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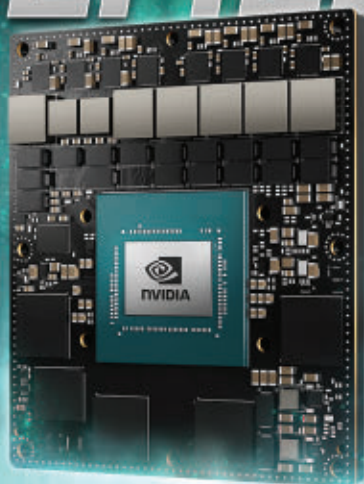
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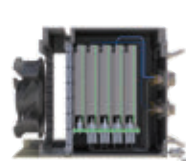


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Military takes on question of when AI is the right thing to do



BY **John Keller**
EDITOR IN CHIEF

We hear a lot of discussion about what capabilities artificial intelligence (AI) and machine learning can offer to the military. It's less common to talk about when or why AI might be the right thing to do. That's a much deeper, complex, and philosophical issue.

At its core, the military's AI dilemma boils down to this: where in the military's chain of command does human reasoning and decision-making end, and where do computers take over? That's an extremely touchy subject, and encompasses the question of can we trust computers to make life-or-death decisions — ranging from strategic deployments of military forces, to whether or not to pull the trigger on a suspected terrorist. This also involves deep consideration of who's really in charge of crucial military decisions — people or machines?

What's making a lot of people nervous is the increasing use of military AI, and how far can we go before dancing too close to that line.

Science fiction aside, AI and machine learning are proving to be valuable assistants to human decision makers. Machines process data much more quickly than human brains do, and can lay out a range of suggestions on which way to turn in difficult situations. The longer the military integrates AI into its reconnaissance and combat systems, the more commanders become comfortable with it, and the more difficult it becomes to draw a clear line of where the use of AI ends, and when humans have to take over.

Answering these questions is not an enviable task, but the military, nevertheless, is starting to confront the issue. In October U.S. military researchers announced an \$8 million contract to COVAR LLC in McLean Va., for the Autonomy Standards and Ideals with Military Operational Values (ASIMOV) project.

ASIMOV seeks to find ways to measure ethical use of military machine autonomy, and the

readiness of autonomous systems to perform in military operations. The project aims to develop benchmarks to measure the ethical use of future military machine autonomy, and the readiness of autonomous systems to perform in military operations.

The ASIMOV program intends to create an ethical autonomy language to enable the test community to evaluate the ethical difficulty of specific military scenarios and the ability of autonomous systems to perform ethically within those scenarios.

COVAR will develop prototype modeling environments to explore military scenarios for machine automation and its ethical difficulties. If successful, ASIMOV will build some of the standards against which future autonomous systems may be judged.

COVAR will develop autonomy benchmarks — not autonomous systems or algorithms for autonomous systems — to include an ethical, legal, and societal implications group to advise and provide guidance throughout the program.

ASIMOV will use the Responsible AI (RAI) Strategy and Implementation (S&I) Pathway published in June 2022 as a guideline for developing benchmarks for responsible military AI technology. This document lays out the five U.S. military responsible AI ethical principles: responsible, equitable, traceable, reliable, and governable.

A measurement and benchmarking framework of military machine autonomy will help inform military leaders as they develop and scale autonomous systems — much like Technology Readiness Levels (TRLs) developed in the 1970s that today are used widely.

The ASIMOV project will not settle all questions related to the military's use of AI and machine learning — far from it — but it's a start. Not only will the project start discussions, and find real ways of measuring the ethics of AI in life-critical decisions, but it also is a step toward taking the science fiction out of the equation. ←

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2024 Military & Aerospace Technology Innovators Awards announced for aerospace and defense achievement

NASHUA, N.H. – Military & Aerospace Electronics has announced the 2024 Technology Innovators Awards to recognize companies offering substantial military, aerospace, and avionics design solutions.

Awards are in three tiers — ranging from platinum, the highest, to the gold awards, and finally to the silver awards — and are based on the recommendations of an independent panel of industry judges.

Platinum honorees

The Power Blade from AirBorn Inc. in Georgetown, Texas, is a 6U DC-DC module that offers 2000 Watts of power output — nearly double compared to other 6U VPX power supplies. It is a SOSA-aligned, rugged, reliable, conduction cooled, switch mode unit built for high-end defense and space applications. The Power Blade has no minimum load requirement and has short circuit protection as well as over current and thermal protection. The Power Blade module is designed to support the rigors of mission critical airborne, shipboard, vehicle, mobile and space applications.

The SInergy from AirBorn Inc. is a high-speed, high-density modular hybrid interconnect that makes the most of board space by using one interconnect for several signal types. SInergy offers a mini-modular hybrid solution in 1 to 5 configurable bays; a 1 or 2 bay SInergy connector is roughly the size of a U.S. 25-cent coin. With speeds to 25 gigabits per second per lane or 75 gigabits per second aggregate bidi bandwidth per module, SInergy meets and exceeds popular protocols, and is tested and qualified to MIL-DTL-83513 performance requirements.

The Getac X600 rugged mobile workstation from Getac in Baoshan, Taiwan, provides cutting-edge computing in mission-critical environments. The X600 is tailor-made for

expandability and can configure to suit many scenarios. It is designed to be mobile, thanks to a lightweight, yet rugged composition and batteries that can be hot-swapped in the field. The X600 brings Intel 11th gen vs 7th gen processor and related technology, 50 percent more battery capacity, increased ruggedness, capacitive instead of resistive touch, and PCI Express NVMe instead of slower SATA primary and optional storage.

The Cable Fault Locator for Manufacturing, Installing, and Troubleshooting Wiring Harnesses from Psiber Data Systems Inc. in San Diego provide the physical layer connectivity. Testing a harness from one harness end is a huge improvement over continuity testers (Digital Multimeter). A DMM requires both ends of a harness to be isolated and a test lead attached to both ends. Psiber has developed multi-channel CFLs that test harnesses using only one end. This is especially important when one end has limited accessibility and requires extensive effort to isolate. CFLs identifies faults and gives the location which provides essential information to make a repair.

The X9 Server from General Micro Systems Inc. in Rancho Cucamonga, Calif., offers mechanical, interconnect and thermal innovations. With more than 26 patents pending, this rugged small form factor (SFF) rackmount computer in a compact, portable chassis has add-in I/O and solid-state drive storage. Based on Intel's Xeon D Ice Lake, the microserver CPU has 20 cores operating at 3.1 GHz in Turbo mode with 30 megabytes of Smart Cache and as much as 128 gigabytes of DDR4 ECC DRAM. There are dual 100 Gigabit Ethernet fiber optic ports. Dual Thunderbolt 4 ports connect to other X9 modules over copper or fiber with 100 Watts of Power Delivery.

The Counter-Drone Immediate Response Kit (IRK) from DroneShield LLC in Warrenton, Va., consists of the RfPatrol Mk2, a portable detection device, and a DroneGun Mk4, a

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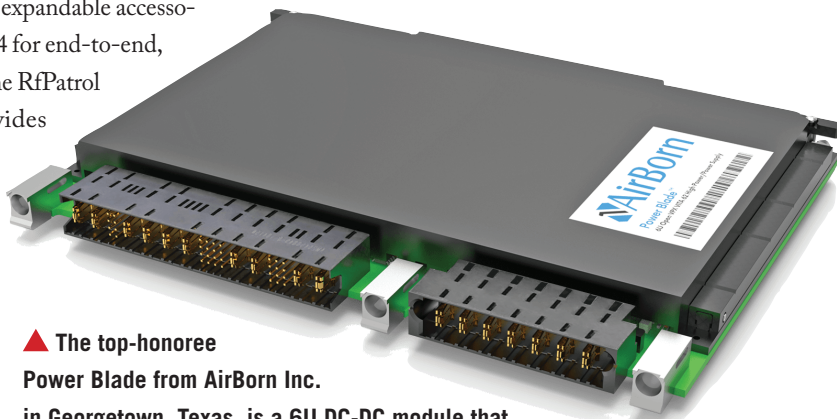
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handheld defeat device, in one rugged case that offers situational awareness through the RfPatrol and expandable accessories and response, with the DroneGun Mk4 for end-to-end, on-ground, portable C-UAS. Detection The RfPatrol Mk2 is a wearable detector that provides real-time situational awareness without complex operation. The RfPatrol Mk2 integrates software-defined radio and uses AI for detection and classification. DroneGun Mk4 is a rugged, handheld cUAS effector provides countermeasure capability.

The RF+ System-in-Package from Spectrum Control in Fairview, Pa., is an RF+ system-in-package that delivers wideband RF front end in a 30-square-millimeter BGA package. It delivers an integrated microwave assembly in a surface-mount package, and functions as a co-processor to Direct RF FPGAs and mixed signal control processors. This can be applied to any RF subsystem where size, weight, power consumption, and cost (SWaP-C) are a factor. The first product in the series is an RF front end with a range of 6-18 GHz and



▲ The top-honoree Power Blade from AirBorn Inc. in Georgetown, Texas, is a 6U DC-DC module that offers 2000 Watts of power output — nearly double compared to other 6U VPX Power Supplies.

unfiltered range of 2-20 GHz with 2 GHz instantaneous bandwidth.

The Enclosure Protector from Inventive Resources Inc. in Salida, Calif., protects enclosures from contamination brought by moisture and oxygen. It prevents air leakage with a combination of variable volume device, heat pipe, desiccant, oxygen absorber, and pressure and vacuum relief valves. Key benefits include keeping enclosure leak free and maintaining components clean and dry in new OEM enclosures; can be added to existing enclosures; avoids internal corrosion of enclosure components and electrical shorts; maintains enclosure at ambient pressure; has no moving mechanical parts; uses no outside power; and is suitable for high-humidity areas, corrosive environments, wash down areas, dusty, dirty, and wet environments.

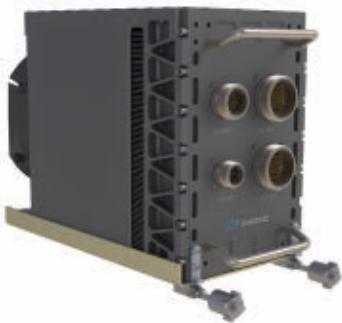
The Teledyne FLIR Prism from Teledyne FLIR LLC in Wilsonville, Ore., brings end-to-end computational thermal imaging and decision support to the edge. It supports a wide array of projects and custom development that run on the latest generation of low-power, embedded mobile processors including from Qualcomm and NVIDIA. The Prism digital ecosystem enables integrators in defense, commercial, and industrial markets to enhance perception and reduce time to market for counter UAS, ground intelligence, surveillance, and reconnaissance (ISR), air-to-ground, and autonomous vehicle systems and applications.

The Sense interference-avoidance and anti-jamming system from Doodle Labs LLC in Marina Del Rey, Calif., is a long-range, high-throughput mesh datalink for advanced robotics. Sense is a feature-set for Mesh Rider Radios that dynamically addresses the challenges of interference and RF jamming for long-range, mission-critical drones. Sense is



Rugged Field Testing of VPX SOSA Aligned Payloads

LCR's Rugged Test Systems enable functional and environmental testing in a development chassis that is deployment capable. RTS chassis support system integration, backplane design and I/O configuration in a single chassis as developers



proceed from development to demonstration to the deployment of VPX / SOSA aligned systems. The RTS system was recognized as a gold award recipient in this year's Military and Aerospace Electronics magazines Product Innovators Award Program.



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engineered to monitor in-band interference and automatically switch to an alternate channel or frequency band to find the best-performing frequency. When combined with Mesh Rider's Low Probability of Intercept (LPI) and Low Probability of Detection (LPD) waveform, Sense ensures uninterrupted communications and connectivity for advanced drones in challenging environments.

Gold honorees

Milpower Source Inc., Miltech 9080 PDU with Gigabit Ethernet Switch; Real-Time Innovations (RTI), RTI ConnexT TSS; LCR Embedded Systems, 5 Slot VPX Rugged Test System; D-Fend Solutions, EnforceAir2 Software V.24.04.2; Concurrent Real-Time, SIMulation Workbench on Windows; Elma Electronic, MORA Ready 2 tolerant N-channel MOSFETs; Inventus Power, CWB 3.6.2 InvincStable 200-Watt-hour Conformal Wearable Battery; Neousys Technology Inc., Neousys SEMIL-2000GC, 19-inch Rack Mount IP69K Waterproof Computer including NVIDIA L4 GPU; Curtiss-Wright Defense Solutions, Fortress CSR; Curtiss-Wright Defense Solutions, V3-1222 Avionics Processor; General Micro Systems, X9 Spider Workstation I/O; Elma Electronic, VNX+ Test and Development Chassis; Systel Inc., Sparrow-Strike small-form-factor rugged

computer; and Lone Star Analysis, MaxUp ORDAIN (One-Shot Readiness Digital Twin AI Network).

Silver honorees

Star Lab Corp., Titanium Technology Protection; Rantec Power Systems Inc., 1200-Watt 3U VPX Power Supply; Kontron, Harakan compact mission computer with AI processing; Milpower Source Inc., Miltech 471 Smart Hub; Fuse Integration Inc., Network Provisioner; Advanced Cooling Technologies Inc., Vaphtek environmental-control unit; Curtiss-Wright Defense Solutions, Axon Pico A/D converter; Curtiss-Wright Defense Solutions, VPX3-623 Cisco Catalyst Switch; Anritsu Company, Field Master Pro family analyzers; Elma Electronic, Rugged deployable CMFF chassis aligned to SOSA™ with SAVE tray; Wind River Systems, Wind River Studio Virtual Lab; and Pendulum Instruments, FTR-210R GNSS-controlled Rubidium Frequency & Time Reference.

Don't see your company's name? Start thinking about submitting entries for the 2025 Military & Aerospace Electronics Innovators Awards, which should be announced in October 2025, with submissions starting in April 2025. More information is online at <https://designengineering.endeavorb2b.com/military-aerospace-electronics-innovators-awards/>. ←



MORA-Ready Development Platform (MRDP) Wins 2024 Gold Award

The MRDP is a development chassis integrated with SOSA aligned PICs and Sciens Innovation helux Core RF tools to support MORA development.

The MRDP is a turn-key product. A developer can instantly view, evaluate and control MORA resources to explore device capabilities and functionality, and create, view, or modify MORA Signal Resource Profiles (MSRPs). It provides a known reference platform to support system development. Several plug-in cards are already verified on the MRDP, rapidly accelerating development time.



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Elma's All-New VNX+ Development Chassis Takes Home the Gold!

This VNX+ Development platform is designed to accelerate product development and testing of VNX+ plug-in cards (PICs) aligned to the SOSA™ Technical Standard and VITA 90. VNX+ provides a significant size reduction over 3U VPX for SWaP-constrained applications. At its core is a 7-slot VNX+ backplane with well-defined slot profiles for payload, switches, PNT and more. The platform includes a VITA 46.11 chassis manager and maintenance port aggregator, and extensive front panel I/O connectors. Switch between internal PSU and a plug-in PSU.



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▲ FAA officials are trying to update and replace old radar systems in U.S. airspace, specifically in terminal areas within 60 nautical miles of airports. 12987989 © Jakub Jirsak | Dreamstime.com

FAA seeks industry input to upgrade aging airport radar systems

BY Jamie Whitney

WASHINGTON—The U.S. Federal Aviation Administration (FAA) in Washington is looking for industry insight as part of the agency's Airspace Non-Cooperative Surveillance Radar (ANSR) program to replace outdated air-surveillance radar systems.

FAA officials are trying to update and replace old radar systems in U.S. airspace, specifically in terminal areas within 60 nautical miles of airports.

The ANSR program aims to sustain non-cooperative surveillance, improve radar coverage, reduce false detections from wind turbine interference, enhance detection algorithms, and modernize data protocols to align with current cybersecurity standards.

The FAA notes that primary radars, such as the ASR-8, ASR-9, and ASR-11, detect aircraft through reflections from the airframe, while the secondary Cooperative Surveillance Radars (CSR) use transponders on equipped aircraft to obtain identification and altitude. This combined radar data supports FAA automation systems by delivering both cooperative and non-cooperative target reports.

These systems were not designed to meet modern standards for cyber security and data communications or handle

new challenges such as interference from wind turbines. With limited availability of replacement parts, the FAA has had to rely on cannibalizing equipment from decommissioned systems to keep others operational, sometimes even running radars in single-channel mode for extended periods.

The FAA is evaluating acquisition strategies for ANSR, including direct procurement or contracting non-cooperative radar data as a service. Under the service model, the FAA would obtain data feeds from private vendors but would not own or maintain the radar equipment.

Any service provider would need to meet performance standards, including NIST 800-53 Rev 5 cyber security controls, and provide data over private telecom infrastructure to FAA service delivery points.

The FAA says that submissions, particularly non-proprietary, are encouraged to facilitate FAA's acquisition planning, and confidential submissions will be handled as such.

Written responses are due via email by 15 January 2025 to Chris Archer at christopher.c.archer@faa.gov. Additional information, including documentation, is available at <https://sam.gov/opp/8320a88800d24e0ebad635f030604563/view>. ◀

Marines pick two companies for counter-UAV electromagnetic warfare systems against uncrewed aircraft

BY John Keller

QUANTICO, Va. — U.S. Marine Corps leaders needed a battlefield system to counter uncrewed aircraft. They found solutions from Invariant Corp. in Huntsville, Ala., and Anduril Federal in Costa Mesa, Calif.

Officials of the U.S. Marine Corps Systems Command at Quantico Marine Base, Va., announced separate contracts in October, each worth a potential

► The Anduril Pulsar is an AI-enabled family of software-defined electromagnetic warfare systems for counter-UAV missions.



\$200 million, to Invariant and Anduril to integrate and deliver a counter-unmanned aircraft system engagement system.

The Marine Corps will pay the companies \$15.5 million up-front, and will pay each company for subsequent delivery orders as other funding becomes available.

Invariant specializes in hardware and sensor development, prototyping, and cutting-edge custom software development, while Anduril specializes in autonomous systems.

