cushion, and can move at speeds faster than 40 knots. The entire hull rides about four feet above the ocean's surface.

The SSC program will replace the existing fleet of 73 LCAC vessels, which are nearing the end of their 30-year service lives, Navy officials say. The SSC LCAC replacement vessels will land war-

fighters and equipment from the sea at over-the-horizon distances while operating from amphibious ships and mobile landing platforms.



The U.S. Navy is upgrading its 1970s-vintage LCAC landing craft with modern electronics and increased payload.

SSC LCAC replacement vessels will provide increased performance to handle current and future missions, as well as improvements which will increase craft availability and reduce total ownership cost, Navy officials say. The program will increase the LCAC's payload from 60 to 74 tons.

Textron Marine & Land Systems originally won a potential \$570.5 million contract (N00024-12-C-2401) in July 2012 to kick off the SSC program by designing and building SSC test and training craft.

Before the SSC program, Navy officials had been upgrading LCAC electronics and other equipment in the LCAC C4N to replace obso-

lete equipment on the LCAC, focusing on replacing the vessel's LN-66 radars with modern, high-power P-80 radar systems.

LCAC C4N focused on open-architecture systems with modern commercial off-the-shelf (COTS) equipment. LCAC C4N contractors included Aitech Defense Systems Inc. in Chatsworth, Calif., which provided single-board computers; Concurrent Technologies in Woburn, Mass., which will provide single-board computers; and Tracewell Systems in Westerville, Ohio, which provided rackmount chassis.

Last July officials of the Naval Surface Warfare Center (NSWC) in Panama City, Fla., issued a solicitation for as many as 83 6U VME32 LCAC control cards over the next five years for the LCAC system.

On the contract modification announced last month, Textron personnel will perform the work in New Orleans; Huntington Beach, Calif.; Chanhassen, Minn.; Coronado, Calif.; and Minneapolis, and should be finished by August 2017. ◀

FOR MORE INFORMATION visit **Textron Marine & Land Systems** online at www.textronsystems.com/businesses/marine-land, or **Naval Sea Systems Command** at www.navsea.navy.mil.

IN BRIEF

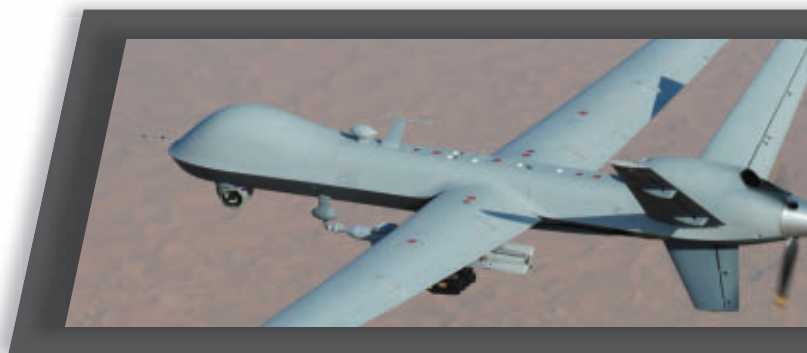
► Infineon to acquire International Rectifier to boost GaN power semiconductors

Executives of semiconductor specialist Infineon Technologies AG in Neubiberg, Germany, are boosting their company's expertise in power electronics with their announced acquisition of International Rectifier Corp. in El Segundo, Calif. Leaders of Infineon and International Rectifier announced a definitive agreement under which Infineon will acquire International Rectifier for \$3 billion cash. The acquisition brings advanced gallium nitride (GaN) on silicon power semiconductor technology to Infineon. This combination will accelerate and solidify Infineon's position in GaN discretely and GaN system solutions, officials say. The acquisition combines two power-management semiconductor companies, and will enable Infineon to complement its offerings broaden its range of products and grow its regional footprint, Infineon officials say. ◀

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Navy orders EW missile-control computers for U.S. and Australian combat aircraft

BY JOHN KELLER

PATUXENT RIVER NAS, Md.—Military avionics experts at the Raytheon Co. will provide airborne computers that link sensors aboard the U.S. Navy Boeing F/A-18E/F and EA-18G combat aircraft and the Raytheon AN/AGM-88 anti-radar missile.

Officials of the Naval Air Systems Command at Patuxent River Naval Air Station, Md., announced a \$24.6 million order to the Raytheon Missile Systems segment in Tucson, Ariz., to provide 158 command launch computers for the AN/AGM-88 high-speed anti-radiation missile (HARM). The order involves 121 command launch computers for the U.S. Navy and 37 of the computers for the government of Australia.

The Raytheon CP1001 HARM command launch computer provides the digital interface between the AN/AGM-88 HARM anti-radar weapon and the F/A-18E/F and EA-18G aircraft. The FA/18E/F Super Hornet is a carrier-based jet fighter bomber, while the EA-18G Growler is a carrier-based electronic warfare jet.

The CP1001 HARM command launch computers act as intelligent MIL-STD-1553B bus terminals; they translate protocols between the HARM computer and the MIL-STD-1553B databus, as well as provide other HARM-specific functions. The HARM command launch computer couples tightly to the FA/18E/F and EA-18G radar warning receivers and queue active threats automatically. The HARM command launch



Raytheon will build command launch computers to help equip F/A-18 combat jets with the HARM radar-hunting missile.

computer helps decide which targets to attack, transmits data to the missile, and launches the AGM-88 HARM anti-radar weapon. HARM is designed to sense and destroy enemy radar installations.

The HARM command launch computer receives target data from the missile and onboard avionics, processes the data for display to the aircrew on the appropriate display, determines target priority, and collects aircraft data for pre-launch hand-off to the AGM-88 HARM missile.

The computer determines time coincidence between the AGM-88 HARM missile and the radar warning receiver's directional data and pulse repetition intervals and formats. The computer processes identification data to identify targets and rank them in order of importance, and then displays information to the air crew. ◀

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Contractor protests could hold up Navy CANES shipboard networking program until December

BY JOHN KELLER

SAN DIEGO—An important multi-billion-dollar U.S. Navy project to upgrade the command, control, communications, computers, intelligence (C4I), and networking equipment aboard the nation's surface warship fleet is being held up for as long as three months due to contractor protests.

The protests involve contracts awarded last month worth as much as \$2.53 billion over the next eight years to manufacture equipment for the Navy Consolidated Afloat Networks and Enterprise Services (CANES) shipboard networking program.

Two companies—DRS Laurel Technologies Inc. in Johnstown, Pa., and CGI Federal Inc. in Lebanon, Va.—filed protests with the U.S. Government Accountability Office (GAO) in Washington on 2 Sept., which triggered a 100-day, stop-work order for the CANES equipment contract. The GAO is the investigative arm of Congress.

In August, officials of the Space and Naval Warfare Systems Command (SPAWAR) in San Diego, announced contracts to BAE Systems Technology Solutions & Services Inc. in Rockville, Md.; General Dynamics C4 Systems in Taunton Mass.; Global Technical Systems in Virginia Beach, Va.; Northrop Grumman Corp. in Herndon, Va.; and Serco Inc. in Reston, Va. These

five companies are to share as much as \$2.53 million to manufacture equipment for the CANES program. The Northrop Grumman Corp. Information Systems segment in San Diego is the overall CANES shipboard electronics systems architect, and will install CANES equipment aboard Navy surface warships.

DRS Laurel and CGI Federal had bid on the CANES equipment manufacturing contract but were not chosen. The project will be held up until about 11 Dec. 2014 unless DRS and CGI withdraw their protests.

"CANES represents an essential element of the Navy's modernization plan, including the enhancement of our afloat cyber security posture and increased operational effectiveness," says SPAWAR spokesman Steven A. Davis. "We are confident in the source selection process and are working diligently to minimize any schedule impacts to the fleet."

When the CANES equipment manufacturing program resumes, the program's contractors will compete for orders worth as much as \$2.53 billion.

CANES serves as the bridge to the future of Navy afloat networks, consolidating existing legacy and stand-alone networks, providing infrastructure for Tactical applications, systems, and services, Navy of-



A contractor protest could hold up the Navy's CANES shipboard networking program until December.

officials say. CANES will consolidate and modernize shipboard network systems to improve operational effectiveness and affordability across the fleet.

CANES delivers its capabilities within one system, bringing infrastructure that will enable timely and interoperable information exchange among tactical, support, and administrative users, applications, and computer systems.

Thus far, CANES has been installed on nine destroyers, and is in progress on three aircraft carriers, one amphibious assault ship, eight destroyers, one landing dock ship, and one cruiser, Navy officials say. An additional 28 installations are planned over the next two years. CANES ultimately will be deployed on 180 ships, submarines, and land sites by 2022. ◀

FOR MORE INFORMATION

visit SPAWAR online at www.spawar.navy.mil, and the GAO at www.gao.gov.



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Unmanned command and control

*Displays, graphics, and data links for
unmanned vehicle command and control*

BY Courtney E. Howard



Mission management can be performed in a highly autonomous manner via an Elbit ground control system (GCS) and ground data terminal (GDT).

Unmanned vehicles continue to grow in number and capabilities, as an ever-increasing number of organizations invest in, adopt, and employ robots for myriad civil and military applications. Unmanned vehicles are taking to the air, land, and sea to perform a wide variety of military, law-enforcement, homeland security and border patrol, and public-safety missions worldwide.

Unmanned vehicles unleashed

The robust unmanned vehicle market shows no signs of slowing. Researchers at MarketsandMarkets in Dallas

predict continued and impressive growth for years to come. "The UGV [unmanned ground vehicle] market is valued at \$1.51 billion in 2014 and is expected to reach \$8.26 billion by 2020," MarketsandMarkets analysts say. At the same time, the global unmanned underwater vehicle (UUV) market is expected to more than double over the next five years, reaching \$4.84 billion by 2019.

Air power is a central focus for militaries the world over. It is not surprising, then, that unmanned aerial vehicles (UAVs) constitute the largest portion of the unmanned vehicle market. "UAVs continue as the most dynamic growth sector of the world aerospace industry this decade," affirm industry analysts at Teal Group in Fairfax, Va. MarketsandMarkets analysts put the global UAV market at roughly \$7.1 billion today, and predict global market revenue to grow to \$8.351 billion by 2018.

Commanding characteristics

Unmanned vehicles deliver a wealth of benefits, not the least of which is keeping soldiers out of harm's way; yet, robots also raise concerns, including potential threats to privacy and public safety. Unmanned vehicle customers, therefore, have a growing list of requirements and requests—all of which aerospace and defense technology firms and engineers are working hard to address.

