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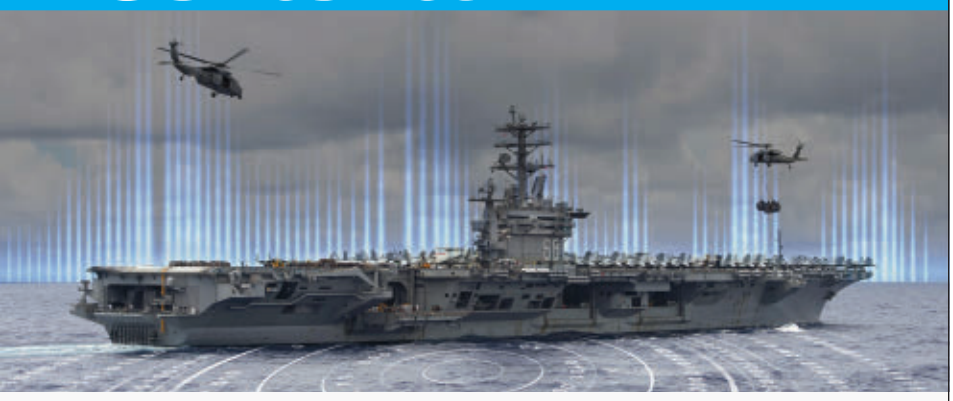

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U.S. military to put its money where its mouth is in half-billion-dollar anti-tamper program

BY **John Keller**
EDITOR IN CHIEF

Anti-tamper technology — or the ability to prevent an adversary from stealing design secrets, reverse-engineer critical components, or dissecting important technologies just to see what makes them tick — long has been a hot-button issue for the U.S. Department of Defense.

A big emphasis of anti-tamper capabilities has resulted from loss of intelligence data to a thriving black market for counterfeit electronic components, and it seeks to shut-down the kind of technology theft that has been the dark underside of the microelectronics revolution.

The push for anti-tamper technologies goes back at least 21 years — and probably for much longer than that — to the so-called Hainan Island incident in April 2001 when a U.S. Navy EP-3E ARIES II signals intelligence aircraft was gathering electronic information off the coast of China.

People's Liberation Army Navy sent up a J-8II jet fighter to intercept the four-engine Navy turboprop. The jet fighter collided with the Navy reconnaissance aircraft, and forced the EP-3E to make an emergency landing on the Chinese island of Hainan near Vietnam.

Navy personnel aboard the surveillance plan tried to destroy sensitive technology and gathered data, but on landing, the Chinese government impounded the EP-3E, took it apart to learn its secrets, and eventually returned the plane and its on-board systems in various stages of disassembly.

It was this incident that kicked U.S. anti-tamper efforts into high gear, with projects to erase data on hard disks permanently at the push of a button, devices to destroy computers if their covers are removed in an unauthorized way, and advanced encryption to keep software operating systems out of the wrong hands.

With this in mind, the U.S. Air Force is formulating a plan for a 10-year half-billion-dollar initiative called Anti-Tamper Executive Agent Program Office Multiple Award Indefinite Delivery/Indefinite Quantity Contract (MAC ID/IQ) to develop anti-tamper enabling technologies to foil enemy efforts to steal U.S. technology to gain access to its secrets.

The Air Force Life Cycle Management Center at Wright-Patterson Air Force Base, Ohio, has released a draft request for proposal (AT2022DraftRFP) for MAC ID/IQ, which seeks acquisition approval to issue a $499 million 10-year contract solicitation to procure anti-tamper product and technology development of anti-tamper solutions in secure processing; volume protection and sensors; and cryptographic protection.

Secure processing will develop products and technologies to establish and maintain secure processing in single-board computers and other electronics.

This will involve a secure physical boundary around critical components in products to prevent non-privileged users from gaining access to the critical components or information in line-replaceable units (LRUs) and shop-replaceable units (SRUs).

Companies interested were asked to email comments and questions by 9 Sept. 2022 to the Air Force's Sara Smith-Custer at sara.smith-custer@us.af.mil, and Jonathan Mashburn at jonathan.mashburn.3@us.af.mil. More information is online at https://sam.gov/opp/7a7c65049adb4032b991dc6c68dc675c/view.

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Axiom Electronics

Raytheon eyes electromagnetic weapons for ballistic and hypersonic missile defense

BY **John Keller**

ALBUQUERQUE, N.M. – Missile defense experts at Raytheon Technologies Corp. are moving forward with a project to develop high-power microwave technologies to help defense the U.S. and its allies from attack by ballistic and hypersonic missiles.

Officials of the U.S. Missile Defense Agency (MDA) in Albuquerque, N.M., have announced a $13 million order to the Raytheon Missiles & Defense segment in Tucson, Ariz., to complete the technology critical design review of the company's Microwave Technology Testbed system.

The Microwave Technology Testbed seeks to develop and mature electromagnetic weapons technologies with very long range and extreme power levels to defend against enemy ballistic and hypersonic missiles.

Electromagnetic weapons use high-power microwaves to damage or destroy the guidance and control electronic subsystems in enemy weapons systems like nuclear-tipped ballistic missiles and conventional hypersonic weapons.

A critical design review (CDR) ensures that a system can proceed into fabrication, demonstration, and test, and can meet performance requirements within cost, schedule, and risk.

The Microwave Technology Testbed will help test the lethality of different electromagnetic weapons technologies for ballistic and hypersonic missile defense, and procure long-lead items for the testbed. Long-lead items are difficult and time-consuming to obtain, and are funded early in the design process to keep overall production on schedule.

Raytheon will move forward from a baseline design, advanced technology insertion evaluation, and test planning, and prepare to support future phases for integration of the Microwave Technology Testbed. Raytheon won a $9.8 million contract from MDA in September 2020 to begin work on the Microwave Technology Testbed.

The Microwave Technology Testbed seeks to develop and mature long-range and high-power electromagnetic weapons to defend against enemy ballistic and hypersonic missiles.

On This order, Raytheon will do the work in Tucson, Ariz., and should be finished by February 2024. For more information contact Raytheon Missiles & Defense online at www.raytheonmissilesanddefense.com.

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NASA reaches out to industry to conduct on-orbit CubeSat technology demonstrations

BY **Jamie Whitney**

WASHINGTON - The U.S. National Aeronautics and Space Administration (NASA) has announced additional opportunities through the agency's CubeSat Launch Initiative (CSLI) for cubesat developers to conduct scientific investigations and technology demonstrations in space and contribute to the agency's exploration goals.

▲ NASA is looking for cubesat designers to conduct on-orbit technology demonstrations between 2024 and 2027.

The next round of NASA's CSLI opportunities is providing access to low-Earth orbit for U.S. educational institutions, nonprofits with an education or outreach component, and NASA centers and programs for workforce development. Developers can gain hands-on experience designing, building, and operating these small research satellites.

Applicants must submit proposals no later than 18 Nov. 2022. NASA anticipates making selections by March 2023 with flight opportunities set for 2024 to 2027, although selection does not guarantee a launch opportunity.

Designs that include restrictive orbit requirements may limit launch opportunities and lead to later-than-desired launch dates. Applicants are responsible for funding the development of the small satellites.

CSLI encourages participation by minority serving institutions and is seeking participation particularly from organizations in Delaware, Mississippi, Nevada, North Carolina, Oklahoma, South Carolina, South Dakota, and Wyoming.

CubeSats are part of a class of research spacecraft called nanosatellites. These small satellites are built to standard dimensions (Units or "U") of approximately 10 by 10 by 11 centimeters. CubeSats supported by this launch initiative include volumes of 1U, 2U, 3U, 6U, and 12U or volumes that add up to these specified dimensions.

CSLI will not select any CubeSat missions proposing to deploy or release parts that are smaller than 1U in size due to trackability, space situational awareness, and orbital debris concerns.

To date, NASA has selected 211 CubeSat missions, 148 of which have been launched into space, with more than 20 missions scheduled for launch within the next year. The selected CubeSats represent participants from 42 states, the District of Columbia, Puerto Rico, and 102 unique organizations.

CSLI is managed by NASA's Launch Services Program, based at the agency's Kennedy Space Center in Florida. For more information about NASA's CubeSat Launch Initiative, please visit https://go.nasa.gov/CubeSat_initiative.

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NASA selects Microchip Technology to develop spaceflight processor

BY Jamie Whitney

Microchip Technology is designing the High-Performance Spaceflight Computing (HPSC) processor to be radiation-hardened and to offer 100 times the processing power of today's space microprocessors.

WASHINGTON - The National Aeronautics and Space Administration's (NASA) Jet Propulsion Laboratory in La Cañada Flintridge, Calif., has selected Microchip Technology Inc. of Chandler, Ariz., to develop the High-Performance Spaceflight Computing (HPSC) processor.

Microchip's HPSC will provide at least 100 times the computational capacity of current spaceflight computers, and aims to advance all types of future space missions, including surface missions.

Microchip will architect, design, and deliver the HPSC processor over three years, with the goal of employing the processor on future lunar and planetary exploration missions.

Microchip's processor architecture will improve the overall computing efficiency for these missions by enabling computing power to be scalable, based on mission needs. The work will take place under a $50 million contract, with Microchip contributing significant research and development costs to complete the project.

"We are pleased that NASA selected Microchip as its partner to develop the next-generation space-qualified compute processor platform." says Babak Samimi, corporate vice president for Microchip's Communications business unit.

"We are making a joint investment with NASA on a new trusted and transformative compute platform. It will deliver comprehensive Ethernet networking, advanced artificial intelligence

and machine learning processing and connectivity support while offering unprecedented performance gain, fault-tolerance, and security architecture at low power consumption.

"We will foster an industry wide ecosystem of single board computer partners anchored on the HPSC processor and Microchip's complementary space-qualified total system solutions to benefit a new generation of mission-critical edge compute designs optimized for size, weight, and power," Samimi says.

Current space-qualified computing technology is designed for computationally intensive parts of space missions – a practice that leads to overdesigning and inefficient use of computing power.

For example, a Mars surface mission demands high-speed data movement and intense calculation during the planetary landing sequence. However, routine mobility and science operations require fewer calculations and tasks per second.

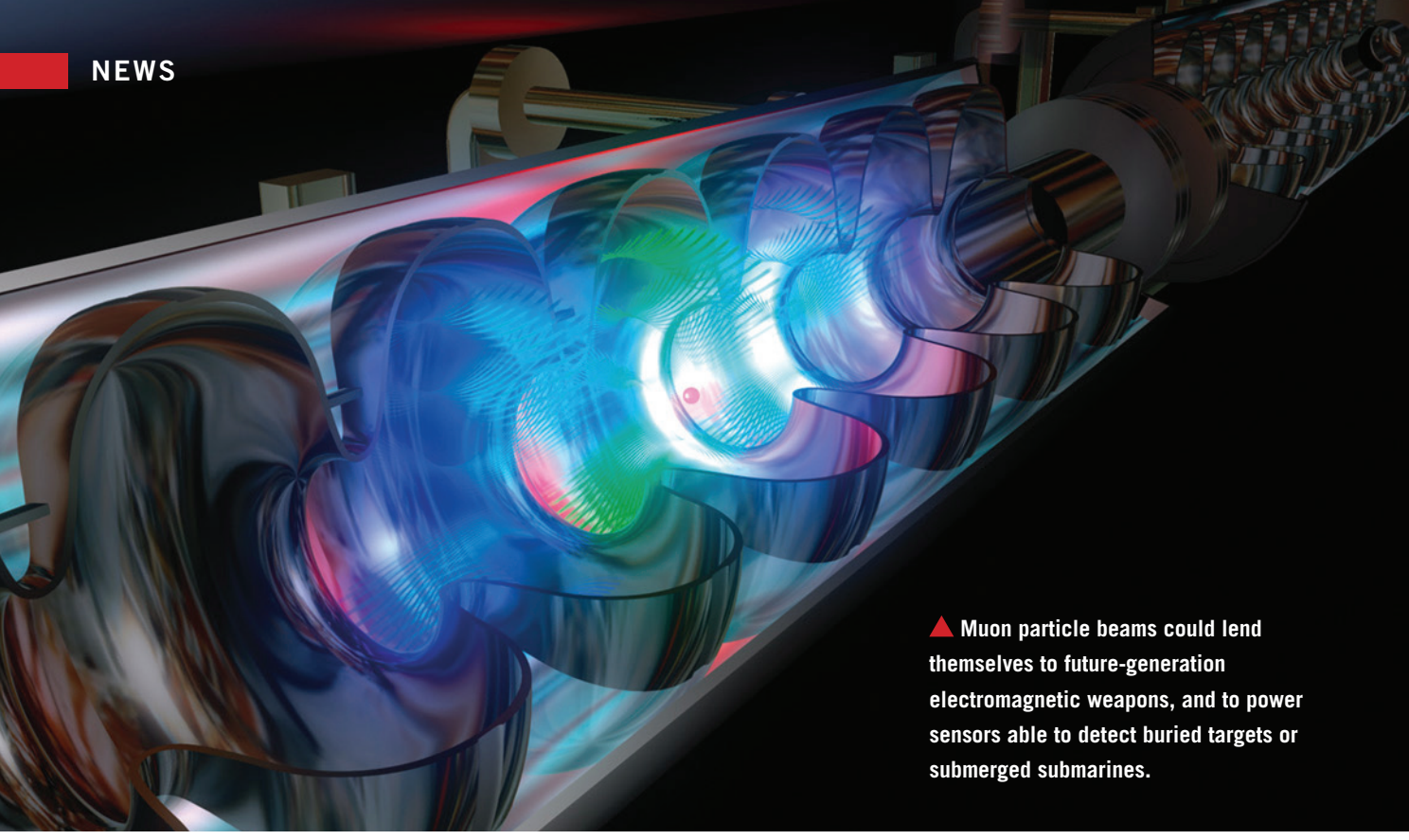
Microchip's new processor architecture offers the flexibility for the processing power to ebb and flow depending on current operational requirements. Certain processing functions can also be turned off when not in use, reducing power consumption. This capability will save a large amount of energy and improve overall computing efficiency for space missions.

