Standard payloads for hypersonic missiles PG. 4 Energy storage for military applications PG. 26

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Russian hypersonic missile use in Ukraine: is it a big deal?



BY **John Keller**
EDITOR IN CHIEF

Russian armed forces reportedly launched a hypersonic missile last month at a high-value target during Russia's invasion of neighboring Ukraine. So we've seen one of the first uses of much-vaunted hypersonic weapons in a real-world scenario. Is this a big deal?

As far as military value is concerned, the Russian Kh-47M2 Kinzhal hypersonic missile, launched in March, the answer is probably not. Yet where propaganda and sending a message to potential adversaries in the West are concerned, the answer is probably yes.

Hypersonic missiles travel at speeds exceeding Mach 5, or 2,840 miles per hour. The Russian Kinzhal reportedly travels at Mach 12, or 9,216 miles per hour. That's a little faster than two and a half miles per second.

The Russian Kinzhal hypersonic missile has been deployed since 2017 or 2018, Western intelligence experts believe.

So why use it in the Ukraine invasion?

Arguably this use of a hypersonic weapon had at least some military value. The Kinzhal destroyed a large underground warehouse of Ukrainian military missiles and aviation ammunition in the village of Delyatin, Ukraine, Russia's Defense Ministry said.

For a target like that, which at least temporarily could tamp-down Ukraine's ability to resist Russian attacks, the hypersonic missile might have been a suitable choice. Hypersonic missiles, in addition to their speed, can maneuver to avoid air defenses. It's sheer kinetic energy of hitting an underground weapons bunker at close to a thousand miles per hour would inflict devastating damage even with no explosive warhead.

Still, a land war is a strange place to see hypersonic weapons — at least for now. In these kinds of military operations, conventional weapons typically are up to the job. Hypersonic weapons are being designed primarily as anti-ship missiles for high-value targets like aircraft carriers, fleet oilers, and missile cruisers. In a land war, a hypersonic missile would seem to be overkill.

Developing a hypersonic weapon isn't easy. Besides the obvious technological challenges of designing hypersonic propulsion, the successful use of hypersonics requires extremely rugged electronics for guidance and control that can withstand the extremes of shock and vibration from hypersonic missile launch. In addition, a hypersonic weapon traveling through the atmosphere generates tremendous amounts of heat — akin to a spacecraft re-entering the Earth's atmosphere — so must use electronics that either can be cooled sufficiently or that are specially designed to survive temperature extremes.

With so much involved, you don't hear much about the use of hypersonics against land targets — unless it's for heavily defended and high-priority targets. Perhaps the Ukraine War will set the tone for hypersonic weapons tactics in the near future.

Weapons and military tactics aside, however, launching the hypersonic Kinzhal in Ukraine puts the Western power on notice that Russia has hypersonics and won't hesitate to use them.

It's kind of a Sputnik moment in the world of hypersonics. Russia's launch of the Sputnik satellite in 1957 clearly demonstrated Russia's capability to launch nuclear warheads on its best intercontinental ballistic rockets. Now use of the Kinzhal hypersonic missile in Ukraine does much the same: Russia clearly has the capability to launch nuclear warheads on a hypersonic missile, which is difficult, if not impossible, to shoot down.

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Wanted: hypersonic missile with standardized payload interface for different missions

BY **John Keller**

WRIGHT-PATTERSON AFB, Ohio – U.S. Air Force researchers are kicking-off a shadowy project to develop a large air-breathing missile able to carry out several different kinds of missions with a standardized payload interface.

Officials of the U.S. Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio, have issued a broad agency announcement (FA8650-17-S-2002_Call_003) for the Expendable Hypersonic Multi-Mission ISR and Strike (Mayhem) program.

▲ Potential $334 million project seeks to develop a standardized payload interface with different opportunities for payload integration within the same hypersonic system.

This potential $334 million project seeks to provide a significant technological advancement and future capability, with a standardized payload interface that would create several different opportunities for payload integration within the same hypersonic system.

It is expected that Mayhem payloads will involve delivering kinetic or explosive weapons, or intelligence and reconnaissance sensor payloads at hypersonic speeds. Hypersonic typically refers to objects traveling faster than Mach 5, or 3,836 miles per hour.

Few additional technical details of the Mayhem project are openly available. Companies interested in bidding should email the Air Force's Megan Rosenbeck at megan.rosenbeck@us.af.mil, and Joseph Cook at joseph.cook.39@us.af.mil no later than 15 March 2022 to request a Mayhem Proposal Requirements Package. ←

Companies interested should submit proposals no later than 24 May 2022. Send unclassified proposals on CDs by mail or by courier to Joseph Cook or Megan Rosenbeck at AFRL/RQHP Building 45, RM 90 2130 8th St. Wright-Patterson AFB OH 45433. Air Force researchers say they expect to award a contract by December 2022. More information is online at https://sam.gov/opp/4d1797ce5cd04eb4a9f7e77756031d81/view.

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Proposals should use guidelines of the military's Modular Open Systems Approach (MOSA), other open-systems standards, and commercial off-the-shelf (COTS) components.

MDA considers upgrading THAAD using MOSA and other open-systems standards

BY **John Keller**

HUNTSVILLE, Ala. – U.S. ballistic missile defense experts are reaching out to industry to find companies with the interest, knowledge, and resources to replace or upgrade the Terminal High Altitude Area Defense (THAAD) anti-missile system using open-systems standards.

Officials of the Missile Defense Agency (MDA) in Huntsville, Ala., released a request for information (MDA22THRFI01) in March for the Terminal Missile Defense Layer Enhancement project, which will rely on open-systems standards like the Modular Open Systems Approach (MOSA).

Evolving missile threats present complex challenges to existing missile defense systems, which drive the need for new solutions to enhance the terminal defense layer, MDA officials say.

THAAD plays a key role in the terminal missile-defense layer by protecting against short- and medium-range ballistic missiles using hit-to-kill technology. MDA continues to develop, procure, and sustain the THAAD Weapon System.

MDA experts are interested in potential open-systems solutions that could defeat known and future terminal-defense threats, and in determining industry's interest and capability to build, test, and support these kinds of designs.

Proposed solutions should capitalize on design guidelines of the military's Modular Open Systems Approach (MOSA), other open-systems standards, and commercial off-the-shelf (COTS) hardware, applications software, operating systems, and middleware.

Companies should provide details of how proposed solutions would integrate with the broader missile-defense systems architecture, and describe its logistics and sustainment.

Solutions should address development and fielding of existing THAAD components, such as its launcher, fire control, communications, interceptor, support equipment, integration, and testing. This project should begin in 2025.

Companies interested should email unclassified responses no later than 6 June 2022 to MDATerminalDefenseRFI@mda.mil, with RFI Terminal Missile Defense Layer Enhancement in the subject line.

More information on MOSA open-systems standards is online at https://ac.cto.mil/mosa/. More information about the Terminal Missile Defense Layer Enhancement project is online at https://sam.gov/opp/002e79ece1874b19839a96f74aba304b/view.

Russian strategy relied on technology; it appears inadequate

Last February, many political and military experts predicted that the Russians would be successful in their invasion of Ukraine. However, the war has not gone as the Kremlin planned. Their gains have been small, and they have been met with fierce resistance. As the conflict continues, they are also losing on the world stage. Although initial reports from the war are filled with disinformation and propaganda, it appears that the culprit for the Russian failure is their military technology. At the culmination of the war, Russia assembled a force of approximately 200,000 troops along the Ukrainian border. This force may seem formidable, but by most military doctrine, it was somewhat small. The Ukrainian military has approximately 360,000 troops. Doctrine holds that an offensive operation should have a 3-to-1 advantage in manpower, which would require the Russians to have a much larger force. The United States and its coalition partners overcame a similar manpower deficiency in the invasion of Iraq through their use of technology overmatch. Technology overmatch, especially air power, allows a small military force to achieve the combat power of a much larger force. Presumably, the Russian military had planned something similar.

NASA Langley works to revive supersonic flight without sonic booms

There was plenty to gape at as NASA Langley Research Center staff briefed members of Virginia's Capitol Hill delegation — but it was the slender, streamlined X-59 with its promise of supersonic flight without sonic booms that may have best exemplified the work of the nation's oldest aeronautics lab. The X-59 is shaped to reduce the loudness of a sonic boom reaching the ground to that of a gentle thump, if it is heard at all. It will be flown above select U.S. communities to generate data from sensors and people on the ground in order to gauge public perception. That data will help regulators establish new rules to enable commercial supersonic air travel over land. Usually, engines are placed on the bottom of an aircraft, but on the X-59 this section of the inlet and engine are mounted to the top of the plane. This way supersonic shock waves from the inlet and engine are shielded by the wing — one of the many ways that NASA reduces the sonic boom to a sonic thump. With the engine's unique location on the plane in mind, the team conducts high-speed wind tunnel testing to increase confidence that the inlet will work as designed.

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Air Force asks industry to develop real-time signal processing for SIGINT applications

BY **John Keller**

ROME, N.Y. – U.S. Air Force researchers are asking industry to develop real-time signals intelligence (SIGINT) processing to improve information extraction, identification, analysis, and reporting for U.S. intelligence analysts.

As time is critical and ISR mission analyst's workload is high, automating SIGINT collection and processing in tasking and training is a major goal.

Officials of the Air Force Research Laboratory Information Directorate in Rome, N.Y., have issued a broad agency announcement (FA8750-21-S-7002) for the SIGINT Solutions For Evolving Scenarios (SSES) project.

Goals include providing situational awareness for worldwide signals and network intelligence sources; sensor data collection and processing with a network-centric approach; identifying processes to understand the adversarial battlespace; and multi-platform/multi-intelligence support to increase blue coalition warfighting capabilities. Researchers seek to provide the warfighter with real-time tools to assess and pinpoint the right decision quickly. Processed information will support intelligence, surveillance and reconnaissance (ISR); protect blue coalition forces with command, control, computer, and intelligence applications; and support battlespace awareness for the warfighter.

SIGINT technologies today process information on various communications media, operate in environments in low signal-to-noise ratio areas. and conduct operations against uncooperative targets where the noise types and channel conditions vary frequently from message to message.

As time is critical and ISR mission analyst's workload is high, automating SIGINT collection and processing in tasking and training is a major goal. This project is divided into three broad technology areas: information extraction, signal processing, and automation enhancements.

Information extraction takes information from a broadband signal to identify and catalog signals of interest. Signal processing enhances the signal to improve processor performance by removing noise and interference in one or more channels. Automation enhancements, meanwhile, focuses on automated signal processing to manipulate the signal of interest for storage and transmission, or to synthesize the signal for a variety of purposes.