A central engineering focus is on the command and control (C2) system, including both the electronic hardware and safety- and mission-critical software involved in unmanned vehicle operation. Ensuring the safety, security, and reliability of unmanned C2 systems is a paramount concern—not only for unmanned vehicle customers and operators, but also the general public.

What if the link between an unmanned vehicle and ground control station (GCS) is lost or usurped?

Cost, reliability, security, range

Communications technology is an integral and critical

element of any unmanned vehicle command and control system. For today's UGV, UUV, and UAV customers, the ideal communications solution comes down to a combination and balance of four factors: cost, reliability, security, and range, explains Phil Linker, senior product line manager at FreeWave Technologies, a provider of machine-to-machine wireless networking and communications solutions in Boulder, Colo.

Customers seek communications products that are reliable; they will not fail and they can count on the link being maintained, Linker says. They also seek security, such as Federal Information Processing Standard (FIPS) 140-2, Secret and Below, or National Security Agency (NSA) Type 1

encryption capability, depending on the application. Likewise important is range; "for unmanned aircraft using terrestrial line of site, they are looking for ranges in excess of 60 miles, and in most cases 90 miles," says Aviho Hausman, senior director data links programs at Elbit Systems UAS Division in Haifa, Israel.

Customers want throughput and reduced latency; e.g., "the throughput to exchange the necessary C2 information to operate the aircraft safely and control the payload." FreeWave provides FIPS 140-2 certified radios that outfit the Insitu ScanEagle and Textron Unmanned Systems Aersonde unmanned vehicles with C2 secure links. "The solution provides a secure and reliable C2 link that

meets the throughput and latency demands as well as achieves a range of up to 90 miles," Hausman says.

Hausman predicts that militaries will continue to need and demand additional unmanned capabilities; for now, though, the industry is concentrating on the national airspace (NAS), for which someone must validate the use of these platforms.

No missing link

A multitude of organizations use unmanned vehicles to gather valuable information. Many militaries conduct various intelligence, surveillance, and reconnaissance (ISR) missions with unmanned vehicles. Data-intensive tasks drive the demand for high-quality, robust components and

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systems, including high-resolution displays, graphics cards, high-capacity data storage, software algorithms, and high-bandwidth data links.

“The air to ground data link (DL) system is a critical element of every unmanned airborne vehicle system,” Hausman says. The DL system is bi-directional, and “used to control the UAV platform and payloads (sensors) as well as to transfer UAV payload data to the ground control station (GCS) and other users.”

Hausman describes a DL system’s main capabilities as: “supporting UAV operational scenarios and flight envelopes from Take-Off and Landing (TOL) phase to the mission area; providing the proper data rates (uplink and downlink) with growth potential; supporting different types of information transfer; and the efficient utilization of the radio-frequency (RF) spectrum allocated by customers’ authorities.”

The DL system, given its important role in unmanned command and control, must be both reliable and safe, Hausman says. “A DL system that controls a UAV flying over non-segregated airspace should be secured, protected, and robust.”

Many unmanned vehicle owners and operators also require electronic counter-countermeasures (ECCM), also known as electronic protective measures (EPM). The addition of electronic warfare (EW) functionality can help to lessen or eliminate the effect of electronic countermeasures (ECM)

on sensors, radar and navigation equipment, and weaponry onboard unmanned vehicles. Similarly, customers seek DL systems capable of operating under extreme environmental and electromagnetic interference (EMI) conditions.

Unmanned vehicle customers also place a premium on DL systems that are able to coexist in the presence of other RF systems, integrate with UAV



The Boeing Forester autonomous unmanned helicopter was designed to be quiet, hover, reach high altitudes, and travel great distances. (Boeing image.)

avionics and GCS computers, and meet the size, weight, and power (SWaP) constraints common of UAVs.

Technology trade-offs

Engineers are working to deliver on a growing wish list of unmanned characteristics and capabilities. Added functionality often comes at a price, such as a reduction in performance.

“UAV DL System technical performances are driven by the operational requirements,” Hausman says. “UAV DL system definition is usually performed as part of UAV system operational requirements specification, taking into consideration the technology and integration complexity

within the UAV system (air platform and GCS).” He recommends working with the UAV system supplier to perform a trade-off analysis of the requirements from the airborne and ground DL segments.

Elbit Systems provides unmanned airframes, air vehicle payloads, ground control systems, ground support equipment, training systems, tactical data links, and networking

solutions. As a result, Hausman and his colleagues “have the proven past experience and flexibility to perform tradeoffs between the relevant subsystems’ characteristics while maintaining overall UAV system performances,” he says. “We have different UAVs with unique DL systems that enable us to tailor a cost-effective solution that meets customers’ operational requirements.”

Elbit engineers designed the company’s Tactical Video Data Link (TVDL), a compact and lightweight (less than 4 kilograms) video and data receiver/transmitter system, for attack helicopters. The system displays real-time, high-quality video imagery and data captured by UAV payloads or ground-based sensors. The system can simultaneously transmit video and data as well as deliver imagery captured by onboard payloads to tactical forces for enhanced coordination and battle management.

“The TVDL augments current systems by providing helicopter pilots video data from off-board sensors which reduce target identification times and improve precision targeting capability. The link reduces the

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The Northrop Grumman-built Triton UAS, which made an historic flight last month, employs two systems management subsystems from Curtiss-Wright Corp.'s Defense Solutions division.

helicopter's exposure to battle space threats and increases stand-off distances from those threats as critical airborne attack tactics and engagement scenarios are formulated. The TVDL also supports advance video display of forward arming and refueling points (FARPs)," officials say.

Control system upgrades

U.S. adoption of new unmanned vehicles has slowed, but investment in unmanned electronics upgrades continues at a steady pace. Officials in the U.S. Navy's Aerial Target and Decoy Systems Program Office recognized the need to update the Navy's fleet of UAVs with modern command and control systems. They found their solution at Micro Systems Inc., a subsidiary of Kratos Defense and Security Solutions' Unmanned Systems Division in Fort Walton Beach, Fla.

The Kratos Unmanned Systems Division (KUSD) provides unmanned aircraft and related avionics, electronics, command and control systems, solutions, services, and logistics. KUSD won a \$4.8 million Navy contract award to develop upgrades to unmanned aerial drone command and control electronics and related ground control stations, as well as to

provide engineering support.

Critical flight systems

An MQ-4C Triton unmanned aircraft system (UAS), built by Northrop Grumman Corp. for the U.S. Navy, made an historic, cross-country flight with the help of two systems management subsystems from Curtiss-Wright Corp.'s Defense Solutions division in Santa Clarita, Calif.

The UAS flew from Palmdale, Calif., to Patuxent River Naval Air Station, Md., where it will start the next phase of testing. Triton, the U.S. Navy's newest persistent maritime ISR system, will protect the fleet and provide the capability to detect, track, classify, and identify surface ships and submarines near coasts and in the open ocean, officials say.

Curtiss-Wright, a partner on Northrop Grumman's Triton program, provides two critical onboard subsystems: the Integrated Mission Management Computer (IMMC) that controls the aircraft's flight and the Advanced Mission Management System (AMMS) that communicates with onboard sensors and relays information to the ground station.

The Curtiss-Wright Defense Solutions rugged, conduction-cooled,

network centric flight control and management computer is designed to operate in a rugged UAV environment and provides a total flight control solution. The flexible and open architecture provides a future-proof and scalable platform to execute vehicle-tailored flight control law algorithms on Wind River VxWorks 6.x or ARINC 653 BSP, and is qualified for rugged deployed environments.

The IMMC features high-performance processing elements that execute elaborate flight control law algorithms and provide controls for redundant architecture implementation. Its integrated I/O interfaces with UAS flight-critical subsystems, including temperature and pressure sensors, engine, fuel system, altimeter, power, bay doors, air speed sensors, and ice detector. The IMMC also closes the control loop with various interfaces, such as weapons coordination, radar, communications, GPS navigation, brakes, telemetry, anti-jam module, crash recorder, and fuel management systems.

Curtiss-Wright's AMMS unit provides network-centric mission management, data collection, and data correlation and serves as a total sensor management solution for the end user. AMMS is a VPX-based system that implements internal volatile storage, a Discipline Rubidium Oscillator module, VPX-based PPC modules, and Gigabit Ethernet switches. The company develops and manufactures the IMMC and AMMS units for Northrop Grumman's Triton UAS at its facility in Santa Clarita, Calif.

Integrated air operations

U.S. Marine Corps officials selected Lockheed Martin in Bethesda, Md., to upgrade and maintain the battle

command system used to manage and monitor virtually all airborne platforms, including UAVs, fighter jets, bombers, tankers, and helicopters. Lockheed Martin won an \$18 million contract to upgrade and sustain the Marines' Virtualized Theater Battle Management Core Systems (TBMCS), which interfaces with joint services and coalition systems to enable synchronized air mission planning for the entire U.S. military.

TBMCS facilitates distributed battle management, enabling Marine Corps, Navy, Army, and Air Force personnel to help manage the air campaign. Marines use TBMCS at locations throughout the world to plan, direct, and control theater air operations, and to coordinate activities with ground and Air Force elements.

"By automating the way air power is commanded and controlled, TBMCS provides a seamless information flow that shortens decision cycles," says Rob Smith, vice president, C4ISR, Lockheed Martin Information Systems and Global Solutions.