"Our current spaceflight computers were developed almost 30 years ago," says Wesley Powell, NASA's principal technologist for advanced avionics. "While they have served past missions well, future NASA missions demand significantly increased onboard computing capabilities and reliability. The new computing processor will provide the advances required in performance, fault tolerance, and flexibility to meet these future mission needs."

Microchip's HPSC processor may be useful to other government agencies and applicable to other types of future space mission to explore Earth's solar system and beyond, ranging from Earth science operations to Mars exploration and human lunar missions.

The processor potentially could be used for commercial systems on Earth that require similar mission-critical edge computing as space missions and are able to continue operations safely if one component of the system fails.

These potential applications include industrial automation, edge computing, time-sensitive Ethernet data transmission, artificial intelligence, and even Internet of Things gateways, which bridge various communication technologies.



Muon particle beams could lend themselves to future-generation electromagnetic weapons, and to power sensors able to detect buried targets or submerged submarines.

Industry to investigate future muon particle beams for electromagnetic weapons and sensors

BY **John Keller**

ARLINGTON, Va. – U.S. military researchers are asking industry to develop enabling technologies for a future atomic charged-particle beam potentially able to destroy enemy electronics and weapons, as well as to inspect caves containing nuclear weapons, or even detect submerged submarines in the ocean.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., have issued a broad agency announcement (HR001122S0049) for the Muons for Science and Security (MuS2) project.

Muons are atomic particles similar to electrons, but are 207 times heavier. A muon beam has the potential to help create new kinds of electromagnetic weapons, sensors to penetrate mountains and oceans, and help study the nature of matter and the universe.

The DARPA MuS2 project seeks to create a source for a muon beam strong enough to support demonstrations of national security and scientific applications.

DARPA researchers are asking industry investigate the generation of directional muon beams with energies of 10 to 100 giga-electron volts, and produce 106 to 108 muons while showing a clear path to a practical design for transportable military weapons and sensors.

No practical active sources of muons exist today because of the high energies necessary to create them, researchers say. Muons are charged elementary particles about 200 times heavier than electrons, with a mean lifetime of 2.2 microseconds.

Muons form naturally through giga-electron volt cosmic-ray interactions in the upper atmosphere or synthetically at high-energy physics experimental facilities such as Fermilab and the European Organization for Nuclear Research.

Muons penetrate easily, with ranges of tens to hundreds of meters through water or rock; are highly detectable; sensitive to density variations, and generally impart low doses to people and objects.

Applications to date have included finding hidden chambers in Egyptian pyramids; predicting volcano eruptions; detecting contraband in cargo; and inspecting nuclear reactors.

Unfortunately, cosmic sources of muons are very dim, with only about one passing through the area of a human hand per second, which then requires integration times of hours to months, depending on the application. Muons are also produced at a wide range of angles in the atmosphere, which influences their resolving power for imaging applications.

Developing a path to a transportable source of high-intensity muons could enable applications like screening large objects or searching buildings for nuclear materials. Muon imaging could also could provide a capability for tunnel or chamber detection because muons can penetrate 65 to 600 feet of heavy soil. In addition, a muon source could provide a stepping stone to muon-catalyzed low-temperature fusion.

The MuS2 project seeks to develop enabling technologies sufficient for a future prototype muon beam generator with a strength of 10 to 100 giga-electron volts, a weight of no more than about 16 tons, and a size able to fit inside a 40-foot intermodal shipping container. The actual prototype muon beam generator is not part of this project.

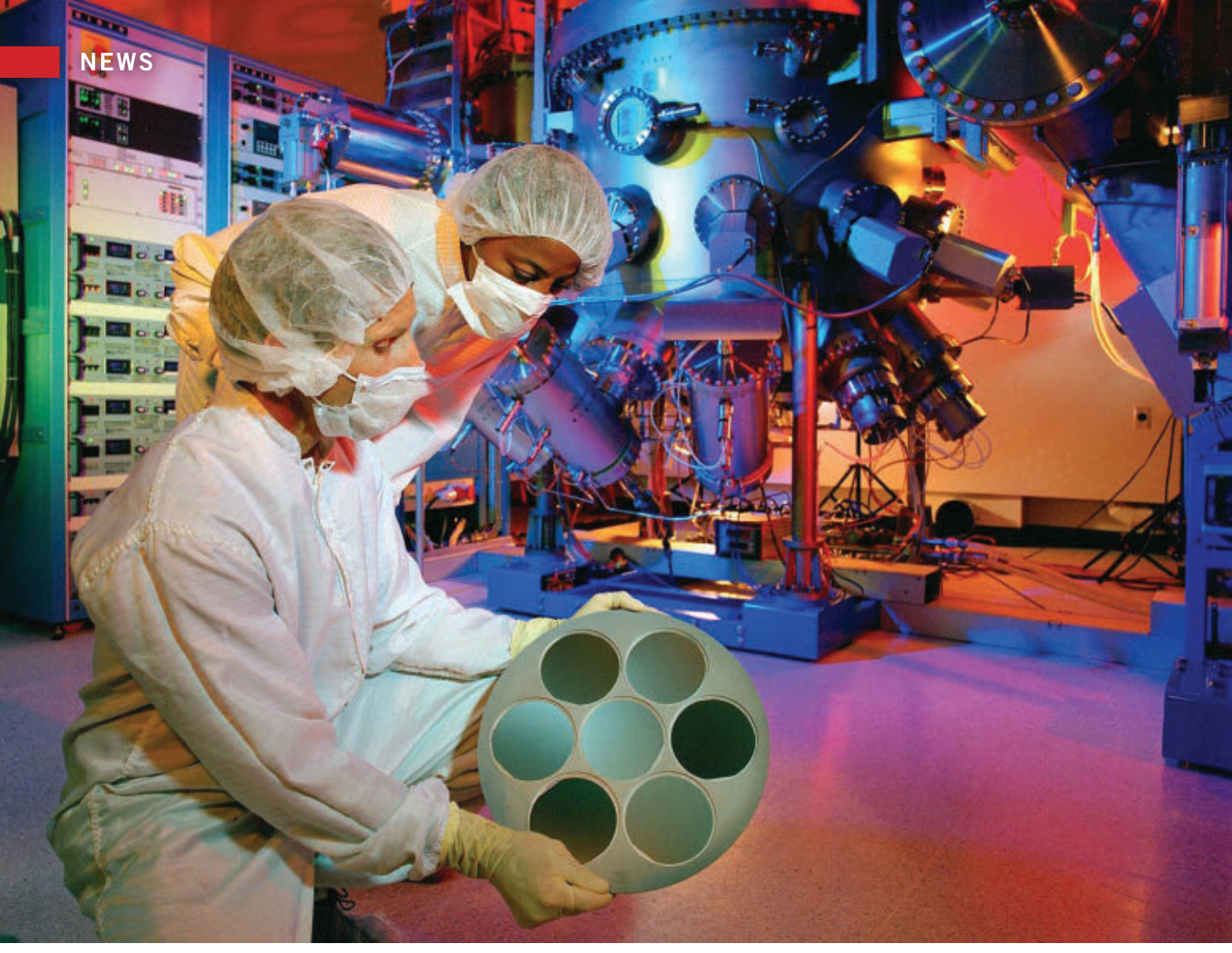
MuS2 is a four-year program with two 24-month phases for experiments, simulations, and system studies. The firsts phase will examine the feasibility of muon production, including modeling and preliminary experimental work.

Teams will demonstrate accelerating electrons to 10 giga-electron volts or greater, and explore designs for an advanced laser driver that would enable a transportable system capable of producing 100 giga-electron-volt muons and intensities 108 muons per second.

The second phase will emphasize applied research leading to proof-of-concept studies at high energy. At the end of phase 2, teams will demonstrate accelerating electrons to 100 giga-electron volts or greater and produce a minimum of 106 muons per experiment.

There will be two go/no-go decisions, the first at about one year into the first phase, and the second before a possible move to phase 2.

Companies interested were asked to submit abstracts by 12 Aug. 2022 to the DARPA BAA website at https://baa.darpa.mil. Full proposals are due by 11 Oct. 2022 online at https://www.grants.gov/web/grants/applicants/apply-for-grants.html. Email questions or concerns to Mark Wrobel, the DARPA MuS2 program manager at MuS2@darpa.mil. More information is online at https://sam.gov/opp/c234cf7ab74640028cf20dd62a3a9ab1/view.



Teledyne to design RF and microwave MMICs for communications and sensing at G-band

BY **John Keller**

ARLINGTON, Va. – U.S. military researchers needed a company to develop fabrication and integration technologies to create compact, high-performance RF and microwave electronics to enable communications and sensing systems at G-band frequencies. They found their solution from Teledyne Technologies Inc.

▲ Teledyne will design MMICs able to operate in the sub-terahertz G-band frequency range for applications in radio astronomy, remote security sensing, and telecommunications.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., have announced an $18.6 million contract to the Teledyne Scientific & Imaging segment in Thousand Oaks, Calif., for the Electronics For G-Band Arrays (ELGAR) project.

Experts from the DARPA Microsystems Technology Office want Teledyne experts to develop monolithic microwave integrated circuits (MMICs) and receive array front-end test articles able to operate in the sub-terahertz G-band frequency range between 110 and 300 GHz for applications like radio astronomy, remote security sensing, and telecommunications.

The growing thirst for information in military and commercial applications is driving RF and microwave technologies towards increasingly higher data rates and wider bandwidths of operation, DARPA researchers say. This drives systems designs in higher operating frequencies to support large channel bandwidths.

Today's 5G cellular networks, for example, operate at 6 GHz and below, and researchers are considering future 5G communications at millimeter wave frequencies from 24.25 GHz to 52.60 GHz. 6G will push frequencies even higher for large-channel bandwidths and high-channel capacities.

The upper millimeter-wave G band of 110 to 300 GHz represents an attractive, underused portion of the electromagnetic spectrum for high-rate data communications — particularly above 200 GHz, where atmospheric absorption is low.

Today, however, RF electronics adequate to support operation in this frequency band does not yet exist — particularly for size, weight, and power (SWaP)-constrained applications. The efficiency of G-band electronics today is poor, and must be addressed to make G-band systems viable.

RF and microwave experts can build G-band communications arrays with silicon-based RF integrated circuits or with III-V compound semiconductor MMICs. Each approach has advantages and limitations.

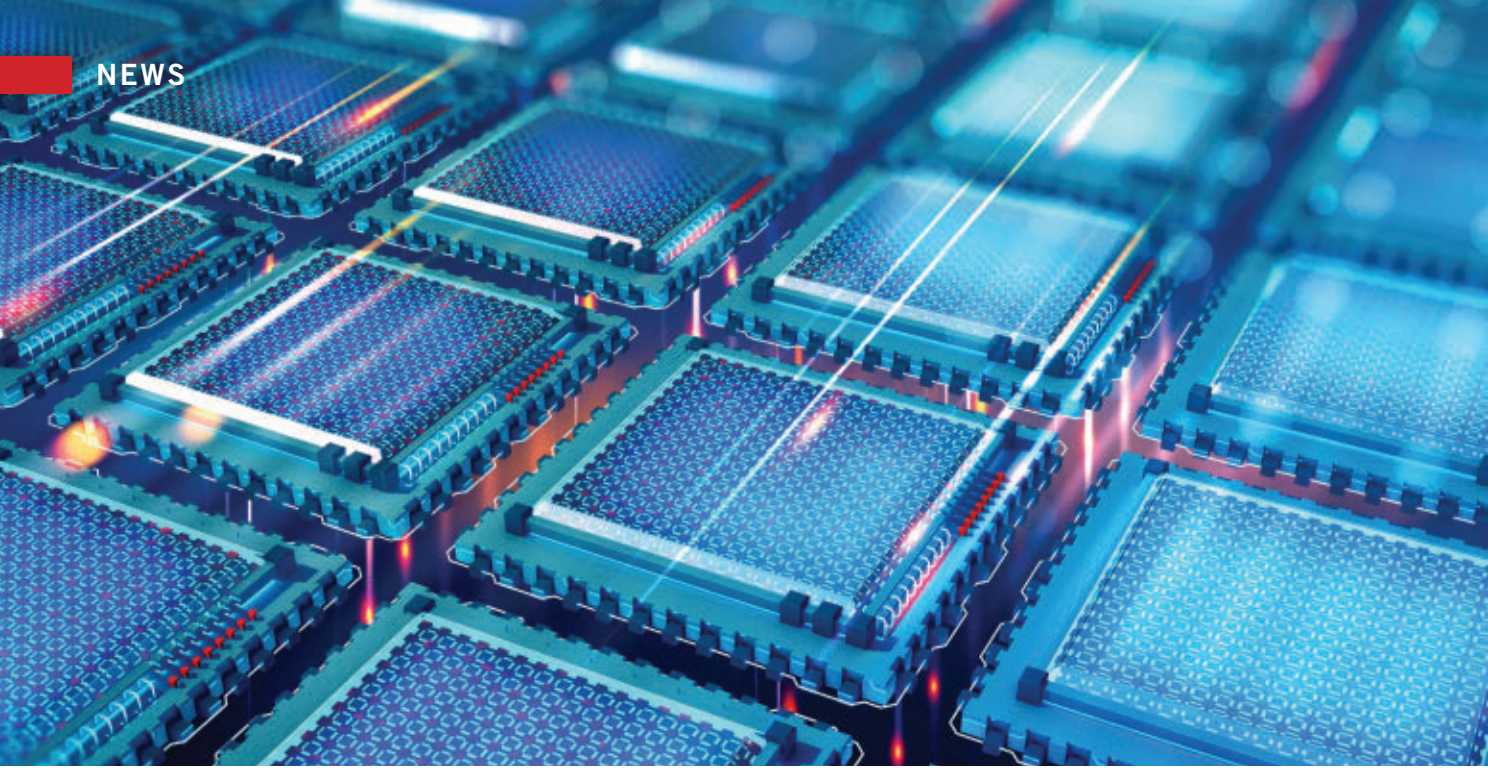
Through significant investment in programs such as Sub-millimeter Wave Imaging Focal-plane Technology (SWIFT), Terahertz (THz) Electronics, and Nitride Electronic NeXt-Generation Technology (NEXT), DARPA has developed III-V transistor technologies in indium phosphide and gallium nitride that can overcome the gain and breakdown voltage limitations of silicon- based transistors at G-band.