Companies interested in participating should email white papers no later than 15 Aug. 2024 to the Air Force's Daniel Robbins at daniel.robbins.8@us.af.mil. Those interested in participating in 2023 should email white papers by 15 Aug. 2022. Those submitting promising white papers will be invited to submit full proposals.

Email technical questions to Daniel Robbins at daniel.robbins.8@us.af.mil. Email business questions to the Air Force's Amber Buckley at Amber.Buckley@us.af.mil. More information is online at https://sam.gov/opp/7e077c83c0364b68a3828cc5330d1c87/view.

Alif Semiconductor and OQ Technology to deploy NB-IoT connectivity for satellite networks

Alif Semiconductor, a global provider of microcontrollers and fusion processors, and IoT satellite operator OQ Technology have signed a memorandum of understanding (MOU) to collaborate on a narrowband internet-of-things (NB-IoT) solution for hybrid terrestrial satellite networking. Alifs small cellular enabled IoT devices will allow users to roam freely between mobile networks on the ground and OQ's IoT satellite constellation anywhere in the world. In addition to cost reduction, the solution being developed by Alif and OQ is expected to be superior due to its ability to switch between satellite and cellular terrestrial IoT networks, such as NB-IoT and CAT-M1, without modifying any radio or hardware on the chip. This is a direct result of OQs patented satellite technology which uses LTE Band 65 in its satellite constellation and can also be applied to terrestrial mobile networks. The Crescendo family's small size and optimized power consumption makes it suitable for applications that require cellular IoT connectivity.

FAA and United Kingdom's CAA issue statement that recognizes potential of eVTOL aircraft

The U.S. Federal Aviation Administration (FAA) and the United Kingdom Civil Aviation Authority recognize the potential of electric vertical take-off and landing (eVTOL) and other Advanced Air Mobility (AAM) aircraft to benefit the public. To support future eVTOL aircraft development and operation, the U.S. and UK civil aviation authorities are engaged in a range of bilateral and multilateral discussions focused on facilitating certification and validating new eVTOL aircraft, production, continued airworthiness, operations, and personnel licensing. To streamline and expedite integration, this technology should use existing regulatory frameworks on which that strong safety record is founded. Both regulators recognize AAM is a collection of new and emerging technologies in the existing aviation system. Both authorities have a strong history of collaborating in aircraft certification, airspace integration, operations, and infrastructure, which lead to a safer, more sustainable sector.



Sikorsky to redesign computers on CH-53K helicopters to stave-off obsolescence

BY **John Keller**

PATUXENT RIVER NAS, Md. – Military avionics designers at Sikorsky Aircraft in Stratford, Conn., will redesign the flight-control computer aboard the U.S. Marine Corps. CH-53K King Stallion heavy-lift helicopter under terms of a $36 million three-year order.

Officials of the U.S. Naval Air Systems Command at Patuxent River Naval Air Station, Md., are asking Sikorsky, a Lockheed Martin company, to provide a CH-53K flight-control computer redesign due to obsolescence.

The order includes non-recurring engineering efforts to integrate, test, and qualify an updated flight-control computer for the CH-53K. The redesigned flight-control computer will undergo qualification testing to ensure all changes meet CH-53K performance specifications, and are backward compatible with all CH-53K flight control system hardware and software interfaces.



The flight-control computer in the CH-53K heavy-lift helicopter's cockpit needs a redesign to help maintenance personnel deal with obsolescent parts.

The flight-control computer takes inputs from the CH-53K helicopter's flight control surfaces and engine controls, and outputs to the engine-indicating-and-crew-alerting system (EICAS) and the flight management computer (FMC). The flight-control computer plays a vital role in safe flight.

Over time, some of the electronic components inside a flight-control computer can become obsolete and no longer have support from their manufacturers, which can make maintaining and upgrading these computers difficult, if not impossible.

Officials of the Navy PMA-261 CH-53 Heavy Lift Helicopters Program Office is awarding the contract to Sikorsky sole-source. Sikorsky is the designer, developer, and sole producer of the CH-53K helicopter, and the only responsible source for the flight-control computer redesign, officials say.

Sikorsky is the only known company with the data, technical skills, and requisite knowledge of the design, fabrication, performance, operation, maintenance, and support characteristics of the CH-53K helicopters to fulfill this need in a reasonable amount of time, experts say.

The CH-53K King Stallion is a large cargo helicopter designed to replace the Marine Corps fleet of CH-53E heavy-lift helicopters to help move Marines and their equipment from ships offshore onto attack beaches. The CH-53K is a general redesign of the CH-53E.

The CH-53K sea-based, long range, helicopter is designed to provide three times the lift capability of its predecessor. The CH-53K will conduct expeditionary heavy-lift transport of armored vehicles, equipment, and personnel to support distributed operations deep inland from a sea-based center of operations, Sikorsky officials say. It can lift more than 18 tons.

The CH-53K will have new engines and cockpit avionics layout, and will have more than twice the lift capacity and combat radius of the CH-53E. A wider cargo hold to enable the new aircraft to carry a light combat vehicle internally, and

will have new composite rotor blades. It will use the General Electric GE38-1B engine.

It can operate at high altitudes, hot temperatures, and in degraded visual conditions; sling load 36,000 pounds; can fly faster than 200 knots; can make 60-degree-angle bank turns; can climb to 18,500 feet above sea level; conduct 12-degree slope landings and takeoffs; and can auto-jettison external loads, and survive gunfire.

The CH-53K first flew in late 2015, and the helicopter was introduced to Marine Corps squadrons in 2018. The Marines plan to buy 227 CH-53K helicopters for about $23.3 billion.

The Raytheon Technologies Corp. Collins Aerospace segment in Cedar Rapids, Iowa, is providing the CH-53K's avionics management system; Sanmina-SCI Corp. in San Jose, Calif., is providing the new helicopter's intercommunications System; and Spirit AeroSystems in Wichita, Kan., is providing the CH-53 cockpit and cabin. Other major subcontractors are GKN Aerospace in Redditch, England; and Onboard Systems International in Vancouver, Wash.

Collins Aerospace is providing the company's Common Avionics Architecture System (CAAS) for the CH-53K. The CAAS integrates several communications, navigation and mission subsystems through its Flight2 system. It uses common reusable processing elements in an open-systems architecture based on commercial standards.

The Collins Aerospace CAAS avionics initially was developed for the Special Operations Forces' MH-47 and MH-60 helicopter fleets. In addition to the CH-53K, CAAS avionics also has been selected for the CH-47F, MH-60T, MH-65E, and VH-60N aircraft.

The Sanmina-SCI FireComm Intercommunications Control System for the CH-53K uses digital processing techniques and controls. Its system architecture uses the MIL-STD-1553 avionics data bus; the IEEE 1394b data bus; 10/100 Base-T Ethernet; and TIA/EIA-485 interface ports.

On this CH-53K flight-control computer redesign, Sikorsky will do the work in Stratford and Windsor Locks, Conn; Patuxent River Naval Air Station, Md.; and Fort Worth, Texas, and should be finished by September 2025.

For more information contact Sikorsky, a Lockheed Martin company, online at www.lockheedmartin.com/en-us/capabilities/sikorsky.html, or Naval Air Systems Command at www.navair.navy.mil.



Raytheon BBN and USC researchers to test limits of military quantum computing

BY **John Keller**

ARLINGTON, Va. – U.S. military researchers are asking two research organizations to find new ways of measuring the long-term utility of next-generation quantum computing technology for military applications.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., announced contracts in February to Raytheon BBN in Cambridge, Mass., and to the University of Southern California (USC) in Los Angeles for the Quantum Benchmarking program.



DARPA is asking Raytheon BBN and USC to determine if industry could design application-specific and hardware-agnostic benchmarks to test the utility of and best applications for quantum computers.

DARPA is asking Raytheon BBN and USC to determine if industry could design application-specific and hardware-agnostic benchmarks to test the utility of and best applications for quantum computers, as well as estimate the hardware resources necessary for quantum computing operations.

Raytheon BBN won a $2.9 million contract on 24 Feb. 2022, and USC won a $4.1 million contract on 23 Feb. 2022 for the DARPA Quantum Benchmarking program.

Future generations of quantum computing are expected to solve computing problems of unprecedented size and complexity, or those that today's most powerful computers are unable to solve. Quantum computing represents a new computing paradigm that capitalizes on the quantum mechanical phenomena of superposition and entanglement to create states that scale exponentially with number of quantum bits.

Experts believe that quantum computers within the next few decades will revolutionize scientific and technical fields like machine learning, quantum chemistry, materials discovery, molecular simulation, many-body physics, classification, nonlinear dynamics, supply chain optimization, drug discovery, battery catalysis, genomic analysis, fluid dynamics, and protein structure prediction.

For some of these examples, quantum computers are expected to be useful simulators. In others, quantum computers will be expected to handle combinatorial complexity that is intractable for conventional computers.

What today's computer scientists don't know, however, is what size, quality, and configuration of quantum computer would enable kinds of advances that military systems integrators will need in the future.

Still to be answered are questions like what applications could benefit most from quantum computing, and at what kind of scaling; how can systems integrators understand the new core computational capability of quantum computing; and what kind of metrics and testing procedures do scientists need for quantifying progress towards quantum computing capabilities.

That's where the DARPA Quantum Benchmarking project comes in. The project seeks to distil benchmarks for quantum utility to be useful for specific applications at specific scales — especially using the kinds of metrics that suitable for driving research and development.

The Quantum Benchmarking contractors will create new benchmarks that quantitatively measure progress towards specific computational challenges. In parallel, the program seeks estimate the computer hardware necessary to measure benchmark performance. The project's benchmarks will be hardware-agnostic for problems where quantum approaches most likely will be needed.

The Quantum Benchmarking contractors will quantify the long-term utility of quantum computers by solving some hard problems from a list of application in a variety of military domains, and grouping these application by common enabling capabilities.

Raytheon BBN and USC also will develop test procedures for quantifying progress in research; create scalable multi-dimensional benchmarks; and develop tools for estimating necessary quantum hardware resources for hard-to-achieve military capabilities.

The two organizations will analyze applications that require large-scale, universal, fault-tolerant quantum computers; estimates of the classical and quantum resources necessary to execute quantum algorithms on large-scale; applications of fault tolerance and error correction; and nontraditional quantum computing paradigms.

Raytheon BBN and USC researchers will focus on two technical areas: hardware-agnostic approaches, and hardware-specific approaches.

For more information contact Raytheon BBN online at www.raytheonintelligenceandspace.com/what-we-do/bbn, USC at https://research.usc.edu, or DARPA at www.darpa.mil/program/quantum-benchmarking.