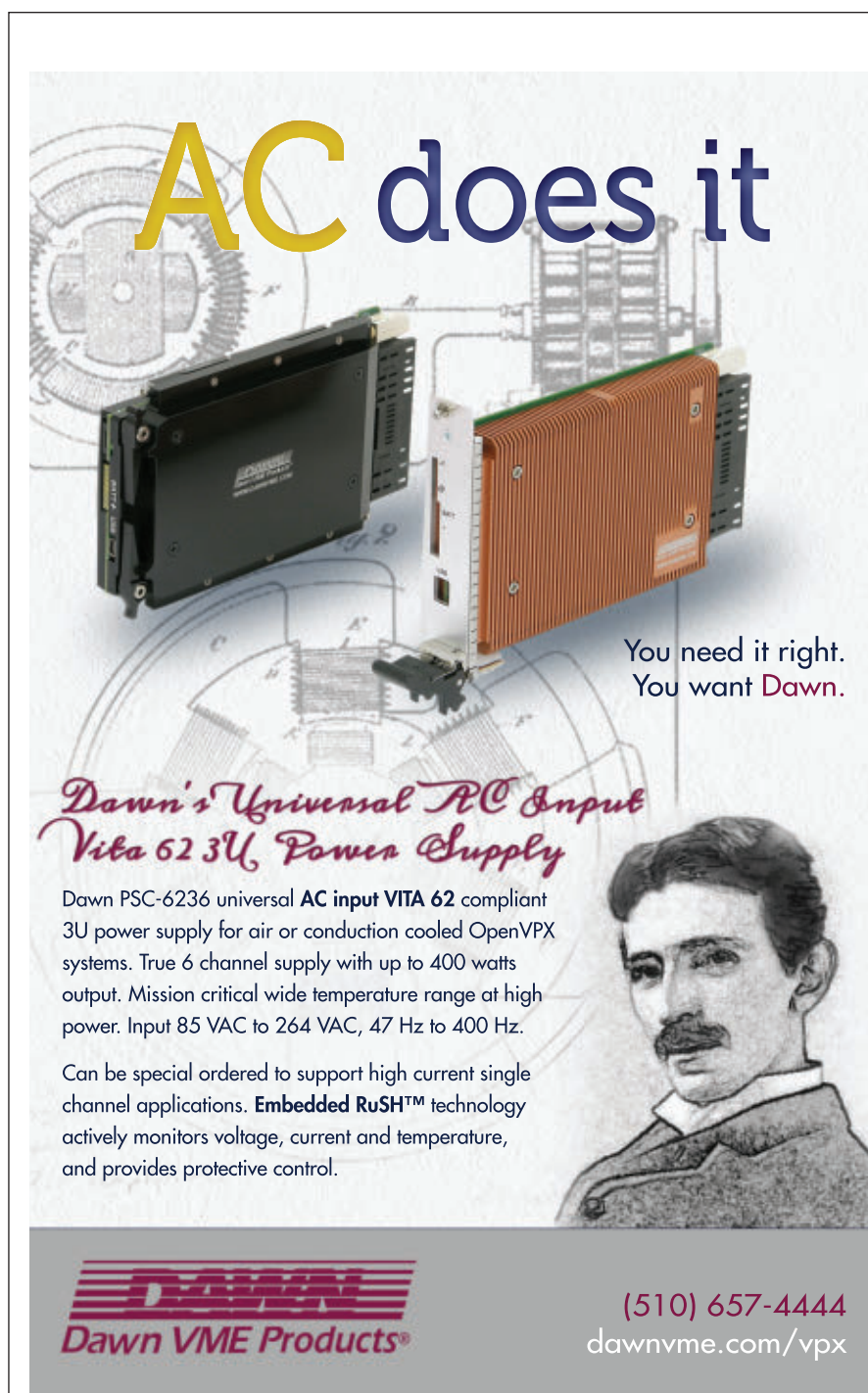
Lockheed Martin engineers are upgrading the TBMCS to provide faster access to real-time operations information; better planning and collaboration tools; and enhanced situational awareness while reducing sustainment costs. It includes updates for approximately 200 integrated software applications, from large planning tools to smaller plug-in applets that allow force status monitoring. The team also will maintain airspace deconfliction applications, which support the coordination of precision engagement fires. Lockheed Martin staff will update the automated tools that generate, disseminate, and execute air tasking and airspace control orders for the Marine Corps.

GA-ASI radar

General Atomics Aeronautical Systems Inc. (GA-ASI), a manufacturer of remotely piloted aircraft (RPA) systems, radars, and electro-optical and related mission systems solutions, demonstrated the ability of its

Lynx Multi-mode Radar to support maritime operations in a littoral environment during U.S. Navy Exercise Spearhead IIA off the coast of Key West, Fla., in June.

Lynx was integrated aboard a Predator B/MQ-9 Reaper surrogate,



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a King Air 350 aircraft, for the exercise. The King Air 350 data linked the Lynx and video data via the onboard L-3 Mini-T data link system to the Navy's Intelligence Carry-On Program (ICOP) data link system installed on the Joint High Speed

Vessel (JHSV), with the ICOP system employing the VideoScout-CM2 video exploitation and management system from L-3 Interstate Electronics Corp. in Anaheim, Calif.

L-3's VideoScout interoperable video exploitation and management

systems capture video and telemetry from various UAVs, receivers, sensors, and network feeds. VideoScout enables users to create, annotate, geo-reference, store, and share intelligent video and still imagery files with others across the battle space. It is designed to help military personnel quickly turn "vast amounts of video data into concise, easily shared video intelligence to improve mission planning, execution, and post mission analysis," officials say.

"GA-ASI's main goal in supporting this exercise was to provide the ICOP system onboard the JHSV and deliver near-real-time, all-weather, day/night Lynx radar and electro-optical/infrared [EO/IR] imagery on high-interest maritime targets," says Claudio Pereida, executive vice president, mission systems, GA-ASI. "We achieved several historical firsts, with the MQ-9 surrogate providing the ICOP system with tactical Lynx Radar maritime data, demonstrating Reaper's operational relevancy via new Lynx capabilities, and leveraging Reaper in support of the air-sea battle concept."

Lynx's synthetic aperture radar (SAR) and maritime wide-area search modes detected mine-like objects and very small vessels, including fast boats, sailboats, and fishing boats, during the exercise. GA-ASI's Claw sensor payload operated software cross-cued the Lynx imagery to the EO/IR sensor for visual target identification. The Lynx target data was used to cross-cue other platform sensors in Spearhead IIA.

The Lynx multi-mode radar, upgraded to the two-channel Lynx Block 20A and in production, is capable of high-resolution video dismount detection and a

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30-degree-per-second scan rate with algorithms optimized for detecting small vessels, including self-propelled semi-submersible vessels. GA-ASI officials plan to continue integration and test coordination efforts to enhance surface vessels and shore C2 nodes receiving and conducting data exploitation capabilities of Lynx SAR and Moving Target Indicator data further.

Autonomous-vehicle algorithm

Autonomous vehicles have the potential to revolutionize transportation, increasing efficiency and productivity. Yet, safety is a major concern and a challenge that must be overcome before fielding autonomous vehicles.

"The cost and difficulty of guaranteeing safety has prevented autonomous vehicles from being used as much as we would hope and expect," says James English, chief technology officer at Energid Technologies Corp. in Cambridge, Mass.

Energid engineers are developing a digital simulation for safety testing of autonomous military convoys. The Tank Automotive Research, Development, and Engineering Center (TARDEC) is managing the project and the Office of the Secretary of Defense is providing funding. Proving safety is hard, as rare events can trigger failures, officials say. Testing to the level required for fielding is expensive and time consuming; in fact, the cost can be so high it prevents the use of autonomous vehicles. Energid's method is to apply autonomy algorithms to simulated vehicles in a way that actively seeks out problems, combining randomized dynamic simulation with optimization for finding algorithmic failures. Finding safety problems early at reduced cost will enable

autonomous convoys to be fielded sooner rather than later.

"Energid's software will find those events that rarely happen but have serious consequences when they do," says Energid Senior Engineer Ryan Penning. "Understanding

and removing these hazards is critical. We have powerful software technologies to simulate vehicle movement and wheel-road interaction... with the goal of large-scale acceptance and use of autonomous vehicles." ←

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Electro-optical sensor payloads are giving today's armored combat vehicles, trucks, and unmanned ground vehicles (UGVs) enhanced capability to enable users to find and disarm explosives, survey rugged terrain, and uncover enemy positions from safe distances.

BY J.R. Wilson

Sensors have become the invaluable eyes and ears of warfighters in combat, ranging from space-based systems to manned aircraft, ship-board and ground-based. The latter have been the most difficult and the most immediately valuable to warfighters, who are relying on the rapid evolutions in technology to make them better meet size, weight and power (SWaP) requirements, while also significantly improving available imagery and situational awareness.

Electro-optical (E/O) sensors, at the lead of those best suited for on-the-move field applications, come in two basic forms: passive, which sense energy emitted by or reflected off a target, and active, which possess their own light source, typically used to illuminate an object or detect reflections. In both cases, E/O sensors convert light or a change in light into an electronic signal, enabling detection of flashes of light (such as a gun muzzle), interruptions caused by moving objects or

the distance, absence or presence of an object in the sensor's field of view (FOV).

By using relatively short wavelengths of infrared and visible light, active E/O systems significantly exceed the angular resolution by as much as 20,000 times) and range precision of standard radars. Another advantage over passive E/O is being able to control illumination in environments where the target may not be emitting.

"The number-one thing we're seeing is a move toward multi-band systems—two or three bands, sometimes merging that imagery rather than switching between them," says Tara Martin, business



The iRobot back-packable small unmanned ground vehicle can accommodate a variety of electro-optical sensor payloads.

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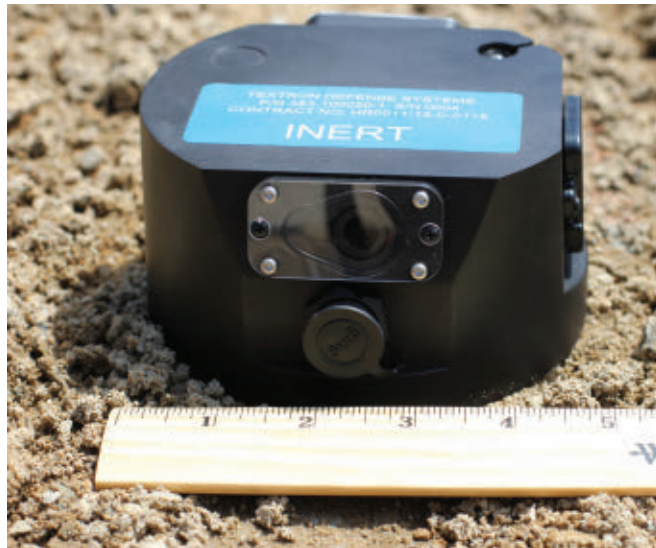


development director at UTC Aerospace Systems (nee Sensors Unlimited), in Princeton, N.J. “Another requirement we’re seeing a lot more is laser-spotting and decoding to deal with fratricide. The time to lock onto and engage the target while also reducing fratricide is big, going from just trusting a bore sight to seeing a laser designator, for example.

“One of the biggest changes [since 9/11] has been increased sensitivity for low-light imaging and the increase in dynamic range, especially in urban conditions where you might want to see into a dark shadowed area or around bright light sources,” Martin continues. “That has been one push for using SWIR [short-wave infrared], because, in addition to the immediate problem, the more NVGs are exposed to light, the more they degrade and the sooner they have to be replaced.”