Anduril has major products in unmanned aerial vehicles (UAVs), *Continued on page 11*

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Northrop Grumman to make lifetime buy of silicon carbide (SiC) radar power parts to mitigate obsolescence

BY John Keller

PATUXENT RIVER NAS, Md. — U.S. Navy avionics experts are looking to Northrop Grumman Corp. to ensure a long-term and steady supply of silicon carbide components for radar power electronics aboard the Navy's E-2D Advanced Hawkeye carrier-based surveillance aircraft.

Officials of the Naval Air Systems Command at Patuxent River Naval Air Station, Md., announced a \$10.8 million contract to the Northrop Grumman Aeronautics Systems segment for a lifetime quantity of 4-inch silicon carbide (SiC) transistor wafers.

The end-of-life buy is necessary to maintain production, spare parts, and repairs for the APY-9 radar's primary power supply, power amplifier module on the E-2D aircraft.

A lifetime buy involves the purchase and storage of electronic parts in sufficient quantities to meet future demands, and is a primary way the military helps to mitigate the effects of parts obsolescence.

Silicon Carbide provides better switching performance than silicon MOSFETs and insulated-gate bipolar transistors (IGBTs) with minimal variation versus temperature, experts say.

Power semiconductors like SiC can far surpass the performance of conventional silicon power technology and make them prime candidates for next-generation high-power switching devices for military and commercial applications. SiC has demonstrated greater than twice the power density of

▲ **The end-of-life buy is necessary to maintain production and repairs for the APY-9 radar's primary power supply power amplifier on the E-2D aircraft.**

silicon power devices and at greater efficiency.

The Northrop Grumman E-2D aircraft uses the

Lockheed Martin AN/APY-9 radar for Navy carrier surveillance and theater air and missile defense missions. The AN/APY-9 provides the enhanced airborne command and control and expanded surveillance for the E-2D. The radar detects small maneuverable targets in difficult coastal-water and over-land environments.

The AN/APY-9 radar for the E-2D surveillance aircraft features advanced radar signal processing subsystems to enable flexible radar beam management and enhanced target processing to help the radar pinpoint and track enemy aircraft and missiles, and reject clutter and radar interference.

The AN/APY-9 features mechanical and electronic scanning modes, providing the warfighter with 360-degree situational awareness around the aircraft, and the ability to augment mechanical scanning with electronic scanning to dedicate extra resources to challenging targets or 90-degree sectors in any direction.

The AN/APY-9 Radar detects air and sea surface targets simultaneously with its space-time adaptive processing architecture, which suppresses clutter, jamming, and other sources of electromagnetic interference to focus on the target.

The AN/APY-9 operates at UHF which excels at long-range detection of difficult-to-find targets. High-power solid-state transmitter electronics increases reliability and sensitivity.

The radar has a high-reliability solid-state transmitter design, digital receivers, and exciter for waveform flexibility, low noise, and increased sensitivity. Its open-systems-architecture processor supports continuous technology insertion, and its circuit card computer hardware architecture simplifies system maintenance.

On this contract Northrop Grumman will do the work in Durham, N.C.; and Baltimore, and should be finished by February 2027. For more information contact Northrop Grumman Aeronautics online at www.northropgrumman.com/who-we-are/business-sectors/aeronautics-systems, or Naval Air Systems Command at www.navair.navy.mil. ←

Continued from page 9

counter-UAV, semi-portable autonomous surveillance systems, and networked command and control software. The company has counter-UAV technologies that can identify, track, and disable rogue drones in any environment, day or night.

The Anduril Roadrunner, for example, is a 6-foot twin turbojet-powered delta-winged aircraft capable of high subsonic speeds and extreme maneuverability — a cross between an autonomous drone and a reusable missile.

The Roadrunner-M version has an explosive warhead to intercept enemy UAVs, cruise missiles, and manned aircraft, and can take off and land vertically from a dedicated container. It can be recovered if not detonated.

The Anduril Lattice software uses artificial intelligence (AI) to classify objects by fusing data from disparate sensors, and typically is used for military base surveillance.

The Anduril Anvil is an unmanned quadcopter designed to attack other UAVs. It locates target drones using computer vision, and can be commanded to ram targets by its operator. A detonating version called the Anvil-M was unveiled in October 2023.

The Anduril Pulsar is an AI-enabled family of software-defined electromagnetic warfare systems that can adapt rapidly to emerging threats. Pulsar's modular form factor can adapt to and integrate onto ground vehicles or aircraft to support different counter-UAV missions.

On this contract Invariant and Anduril will do the work in Huntsville, Ala., and in Costa Mesa, Calif., and should be finished by October 2031. For more information contact Invariant online at www.invariant-corp.com, or Anduril Federal at www.anduril.com/capability/counter-uas. ←



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NASA taps Quantum Computing Inc. to support quantum sensing for space lidar missions

BY Jamie Whitney

HOBOKEN, N.J.—Quantum Computing Inc., an integrated photonics and quantum optics technology company in Hoboken, N.J., has been awarded a fifth project from the National Aeronautics and Space Administration (NASA) to develop quantum remote sensing technology that would significantly lower the cost of spaceborne lidar imaging and advance scientific understanding of the mechanisms of climate change.

This project is part of an ongoing collaboration to develop a new approach to lidar technology for atmospheric remote sensing. The project, currently under development by QCI, aims to significantly reduce the cost of lidar missions, enabling NASA to conduct more frequent flights to better study climate change.

The contract represents a milestone in evaluating the feasibility of QCI's technology for NASA's remote sensing needs.

▲ **Quantum Computing is developing quantum remote sensing technology to cut the cost of spaceborne lidar imaging and advance scientific understanding of climate change.**

146581 © G. K. | Dreamstime.com

It also marks a step toward deploying the technology in lidar missions and exploring its use in areas such as civilian and military surveillance.

"QCI is honored to support NASA in this critical mission dedicated to advancing remote sensing and climate change

monitoring. This new technology aims to reduce the cost of lidar missions from billions to millions and ultimately will help us in understanding the root causes of climate change and contribute to NASA's efforts to protect the earth's environment," said Dr. William McGann, QCI's Chief Executive Officer.

The contract builds on QCI's previous work with NASA, which involved reducing sunlight interference in satellite lidar images. The company used its Dirac-3 entropy quantum optimization machine to simulate background noise and turn the de-noising process into an optimization task. ←

Air Force wants model-based design in combat jet self-forming aerial networking

BY John Keller

ROME, N.Y. — U.S. Air Force researchers are asking industry to develop on-demand, self-forming, and self-healing aerial networking to provide data and voice links to high-performance combat aircraft.

Officials of the Air Force Research Laboratory Information Directorate in Rome, N.Y., have re-issued a broad-agency announcement (FA875023S7002) for the Aerial Layer Networking & Transmission Technologies project.

Today's aerial layer networking requires significant pre-planning, and has limited interoperability, Air Force researchers explain. Instead, the Air Force wants to move to a significantly more on-demand, self-forming, and self-healing aerial layer network.

The Aerial Layer Networking & Transmission Technologies project will capitalize on research in network monitoring and management, robust aerial networks, and proof-of-concept capabilities.

This project is a follow-on to the Air Force Timely, Secure & Mission Responsive Aerial Warfighting Network Capabilities project, which seeks to develop aerial networking for contested, degraded and operationally limited environments.

The project also seeks to develop capabilities to manage and plan today's multi-link based airborne network environment and tomorrow's dynamic ad-hoc opportunistic architectures using

▲ The project will capitalize on research in network monitoring and management, robust aerial networks, and proof-of-concept capabilities.

autonomous human-in-the-loop network management and recovery to improve network reliability and survivability.

These new capabilities should enable the Air Force to transform current aerial

layer networking a 'stitched together' state to one that is truly seamless, adaptive, and mission- environmentally-aware.

Of particular interest are hardware and software development; validation with model-based

Continued on page 15

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Honeywell and Merlin collaborate on autonomous flight tech for civil and military aircraft

BY Jamie Whitney

PHOENIX—Honeywell in Phoenix and Merlin Labs, a Boston-based developer of autonomous flight technology for fixed-wing aircraft, are collaborating on autonomous systems across various aircraft, including military fleets.

The partnership will integrate Merlin Pilot, Merlin's autonomous flight system, with Honeywell Anthem's avionics suite, aiming to reduce pilot workload and boost efficiency on special missions.

Honeywell Anthem offers an intuitive interface and flight management capabilities that align with Merlin Pilot's automation system, enabling a range of automated flight tasks.

Initially, the collaboration will focus on retrofitting fixed-wing military aircraft with Merlin's automation technology to support reduced crew operations, with plans to eventually enable uncrewed flight. The approach contrasts with new, fully autonomous aircraft systems, as this integration targets existing aircraft, aiming to reduce the number of pilots needed while meeting safety standards.

"This collaboration will benefit the military significantly, as this autonomy solution helps alleviate the pilot shortage by reducing the number of pilots required for certain aircraft operations," said Bob Buddecke, president of Electronic Solutions at Honeywell Aerospace Technologies. "By enabling single-pilot

▲ **Honeywell Anthem avionics will integrate with the Merlin Pilot to reduce pilot workload and enhance flight safety for commercial and military aircraft.**

126243840 | Air Crew © motorion | Dreamstime.com

operations and automating key tasks, this partnership provides a scalable and safe solution to ease pilot workload and optimize fleet operations for both the military and commercial aviation industry."

"The safety and scalability of the aviation industry is highly dependent on the progressive advancement of autonomous capabilities," Merlin CEO and founder Matt George said. "This partnership is an important step for Merlin and Honeywell to bring this technology to commercial and military aircraft, starting with single pilot operations. Honeywell is a respected company in aerospace, and paired with Merlin, together we will be able to significantly advance pilot efficiency and create a safer aviation ecosystem."

Merlin has secured a \$105 million contract with U.S. Special Operations Command (USSOCOM) and partnered with Air Mobility Command (AMC) and Air Force Materiel Command (AFMC) to deploy Merlin Pilot on C-130J and KC-135 aircraft, respectively. ◀

BAE Systems to continue building tactical networking for shipboard reconnaissance

U.S. Navy multi-domain battle management experts needed transmit/receive capability of intelligence, surveillance, and reconnaissance data for tasking, collection, processing, and dissemination. They found their solution from the BAE Systems Electronic Systems segment in Greenlawn, N.Y. Officials of the Naval Information Warfare Systems Command in San Diego announced a \$85 million order to BAE Systems for Network Tactical Common Data Link (NTCDL) systems. The order brings the value of the BAE Systems NTCDL contract to \$296.2 million. NTCDL provides a real-time exchange of voice, data, imagery, and full-motion video from aircraft, surface warships, submarines, and warfighters on land. It helps the Navy tactical networking operations using currently fielded common data link (CDL) equipment, as well as next-generation manned and unmanned systems. Initial NTCDL systems are going aboard Navy aircraft carriers and large-deck amphibious assault ships. NTCDL is a modular, scalable system designed to increase link capacity. The technology uses an open-systems architecture with non-proprietary interfaces, and is reprogrammable to adapt to new and evolving mission needs. BAE Systems is building NTCDL technology at its facilities in Wayne, N.J., and Greenlawn, N.Y. BAE Systems is working with partner Ball Aerospace to advance the two companies' joint Multi Link CDL Systems development. Ball is building the Ku-band phased array antenna suite for BAE Systems on the NTCDL project. For more information contact BAE Systems Electronic Systems online at www.baesystems.com/en/our-company/our-businesses/electronic-systems, or the Naval Information Warfare Systems Command at www.navwar.navy.mil. ←

Continued from page 13

design and simulation; and hardware-in-the-loop validation techniques.

Focus areas are airborne network management and monitoring; network technologies to improve network monitoring; self-managing and self-healing autonomic wireless network capabilities; robust airborne networking in apertures, waveforms, and networking; aerial network security; heterogeneous aerial layer networks; next generation mesh networking; ad-hoc tactical edge mesh networking; and enhanced network robustness, resilience, and availability.

This project will involve technology demonstrations using advanced radios, waveforms, networking, and management technologies; as well as low-cost demonstrations at Air Force facilities in Rome, N.Y. Funding will be about \$99.5 million.

Companies interested should email white papers to the Air Force's Peter Fitzgerald, the Aerial Layer Networking & Transmission Technologies program manager at peter.fitzgerald.1@us.af.mil. White papers for 2026 are due by 15 Sept 2025, and for 2027 by 15 Sept. 2026.

Email technical questions or concerns to Peter Fitzgerald at peter.fitzgerald.1@us.af.mil, and business questions to Amber Buckley at amber.buckley@us.af.mil. More information is online at <https://sam.gov/opp/90fac2ae38d04307b466694fb24e4c75/view>. ←



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5G TAKES ITS PLACE

leading-edge military c

BY John Keller



5G has ultra-low latency, operates on low-power and low-cost devices, and offers massive inter-connectivity with unmanned systems and sensors, as 5G experimentation demonstrates use cases in smart bases, smart depots, and smart warehousing.

Fifth-generation (5G) communications and networking is transforming how military forces exchange information and coordinate how they respond to threats, as 5G holds the promise of secure wide-bandwidth digital links from orbital space to the leading edge of the battlefield.

Military fifth-generation networking, largely adapted from commercial 5G technology, offers unprecedented advantages: high speeds, wide bandwidth, and low latencies; security and stealth; better coordination than ever before; affordability and scale of open-systems standards; and a pathway to widespread use of artificial intelligence (AI) and machine learning everywhere on the battlefield.

Speed and bandwidth

“The robustness and resilience of 5G communications is critical to the power you get from network-enabled warfare,” says Patrick Lardieri, principal architect of cyber support operations at Lockheed Martin Corp. in Bethesda, Md. “5G



ommunications systems

brings with it several things that can really help. It has very robust communications in higher bandwidth and lower latencies that can provide direct user access links that are higher bandwidth than some of the existing communications networks that are in play today in the tactical world.”

Lardieri made his comments in late July at the Military + Aerospace Electronics-hosted webinar, “How can military 5G help transform communications and enable applications?” Also speaking at this webinar were Baljit Chandhoke, product manager of RF Products at the Microchip Technology Discrete Products Group in Chandler, Ariz.; and Randy Cox, vice president of product management and business operations at Wind River Systems in Alameda, Calif.

5G communications designers are looking ahead to future military and civil applications with widespread millimeter wave signals that will operate on frequencies between 24 and 300 GHz. The millimeter wave frequency range offers military and civil authorities applications like

▲ A work crew prepares a 5G mobile test station at Hill Air Force Base, Utah, to implement 5G technologies without compromising the safety of military and civilian aircraft.

U.S. Air Force photo by R. Nial Bradshaw



▲ A Bangladeshi soldier operates a Unicorn 5G explosive ordnance disposal robot in Dhaka, Bangladesh.

Air National Guard photo by Master Sgt. Aaron Perkins, Oregon Military Department Public Affairs

control of swarming unmanned aerial vehicles (UAVs); augmented- and virtual reality for simulation, training and mission rehearsal; real-time intelligence, surveillance, and reconnaissance (ISR); distributed command and control; smart warehousing and logistics; and dynamic RF spectrum use.

"5G millimeter wave brings to the battlefield, as the technology matures, the latest spectrum, which is at 28 gigahertz in the U.S., and 24.5 GHz in China and other parts of the world," says Microchip's Chandhoke. "New advancement in 5G will bring high-speed connectivity to the battlefield, while minimizing vulnerabilities like electronic warfare jamming. New

generations of millimeter wave communications solutions offer speed that can provide ultra-wide bandwidth and low latency for broadband communications, which is increasing the amount of information we can share to support real-time decision making."

Applications of 5G

For the military, 5G could improve intelligence, surveillance, and reconnaissance (ISR) systems and signal processing, enable new command-and-control applications, and streamline logistics. 5G also could give the military broad access to augmented and virtual reality, 5G smart warehousing, distributed command and control, and dynamic spectrum use.


"Applications of 5G include mobile disaggregated command posts," says Lockheed Martin's Lardieri. "It would support Marines on the move and expeditionary basing operations while maintaining high-quality access to information. There is an opportunity to interconnect different networks for information, and connect sensors to shooters." He suggests other potential 5G applications include smart warehousing, logistics distribution, and virtual reality-assisted medical diagnosing.

5G could broaden the military's use of virtual reality, not only in military operations, but also in simulation and mission rehearsal in 5G enabled virtual reality in air, land, and sea missions. "Every second counts in defense," says Microchip's Chandhoke. "Getting seamless ultra-fast connectivity

gives a real-time picture of land, sea, and air under stressful conditions. 5G enhances connectivity and enhances the ability to deliver decisive action even faster."

Perhaps the most promising future applications of 5G communications involve automation, artificial intelligence (AI), and machine learning. In terms of learning and experience, life cycle management from day zero to day 2 operations is critical today," points out Wind River's Cox. "As we move forward in the evolution of networks, the use of automation is becoming more and more critical, and is absolutely required as it gets more complex, and also to reduce cost.

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▲ **U.S. Marine role-players post security during a 5G network demonstration at the Marine Corps Air Ground Combat Center (MCAGCC) at Twentynine Palms, Calif.**

U.S. Marine Corps photo by Cpl. Jonathan Forrest

Some experts in the field are looking beyond 5G to the applications that future 6G applications might offer. “6G has a huge opportunity for new applications that could be spun-up quickly and for AI and Machine learning for the warfighter to get critical data for decision making, with higher data rates, lower latency, and massive device distribution,” Cox says.

Integrating new and legacy systems

Part of the power of 5G for the military is its potential to stitch together new and legacy communications and networking systems. “For DOD [the U.S. Department of Defense] 5G is a unifying technology, to ensure seamless communications across all environments,” says Microchip’s Chandhoke. “Unification across

5G is a game-changing technology for the military.”

Part of that will be the military’s ability to draw enterprise and tactical computer networking together more closely than ever. “Another benefit is enterprise and tactical deployments so that DOD can leverage 5G,” Chandhoke continues. “The tactical version of 5G is ideal for smaller groups of people on the battlefield to deploy 5G solutions. DOD can support a wide range of use cases quickly, and support the comprehensive coverage that 5G offers with extreme bandwidth, with standardized interoperabilities, common applications, and hardware that are interoperable. For the DOD that means global partners can talk to each other, with improved communications, cost savings, and the ability to streamline security.”

5G also provides the military with the ability to integrate users over backhauled and reachbacks, points out Lockheed Martin’s Lardieri. “Through very solid integration with wired Internet and other communications infrastructure, new channel models like the non terrestrial networking capabilities to allow direct access from space.”