NetJets to buy 150 Lilium electric vertical take-off and landing (eVTOL) aircraft

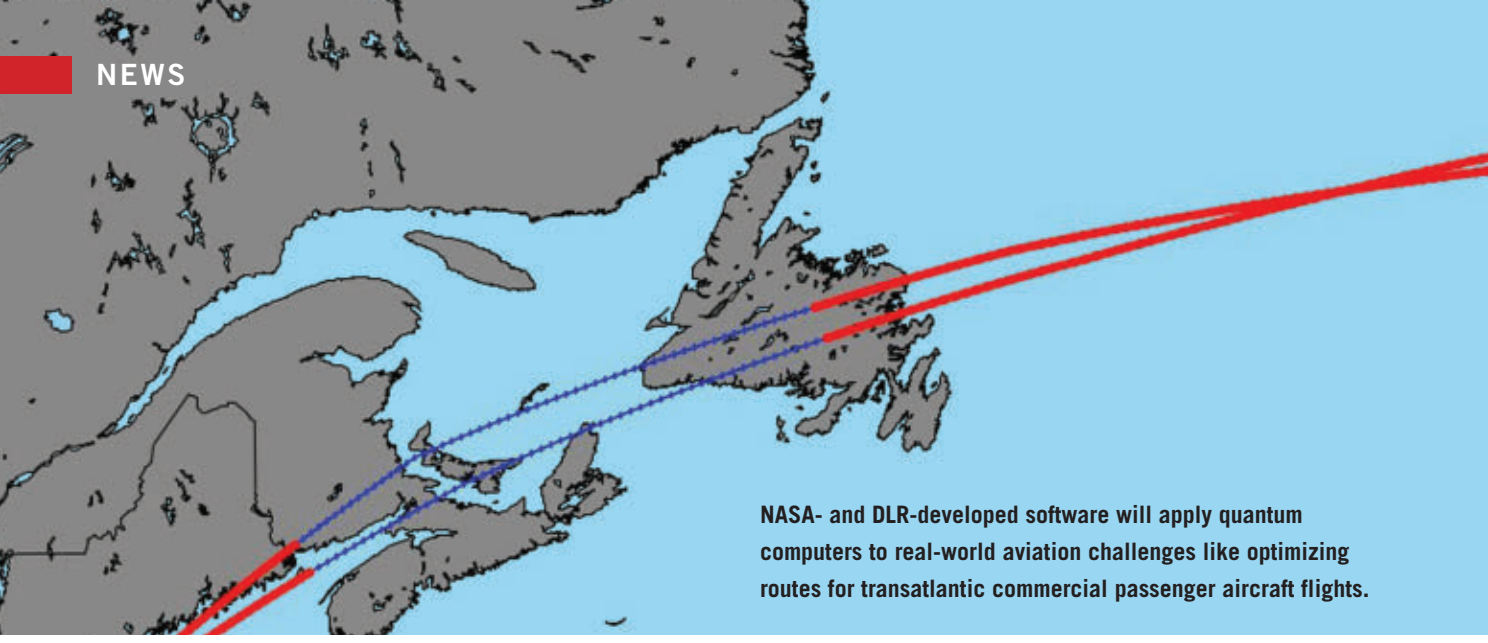
NetJets executives are buying 150 electric vertical take-off and landing (eVTOL) aircraft from Lilium Air Mobility in Weßling, Germany. NetJets will operate the eVTOL aircraft as Part 135 charter aircraft. The eVTOLs will be based in Florida where Lilium will build an eVTOL network serving central and southern parts of the state. NetJets will be a partner in the network, which will link larger cities with existing and new-build vertiport facilities. In 2021, Lilium selected Honeywell's avionics and flight control systems for its seven-seater eVTOL. The compact fly-by-wire system will act as the flight control system on the all-electric 7-Seater Lilium Jet, responsible for controlling its moveable parts, including the 36 control surfaces and ducted fans that provide its high levels of maneuverability in every stage of flight. The selection of Honeywell's next-generation Urban Air Mobility avionics system is the result of ongoing collaboration between Lilium and Honeywell to converge on the specific technical requirements suitable for the Lilium Jet.



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NASA- and DLR-developed software will apply quantum computers to real-world aviation challenges like optimizing routes for transatlantic commercial passenger aircraft flights.

NASA working together with German Aerospace Center to develop quantum computing software

BY **Jamie Whitney**

WASHINGTON - The U.S. National Aeronautics and Space Administration (NASA) in Washington is joining hands with the German Aerospace Center (DLR) in Cologne, Germany, to develop open-source software for quantum computers in real-world aerospace applications.

The DLR established a quantum computing research group in 2015 as part of its High-Performance Computing department. DLR and NASA announced the partnership earlier this year.

DLR has published a software module that uses quantum computing for optimizing routes for transatlantic flights, allocating aircraft at major airports, or planning satellite missions.

NASA and DLR are developing additional software modules and subsequently will make them available to industry as open-source software.

"Quantum computers promise extreme runtime improvements for certain application problems that cannot currently be solved with conventional computers," DLR wrote of quantum computing for its Institute for Software Technology.

"While computational tasks on classical computers are processed with bits that have either the state zero or one, quantum computers operate on the basis of qubits that can assume many different states simultaneously," DLR wrote. "Algorithms that make optimal use of these properties can demonstrate an advantage over classical algorithms."

The partners are continuing work on the DLR group's software module, which serves as an interface for the transfer of industrial planning problems to quantum computers. It was developed as part of the Enabling QUAnTum AdvantagE (EQUATE) project.

The project is investigating whether a certain problem can be solved faster on a state-of-the-art quantum computer than on a conventional computer. It also is looking at how quantum computers can be used efficiently in combination with conventional computers.

NASA's research group, the Quantum Artificial Intelligence Laboratory in (QuAIL) at the NASA Ames Research Center in Mountain View, Calif., is a cooperation partner for DLR.

There are many similarities with DLR's research goals and use cases," says Tobias Stollenwerk, head of the Quantum Computing Research Group at the DLR Institute for Software Technology.

DLR and NASA have been doing research on quantum computing together since 2016. Software is to be developed to support the creation of new quantum computer algorithms, and for compiling and error suppression in computer processes.

For more information contact the NASA Quantum Artificial Intelligence Laboratory online at https://ti.arc.nasa.gov/tech/dash/groups/quail/, or the German Aerospace Center at www.dlr.de/EN/Home/home_node.html.



Collins Aerospace will provide Pitot and Total Air Temperatures sensors for the Hainan Airlines fleet of 500 passenger aircraft.

Hainan Airlines selects Collins Aerospace for long-term sensor supply agreement

BY **Jamie Whitney**

SINGAPORE - Collins Aerospace in Cedar Rapids, Iowa, has signed a long-term agreement with Hainan Airlines to provide Pitot and Total Air Temperatures sensors for Hainan's fleet of 500 passenger aircraft, including the Airbus A320, Airbus A330 and Boeing 737NG. Hainan Airlines is a global airline, based out of China, with worldwide routes.

The Airbus aircraft will be retrofitted with the 0851MC Pitot probe, developed to comply with current FAA and EASA ice crystal and mixed phase icing requirements. This will provide the aircraft with improved performance during icing conditions, enhance safety and help keep flights on time and on schedule.

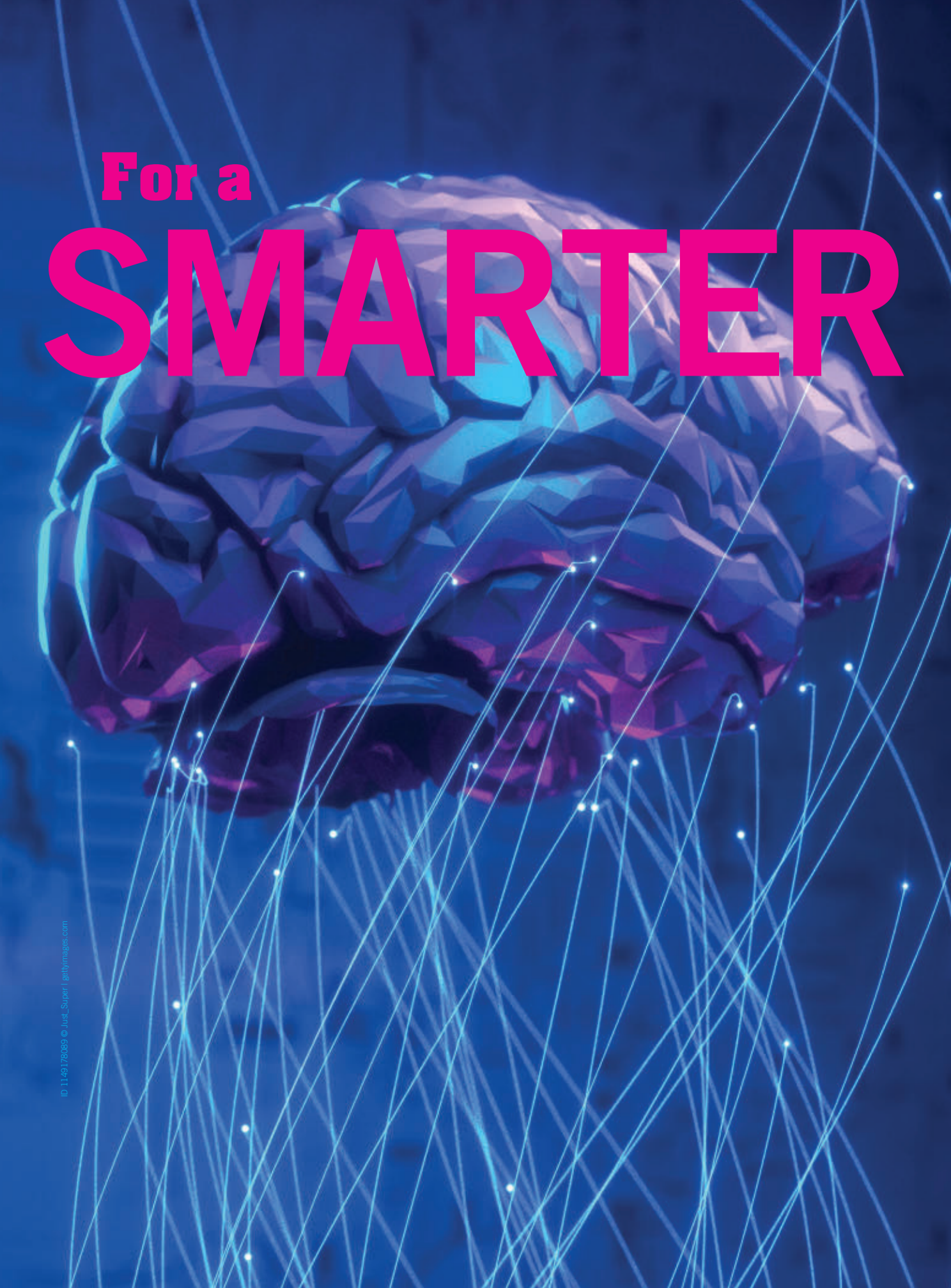
In addition, the Collins OEM-approved Air Data Sensors — which are critical to aircraft performance by measuring a range of important data including air speed, altitude and air data computer calculations — will provide the Boeing 737NG fleet with higher product reliability, cost savings and improved aircraft efficiency.