Rapid advances in computing and related technologies have led to increasingly sensitive and useful E/O sensors, while the past decade-plus of land combat in Southwest Asia has generated increased demand from warfighters. Both soldiers and Marines on the ground also want systems with significant improvements in SWaP, while the Pentagon adds to that lower cost (SWaP-C).

“Millimeter wave infrared [MMWIR] coming out of some of the national labs is overwhelming. The distances and the precision of the image, even in early morning low light, has changed how we work on



DARPA's Adaptable Sensor System (ADAPT) program aims to transform how unattended sensors are developed for the military by using an original design manufacturer process similar to that of the commercial smartphone industry.

some models,” notes Michael Helfrich, founder and CEO of Blueforce Development Corp. in Salem, Mass.

“I see that for offensive and defensive applications. From a defensive perspective, it’s a great app for integrated base defense, but also for interdiction missions offensively. SWIR [shortwave infrared] is pretty good for close in and a short distance out, but nowhere near MMWIR, which is really good for mass expanses and looking out far, even in extremely low light.”

With ever-tightening budgets, the military has less money for cutting-edge research, which places a greater reliance on commercial off-the-shelf (COTS) components. But in a global market economy, COTS is not subject to U.S. trade restrictions on technology, such as ITAR (International Traffic in Arms Regulations). That makes many of the newest technologies available to potential adversaries at roughly the same time they reach U.S. military and contractor labs.

A report on “The Global Military E/O-IR Market 2014–2024” released by Strategic Defence Intelligence predicts that market to reach \$7.3 billion by the end of 2014, rising to \$10 billion by 2024.

Army and Marines

There are differences between the Army and Marine Corps as well as the U.S. Special Operations Command (SOCOM) regarding funding and fielding of cutting-edge sensor technologies. But there also can be user resistance

without proof something new also is significantly better.

“Once somebody has a capability, they never want it taken away. So if someone has an E/O long-wave sensor, they won’t allow you to take it away unless you replace it with something better—and something smaller, no more costly and with higher capability. So we are constantly being driving to make that happen, such as smartly integrating sensors without driving up SWaP while still adding capability. But in the current government budget climate, most of what you hear is cheaper,” Martin notes.

“The Marines are more willing to take a risk on new technology, while the Army is more comfortable with technologies that already have been vetted. Unfortunately, the Marines don’t have the volume or budget to do their own sensors, so they usually end up adding on to an Army buy. SOCOM is willing to take an 80 or 90 percent solution to have the latest/greatest technology out



The iRobot 510 small unmanned ground vehicle uses electro-optical sensor payloads to detect, locate, and disarm hidden improvised explosive devices (IEDs) and other threats.

their covert missions. But while they are capable of making the most use of the best technology, SOCOM doesn't have a lot of development funding—and still have bigger ideas than budgets.”

In the 1980s and 1990s, with the introduction of then-high-tech night vision goggles (NVGs), the U.S. Army and Marine Corps legitimately could claim to “own the night.” But by the turn of the century, technology proliferation meant only those with the latest technology improvements held any edge in low-light operations.

“The U.S. military has long prided itself on owning the night, but that changed as everyone got NVGs and cheap cell phones to detect illuminators. It is very important to have an asymmetrical advantage, but I think there will be a lot of sharing of the night in the future,” Martin says. “The blending of multiple image bands is the main way to achieve that goal—and doing so in smaller SWaP packages will be a big driver in systems going forward. In the next five to ten years, I would say every system will become a blended system of multiple sensors.

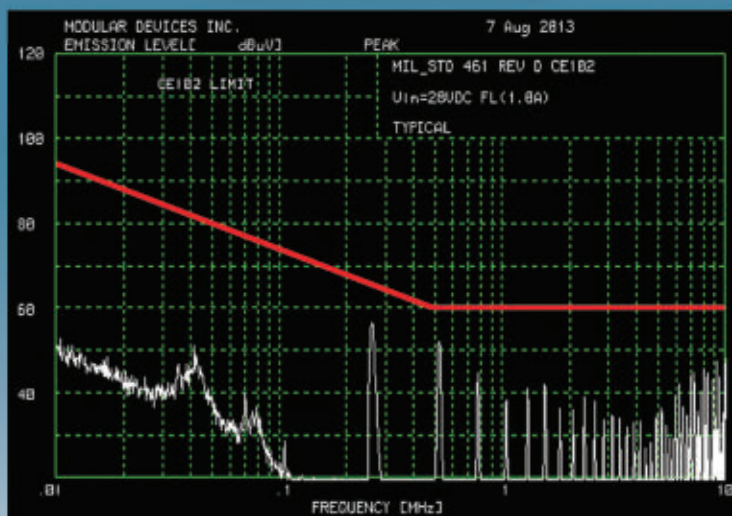
“The days of having a long-wave




or NVG, low-light level-only system will end. As soon as you turn on an NVG illuminator, you might as well be turning on a flashlight because almost everyone has the ability to see those now. So industry will be doing packages that are smaller,

lighter, cheaper than today, but also more advanced and multi-band for better recognition, ID and detection capability operating across a much wider range of lighting and environmental conditions, while also having improved SWaP.”

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Sensor fusion, in this case, applies to individual systems for manned and unmanned ground vehicles, carried by individual warfighters or in fixed systems set up across the battlespace—as well as bringing the data collected by those systems together. But that, too, is an area of great international interest, as demonstrated by the Manpack Recce System (Lightweight Surveillance Package) being developed by Thales Defense and Security Systems in Germany.

“Infantry, airborne, and special forces, as well as border guards, may still have to deploy their assets on foot over substantial distances or need to use very small vehicles (quads, snowmobiles etc.) for transport. The very same users do, however, more and more require sophisticated surveillance systems as part of their mission to enable various operations as well as protecting borders or the forces themselves,” according to Thales Group officials.

“The MRS as an integrated, modular and scalable solution where Ground Surveillance Radars [GSRs], E/O Systems, UGS and other sensors are integrated via a one-workstation control system. All sensors/components are man-pack—divided into one or two man-packs each—and self-sustaining, including positioning/alignment, power supply by batteries, and communication means.”

The Thales brochure on its MU-SEC2 control system says it can integrate 16 radars and 16 E/O sensors, with “display and superposition

The Blighter Surveillance Systems Blighter Scout with a lightweight e-scan radar and camera surveillance system designed for rapid deployment in border security hot spots and other similar security applications.

of radar, UGS, E/O and other sensor data, [with] full control of sensors” and the ability to cue cameras to those sensors. Warrior-carried MRS sensors are rated with detection ranges as much as 5 miles, light vehicle-mounted as much as 7 miles and larger vehicle-mounted as much as nearly 10 miles.

In the U.S., the Vehicle-Mounted Surveillance System from STARA Technologies Inc. in Gilbert, Ariz., offers a mast-based multi-sensor payload that can be customized to the operational and sensor needs of different users, including E/O-IR, GMTI (Ground Moving Target Indicator) radar and COP (Common Operational Picture).

“The VMSS is a multi-sensor, mast-mounted, persistent surveillance platform used to detect and identify hostile and/or foreign subjects. A flexible design allows for installation on a wide range of commercial and/or military vehicles, including pickup trucks, SUVs, tactical vehicles and more,” STARA officials say.

“[An] optional on-board operator workstation provides full system

control in the field, incorporating a moving map display and automated tools (slew to cue, alarm zones and recording/playback) to assist with the prioritization of threats in congested environments. Each VMSS can operate independently or wirelessly network with other assets to create a highly flexible mobile surveillance network.”

Meanwhile, Raytheon Vision Systems in Goleta, Calif., is working on the next generation of E/O-IR detectors with the development of advanced discriminating focal plane array (FPA) technologies in the 33-to-5-micron mid-wavelength infrared (MWIR) and the 8-to-12-micron long-wavelength infrared (LWIR) spectral regions by using a variety of semiconductor materials and FPA architectures.

“These include advanced III-V1 semiconductor strained-layer-superlattice (SLS) FPAs, II-VI2 semiconductor mercury cadmium telluride (HgCdTe) dual-band FPAs and uncooled bolometer FPAs using micro-electromechanical systems (MEMS). Each of these FPA technologies address different mission



requirements and are being developed to not only increase sensor capability and performance, but also to provide improved manufacturability and reduce costs," Raytheon officials reported in the January 2014 issue of the company's *Technology Today* magazine.

"MWIR FPAs with higher operating temperatures are advantageous for reducing the SWaP of cooled systems. For this reason, high operating temperature FPAs are being developed based on molecular beam epitaxy-grown indium arsenide/gallium antimonide (InAs/GaSb) SLS bandgap-engineered barrier device structures. The goal is to develop materials that have the producibility advantage of traditional III-V indium antimonide technology, but the operating temperature advantage of HgCdTe... Together, these factors offer the promise of improved performance, higher yield, and reduced cost for FPAs fabricated on SLS material."

U.S. military commanders and warfighters in the field, having seen the advances in E/O-IR sensors in recent years, are asking for more—much more.

"Definitely greater range, more precision at distance, low light capability and, as we develop the needed technologies, the ability to leverage non-human analytics, virtual trip wires, trigger boxes, etc.," says Blueforce's Helfrich. "Warfighters are being asked to monitor more and more ground and air machines, so automation and analytics are in high demand. So is the ability to correlate a ground hit with imagery, so you can escalate the right information."

At the Special Operations Forces Exhibition & Conference in Amman,

Jordan, on 8 May 2014, Aselsan A.S. in Ankara, Turkey, an affiliated company of the Turkish Armed Forces Foundation, announced its Middle East joint venture with the King Abdullah Design and Development Bureau (KADDB) would enable it to

strengthen its ties with the Jordanian Armed Forces. That will involve ASELSAN's border surveillance system, employing the Advanced Capability Aselsan Radar (ACAR) GSR and E/O Units (cooled thermal imagers, day TV cameras, laser rangefinder)



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as primary sensors.

"These systems are integrated with ASELISAN software, while the voice and data can be transmitted through its range of software-defined radios. Options include the integration of various other communication and sensor subsystems," the company says. "ASELISAN proposes adaptable and modular system solutions that can be tailored according to emerging threats, mission requirements and operational scenarios following a detailed analysis of the user requirements."

A 2014 report by the National Research Council Committee on Review of Advancements in Active E/O Systems to Avoid Technological Surprise Adverse to U.S. National Security—"Laser Radar: Progress and Opportunities in Active Electro-Optical Sensing"—reported one

potential use for active E/O would be creating 3D imaging for greater situational awareness for unmanned ground vehicles.