Lockheed Martin is integrating 5G as a primary communications technology with other existing military communications

► **An AT&T civilian contractor monitors the status interface of a “Cell on Wings” drone to provide 5G connectivity at White Sands Missile Range, N.M. U.S.**

Air Force photo by Staff Sgt. Charlye Alonso





▲ A U.S. Marine Corps transmission systems operator installs a 5G antenna for a demonstrat at the Marine Corps Air Ground Combat Center at Twentynine Palms, Calif. U.S. Marine Corps photo by Pfc. Ryan Kennelly

technologies in terrestrial, seaborne, or space, or airborne assets, Lardieri says “We can use 5G as a sort of interlinking or inter-networking capability to provide robust backhauls. 5G can provide this interlocking web that will allow us to interconnect many disparate communications systems while providing new and enhanced user access and backhaul communications links that can supplement those existing ones.”

Lardieri also explains Lockheed Martin approach to what he calls a “hybrid base station” “where we integrate 5G technology with other more traditional DOD-like technologies, showing how we can provide alternative access so that operators and users can get into the network of the base station using waveforms other than the standard 5G waveform. This can help in contested space and security, and spectrum relocation for some of that initial access.”

In this way, systems designers can bring 5G into useful applications using “things that allow us to take 5G and

integrate it with other existing networks. “This is a real criticality to the military and aerospace community.”

It doesn’t make sense not to integrate existing military communications systems into new 5G-based systems, Lardieri points out. “We have to respect that we have trillions of dollars in legacy military equipment, and we’re not going to go replace all that anytime soon in one fell swoop.”

For now, Lardieri says systems designers “are looking for inter-networking solutions to bridge these communications islands with different networking technologies and interoperability standards. 5G is highly disaggregated, ready for edge cloud deployment, and looking to pull hyperconverged infrastructures out to the edge. It also creates the opportunity for other services like interoperability services to do message translations, bridges to other networks, 5G offers these great user access capabilities in high performance and low latency, and the ability to link into other



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commercial infrastructures, and to leverage legacy military existing capabilities.”

Security and detectability

An effective military 5G infrastructure cannot exist without secure links able to resist enemy attempts to jam, disrupt, eavesdrop, or hack into sensitive communications. “Security is a big one,” says Lockheed Martin’s Lardieri. “We need to ensure confidentiality, and operate in a way that does not allow users to be detected or geo-located.”

One advantage to the military may lie in the military-specific and non-commercial nature of many legacy military communications. The DOD has spectrum of its own that we could leverage in some cases, Lardieri says. “If we put 5G in the hands of people operating in foreign lands in potentially military maneuvers, we need to make sure they are safe and secure. Commercial waveforms may not provide the types of protection to geo-location or detection of the users, as well as they may not provide as much security for the users.

Using sophisticated encryption in 5G communications is an obvious consideration — but should be done in the right way,” Lardieri points out. “We need to integrate encryption protocols and waveforms in a way that doesn’t destroy performance or overturn the entire architecture. Using the



▲ A UH-60 Blackhawk helicopter flies at different altitudes over the runway during 5G avionics testing at Hill Air Force Base, Utah.

U.S. Air Force photo by Cynthia Griggs

right interfaces and leveraging the right industry standards that are being opened up is one of the key considerations to effectively moving this forward — especially for tactical systems on the move.”

When it comes to the less-discussed shortcomings of military 5G technology, security perhaps is top of the list. “Does 5G bring new security challenges? It does because it uses more software-driven information technology,” Lardieri says. “Software today is a great surface for adversary attack. As we bring more software control and networking, we

need to bring a higher standard of supply chain security and software cyber security to ensure that adversaries can’t exploit that software complexity. Will be a higher standard of security.”

The vulnerability of 5G to enemy detection also is a big concern. “5G is protected, but to anyone with sophisticated equipment it is detectable and subject to attack,” says vice president of product management and business operations at Wind River Systems in Alameda, Calif. “New techniques to prove the resilience of the 5G network are needed, such as mesh connectivity and redundant paths. Software-defined radios can provide alternative paths to degraded or contested networks, and new backhaul networks can help link 5G networks and satellites, 5G, and terrestrial networks.”



▲ A multi-utilization secure tactical and network ground station vehicle operating at the U.S. Air Force Warfare Center 5G at Nellis Air Force Base, Nev., helps build a mobile 5G network. U.S. Air Force photo by Staff Sgt. Gabriela Keiser.



▲ **5G Communications gives warfighters enhanced communications with fast data throughput, low probability of detection and interception, and strong anti-jam protection.** Graphics by Art Armendariz, Naval Information Warfare Center (NIWC) Pacific

Such a challenge might not be easy to overcome. “5G from a commercial standpoint is going to require a need for military-level security to protect highly sensitive and classified information at every level,” Cox says. Zero trust is really a must. Susceptibility to RF jamming also is a concern.”

Standards and interoperability

U.S. military officials are considering open-systems standards for the hardware and software used in 5G communications. In 2022 the DOD launched the Open6G project that revolves around open radio access networks, also called Open RAN. Open6G is a new industry-university effort that seeks to boost 6G systems research on

Open RAN. The DOD also is looking to enable open-systems standards within 5G networks. Military experts are working with the National Telecommunications and Information Administration (NTIA) with \$7 million in awards.

“5G has been rolled out commercially for years, however operations are at an inflection point in 5G where they are converting from a traditional network to a more open disaggregated and edge-computing network with many vendors supplying different network elements,” says Wind River’s Cox. “This can drive flexibility of the network, reduce total cost of ownership, and innovation into the network as well. This will be applicable to the defense industry as well.” ◀



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Military test and measurement keeps electronics on-track

Systems designers must ensure that their enabling technologies work correctly, and the test and measurement industry has responded with many new kinds of instruments.

BY Jamie Whitney

In military missions, there are no second chances; warfighters must trust their equipment to perform flawlessly from the start. Beyond the demand for unwavering reliability, their technology also must be operational instantly.

Ensuring that sensitive systems function reliably in extreme conditions requires experts to inspect each individual component of today's advanced technologies meticulously, verifying that every link in the chain is dependable. To achieve this state of readiness, accurate test and measurement equipment is essential.

▲ A Navy sailor performs a hydrostatic test with an Australian sailor aboard the USS Emory S. Land in Australia in August 2024. Navy photo

These complex systems rely on interconnected components that must work together seamlessly, often in difficult environments. Even small malfunctions can jeopardize a mission or endanger lives. By delivering essential data, test equipment helps detect potential issues early, enabling preventive maintenance and timely adjustments.

“In terms of military and aerospace electronics, failures in equipment functionality can be catastrophic,” says Charles Greenberg, senior product marketing manager of Astronics in East Aurora, N.Y. “Radio communications networks, weapons systems, and aircraft wiring are all mission-critical to any defense organization. There must be a high level of confidence that the equipment is functional and meets exacting specifications. Highly accurate test equipment provides repeatable and precise test data which can be used to create test profiles and analyze failure patterns.”

Greenberg continues, “Capturing and using data from your test equipment can tell you an enormous amount about equipment performance and product longevity. Once you have substantial data, it can be organized in such a way to see patterns of failures, or at least estimate when they may happen, so that you can proactively maintain your equipment to prevent failures before they occur.”

Francisco J. Flores Sánchez, business development manager for aerospace and defense at dSPACE Inc. in Wixom, Mich., explains that the best way to correct errors and faults is to identify them as early as possible.

“In simulation, this becomes a critical necessity, as both money and time can be reduced by implementing fixes as early as possible,” Flores Sánchez says. “dSPACE is investing heavily in our software solutions to allow users to test, validate and verify software models and code within both MIL/SIL [software-in-the-loop] applications which provide a window to see deviations from requirements during the early stages of development. To add to this capability, we have also investments in scaling up simulations via cloud simulations, thus allowing for large-scale simulation in the cloud utilizing the same models as deployed on a real-time HIL [hardware-in-the-loop] system, to improve confidence in the systems being developed and tested, identifying edge and corner cases that need to be further scrutinized and improved as necessary to deliver a robust and reliable system.”

This spring, U.S. Air Force and university researchers tapped dSPACE to provide design and development tools as the USAF sought to simulate the effects of turbulence on a wide variety of military and civil aircraft. The Air Force selected dSPACE’s MicroLabBox, which is an all-in-one development system for the laboratory that offers compact size with high performance and versatility.

“I needed to look at the flow fields and study the physics, and the MicroLabBox has been a good

means to an end for us because it allows us, through a very familiar programming architecture, Simulink, to write and develop these controllers and control structures for our lab that we can just drop in, plug them in, and run the experiments,” says Michael Mongin, an engineer at the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio. “Before the MicroLabBox was in the lab, researchers would have to come up with open-loop profiles for the wing pitch. They had to have perfect models and run prescribed profiles then analyze in post to see how well it did at mitigating. Now we say, ‘target this amount of lift’, and the controller can make corrections in the loop to get us to the mitigation we want.”

Automation and AI

Automated systems and those with artificial intelligence (AI) or machine learning capabilities can help technicians analyze swathes of data patterns to predict potential system failures, enabling preventive maintenance before issues arise. This technology is especially valuable for maintaining the complex systems that military and aerospace equipment rely on, reducing the risk of unexpected breakdowns.

“Automated test equipment provides convenience, saves time, eliminates human error, and increases the number of potential users of the equipment,” Astronics’ Greenberg says. “Automated test programs or applications run on their own once parameters are set, allowing the user to perform other tasks while tests are running. Because testing is automated, less technical knowledge is required to run the test equipment



▲ This spring, the Air Force selected dSPACE’s MicroLabBox to simulate the effects of turbulence on a wide variety of military and civil aircraft.

and diagnose the unit under test (UUT). When dealing with fine tolerances and high accuracy, the ability to automate becomes even more important, as does timing and capturing of data.”

Of course, AI, machine learning, and high-performance computing (HPC) applications and the networks that power them need to be tested themselves. This fall, Keysight Technologies Inc. in Santa Rosa, Calif., debuted its portable 800GE benchtop system focused on testing AI and data center interconnects. The platform offers a portable, multi-user, multi-speed testing solution for manufacturers of networking equipment, silicon chips, optical transceivers, cables, and data center operators.

Supporting high-power optical receivers up to 30 Watts, the unit allows multiple users to conduct simultaneous tests across two or four ports, enabling faster testing of various scenarios and reducing time spent on testing single-user setups.

The platform supports all Ethernet speeds from 50GE to 800GE across layers 1 through 3 and integrates Keysight’s IxExplorer software for streamlined control. Operators can also connect the system to external devices for remote testing.

“The rapid growth in AI and HPC infrastructures is driving an unprecedented need for innovative testing solutions, and Keysight’s mission is to champion these efforts,” said



▲ The Astronics ATS-3100 VRS is a benchtop software-defined solution built for testing legacy, current, and future radio technology.

Ram Periakaruppan, vice president and general manager of network test and security solutions at Keysight.

Keysight says this technology speeds up AI training and cuts costs by simulating large-scale workloads, delivering insights into communication performance, running pre-defined models, supporting flexible “what-if” scenario testing, and including pre-built applications to streamline the benchmarking process.

Software solutions

Software-defined test equipment (SDTE) in the military and aerospace industry offers a programmable, flexible method for system testing and validation that adjusts quickly to changing technical needs. Unlike traditional hardware-dependent testing, SDTE relies heavily on software, making it easier to customize, scale, and operate remotely.

“Software-defined test and measurement equipment is crucial to extending the lifetime value of a test system,” says Astronics’s Greenberg. “For example, many instruments included in our test platforms are software-defined, allowing for future technology insertions and upgrades to be made to existing equipment with little to no hardware changes. In turn, this helps ensure that militaries have the latest technologies as soon as they become available, contributing to overall operational readiness.

Greenberg says that another trend Astronics is seeing from customers are



▲ The Astronics ATS-6100 offers 19 integrated tools to diagnose faults and verify radio communications readiness across various levels of deployment.

solutions that can validate and test legacy equipment nearing obsolescence in addition to new technology.

"This is another excellence case for software-defined instrumentation such that multiple generations of equipment can be tested using the same platform," Greenberg says. "The ATS-3100 Radio Test Set (RTS) and ATS-6100 RTS are two platforms that support this need, delivering reliable radio testing from factory to field. The former is our benchtop solution, ideal for a factory or depot setting, and delivers O-level testing and diagnostics on tactical radios from virtually any OEM. The latter is the handheld version, allowing users to have radio test capability in the field, or wherever it is needed. Both platforms are capable of testing both ground and airborne radios."

The ATS-6100 features more than 19 integrated tools to diagnose faults and verify radio communications readiness across various levels of deployment, and it is compatible with multiple communication systems, including SINCGARS, SRW, WNW, and HAVEQUICK. Astronics also provides an extensive library of test program sets for tactical radios from a wide range of original equipment manufacturers (OEMs).

As a software-driven system, the ATS-6100 can support future waveform updates and features an interface that guides users through automated testing scripts, which the company says simplifies the testing of tactical radios.

Additionally, Astronics's ATS-3100 VRS represents the company's fifth generation of radio testing technology. The system is capable of testing advanced software-defined radio (SDR) waveforms, modern multi-band radios, and legacy models like SINCGARS from any OEM.

Built with National Instruments' PXI Vector Signal Transceiver (VST), the ATS-3100 VRS offers fast test times and a wide bandwidth of up to 1 GHz, aiming to optimize field radio maintenance with high throughput and reduced mean time to repair.

The new ATS-3100 VRS is a bench-top, software-defined solution built for testing legacy, current, and future radio technology. Its modular design allows for future upgrades and adapts to evolving maintenance needs, extending the system's operational lifespan.


Fieldwork

Field testing military electronics is a rigorous process that ensures reliability, durability, and functionality in the challenging conditions typical of real-world operations. Testing programs mimic the environments and stresses that these

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▲ Keysight's portable 800GE benchtop system focuses on testing AI and data center interconnects, and offers a portable, multi-user, multi-speed testing solution.

systems will face in the field, from desert heat to electromagnetic interference. Test planners define the objectives based on the specific system under evaluation, whether radar, communications, or navigation equipment. Then, testing sites are chosen to reflect the extreme conditions the equipment might encounter in operational settings, such as high or low temperatures, humidity, dust, or salt spray. Baseline testing is often performed in controlled labs beforehand to provide reference points for later comparison.

During the field test, systems undergo simulated operational scenarios that resemble actual use cases, including combat settings or communication setups under varied environmental and adversarial conditions. Stress tests put the equipment through extremes in temperature, vibration, shock, and electromagnetic interference to assess their physical resilience. Communication systems are evaluated for signal integrity and range in jamming or congested signal environments. Real-time diagnostics log metrics like power consumption, signal strength, error rates, and system status, helping identify potential weaknesses.

Following testing, engineers analyze failures to determine root causes, using diagnostic data and examining stress levels to pinpoint vulnerabilities. Field data is compared against lab benchmarks to evaluate whether the system meets the required standards. If repeated issues emerge under certain conditions, engineers may recommend design adjustments, additional shielding, or more robust component selection.

Testing technology in the field provides not only a tangible proof-of-concept, but also confidence it can mesh well with existing programs between allied forces.

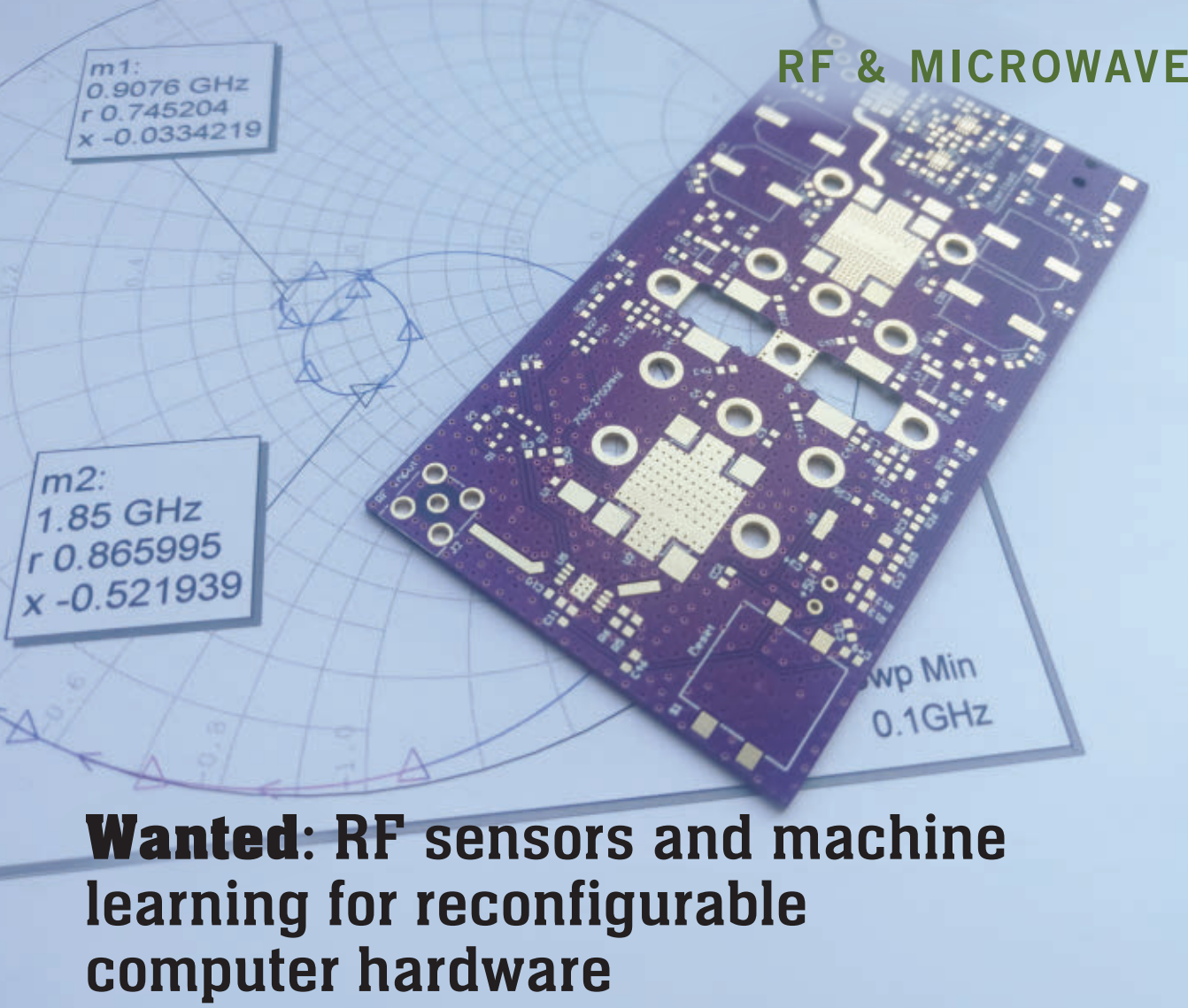
In October, the Australian military played host to colleagues from the United Kingdom and the United States (AUKUS) as the allies ran tests to boost trilateral capabilities, improve operational compatibility, and scale up the use of autonomous systems in maritime operations.