The Airbus aircraft will be retrofitted with the 0851MC Pitot probe, developed to comply with current FAA and EASA ice crystal and mixed phase icing requirements. Pitot probes relays vital information for aircraft flight control by providing highly accurate Pitot pressure measurement over a wide range of angles of attack and airspeeds even in extreme icing conditions.

This will provide the aircraft with improved performance during icing conditions, enhance safety and help keep flights on time and on schedule.

In addition, the Collins OEM-approved Air Data Sensors — which measure a range of data including air speed, altitude and air data computer calculations — will provide the Boeing 737NG fleet with higher product reliability, cost savings and improved aircraft efficiency.

For a SMARTER



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FUTURE: artificial intelligence and machine learning

U.S. military relies on artificial intelligence (AI) and machine learning for a growing number of important applications ranging from uncrewed vehicles and robotics, to command and control.

BY Megan Crouse

For the first time, the U.S. Department of Defense (DOD) has a Chief Digital and AI Officer (CDAO). Or, at least, DOD Chief Information Officer John Sherman has an additional job title. On Feb. 2, the Pentagon added the Defense Digital Service, the Joint Artificial Intelligence Center to Sherman's existing CIO role.

What does that mean for the industry? While it's not possible to say for certain, this does provide a direction as more companies across aerospace, defense, and other tech fields adopt artificial intelligence (AI) and machine learning. How might it trickle down into software and hardware design for military and aerospace electronics?

"In addition to getting CDAO up and ready for [full operational capability], rest assured we'll remain laser focused on our CIO duties of cyber security; digital modernization; command, control, and communication [C3]; and other areas that the department relies on," Sherman says.

The department likely will move 200 to 300 people into the joint effort that is the new office. It operates with an approximately $500 million budget.

This also comes with some clarifications on restructuring. Industry will look to the office of the CDAO for infrastructure requirements, policy, and guidance. That may mean some changes.



The Pentagon's Joint Artificial Intelligence Center is to use artificial intelligence and machine learning to help the Army reduce the amount of time it takes to correct financial errors.

"Of course, this means than the U.S. sees a strategic path forward for AI," says Dan Mor, director of the video and general-purpose graphics processing unit (GPGPU) product line at Aitech Systems Inc. in Chatsworth, Calif. "The new office was established to better align a number of data, analytics, digital solutions, and AI efforts across the DOD."



Artificial intelligence, human-agent teaming, and machine learning will help soldiers provide commanders with real-time information about the enemy, and include possible courses of action.

"We will see more requirements coming from DOD for AI and machine learning solutions," Mor says. "And since this information publicly available, it's anticipated that other countries will try to align and push AI and machine learning technologies, as well."

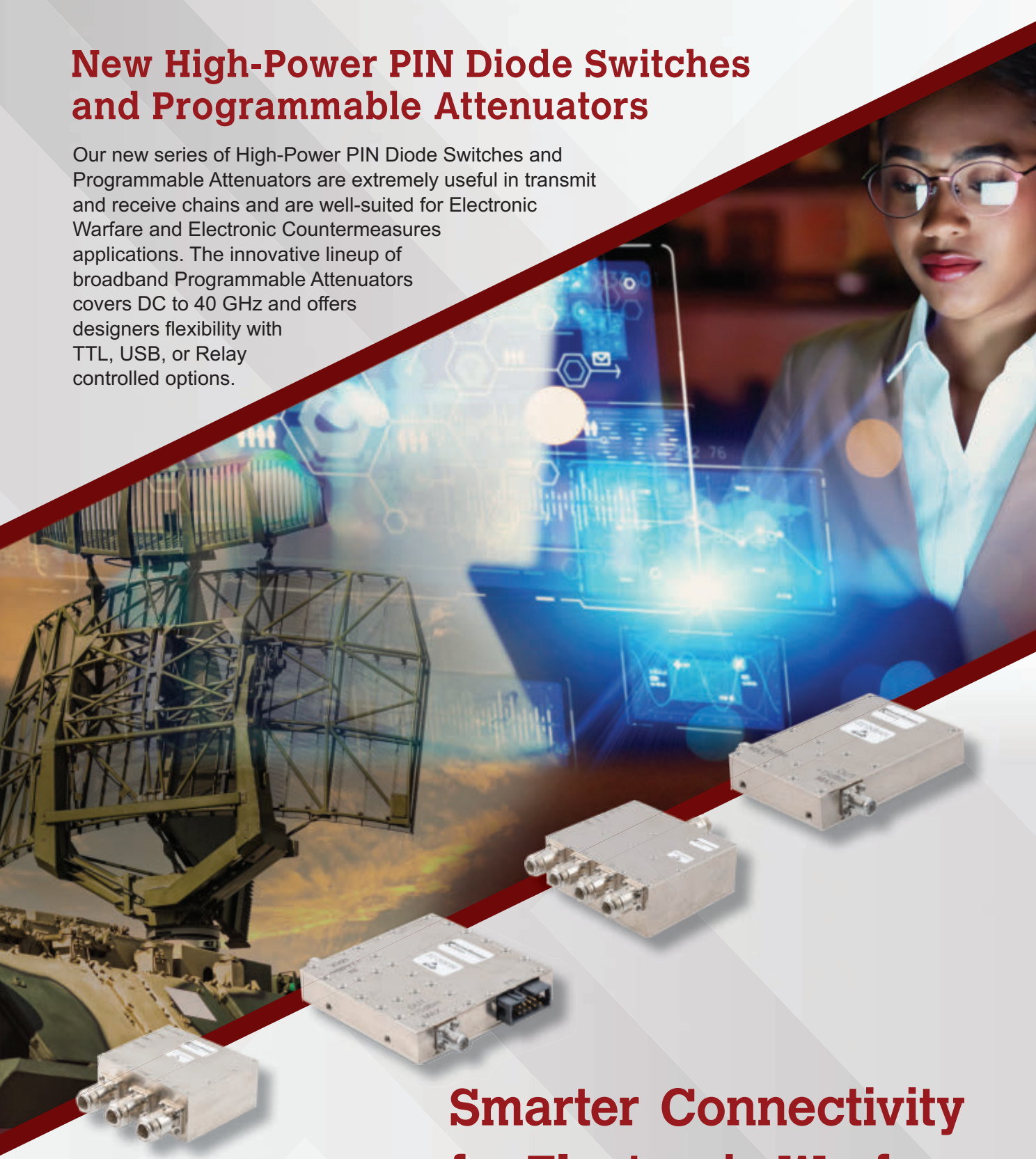
AI and machine learning have been part of the conversation in manufacturing and electronics for decades. Why not train systems to be able to make conclusions and decisions on their own, automating more difficult tasks?

The distinction between AI and machine learning includes a bit of overlap. Broadly, AI is the capability that enables a computer to "mimic human cognitive functions such as learning and problem-solving," as Microsoft describes it. Machine learning is a process within this capability, the process of training a computer to think in ways that let it make independent decisions and keep learning. Both are being applied at various stages of technological product development, from manufacturing to deployment and performance.

"Several years ago, AI was a new technology that need to be deployed and proved on field, but nowadays, it's already deployed in many projects and target platforms," says Mor. "Since the technology has already been established, it's time to improve performance per watt every year. Customers need to analyze an increasing amount of data and need more powerful AI and machine learning engines without jeopardizing size, weight and power (SWaP)."

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Artificial intelligence a focus for DOD

The DOD has feelers out in regards to almost 700 artificial intelligence projects, according to a February report from the Government Accountability Office (GAO) in Washington. About 200 of those are fielded by the U.S. Army, whose officials are hoping AI can add capability to target recognition, battlefield analysis and autonomy aboard uncrewed systems, including smart sensors.

For the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., AI needs to be introduced a step at a time. In late February, DARPA issued a solicitation to convert existing F-16 aircraft into test beds to run human-in-the-loop, safety-sandboxed testbed trials with AI assistance.

DARPA researchers are combining the idea of human-AI partnerships with drone swarm technology, proposing that one pilot could control a swarm of semi-autonomous craft around the central craft. The pilot paired with the AI would have a 'system mission commander' role, coordinating the overall engagement strategy and choosing weapons for the swarm. Called the Air Combat Evolution (ACE) Full-Scale Aircraft TA-4 project, the goal of this test program is to implement the AI, including human machine interfaces, and other algorithms and technologies created by participating contractors.