"Active E/O sensing is poised to significantly alter the balance in commercial, military and intelligence operations, as radar has done over the past seven decades. The close analogy between conventional radar and active E/O sensing can



serve as a guide to the trajectory of development for active E/O sensing," the report says. "Many of the techniques developed for radar have analogs in active E/O sensing, such as advanced waveforms and synthetic aperture imaging, and are gradually being implemented in active E/O sensing. Our knowledge of the diverse applications of radar technology has enabled a more diverse set of active E/O sensing modes in a relatively short time frame.

"The United States leads in the development of high-performance active E/O systems in the military arena. However, significant E/O technologies are now being developed globally. For example, most commercial mapping and surveying systems are produced outside the United States—and all the DARPA Grand Challenge (2004–2005) autonomous vehicles used systems manufactured by the German company SICK because of their low cost and availability. In the literature, Europe has demonstrated a strong capability in a variety of military active E/O sensors. Many foreign-based component laser and detector technologies are

more advanced than their U.S. counterparts for application in commercial and high-end active E/O sensors."

Noting recent advances in laser illuminators, sensitive broadband detectors, and rapid data processing are combining to enable active E/O

The Israeli ISR patrol vehicle, the Granit, is equipped with advanced radar, sensors and communication systems.



Aimpoint's FCS12 fire control system has been placed in active service with the Swedish Army on the 84mm CARL GUSTAV M3 multi-purpose weapon system built by Saab Dynamics.

sensing “to bring revolutionary advances in areas such as mapping, targeting, autonomous robotics, environmental monitoring, weather prediction and intelligence gathering,” the committee drew what it termed an “overarching conclusion.”

“Active electro-optical sensing is a rapidly emerging technology with many applications across intelligence, military, scientific, and commercial domains. It has the potential to alter the balance in many of these areas. Interest in developing and applying active E/O sensing has consequently risen in other nations, putting U.S. leadership at risk, to the degree that in some instances the United States no longer leads.”

Blueforce's Helfrich says he agrees, but still sees a lot of significant advances in U.S. technology making its way from the lab to the battlespace—including COTS, but used in ways few other nations can match.

“I’ve watched multiple generations in sensors and I’m seeing a greater correlation of sensors and imagery assets with different ranges. They have tightly coupled off-the-shelf capabilities in UGS—smaller form factors, smaller optics, smaller

gateways to move information, more freedom of choice in how they move data and in what format, especially standardization rather than proprietary,” he says. “So we’re seeing things being made much smaller, with more variety in how we move information and much more in-

teroperability. The early stuff was Iridium and other SATCOM, ground sensors using traditional RF spectrum, but now there is a lot more leverage of terrestrial broadband, LTE, 4G, etc. And the smaller the company building UGS, the more the use of open standards.”

As to the future: “Certainly we will have to continue to miniaturize. In unattended apps, there will have to be greater efficiencies in power consumption,” says Blueforce's Helfrich. “The encoders still aren’t giving us the compression we need without loss in image resolution.

If I can reduce the stream size but keep image quality, it will have a positive impact on communications requirements.

“There needs to be additional consideration for the breadth and types of sensors that might cause cameras to take photos or open

communications, especially signal detectors picking up devices that shouldn’t be there. So service-oriented architectures that can be integrated with E/O sensors—systems of systems.”

UTC Aerospace Systems' Martin also echoes the concerns many others have voiced about technology restrictions originally created to protect the U.S. edge now becoming the undoing of that advantage in combat.

“I think we’ll continue to see [U.S.] companies working together to come up with solutions to build these systems. We generally have a very strong industrial/technology base here, but one of the big issues may be that ITAR, rather than protecting U.S. technology, may simply encourage others to develop their own. And while that might not be

a significant investment, compared to U.S. budgets, it still would create a protected market we really can’t enter.

“We see a lot of that with SWIR, being as ‘protected’ as it is now on the munitions list, which creates quite a business challenge for commercial applications. That means

you have to rely entirely on military funding to move technology forward. So if we want technology that is better than what is available elsewhere, a lot of funding needs to be put into it to keep that from happening. And that is getting tougher these days.” ◀



DARPA is using the QinetiQ TALON IV tracked UGV to carry a variety of sensor payloads as part of the Autonomous Mine Detection System (AMDS) to detect, mark, and neutralize explosive hazards.

Military data recorders trending to solid-state drives, data security, and fast throughput

BY John Keller

Data recorders for aerospace and defense applications are becoming smaller, faster, more reliable, and higher in data storage capacity in applications ranging from simple temperature and attitude data recording to gathering and organizing extremely fast streaming data such as radar signals.

The three primary aspects of modern data recorders are the speed at which they can record data, their storage capacities, and the integrity and reliability of the data they gather, experts say.

Moreover, program managers who are specifying today's rugged data recorders for military and aerospace applications increasingly are concerned with multi-level security that can record data quickly, yet separate top-secret, secret, and sensitive-but-unclassified data.

Recording speed

One of the primary factors that separates data recorders from data-storage disks and disk arrays is its front end, which can accept data at various speeds and with various kinds of I/O. "Any data recorder is going to have at least two elements: a front end where you have inputs that are receiving data from sensors, and then the storage on the back end," explains Paul Davis, director of product management at

the Curtiss-Wright Defense Solutions Division's data solutions group in Dayton, Ohio.

The data recorder's speed can depend on the bandwidth of the input medium, such as Giga-bit Ethernet on the high end or MIL-STD-1553 on the low end. Analog-to-digital and digital-to-analog converters also play a role in specialized signals-analysis systems, and data compression can be essential in fast systems.

"Data compression can be important, but if it's on a 1553 bus

it's nothing. With streaming video, you do have to compress that data," says Doug Patterson, vice president of marketing and sales at Aitech Defense Systems Inc. in Chatsworth, Calif.

Companies like Pentek Inc. in Upper Saddle River, N.J., specialize in recording extremely fast analog information from radar, signals intelligence, and software-defined radio. These approaches not only require extremely fast recording speeds, but also extremely fast data conversion.

COMPANY INFO

Aitech Defense Systems Inc.

Chatsworth, Calif.
rugged.com

Ampex Data Systems Corp.

Redwood City, Calif.
ampex.com

AOS Technologies AG

Dättwil, Switzerland
aostechnologies.com

Astro-Med Inc.

Brossard, Quebec
astro-med.ca

Calculux Inc.

Las Cruces, N.M.
calculux.com

Cambridge Technologies

Victoria, Australia
cambridgetechnologies.com.au

Computer Aided Solutions LLC

Chesterland, Ohio
dataloggerinc.com

Curtiss-Wright Defense Solutions

Ashburn, Va.
cwcdefense.com

DEWETRON GmbH

Grambach, Austria
dewetron.com

DRS Technologies

Arlington, Va.
drs.com

Epiphan Systems Inc.

Ottawa
epiphan.com

Galleon Embedded Computing LLC

Katy, Texas
galleonembedded.com

HGL Dynamics USA

Indianapolis
hgl-dynamics.com

L3 Aviation Recorders

Sarasota, Fla.
l-3ar.com

L3 Targa Systems

Ottawa
targasystems.com

Mercury Systems

Chelmsford, Mass.
mrcy.com

Pentek Inc.

Upper Saddle River, N.J.
pentek.com

Pleora Technologies Inc.

Kanata, Ontario
pleora.com

Among today's key industry drivers is the need for increased recording capability on manned and unmanned aircraft to capture signals intelligence that can be brought back for later analysis, says Rodger Hosking, vice president of Pentek.

"That kind of signals intelligence (SIGINT) gathering in airborne applications is constantly growing importance, and needs higher-speed data recorders," Hosking says. Some of these systems must be able to record small, fast and weak signals, which requires fast and precise A/D and D/A converters.

"We can do 250 MHz with 16-bit resolution, and we expect that soon we will move that sampling rate up to 1 GHz sampling speed at 16-bit resolution," Hosking says. "The higher sampling rates give you more bandwidth, and the extra resolution provides sensitivity and dynamic range necessary to capture the weaker signals."

Curtiss-Wright has been involved in a signals-intelligence project that required 22 channels of data coming in to capture large amounts of high-speed radar data.

"We have a universal capture card that allows four different streams of serial FPDP [front-panel data port] data to be brought in, and we actually look at each of the streams," says Curtiss-Wright's Davis. The system uses a field-programmable gate array (FPGA) to bring in all four streams, time-stamp each frame of data, and move the data to storage media.

"The real trick is to capture the data at line speeds and save it so you can replay it later," Davis says. This can be more complicated than

it sounds, because today's solid-state data-storage disks cannot accept data quickly enough on their own. To keep speeds up, Curtiss-Wright designers record data streams over several solid-state disks and time-stamp the data to keep it organized for playback.

Data storage

When it comes to data storage, today's data recorders are moving to solid-state disks, experts agree. "Solid-state drives are immune to

The three primary aspects of modern data recorders are the speed at which they can record data, their storage capacities, and the integrity and reliability of the data they gather, experts say.

shock and vibration, and we have transitioned over the last year from spinning drives to solid-state drives," says Pentek's Hosking. They are rugged, getting less expensive, and are faster than spinning disks. This is a trend across the industry."

Aitech's Patterson says he agrees. "Most of the world has moved over to solid-state memory," he says. "Certainly Flash memory has a great track record."

The speed, reliability, and decreasing cost of solid-state memory are making this technology the storage medium of choice for data recorders. "The applications for rugged storage is being enabled by the reduction in cost of solid-state drives; they are becoming more and more affordable," says Curtiss-Wright's Davis.

Data integrity

As data recorder technology moves forward, systems designers increasingly demand higher levels of data integrity. Some data recorded is so rare and precious that users simply cannot afford to lose it under any circumstances.

Some applications call for data to be recorded and stored in different places on the aircraft or other platform to enhance reliability. "They want the data recorder as a separate unit in case something hap-

pens to the mission computer," says Aitech's Patterson. "There sometimes is a need for redundancy of data, and to record data in two different places."

Data encryption and multi-level security also are trends in the data recorder business. "One of the things we are seeing over the past year is an ever-increasing security push," says Curtiss-Wright's Davis. "Customers want to separate different data at different levels of security; they want to keep that data separated."