DARPA is interested in heterogeneous integration approaches that result in transmit and receive circuit compactness that enable a revolutionary increase in power density and power efficiency of MMICs and phased arrays at G-band.

The ELGAR program seeks to develop integration technologies to implement demonstration and validation circuits and test articles including compact, high-efficiency G-band power amplifier MMICs and transmit and receive array front-end test articles that operate at 220 GHz.

DARPA anticipates that the most challenging performance aspects of these MMICs and array test articles will be achieving 30 percent power amplifier power-added efficiencies, and more than 34 Watts per square centimeter transmit array power density and 24 percent transmit array efficiency at the 220 GHz operating frequency.

For more information contact Teledyne Scientific & Imaging online at www.teledyne-si.com, or DARPA at www.darpa.mil.



Wanted: quantum computing software algorithms for next-gen command and control

BY **John Keller**

ROME, N.Y. – U.S. Air Force researchers are asking industry to develop new quantum computing algorithm software for machine automation and machine learning in future command, control, communications, and intelligence systems.

▲ Researchers are interested in quantum software algorithms for machine learning, neural networks, optimization, quantum walks, unstructured searches, and decision and risk analysis.

Officials of the Air Force Research Laboratory Information Directorate in Rome, N.Y., issued a broad agency announcement (FA8750 AFRL RIK ROME NY 13441-4514 USA) in August for the Quantum Information Services project.

Researchers want companies to submit white papers for research, design, development, concept testing, experimentation, integration, evaluation, and delivery of technologies to support Air Force research in command and control.

Quantum computing seeks to capitalize on quantum mechanics to deliver a huge leap forward in processor performance to solve particularly difficult problems.

The project has five focus areas: quantum algorithm and computation; quantum information processing; memory-node-based quantum networking; superconducting hybrid quantum platforms; and quantum information sciences.

Quantum algorithm and computation seeks to develop quantum software algorithms for today's computers, including noisy intermediate-scale quantum (NISQ) computers and quantum annealing and adiabatic quantum computers.

Researchers are interested in quantum software algorithms for machine learning, neural networks, optimization, quantum walks, unstructured searches, decision and risk analysis, hybrid classical and quantum algorithms, efficient quantum gate and circuit decomposition and characterization, protocols and algorithms for quantum photonic integrated waveguide chips, superconducting qubit, and trapped-ion platforms.

Quantum information processing concerns entanglement distribution, quantum information processing, and local and distributed quantum computation. The project will emphasize photon-based qubits including quantum integrated photonic circuitry, interactions between photon-based qubits, and other qubit technologies.

Other interests include quantum repeaters, high dimensional entanglement, efficient generation and measurement of quantum states, quantum channel characterization and discrimination, and measurement based quantum computation.

Researchers are focusing on photon-based qubits, single-photon and entangled-photons on demand, quantum

algorithms employing cluster and graph states, trapped-ion qubits, superconducting qubits, quantum annealing or adiabatic quantum computation, and blind quantum computation.

Memory-node-based quantum networking includes quantum networking, quantum communication, and quantum information processing with an emphasis on trapped-ion qubits, superconducting qubits, integrated-circuit-based qubits, and entanglement distribution.

Focus areas include multi-node network connections, quantum transduction across frequency bands, interfacing heterogeneous qubit technologies, quantum information mapping between homogenous and heterogeneous qubit technologies, entanglement distribution, entanglement verification and validation, ultra-high vacuum technology, dilution refrigerator technology, laser development and laser control, and interfaces across different platforms.

Superconducting hybrid quantum platforms focuses on developing new quantum devices, new functionalities, and exploring fundamental quantum networking physics, with an emphasis on hybrid superconducting systems.

The focus includes cross-quantum technologies for interfacing superconducting qubits and circuitry with ion-trap systems, integrated photonic circuitry, and electromechanical and optomechanical systems; quantum and classical microwave-optical interfaces; developing 3D-integrated heterogeneous quantum architectures; chip-scale refrigeration; and quantum interfaces across large temperature gradients.

Quantum Information Sciences focuses on quantum communications, quantum networking, and quantum computing, with an emphasis on quantum bit technologies, quantum protocols for networking and computation, and enabling technologies. Funding for this project will be about $20 million over the next two years.

Companies interested were asked to email two-to-four-page white papers by 29 Sept. 2022 for 2023 funding, and by 29 Sept. 2023 for 2024 funding to the Air Force's Kristi Mezzano at AFRL.RIT.Quantum@us.af.mil.

Email technical questions to Kristi Mezzano at AFRL.RIT.Quantum@us.af.mil, or contracting questions to Amber Buckley at Amber.Buckley@us.af.mil. More information is online at https://sam.gov/opp/afdb23099e5b4275b211e72f6cef0861/view.

The sensor- and signal-processing challenges of ELECTRONIC WARFARE

Greater processing power, advanced filtering, and better signal rejection are among the digital signal processing enabling technologies for electronic warfare projects today.

BY Megan Crouse

Electronic attacks have been a part of warfare since the radio transmitter was invented in the 1890s. The invisible electromagnetic spectrum enables users to listen to music, cook food, and view hidden injuries via X-ray.

Today it's also another type of battlefield.

Before warfighters and vehicles make a move, they need to ensure the avenue is open not only on the physical battlefield, but also on the electromagnetic spectrum. All branches of the military can gain a big advantage by dominating the electromagnetic spectrum.

Electronic warfare (EW) — jamming or spoofing an enemy's communications and RF sensor systems — has some crossover with other technologies such as radar or directed-energy electromagnetic weapons. However, it also has its own equipment, technology needs, and unique standards. Spectrum-dependent systems can be found across air, land, and sea domains, plus cyber.

Types of electronic warfare

In its 2022 report on military use of the electromagnetic spectrum, the Congressional Research Service noted that most of the focus in this area is on radio wave, microwave, and infrared. Multispectral operations, which combine tools such as broadband radar and several electro-optical and infrared (EO/IR) sensors, also fall under this broad category, as does everything from digital cameras to missile jamming.

In terms of jamming for missile defense, anti-air munitions tend to use either infrared or radar for guidance once they've launched. Jammers on the radio, microwave, and infrared spectra can disrupt these signals. EW can also take advantage of tactical control of the electromagnetic spectrum to detect, analyze, and track potential threats. It's a key part of modern situational awareness, as well as providing information for diplomatic insights or presenting options for possible offense before an attack arrives.

Sensors and signal processing technologies are essential systems on a variety of vehicles and in a variety of environments, including ground stations, aircraft, and ships. The BAE Systems Electronic Systems segment in Nashua, N.H., separates electronic warfare technology into four categories: electronic support (ES) or signal detection, electronic protection (EP), electronic attack (EA) or jamming, and mission support.

Another key element is quick response capabilities (QRC), which includes identifying new threats, or distorting or delaying the response to a signal. Electronic warfare contains offensive and defensive capacities, from preemptive targeting and spoofing, to countermeasures against adversary EW.

Current military efforts

The U.S. Army C5ISR Center at Aberdeen Proving Ground, Md., shows some examples of what is considered cutting edge in electronic warfare with recent efforts to revitalize conversation around the subject, according to a Breaking Defense interview with Bill Taylor, cyber technology division chief at the C5ISR Center, and other researchers.

One of the challenges for the Army's science and technology community is that the electromagnetic spectrum is "very dense," and adversary systems operating in different frequency bands make them difficult to track.

"Our ability to be able to detect those RF emissions, sense them, understand them at a rapid speed at the pace of operation is challenging," Taylor says.

The U.S. Air Force celebrated the inaugural flight last year of new Gulfstream G550 business jets equipped with legacy electronic warfare systems from the EC-130H aircraft in an effort to modernize the EW-focused Compass Call fleet. L3Harris Technologies in Melbourne, Fla., is the lead the systems integration along with BAE Systems working on the EW suite, while Gulfstream provides the aircraft expertise and facilities. The changes to the fleet will include an open-systems architecture to make it easier to plug-in new EQ payloads to the aircraft as needed.

Meanwhile, experts from the Northrop Grumman Corp. Mission Systems segment in Linthicum, Md., worked on moving an electronic attack system to surface warships. They aim to find a balance of radio frequency versus available power and

cooling, the organization's Mike Meaney, vice president of land and maritime sensors, told C4ISRNET.

"On smaller ships sizes, we know it's of great interest to the Navy to put this soft-kill capability with unlimited bullets on almost every ship that they have because the incredible protection electronic warfare offers you," Meaney said. "We know that they're interested in doing that, so we're off on our own trying to develop what we think would make sense to go do in anticipation of the Navy having a requirement to do a scaled-down version of it."

▲ **The Mercury Systems mPOD, a rapidly reprogrammable electronic attack training system designed to train pilots using realistic, near-peer jamming capabilities, is undergoing final flight testing. Mercury Systems photo**

The system they're talking about in particular is the Surface Electronic Warfare Improvement Program Block III (SEWIP). It shows a variety of offensive EW capabilities, including electronic attack against incoming anti-ship missiles. Integrated with the rest of the SEWIP system, it can provide Signals Intelligence, cover some of ESM [Electronic Support Measures) mission currently done by the Block II project, provide new and advanced communication waveforms and ways to connect to other ships and platforms, and function as simple versions of radar.

The Army is working on fielding several other new EW capabilities using the increase in processing power. The Electronic Warfare Planning and Management Tool for visualization is nearing maturity, as are the Terrestrial Layer Systems for EW and cyber. The former is a mission planning tool that maps out the military and commercial electromagnetic environment, while the latter is a planned vehicle-mounted platform.

EW gaining greater processing power means sensors that can "have increasingly broad, instantaneous bandwidth for much faster processing and greater awareness," Brent Toland, sector vice president and general manager for the navigation, targeting and survivability division at Northrop Grumman Mission Systems, told Breaking Defense this April.

"In addition to typical aerospace interfaces such as discrete I/O, analog sensors, and low-speed serial interfaces, customers are looking for high-speed interfaces — multi-channel, high-definition video links, 10 gigabit or higher communication links," says Emil Kheyfets, director of military and aerospace product line and director of engineering at Aitech Defense Systems in Chatsworth, Calif. "Modern aerospace electronics systems must be able to receive, send and process large amount of data from high resolution sensors and from other systems."

EW and the cyber domain

The cyber domain is a source of some confusion in the industry, and it's important to differentiate it here from the protection of ally online systems from digital attack, or "cyber security." There is some debate over why cyber is considered a separate domain of warfare, while the electromagnetic spectrum is not, C4ISR.net points out.

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The electronic warfare and countermeasures system on the F-15 Eagle, made by BAE Systems, provides advanced electromagnetic capabilities that protect pilots and help them maintain air superiority during their toughest missions. BAE Systems photo

The Navy, for instance, blends both with a new airborne electronic jammer, Rear Adm. John Meier, commander of Naval Air Force Atlantic, noted in April 2021.

"Now with the ability to do phased array, advanced jamming techniques, we really start to blur the lines, I think, between what we would consider traditional jamming with cyber warfare," he said.

The Next Generation Jammer, mounted on a EA-18G Growler aircraft, covers all three portions of the electromagnetic spectrum. Referred to as radio frequency-enabled cyber, this type of combined technology comes in response to adversaries "moving a lot of their stuff onto wired networks," said Bryan Clark, a senior fellow and director of the Center for Defense Concepts and Technology at the Hudson Institute, quoted by C4ISRNET.

"Security threats are happening through all phases of the life cycle of an embedded system," said Aitech's Kheyfets. "Cyber attacks to gain access to servers or steal design information as well as take control of embedded systems or retrieve classified information are among the top threats."

Those can include "from operational and data concerns to protecting design IP, as well as GPS service jamming or spoofing, wireless communication jamming or interception," he said.

Changes and predictions

Sensors and signal processing for electronic warfare covers a broad spectrum of abilities. Multi-intelligence signal processing also can include artificial intelligence (AI) and machine learning, according to BAE Systems. Their algorithms collect geospatial signals intelligence from a wide swath of domains. They digitally identify and exploit acoustic, radar, communications, navigation, and optical signals.

Christopher Rappa, chief technologist at BAE Systems, notes three major recent changes: a more widely accessible ability to bring custom electronics to edge processing; open interface design; and AI and machine learning. New digital engineering paradigms like digital modeling, digital engineering, and better software paradigms like containerization and cloud-native computing on top of hardware have enabled bringing electronics to the edge much faster.