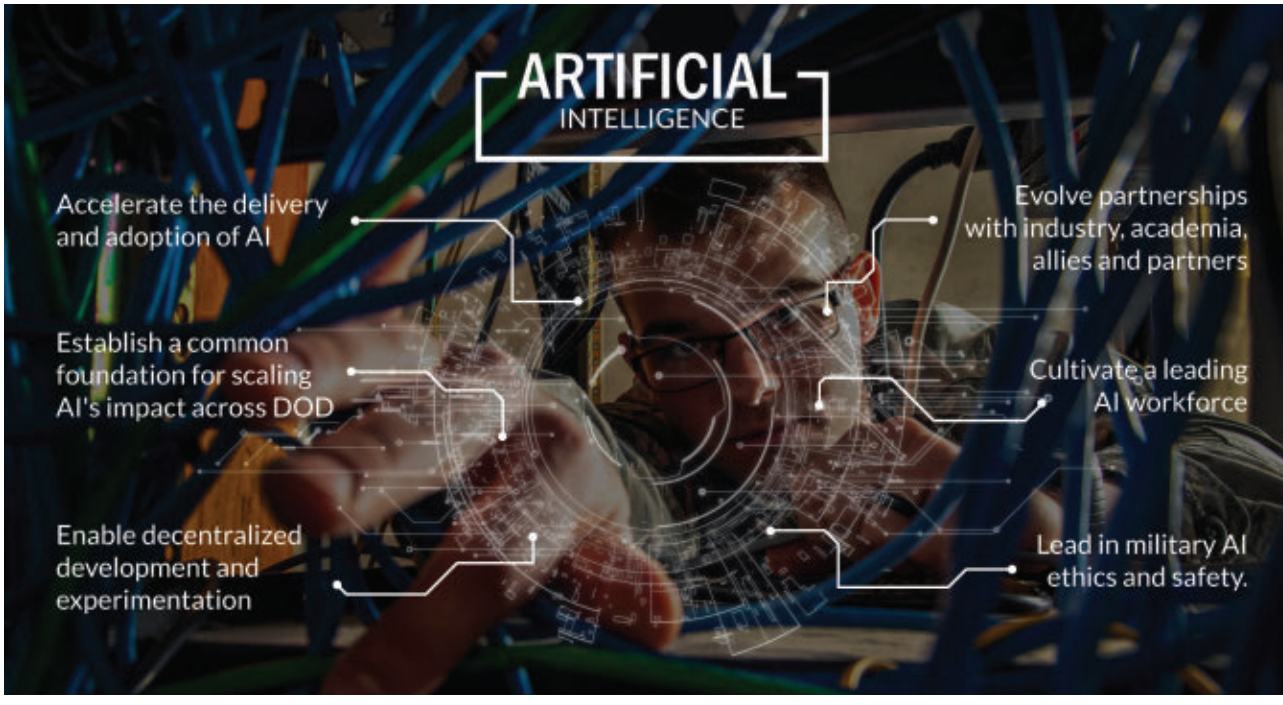
Steven Walker, chief technology officer of Lockheed Martin Corp. in Bethesda, Md., said last year that artificial intelligence will be a priority for the aerospace company. He already has experience doing this from his leadership role at DARPA, where he created the AI Next campaign in 2018. "The ultimate application in my opinion, is to use AI and machine learning on the battlefield to help make decisions faster," Walker told IEEE Spectrum.



The Defense Department's artificial intelligence community has moved from being artificial intelligence pioneers to practitioners.

Cases against AI

There are some reasons and use cases for which AI might not be the right choice, too. The GAO report that outlined all AI research projects currently underway acknowledge that the large



This information graphic summarizes the goals of the Defense Department's artificial intelligence strategy.

amount of data and complex software involved could be a challenge. Not only does it take a lot of computing power, highly specialized people power, and a large amount of data on which to train AI, it also needs to be integrated into existing systems.

Future-proofing efforts exist, but can't cover everything. Sufficiently smart AI might require ethical considerations if it is making decisions completely independently of human input in high-risk situations. Also there's the organizational and bureaucratic angle — one of the GAO's jobs going forward will be a system to track the ongoing AI projects.

One of the challenges to deploying artificial intelligence in military environments in particular is a lack of relevant data, says Shivani Desai, an AI systems architect with the Northrop Grumman Corp Aeronautical Systems segment in Redondo Beach, Calif. Balanced data sets may not exist. The AI will likely not have all the information it needs to react to a rapidly changing situation. That's in opposition to a relatively predictable situation, such as the lines on a road AI might help a commercial vehicle follow.

Operating AI also requires very specific skill sets in the people who work with it, such as certain sensors for high-volume data collection, AI software and related network engineering.

Instead of giving AI free reign, "man-in-the-loop" AI is more practical today. This means the algorithm can help people make decisions, not make decisions for them.

"It might suggest to a pilot that the weather looks too cloudy and that he should not fly. Or it might advise a warfighter on what action he or she should take next," says Desai.

Of course, another problem with AI for defense applications is the high cost of AI acting by itself. This also needs to be taken into account in commercial aerospace, as any operation involving heavy machinery requires some risk. But commercial aerospace operates under much more controlled conditions.

"If the AI used by an unmanned aerial vehicle to surveil and analyze enemy missile sites misinterprets what it sees, for example, it could result in a loss of life or irreparable damage to international relationships," Desai said in an interview for Northrop Grumman. "We work to avoid such outcomes by subjecting every AI algorithm to rigorous verification and validation processes. If there's a chance that an algorithm could create unintended consequences, it will never make it out the door."





A materials researcher examines experimental data on the Autonomous Research System (ARES) artificial intelligence planner, developed by the U.S. Air Force Research Laboratory.

AI in-training

Tension between the possibilities of technology and actually making it practical always exist. There are plenty of examples of successful deployment, as well.

In particular, Mark Littlefield, senior manager of embedded computing solutions at Elma Electronic in Fremont, Calif., says deep learning multilayered computational neural nets are the focus in the industry now.

"People are really starting to grasp all the potential applications. Anything for which you've got a pattern recognition problem and a lot of data to feed it you can apply computational neural nets or deep learning," Littlefield says. "Some of the problems you'd think might be really applicable in fact aren't. Your typical robotic control problem of having a hand or arm do something doesn't really work well because there's not good broad data to feed that to train it."

For example, he says, it would be prohibitively difficult to teach a robot arm to assemble a breakfast meal. Enough training data to account for all the variables and quirks in that situation does not exist. However, the companies working on more practical applications have now had a lot of time to collect data.

"You need to have training data," Littlefield says. "But if you have training data you can make a neural net do just about anything pattern recognition-wise or control-wise."

Despite these kinds of challenges, training data does exist for some military applications.

"The nice thing in the defense and aerospace environment is data has been collected in a lot of different problems and given a lot of different environmental conditions," says Littlefield. "Denied information spaces and what have you, maybe an electronic warfare contested environment, the military has a ton of broad data to draw on to train their systems. Some folks are starting to think a computer with a properly trained neural net is actually a better problem solver than a person in such situations."

U.S. Navy Cmdr. Edgar Jatho and Joshua A. Kroll, a computer scientist at the U.S. Naval Postgraduate School in Monterey, Calif., point out in an essay for the U.S. Naval Institute Proceedings that "persistent, critical vulnerabilities" in today's AI could be a problem, not a solution, for military applications.

Their essay, a contest submission sponsored by Booz Allen Hamilton, lays out numerous pros and cons, including the "fragility" of AI and the possibility of AI effecting human decision-making in a way that does not actually encourage correct and efficient decisions. Instead, it might "further compound automation bias, ensuring the human operator only feels justified in arriving at the decision suggested by the system," Jatho and Kroll wrote.

New industrial standards

Along with emerging government regulations, the industry also is putting new standards in place to make AI development easier. This March, the Industry IoT Consortium in Boston released the Industrial IoT Artificial Intelligence Framework, a document addressing emerging requirements and implementation challenges. IoT stands for the internet of things.

"The framework takes a comprehensive look at opportunities and challenges for deploying AI systems," says Wael William Diab, chair of the organization's IIC Industrial AI Task Group and Secretary IIC Steering Committee. "This includes looking at it from a variety of decision makers' perspectives that range from the business view to that of the architectural. In addition,



The Pentagon's vision for artificial intelligence is guided by the National Defense Strategy, which describes an increasingly complex security environment with technological challenges from adversaries in every domain.



Deputy Defense Secretary Kathleen H. Hicks receives a briefing during a tour of the Joint Artificial Intelligence Center in Arlington, Va.

themes like trustworthy AI, dealing with issues like bias to ensure ethical AI deployments and interaction with other emerging technologies are discussed."

Companies in industrial AI and machine learning development need to consider international standards, open source, and guidance from industry consortia as part of the emerging AI ecosystem. Open source, which is emerging as a more popular option throughout industrial organizations, may increase the speed of implementation, Diab says.

"The AI enables deeper insights and analytics that were practically not possible," Diab says. "[IIC's framework] ensures that decision makers are asking the right questions and have the answers they need in order deploy AI enabled next generation IIoT [industrial internet of things] systems."

The commercial aerospace industry also is working on applying AI, with different needs from the military. Chinese airports put a high priority on online efforts like business intelligence and app-based health checks. Of the airlines surveyed for SITA's 2021 Air Transport IT Insights, 87% were prioritizing implementing artificial intelligence.

Cyber security considerations

The industry is seeing growing overlap between conversations about AI and machine learning and cyber security, says Elma's Littlefield. Attackers trying to interfere with a highly-connected enterprise setting can distort what AI or machine learning systems think they know, says Beat Buesser, research staff member for AI and machine learning at the IBM Research Dublin Research Laboratory in Dublin, Ireland.

"It does affect us in that we get requirements about cyber security driven down to us," says Elma's Littlefield. "A little bit in backplanes and chassis we are sometimes asked to add features for security… Certainly our customers are increasingly concerned about that."

For Aitech's Mor, the key is to remember Spider-Man. "With great power comes great responsibility," he says. "This mean that once we have autonomous systems and the decision-making process moving from human beings to artificial intelligence intellect, we should be able to protect these systems from being 'hacked,' or the consequences can be very harmful. Cyber security is growing and goes hand in hand with AI development. The ones who do both will gain the market."

SWaP considerations

As with any device that is going to be installed on an aircraft, size, weight, and power consumption (SWaP) constraints come into play. The type of runtime required for AI and machine learning needs lots and lots of parallel processing, Littlefield says.

"You've got to do a huge amount of processing in parallel. So things like GPUs or more specialized processors like the NVIDIA Jetson Xavier are the key to doing that because they're designed to do those massively parallel computations. So for us in





Air Force Staff Sgt. Renee Scherf, curriculum engineer, demonstrates a virtual reality training system that uses artificial intelligence at Joint Base San Antonio, Texas.

the military and aerospace community the trick then is enabling the processing with the SWaP constraints."

It isn't always possible to take a 200- or 250-Watt GPU and package it to fit inside a uncrewed aerial vehicle (UAV). The SWaP math just doesn't work. Conventional conduction, liquid or air cooling can be used here, but still comes with restrictions that might remove the possibility for the kind of processor serious AI needs.

"Typically, you're constrained in a VPX system to about 65 or 70 Watts in a 3U slot for conduction cooled. If you have liquid or airflow cooled you can probably get up to about twice that range," Littlefield says.

However, Elma has also already integrated AI into some small-form-factor embedded computing products. The Jetsys-5320 includes a server-class AI processing system based on the NVIDIA Jetson TX2i system-on-module (SOM). The company also sells the JetKit-3010 board with the NVIDIA Jetson AGX Xavier on CompactPCI Serial for a variety of AI applications, including autonomous driving and video analytics. Elma officials say they are planning to expand this product line, as well.

"Deep learning, AI, machine learning types of problems are starting to color our backplane and chassis decisions," says Littlefield. "We were going through a planning exercise on this very topic this morning. Our decisions on how we architect off the shelf backplanes for the VPX are being colored by these applications. It's all about how to leverage multiple GPUs. The GPU platform with a fat PCI Express pipe is the enabling technology for being able to do AI deep learning problems."