For these kinds of applications "the trend is separate storage devices," Davis says. "A lot of people worry about data bleed-over from one security level to the other, and physical separation is a practical and low-risk approach." ◀



UNMANNED vehicles

iRobot to build CBRN-detecting robots for Canadian military

Canadian military leaders needed unmanned ground vehicle (UGV) robots to alert users to the presence of chemical warfare agents, toxic industrial chemicals, volatile gases, explosives, and radiation. They found their solution at iRobot Corp. in Bedford, Mass. Officials of the Canadian Department of National Defence in Ottawa have awarded multi-year contracts to iRobot worth \$9.6 million for 20 iRobot 510 PackBot CBRN Recce UGVs with sensor suites that detect chemical, biological, radiological, and nuclear threats.

Air Force orders advanced Global Hawk UAVs

Officials of the Air Force Life Cycle Management Center's Global Hawk Program Office at Wright-Patterson Air Force Base, Ohio, have ordered three Block 30M RQ-4B Global Hawk high-altitude, long-endurance (HALE) unmanned aerial vehicles (UAVs) with Enhanced Integrated Sensor Suites and Airborne Signals Intelligence Payloads from Northrop Grumman Aerospace Systems in San Diego under a \$240.7 million contract. The Block 30 Global Hawk carries sophisticated imaging and electronic signals sensors on missions that can exceed 32 hours. ◀

Army researchers choose IMSAR to develop small radar systems for unmanned aerial vehicles

BY John Keller

NATICK, Mass.—U.S. Army researchers needed synthetic aperture radar (SAR) systems for a variety of unmanned aerial vehicle (UAV) systems. They found their solution from IMSAR LLC in Springville, Utah.

Officials of the Army Contracting Command at Natick, Mass., announced a \$99 million contract to IMSAR for research and development, rapid advancement, and integration of small-aperture radars on small unmanned aerial systems (sUAS).

IMSAR specializes in small radar systems, digital signal processing, radar, manufacturing, and inertial measurement systems. The Army Contracting Command-Natick supports the Army's Natick Soldier System Center (NSSC), which develops technologies for combat effectiveness and survivability for U.S. soldiers.

IMSAR builds the NanoSAR B and NanoSAR C small radar systems. The NanoSAR B provides high-quality radar imagery by working together with a tactical inertial navigation system and digital data link with throughput of 6.5 megabits per second.

The NanoSAR B measures 6.2 by 7.2 by 4.5 inches, weighs 3.5 pounds, and transmits 1 watt of power. On-board firmware compresses real-time SAR data and transmits it to a ground station that generates and archives the imagery.

The system operates day or

night, in rain, snow, fog, dust, or smoke.

The IMSAR NanoSAR C is designed for cost-effective detection, location, and classification of targets. The unit measures 5.5 by 3.5 by 2 inches, weighs 2.6 pounds, and transmits 1 watt of power.



IMSAR will develop small, lightweight synthetic aperture radar systems for small unmanned aircraft that are launched near the front lines.

NanoSAR C provides detailed real-time aerial radar images from a payload small and light enough to be mounted in a Tier I or II UAV. NanoSAR C is integrated with IMSAR's Lisa ground station and Viper communication link, and operates day or night, in rain, snow, fog, dust, or smoke. IMSAR officials claim the NanoSAR C is the world's smallest SAR.

Its radar, turret, antenna, and cabling total less than 86 cubic inches, and can mount in a 7-inch-diameter wing-mounted pod, or inside the aircraft fuselage.

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Carnegie Robotics to develop mine-hunting sensor payloads for ground robots

BY John Keller

PICATINNY ARSENAL, N.J.—U.S.

Army counter-mine experts are choosing Carnegie Robotics LLC in Pittsburgh to develop the unmanned ground vehicle (UGV)-mounted Autonomous Mine Detection System (AMDS) to detect, mark, and neutralize explosive hazards.

Officials of the Army Contracting Command at Picatinny Arsenal, N.J., announced a \$22.8 million contract to Carnegie Robotics to develop a prototype UGV-based, mine-detection sensor suite able to find buried anti-personnel mines.

Carnegie Robotics experts will design and build several AMDS prototype mine-detection sensor suites and mount them to a government-furnished TALON IV tracked UGV from QinetiQ North America in Reston, Va., which the Army calls the man-transportable



Carnegie Robotics will install mine-hunting sensors on a QinetiQ Talon unmanned ground vehicle as part of the Army Autonomous Mine Detection System (AMDS).

robotic system (MTRS).

The AMDS consists of a suite of three payload modules to be deployed on an MTRS unmanned vehicle. In addition to the prototypes, Carnegie Robotics eventually may be asked to build 16 AMDS systems and related maintenance as contract options.

The Army Contracting Command awarded the contract on behalf of Project Manager for Close Combat Systems (PM CCS) and the Product Manager, Counter Explosive Hazard (PdM CEH), at Picatinny Arsenal.

The three mine-detection sensors involved in the Army Carnegie Robotics AMDS project are the mine detection and marking pay-

load module; the explosive hazards detection and marking payload module; and the neutralization payload module.

The mine detection and marking payload module remotely detects and marks surface-laid and buried metallic and low-metallic antitank and antipersonnel land mines and scatterable munitions. The explosive hazards detection and marking payload module remotely detects and marks surface-laid, partially buried, and camouflaged explosive hazards. The neutralization payload module, meanwhile, remotely neutralizes surface laid, buried and camouflaged explosive hazards.

In recent years, L-3 CyTerra in Orlando, Fla., and NIITEK in Dullies, Va., have developed complementary sensor suites using ground-penetrating radar and electromagnetic induction sensors. Applied Research Associates Inc. (ARA) in Albuquerque, N.M., also has been involved in AMDS sensor development. The AMDS program also is working with industry and academia to develop automatic target recognition (ATR) algorithms.

On this contract, Carnegie Robotics will do the work in Woburn, Mass; King of Prussia, Pa.; and Pittsburgh, and should be finished by March 2018. ◀

FOR MORE INFORMATION visit Carnegie Robotics online at <http://carnegierobotics.com>, or the Army Contracting Command at Picatinny Arsenal at www.pica.army.mil.

ARMY CONTINUED FROM PAGE 28

SAR uses the relative motion between its aircraft platform and the target provide long-term coherent-signal variations that yield fine spatial resolution. SAR repeatedly illuminates target areas with radar pulses at wavelengths anywhere from a meter down to millimeters, IMSAR officials say.

The system coherently detects and stores the radar returns at the different antenna positions and post-processes them together to resolve image elements.

SAR images are useful for remote sensing and mapping the Earth's surface, and can be implemented as inverse SAR by observing a moving target over a substantial time with a stationary antenna, company officials explain.

On this contract, IMSAR will do the work in locations based on the needs of each order, and should be finished by August 2019. ◀

FOR MORE INFORMATION visit IMSAR online at www.imsar.com, or the Army Contracting Command-Natick at www3.natick.army.mil.

► Navy scraps prototype laser weapons project for sea-based helicopters

U.S. Navy laser weapons experts say they are scrapping a plan to develop a high-energy laser weapon for manned and unmanned helicopters to perform a variety of military operations at sea. Officials of the Naval Air Warfare Center Weapons Division at China Lake Naval Weapons Station in Ridgecrest, Calif., are cancelling—at least for the time being—the anticipated High Energy Fiber Laser industry competition to develop a prototype laser weapon for demonstrations aboard a Navy helicopter. Industry officials had expected a request for proposals in August, with a contract award for the program before the end of the year. The contract also was to call on the winning company to perform qualification testing, provide drawings, install the prototype system, develop test procedures, and provide system support.

► Navy chooses long-range thermal cameras from FLIR Systems

Navy surveillance experts needed high-definition, long-range infrared surveillance cameras for a variety of U.S. military ranges and similar facilities. They found their solution from FLIR Systems Inc. in Wilsonville, Ore. Officials of the Range Systems Engineering Branch of the Naval Surface Warfare Center Corona Division in Norco,

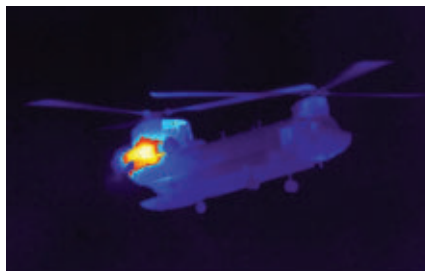
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Air Force mulls staring infrared search and track for combat aircraft

BY John Keller

WRIGHT-PATTERSON AFB, Ohio—U.S.

Air Force electro-optics researchers are reaching out to industry for ideas and enabling technologies for a next-generation infrared search-and-track (IRST) system to provide advanced passive surveillance, tracking, and target-acquisition capability for military combat aircraft.



Air Force researchers are investigating infrared search technologies to help combat aircraft find targets without radar (Army photo).

Officials of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio, have issued a sources-sought notice (RFI-RQKS-2014-0001) for the Infrared Search and Track Technologies program, which seeks to determine the feasibility of developing a next-generation airborne, long-range offensive IRST.

Air Force researchers are interested in a new kind of IRST that is a staring sensor, rather than a scanned system, based on combinations of innovative optical design, high dynamic range infrared large format focal plane array (FPA) tech-

nology, and advanced processing methods.

Infrared search and track capability is important for modern aircraft because it can detect and track enemy aircraft and missiles without giving away its presence. Active search systems like radar, for example, must emit electronic signals that tip off the enemy to its presence; it's like shining a flashlight in a darkened room.

This exploratory concept is fundamentally different from current IRST implementations that use scanned and smaller-format infrared focal plane arrays for detection and tracking of enemy aircraft and missiles, researchers explain.

An IRST with a staring rather than a scanning sensor will yield higher performance in a more compact, lighter-weight design with greater installation flexibility, Air Force researchers say.

Advancements in large-format, two-dimensional infrared focal plane arrays offer potential advantages in clutter rejection, more frequent updates, longer integration times, and multi-frame detection techniques.

These advantages could yield an advanced IRST for military combat aircraft that supports long-range detection and tracking of targets in cluttered environments with a

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Raytheon to upgrade TV-guided Maverick air-to-ground missiles with laser guidance

BY John Keller

PATUXENT RIVER NAS, Md.—Missile designers at the Raytheon Co. are upgrading versions of the AGM-65 Maverick air-to-ground missile by replacing relatively old optical TV-guided seekers with late-model precision-guided laser sensors.



Raytheon is upgrading the Navy's venerable Maverick air-to-ground missile with advanced laser guidance.

Officials of the U.S. Naval Air Systems Command at Patuxent River Naval Air Station, Md., announced a \$49.5 million contract to the Raytheon Missile Systems segment in Tucson, Ariz., to convert 500 GM-65A/B guidance control sections to an AGM-65E2 configuration.