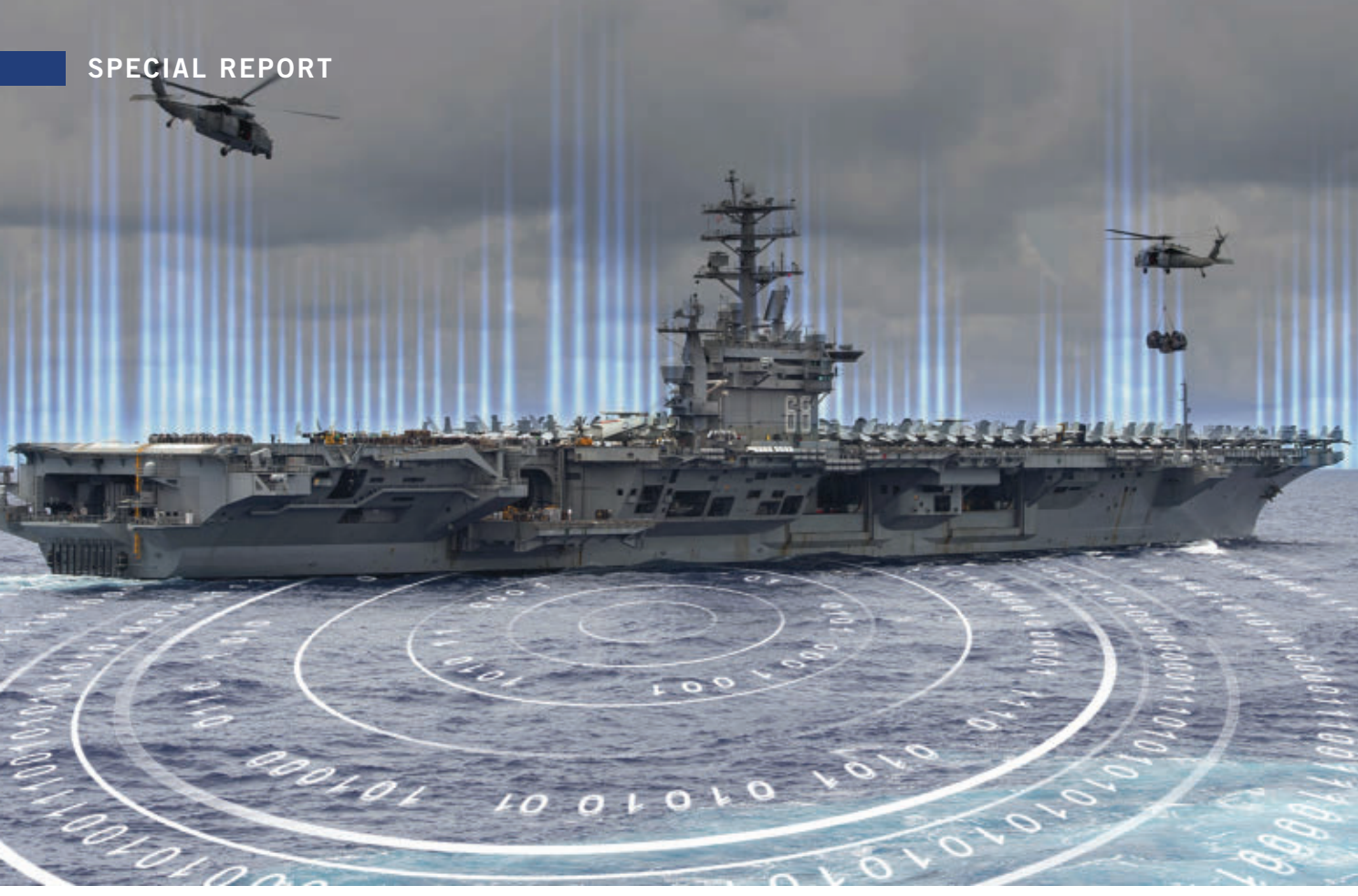
For BAE Systems, this also looks like partnerships with other companies like Intel, as well as various foundries and digital IP block providers. Two projects in particular, push in this direction: the $5 million DARPA T-MUSIC, which explores integrating mixed-mode RF analog and digital electronics into advanced onshore semiconductor manufacturing processes; and the $5 million Wideband Adaptive RF Protection (WARP) research project.

"These are both examples of us pushing tech further for higher speed electronics as well as better rejection of bad signals," BAE Systems's Rappa said.

The work of Mercury Systems in Andover, Mass., on digital RF memory (DRFM) systems shows some of the challenges in signal processing today as well. DRFM systems — usually broadband RF hardware, high-speed digitization modules and low-latency FPGA processing boards — can deceive adversaries' radar pulses such as those used on missiles.

"There is a game of cat-and-mouse where seeker developers create smarter, higher functioning hardware, while DRFM developers counter the smarter seeker via test/training in anechoic chambers, open-air ranges and/or in laboratories," says Joseph Styzens, product manager at Mercury.

"The evolution of test and training requires the ability to exercise platforms over wider instantaneous bandwidths (IBWs), narrower pulse widths, and denser operating environments with time-coincident emitters. Additionally, there is a continuous need for our platforms to be reprogrammed quickly with new waveforms or they need to learn how to adapt to the environment," Styzens says.



An illustration showing two MH-60S Seahawk helicopters conducting a vertical replenishment-at-sea with the aircraft carrier USS Nimitz. U.S. Department of Defense illustration

In test and training. Styzens says he is seeing changes from limited IBWs and single-target returns to those that can sift through a variety of incoming information at once. For example, a proven traditional architecture for test and training might be a DRFM with 1 GHz of IBW per channel, which detects the frequency and then tunes the system.

"This tuning takes time that is no longer available with newer, faster platforms," Styzens said. "These systems incorporate features for a mock environment such as simulating weather, inserting targets and applying jammers. For each target or EA return, additional channels are needed, increasing the amount of software, firmware and hardware. Newer, more advanced platforms recognize the traditional approaches and immediately discard returned information as false."

Technology like RF systems-in packages (RFSiPs) offer many more channels than before, and the newest architectures can cover several staring RF channels which dynamically cover large swaths of frequencies.

"Merging the RFSiP with commercially available RF devices, whether discrete or integrated into the RFSiP, disrupts and transforms sensor chains," Styzens said. "If we're savvy in our architectural decisions, we can do things not previously possible in test and training, such as provide wider IBWs, multiple time-coincident emitters, direct-to-digital wideband staring, very narrow pulses in dense environments, with cognitive EW."

For BAE Systems's Rappa, an important distinction lately in how BAE Systems thinks about electronic warfare sensors and signal processing is that they use more custom intellectual property blocks, which can be unique to specific EW or signals needs. No longer does each organization have to buy everyone from one "parts catalog," he said.

EW architectures

As the digital landscape changes, EW today needs to improve its processing efficiency with broader bandwidth sensors and the ability to switch rapidly between different sensors. Relatively new tactics, such as one pilot controlling a swarm of drones, may include EW capabilities. So, how does this work?

An important distinction between EW and radar systems architectures is that EW systems operate bidirectionally much more often, says Denis Smetana, senior manager of DSP products at the Curtiss-Wright Corp. Defense Systems segment in Ashburn, Va. EW signals need to move as quickly as possible, which calls for low latency, he says.

Many of these capabilities are built on the Sensor Open Systems Architecture (SOSA) Reference Architecture, which defines modules, hardware elements and software elements according to SOSA open-systems guidelines. They provide a framework through which new waveforms or techniques can be introduced relatively quickly.

"Today's backplane design must support the routing of high speed I/O signals," Kheyfets said. "SOSA requirements help to simplify backplanes designs, since a standardized architecture reduces the number of possible VPX cards slot profiles and pinouts."

The most critical component of an EW system at the plug-in card level is the front-end sensor processor, usually a tuner or field-programmable gate array (FPGA) card. This distributes sensor I/O data to other downstream plug-in cards.

SOSA-standard plug-in card profiles (PICPs) also support rear-panel fiber or coaxial cable interfaces, which remove many cable management problems, since they enable cabling within the sensor-processing chassis. That's another design element that makes them well-suited for EW. There's no need to disconnect cables when replacing a plug-in card, which reduces wear and tear and simplifies maintenance, says Curtiss-Wright's Smetana.

One recent development is the addition optical or coax connectors on the backplane to VITA 66 and VITA 67 provisions, as opposed to the previously common front-panel connections to cables leading to the sensors. Today it's common to see analog sensors and smart sensors with optical backhauls — sometimes in the same system.

The SOSA technical standard also takes into account the flexibility needed to work with a wide range of antennae and sensor front ends.

Open standards, SOSA, and C5ISR

The SOSA Consortium, part of the Open Group in San Francisco, is an important part of the conversation today. SOSA defines accompanying quality attributes, such as modularity, portability, securability, and scalability, for the underlying reference architectures.

"The choices we provide are limited to maximize reuse, but they are there to allow for growth," says Judy Cerenzia, vice president of forum operations, The Open Group. "Whether it is the way a SOSA Slot Profile is constructed or the number and type of protocols used in an AMPS string."

▲ **A signal support system specialist prepares the radio system used to allow soldiers and airmen to keep in constant communications with one another during a mission. DOD illustration**

Decision-makers in the aerospace electronics industry in regard to open standards and electronic warfare in the past year today have to consider whether open standards will prevent them from providing the best options, whether it will allow for innovation, and what it will cost, Cerenzia said.

For Mercury, SOSA aligned product development takes advantage of enhanced performance and reduced power consumption to adhere to the U.S. Department of Defense's MOSA mandate, says Mercury's Styzens. "The SOSA technical standard reduces development risks and helps ensure significantly longer operational life cycles with benefits including reconfigurability, easier insertion of new technology and the repurposing of hardware, firmware and software."

This also helps meet that goal of moving sensing closer to the edge, says BAE Systems's Rappa. "When you take things like a SOSA approach and can have different sensors of different modalities or different intelligence types, classically the program broke down because you had one sensor of one type going into a processor and the dissemination and processing of that data went into a central processing facility. By us being able to have better software and hardware architectures we can connect data from different sources closer to the edge."

Doing that with the mission systems integrator or weapons system integrator means being more responsive and more relevant in the field. This is also where "smart algorithms" (artificial intelligence or not) also can be good close to the edge.

Mercury's Styzens points out that a few new products that use SOSA standards as part of their improved performance. The Avionics Modular Mission Platform (AMMP) draws 50 percent less power than current-generation avionics computers while delivering 40 time more performance. The SOSA-aligned, single-slot 3U VPX Models 5585 and 5586 are open architecture 3U products that feature high-bandwidth memory (HBM) that integrates memory directly on the module's FPGA chip and shows a 20 times increase in memory bandwidth over traditional DDR4 memory, he said.

Rappa pointed out that it's important not to make SOSA compliance the only design consideration when working on

products with non-standard sizes, though. He specified a case where one might need to break a 15-slot SOSA rack into four boxes for size and space needs. Or, the box might need to sit next to a hot amplifier.

"If you want to put electronics on a wing tip or in the top of the tail, you can't put a piece of rack mounted equipment there. Even within the same aircraft there's not one size fits all," he said.

"There will always be cases where a proprietary optimized system provides better SWaP than an open standard option," Cerenzia said. "The drawback is the proprietary system is not useful in other applications."

Relatedly, Rappa says his organization is looking for and seeing more demand for different blocks from different IP in the same product, some from major suppliers, some from an electronic design automation providers, some from a foundry. BAE Systems is using interfaces that offer modularity at very tight levels of integration at the chip level to fit all of these together.

"The ecosystem of collaboration is integrated on the nano scales," Rappa said.

What's next?

What does the future hold for signal processing in electronic warfare? Some Army researchers are working on atomic sensors, although Breaking Defense cautions that this is still in the early stages of research. The Army is also looking for ways to extend EW across longer distances, to detect adversary electromagnetic sensors, and methods to tell whether ally EW attacks (which are often silent) did what they were intended to do.

Development times have moved from years to months, Rappa noted. "If you're playing this cat-and-mouse game against countermeasures, if you're going to be responsive, your timeline always has to be faster than your competitor. What I predict is that will move from us talking about development timelines and integrations and updates as major upgrades to this timeline being so fast that it's almost real time. Every time your plane lands new capabilities are being added to it. It's taking what it learns and applying that. It's going to surpass our ability to think about designs."

He added that it may take anywhere from five to 50 years to get to that point. Overall, though, he says to look forward to better power efficiency and more cooperative communications, perhaps with allies coming up with new waveforms to talk around new source of noise.. That type of development will need to happen at the "speed of the sensor."

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SOSA and open standards for military embedded computing

BY **Jamie Whitney**

The Open Group's Sensor Open Systems Architecture (SOSA) has become arguably the most influential embedded computing standard in the embedded computing industry as companies think about the boards and other components they are making for American warfighters.

Last fall, The Open Group — an industry consortium in San Francisco dedicated to ensuring vendor-agnostic technology requirements set by the Department of Defense (DOD) are established — rolled out the SOSA 1.0 standard. Now, the military embedded technology sector is hard at work making SOSA goals a reality.

In 2019, the U.S. Department of Defense (DOD) issued a directive to the U.S. Army, Navy, and Air Force dubbed the "Tri Services Memo." The use of modular open standards is a "warfighting imperative" according to the DOD.

The high-level goals of SOSA include openness and being platform- and vendor-agnostic while being aligned with Modular Open Systems Approach (MOSA) using standardized software and hardware. The consortium aims to leverage existing and emerging open standards and align with DOD service objectives. Finally, SOSA aims to keep technology affordable and adaptable.

Open architectures support aerospace and defense applications for manned and unmanned surface vessels, submarines, aircraft, land vehicles, and spacecraft. The goal is to reduce development and integration costs and reduce time to field new sensor capabilities.

Thankfully, the embedded computing industry had years of lead time and a fundamental philosophy to work around before aligning products to the SOSA standard. With that standard set, there is still plenty of work to do as The Open Group sets up a third-party system to certify products as SOSA compliant.

"There wasn't a future shock of what it was," says Rodger Hosking, director of sales at Mercury Systems Inc. in Upper Saddle River, N.J. "1.0 was really a clean-up of a lot of details and loose ends that were being debated and discussed and refined so we could drive a stake in the ground and say, 'there it is.'"

▲ **Mercury's SOSA aligned 5553 is based on Xilinx Zynq UltraScale+ RFSoC. The RFSoC integrates eight RF class A/D and D/A converters into the Zynq's multiprocessor architecture.**

This July, The Open Group released the first edition of its SOSA Business Guide, which experts say is a new comprehensive guide in the acquisition, deployment, modernization, and sustainment of sensor systems that support command, control, communications, computers, cyber, intelligence, surveillance, and reconnaissance (C5ISR).

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"As threats to sensing and communications advance and accelerate, the US Government needs to acquire sensor capabilities in a more agile and affordable way than traditional acquisition methods," Dr. Ilya Lipkin, SOSA Steering Committee Chair and US Air Force Open Architecture Technical Expert said when the business guide was launched this summer. "Moreover, the industry needs a viable business model with real opportunities to compete for business. The Open Group SOSA Consortium provides these differing interests with a balanced open approach where all stakeholders' needs are fairly represented in a collaborative forum."

▲ **The Pixus 19-inch rugged rackmount chassis in this example was designed specifically for the higher powered SOSA applications, with airflow over internal fins and the ability to target hot spots in the system.**

Beyond standards

While the SOSA standard aims to make systems and their components less expensive and easier to work on, industry experts note that end users may receive a more powerful product than non-aligned offerings.