Aitech also is implementing NVIDIA's Jatson Xavier NX platform in its products. "Rugged AI performance is now the leading-edge advantage in military intelligence," Mor says. "Being able to use compact GPGPU-based systems in these harsh environments gives system engineers the ability to forge new ground in rugged embedded computing.

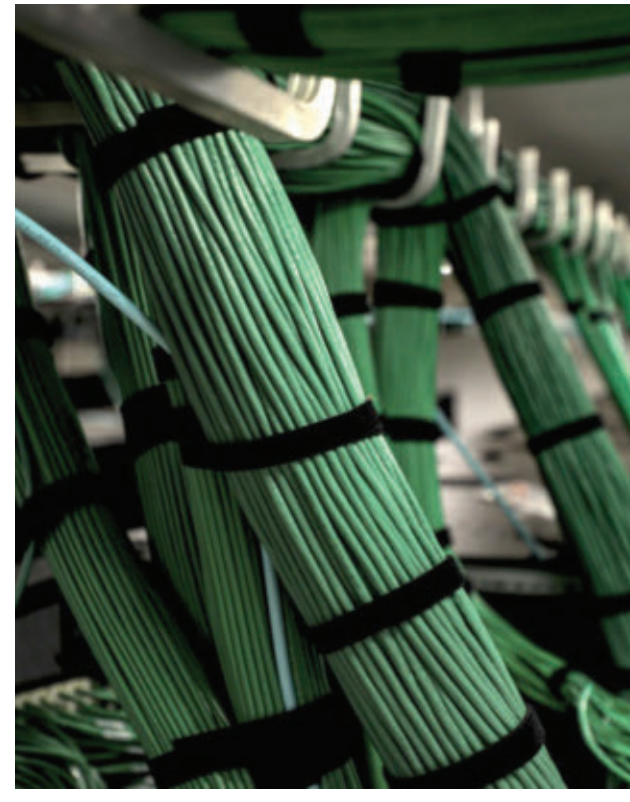
"For example, at roughly the size of a cell phone, and reaching a remarkable 21 TOPS INT8 at exceptional levels of energy efficiency, Aitech's new A179 Lightning is a rugged, fanless AI supercomputer that delivers more performance than any other rugged system on the market in an ultra-compact footprint," Mor says.

The A179 can be used in military computing for a variety of purposes, including situation awareness systems, EW systems and drones, smart soldier and man-portable systems and augmented reality.

Open access

There's a reason NVIDIA shows up in both of these products, and it connects to another hot topic in the wider digital world — open access.

In 2020, the Sensor Open Systems Architecture (SOSA) open-systems computing standard started what would become a trend: encouraging open-systems industry standards for the aerospace and defense market. This level of cooperation between government and industry might mark a turning point.



AI requires large amount of data storage, processing, cable, and connectors.

"One of the reasons NVIDIA successfully gains AI market is that they develop an entire software ecosystem and provide AI development tools and examples free of charge," says Aitech's Mor. "This was possible due to an open-source approach and a lot of people being involved. Now that a large community developing and sharing knowledge has been established, we are seeing the AI development infrastructure constantly improve and grow. People can 'reuse' existing software blocks, which decreases development time, cost and time to market."

Machine learning

By nature, a lot of the same considerations apply to machine learning as to artificial intelligence. Experts at the U.S. Air Force Research Laboratory Information Directorate in Rome, N.Y., say they believe it could be a valuable asset in terms of object and hazard detection, data federation, and refining aerial delivery.

"Machine learning is the process of taking your training dataset and creating a neural network model or convolution neural net model that then can be applied for AI," says Littlefield. "You can think of it as two states: the training stage, which takes a long, long time and a lot of processing, and then the run time stage, where you're using this pre-trained model over and over again. There are ways to use the data that you're actually processing at the run time and go back and tweak your model. A lot of people are doing research on basically making your model better over time. But in general it's a two-stage approach. In general, we tend to be focused on the run time. The training is usually used for data center type hardware, so you can apply lots of processing over days or weeks or months."

What's next?

AI hardware and software can process more data now than ever before, and increased stability in today's products lead to more deterministic and accurate results. In addition, applying this to space environments might be the way of the future. Mor lists the three main targets Aitech is aiming to reach in terms of AI as such:

- AI (maturing);
- space (expanding); and
- AI in space (innovating)

Aitech's top-of-the-line product stepping in this direction is the S-A1760 Venus small form factor (SFF) system, which Mor calls "a great example of how AI intelligence is being brought into space environments."

A radiation-characterized space AI GPGPU, this COTS-based system is validated for use in short-duration as well as near-earth orbit (NEO) and low-Earth orbit (LEO) environments. Aitech developed it to meet the demands for advanced imaging and data processing throughout space-rated applications, especially in the growing commercial space and small sat cluster sectors. This product also runs on a NVIDIA module, a Jetson TX2i system-on-module.



Navy Rear Adm. David Hahn, chief of naval research, tours the National Robotics Engineering Center during a visit to Carnegie Mellon University in Pittsburgh.

Other companies are also embracing AI on rugged embedded computing modules, including Intel Corp. in Santa Clara, Calif. and the Curtiss-Wright Corp. Defense Solutions Division in Ashburn, Va.

"It was hard to imagine that within my lifetime it would actually become something that would be useful and fielded in the types of problems I was working on and in real time," Littlefield says. "It's hard to judge the exact pace of tech, but now we're here and it's exciting to see it."

WHO'S WHO IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Aitech Defense Systems Inc.
Chatsworth, Calif.
https://aitechsystems.com

Curtiss-Wright Defense Solutions
Ashburn, Va.
https://www.curtisswrightds.com

Elma Electronic
Fremont, Calif.
https://www.elma.com/en

IBM Research-Almaden
San Jose, Calif.
https://research.ibm.com

Intel Corp.
Santa Clara, Calif.
https://www.intel.com

Northrop Grumman Corp.
West Falls Church, Va.
https://www.northropgrumman.com

Lockheed Martin Corp.
Bethesda, Md.
https://www.lockheedmartin.com

Nvidia Corp.
Santa Clara, Calif.
https://www.nvidia.com/en-us/

Energy storage for military applications faces demands for more power

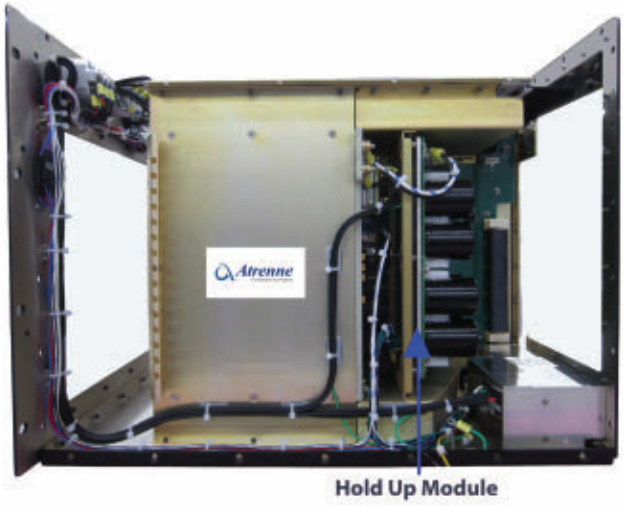
Batteries, capacitors, and other energy-storage media are asked to provide increasing amounts of power for a wide variety of mobile applications, yet concerns for safety and certification remain paramount.

BY **John Keller**

Mobile electronics for the battlefield go hand-in-hand with batteries, and have done so for years. It's not news that electronics that can't be plugged-in relies on the energy-storage medium of batteries. What's new, however, is the growing reliance on batteries and other kinds of energy-storage media for sophisticated electronics that, despite their mobility, demand ever-growing amounts of power.

"The military is primarily concerned with off-grid operations," explains Dominic Perez, chief technology officer at the Curtiss-Wright Corp. Defense Solutions Division in Ashburn, Va. Curtiss-Wright engineers view energy-storage design issues from the standpoint of a systems integrator.

"The military needs the power to sustain that mission," Perez continues. "I am sure there are military folks who are looking, for example, at fully electric military vehicles and unmanned vehicles."



Embedded computing VPX chassis products from Atrenne can accommodate power hold-up modules, which rely on capacitors for short-term energy storage and discharge.

The biggest energy-storage concerns of manufacturers and systems integrators revolves around power-storage issues like electrical capacity and discharge rate. Still, other concerns are nearly as important, such as industry standards and certification, safety, a reliable supply chain, battery form factors, battery technologies, and even alternatives to batteries like capacitors, generators, and solar power generation

Power storage

"For aviation, especially, they need more power, and they need more energy for fixed-wing and rotary aircraft," says Kyle Roelofs, vice president of business development at battery designer Bren-Tronics Inc. in Commack, N.Y. "They want to use all the electronics at their disposal."

For batteries in aviation applications, size and weight are crucial considerations. The trick is to pack as much electrical energy as possible into the smallest package. "Higher densities and different form factors are very compelling," says Curtiss-Wright's Perez.

A prime consideration is balancing the battery's storage capacity and energy-discharge rate to the needs of the target application. Capacity refers to the total amount of electricity a battery can hold, and discharge rate describes the speed at which the battery can supply its application. Discharge rate isn't trivial; some applications need a lot of power quickly, while others need a low and steady flow to maintain their operation over time.

"There is a lot that goes into battery design, and it is a tradeoff between discharge rate and capacity," Perez explains. "You can have a large capacity, but will give-up some of that discharge rate." Curtiss-Wright systems integrators typically look for sustained discharge rate, or energy storage that lasts for a relatively long time.

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Typically military batteries are built with several individual power cells, which can enable battery designers to customize their products. "They can tune the capacity and discharge rate for the application," Perez says.

Battery designers also can design computer control into their batteries, or smart batteries, which offers advantages like cutting-off a charge once the battery has reached its capacity, or reducing the battery's discharge rate when its power level gets low.

Industry has formulated an open-systems standard called Smart Battery System (SBS) that enables software operating systems to perform power management and battery charge rate via a smart battery charger. The Smart Battery System defines the SMBus connection. Virtually any battery operated product can use SBS.

A special integrated circuit in the battery pack called a fuel gauge or battery management system monitors the battery and reports information to the SMBus. This information might include battery type, model number, manufacturer, characteristics, charge and discharge rate, predicted remaining capacity, temperature, voltage, and an almost-discharged alarm so that the PC or other device can shut down gracefully.



The URB12400-U1-SMB lithium-iron-phosphate smart battery from Ultralife Corp. is for transportable and stationary equipment, and uses Ultralife's SMART CIRCUIT battery management electronics that provides runtime information, balancing, and protection for safety and performance.