The Maverick air-to-surface missile is one of the most widely produced precision munitions in the world, and has been in use as far back as the Vietnam War in the 1970s. The aircraft-launched missile is designed for use against armored vehicles, air defenses, surface ships, ground transportation, fuel storage facilities, and similar targets.

The early model AGM-65A/B use electro-optical television guidance systems. The AGM-65E2 version uses precision laser guidance for use against targets in cities and other densely populated areas with the potential for collateral damage. This version also is designed

for use against rapidly moving targets in urban environments.

Raytheon personnel completed testing of the latest laser-guided version of the Maverick missile in early 2012.


The missile can be fired from Navy and Marine Corps F/A-18C/D Hornet strike fighters, F/A-18E/F Super Hornet

fighter-bombers, AV-8B Harrier jump jets, and other tactical aircraft.

AGM-65E2 is the U.S. Navy and Marine Corps designation for the laser-guided Maverick, while the Air Force designates laser-guided Maverick missiles as the AGM-65L.

Raytheon will do the work on the contract in Tucson, Ariz.; Williamsport, Pa.; Orlando, Fla.; Ontario, Canada; Joplin, Mo.; and Grass Valley, Calif., and should be finished by January 2017. ◀

FOR MORE INFORMATION visit Raytheon Missile Systems online at www.raytheon.com, and Naval Air Systems Command at www.navair.navy.mil.



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low false alarm rate over a large field-of-view (FOV), researchers say.

U.S. aircraft have had infrared search and track systems since the now-retired Navy F-14 Tomcat carrier-based jet fighters of the 1970s. Today, the Lockheed Martin Corp. Missiles and Fire Control segment in Orlando, Fla., builds the IRST21 Sensor System, an IRST that can be installed on the F-16 fighter, F/A-18E/F fighter-bomber, and F-15C jet fighter.

The Lockheed Martin F-35 Joint Strike Fighter has the Northrop Grumman AN/AAQ-37 Distributed Aperture System (DAS), which provides the aircraft with 360-degree IRST capability, missile detection and tracking, launch point detection, weapons support, and navigation in daylight and at night.

The Air Force would like to hear from companies that could provide advanced IRST enabling technologies as part of assessment of industry's ability to provide component and system-level technologies for a next-generation airborne IRST.

Key considerations include wave-band selection; single-band longwave vs. medium-wave infrared sensors; dual-band longwave and medium-wave infrared sensors; sensitivity; dynamic range; frame rate; integration time; resolution; operability; readout design trades; wide-field optical design for large format arrays; opto-mechanical design; stabilization; real-time algorithms and processing; processing techniques; clutter rejection methods; target detection and track algorithms; clear sky; sky clutter; and look down into heavy clutter.

From industry, Air Force researchers would like information about component technical maturity and availability, as well as system implementation considerations. This RFI is for planning purposes only.

Companies interested should email white papers to the Air Force's Robert Feldmann at Robert.Feldmann.2@us.af.mil and Jo Ann Sillaman at jo.sillaman@us.af.mil. E-mail technical questions to Robert Feldmann at Robert.Feldmann.2@us.af.mil, and e-mail contracting questions to Jo Ann Sillaman at jo.sillaman@us.af.mil. ◀

MORE INFORMATION IS online at <https://www.fbo.gov/spg/USAF/AFMC/AFRLWRS/RFI-RQKS-2014-0001/listing.html>.

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Calif., have announced their intention to negotiate a sole-source contract with FLIR Systems for several of the company's Ranger HRC cameras for air-to-ground training ranges and similar sensitive facilities. The FLIR Ranger HRC electro-optical camera is a portable, long-range thermal-imaging surveillance system with multi-sensor options. The camera has a cooled, ruggedized, large-format 640-by-480-pixel indium antimonide infrared detector, autofocus, and 12.5X continuous zoom capability.

▶ **Army considers advanced visible/near infrared focal plane arrays**

U.S. Army researchers are looking for companies able to develop advanced visible-light and near-infrared focal plane array sensors for applications such as electro-optical payloads, weapon sights, night vision, and sensors for unmanned vehicles. Officials of the Army Contracting Command at the Aberdeen Proving Ground Belvoir Division at Fort Belvoir, Va., issued a sources-sought notice for the Advanced Visible/Near Infrared TDI Focal Plane program. Researchers are interested in developing advanced visible/near infrared time-domain integration (TDI) focal plane technology for production in a limited number that push the state of the art of this technology.

▶ **Hyperspectral VNIR sensor for hand-launched UAVs offered by Headwall**

Headwall Photonics Inc. in Fitchburg, Mass., is introducing the Nano-Hyperspec sensor to provide small, hand-launched, commercial unmanned aerial vehicles (UAVs) with hyperspectral imaging capability. The low-cost, electro-optical sensor operates in the visible and near-infrared (VNIR) portion of the electromagnetic spectrum (400 to 1000 nanometers) and includes on-board data processing and storage to minimize size, weight, and power constraints inherent with small UAVs. The Nano-Hyperspec sensor can work together with optional Global Positioning System (GPS) and inertial measurement unit (IMU) navigation technologies. The total sensor package with data processor and storage weighs about 1.5 pounds and measures 3 by 3 by 4.7 inches. ◀

PRODUCT applications

BATTERIES

Navy chooses batteries from K2 Energy for electromagnetic railgun

U.S. Navy hypervelocity weapons experts needed powerful and reliable batteries to power a large modular capacitor bank for the electromagnetic railgun. They found their solution from K2 Energy Solutions Inc. in Henderson, Nev.



Officials of the Naval Sea Systems Command in Washington announced a potential \$81.4 million contract to K2 Energy for the fully self-contained battery intermediate energy store system to power capacitor banks for the Navy's future electromagnetic railgun.

K2 Energy specializes in lithium iron phosphate battery technology—a special kind of lithium battery that addresses the four major issues with current lithium technologies: safety, life, power, and environmental friendliness.

Navy leaders plan to use electromagnetic railguns aboard future surface warships to shoot non-explosive shells at a speed of Mach 8—eight times the speed of sound, or roughly 6,000 miles per hour. At that speed the weapon does not require explosives; the kinetic energy alone is enough to vaporize vehicle-size objects.

FOR MORE INFORMATION visit **K2 Energy** online at www.k2battery.com, and **Naval Sea Systems Command** at www.navsea.navy.mil.

TEST AND MEASUREMENT

Navy chooses Textron to provide IED jammer test equipment

U.S. Navy bomb-disposal experts needed test and measurement gear to validate the performance of equipment designed to jam RF and microwave signals intended to detonate improvised explosive devices (IEDs). They found their solution

from the Textron Systems Corp. Electronic Systems segment in Hunt Valley, Md.

Naval Explosive Ordnance Disposal Technology Division officials in Indian Head, Md., announced a \$27.3 million contract to Textron Electronic Systems to produce versions 1 and 2 of the AN/GLM-11 universal test set for IED jamming systems.



The contract also calls for Textron to provide AN/GLM-11 engineering services and program and configuration management. Textron Electronic Systems formerly was known as AAI Corp., a company Textron acquired in 2007.

The AN/GLM-11 universal test set is a portable, battery-powered, programmable, ruggedized RF test system designed to validate IED jamming equipment. The unit provides in-field testing for warfighters employing IED jammers prior to departure, Textron officials say. The AN/GLM-11 system executes preprogrammed test sequences that replicate threats and measures expected jammer responses. These measurements use the build emitter, build measurement, and build sequence applications of the AN/GLM-11.

FOR MORE INFORMATION visit **Textron Electronic Systems** online at www.textronssystem.com/businesses/electronic-systems.

RADIO COMMUNICATIONS

Air Force orders Harris software-defined radios for special ops

U.S. Air Force Special Forces needed handheld radios to conduct combat

control, pararescue, tactical air control, and other sensitive operations. They found their solution from the Harris Corp. RF Communications segment in Rochester, N.Y.

Officials of the Battlefield Airmen branch of the Air Force Life Cycle Management Center at Wright-Patterson Air Force Base, Ohio, announced a \$19.5 million contract to Harris RF last week for 1,500 AN/PRC-152A radios and accessories.

The Harris FALCON III AN/PRC-152A wideband networking handheld radio provides simultaneous voice and high-speed networked data using the Harris Adaptive Networking Wideband Waveform and the Soldier Radio Waveform, part of the Joint Tactical Radio System (JTRS).

The PRC-152A Type-1 certified handheld radio that handles



high-bandwidth data services and narrowband legacy waveform support. The radio provides simultaneous voice and high-speed data services on the move, and works together with traditional narrowband line-of-sight and satellite communications waveforms such as SINCGARS, Havequick II, and VHF/UHF AM and FM in the 30-512 MHz range.

The Air Force's Battlefield Airmen are the service's special operations force, and include combat controllers, pararescumen, tactical air control party members, and special operations weather technicians. In addition to traditional radio waveforms, the Harris PRC-152A can handle wideband voice and data communications in the 1.2 MHz bandwidth, and Internet Protocol-based networking waveforms from 225 to 450 MHz.

FOR MORE INFORMATION visit **Harris**

RF Communications online at <http://rf.harris.com>.

POWER ELECTRONICS

Air Force orders ground power units from Essex Electro Engineers

U.S. Air Force maintenance experts needed ground-based electrical generators to supply a variety of different power voltages for military aircraft. They found their solution from Essex Electro Engineers Inc. in Schaumburg, Ill.

Officials of the Air Force Life Cycle Management Center at Robins Air Force Base, Ga., announced a \$6.7 million order to Essex Electro Engineers for 72-kilowatt generators to provide 400 Hz, 28- and 270-volt DC power for various aircraft maintenance tasks on Air Force aircraft.

The power electronics order announced this week is part of an estimated \$72.1 million Air Force contract that Essex Electro Engineers won in 2011 for 72-kilowatt ground power units. These stand-alone, trailer-mounted, self-contained ground power units are for providing external ground power during maintenance for Air Force C-130 utility turboprop aircraft, C-17 transport jets, C-5 heavy-lift transports, B-1B jet bombers, B-2 stealth bombers, F-22 advanced tactical jet fighters, F-35 joint strike fighters, A-10 ground-support jets, KC-135 mid-air refuelers, and B-52 bombers. The



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Essex Electro Engineers ground power units also can provide secondary power during ground maintenance for the F-15 and F-16 jet fighters.