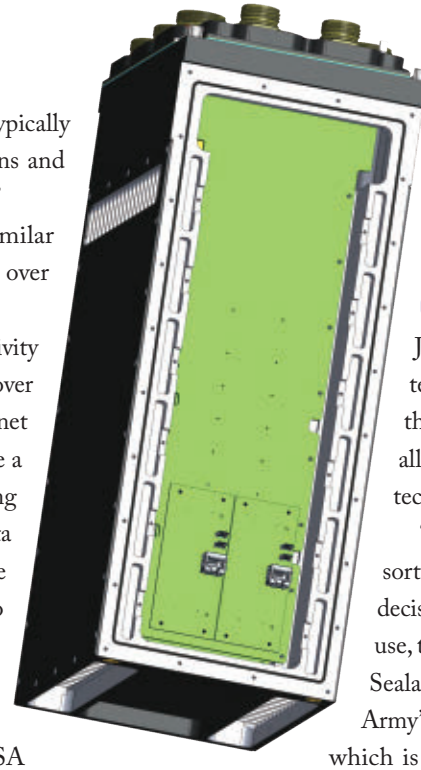
Justin Moll, the vice president of sales and marketing at Pixus Technologies Inc. in Waterloo, Ontario, notes that the SOSA efforts have driven backplane designs with new routing configurations and even increased performance.

"Typically, these designs incorporate VITA 67 and/or VITA 66 interfaces for RF/optical through the backplane," Moll says. "Some of the larger backplanes incorporate a timing slot. The speeds are typically higher in the SOSA designs, where 100 Gigabit Ethernet requirements are not uncommon.

The enclosures are affected by the typically hotter boards in SOSA applications and more I/O and cabling complexity."

Mercury's Hosking echoed similar sentiments about what can be done over Ethernet with SOSA products.

"SOSA really allows the connectivity to the outside world to also be done over the same high-speed Gigabit Ethernet links. So, for example, you can have a sensor and antenna that's acquiring data. The sensor will digitize the data closer to the antenna so that all the data that antenna delivers to the to the SOSA chassis will be Gigabit Ethernet and that will be immediately compatible with the links that are internal to the chassis for SOSA and then allow the same kind of interface to be used for both internal and external connectivity. It's really nice — it makes sense. It's kind of neat and it's clean and very scalable."



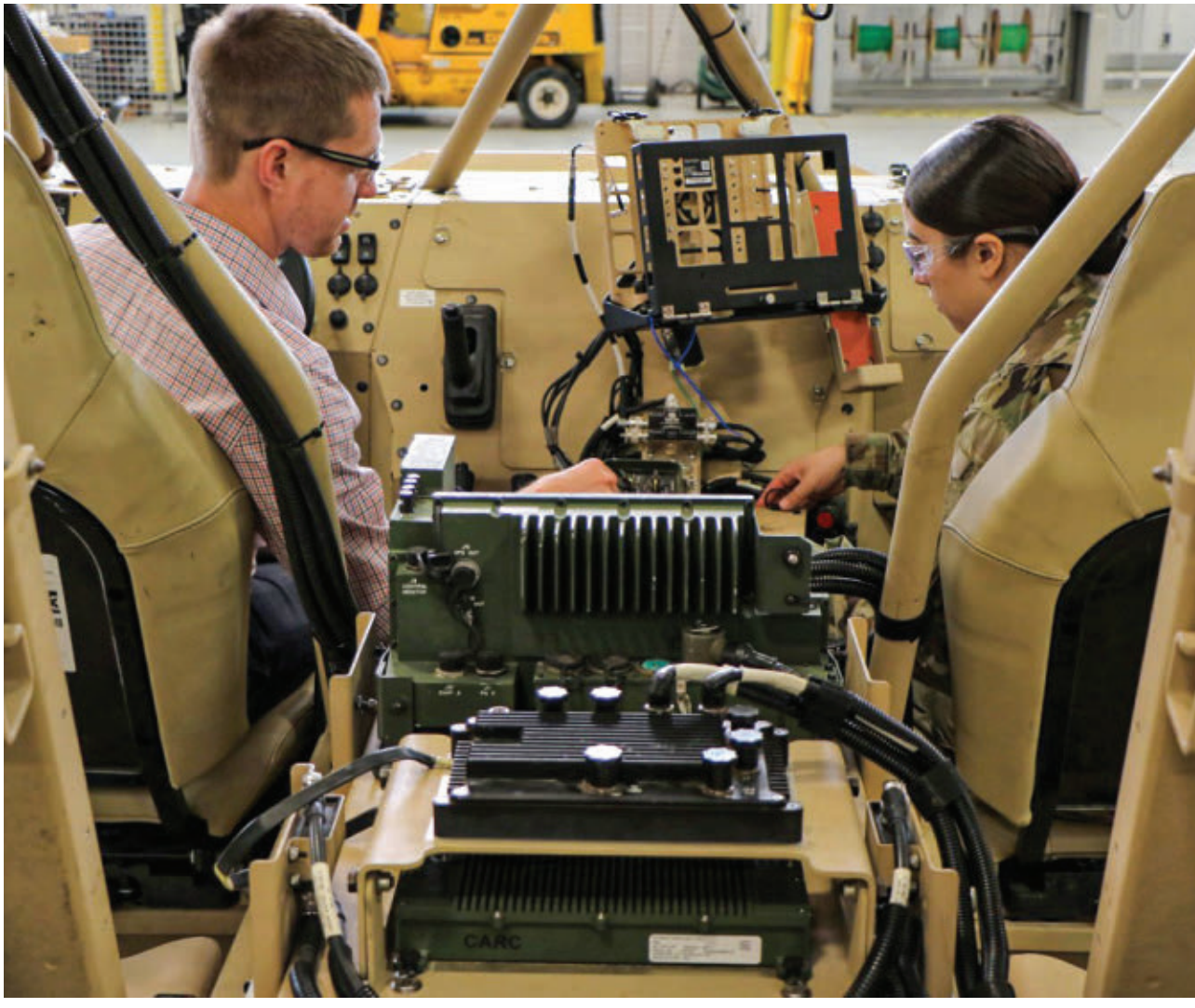
The Pixus SOSA aligned VPX chassis manager mezzanine mounts to the rear of the backplane, saving a slot of space. The units in this example are shown in redundant mode.

Openness onboard

Jacob Sealander, the chief architect for C5ISR systems at Curtiss-Wright Defense Solutions, explains that while SOSA is a "big catch all," the approach still allows options to refine systems to what is required both technologically and to each branch's needs.

"What I think we're seeing is people aligning with sort of the philosophy of SOSA, but as they make their decisions about which of the different options in SOSA to use, they're creating what I would call subset documents," Sealander explains. As an example, Sealander cites the U.S. Army's GCS Common Infrastructure Architecture (GCIA), which is based on the Modular Open Systems Approach (MOSA) model.

"They're creating architecture standards that really reflect all the same philosophies and leverage SOSA," Sealander



▲ The Pixus SOSA aligned VPX chassis manager mezzanine mounts to the rear of the backplane, saving a slot of space. The units in this example are shown in redundant mode.

says and also notes similar endeavors like the Future Airborne Capability Environment (FACE) and VITA 65 being leveraged as well. "It's interesting because I feel like SOSA is the influencing standard behind all these things, but you're still seeing these sorts of focused subsets coming to existence. So, all of these things really driven by the DOD's push for MOSA. All of these things are kind of playing together, and I see SOSA as sort of the backbone for all of them."

Sealander's colleague, Dominic Perez, who is the chief technology officer at Curtiss-Wright, notes that the limitations in the SOSA standard allows companies to focus on the variances rather than base it is built upon.

"So, we can very clearly go, hey, this is going to be the most popular profile or couple of profiles for this style of card. Certainly, if we have other legacy systems that are using different profiles, we can support those, but typically what we're moving to is a SOSA-aligned-profile-first design inside of Curtiss Wright."

Pixus' Moll agrees, saying "There is the potential for our chassis managers, SOSA aligned backplanes, and base-chassis platforms to be utilized in a lot of different applications/programs. The overall size, dimensions, slot count, etc. would be the same as they would incorporate the same main enclosure, utilized in varying customer projects."

That could mean more re-use of existing designs, less customization. But, for backplanes and I/O, it seems likely that there is going to be enough differentiation in configuration requirements that it will drive 'modified standards' for SOSA aligned systems. So, less customization, but still some modification."

Pros and cons

Curtiss-Wright's Perez notes that there are benefits aplenty for the SOSA revolution including easily swapping and upgrading systems, however, he sees potential growing pains as companies begin their drive to get their embedded systems approved as being fully certified in the program.

"But I think there's a little hair on the vision that may prevent it from coming true, at least in the next couple of years," says the Curtiss-Wright CTO. "One is that the conformance profile or the conformance programs are not fully established yet, so there are no conformant products on the market. There are a lot of companies putting their best effort towards being aligned in hopes of doing future performance, but we're not quite there yet. The other is if we're going to insert a different vendor or a technology upgrade, even though the profiles are the same, there are a lot of other pieces of system design that may or may not be the same. One thing that springs to mind is I can have a compute intense profile that could be an Intel processor versus, say, an Arm processor."

Perez continues, "And certainly the system and software that lays on top of those is not interchangeable, so there's more to it than [hardware]. The other issue is testing qualification

▲ Curtis-Wright Defense Solutions' SWaP-efficient VPX3-673 delivers technology services including a GPS/GNSS receiver, chip scale atomic clock, and an on-board inertial measurement unit.

— things like vibration and shock testing. Those are going to be unique to each vendor's instantiation. Yes, they may both conform to the same spec, but often government programs are required to do system tests, so things like EMI can change."

Mercury's Hosking, who along with other experts at Mercury — and previously at Pentek — says that the roll-out of the certification process could take another four to six months.

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"Last fall, I was predicting by this time [in 2022] we'd have the first boards certified. I've talked to people at shows and in general, people are behind it, but it's inertia. It's new, and there's a lot of processes that need to be put into place," Hosking says.

Ready for takeoff

While the industry patiently waits for the certification process to work itself out, companies are definitely developing products with the SOSA standard in mind.

"Pixus has also developed a SOSA aligned 19-inch rugged rackmount enclosure for mil-aero applications. It features conduction-cooled card mats with fins to dissipate 1600 Watts in the system," Moll says. "Rear fans pull airflow over the fins for

enhanced thermal management. The chassis can support up to 16 slots and 100 Gigabit Ethernet signals in the backplane. The SOSA aligned SlotSaver mezzanine-based chassis manager is optional.

Likewise, Mercury engineers had SOSA alignment in mind when they designed the company's Quartz Model 5553 3U OpenVPX board. The 5553 is based on Xilinx Zynq UltraScale+ RFSoC. The RFSoC integrates eight RF class A/D and D/A converters into the Zynq's multiprocessor architecture, creating a multichannel data conversion and processing solution on one chip.

The 5553 boasts a sophisticated clocking section for single board and multiboard synchronization, a low-noise front end for RF input and output, 16 gigabytes of DDR4, a 10 Gigabit Ethernet interface, a 40 Gigabit Ethernet interface, a gigabit serial optical interface capable of supporting dual 100 Gigabit Ethernet connections and general-purpose serial and parallel signal paths to the field-programmable gate array (FPGA).

The factory-installed dual 100 Gigabit Ethernet UDP IP cores provides greater than 24 GB/sec data transfers, and other protocols are supported with user installation IP.

Curtiss-Wright Defense Solutions offers a SOSA-aligned radial clock LRM for assured position, navigation, and timing (A-PNT) with its VPX3-673. The A-PNT is also CMOSS aligned and is designed with size, weight, and power (SwAP) concerns in mind. The SWaP-efficient VPX3-673 delivers technology services including a GPS/GNSS receiver, chip scale atomic clock (CSAC), and an on-board inertial measurement unit (IMU), all of which are contained within one slot.

Curtiss-Wright says the VPX3-673 is also ideal for radial clock distribution applications and can provide a server for various low-power timing services. Serving as a low-skew clock master powered by a GPS-disciplined CSAC, the module offers a variety of configurable clock reference sources and support for up to 16 synchronized clock outputs.

The VPX3-673's onboard 10 degree of freedom IMU makes it capable of precise motion tracking in a denied or untrusted GPS environment. Support for an onboard GB-GRAM type II GPS with SAASM or MCODE support is provided, including dedicated zeroize and keyfill functionality. An RS-232 port and RF 1 PPS input are provided for interfacing with an external RS-232 GPS sources.

Northrop Grumman to build guidance kits to help guide artillery smart munitions

BY **John Keller**

NEWARK, N.J. – U.S. Army explosives experts are asking Northrop Grumman Corp. to provide precision-guidance kits to transform conventional 155-millimeter artillery shells into GPS-guided smart munitions.

Officials of the Army Contracting command in Newark, N.J., have announced an $11.3 million order to the Northrop Grumman Armament Systems and Ammunition segment in Plymouth, Minn., for M1156 precision guidance kits for the Army.

The Northrop Grumman precision guidance kit (PGK) transforms existing 155-millimeter high-explosive artillery projectiles into affordable satellite-guided precision weapons.

The PGK conversion kit uses signals from the Global Positioning System (GPS) to guide artillery shells to their targets with accuracy of less than 10 meters.

▲ The Northrop Grumman precision guidance kit transforms 155-millimeter high-explosive artillery shells into satellite-guided weapons.

The low-cost reliable, fuze-sized guidance kit installs in the artillery shell's fuze well and also provides traditional fuze functions for height-of-burst and point detonation.

PGK conversion kit provides maneuver forces with an organic precision capability that works in all weather conditions, and fills a gap between conventional artillery and smart munitions capabilities.

On this contract modification Northrop Grumman will do the work in Plymouth, Minn., and should be finished by July 2026. For more information contact Northrop Grumman Armament Systems and Ammunition online at www.northropgrumman.com/what-we-do/land/armament-systems-and-ammunition, or the Army Contracting Command at www.army.mil/ACC.