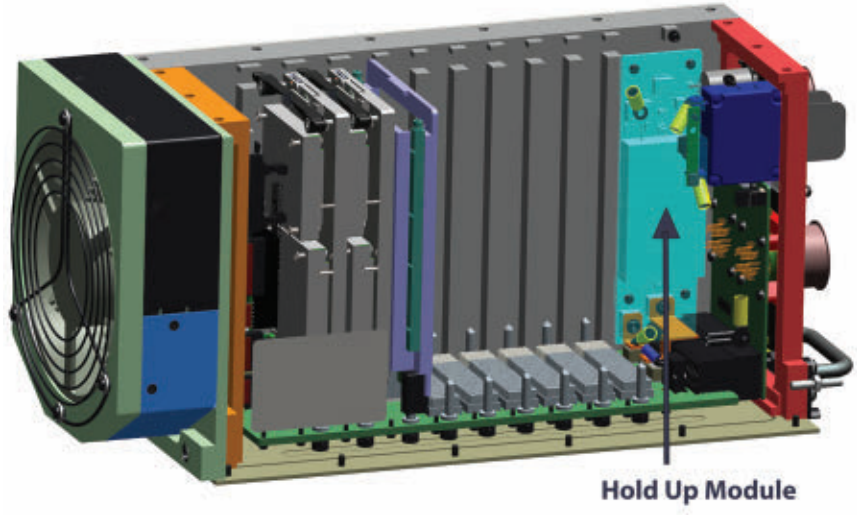
Lithium-ion batteries

Batteries with the largest energy capacities today are lithium-ion batteries, which are promising for a wide variety of applications ranging from electric cars to wearable electronics for infantry warfighters on the battlefield. "The trend is how do we get the higher energy and power, and the answer is lithium-ion over nickel and lead batteries," says Bren-Tronics's Roelofs.

Lithium-ion batteries are rechargeable, feature low self-discharge, and are among most promising technologies, but are the newest and least-proven. Although they offer superior energy capacities and a variety of power discharge rates, these batteries still can be hazardous if mishandled, and are restricted in their uses — especially in aviation.

"We are 90 percent lithium-ion batteries," Roelofs says. "It has a sweet spot in soldier-worn applications, where the market has been all-lithium-ion for years. Today, all new vehicles will be lithium-ion. Everyone is moving to lithium-ion where they look to provide more energy and power."

Still, these batteries have their downsides. They contain flammable electrolytes and if damaged or incorrectly charged can lead to explosions and fires. "Lithium-ion batteries are new, and



Hold-up modules store energy that can discharged in a fraction of a second to keep critical electronic systems running in case of a power disruption.



Tadiran Batteries in Lake Success, N.Y., provides harsh-environment lithium-ion batteries for sensors, night vision, and GPS devices.



Curtiss-Wright PacStar 400-series module products work with AN/PRC-148 MBITR (shown on left) and AN/PRC-152 MBITR (shown on right) batteries.



Curtiss-Wright PacStar Smart Chassis products have integrated options for BB-2590/U and BB-380/U families of batteries for power backup.

there are potential issues of it not working on what is fielded," Roelofs says. "Lithium-ion is more expensive than some other battery technologies."

One of the biggest concerns of lithium-ion technology is safety. "Lithium-ion is the same chemistry as your cell phone in your pocket," Roelofs points out. "Unlike lead-acid batteries, however, if you do puncture them it could have an event. It could vent, have smoke, gas, or flames."

Researchers are trying to extend the lifetime of lithium-ion battery technology, increase its energy density, improve safety, reduce cost, and increase charging speed. Researchers also are considering using non-flammable electrolytes for increased safety.

"I would estimate that lithium-ion today is fractional for use on aircraft," Roelofs says. "today it is a very low percentage, but that will be trending higher in the future. Lithium-ion will grow, but it will be a slow process. In the near term, lithium-ion will replace other battery technologies in wide swaths. It will be niche for a while, and will be used in places where they need more energy, in which lead-acid can't provide it."

Despite its advantages, lithium-ion isn't for everybody. For aviation, the choices today predominantly are for nickel-cadmium or sealed lead-acid batteries, Roelofs says. Demand for those kinds of traditional battery technologies typically comes from long-term contracts, or even from warfighters buying directly for their units, he says.



The Bren-Tronics BB-2590/U, 7.5 Ah Rechargeable Lithium-Ion Battery is certified by the U.S. Department of Defense for military, and is for military devices like battlefield radios, robots, and electronic warfare jammers.

Battery certification

For aerospace and defense applications, certification issues often are just as important as technology issues, which requires long-term planning for battery upgrades or system redesigns that involve new batteries. "You just can't take an approved battery and swap it out with something new without acquiring the proper certification for it," says Bren-Tronics's Roelofs. "It's a three-year, or longer process to get a battery approved."

When it comes to choosing proper certification over advanced technology, engineers at Curtiss-Wright take certification every time. "Higher densities and different form factors are very compelling, but my first question is what is your plan for certification and registration of those products," says Curtiss-Wright's Perez. I am seeing that it can take a year or more to get the proper certifications and registration."

Curtiss-Wright specializes in embedded computing, rugged computing, and battlefield networking systems, which can require batteries for backup and other uses. The company uses batteries that are certified by the

WHO'S WHO IN MILITARY BATTERIES

Arotech Corp.
Ann Arbor, Mich.
https://www.arotech.com

Bren-Tronics Inc.
Commack, N.Y.
https://www.bren-tronics.com

BST Systems Inc.
Plainfield, Conn.
https://www.bstsys.com

EaglePicher Technologies
Joplin, Mo.
https://www.eaglepicher.com

EnerSys
Reading, Pa.
https://www.enersys.com

IBM Research Almaden
San Jose, Calif.
https://research.ibm.com/labs/almaden/

Inventus Power LLC
Woodridge, Ill.
https://inventuspower.com

Mathews Associates Inc.
Sanford, Fla.
https://www.maifl.com/index.html

Navitas Advanced Solutions Group LLC
Ann Arbor, Mich.
https://www.navitassys.com

North Atlantic Industries
Bohemia, N.Y.
https://www.naii.com

Saft
Levallois-Perret, France
https://www.saftbatteries.com

The Swatch Group Inc. Renata Batteries Division
Miami
https://www.swatchgroup.com/en/companies-brands/electronic-systems/renata

Tadiran Batteries
Lake Success, N.Y.
https://www.tadiranbat.com

Ultralife Corp.
Newark, N.Y.
https://www.ultralifecorporation.com/ecommerce/

U.S. Department of Transportation (DOT), the Department of Defense (DOD), and the International Air Transport Association (IATA), among others, Perez says.

"Our batteries also must be assigned a national stock number (NSN)," Perez says. "It is important that we not have to certify unique batteries. They need to have that NSN and the proper certifications."

Obtaining batteries with the correct certifications typically isn't difficult for Curtiss-Wright. "If it is a standard product line offering, then the manufacturers know that it is part of the process," Perez says.

Time-to-market pressures, however, sometimes can induce battery companies to certification as a less than top priority, and Perez says he understands. "Like anyone, they want to secure the technology first, patent it if necessary, and announce it to customers without having to wait for that certification and regulation process." Still, Perez encourages his suppliers to keep certification at the top of their planning.



EaglePicher Technologies provides standard and custom batteries for aerospace applications, including conformal batteries for missile applications.

In addition to certification, systems integrators who design-in batteries also are looking for standard form factors, Perez says. "We use the 2590 form factor battery. It has been upgraded over time, and Bren-Tronics is one of our key partners. They have been able to increase the power density of these batteries over almost anything else on the market."

Non-battery power storage

Considerations about battery safety, reliability, size, weight, and certification sometimes put batteries out of bounds for some applications — particularly in military and commercial aviation. "For the most part, we rarely use batteries in any aviation hardware; often batteries are forbidden," says David Masucci, program manager at embedded computing specialist Atrenne Computing Solutions, A Celestica Company in Brockton, Mass. "Even the little button batteries can be prohibited."

For applications where batteries are not allowed, Atrenne relies on capacitors for holdup power, which provides short-term electricity for applications such as commercial airline gates in which power to critical systems must be maintained when the aircraft disconnects from airport power before the aircraft can get power from its engines.

"They need power for a 50-to-200-millisecond duration as the plane disconnects from the gate," Masucci says. Atrenne designs VPX embedded computing systems that contain a holdup-power module for just these kinds of uses.

"Most of the equipment we do has built-in CPUs, and if there were a power glitch, these systems would reset, and then you have to wait for them to reboot," he says. "In a critical military situation, this could be deadly."

Northrop Grumman to provide processors and detectors for radar warning receivers

BY **John Keller**

PATUXENT RIVER NAS, Md. – U.S. Navy avionics experts are asking engineers at Northrop Grumman Corp. to provide components for an upgrade to the Navy's AN/APR-39 family of radar warning receivers, which will have new digital signal processing (DSP) capability.

Officials of the Naval Air Systems Command have awarded a $31.3 million order to the Northrop Grumman Mission Systems segment in Rolling Meadows, Ill., for weapon replaceable assemblies and AN/APR-39D(V)2 support equipment hardware.

Components will include 31 processors, 124 antenna detectors, 96 radar receivers, 31 low band arrays, and 14 battery handle assemblies for the AN/APR-39D(V)2 radar warning receiver.

The AN/APR-39D(V)2 is the latest upgrade to the AN/APR-39 radar warning receiver that corrects deficiencies and enhances capability in the same weight and dimensions as the previous system. The upgrade calls for a new digital receiver for the AN/APR-39D(V)2.

The AN/APR-39 family of radar warning receivers is for a variety of Navy aircraft and ships. It detects radar threats to aircraft, such as radar ground sites and particularly radar-guided missiles, and provides 360-degree coverage around the aircraft. When the system detects radar threats, it alerts the aircraft crew to each threat with a graphic symbol on the cockpit display.

The APR-39 provides the pilot and air crew with information on threat types, bearing, and the severity of the threat. The system also gives the aircrew synthetic speech audio threat warnings.

The APR-39 also functions as an electronic warfare management system, and serves as the heart of Northrop Grumman's suite of integrated sensors and countermeasures that integrates and displays data from onboard sensors radio frequency and electro-optical sensors.

On this contract modification, Northrop Grumman will do the work in Rolling Meadows, Ill.; Woburn, Mass.; Lansdale, Pa.; Menlo Park, Calif.; Lewisburg, Tenn.; Verona, Wis.; Longmont, Colo.; Phoenix; New York; and Melbourne, Fla., and should be finished by October 2024.