Essex Electro Engineers provides several 72-kilowatt ground power units. One example is the B809D-1, which is designed to supply 90-kilovolt-ampere, 0.8 power factor, 115- and 200-volt, three-phase, 400 Hz, 28.5- and 270-volt DC electrical power for starting and servicing aircraft.

FOR MORE INFORMATION visit **Essex Electro Engineers** at www.essexelectro.com.

EMBEDDED COMPUTING

Navy orders PMC daughter cards from GE for shipboard landing system
U.S. Navy air traffic control experts needed data-transfer embedded

computing cards for the Joint Precision Approach and Landing System (JPALS). They found their solution from GE Intelligent Platforms in Huntsville, Ala.

Officials of the Naval Air Systems Command at Patuxent River Naval Air Station, Md., intend to negotiate a sole-source purchase for the GE PMCD3 PCI Mezzanine Card (PMC) for the JPALS system. The PMCD3 is a multifunction PMC with Gigabit Ethernet, serial, and Firewire (IEEE 1394) interfaces that supports three copper 10/100/1000BaseT ports and two fiber optional optic 1000BaseLX or 1000BaseSX Ethernet ports. GE discontinued the PMCD3 in 2011.

JPALS is a differential GPS that



will provide an adverse weather precision approach and landing capability. It works with

the GPS satellite navigation system to provide guidance for fixed-wing aircraft and helicopters with anti-jam protection for use in hostile environments.

The GE PMCD3 daughter card can enable three its ports can be active at any one time, company officials say. Two of the copper ports are routed to rear I/O, the third can be routed to either the front or rear. The two optional fiber-optic ports are routed through the front panel via fully rugged, low-profile optical receivers. ◀

FOR MORE INFORMATION visit **GE-IP** online at <http://defense.ge-ip.com>.

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RUGGED COMPUTERS

GMS introduces rugged server for information sharing among computers

General Micro Systems (GMS) in Rancho Cucamonga, Calif., is introducing the Tarantula (SO302 4-in-1) conduction-cooled, ruggedized, secure virtual machine (SVM) server for applications requiring ultra-efficient information sharing between several computers. The Tarantula rugged computer has six hard-



ware-independent I/O modules and is designed to replace several workstations using virtual machine technology. It has an enterprise-level Layer 2 or Layer 3 intelligent switch for high-speed connectivity. The rugged embedded computer consists of a host CPU module and 18-port intelligent Gigabit Ethernet switch module housed in one low-profile, lightweight package that is smaller than a shoe box, GMS officials say.

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

EMBEDDED COMPUTING

GE offers rugged 6U VPX single board computer for unmanned vehicles, radar, and sonar

GE Intelligent Platforms in



Huntsville, Ala., is introducing the SBC626 rugged 6U VPX single board computer for constrained environments, such as manned- and unmanned vehicles. The computer board is based on the quad-core 4th generation Intel Core i7 processor. The SBC626 embedded computing board delivers enhanced processor performance, improved graphics performance, connectivity, and upgraded security within the same power envelope as previous generations of GE's single-board computer family for signal processing applications in command and control, intelligence, surveillance, and reconnaissance (ISR), sonar, radar, and demanding industrial and commercial applications. The SBC626 includes an optional Security Hub field-programmable gate array (FPGA) that combines passive and active features to develop an on-board anti-tamper capability.

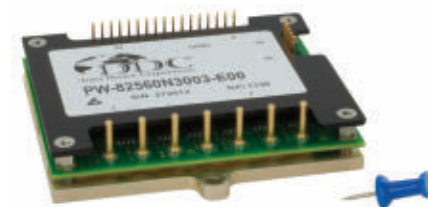
FOR MORE INFORMATION visit **GE Intelligent Platforms** online at <http://defense.ge-ip.com>.

MOTOR CONTROL

DDC introduces speed and torque brushless DC electric motor controller

Data Device Corp. (DDC) in Bohemia, N.Y., is introducing the PW-82560N0 speed and torque brushless DC electric motor controller for military applications such as gun turrets,

pumps, fans, compressors, missile fin control, and rotating antennas. The power electronics device has advanced programmability to provide a turnkey solution that can be tuned for use with a brushless DC motors and loads using either Hall sensor or sensorless feedback. Users can program



the brushless DC motor via an graphical user interface (GUI) to reduce time-to-market costs and in-house development efforts by enabling system parameters to be tuned during system development, and then reprogrammed for several or evolving applications, DDC officials say.

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

CONNECTORS

LEMO offers rugged connectors for COTS military and aerospace applications

LEMO USA Inc. in Rohnert Park, Calif., is introducing the MM compact connectors for COTS military, security, and aerospace, as well as other harsh-environment applications. The MM connectors are the most compact in the lightweight M



series product line. MM Plugs and cable mount sockets come with LEMO's ratchet-coupling shells and offer weight and space savings with environmental protection. Major trends in connector development over the last few years are miniaturization and increased contact density. Design engineers are looking to increase the number of connections in a reduced compact space, company officials say. The MM connectors are suitable for cable diameters 2 to 27 millimeters and contact configurations from 2 to 114 contacts.

FOR MORE INFORMATION visit **LEMO** online at www.lemo.com.

TACTICAL NETWORKING

Curtiss-Wright offers rugged mobile IP router for ground vehicles

The Curtiss-Wright Corp. Defense Solutions division in Ashburn, Va., is introducing an enhanced Parvus DuraMAR 5915 rugged mobile IP router subsystem for network switching in deployed military and commercial aerospace embedded computing applications such as tactical ground vehicles, helicopters, and fixed-wing aircraft. The new version of the commercial off-the-shelf (COTS) SWaP-C optimized DuraMAR 5915 has an integrated Cisco ESS 2020 Gigabit Ethernet switch. The 23-port (2x Routed, 21x

Switched) Parvus DuraMAR 5915 (2X series) reduces power consumption while delivering expanded port count by combining a Cisco 5915 embedded services router and a Cisco ESS 2020 Ethernet switch in one line replaceable unit (LRU). The DuraMAR 5915 also can reduce user training requirements. Designed for use in harsh conditions, the rugged, compact unit is designed to meet MIL-STD-810G, MIL-STD-461F, MIL-STD-1275, MIL-STD-704F, and RTCA/DO-160G standards.

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

CHASSIS AND ENCLOSURES

ADL introduces rugged enclosures for military and aerospace applications

ADL Embedded Solutions in San Diego is introducing the ADLMES-8200 family of high IP modular enclosures for military, aerospace, and other embedded computing applications that must operate in rugged conditions. The ADLMES-8200 is a config-



urable, modular enclosure system aimed at quick-turn delivery of rugged or extended-temperature enclosures for a variety of applications. The modular sidewall design supports variable PC/104 stack heights, the ADL Embedded Solutions 3.5-inch single-board computers and other single-board computer intelligent systems. The ADLMES-8200 is available in 3 different variations: the ADLMES-8200-LP low-profile

2-card chassis, which measures 3.2 by 7 by 6.6 inches; the ADLMES-8200-P1 4-card chassis that measures 4.6 by 7 by 6.6 inches; and the ADLMES-8200-P2 6-card chassis that measures 5.9 by 7 by 6.6 inches.

FOR MORE INFORMATION visit **ADL Embedded Solutions** online at <http://adl-usa.com>.

TEST AND MEASUREMENT

Agilent offers multi-channel PXI-based test solution

Agilent Technologies Inc. in Santa Clara, Calif., is introducing the LTE/LTE-Advanced multi-channel PXI-



based test solution to accelerate the setup of multi-channel test system configurations and enable engineers to gain deeper insight into complex carrier aggregation and spatial multiplexing MIMO designs. Designing and characterizing components and RF subsystems for base stations, microcells, picocells, repeaters and mobile devices is becoming more complex as multi-antenna designs require increasingly complex multi-channel test configurations. Agilent's test solution provides tools to generate complex LTE/LTE-A multi-channel/MIMO waveforms and analyze several channels in the frequency and modulation domains simultaneously. ←

FOR MORE INFORMATION visit **Agilent** online at www.agilent.com.





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Carrie Zethmayr

Aerospace community becomes an epicenter of aerospace activity, and competes for business on a global scale.

Why is Rockford making headlines?

AAR—the largest nationwide and third-largest global maintenance, repair, and overhaul (MRO) provider—is building a new hangar facility on Chicago Rockford International Airport (RFD) grounds. The facility is expected to employ at least 500 people and expands RFD's service offerings and infrastructure. The 200,000 square-foot MRO facility is expected to operate 24 hours a day and service military and commercial aircraft.

What is interesting about the Rockford aerospace cluster?

More than 250 aerospace and aviation companies, including 90 in the Rockford metro area, make up the cluster, which is mostly centered on Tier I suppliers, such as UTC Aerospace, GE Aviation, B/E Aerospace, Woodward, Esterline, and AAR.

The entire brain of the aircraft is designed here; a lot of the focus is electric system development, power management, and actuation systems. So much of the aerospace activity in Rockford has to do with the research and development (R&D) of electric systems of the aircraft.

Northern Illinois has a strong focus on innovation within the aerospace network, and it is an important part of the Rockford area. It is an aligned strategy within the cluster, but companies also do quite a bit independently. For example, UTC Aerospace has within its lab a recreation of the entire Boeing 787 electrical system—the only one in the world.

Are area aerospace firms involved with defense organizations?

A large number of companies work with military aircraft and apply for U.S. Department of Defense contracts and Small Business Innovation Research (SBIR) grants. We also invite prime contractors to speak to and

participate in the business-to-business (B2B) supply chain.

Congressman Adam Kinzinger brought Lockheed Martin to Rockford recently to participate in one-on-one meetings with aerospace companies that might become part of its supply chain. We have hosted similar events with Boeing, GE Aviation, Woodward, Navistar, and others.

How is Rockford, Ill., unique?

One area is logistics! Rockford Airport (RFD) is the 25th largest air cargo airport in the U.S. and the second largest UPS air cargo hub. It provides easy access to I-90 and I-39, the only north/south interstate in the Chicago market which bypasses congestion in Chicago. In fact, a cargo plane that lands at RFD can have its cargo in a Chicago-O'Hare (ORD) airport-based distribution facility faster than if it had landed at ORD because of a lack of congestion at RFD airport and the interstate highways.

Rockford area aerospace companies work in the commercial aerospace sector. Area businesses, including Ingenium Aerospace, performed some engineering work and contributed to the Virgin Galactic spacecraft, and Forest City Gear manufactured gears for NASA's Mars rover. ◀



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