C-130 aircraft-mounted MIMO radio for Special Operations introduced by Silvus and R4

Silvus Technologies Inc. in Los Angeles and R4 Integration Inc. in Fort Walton Beach, Fla., are working together to introduce the Roll On/Roll Off (RO/RO) Mobile Network-MIMO airborne communications hatch-mount kit for military C-130 special forces aircraft. The RO/RO Mobile Network-MIMO airborne communications hatch-mount kit is an en-route communications system for U.S. Special Operations warfighters that requires no modification to the aircraft and can be re-deployed quickly from one aircraft to another depending on the mission. At the heart of the system is the Silvus StreamCaster 4400 enhanced mobile ad-hoc networking (MANET) radio. With 20 Watts of transmit power, the system can establish air-to-air and air-to-ground datalinks at distances beyond 100 miles. The RO/RO Mobile Network-MIMO Airborne Communications system offers 80 Watts of effective transmit power because of a six-decibel signal boost from Silvus proprietary Transmit Eigen Beamforming technology. R4 has developed the Silvus SC4400E MANET radio into an ultra-lightweight RO/RO C-130 solution that has enabled the companies to increase the warfighter's communications-on-the-move capability, says John Parsley, president of R4 Integration. For more information contact Silvus Technologies online at https://silvustechnologies.com, or R4 Integration at https://r4-integration.com.

Commerce investigates how U.S. electronic components ended up in Russian radar

Federal agents have begun questioning U.S. technology companies on how their computer chips ended up in Russian military equipment recovered in Ukraine. U.S. Commerce Department agents who enforce export controls are conducting the inquiries together with the FBI, paying joint visits to companies to ask about Western integrated circuits and other electronic components found in Russian radar systems, unmanned vehicles, tanks, ground-control equipment, and surface warships, say people familiar with the matter. It isn't clear which specific electronic components are being probed, yet investigators from a variety of countries have identified Western electronics in Russian weaponry found in Ukraine. Many of those components appear to have been manufactured years ago, before the U.S. tightened export restrictions after Russia seized Crimea in 2014. Other

parts, however, were manufactured as recently as 2020, according to Conflict Armament Research (CAR), a research group in London that has examined some of the parts.

Wireless networking antennas for 5G, Wi-Fi, public safety introduced by KP

KP Performance Antennas in Edmonton, Alberta, is introducing wideband, log periodic, and directional RF antennas covering 790 MHz to 6 GHz for wireless networking applications. The antennas offer all necessary wideband frequency access in one product to support applications such as distributed antenna systems (DAS), 4G, 5G, Wi-Fi, public safety, and NB-IoT networks. They offer high-gain directional coverage, are for global cellular and wireless network applications, provide 9 to 16 dBi gain, MIMO capabilities to boost speed and mitigate interference, and RG58 pigtails for short-patch connections from radio to antenna. The radome's weatherproof ABS construction with polycarbonate materials help these antennas perform optimally even in inclement weather and in harsh operating environments. For more information contact KP Performance Antennas online at www.kpperformance.com.

RF tuner modules for EW and signals intelligence introduced by Mercury

Mercury Systems Inc. in North Andover, Mass., is introducing the AM9018 receive and AM9030 transmit low-power, ultra-compact RF and microwave tuner modules for spectrum processing applications such as signals intelligence (SIGINT), direction finding (DF), and test and measurement applications. The high-performance and compact size of the AM9018 and AM9030 modules brings fast broadband RF processing to mission-critical operations in harsh environments, where space is at a premium such as in small intelligence, surveillance, and reconnaissance (ISR) drones and portable SIGINT systems. Mercury's RF and microwave technology provides the agile broadband RF necessary to identify and counter a target's electronic signals and communications quickly in SIGINT and electronic warfare (EW) applications. Mercury's RF tuner modules leverage the company's custom MMIC design capability resulting from Mercury's acquisition late last year of Atlanta Micro Inc. For more information contact Mercury Systems online at rf.microwave@mrcy.com, or Atlanta Micro at www.atlantamicro.com.

Leidos to develop medium-sized unmanned underwater vehicle for environmental sensing

BY **John Keller**

WASHINGTON – Unmanned systems designers at Leidos Inc. in Reston, Va., will design a medium-sized unmanned underwater vehicle (UUV) for marine environmental sensing and counter-mine warfare under terms of a $12 million contract.

Officials of the U.S. Naval Sea Systems Command in Washington are asking Leidos to design the Medium Unmanned Underwater Vehicle (MUUV) for torpedo tube-launched environmental sensing mission and maritime expeditionary mine countermeasures. This contract has options that could extend through 2032 and increase its value to $358.5 million.

The MUUV will combine unmanned vehicle and sensors to provide persistent surface-launched and -recovered mine countermeasures and submarine-based autonomous oceanographic sensing and data collection.

▲ The underwater craft will provide persistent surface-launched and -recovered mine countermeasures and submarine-based autonomous oceanographic sensing and data collection.

The MUUV will be a modular open-systems unmanned underwater vehicle that will support the next generation of the Navy's Program Executive Office Unmanned and Small Combatants (PEO USC) Unmanned Maritime Systems Program Office (PMS 406) Razorback UUV program and the Expeditionary Missions Program Office (PMS 408) Viperfish Maritime Expeditionary Mine Countermeasures UUV.

Initial MUUV production systems will be for expeditionary mine countermeasures, while others will support submarine-based autonomous oceanographic sensing and data collection for environmental sensing and mine countermeasures.

On this contract Leidos will do the work in Lynnwood, Wash.; Arlington, Va.; Newport, R.I.; Long Beach, Miss.; and San Diego, and should be finished by June 2023. For more information contact Leidos online at www.leidos.com.

Boeing to install sensors and weapons aboard Orca large unmanned underwater vehicles

BY **John Keller**

ARLINGTON, Va. – Undersea warfare experts at the Boeing Co. are moving forward with a project to integrate an advanced undersea payload-delivery system aboard the company's Orca extra-large unmanned underwater vehicle (XLUUV) under terms of a $8.5 million order.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., are asking the Boeing Defense, Space & Security segment in Huntington Beach, Calif., for option three of the second phase of the DARPA Hunter program. The Hunter program involves only developing and integrating the payload-delivery system, and not the extra-large UUV itself.

DARPA Hunter for unmanned submarines payloads is in three phases: the first to design and build the payload-delivery device to fit inside a government-provided payload module; and the second and third phases to support integration of the payload-delivery device into the big UUV for testing. Technical details of the Hunter program are classified.

The Northrop Grumman Mission Systems segment in Linthicum Heights, Md., is in charge of developing the payload-delivery system, which Boeing is integrating aboard the company's Orca extra-large UUV.

Northrop Grumman won a $9.9 million DARPA Hunter phase-two order in June 2019. Two years before that, the company won a $5.8 million Hunter phase-one contract.

Northrop Grumman and Boeing are integrating the XLUUV payload-delivery system aboard the Boeing Orca for persistent-surveillance sensors, and to deploy weapons, other UUVs, and unmanned aerial vehicles (UAVs).

The Boeing Co. Defense, Space & Security segment in Huntington Beach, Calif., won a $43 million order in February 2019 from U.S. Naval Sea Systems Command in Washington to build four Orca XLUUVs that could undertake long-endurance missions to deploy sensors or other UUVs.

Extra-large UUVs and their weapons and sensors typically are autonomous mini-submarines that measure about seven feet

▲ **Boeing will integrate an advanced undersea payload-delivery system aboard the company's Orca extra-large unmanned underwater vehicle (XLUUV).**

in diameter — sometimes larger. They are designed for launch from shore, from large military ships with well decks, or from large civil vessels with moon pools.

One of the U.S. military research projects that have led to the Boeing Orca XLUUV and the Northrop Grumman Hunter XLUUV payload-delivery system has been the Large Displacement Unmanned Undersea Vehicle (LDUUV) of the U.S. Office of Naval Research (ONR) in Arlington, Va.

On this contract Boeing will do the work in Huntington Beach, Calif., and should be finished by March 2023. This order brings the total value of the contract to $36.8 million. For more information contact Northrop Grumman Mission Systems online at www.northropgrumman.com, Boeing Defense, Space & Security at www.boeing.com/company/about-bds, or DARPA at www.darpa.mil.

UAV payload to detect biological agents and biohazards introduced by Teledyne FLIR

The Teledyne FLIR LLC Defense segment in Wilsonville, Ore., is introducing the MUVE B330 unmanned aerial vehicle (UAV) payload able to detect deadly biological agents and other airborne biohazards. The MUVE B330 is a continuous biological detector and collector that provides drones with real-time monitoring of biological threats while on the move. The payload enables operators assess a potentially hazardous scene from a safe distance. In dangerous conditions exist or are expected, the MUVE B330 can fly into suspect areas for an initial assessment of what biological agents may be present. The sensor payload deploys in minutes to reduce time to action. The Teledyne FLIR SkyRanger R70 and R80D SkyRaider unmanned aircraft will serve as initial deployment platforms for the B330. The MUVE B330 enables operators to make quick assessments of the threat perimeter; trigger automated sample collection for follow-on identification; make informed decisions before human operators approach a hazardous scene; locate the threat and track progression as the scene unfolds; and cover difficult terrain from the air. The MUVE B330 biological detector complements the FLIR MUVE C360 multi-gas detector, which is deployable on Teledyne FLIR as well as commercial UAVs and robots. Teledyne FLIR has teamed with Boston Dynamics, whose Spot robot will carry the C360 to remotely monitor chemical threats in industrial and public safety applications. Visuals and detailed indications help identify threats

and display them on a map using pin drops. For more information contact Teledyne FLIR Defense online at www.flir.com/applications/government-defense.

TruWeather teams with Iris for ground-based weather surveillance for uncrewed aircraft

TruWeather Solutions in Reston, Va., and Iris Automation in Reno, Nev., will combine technologies in Iris Automation's Casia G ground-based surveillance system (GBSS). TruWeather is a data and analytics firm, while Iris Automation is an avionics safety technology company. This meshed network will provide real-time integrated communications, collision avoidance and micro-weather data to operators. Micro weather or low-altitude local atmospheric conditions can often substantially differ from that in higher altitudes, injecting uncertainty into the safety equation. This can significantly impact uncrewed aircraft systems (UAS) and advanced air mobility (AAM) operations and revenue. According to an FAA-funded MIT Lincoln Lab study, currently only 3% of the U.S. has accurate surface weather and cloud ceiling report measurements. TruWeather recently turned its focus to sensor placement and density optimization to capture microscale features with rapid update, at the lowest cost possible. Incorporating weather sensors into Iris Automation's non-radar based passive ground based system, Casia G, simply made sense for both companies.

Drones are here to stay and academia is helping make that safer

Tens of thousands of aircraft take to the skies on any given day. And the airspace is expected to become even more congested with drones in years to come. Raytheon Intelligence & Space, a Raytheon Technologies business, is working with universities to shape the future of air travel by integrating drones into the airspace and figuring out how to make that safe. Raytheon is lending college researchers several of its products, including systems for air traffic management, weather prediction, cyber security and mobile radar. The equipment helps them conduct the research and development that is fundamental to innovation. Sharing such sophisticated equipment and engineering resources with universities enables fundamental research, development and innovation in academia. It's also helping to

leverage existing knowledge of the piloted environment and apply it to the uncrewed environment. For example, researchers from Stony Brook University, the University of Massachusetts Amherst, Virginia Tech and Hampton University have used RI&S' Skyler radar to capture critical data in low-altitude surveillance, precision weather observation and the tracking of small unmanned aircraft systems.

Acecore Technologies releases the Zoe UAV on Auterion's open system

Auterion in Moorpark, Calif., has announced that the Acecore Zoe is now part of the Auterion Open Ecosystem. The uncrewed Zoe is a portable heavy-lifter that can be configured from quadcopter to octocopter for added motor redundancy. By connecting with Auterion Suite via Skynode, the Acecore Zoe delivers data and live video streaming automatically, in real time, while the drone is flying and performing its mission. This zero-touch, fleet-to-suite integration means data is collected, analyzed and presented for a dramatically improved data work flow. Online-first capabilities with 5G connectivity and a wide array of new, tightly integrated payload options make drone operations more flexible and efficient for enterprise. Currently, each drone system on the market comes with its own dedicated ground control station and user experience.

Septentrio teams with MicroPilot on GNSS positioning systems in UAVs

Septentrio, a Belgian company specializing in high-precision GNSS positioning solutions, announced its collaboration with MicroPilot, a company based in Manitoba, Canada, that produces autopilots for uncrewed aerial systems (UAVs). Septentrio receivers, including the small-form-factor mosaic modules, as well as the OEM board AsteRx-m3, will support integration of positioning and orientation. In addition to developing autopilots, MicroPilot provides supporting software and services that enable customers to use development time more efficiently, reducing time-to-market. "Working closely with Septentrio gives MicroPilot the ability to better leverage resilient and robust GNSS technologies strengthening our offering to the professional UAV market for safe and reliable flight control," commented Howard Loewen, President of MicroPilot.

Honeywell has a new urban air mobility lab; why avionics research matters for UAM

Nestled into arid Phoenix, Arizona, deep in the stretches of its business parks, sits Honeywell Aerospace, the aircraft engines and avionics division of Honeywell International and just one of the many arms of the multinational manufacturing and business solutions conglomerate. The company at-large has a global footprint that touches a number of critical industries; from building management, to last mile software delivery solutions, to inorganic chemical compounds. Though, under its Phoenix roof is maybe the company's most exciting, cutting-edge and future-focused research: developing new avionics solutions in urban air mobility. MarketScale got an invitation to see Honeywell's new research and development lab where it develops hardware and software for the uncrewed aerial systems (UAS) and urban air mobility (UAM) markets. The new lab is located at Honeywell's Deer Valley avionics facility in Phoenix, Arizona. Configured to look like the front end of an aircraft, the new lab has one seat situated in front of a primary display with three additional large wraparound displays to view the simulated outside environment around the aircraft. It has hardware typically seen in a traditional aircraft cockpit and Honeywell's Compact Fly-by-Wire System acts as the brains of the operation, with flight routes and actual control laws built into the software, so the simulated vehicle will operate the same way it would in the real world.

Lockheed Martin to buy 22 electro-optical sensors for F-35 jets

BY **John Keller**

PATUXENT RIVER NAS, Md. – Combat aircraft experts at Lockheed Martin Corp. will buy 22 360-degree electro-optical sensor systems for the U.S. F-35 joint strike fighter under terms of a $22.6 million order.