"Autonomous Warrior/Maritime Big Play creates a unique opportunity for our three countries to work together, which will ultimately improve operational efficiency and allow us to work more cohesively against common threats," said Heidi Shyu, Under Secretary of Defense for Research and Engineering. "This collaborative approach enables us to reduce acquisition, maintenance, and training costs by creating economies of scale."

The October exercise included testing systems designed for various operational levels, from deep-sea to high-altitude. Technologies tested included software-defined acoustic modems, autonomous underwater and surface vehicles, and low-cost, expendable unmanned surface vessels. The trials also showcased a "low-cost gondola," which provides stratospheric support with minimal staffing and logistical needs, and T-200 high-altitude balloons designed to deliver stable communications in contested environments from the stratosphere.

A flexible software-defined network called Multi-Domain Uncrewed Secure Integrated Communications (MUSIC) was evaluated for its potential to facilitate communication across various unmanned systems and operational areas. The Common Control System (CCS), also featured, is built on open architecture, allowing integration across multiple uncrewed platforms. This technology is expected to support the development of an AUKUS-wide control system that blends the three countries' best capabilities.

"AUKUS partners have long histories of working together on defense and security issues, and have deep, enduring partnerships based on shared values, said Shyu. "By investing in novel and innovative capabilities directly aligned to AUKUS mission priorities, as well as making future advancements in emerging technologies like AI and Quantum, we support a more stable region — one where all nations are empowered to make their own sovereign decisions free from coercion — a world that centers on hope for the opportunity and prosperity of the future." ◀



Wanted: RF sensors and machine learning for reconfigurable computer hardware

BY John Keller

ARLINGTON, Va. – U.S. military researchers are asking industry to find new ways of developing advanced RF sensors for array control and signal processing that will help reason over the possibilities of reconfigurable computer hardware.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., issued a program solicitation this month (DARPA-PS-24-18) for the Next Generation Electronic Surveillance Technology (NGEST) program.

Execution of NGEST likely will require expertise in subject areas like machine learning, signal processing, RF hardware properties, software, and control theory, DARPA officials say.

NGEST is a 33-month program organized into 15-month first phase, and an 18-month optional second phase. NGEST Phase 1 will focus on modeling and simulation within a government-defined RF sensors testbed. Phase 2 will focus on prototyping, testing, and measurements in laboratory and outdoor environments.

▲ **NGEST will require expertise in machine learning, signal processing, RF hardware properties, software, and control theory.** 236561654 © Audrius Merfeldas | Dreamstime.com

Performer teams will integrate real-time orchestration software onto prototype reconfigurable computer hardware developed by the government team. Not all phase-one performers will be phase-two performers, and only the most promising approaches will move on to phase-two.

During phase-one, the performers will integrate their software onto a government-provided modeling-and-simulation test bed, which will be updated periodically based on feedback and lessons learned.

Companies interested were asked to send abstracts no later than 27 Aug. 2024 to DARPA at DARPA-PS-24-18@darpa.mil. Email questions or concerns to DARPA-PS-24-18@darpa.mil. More information is online at <https://sam.gov/opp/e1d60102c47b491dabdddbdceb3ad595/view>. ◀

CAES to provide electronic warfare (EW) antenna arrays for SEWIP systems aboard surface warships

BY John Keller

MECHANICSBURG, Pa. – U.S. Navy surface warfare experts needed antenna arrays for the Lockheed Martin AN/SLQ-32(V)6 Surface Electronic Warfare Improvement Program (SEWIP) Block 2 systems aboard Navy surface warships. They found their solution from Cobham Advanced Electronic Solutions Inc. (CAES) in Lansdale, Pa.

Officials of the Naval Supply Systems Command Weapon Systems Support activity in Mechanicsburg, Pa., announced a \$16.1 million contract to CAES in August for 25 antenna array panels supporting the AN/SLQ-32(V)6 electronic warfare (EW) system.

SEWIP Block 2 is an evolutionary acquisition and incremental development program to upgrade the existing AN/SLQ-32(V) electronic warfare system aboard surface warships.

SEWIP provides enhanced shipboard EW for early detection, analysis, threat warning, and protection from anti-ship missiles. SEWIP Block 2 will enhance the shipboard EW systems's receiver and antenna group to meet the latest threats.

SEWIP Block 2 expands on the receiver and antenna group necessary to keep capabilities current with the pace of the threat and to yield improved system integration, Navy officials say.

The Lockheed Martin Block 2 SEWIP design is based on its integrated common electronics warfare system (ICEWS), which enables rapid reconfiguring of the system with commercial technology.

Mercury Systems in Andover, Mass., is providing advanced radio frequency (RF) microwave tuners and intermediate frequency (IF) products for SEWIP Block 2. Lockheed Martin chose the

Mercury Echotek series microwave tuner and digital receiver, which are optimized for fast tuning and high performance.

Developed by Raytheon in the 1970s, the original AN/SLQ-32 systems employed passive radar technology for early warning, identification and tracking of enemy threats. Subsequent upgrades provided an additional active capability for simultaneous jamming of several different threats.

On this order CAES will do the work in Lansdale, Pa., and should be finished by August 2027. For more information contact CAES online at <https://caes.com/products/antennas>, or Naval Supply Systems Command Weapon Systems Support at <https://www.navsup.navy.mil/NAVSUP-Enterprise/NAVSUP-Weapon-Systems-Support/>. ←



▲ Cobham Advanced Electronic Solutions Inc. (CAES) will provide for 25 antenna array panels supporting the AN/SLQ-32(V)6 electronic warfare (EW) system.

Lockheed Martin to provide submarine EW and digital signal processing

Submarine combat systems experts at Lockheed Martin Corp. will design and test U.S. Navy AN/BLQ-10 electronic warfare (EW) systems for Navy submarines under terms of an \$43.4 million order. Officials of the Naval Sea Systems Command in Washington are asking the Lockheed Martin Rotary and Mission Systems segment in Syracuse, N.Y., for the design, prototyping, and qualification testing of submarine electronic warfare equipment. The order involves a modification to a potential \$970.1 million 10-year contract announced in February 2019 for Lockheed Martin to design, upgrade, and support the AN/BLQ-10 submarine EW system. This order could increase the contract's total value so far to \$111.7 million. The AN/BLQ-10 provides automatic detection, classification, localization, and identification of potentially hostile radar and communications signals at sea. The AN/BLQ-10 helps Virginia-, Los Angeles-, and Seawolf-class fast-attack submarines, Ohio-class conventional guided-missile submarines, and future Columbia-class ballistic-missile submarines detect enemy radar and communications. It is not for existing Ohio-class ballistic-missile submarines. The AN/BLQ-10 does digital signal processing from the submarine's imaging mast or periscope when the boat is at periscope depth. It provides threat warning to avoid counter-detection and collision; determines the number and location of targets for subsequent prosecution; and conducts intelligence, surveillance, and reconnaissance (ISR) to support the fleet or battle group. The program is adopting an open-architecture, incremental development process that fields hardware and software technology insertions every two years. For more information contact Lockheed Martin Rotary and Mission Systems online at www.lockheedmartin.com/en-us/who-we-are/business-areas/rotary-and-mission-systems.html.

Air Force to help goTenna improve military mesh network radio communications

U.S. Air Force navigation and guidance experts needed next-generation mesh network radio technology. They found a solution from goTenna Inc. in Jersey City, N.J. Officials of the Air Force Life Cycle Management Center's Theater Battle Control Division at Hanscom Air Force Base, Mass., announced a \$15 million contract to goTenna in July to design and build a next-generation small, lightweight, affordable, and efficient radio capability (Pro X3) to expand overall Pro

X series capabilities. Tactical communications that enable mission-critical command and control down to the individual operator in hostile and austere environments. The company's Aspen Grove mesh networking protocol provides long-range, short-burst, low-SWaP mobile mesh networking. The key benefits of the Aspen Grove protocol stack apply to many types of wireless or wired communications. Today, Aspen Grove is implemented in the goTenna's Pro X Series products to promote the scalable distribution of low-bandwidth information. On this contract goTenna will do the work in Jersey City, N.J., and should be finished by July 2026. For more information contact goTenna online at <https://gotenna.com>, or the Air Force Life Cycle Management Center at www.afclmc.af.mil.

General Dynamics to build multifunction maritime radios for ships and submarines

U.S. Navy shipboard communications experts are asking General Dynamics Corp. to provide AN/USC-61(C) maritime radios to enable Navy surface warships and submarines to communicate over high frequency (HF), very high frequency (VHF), ultra-high frequency (UHF) line of sight, and UHF satellite communications (SATCOM) radio bands. Officials of the Naval Information Warfare Systems Command (NAVWAR) in San Diego have announced a \$88.5 million sole-source order to the General Dynamics Mission Systems segment in Scottsdale, Ariz., to build AN/USC-61(C) digital modular radio (DMR) systems. The contract includes high-frequency distribution amplifier group components and spare parts for both systems. DMR is a modular, software reprogrammable multifunction shipboard radio system with embedded cryptography that provides all radio frequency (RF) to-baseband and baseband-to-RF conversion functions required for U.S. naval line-of-sight, beyond line-of-sight and satellite communications systems. NAVWAR awarded the order on behalf of the Navy's Program Executive Office for Command, Control, Communication, Computers, and Intelligence (PEO C4I) in San Diego. The AN/USC-61(C) is a maritime software-defined radio (SDR) that has become standard for the U.S. military. On this order, General Dynamics will do the work in Scottsdale, Ariz., and should be finished by February 2029. For more information contact General Dynamics Mission Systems online at <https://gdmissionsystems.com>, or NAVWAR at www.navwar.navy.mil. ←



Wanted: heavy-lift uncrewed aircraft to fly 35-ton shipping containers from ships

BY John Keller

ARLINGTON, Va. – U.S. military researchers are considering asking industry to develop heavy-lift uncrewed aerial vehicles (UAVs) able to fly loads equal to that of a fully loaded 747 cargo jet or loaded 18-wheel commercial freight truck.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., issued a request for information (DARPA-SN-24-109) in September for the

▲ Heavy-lift UAVs could transport equipment, supplies, and large platforms in bad weather and avoid enemy defenses effectively.

Cost Efficient Cargo project to develop heavy-lift UAVs able to lift 35-ton payloads using commercial off the shelf (COTS) engines and drive train technology. 35 tons weighs 70,000 pounds.

Armed forces must move troops, vehicles, and supplies from naval vessels to beachheads, and then across terrain and obstacles; any delays can expose forces to enemy fire and hinder establishing secure footholds.

Heavy-lift UAVs could transport equipment, supplies, and large platforms in bad weather and avoid enemy defenses effectively. Using heavy-lift UAVs could help maintain operational speed, reduce vulnerability to attack, and ensure continuous logistical support.

The Sikorsky CH-53K King Stallion today is the American helicopter with the highest payload capacity at 36,000 pounds and serves as the U.S. Marine Corps primary heavy-lift helicopter. Developing crewed helicopters with greater lifting capacity is limited rotor design, power-to-weight ratio, air-frame strength, vibration and stress, and crew safety.

UAVs, on the other hand, could offer innovation in design and greater mission profile flexibility, without the cost of crewed safety considerations, and reduce training and certification time for pilots.

DARPA researchers are looking for leap-ahead enabling technologies, and say they are not interested in incremental improvements, derivatives of standard helicopters, multirotor copters, tail sitters, or jump platforms with wing kits. There are no restrictions on internal vs external cargo.

The bottom line is that the U.S. needs to move large and heavy cargo cheaply, DARPA researchers point out. Examples are moving 40-foot transport containers to invasion beaches from ships located 10 miles offshore.

DARPA also is interested in identifying design insights and key risks that can be addressed within a scaled-down form to substantiate additional military investment in heavy-lift systems.

From industry, DARPA wants information on the design and maneuverability, mission profile, costs, scalability, and ranges of potential heavy-lift UAV designs. These future large cargo UAVs would be able to fly 70,000-pound payloads over 25 miles at 500-foot altitudes, detach payloads, and return to base. Submissions should consider 10,000-, 30,000-, and 45,000-pound payloads able to operate at ranges of 10, 25, 50, and 100 miles. Inexpensive, technically acceptable small-scalable versions may help prove concepts.

Companies interested should email concise white papers by 20 Dec. 2024 to DARPA at DARPA-SN-24109@darpa.mil. Email questions or concerns to DARPA-SN-24109@darpa.mil. More information is online at <https://www.fbdaily.com/archive/2024/09-September/25-Sep-2024/FBO-07220784.htm>. ◀

Army chooses Teledyne FLIR for remotely operated bomb-disposal robots

U.S. Army unmanned ground vehicle (UGV) experts needed a medium-sized bomb-disposal robot able to detect, confirm, identify, and dispose of concealed explosives. They found their solution from the Teledyne FLIR LLC Unmanned Ground Systems (UGS) segment in Chelmsford, Mass. Officials of the Army Contracting Command-Detroit Arsenal in Warren, Mich., announced a \$10.3 million contract to Teledyne FLIR to build the Man Transportable Robot System Increment II (MTRS Inc II) — a remotely operated unmanned ground vehicle (UGV) that can find and destroy hidden explosives while keeping human operators at safe distances. The MTRS Inc II explosives-detection system has a standard chassis and modular mission payloads to support Army engineers; chemical, biological, radiological and nuclear (CBRN) soldiers; and special operations forces. The MTRS Inc II provides remote standoff ability to locate, identify, and clear land mines, unexploded ordnance, and improvised explosive devices (IEDs) in the path of maneuvering Army or joint forces. It also enables CBRN Soldiers to employ CBRN sensors from a safe distance. The unmanned ground vehicle replaces the aging non-standard fleet of robots with enhanced capabilities to clear obstacles and threats. The MTRS Inc II is part of the Army's common modernized unmanned ground vehicles fleet, which consists of the MTRS Inc II, Common Robotic System-Individual (CRS-I), and the Common Robotic System-Heavy (CRS-H). For more information contact Teledyne FLIR Unmanned Ground Systems online at www.flir.com/uis/ugs, or the Army Contracting Command-Detroit Arsenal at <https://acc.army.mil/contractingcenters/acc-dta/>.

Army asks AeroVironment for more Switchblade armed uncrewed smart mortars

U.S. Army fire support experts are asking AeroVironment Inc. in Simi Valley, Calif., to build manpackable armed uncrewed aircraft to attack enemy tanks, light armored vehicles, hardened targets, and warfighters under terms of a \$54.9 million order. Officials of the U.S. Army Contracting Command at Redstone Arsenal, Ala., are asking AeroVironment to build the Switchblade armed

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Army wants human-machine interfaces to join soldiers to mixed reality and autonomous robots

BY John Keller

NATICK, Mass. – U.S. Army researchers are asking for industry's help in developing new ways for soldiers to communicate and interact with mixed-reality and autonomous robots to speed operations

and enhance situational awareness.

Officials of the Army the Cognitive Science and Applications Branch of the Army Combat Capability Development Command Soldier

▼ Project seeks to assess industry's ability to develop multimodal human-machine interfaces to control mixed-reality and autonomous robotic systems.



Center in Natick, Mass., have issued a request for information (W911QY-25-R-MHMI) for the Multimodal Human-Machine Interface for Mixed Reality (XR) and Robotic Autonomous Systems (RAS) Control project.

The project seeks to assess industry's ability to develop cutting-edge technology for multimodal human-machine interfaces to control mixed reality and autonomous robotic systems.

Proposed solutions should help soldiers interface with mixed-reality and autonomous robots to minimize cognitive load and training requirements; enhance situational awareness; and enable soldiers to offload risk and work to robots, and instead help them focus on higher-level tasks.

Researchers are interested in human-machine interfaces that use mixed-reality displays, augmented reality overlays, and intuitive graphical user interfaces; voice commands, spatialized audio cues, and natural language processing;

force feedback devices, tactile sensors, and gesture recognition; as well as physiological monitoring, eye tracking, and brain-computer interfaces.

Proposals solutions should address the Modular Open System Architecture (MOSA) design approach; integrated inertial measurement units; surface electromyography; electroencephalogram; eye tracking, head movement, and voice; and mature software development kits and application programming interfaces.

System latency should be between 50 and 200 milliseconds; have input recognition accuracy of between 80 and 95 percent; be set up and broken down in between two and 10 minutes; have battery power for two to six hours; have cyber security; and use Windows-based computing. The Army wanted responses by mid-November. More information is online at <https://sam.gov/opp/94b628e4144e42f0820d829d7c23dbf7/view>. ◀

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loitering unmanned aerial vehicle (UAV) that launches from a small tube that can be carried in a warfighter's backpack. The Switchblade attack drone system, which essentially functions as a smart mortar round, transmits live color and infrared video wirelessly after launch for display on a small ground-control unit. The operator confirms the target using the live video feed, commands the air vehicle to arm its payload and lock its trajectory onto the target. AeroVironment won a \$990 million Switchblade production contract in last August. The Switchblade anti-personnel UAV weapon reportedly has been successful in Ukraine against Russian light combat vehicles and other valuable targets of opportunity. Ukraine officially uses the Switchblade 300 attack drone. For more information contact AeroVironment online at www.avinc.com/lms/switchblade-600, or the Army Contracting Command-Aberdeen Proving Ground at <https://acc.army.mil/contractingcenters/acc-apg/>.