Officials of the Naval Air Systems Command at Patuxent River Naval Air Station, Md., are asking the Lockheed Martin Aeronautics segment in Fort Worth, Texas, to procure 22 Electro-Optical Distributed Aperture System (DAS) sensors for the F-35 systems technology refresh-3.

The contract also calls for Lockheed Martin to procure developmental and operational testing, block 4 testing, the Electromagnetic Environmental Effects aircraft, and a spare sensor set for F-35 next-generation capabilities.

The electro-optical DAS collects real-time, high-resolution imagery from six infrared (IR) cameras mounted around the aircraft and sends it to the pilot's helmet-mounted display, providing a 360-degree spherical view of the environment.

The next-generation electro-optical DAS is from the Raytheon Technologies Corp. Intelligence & Space segment in McKinney, Texas. The system's original manufacturer was Northrop Grumman Corp., but the Pentagon and Lockheed Martin switched suppliers of the system to Raytheon in mid-2018.

The Raytheon-built DAS sensor system will be integrated into F-35 aircraft starting with Lot 15 aircraft, expected to begin deliveries in 2023.

The electro-optical DAS is designed to warn the pilot of incoming enemy aircraft and missiles, daylight and nighttime vision; fire control; and precision tracking of nearby aircraft for tactical maneuvering.

By projecting the DAS video stream into a helmet-mounted display, the F-35's pilot can see through the aircraft structure to view the surrounding environment.

Lockheed Martin Aeronautics is the manufacturer of the F-35 jet fighter-bomber for the U.S. Navy, Marine Corps, Air Force, and allied air forces.

The DAS collects imagery from six infrared (IR) cameras mounted around the aircraft and sends it to the pilot's helmet-mounted display for a 360-degree spherical view of the environment.

On this order Lockheed Martin and Raytheon will do the work in McKinney and Fort Worth, Texas, and should be finished by July 2023. For more information contact Lockheed Martin Aeronautics online at www.lockheedmartin.com, Raytheon Intelligence & Space at www.raytheonintelligenceandspace.com, or Naval Air Systems Command at www.navair.navy.mil.

Lockheed Martin to build HIMARS missile launchers for multimode seeker munitions

BY **John Keller**

REDSTONE ARSENAL, Ala. – Tactical missile designers at Lockheed Martin Corp. will build launchers for next-generation surface-to-surface rockets designed to destroy enemy targets as far away as 300 miles. under terms of a $204.7 million order.

Officials of the Army Contracting Command at Redstone Arsenal, Ala., are asking the Lockheed Martin Missiles and Fire Control segment in Grand Prairie, Texas, for production of M142 High Mobility Artillery Rocket Systems (HIMARS) launchers.

These launchers will fire the Army's future long-range Precision Strike Missile (PrSM) — a surface-to-surface, all weather, precision-strike guided missile fired from the M270A1 Multiple Launch Rocket System (MLRS) and the M142 HIMARS. PrSM should enter service in 2023.

The PrSM multimode seeker homes-in on an enemy target's radar or radio communications emissions to give the weapon passive stealth capability. It also uses an imaging infrared sensor for terminal guidance, and also takes guidance from Global Position System (GPS) and inertial measurement sensors.

PrSM is to replace non-insensitive and cluster munition versions of the Army MGM-140 Army Tactical Missile System (ATACMS). It will provide Army and U.S. Marine Corps field artillery units with long range and deep strike capability. The PrSM will destroy, neutralize, or suppress targets at ranges from 43 to 250 miles using indirect precision fires.

The baseline missile will be able to engage a wide variety of targets at ranges as long as 310 miles. It will emphasize imprecisely located area and point targets. Primary emphasis for follow-on upgrades will be on increased range, lethality, and ability to attack time-sensitive, moving, hardened, and fleeting targets.

By 2025 the Army will be able to use the long-range PrSM to attack and destroy moving enemy ships operating offshore at ranges out to about 310 miles. While the weapon primarily has surface-to-surface applications for use against enemy air defenses, troop fortifications, and armored vehicle columns, the PrSM is being configured with an advanced targeting multi-mode seeker to include maritime strike.

The PrSM multimode seeker homes-in on an enemy target's radar or radio communications emissions to give the weapon passive stealth capability.

The new targeting seeker has completed a captive carry test wherein it flew aboard an aircraft against representative targets in preparation for further testing and ultimate deployment.

On this order Lockheed Martin will do the work in Dallas; Archibald and York, Pa.; Camden, Ark.; Palm Bay, Boca Raton, and Clearwater, Fla.; Brownsboro, Ala.; Whippany, N.J.; and Jackson, Miss., and should be finished by April 2025.

For more information contact Lockheed Martin Missiles and Fire Control online at www.lockheedmartin.com, or the Army Contracting Command at www.army.mil/acc.

DATA STORAGE

▲ Special forces pick Black Cape for AI-driven military data storage

U.S. Special Operations Command data analytics experts needed platform-agnostic data storage that uses a common data standard for intelligence analysis. They found their solution from Black Cape Inc. in Arlington, Va.

Officials of the U.S. Special Operations Command (SOCOM) at MacDill Air Force Base, Fla., have announced a potential $49 million Small Business Innovative Research (SBIR) III contract to Black Cape for the Platform Agnostic Data Storage Infrastructure (PADSI) program.

The PADSI program provides technologies for data management, data processing, data analytics, and visualization on common user interfaces to support SOCOM.

The project seeks to develop a scalable platform-agnostic data storage system that will enable cross indexing of layered data using a common data standard for big data analytics. Standard data will enable machine-to-machine communication using artificial intelligence (AI) and deep learning.

The data repository will be able to support several tool suites to reduce or eliminate the data's reliance on specific computing systems. This will enable special forces analysts to reduce the costs of replicating data storage in different tool suites.

At full capacity, this system will enable analysts to identify and extract useful information rapidly across all available data sources to reduce the computer resources allocated to data mining.

The systems architecture will process data from several sources, identify the data type, and label information according to a common data standard for storage in the database. Key military applications will be multi-intelligence processing, and large scale AI-assisted analytics.

The project will consider reusable open-source software code for fielded systems, and then develop a prototype for use in realistic environments, including a government test bed.

This data storage infrastructure could serve a broad range of military applications where special forces and general-purpose forces require large scale common standards data storage.

This capability also could be adopted by first responders, federal law enforcement, and for organizations that must geospatially depict big data sets in common standard format, experts say.

On this contract Black Cape will do the work at MacDill Air Force Base, Fla. For more information contact Black Cape Inc. online at https://blackcape.io, or U.S. Special Operations Command at www.socom.mil.

DISPLAYS

▼ Intellisense to provide multifunction displays for Air Force C-5M cargo aircraft

Military avionics experts at the System of Systems Consortium (SOSSEC) in Salem, N.H., needed replacement multifunction controls and displays for the U.S. Air Force C-5M Super Galaxy giant cargo aircraft. They found their solution from Intellisense Systems Inc. in Torrance, Calif.

Intellisense has received a contract via SOSSEC Inc., which manages the consortium, to provide replacement controls and displays for the Air Force C-5M Super Galaxy airlifter, company officials say.

Intellisense will provide a high-resolution version of the Video Display Terminal, also known as the VDT-1209, which is currently in use on the MC-130J military utility aircraft.

As the replacement multifunction controls and displays hardware systems prime contractor, Intellisense will

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work with CMC Electronics in Montreal, which the PU-3000 multicore avionics computer as the graphics processing unit (GPU) to complete the C-5M cockpit display system replacement.

Intellisense and CMC will provide an open modular avionics architecture that enables easy software integration, and can grow with aircraft and user needs, Intellisense officials say.

The C-5M Galaxy is the Air Force's largest cargo aircraft and the third largest airplane in the world. It has six multifunction smart displays that provide the pilot, copilot, and flight engineers with primary flight and navigation information.

Air Force experts will replace the existing displays with modernized, large-format 15-inch displays and three separate graphics processing unit line-replaceable units.

Intellisense will provide the Air Force with prototype shipsets, as well as support development and rehosting of the C-5M Operational flight program. Additionally, Intellisense will develop the system to meet airworthiness requirements.

The project also will demonstrate the feasibility of using this modernized display and processing system on other important military aircraft. The prime contractor for the C-5M is the Lockheed Martin Corp. Aeronautics segment in Fort Worth, Texas. For more information contact Intellisense Systems online at www.intellisenseinc.com, or SOSSEC Inc. at https://sossecinc.com.

EMBEDDED COMPUTING

▲ Navy orders targeting network embedded computing for attack jets from Boeing and L3Harris

U.S. Navy aerial warfare experts are beefing-up the capability of carrier-based jet fighter-bombers to share networked targeting information with other aircraft and weapons systems.

Officials of the Naval Air Systems Command at Patuxent River Naval Air Station, Md., announced a $39.7 million order to the Boeing Co. Defense, Space & Security segment in St. Louis for the Distributed Targeting Processor-Networked (DTP-N) for U.S. and Australia to carry out anti-ship warfare from the F/A-18E/F and EA-18G attack jets.

Boeing will provide 63 DTP-N B kits — 32 for the Navy and 31 for — Australia; and 56 DTP-N A1 kits — 32 for the Navy and 24 for Australia — as well as DTP-N cyber security support.

The DTP-N network and computer avionics, from L3Harris Technologies Inc. in Melbourne, Fla., is a high-performance data- and signal-processing computer that bridges gaps between onboard and external data networks in real time.

The system incorporates the tactical targeting network technology and produces a common operating picture. It has one air-cooled weapon replaceable assembly consisting of a chassis, backplane assembly, and several removable embedded computing modules. Boeing is the systems integrator of the F/A-18E/F and EA-18G attack aircraft.

DTP-N is designed to reduce pilot workload by providing actionable information to the warfighter on the large-area display. It computers algorithms quickly, and provides performance scalability, technology insertion and functional growth capability via an open system architecture.

The DTP-N multilevel security capability supports several security enclaves on board and provides secure interoperability with other subsystems.

The DTP-N is designed to improve mission processing, subsystem interfacing, display generation, and secure multilevel information management. It hosts user-generated software with third-party and supplier-provided software.

The DTP-N computer provides a gateway from existing F/A-18E/F and EA-18G avionics to new external wireless tactical networks. It connects to the L3Harris Tactical Targeting Network Technology (TTNT) through Multifunction Information Systems Joint Tactical Radio System (MIDS JTRS) Ethernet interfaces to increase bandwidth, and to collect and share time-critical information using voice, streaming video, and still imagery.

On this contract Boeing will do the work in St. Louis, and should be finished by September 2024. For more information contact Boeing Defense, Space & Security online at www.boeing.com/company/about-bds, or Naval Air Systems Command at www.navair.navy.mil.

EMBEDDED COMPUTING

▶ XMC FPGA embedded computing card for signal processing introduced by New Wave

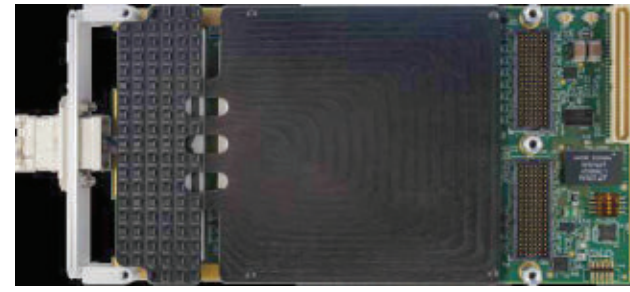
New Wave Design and Verification in Eden Prairie, Minn., is introducing the V1163 12-port rugged XMC ACAP embedded computing card for workloads that require configurable Adaptive Compute Acceleration Platform (ACAP) field-programmable gate array (FPGA) resources. The Switched Mezzanine Card (XMC) heterogeneous computing card combines hard ARM processor cores, large FPGA fabric, artificial intelligence (AI) engines, and high-bandwidth interfaces for applications such as rugged optics. The embedded computing board offers a 100-gigabit network interface card (NIC) with rugged optics; as many as 12 1G-to-25G optical ports via front panel I/O; optical backplane I/O or electrical I/O; support for Ethernet, Fibre Channel, sFPDP, ARINC 818, and Aurora; and the Xilinx Versal network interface device. The board is designed for AI workloads, digital signal processing (DSP), video processing, application co-processing, and secure networking. It complies with VITA 20 and VITA 47, and supports electrical or optical interfaces. For more information contact New Wave Design and Verification online at https://newwavedv.com.

NAVIGATION AND GUIDANCE

▼ Time-space navigation information system for positioning data offered by Curtiss-Wright

The Curtiss-Wright Corp. Defense Solutions division in Ashburn, Va., is introducing the MiTSPI nTTU-2600 miniature network tactical time-space position information system for demanding size-, weight-, and power (SWaP)-constrained applications like flight test, missile test, and hypersonics test.

The compact MiTSPI nTTU-2600 provides positional information for location and orientation in space to capture critical data that involves navigation, inertial measurement unit (IMU), and GPS Global Positioning System (GPS) information. MiTSPI nTTU-2600 delivers user defined time-space position information to support real-time telemetering via Ethernet and Chapter 4 pulse code modulation. It also supports simultaneous recording for data retrieval post-flight. Curtiss-Wright's family of MiTSPI miniature time-space position information stack subsystems provides 4x accuracy in an envelope



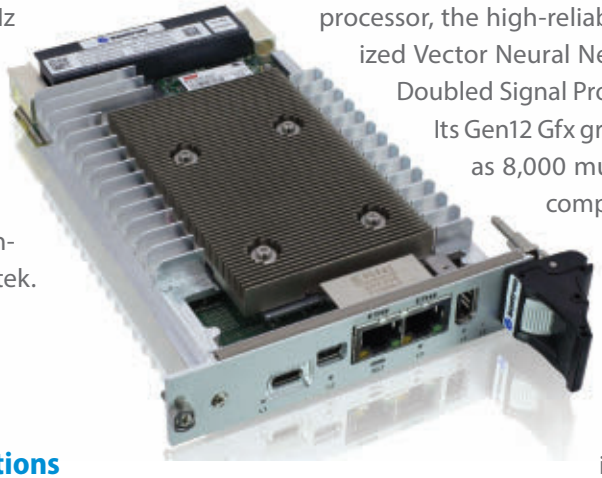
1/10 the size of legacy units typically deployed on existing military platforms. The system weighs 1.5 pounds, and measures 3.29 by 3.14 by 4 inches. The MiTSPI nTTU-2600 transmits real-time serial and Ethernet time-space position information at data rates as fast as 20 megabits per second and features a 100Base-T Ethernet interface. It supports a MINS-600 egress rate of 1 megabit per second. The unit's data recorder features a pulse code modulation output to transfer data into a transmitter. For more information contact Curtiss-Wright Defense Solutions online at www.curtisswrightds.com.