Boeing continues work on autonomous large-displacement unmanned underwater vehicle (UUV)

U.S. Navy unmanned submarine experts are asking the Boeing Co. to continue technical support of the Orca Extra Large Unmanned Undersea Vehicle (XLUUV) to undertake long-endurance missions to deploy sensors or other UUVs. Officials of the U.S. Naval Sea Systems Command in Washington announced an \$8.5 million order to the Boeing Defense, Space & Security segment in Huntington Beach, Calif., for engineering support services in support of

the XLUUV program. The order involves continued engineering and technical support of system design, testing, and delivery of the large-displacement uncrewed undersea vehicle. Extra-large UUVs typically are autonomous mini-submarines that measure about seven feet in diameter — sometimes larger. They are designed for launch from shore or from large military ships with well decks, or from large civil vessels with moon pools. The modular-construction Boeing Orca XLUUV will be an open-architecture reconfigurable unmanned underwater vehicle (UUV) with the core vehicle providing guidance and control, navigation, autonomy, situational awareness, core communications, power distribution, energy and power, propulsion and maneuvering, and mission sensors, Navy officials say. For more information contact Boeing Defense, Space & Security online at www.boeing.com/defense/xluuv#gallery, or Naval Sea Systems Command at www.navsea.navy.mil.

Robot-to-drone food deliveries take off in Dallas

Though not exactly commonplace quite yet, rolling robots have been delivering goods to local customers for a while now. At the same time, packages have been flying overhead by drone. Now Serve Robotics and Wing Aviation are ready to merge the two. Serve Robotics in San Francisco has teamed with Google's Wing Aviation to use Serve's ground delivery robots with Wing's drone autoloader which will enable deliveries up to six miles away. Serve

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Machine autonomy to let military unmanned ground vehicles (UGVs) go as fast as they can

BY John Keller

ARLINGTON, Va. – Computer scientists at the University of Washington in Seattle are continuing a project to develop machine autonomy that enables unmanned ground combat vehicles to maneuver safely over rough off-road terrain at speeds a human driver could achieve.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., announced a \$10.5 million contract to University of Washington for the Robotic Autonomy in Complex Environments with Resiliency (RACER) phase-two program.

Such a vehicle should be able to operate quickly over unstructured off-road terrain at speeds limited not by the autonomy software or processing time, but only by onboard sensor limitations and vehicle mechanical limits. Its speed should be similar to that of a human driver or a tele-operated

▲ **UGVs should be able to operate off-road at speeds limited not by machine autonomy, but only by sensor limitations and vehicle mechanical limits.**

vehicle. This contract follows an initial \$10.4 million RACER contract awarded to University of Washington in 2023 for the RACER program.

In addition to University of Washington, Carnegie Mellon University in Pittsburgh and NASA-Jet Propulsion Laboratory in Pasadena, Calif., have been involved in the RACER program.

The three RACER teams have conducted live on-vehicle tests at the National Training Center at Fort Irwin near Barstow, Calif., and at Camp Roberts, a California National Guard base in Monterey and San Luis Obispo counties in California.



The self-driving car industry is making rapid advances in on-road autonomous mobility of commercial cars, yet military off-road autonomy algorithms and capability development has lagged because of the increased complexity of the off-road problem, DARPA researchers say.

Military off-road must deal with 3D surfaces, hundreds of obstacles, incomplete mapping data, no defined road networks, and no driving rules. RACER seeks to develop machine autonomy algorithms that enable unmanned ground vehicles (UGVs) to operate at high speeds in open and complex terrain, with minimal interventions.

RACER phase-one focused on developing, maturing, and demonstrating algorithms on lightweight tactical all-terrain vehicles (LTATV) in three DARPA-hosted field experiments.

RACER phase-two is maturing technology, and increasing system speeds over long off-road distances and complex maneuver terrain with a decreasing number of human interventions. Phase-two, moreover, is using a combat-size vehicle for field demonstrations, while keeping to the LTATV for algorithm maturation.

DARPA is providing LTATVs equipped with a sensor suite, computing resources, an optional baseline autonomy stack, vehicle and sensor models, and initial data sets.

This brings the total value of the contract to \$23.1 million. University of Washington will do the work in Seattle and Ellensburg, Wash, and should be finished by March 2026. For more information contact University of Washington online at <https://racer.cs.washington.edu>, or DARPA at <https://www.darpa.mil/program/robotic-autonomy-in-complex-environments-with-resiliency>. ←

Continued from page 37

Robotics says the robot-to-drone delivery will enable merchants to tap into drone delivery without any changes to their facilities or workflow and extend the delivery area for sidewalk delivery robots. This collaboration represents an important step towards enabling highly automated delivery. “At Wing, we have been delivering food and other goods directly to consumers for over five years, completing more than 400,000 commercial deliveries across three continents. We have a proven ability to make deliveries quickly and efficiently,” said Adam Woodworth, CEO at Wing. “Both Wing and Serve offer innovative solutions that are changing the way goods are delivered. Through this pilot partnership, Wing hopes to reach more merchants in highly-congested areas while supporting Serve as it works to expand its delivery radius.”

MIT's Technology Review asks 'what's next for drones?'

Drones have been a mainstay technology among militaries, hobbyists, and first responders alike for more than a decade, and in that time the range available has

skyrocketed. No longer limited to small quadcopters with insufficient battery life, drones are aiding search and rescue efforts, reshaping wars in Ukraine and Gaza, and delivering time-sensitive packages of medical supplies. And billions of dollars are being plowed into building the next generation of fully autonomous systems. O'Donnell's work, which is part of the MIT Technology Review's “What's Next?” series, discusses how uncrewed technologies are being used by police, delivery companies, as autonomous weapons systems, and how/why the U.S. is domesticating its drone supply chain. On the first point, over 1,500 U.S. police departments now operate drones, primarily for search and rescue, crowd monitoring, and other tasks. Scottsdale, Arizona's police department used a drone to find a missing elderly man with dementia, but the FAA's “line of sight” rule limits its pilots' operational range. However, the department plans to deploy a new autonomous drone and is seeking FAA approval to fly beyond visual range. Capable of flying up to 57 mph and covering three miles, the drone will assist in tracking suspects and providing real-time visual support during traffic stops. ←



◀ MEDUSA is to be a tactical clandestine mining system using expendable unmanned underwater vehicles (UUVs) launched from submarine torpedo tubes. 170258311 © Razihusin I Dreamstime.com

UUVs to help U.S. submarines deploy ocean mines using torpedo tubes from long range

BY John Keller

WASHINGTON – U.S. Navy undersea warfare experts needed to enable submerged submarines to deploy ocean mines with unmanned vehicles from long ranges via the submarine's torpedo tubes. They found a solution from General Dynamics Mission Systems in Quincy, Mass.

Officials of the Naval Sea Systems Command in Washington announced a potential \$58.1 million contract to General Dynamics to develop the Mining Expendable Delivery Unmanned Submarine Asset (MEDUSA) system. The contract without options is for \$16 million.

MEDUSA will be an advanced maritime mining system with long-range offensive capabilities, and is to meet requirements for future submarine delivery of ocean mine payloads.

It is to be a tactical clandestine mining system, with expendable unmanned underwater vehicles (UUVs) launched from submarine torpedo tubes. The MEDUSA system will consist of the MEDUSA medium-class UUV, supporting equipment,

and payloads. This contract is for prototype design, test, and risk reduction. If design efforts are promising, the Navy may ask General Dynamics to build four MEDUSA prototype units as early as 2026.

MEDUSA development is to follow the Unmanned Maritime Autonomy Architecture (UMAA), which seeks to develop open-systems common, modular, and scalable software for unmanned maritime vehicles. The idea is to reduce costs and accelerate deploying autonomous systems at sea.

On this contract, General Dynamics will do the work in Quincy and Taunton, Mass; Fairfax and Manassas, Va.; Scottsdale, Ariz.; Middletown, R.I.; and Greensboro, N.C., and should be finished by September 2026.

For more information contact General Dynamics Mission Systems-Quincy online at <https://gdmissionsystems.com/about-us/major-locations/quincy>, or Naval Sea Systems Command at www.navsea.navy.mil. ◀



DARPA taps BBN for quantum optical sensors for SWaP-constrained applications like imaging

BY John Keller

ARLINGTON, Va. — U.S. military researchers needed electro-optical enabling technologies to enhance the precision and sensitivity of optical sensors in SWaP-constrained applications like active imaging; atomic sensing; navigation; microscopy; and communications. They found a solution from the RTX Raytheon BBN segment in Cambridge, Mass.

Officials of the U.S. Defense Advanced research Projects Agency (DARPA) in Arlington, Va., has announced a \$9.3 million contract to Raytheon BBN for the Intensity-Squeezed Photonic Integration for Revolutionary Detectors (INSPIRED) project.

The goal is develop small size, weight, and power consumption (SWaP) optical sensors with sensitivity below the quantum shot noise limit by using so-called squeezed light. Several contractors are expected to participate in this program.

Low-noise detectors are vital components in optical science and technology, DARPA researchers explain. Decreasing the noise in optical detection could increase chances of deploying advanced optical technologies in SWaP-constrained systems.

The quantum sensing advantage of squeezed light to date has not exceeded 10 decibels due to imperfections in even the highest-quality discrete optics. Yet recent advances in nonlinear integrated photonics and heterogeneous integration are

beginning to enable chip-scale photonic devices to outperform bulk discrete optical components.

The nonlinear effects that generate squeezed light are more efficient in chip-scale devices than in bulk devices due to stronger field confinement, researchers say. The inherent stability of solid-state photonic circuits and flexible component design also may provide significant performance advantages in manipulating quantum states of light.

The objective of the INSPIRED program is to develop electro-optical detector modules that integrate squeezed-light measurement techniques into form factors comparable to commercial photodetector modules, and increase sensitivity well beyond the quantum shot-noise limit, researchers say.

Getting there, though, will require broad innovation in materials, design, and fabrication to realize chip-scale photonic devices and circuits that efficiently can prepare, manipulate, and detect quantum states of light.

One challenging aspect of the program lies in achieving low aggregate loss in complex multi-component photonic circuits. Other challenges include generating a high squeezing ratio in size- and power-constrained photonic devices. Ultimately, producing such electro-optical systems should enable INSPIRED detectors to accurately measure weak signals.

The three-year INSPIRED program has two phases to develop a squeezed-light detector prototype. The first phase will develop the central chip-scale photonic devices for a squeezed-light detector, which will include a squeezed-light generator with high squeezing ratio and a phase-sensitive interferometer circuit with low optical loss.

The second phase will demonstrate squeezed-light detector prototypes with ultra-high sensitivity exceeding the quantum

shot noise limit in a module with volume comparable to commercial photodetector components that are currently available. This will include a prototype module using phase-one test articles.

For more information contact RTX Raytheon BBN online at <https://www.rtx.com/who-we-are/we-are-rtx/transformative-technologies/bbn>, or DARPA at <https://www.darpa.mil>. ◀

B.E. Meyers picked for weapon-mounted laser illuminator and pointer for night operations

BY John Keller

MacDILL AIR FORCE BASE, Fla. — U.S. special forces experts needed a rugged weapon-mounted laser pointer and illuminator system for military night operations. They found their solution from B.E. Meyers & Co. Inc. in Redmond, Wash.

Officials of the U.S. Special Operations Command (SOCOM) at MacDill Air Force Base, Fla., announced a \$49.9 million contract to B.E. Meyers in August for the Squad Aiming Laser–Ultra High Power (SAL-UHP) program.

The weapon-mounted laser pointer and illuminator will minimize size and weight while improving performance, reliability, and operability, SOCOM officials say, and will provide beam clarity over an extended zoom range.

The system will include operator controls to deliver appropriate irradiance to the target area at ranges greater than 900 meters, and also to decrease response times to increase lethality.

B.E. Meyers will design the system to survive immersion, recoil, and thermal shock, while maintaining zero position stability. The SAL-UHP is to meet MIL-STD-810H.

The SAL-UHP, part of the Miniature Aiming Systems – Laser (MAS-L) contract, will be a variant of the B.E. Meyers DAGIR Multi-Platform Advanced Laser System, and is to be based on a vertical-cavity, surface emitting laser (VCSEL) core for military night operations.

The DAGIR Multi-Platform Advanced Laser System is a weapon-mountable near-infrared illuminator and near-infrared plus visible aiming device incorporating advanced VCSEL technology that enables manipulation of the system.

The DAGIR series combines minimal size and weight while improving performance, reliability, and operability, and

is for applications that range from close-range carbine use to high-power extended-range machine gun applications, as well as integration with remote weapon stations.

The power and divergence controls on the DAGIR are digital; there is no optical or mechanical movement within the system apart from azimuth and elevation boresight controls. Divergence and power are synchronized for best pointing and illumination. DAGIR also can operate in training mode, or selectable power levels.

On this contract B.E. Meyers will have an ordering period of five years. For more information contact B.E. Meyers online at <https://bemeyers.com>, or U.S. Special Operations Command at www.socom.mil. ◀



▲ **B.E. Meyers will design the system to survive immersion, recoil, and thermal shock, while maintaining zero position stability.**

Safran to build more laser target locators for SWaP-conscious Army infantry warfighters

BY John Keller

ABERDEEN PROVING GROUND, Md. — U.S. Army land warfare experts are asking electro-optics engineers at Safran Optics 1 Inc. in Bedford, N.H., for additional next-generation laser target locator systems.

Officials of the Army Contracting Command at Aberdeen Proving Ground, Md., announced a \$275 million contract to Safran to build Laser Target Locator Module II (LTLM II) systems. A laser target locator enables foot soldiers identify target locations in daylight or at night, as well as in obscured-visibility such as fog or smoke.

The LTLM II is a lightweight handheld laser target locator with a color day camera and night sight, and a selective availability anti-spoof module (SAASM) Global Positioning System (GPS) receiver. The contract includes spare parts and maintenance.

LTLM II is a second-generation lightweight handheld laser target locator with a direct view optic, uncooled thermal camera, low-light camera, eye-safe laser range finder, digital magnetic compass, and a selective availability anti-spoofing module GPS receiver.

It provides infantry forward observers, scouts, snipers, and platoon leaders all-weather capability to locate targets and transmit target data. With LTLM II, Soldiers can determine a target location in seconds. In 2021 Safran delivered the 4,000th LTLM II to the Army.

The LTLM II is smaller and more affordable than previous laser targeting systems, such as the lightweight handheld Laser Target Locator Module (LTLM), which is being manufactured by the BAE Systems Electronic Systems segment in Hudson, N.H.

The Army awarded BAE Systems a \$23 million contract to provide the LTLM in February 2012. The company is providing the company's Target Reconnaissance Infra-Red Geolocating Rangefinder, or TRIGR, which helps soldiers determine target coordinates quickly and accurately.

For LTLM II, however, Army officials say weight is an crucial factor. The goal for this next-generation laser rangefinder is to reduce the system's size, weight and power (SWaP)

consumption while decreasing its cost. Safran won its original LTLM II contract in July 2016.

Among the laser targeting products from Safran is the company's Handheld Precision Targeting Device (HHPTD) — a lightweight, multi-functional, integrated sensor that provides accurate target coordinates for precision target engagement.

The multispectral device delivers precision target coordinates by using several north-finding solutions and displays a 90-percent target location error measurement in the bi-ocular eyepiece, Safran officials say.

The field-proven HHPTD system provides precision target measurements and long-range observation capability in day or night and under all-weather environments. For more information contact Safran Optics 1 online at <https://www.safran-group.com/companies/optics-1-inc>, or the Army Contracting Command-Aberdeen at <http://acc.army.mil/contractingcenters/acc-apg>. ◀

▼ The LTLM II is a lightweight handheld laser target locator with a color day camera and night sight, and a selective availability anti-spoof module. Army photo





RTX Raytheon to upgrade FLIR targeting sensors aboard armored combat vehicles

BY John Keller

ABERDEEN PROVING GROUND, Md. — Electro-optics experts at RTX Corp. helping the U.S. Army upgrade forward-looking infrared (FLIR) sensors for improved targeting and surveillance for armored combat vehicles.

Officials of the Army Contracting Command at Aberdeen Proving Ground, Md., announced an \$86.7 million order to the RTX Raytheon segment in McKinney, Texas, for components related to Army third-generation FLIR sensor technology.

Raytheon will carry out low-rate initial production (LRIP) of Third Generation Forward Looking Infrared B-Kits for the Army's third-generation forward looking infrared program.

B-Kits consist of components that will be integrated into sights of ground vehicles for reconnaissance, surveillance, and target acquisition. These B-Kit upgrades will help Army

▲ **Third-generation FLIR technology is replacing second-generation FLIR sights, starting with those in the Abrams tank and the Bradley fighting vehicle.** *Army photo*

infrared sensors aboard armored combat vehicles provide a common picture across all host vehicles.

Common components include high-definition mid-wave infrared

and long-wave infrared dual-band focal plane array, Dewar Cooler Bench (DCB), optics, and electronics to convert thermal radiation into video images to assist with targeting.

Third-generation FLIR technology is replacing second-generation FLIR sights, starting with those in the Abrams tank and the Bradley fighting vehicle.

On this order, Raytheon will do the work in McKinney, Texas, and should be finished by June 2029. For more information contact RTX Raytheon online at www.rtx.com/raytheon, or the Army Contracting Command-Aberdeen Proving Ground at <https://acc.army.mil/contractingcenters/acc-apg/>. ◀

Lockheed Martin eyes aerial targeting using infrared sensors for search and track

U.S. Navy air combat experts are moving forward with early production of the Infrared Search and Track (IRST) Block II aerial targeting system for the F/A-18E/F Super Hornet jet fighter-bomber under terms of a \$132.4 million order. Officials of the Naval Air Systems Command at Patuxent River Naval Air Station, Md., are asking the Lockheed Martin Corp. Missiles and Fire Control segment in Orlando for critical components for the IRST Block II. IRST Block II enables the Super Hornet to detect, track, and attack enemy aircraft in a stealthy way without making its presence known. The order asks Lockheed Martin to provide 37 infrared receivers — 31 for the Navy and six for the Royal Australian Air Force (RAAF); 28 processors — 24 for Navy and four for the RAAF; and 18 inertial measurement units — 16 for the Navy and two for the RAAF. These components are in support of the procurement and delivery of IRST Block II low-rate initial production lot eight systems. The order includes 3,000 Texas Instruments integrated circuits to protect against obsolescence. On this order Lockheed Martin will do the work in Orlando and Ocala, Fla.; Santa Barbara, Calif.; and Archibald, Pa. and should be finished by April 2028. For more information contact Lockheed Martin Missiles and Fire Control online at www.lockheedmartin.com/en-us/who-we-are/business-areas/missiles-and-fire-control/products.html, or Naval Air Systems Command at www.navair.navy.mil.