TEST AND MEASUREMENT

▼ Portable oscilloscope with benchtop test performance introduced by Tektronix

Tektronix Inc. in Beaverton, Ore., is introducing the 2 Series portable mixed-signal oscilloscope combines optional arbitrary function generator (AFG), pattern generator, voltmeter, and frequency counter into one unit to reduce the number of instruments to carry or purchase. The 2 Series mixed-signal oscilloscope can go from the bench to the field and back, and offers benchtop performance and the Tektronix user interface. It weighs less than four pounds, is 1.5 inches thick, and can fit into a small backpack for portability. The easy to use 10.1-inch touchscreen display has as much as eight hours of battery power. It has the feel of a mobile device and colored LED ring lights around the knobs to indicate active sources or parameters to adjust or to indicate status. The 2 Series mixed-signal oscilloscope includes bandwidths from 70 MHz-500 MHz; two or four analog channel inputs; 16 digital channels (available with future software release); 2.5-gigasample-per-second

sample rate; and optional 50 MHz arbitrary function generator. Natively integrated software tools enable engineers to collaborate, troubleshoot, and debug designs across time zones. For more information contact Tektronix online at www.tek.com/2-series-mso.



COMPUTER BOARDS

▶ High-reliability 3U VPX board for military applications introduced by Kontron

Kontron AG in Ismaning, Germany, is introducing the VX3060 high-performance 3U VPX single-board computer with 11th Gen Intel system-on-chip (SoC) technology for demanding SWaP-C defense and railway applications. Based on the low-power Intel Core i7-1185GRE quad-core processor, the high-reliability VX3060 supports specialized Vector Neural Network Instructions (VNNI) and Doubled Signal Processing performance (AVX512). Its Gen12 Gfx graphics engine provides as many as 8,000 multi-head display interfaces for computer vision and media processing - twice that of the previous generation. 11th Gen Intel Core U-series also features a software configurable TDP from 12 to 28 Watts. The VX3060 embedded computing board is compatible with the previous-generation architecture and with the SLT3-PAY-2F2U-14.2.3, SLT3-PAY-1F1F2U-14.2.4, and SLT3-PAY-1F1F2U1TU1T1U1T-14.2.16 VITA 65 OpenVPX profiles. The VX3060 is available in air- and conduction-cooled versions, and offers several extensions. For more information contact Kontron online at www.kontron.com. ←

PRODUCT & LITERATURE SHOWCASE

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Archer selects Honeywell for climate system tech and actuators for its production eVTOL

BY **Jamie Whitney**

PHOENIX - Archer Aviation in Santa Clara, Calif. needed thermal management and flight control technology for its electric vertical take-off and landing (eVTOL) aircraft. They found their solution from Honeywell in Phoenix.

Honeywell's actuation technology enables Archer's 12 tilt 6 configuration, and Honeywell's thermal management technology will help Archer provide a comfortable in-cabin experience for its passengers.

Archer has selected the MicroVCS for its commercial aircraft, which is Honeywell's thermal management system that provides several advantages compared to conventional systems, including lower weight, higher efficiency, and higher reliability in its class.

Honeywell also has a wealth of experience delivering actuation and thermal management systems for space, aerospace and naval applications. In the eVTOL segment, Honeywell offers a full line of avionics, navigation, electric propulsion, radar and communications systems, in addition to flight controls and actuation technology.

Archer's production aircraft will operate in dense cities as part of the burgeoning urban air mobility (UAM) market. Because dense, urban environments leave little room for errors, Honeywell says making critical precision from the aircraft's flight controls and actuators a must. Honeywell's actuators can accept hundreds of micro adjustments and commands per second from fly-by-wire computers, enabling precise navigation. Archer works to incorporate the latest advancements in technology into its aircraft to draw on its safety benefits.

"Honeywell's position as an established leader in delivering advanced aerospace technologies will be critical to our delivering on our goal of certifying our production aircraft in 2024," said Adam Goldstein, CEO, Archer. "It is evident to us that Honeywell shares our belief that the key to commercializing eVTOL aircraft is working with leading aerospace suppliers to ensure we can deliver as safe an aircraft as possible."

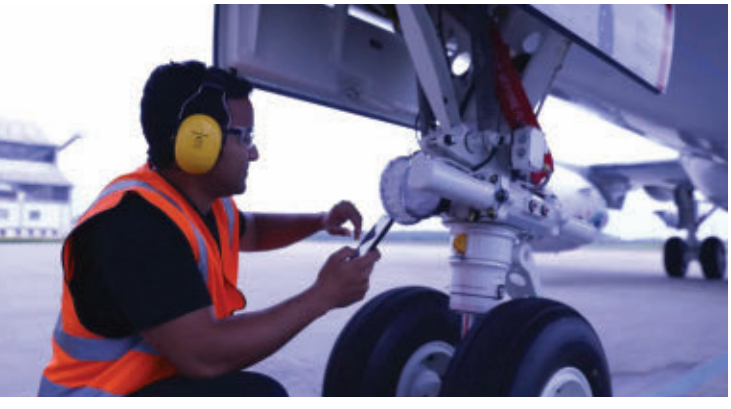
▼ The Archer Aviation electric vertical take-off and landing (eVTOL) aircraft will use thermal management and flight control technology from Honeywell Aerospace in Phoenix.

JetBlue selects EmbraerX's Beacon maintenance platform

BY **Jamie Whitney**

NEW YORK - JetBlue, a commercial airline based in Long Island City, N.Y., needed a maintenance coordination platform. They found their solution from EmbraerX in Boston.

Beacon is a maintenance coordination platform connecting resources and professionals for faster return-to-service aircraft. During the initial rollout, Beacon will help JetBlue simplify coordination of their maintenance events and propel collaboration amongst their maintenance talent pool and providers to accelerate return-to-service.



JetBlue will use the EmbraerX Beacon maintenance coordination platform to help return aircraft quickly to service after maintenance.

Beacon enables crews to see real-time updates and save and access maintenance records. Machine learning capabilities help identify maintenance patterns for optimization and provide insights.

"We think of Beacon not as a replacement for existing tools, but instead as an added layer that brings simplicity and ease," EmbraerX says on its website explaining the system. Beacon integrates with existing maintenance systems and can optimize communication tools such as WhatsApp, text messaging and phone calls with a more secure solution."

The onboarding will begin with JetBlue's selected bases including New York, Boston, and gradually expand to other airports and routes.

"JetBlue is a key commercial partner for Beacon due to the scale of its operation and its reputation in the industry," Beacon's Marco Cesarino says.

"The airline is an industry leader in human driven innovation for the digital and passenger experiences," Cesarino continues. "We are excited to partner with a leader like JetBlue and expand Beacon in North America, increasing the participants in the platform and measuring results to share success with other operators. It is all about keep passengers flying."

World's fastest airliner 'Overture' to usher in new era of supersonic travel

The world hasn't seen commercial supersonic travel in nearly 20 years since the Concorde was retired in 2003, but all that is about to change with the development of a new, environmentally friendly airliner. Overture will fly Mach 1.7 over water with a range of 4,250 nautical miles. Yesterday's Overture reveal at the Farnborough International Airshow is the culmination of 26 million core-hours of simulated software designs, five wind tunnel tests, and the evaluation of 51 full design iterations, resulting in an economically and environmentally sustainable supersonic airliner. On take-off, Overture will use the world's first automated noise reduction system. The airliner will fly without afterburners, meeting the same strict regulatory noise levels as the latest subsonic airplanes. These noise reduction efforts will deliver a quieter experience both for passengers and airport communities. Beyond the commercial applications of the supersonic flyer, Boom and Northrop Grumman announced a partnership to develop special variants for U.S. and allied governments.

Boeing 787-8 deliveries resume

American Airlines received its first Boeing 787-8 aircraft this year and its first since April 2021. The aircraft, with U.S. Registration No. N880BJ, was delivered from Charleston, South Carolina, and is expected to enter commercial service in the coming weeks. Including this delivery, American currently has 47 active 787 family aircraft in its fleet with an additional 42 on order. The FAA had recognized a problem with quality of finished parts in the 787 manufacturing process that resulted in very small gaps at structural joints that were outside of spec. *Continued on page D4*

Türksat selects ST Engineering iDirect for ground-based technology for its SATCOM system

BY **Jamie Whitney**

HERNDON, Va. - Türksat, an Ankara, Turkey-based regional satellite operator, needed ground systems to provide services to their customers. They found their solution from ST Engineering iDirect in Herndon, Va.

ST Engineering iDirect, satellite communications company, has signed a multi-million dollar contract with Türksat for the ground systems required to run a variety of services over the Türksat 5B satellite.

ST Engineering iDirect will provide multiple Dialog XIF hubs and 5,000 remotes, enabling Türksat to augment services to various markets including government, enterprise, mobility and cellular backhaul across 30 beams, which enables throughputs faster than 1 gigabit per second for demanding applications.

The Türksat 5B satellite will use ground systems from ST Engineering iDirect in Herndon, Va., to provide services to the company's data communications customers.

The new installations enable Türksat to run its satellite networks more efficiently, easily and rapidly adapt their existing networks or build new ones through ST Engineering iDirect's Network Management System (NMS) that allows services, capacity, terminals and beams to be scaled in an instant, fully automated and orchestrated way.

Based on the latest DVB-S2X technology and Mx-DMA MRC technology, Türksat can also maximize the benefits of the powerful 5B HTS by leveraging the highest efficiencies and throughputs of the DVB-S2X waveform as well as optimize the return link with Mx-DMA MRC.

"The latest satellite of our fleet, Türksat 5B, will greatly increase our current coverage and bandwidth over Ka HTS," said Selman Demirel, Vice President of Satellite Operations at Türksat. "This will enable Türksat to extend broadband services over many regions including Middle East, Africa, as well as major maritime and airtime routes.

The partnership with ST Engineering iDirect in this expansion is very important for Türksat to provide seamless, cost-effective and flexible services to current and prospective customer needs in a very broad and rapidly improving market.

The Dialog XIF Hub with flexibility, multi-service capability and scalability will be a key asset for Türksat for these active markets. Therefore, we truly appreciate this new contract to strengthen our strategic partnership."

Launched in December 2021, the Türksat 5B satellite provides data communication and broadcasting services over a coverage area that reaches the Middle East, the Persian Gulf, the Red Sea, the Mediterranean, the Black Sea, North Africa, East Africa, South Africa and Nigeria.

It also provides customized services to airlines and commercial ship operators around the world via its Ka-band beams. Commencement of the new services is expected this fall.

Boeing forecasts demand for 2.1 million commercial aviation personnel

BY **Jamie Whitney**

OSHKOSH, Wis. -Boeing's 2022 Pilot and Technician Outlook (PTO) forecasts demand for 2.1 million new aviation personnel over the next 20 years to support the safe recovery of commercial air travel and meet rising long-term growth.

The long-term forecast shows that 602,000 pilots, 610,000 maintenance technicians and 899,000 cabin crew members will be needed to support the global commercial fleet over the next two decades. The worldwide fleet is expected to nearly double and grow to 47,080 airplanes by 2041, according to Boeing's recently released Commercial Market Outlook.

This year's PTO represents a 3.4 percent increase from 2021, excluding the Russia region, which is not forecast in this year's PTO due to sanctions that prohibit exports of aircraft manufactured in western countries and market uncertainty.

China, Europe and North America represent over half of the total new personnel demand. The fastest growing regions are Africa, Southeast Asia and South Asia, with all three regions expected to grow more than 4 percent over the forecast period.

"As the commercial aviation industry recovers from the pandemic and plans for long-term growth, we anticipate a steady and increasing demand for aviation personnel, as well as the ongoing need for highly effective training," says Chris Broom, vice president of commercial training solutions at Boeing Global Services.

Commercial airlines will need 602,000 pilots, 610,000 maintenance technicians and 899,000 cabin crew members to support the global commercial fleet over the next two decades.

"Our customer-centric approach and digital expertise includes a commitment to delivering data driven, competency-based training and assessment solutions as well as technologies that meet the evolving needs of our customers," Broom says.

Boeing says it will be offering new digital solutions to enhance the efficacy and efficiency of training would include immersive learning experiences and virtual learning platforms.

Continued from page D2 Boeing and the FAA have stated that the 787 defects do not pose any immediate safety or flight issues, and the aircraft has not been grounded. Now, Boeing is now allowed to resume delivering the two-row, long-range jet.

Flying electric aircraft by 2024 a realistic timeframe for short-haul trips

It might seem ambitious, but passenger airlines could be using electric aircraft for short trips within two years, an aviation expert has said. It comes as Rex Airlines announces plans to trial the emerging technology by 2024 on selected regional routes. Rex and Australian-headquartered Dovetail Electric Aviation (Dovetail) announced in July the formation of a strategic partnership to pioneer the conversion of turbine powered aircraft to electric, nil emission propulsion. Rex will provide an aircraft to be used as a test bed for the project along with a raft of support facilities including engineering expertise, technical assistance, maintenance, repair and overhaul (MRO) support as well as storage facilities and workforce accommodation. Aircraft will be converted using MagniX engines for which Dovetail is the exclusive distributor in Australia, New Zealand, the South Pacific and Mediterranean Europe. Converted aircraft will be 30-40 percent quieter than their donor planes and will enjoy reduced operating costs of around 40 percent. Dovetail will certify the entire propulsion system of an aircraft by integrating the electric motor, battery packs and hydrogen fuel cells into one 'drive-train' on an existing airframe. In doing so, it will generate unique IP in conversion engineering, testing technology and power plant machine learning to optimize powerplant performance.