Army briefs industry on developing active-protection vetronics against anti-tank weapons

WARREN, Mich. — U.S. Army armored combat vehicles experts briefed industry in November on a vetronics project to enable military vehicles to detect and destroy incoming anti-tank weapons before they can hit their targets. Officials of the U.S. Army Contracting Command-Detroit Arsenal in Warren, Mich., briefed industry on the Soft Kill Active Protection System is to protect ground combat vehicles from anti-tank weapons by detecting an incoming threat, identifying a countermeasure, and neutralizing the threat. The system must be safe, modular, and expandable using open-systems standards. It also must integrate future sensors and countermeasures easily, and comply with the Modular Active Framework (MAF). MAF 1.0 is the Army's roadmap to standardize the development and upgradability to

ensure that vehicular active protection systems are modular, upgradable, safe, and secure, and seeks to make Army combat vehicles affordable, common, interchangeable and able to be integrated with any active protection subsystem. MAF 1.0 is one of two primary products that will result from the Army's Modular Active Protection Systems (MAPS) program, which is an initiative to enhance the survivability of military vehicles against modern threats, such as anti-tank guided missiles (ATGMs), rocket-propelled grenades (RPGs), and other projectiles. MAPS uses an open architecture framework, allowing for the integration of various sensors, effectors, and countermeasure systems from different manufacturers. The Soft Kill Active Protection System project requires modular software and hardware that can expand with other systems as the MAF standard evolves.

Lockheed Martin to build missiles with multi-mode guidance for crewed and uncrewed aircraft

Missile experts at Lockheed Martin Corp. will build advanced air-to-ground missiles for uncrewed aerial vehicles (UAVs) and manned attack helicopters under terms of a \$42 million order. Officials of the Army Contracting Command at Redstone Arsenal, Ala., are asking the Lockheed Martin Missiles and Fire Control segment in Orlando, Fla., to build AGM-114 laser-guided Hellfire II missiles and the AGM-179 Joint Air-to-Ground Missile (JAGM). The AGM-114R is the latest Hellfire II variant, and is equipped with semi-active laser seekers to defeat many kinds of targets. The AGM-114R can be launched from several different kinds of fixed-wing aircraft and helicopters, surface ships, and military ground vehicles. The JAGM is to replace U.S. Army and Navy inventories of Airborne TOW, Maverick, and Hellfire air-to-ground missiles. Lockheed Martin is developing the JAGM for launch from the Army AH-64 Apache attack helicopter, the Army MQ-1C Gray Eagle uncrewed aerial vehicle (UAV), the Navy MH-60R helicopter, and the Marine Corps AH-1Z Viper attack helicopter. JAGM has a multi-mode guidance section with semi-active laser (SAL) sensor for precision-strike and a fire-and-forget millimeter wave (MMW) radar for moving targets in all-weather conditions. The small missile is nearly six feet long, seven inches in diameter, and weighs 108 pounds. On this order Lockheed Martin will do the work in Orlando, Fla., and should be finished by September 2027. ←

RADAR

▼ Marines order four gallium nitride (GaN)-based G/ATOR radar systems

U.S. Marine Corps surveillance experts are asking Northrop Grumman Corp. to build four new mobile land-based radar systems to protect Marines on attack beaches from rockets, artillery, mortars, cruise missiles, unmanned aerial vehicles (UAVs), and other low observables.

Officials of the Marine Corps Systems Command at Quantico Marine Base, Va., announced a \$167.1 million five-year order to the Northrop Grumman Corp. Mission Systems segment in Linthicum, Md., for four Ground/Air Task Oriented Radar (G/ATOR) systems.

G/ATOR is an expeditionary, three-dimensional, short-to-medium-range, multi-role radar system designed to detect low-observable targets with low radar cross sections such as rockets, artillery, mortars, cruise missiles, and UAVs. Marine Corps leaders are developing and fielding G/ATOR in three blocks for use by the Marine Air Ground Task Force across the range of military operations, officials say.

Northrop Grumman is upgrading G/ATOR by switching the system's gallium arsenide (GaAs) technology to gallium nitride (GaN) technology. G/ATOR, which was developed originally with GaAs RF and microwave integrated circuit technology.

Northrop Grumman began converting G/ATOR radar systems from GaAs to GaN technology in 2015 to make the system more effective, and to reduce its costs, and reduce its weight and power consumption.

Substituting gallium nitride electronic components for older gallium arsenide technology will help Northrop Grumman and the Marine Corps reduce the mass of the G/ATOR system without compromising its performance, officials say.

Reducing size, weight, and power consumption (SWaP) especially is important for the G/ATOR system because Marine Corps leaders plan to use the system on attack beaches to help defend Marine expeditionary forces from low-observable threats. The system must be sufficiently small and lightweight to accompany Marines in their initial land attacks.

Northrop Grumman built G/ATOR for short-range air-defense (SHORAD) and tactical air operations Center (TAOC) air surveillance missions, including identification friend-or-foe (IFF). The increment I design was to provide for growth to all following increments without equipment re-design and provide an open architecture to enable upgrades with following increments.

The G/ATOR program was to showcase new component technologies, including the then-new VPX embedded computing fast switch-fabric interconnect. As part of the G/ATOR program's first increment, Northrop Grumman awarded a \$4.3 million contract in 2008 to the Curtiss-Wright Corp. Defense Solutions segment in Ashburn, Va., for VPX-based embedded computers for radar signal processing, to be delivered by 2010.

The Ground Weapons Locating Radar (GWLR) portion of G/ATOR uses active electronically scanned array (AESA) radar technology to provide several different radar missions and adapt automatically to changing battlefield conditions.

On this order Northrop Grumman will do the work in Linthicum Heights and Hampstead, Md.; East Syracuse and Rochester, N.Y.; Stafford Springs, Conn.; Tulsa, Okla.; Santa Clarita and San Diego, Calif.; Atlanta; and other



locations, and should be finished by February 2029.

For more information contact Northrop Grumman Mission Systems online at www.northropgrumman.com/who-we-are/business-sectors/mission-systems, or Marine Corps Systems Command at www.marcorsyscom.marines.mil.



AIRCRAFT RADIOS

▲ Army turns to BAE Systems for software-defined avionics radios for helicopters and fixed-wing aircraft

U.S. Army aviation experts needed airborne radios for helicopters and fixed-wing aircraft. They found their solution from the BAE Systems Electronic Systems segment in Fort Wayne, Ind.

Officials of the Army Contracting at Aberdeen Proving Ground, Md., announced a near-half-billion-dollar 10-year contract to BAE Systems for AN/ARC-231A multi-mode aviation radio suite hardware components, repair services, as well as technical, engineering, and logistic support. The value of the 9 April 2024 contract to BAE Systems is \$459.8 million over the next decade.

The BAE Systems AN/ARC-231A avionics radio is part of the company's Fire series of aviation radios, which are software communications architecture (SCA) and software-defined radio (SDR) designs.

The ability to program these aviation radios can reduce the time it takes to field evolving communication needs, special mission modifications, and performance enhancements, BAE Systems officials say.

These software-defined radios support joint service interoperable voice and data standards for line-of-sight and beyond-line-of-sight VHF and UHF radio communications.

The AN/ARC-231A offers embedded NSA-certified Type 1 cryptography for voice and data security, and

also provides communication capabilities of its predecessor with electronic counter-counter measures such as SATURN, HAVE QUICK, and SINCGARS.

The radios offer DAMA and IW UHF satellite communications (SATCOM) modes, and control interface options like independent red and black MIL-STD-1553, Ethernet, and USB for flexible integration and mission deployment.

The avionics radios provide ED-23C (8.33 kHz) internationally compliant air traffic control communications and mandatory U.S. and NATO capabilities.

Future upgrades eventually could bring the BAE Systems AN/ARC-231A up to capabilities of the company's Starfire radios, which provide secure anti-jam, voice, and data communications in a compact radio set, which handle legacy frequency bands, AM/

FM, voice, and data with air traffic control, maritime, and hailing modes, as well as 8.33 kHz, 5 kHz and 25 kHz channel spacing with frequency range extendable to 2 GHz.

On this contract BAE Systems will do the work at locations to be determined with each order, and should be finished by April 2034. For more information contact BAE Systems Electronic Systems online at <https://www.baesystems.com/en-us/our-company/inc-businesses/electronic-systems>, or the Army Contracting Command-Aberdeen Proving Ground at <https://acc.army.mil/contractingcenters/acc-apg/>.

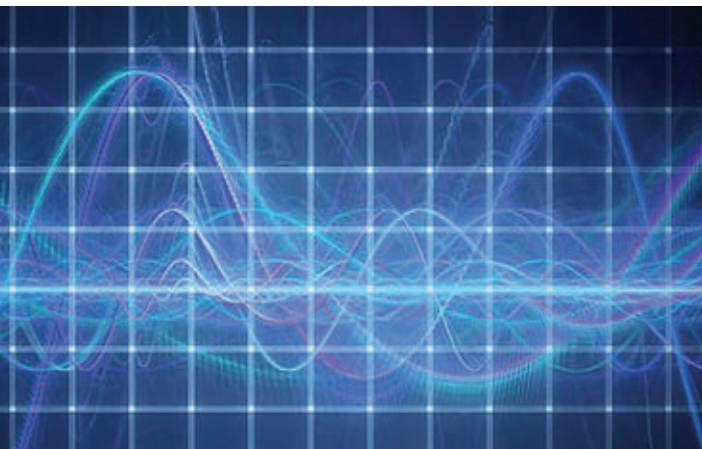
RF AND MICROWAVE

▼ HRL Labs to help develop RF technology for space-constrained sensors and communications

RF and microwave experts at HRL Laboratories LLC in Malibu, Calif., are joining those at SRI International in Menlo Park, Calif., on a U.S. military project develop small RF receivers, transmitters, and antennas for space-constrained applications in sensors and communications.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., announced a \$23.2 million contract to HRL Laboratories for the Macaroni project to develop tiny RF receivers and transmitters. Details of the project are secret.

DARPA announced a \$16.8 million Macaroni contract to SRI International in early April. DARPA is asking HRL



Labs and SRI International to develop RF and microwave components that not only should exceed today's state of the art, but also that should seek to overcome long-established design limitations of the so-called Chu Limit that constrains the bandwidth of data that can be sent and received from small antennas.

Measurement and control of the electromagnetic spectrum is a key research area the U.S. Department of Defense (DOD), researchers point out. Spectrum dominance requires quick and efficient control of electromagnetic radiation from DC to the X-ray regime.

The primary challenge of the Macaroni project that HRL Labs and SRI International will face involves receivers and transmitters that are much smaller in size than the wavelength of the sent and received electromagnetic radiation.

In classical antenna theory, the sensitivity-bandwidth product is fundamentally limited by the shape and size of the antenna. This performance degrades significantly as the antenna size becomes much smaller than the electromagnetic wavelength of operation.

Yet space-constrained applications are driving efforts to move beyond traditional constraints, and develop efficient, electrically small antennas still presents a challenge.

Recent advances in quantum sensors, materials science, electromagnetic shielding, laser technology, resonators, cryogenic systems, and vacuum components have pushed the state of the art in sensing technologies. As these enabling technologies improve, a wider variety of protocols and methodologies become possible and previous notions of the performance limits require validation, researchers say.

For transmitters, new insights in active antenna technology, control schemes, methods of impedance

matching, and strategies for volume filling also present new opportunities. Recent efforts in piezoelectrics, magnetoelectrics, high-index materials, and multiferroic materials may be leveraged to improve the efficiency trade space for small antennas.

DARPA researchers are asking HRL Labs and SRI International for transmit and receive technologies that can achieve performance beyond the Chu limit that can incorporate electric and magnetic technologies — especially in solutions that minimize the antenna size relative to the operating wavelength.

The Macaroni program is a 45-month three-phase program with an 18-month first phase, an 18-month second phase, and a nine-month third phase. The project emphasizes two technical areas: receivers and transmitters.

HRL Labs and SRI International will focus on receiver work involving receive sensitivity, link closure, and systems integration. The company's transmitter work will focus on transmitter strength, demonstrating a transmitter system, and system ruggedization.

For more information contact HRL Laboratories online at www.hrl.com, SRI International at www.sri.com, or DARPA at www.darpa.mil/program/macaroni.

CYBER SECURITY

► Air Force picks SRC to help safeguard military avionics from cyber attack

U.S. Air Force researchers needed new ways to identify and mitigate vulnerabilities to military avionics from cyber attack. They found their solution from SRC Inc. in North Syracuse, N.Y.

Officials of the Sensors Directorate of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio, announced a \$60 million seven-year contract to SRC for the Radio Frequency (RF) Electronic Warfare (EW) Focused Laboratory Evaluations of Critical Technologies (REFLECT) program. SRC prevailed in this contract competition over four other defense companies.

This trusted computing contract provides for exploring new and emerging concepts related to development, integration, assessment, evaluation, and demonstration of cyber security, open system architecture, novel avionics, sensor technologies, and multi-domain technologies focusing on the electric warfare piece of the avionics, Air Force officials say.

REFLECT also seeks to develop simulation capabilities necessary to develop advanced sensors and avionics

technologies, develop agile electronics architecture, and expand emerging open-systems standards for military weapons. The goal is to explore new and emerging technologies related to fending-off cyber-attacks, cyber security, open system architectures, avionics, and sensors.

REFLECT avionics involve manned, unmanned, autonomous, and remotely piloted vehicles; on-board intelligence, surveillance, and reconnaissance (ISR) systems; EW systems, and munitions.

The specific focus is on advanced RF and digital EW simulations, threat models, sensor evaluations, and cutting-edge technology development in the RF domain.

The contract requires SRC to have Top Secret or Sensitive Compartmented Information (SCI) clearances, and deep knowledge of the information related to International Traffic in Arms Regulation (ITAR) export control regulations.

On this contract SRC engineers will do the work in New York, Virginia, Ohio, and Texas, and should be finished by April 2031. For more information contact SRC online at www.srcinc.com, or the Air Force Research Laboratory at www.afrl.af.mil.



ELECTROMAGNETIC WEAPONS

▲ Navy eyes prototypes in electromagnetic weapons and laser weapons to protect ships

U.S. Navy electromagnetic warfare experts needed prototypes and evaluation of high-power RF and millimeter wave effects and technologies to help protect naval warships. They found a solution from Envisioneering Inc. in Alexandria, Va.

Officials of the Naval Research Laboratory (NRL) in Washington announced a \$99 million contract to Envisioneering for research support in high-power electromagnetic systems development, application, and testing.

Envisioneering experts will help design prototype high-power RF electromagnetic weapons, and help evaluate RF and millimeter wave effects and technologies to help safeguard Navy surface warships.

Envisioneering also will look into ultra-short-pulse (USP) and high-energy laser technologies to improve countermeasures in the RF, millimeter wave, infrared bands to counter future enemy missiles, improvised explosive devices (IEDs), uncrewed aerial vehicles (UAVs), and attacking swarms of small boats.

NRL and its support contractors previously have developed experimental countermeasure and high-power microwave technologies that require additional design, prototyping, and initial limited production. Envisioneering



will provide experienced scientific, technical, management, and logistics personnel for this effort.

Directed-energy technologies like high-power RF, high-energy and high-power laser weapons and electrostatic discharge (ESD) systems are applicable technologies to neutralize anticipated future threats to surface warships, ranging from conventional threats and swarm attacks, to pirating and unmanned vehicles.

Efforts will revolve around high-power microwaves to counter electronic sensors, UAV detection and defeat, threat analysis of anti-ship cruise missiles and the evaluation of specific high-power microwave and countermeasure system performance against those threats.

On this contract Envisioneering will do the work at the Naval Research Lab in Washington, and should be finished by September 2025. For more information contact Envisioneering online at <https://envisioneeringinc.com>, or the Naval Research Lab at www.nrl.navy.mil.

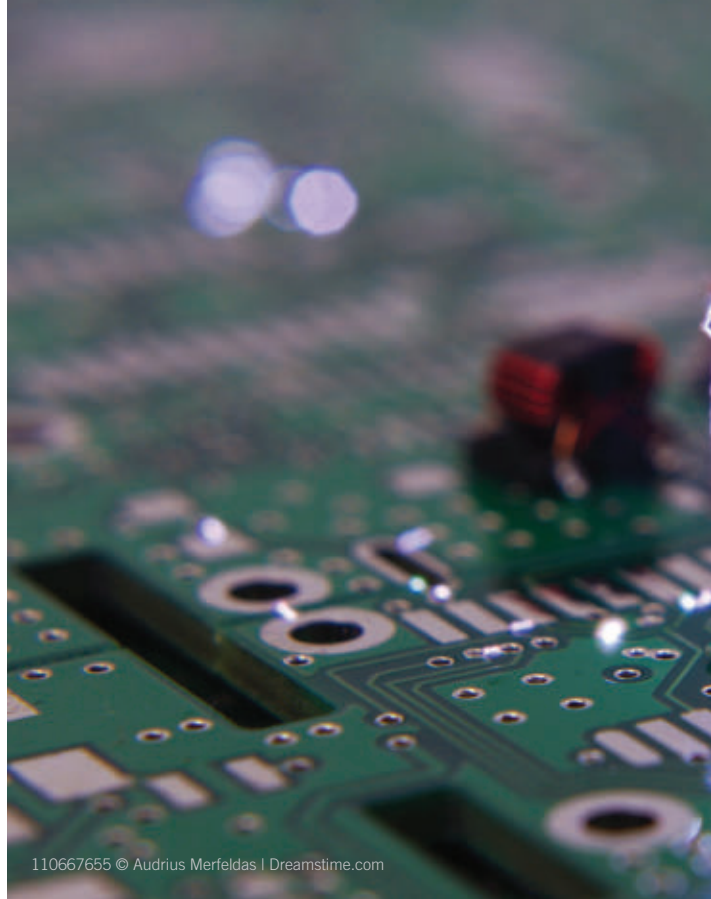
DATA RECORDERS

▼ Safran to provide modular-design airborne data recording hardware for naval aircraft

U.S. Navy airborne data storage experts needed modular data recorder system hardware for a variety of naval aircraft. They found their solution from Safran Defense and Space Inc. in Norcross, Ga.

Officials of the Naval Air Warfare Center Aircraft Division at Patuxent River Naval Air Station, Md., announced a \$47 million contract to Safran for data recording hardware.

Safran will provide solid-state recorders, recorder modules, cameras, connector kits, and power supplies that



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together form completed airborne instrumentation modular data recording systems.

These components are for the Naval Air Systems Command Special Flight Test Instrumentation Pool under the Prototyping Instrumentation and Experimentation Department for use on F/A-18, EA-18G, V-22, F-35, E-6, C-130, CH-53K, MQ-4, MQ-8, MQ-25, P-8, H-1, and MH-60 aircraft.

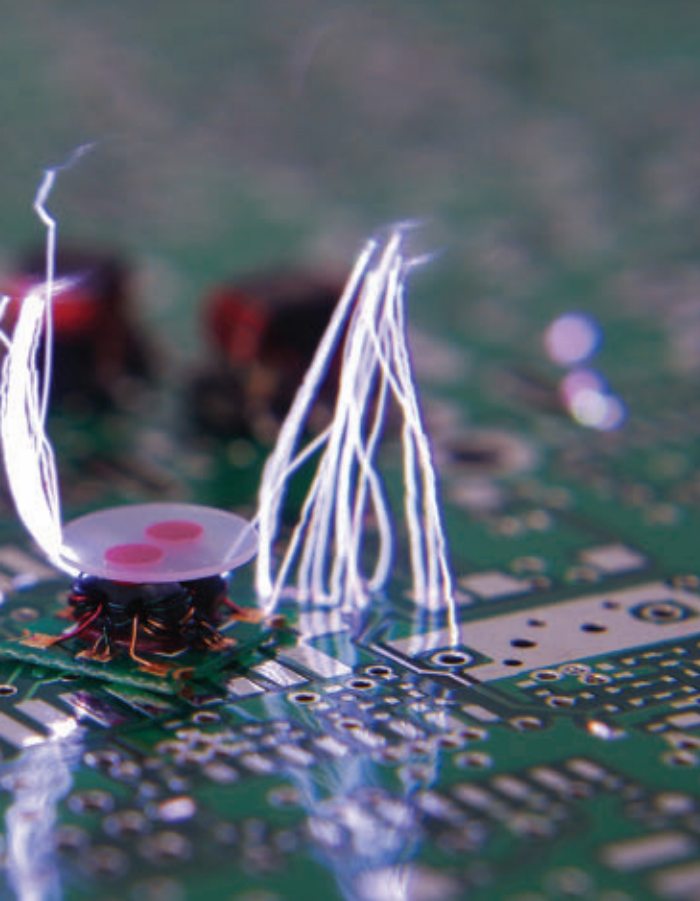
Safran Defense & Space Testing & Telemetry Business Unit (formerly Safran Data Systems) offers modular-design data recorders, flight test instrumentation, aircraft data management, tracking telemetry antennas, and on-the-ground data collection and analysis systems.

The company specializes in advanced onboard data acquisition, data recorders, download stations, RF receivers and recorders, and telemetry tracking antennas that can acquire, transmit, collect, and analyze data in real time.

The company's mission data management systems are intelligence, surveillance, and reconnaissance (ISR); search and rescue; mission planning; and training.

On this contract, Safran will do the work at Patuxent River Naval Air Station, Md., and should be finished by October 2029. For more information contact Safran Defense and Space online at www.safrandatasystems.com, or the Naval Air Warfare Center Aircraft Division at www.navair.navy.mil/nawcad.





ELECTRONICS PROTECTION

▲ Companies help Navy safeguard high-altitude electronics from electromagnetic pulse (EMP)

U.S. Navy electronics experts are hiring two companies to develop enabling technologies to safeguard naval systems from the effects of high-altitude electromagnetic pulse (EMP).

Officials of the Naval Information Warfare Center Pacific in San Diego, announced estimated \$12.5 million separate contracts to Long Wave Inc. in Oklahoma City, and to Reliance Construction Co. in Cary, N.C., for high-altitude EMP hardening processes.

These enabling technologies are expected to protect sensitive electronics on satellites, aircraft, surface ships, and ground systems from EMP energy, which can destroy or disable a wide range of electronics. EMP, which typically comes from high-power microwaves, often results from above-ground nuclear explosions.

High-altitude EMP protection seeks to ensure survivability from a high-altitude electromagnetic pulse event. Since high-altitude electromagnetic pulse shield systems are easily rendered ineffective by incorrect usage and/or inadequate life cycle maintenance, tests, inspections, and maintenance are necessary.

EMP hardening maintenance seeks to uphold the designed levels of protection, and can involve infrastructure or structural changes and upgrades. Long Wave and Reliance Construction will carry out high-altitude EMP processes, testing, hardness maintenance and hardness surveillance.

The two companies will carry out the first task orders in \$20,000 orders. The total obligated amount on orders for all the awarded contracts combined will not exceed \$12.5 million, Navy experts say.

Long Wave specializes in installation and maintenance of very-low-frequency, low-frequency, and high-frequency (VLF/LF/HF) communications systems, nuclear command and control communications, and systems engineering. Reliance Construction, meanwhile, is a general-construction contractor.

For more information contact Long Wave online at www.longwaveinc.com, Reliance Construction at www.reliance-cc.com, or the Naval Information Warfare Center Pacific at www.niwc-pacific.navy.mil.

DESIGN AND DEVELOPMENT TOOLS

▼ Galois to provide trusted computing hardware and software design and development tools

U.S. military researchers needed hardware and software design and development tools to guarantee that software is running correctly by combining formal methods and side-channels. They found a solution from Galois Inc. in Portland, Ore.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., announced a \$12.6 million contract to Galois for the Continuous-correctness On Opaque Processors (COOP) program to develop new trusted computing approaches.

Galois will develop secure design and development tools and techniques to guarantee that software is running correctly if and only if the device physics is correct by combining formal methods and side-channels to unify computer science and physics.

COOP solutions will guarantee software correctness on any digital processor with low overhead. Analog and mixed-signal hardware are of interest, but only after achieving program goals for digital hardware.

Reliability physics is grounded in mathematics and can serve as the rigorous, stable, and tautological basis



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for formal analysis. Still, side-channels only can detect errors; they cannot correct the errors.

Today's safety-critical system design principles such as triple modular redundancy with majority voting or n-variant redundancy could detect, isolate, and correct errors continuously, but the performance penalties are prohibitive for mass deployments.

The solution lies in developing new techniques that can achieve revolutionary improvements in continuous-correctness guarantees and performance.

Galois engineers will develop a threat model that is expected to change, as control boundaries depend on the proposed solutions. A COOP solution that completely mediates all accesses between a processor and the rest of the system can assume that only the processor and non-mission-critical software are untrusted.

The opaque processor and non-mission-critical software components are free to attempt to violate the computational integrity of mission-critical software as long as the goal is not a denial-of-service attack on the system, except when the denial-of-service vulnerability was newly introduced by the proposed approach. It is within the physical limitations of the components and behavior would not render the component commercially non-viable.

To ensure that COOP solutions can be integrated with processors that are manufactured separately,

Galois will develop solutions between two system boundaries. COOP solutions could reside within a processor package, but not on the same die. COOP solutions also could reside within a computer case, but not outside where additional resources are available.

Potential embodiments of a COOP solution include integration within a processor's package, co-located on a board, and independently located on a daughter card. Any proposed embodiment must be able to sense multi-modal side-channels within the computer case.

There are two program-identified technical challenges to COOP program goals: provable physics-based software error isolation; and continuous provable error correction. The COOP program is interested in tools and techniques that can provably isolate mission-critical software errors.

The first phase of the COOP program will demonstrate a solution on a general-purpose processor with multi-threaded cores in simulation. The second phase will demonstrate the COOP solution on real hardware.

On this contract Galois will do the work in Dayton and Columbus Ohio; Portland, Ore.; Tempe, Ariz.; Exton and Pittsburgh, Pa.; Irvine and San Francisco Calif.; Cambridge, Mass.; and Brooklyn, N.Y., and should be finished by April 2026.

For more information contact Galois online at <https://galois.com>, or DARPA at <https://www.darpa.mil>. ←

POWER SUPPLIES

► **Radiation-hardened DC-DC converter for military and commercial space introduced by VPT**

VPT Inc. in Blacksburg, Va., is introducing the radiation-hardened SGRBX gallium nitride (GaN)-based DC-DC converter for space power control and conditioning applications that require high efficiency and low noise. Housing as many as four SGRB DC-DC converter slices, the SGRBX delivers as much as 1600 Watts of output power. Using the SGRB's advanced fixed frequency and reduced voltage switching topology, the SGRBX has extremely low input and output noise. In addition, the radiation-hardened SGRBX features an integrated EMI filter, guaranteed total ionizing dose (TID) performance to 100 kilorads including ELDRS, SEE performance to 85 MeV/mg/cm², and efficiency as high as 96 percent. Systems designers can use several SGRBX boxes in parallel to reach higher power levels depending on program requirements. The SGRBX is designed for demanding commercial, scientific, and military space environments. For more information contact VPT online at www.vptpower.com.

DATA STORAGE

▼ **Mil-spec network-attached data storage for artificial intelligence (AI) offered by Phoenix**

Phoenix International Systems Inc. in Orange, Calif., is introducing the RPC4 rugged network attached storage/data logger for edge computing, autonomous vehicles, and artificial intelligence (AI) applications. The high-performance storage system that can acquire data at speeds far exceeding what a traditional embedded systems can sustain. The RPC4 is a rugged, resilient data storage system for high data throughput, and high-capacity tactical edge data capture applications. It writes at speeds to 9.6 gigabytes per second, and writes at 12 gigabytes per second. The data storage system is configured with four NVMe solid-state



drives with a rapidly removable magazine that enables users to swap-out a full magazine for a fresh magazine to store and move data from edge environments quickly and without any tools. The magazines can then be moved to separate locations and plugged into another RPC4 on any other network for further analysis. The mil-spec RPC4 offers reliable, high-speed data capture; a highly available and resilient architecture; quickly upload of data with removable drive magazine; as much as 120 terabytes storage capacity; AES-256 hardware and file level encryption; FIPS 140-2 validation; secure erase/data elimination; MIL-STD-810G design; and is made in U.S. Phoenix International's RPC4 targets Mobile (Air-Sea-Ground) and Fixed Expeditionary environments with its MIL-STD-810G design. It addresses the demanding requirements of data capture in any challenging environment. For more information contact Phoenix International Systems online at www.phenxint.com.



AVIONICS NETWORKING

▲ **MIL-STD-1553 databus interface with embedded cyber security offered by DDC**

Data Device Corp. (DDC) in Bohemia, N.Y., is introducing the Total-ACE CR cyber-resilient MIL-STD-1553 avionics databus interface for secure networking in a variety of aerospace and defense applications. The Total-ACE CR component is a drop-in replacement for DDC's BU-64863T8 Total-ACE with a 1553 protocol



interface layer, integrated memory, dual transceivers, and transformers, all encapsulated in a plastic BGA package. The databus interface offers the Hardware Watchdog that mitigates inherent cyber security weaknesses within the MIL-STD-1553 protocol, and integrates cyber resiliency within the 1553 protocol layer. This means that users can fortify their avionics networking against cyber security threats without compromising on performance. The embedded cyber-resilient features offer a secure and simplified method to add cyber mitigation to existing and new designs. DDC engineers developed the Total-ACE CR avionics networking interface in coordination with the U.S. Air Force Cyber Resiliency Office for Weapon Systems (CROWS). For more information contact DDC online at www.ddc-web.com/en/connectivity/databus/milstd1553-1/components-1/total-ace-cr-prototype-cyber-resilient-mil-std-1553-solution.

POWER ELECTRONICS

▼ Microchip introduces integrated actuation power for electric aircraft

Microchip Technology in Chandler, Ariz., is introducing an integrated actuation power electronics system for electric actuation systems in aircraft. The power system combines companion gate driver boards with Microchip's Hybrid Power Drive (HPD) modules, available in silicon carbide or silicon technology with a power range of 5 to 20 kilovolt-amperes. The integrated system maintains a consistent size regardless of power output and is designed for applications like flight controls, braking, and landing gear electrification. The devices undergo testing for DO-160 standards. They have protection features such as short circuit protection and under-voltage lockout. Designed for low electromagnetic interference and noise immunity,

the gate driver boards use external pulse width modulation signals that comply with TIA/EIA-644 standards. They provide telemetry outputs for monitoring critical parameters such as current and temperature. The gate driver boards operate in temperatures from -55 to 110 degrees Celsius, and require one 15-volt DC input. For more information contact Microchip Technology online at www.microchip.com.



RUGGED COMPUTERS

▲ Rugged tablet computer and display for vehicle applications introduced by GMS

General Micro Systems Inc. (GMS) in Rancho Cucamonga, Calif., is introducing the lightweight portable and intelligent X9 Spider Rugged Thunderbolt 4 tablet computer and display for mounted and dismounted use on military land vehicles and surface warships. Designed to go from mounted display to tucked under the arm as a dismounted handheld tablet computer with an ARM-based Qualcomm AI processor and built-in I/O, this fanless sealed X9 Spider is a smart version of the GMS high-definition (HD) rugged Thunderbolt display. The system adds the Qualcomm QRB6165 embedded/AI processor, and can be mounted on a ship or vehicle; mounted and then dismounted for portable operations; or used exclusively as a lightweight handheld self-contained tablet computer. With a daylong battery, the tablet meets several mission profiles in different vehicles, platforms. It also runs Android and Linux for flexibility, long life and military software control. Four size options come with bright LCDs, resistive touch screens, removable storage, and security. The Qualcomm CPU offers mobile I/O, image tracking and enhancement, video processing, DSP-based audio processing and enhancement, noise cancellation and security



with included TPM. Sailors, Marines or SEALs can talk to the tablet to alleviate the need for the touchscreen or optional keyboard. The tablet computer is for use in embedded machine vision battery-powered appliances, with all-day battery life, object recognition, voice recognition, and speed. The tablet computer and display is available in 10-, 12-, 17- or 24-inch diagonal LCD sizes. The 12-inch version is for infantry applications. For more information contact General Micro Systems online at www.gms4sbc.com.

DESIGN AND DEVELOPMENT TOOLS

▼ Development system for rapid prototyping of robotics introduced by dSPACE

dSPACE Inc. in Wixom, Mich., is introducing the MicroLabBox II compact development system for rapid control prototyping or simple hardware-in-the-loop (HIL) applications for laboratories in research, education, and industry. The MicroLabBox II combines high calculation speed and versatility in a compact enclosure. ITS quad-core processor enables fast execution of sophisticated Simulink models. In addition, the MicroLabBox II development system offers a freely programmable field-programmable gate array (FPGA) for fast control loops or sophisticated and high-precision simulation models for the simulation of electric motors. I/O interfaces are for developers who want to prototype algorithms. With the dSPACE experiment software ControlDesk, users can access model signals for visualization and measurement purposes and change model parameters. MicroLabBox enables users to set up control, test, or measure applications and implement individual concepts. More than 100 I/O channels are available for

mechatronic research and development, electric drives, power electronics, renewable energies, aerospace, robotics, or medical engineering. For more information contact dSPACE online at www.dspace.com.



DATA STORAGE

▲ Solid-state drive with automatic encryption for server applications introduced by DIGISTOR

DIGISTOR, a CRU Data Security Group (CDSG) company in Vancouver, Wash., is introducing the DIGISTOR CSD 3400 Enterprise solid-state drive for secure data storage applications. The CSD 3400 is built with ScaleFlux technology to increase server performance and reduce costs with no software, driver, or application changes needed. The solid-state drive meets TCG Opal compliance for automatic encryption of sensitive data in server applications; increases solid-state drive endurance; and increases solid-state drive effective capacity, reducing storage costs by using built-in, intelligent data compression and management. The drive automati-

cally compresses data to reduce write amplification to increase the drive's NAND flash memory life. With standard NVMe drivers and a competitive price, organizations of all sizes can deploy data storage easily while addressing cost, density, compute efficiency, and sustainability. The DIGISTOR CSD 3400 is immediately available. For more information contact DIGISTOR online at www.digistor.com.





POWER ELECTRONICS

▲ High-reliability power supplies for communications uses offered by TDK-Lambda

TDK-Lambda Americas Inc. in San Diego is introducing high-power three-phase AC input DIN rail mount power supplies for conventional switch cabinets, stand-alone machinery, industrial, information, and communications technology. These high-reliability power supplies have 24-, 48- and 72-volt outputs, and are rated for continuous operation at 480 or 960 Watts and can deliver a boost of 720 and 1440 Watts respectively for as long as seven seconds to operate with capacitive and inductive loads. These power electronics devices also feature a low-energy-inrush current on initial startup to reduce nuisance tripping of input circuit breakers. The DRB three-phase series has an input range of 350 to 575 volts AC and comes in a rugged metal enclosure with dimensions of 65 by 129 by 159.3 millimeters for the 480-Watt models and 100 by 129 by 171.9 millimeters for the 960-Watt model. This saves space on the DIN rail for other components and reduces cost. A choice of screw terminals or push-in connectors are available for the input and output wiring. The DRB480 and 960 models have an operating efficiency to 96.3 percent and a stand-by power consumption of less than 2.3 Watts when using the remote on-off function. Lower losses also reduce internal heating inside the power supplies, preventing electrolytic capacitor dry-out for

long field life. For more information contact TDK-Lambda online at www.us.lambda.tdk.com.

NETWORKING

▼ 3U VPX Ethernet switch for high-reliability aerospace and defense uses introduced by X-ES

Extreme Engineering Solutions (X-ES) in Verona, Wis., is introducing the XChange3030 conduction-cooled 3U VPX Ethernet switch module for high-reliability aerospace and defense applications. The XChange3030 provides six backplane 40GBASE-KR4 Ethernet ports, six backplane 10GBASE-KR Ethernet ports, two backplane 10GBASE-T Ethernet ports, and one front-panel optical Ethernet port. The XChange3030 delivers wire-speed across all of its ports and supports jumbo frames as large as 10 kilobits for embedded computing applications.

It also supports IPv6 and IETF RFCs and IEEE

protocols. As a managed Layer 2 3U VPX switch,

the XChange3030

supports features such

as VLANs (IEEE 802.1Q), LACP,

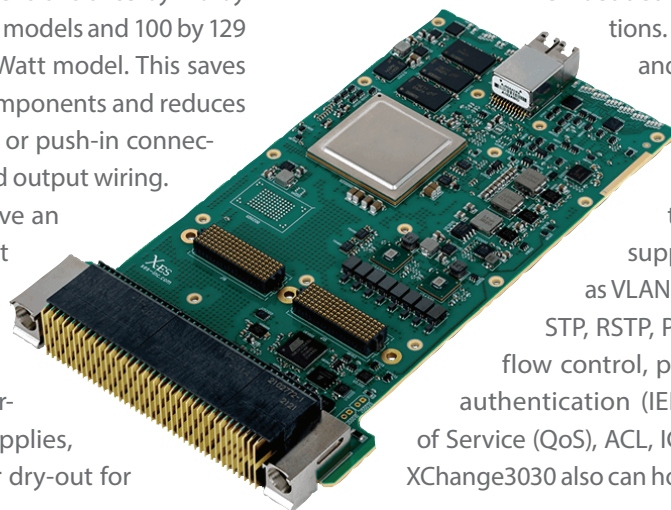
STP, RSTP, PVRST, MSTP, SNMP,

flow control, port mirroring, port

authentication (IEEE 802.1x), Quality

of Service (QoS), ACL, IGMP, and LLDP. The

XChange3030 also can host an XChange6300



Cisco IOS-XE Gigabit Ethernet Embedded Services Router.
For more information contact X-ES online at www.xes-inc.com.

BOARD PRODUCTS

► SOSA-compatible XMC card to integrate IP into VPX and ATX introduced by Curtiss-Wright

The Curtiss-Wright Corp. Defense Solutions Division in Ashburn, Va., is introducing the Switched Mezzanine Card

(XMC) to integrate advanced system IP into VPX, ATX, and legacy VMEbus embedded computing systems. The module also can help increase a system's overall compute power by providing field-programmable gate array (FPGA) co-processing to the base-board. Enhanced TrustedCOTS XMC (VITA 42/61) cards eliminate the need for costly and time-consuming customization of the target hardware. The XMC-528/529 modules enable system integrators to add IP quickly to fielded systems without a complete redesign. These embedded computing cards have also been deployed in high-performance rackmount servers using Curtiss-Wright rugged carrier solutions. For customers of Curtiss-Wright's XF07 family of XMC I/O modules, the XMC-529 provides a compelling replacement option. The compact XMC-529 module works with Curtiss-Wright's Fabric100 family of extremely high-performance SOSA-aligned 100-gigabit processing engines, such as the recently introduced VPX3-1262 single board computer powered by Intel's 13th Gen "Raptor Lake" 14-core hybrid architecture processor. The XMC-529 also can be hosted on a wide range of system modules, such as Curtiss-Wright's



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VME-1910, VPX6-1961, and VPX3-1260 SBCs. For more information contact Curtiss-Wright Defense Solutions online at www.curtisswrightds.com.

RF AND MICROWAVE

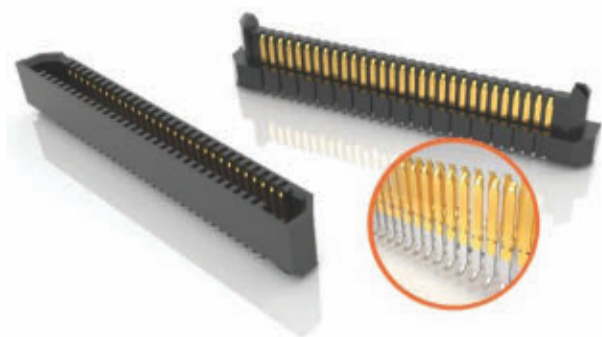
► Waveguide power dividers for communications introduced by Pasternack

Pasternack, an Infinite Electronics brand in Irvine, Calif., is introducing waveguide power dividers for optimizing signal distribution, enhancing system performance, and simplifying installation in several kinds of RF and microwave applications. These two-way power dividers are available in WR-90, WR-51, WR-34, WR-28, and WR-22 sizes for applications in signal amplification, communications, and routing. At the heart of Pasternack's waveguide power dividers is a two-way power splitting configuration, crafted to ensure efficient signal distribution. These power dividers deliver consistent and reliable results in splitting RF and microwave signals for amplification, routing signals in complex communication networks and distributing power in radar systems. Each power divider features a UG-style square cover flange to ease installation and ensure a secure fit. Constructed from aluminum or brass, these dividers are built to withstand demanding environments, offering durability and longevity. For more information contact Pasternack online at www.pasternack.com.

CONNECTORS

▼ Rugged board-to-board connectors for embedded vision introduced by Samtec

Samtec Inc. in New Albany, Ind., is introducing ERF6 and ERM6 Edge Rate board-to-board connectors for 56-gigabit-per-second PAM4 high-speed, rugged mezzanine applications for industrial, embedded vision, instrumentation and monitoring, drones, and robotics. These high-density mated set connectors are half the width



of previous designs and offer a low-profile 5-millimeter mated height. The ERF6 and ERM6 have two rows of pins while maintaining 2.5-millimeter body width. Body length of these board-to-board connectors is 11 to 42.8 millimeters with a 0.635-millimeter centerline. Available positions for each row are 10, 20, 30, 40, 50, or 60. If pull and shear force are a concern, weld tabs are available within the standard part number configuration. The connectors allow 0.9 millimeters of nominal contact wipe for a reliable connection. To ensure connectors are consistently aligned, polarizing features are molded into the connector body. ERF6 and ERM6 connectors allow for angular and linear misalignment. For more information contact Samtec online at www.samtec.com.

PROCESSOR CARDS

► XMC module with quad-core processor for sensor processing introduced by Acromag

Acromag Inc. in Wixom, Mich., is introducing the XMC-ZU5EV Switch Mezzanine Card (XMC) module for real-time control, sensor fusion, data processing, and many other functions for defense, industrial or laboratory applications. The XMC module comes with an AMD (Xilinx) Zynq UltraScale+ field-programmable gate array (FPGA) that combines an ARM-based processing system and FPGA logic in one chip. These XMCs are for military, aerospace, transportation, manufacturing, and scientific research systems. The XMCs mount on VPX, VME, PCI Express, and other embedded computing carrier cards. A quad-core processor and dual-core real-time processor deliver high-performance CPU capabilities, while the programmable logic is for compute-intensive tasks. Dedicated



processing blocks are available for graphics and video processing. Additional resources include on-chip memory, external memory interfaces, and peripheral connectivity interfaces. AMD's XCZU5EV multi-processor system-on-a-chip (MPSoC) hosts a quad-core ARM Cortex A53 and dual-core ARM Cortex R5 for heterogeneous computing and scalability. On-chip programmable logic has 256k cells, 1248 DSP slices, lots of RAM, and high-speed interfaces to outperform multi-chip FPGA solutions. An integrated Mali-400 GPU and video codec support offloading of multi-media processing. Air-cooled versions for front I/O and conduction-cooled models for backplane I/O are available. Acromag's Engineering Design Kit (EDK) provides example designs that provides host access to the hardware I/O. For more information contact Acromag online at www.acromag.com. ←

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Venus Aerospace debuts hypersonic detonation ramjet engine

BY Jamie Whitney

HOUSTON—Venus Aerospace in Houston has introduced its latest propulsion system, the VDR2, designed to power high-speed vehicles such as drones and aircraft. The engine is engineered for long-range travel at high altitudes and can reach speeds of up to Mach 6.

The VDR2 integrates two technologies: the Rotating Detonation Rocket Engine (RDRE), which provides high thrust, and a ramjet, which ensures efficient cruising. This combination allows the engine to operate from takeoff through hypersonic speeds without the need for complex mechanical systems. The VDR2 engine is expected to take flight in Venus Aerospace's hypersonic test drone in 2025.

"This engine makes the hypersonic economy a reality," said Dr. Andrew Duggleby, co-founder of Venus Aerospace, during the unveiling at Up.Summit. "We are excited to partner with Velontra to achieve this revolution in high-speed flight, given their expertise in high-speed air combustion."

Velontra's Chief Operating Officer Eric Briggs expressed enthusiasm for the partnership, stating, "We can't wait to dig in, make the first one fly, and ultimately perfect an engine concept that has lived mostly in textbooks but never as a production unit in the air. We couldn't think of a better partner than Venus."

Venus plans to equip its RDRE on its commercial hypersonic aircraft, the Stargazer M400. Venus says the aircraft

▲ Venus plans to equip its RDRE on its commercial hypersonic aircraft, the Stargazer M400.

will cruise at Mach 4 at 110,000 feet of elevation and have a top speed of Mach 9.

The plane would use advanced propulsion systems to take off from regular runways, reach the edge of space, and cruise at extremely high altitudes before landing at its destination. Stargazer reflects Venus Aerospace's vision to transform high-speed travel with reusable technology, with applications for both commercial and defense purposes.

Earlier this year, Venus and the National Aeronautics and Space Administration (NASA) announced a partnership to test RDREs in a flight-like manner. The engine injector that Venus Aerospace designed and provided was the highest performing and sustained the longest detonation engine run of the entire campaign. Using a regeneratively-cooled RDRE architecture, the engine successfully operated for 4 minutes of hotfire testing. Most engine tests of this type last for only 1-2 seconds. This long-duration hotfire means RDRE's have retired a major risk area and can move into the few remaining steps before a flight demonstration. NASA is considering using RDREs for in-space applications such as lunar and Martian landers, in-space operations and logistics, and other deep-space missions. ◀

GAO says FAA actions are ‘urgently needed’ to address aging ATC systems

BY Jamie Whitney

WASHINGTON—The Government Accountability Office (GAO), an independent, nonpartisan agency that works for the U.S. Congress, has provided seven recommendations to the Federal Aviation Administration (FAA) regarding the urgent need to modernize the nation’s air traffic control (ATC) systems.

The recommendations include a call for the agency to report to Congress on how it is mitigating risks from unsustainable systems and to establish clearer timelines for modernization projects. The recommendations also urged the FAA to streamline the establishment of baselines for investments and improve oversight of high-risk projects.

The FAA manages over 50,000 flights daily. Air traffic controllers rely on systems to monitor weather, conduct navigation and surveillance, and manage communications. However, the FAA has faced growing challenges with aging ATC systems, partly due to difficulty in sourcing parts, increased demand

for airspace, and expanding mission needs. The FAA forecasts that air travel will grow by 6.2% annually, which the GAO says will place additional strain on these outdated systems.

The GAO reviewed the FAA’s efforts to modernize its ATC infrastructure. GAO’s report focused on four objectives: identifying unsustainable ATC systems, determining the extent of FAA’s ongoing modernization efforts, evaluating the progress made on these initiatives, and assessing the FAA’s oversight of the modernization process.

The GAO noted that its definition for “sustainment” is based on an ATC system with significant shortage in spare parts and shortfalls in funding for those systems, or for funding in technology refreshes.

The GAO determined that of the FAA’s 138 systems, 51 (37%) were unsustainable and 54 (39%) were potentially unsustainable. Of those unsustainable and potentially unsustainable systems, 58 “have critical operational impacts on the safety and efficiency of the national airspace.”

The FAA has ongoing projects to modernize 90 of the 105 listed potentially—and actually—unsustainable ATC systems as

▼ **Investigators say the FAA has an urgent need to modernize the nation’s air traffic control (ATC) systems.**

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part of 64 agency investments. Most of those investments are in the form of technology refreshes (27).

“However, FAA has been slow to modernize some of the most critical and at-risk systems,” the GAO says in its report. “Specifically, when considering age, sustainability ratings, operational impact level, and expected date of modernization or replacement for each system, as of May 2024, FAA had 17 systems that were especially concerning. The 17 systems range from as few as 2 years old to as many as 50 years old, are unsustainable and are critical to the safety and efficiency

of the national airspace. However, the investments intended to modernize or replace these 17 systems are not planned to be completed for at least 6 more years, and in some cases, they will not be completed for 10 to 13 years. In addition, FAA does not have ongoing investments associated with four of these critical systems and thus it is unknown when the associated system will be modernized or replaced.”

The GAO’s report on the FAA’s need to modernize aging ATC systems is available here: <https://www.gao.gov/assets/gao-24-107001.pdf>. ←

Short-term focus and aging infrastructure puts space programs at risk, investigators tell Congress

A new report from the National Academies of Sciences, Engineering, and Medicine (NASEM) provided to the United States Congress regarding future prospects for the National Aeronautics and Space Administration (NASA) highlights sagging funding, obsolete infrastructure, and pressure on short-term priorities rather than long-term success. The report, available here, was requested by Congress in the CHIPS and Science Act of 2022. The study was sponsored by NASA. NASEM says that NASA operates in a complex environment influenced by several key challenges. One of the major factors shaping NASA’s work is the rapid pace of technological advancement. As technology evolves, NASA must continuously adapt to stay at the forefront of innovation. Additionally, the agency faces stiff competition for top talent, not only from the commercial space sector but also from other space agencies and high-tech industries. This competition makes it increasingly difficult for NASA to attract and retain the skilled professionals it needs.

NASA selects eight companies as part of its Commercial SmallSat Data Acquisition Program

The National Aeronautics and Space Administration (NASA) announced it had awarded eight companies with contracts to help the agency acquire Earth observation data and provide related services. NASA has awarded contracts worth up to \$476 million under its Commercial SmallSat Data Acquisition Program On-Ramp1. The firm-fixed-price, indefinite-delivery/indefinite-quantity contracts will run through 15 Nov. 2028, and involve several companies tasked with providing Earth observation data to support NASA’s scientific research. The selected contractors include BlackSky Geospatial Solutions, Inc. in Herndon, Va.; ICEYE US Inc. in Irvine, Calif.; MDA Geospatial Service Inc. in Richmond,

British Columbia, Canada; Pixxel Space Technologies, Inc. in El Segundo, Calif.; Planet Labs Federal, Inc. in Arlington, Va.; Satellogic Federal, LLC in Davidson, N.C.; Teledyne Brown Engineering, Inc. in Huntsville, Ala.; and The Tomorrow Companies Inc. in Boston. BlackSky will offer data from its Spectra platform, which combines satellite imagery and AI-enabled analytics to provide real-time monitoring and anomaly detection.

Collins develops power distribution tech for EU’s SWITCH aviation project

Collins Aerospace, part of RTX in Arlington County, Va., announced it has completed the prototype development of a solid-state power controller and power distribution panel for the European Union-backed SWITCH project. The components, designed and produced at Collins’ Nördlingen, Germany, facility, will undergo system integration testing at the company’s electric power systems lab, The Grid, in Rockford, Ill. The SWITCH project addresses the need for high-voltage distribution technology to support hybrid-electric propulsion systems in future aircraft, will operate at megawatt-level power. RTX’s hybrid-electric propulsion system combines two Collins megawatt-class electric motor generators with a Pratt & Whitney GTF engine. Collins’ solid-state power controller and power distribution panel will help safely manage high-voltage electricity within the SWITCH architecture, even at cruising altitudes. Collins’s solid-state power controller was originally developed in collaboration with the RTX Technology Research Center, Collins, and Pratt & Whitney as part of NASA’s Advanced Air Vehicles Program. The SWITCH consortium includes industry leaders MTU Aero Engines AG, Pratt & Whitney, Collins Aerospace, GKN Aerospace, Airbus, and others. The project is funded by the European Union under GA no. 101102006. ←

FAA requests information on integrating uncrewed aircraft systems

BY Jamie Whitney

WASHINGTON—The Unmanned Aircraft Systems (UAS) Integration Office of the Federal Aviation Administration (FAA) has issued a request for information (RFI) to gather input from industry on research areas that may aid the integration of new aviation technologies, such as UAS and advanced air mobility (AAM), into the National Airspace System (NAS).

The RFI seeks feedback from industry on various research focus areas that could support future standards and technology development for safely integrating new airspace entrants. The FAA may request further information from respondents at its discretion, but participation is for informational purposes only.

FAA officials say that research is central to creating effective policies, regulations, and procedures for new entrants like UAS/AAM vehicles. Ongoing research will help the FAA develop a framework for assessing and integrating these new technologies, enabling strategic planning and data-driven decision-making for future rulemaking, policy, certification, and operational considerations.

The RFI requests feedback on whether the identified research areas are sufficient to address anticipated business and operational cases for new entrants in the NAS. The areas of focus include several critical domains. First, the FAA is interested in the potential of beyond visual-line-of-sight (BVLOS) operations. This is followed by exploring command and control link technologies, which ensure reliable communication between operators and unmanned vehicles.

Traffic management systems are another key area, with a particular focus on UAS traffic management and advancements in air traffic management. Research into noise and societal impacts is also necessary, as is the development of industry standards to guide technology interoperability, specifically in vehicle-to-vehicle communication, aircraft-to-everything communication, and detect-and-avoid capabilities.



▲ The FAA wants new ways of integrating uncrewed aircraft into the National Airspace System. 338140389 © Gang Wang | Dreamstime.com

Collision risks among vehicles of various sizes and speeds traveling within shared airspace are also under consideration, as are electronic conspicuity technologies that improve the visibility of unmanned aircraft. Human factors are another research priority, covering aspects such as the human-system interface, operational procedures, and the qualifications of pilots and crew.

The FAA also highlights advanced automation, including applications of artificial intelligence and machine learning, as essential for new entrant operations. Infrastructure requirements, including potential needs for airports, droneports, and vertiports, are necessary to support these evolving technologies. Lastly, the risks posed by hazardous materials aboard UAS, whether as cargo or power sources, are also flagged for research and analysis.

Responses to this RFI were due via email by 3:00 PM EST on 2 December 2024. Responses should be emailed to the FAA Contracting Officer Karina Espinosa at karina.espinosa@faa.gov, and Kristin Frantz at kristin.frantz@faa.gov. More information and documentation is available at <https://sam.gov/opp/5275b3a9a680427e9b66b6c0650e5073/view>. ◀