For more information contact Northrop Grumman Mission Systems online at www.northropgrumman.com, or Naval Air Systems Command at www.navair.navy.mil.



The APR-39 provides the pilot and air crew with information on threat types, bearing, and the severity of the threat.

Navy asks Photonis Defense for amplifier power modules for EW and avionics

BY **John Keller**

CHINA LAKE NAVAL AIR WEAPONS STATION, Calif. – U.S. Navy combat aircraft experts needed microwave power modules for amplifying avionics radio frequency signals to high-power levels. They found their solution from Photonis Defense Inc. in Lancaster, Pa.

Officials of the Naval Air Warfare Center Weapons Division at China Lake Naval Air Weapons Station, Calif., has announced a $38.9 million contract to Photonis Defense to build, test, and deliver amplifier microwave power modules.

The contract also calls for RF and microwave power amplifier module hardware evaluation, repair, and modifications in support of electronic attack threat simulator systems for the Navy.

Photonis Defense combines knowledge of vacuum technology and modern solid-state components to build compact, integrated microwave power modules for amplifying RF signals in military and commercial applications.

Photonis Defense experts combine a high-gain monolithic microwave integrated circuit (MMIC) solid-state driver, a multi-collector traveling wave tube, and power supplies in a powerful lightweight amplifier, company officials say.

Photonis Defense power modules meet the power, bandwidth, and spectral requirements of many modern microwave systems in applications like electronic countermeasures, point-to-point and satellite communications (SATCOM) data links, and radar systems.



Photonis Defense will build, test, and deliver amplifier microwave power modules for Navy avionics.

The company specializes in airborne applications where volume, weight, and prime power are at a premium. For research applications, Photonis Defense microwave power modules can also be used as compact laboratory amplifiers.

Photonis Defense capitalizes on a miniature traveling wave tube for designing efficient low-noise amplifiers with a low size, weight, and power consumption (SWaP).

For more information contact Photonis Defense online at https://photonisdefense.com, or the Naval Air Warfare Center Weapons Division at https://www.cnic.navy.mil/regions/cnrsw/installations/naws_china_lake/about/tenant_commands/NAWCWD.html.

Dataline filters for data transmission in shielded environments introduced by ITG

ITG Electronics Inc. in Elmsford, N.Y., is introducing additions to the company's F2779Y002L series dataline filters for MRI rooms and other shielded areas. These new products for interference-free data transmission include filters for triple and quadruple lines, and redesigned original single-line filters for secure mounting and simple connection to terminal blocks. The new series additions reduce noise by 100 decibels at frequencies from 1 MHz to 10 GHz, with a voltage rating of 120 and 250 volts. The filters offer single-wall penetration that provides as many as four channels of clean data transfer into and out of shielded rooms. For more information contact ITG Electronics online at www.ITG-Electronics.com.

Military-grade enclosure for software-defined radio (SDR) introduced by Pixus

Pixus Technologies in Waterloo, Ontario, is introducing the rugged air-cooled RX310 electronics enclosure for software-defined radio (SDR) applications. The ruggedized electronics enclosure uses the NI Ettus Research brand SDR, and provides transport-grade ruggedization levels. The enclosure accepts either the UBX or TwinRX daughter card options as well as the motherboard with an user-programmable Kintex-7 field-programmable gate array (FPGA). The company also is developing ruggedized enclosures for the NI B210, N310, and X410 styles. For more information contact Pixus Technologies online at https://pixustechnologies.com, or NI at www.ni.com.



Areté lidar sensor for uncrewed aircraft to automate underwater mine detection

BY **John Keller**

ARLINGTON, Va. – U.S. Navy researchers needed an experimental airborne sensor to provide small tactical uncrewed aerial vehicles (UAVs) with capabilities for mine countermeasures, uncrewed underwater vehicle (UUV) detection, and other target detection. They found their solution from Areté Associates in Northridge, Calif.

▲ The PILLS lidar sensor has been demonstrated aboard the CAMCOPTER S-100 uncrewed aircraft from Schiebel Aircraft GmbH in Vienna.

Officials of the Office of Naval Research (ONR) in Arlington, Va., announced a $15.4 million contract to Areté in March for the Pushbroom Imaging LiDAR for Littoral Surveillance (PILLS) system.

PILLS is a compact lightweight light detection and ranging (lidar) system for precision bathymetry and topography suitable for operation from a small tactical uncrewed aerial vehicle.

This contract calls for Areté engineers to extend, adapt, and optimize the PILLS sensor, as well as its signal-processing and data-fusion algorithms to address additional future Navy capabilities like bathymetric survey and charting, underwater target detection, underwater hazard detection and avoidance, and lidar multi-mode sensing.

PILLS is a lightweight, low power, expeditionary sensor that enables high-resolution and accurate topographic and bathymetric maps from manned and uncrewed aircraft to greater depths than commercially available legacy systems.

PILLS provides precision hydrographic and terrain mapping for a variety of uncrewed vehicles. It has no moving parts, and eliminates the weight, size, power, and reliability issues of scanning lidar systems and cooled lasers.

PILLS is an order of magnitude smaller, lighter, and requires a fraction of the power of current lidar systems on manned aircraft, while delivering comparable mapping performance from a small UAV, company officials say.

The system integrates a dedicated real-time kinematic GPS for precise mapping, independent of aircraft systems. PILLS requires a fraction of the power of current lidar systems on manned aircraft, and delivers comparable mapping performance from a small UAV.

Areté engineers have enhanced the PILLS sensor to operate in high shock and vibration typical of ship-launched and recovery uncrewed aerial vehicles in previous government Small Business Innovation Research (SBIR) research grants.

Schiebel Aircraft GmbH in Vienna and Areté demonstrated PILLS aboard the Schiebel CAMCOPTER S-100 UAV for the Office of Naval Research last summer.

Schiebel's CAMCOPTER S-100 us a vertical takeoff and landing (VTOL) UAV that needs no prepared area or supporting launch or recovery equipment. It operates day and night and in bad weather to a range of 125 miles on land and at sea.

The S-100 navigates automatically via pre-programmed GPS waypoints or can be operated directly with a pilot control unit. Missions are planned and controlled via a simple point-and-click graphical user interface. High-definition payload imagery flows to the control station in real-time.

On this contract Areté will do the work in Tucson, Ariz., and Vienna, Austria, and should be finished by March 2027. For more information contact Areté Associates online at https://arete.com, Schiebel Aircraft at https://schiebel.net, or the Office of Naval Research at www.onr.navy.mil.

Zyter and Qualcomm collaborate on apps and dashboard for private 5G networks

Zyter Inc. is collaborating with Qualcomm Technologies Inc. to demonstrate 5G private networks by providing network management, a user interface/dashboard, and three initial production-ready applications that include autonomous mobile robots; lidar-based analytics; and artificial intelligence (AI)-based cameras. 5G private networks offer advantages over today's public 5G and Wi-Fi networks. Advanced network management capabilities, such as allocating bandwidth to different devices or customizing security protocols are also necessary. Current Wi-Fi and 5G public networks offer limited flexibility in these areas. Qualcomm Technologies, Zyter and other ecosystem members are solving these challenges through the demonstration of 5G private networks powered by Qualcomm FSM 5G RAN Platforms. In addition to providing network management and a consolidated dashboard to display application and device data. More information is online at https://www.zyter.com/.

U.S. Navy offers look into Snakehead long-endurance uncrewed submarines

The U.S. Navy has offered a glimpse at its new Snakehead Large Displacement Unmanned Undersea Vehicle (LDUUV) by publishing pictures taken during the christening of one of the vehicles. Navy experts want these uncrewed underwater vehicles (UUVs) to be able to scout ahead or monitor certain areas, as well as perform other long-endurance intelligence-gathering missions. The images of the Snakehead's christening were published by the Naval Undersea Warfare Center (NUWC) Division Newport and the Program Executive Office Unmanned and Small Combatants (PEO USC).

Wanted: dynamic RF spectrum management for future 5G tactical networking

U.S. Navy researchers are asking for industry's help in designing dynamic RF and microwave spectrum management systems that address military tactical networking operations in the presence of 5G network infrastructure. Officials of the Naval Surface Warfare Center Crane Division in Crane, Ind., have issued a request for solutions (N0016422SNB40) for task area three of the Dynamic Spectrum Management @ BG5 Tactical Edge project. Fifth-generation wireless networking technologies (5G) are of fundamental strategic importance to U.S. economic well-being and global leadership, Navy researchers explain. The Navy wants to develop a dynamic spectrum management system with new capabilities that will enable U.S. Department of Defense (DOD) operations to integrate with future military 5G networked operations. Companies interested in bidding must be members of the Strategic & Spectrum Missions Advanced Resilient Trusted Systems (S2MARTS) consortium in Arlington, Va. Contact S2MARTS online at https://s2marts.org. For more information contact the Navy's David Harrell by email at David.l.harrell38.civ@us.navy.mil or by phone at 812-854-8291. Also contact Erin Wittmer by email at paste name hereerin.l.wittmer.civ@us.navy.mil, or by phone at 812-854-5908. More information is online at https://sam.gov/opp/c9640c1d916b43ca995878bdb1464a5a/view.

Textron to provide engineering support for UISS uncrewed counter-mine surface vessel

BY **John Keller**

WASHINGTON – U.S. Navy uncrewed surface vessel (USV) experts are asking the Textron Systems Corp. Autonomy & Control Systems segment in Hunt Valley, Md., for engineering and technical support for the Unmanned Influence Sweep System (UISS) uncrewed surface vehicle (USV).

Officials of the Naval Sea Systems Command in Washington announced a $41.7 million order last month to the Textron Systems Corp. Autonomy & Control Systems segment in Hunt Valley, Md., for engineering and technical support, incidental materials, and travel for the UISS uncrewed patrol boat.

The UISS is one of the counter-mine warfare systems that will enable the Navy littoral combat ship to perform mine warfare sweep missions. UISS will target acoustic, magnetic, and magnetic and acoustic combination mine types only. The UISS program provides rapid wide-area mine clearance to neutralize magnetic and acoustic sea mines in a small, lightweight package.

The UISS uses the Textron Common Unmanned Surface Vessel (CUSV), which will travel aboard the LCS and deploy as necessary to detect, pinpoint, and trigger explosive sea mines hidden under the surface intended to damage or destroy surface warships or commercial shipping.

The system consists of the CUSV uncrewed power boat that tows an acoustic and magnetic minesweeper system that emits acoustic and magnetic signals that provide a false signature that triggers mines. The surface vessel operates far enough away so that it will not be damaged by a detonating mine, Navy officials say.

The UISS uses the Navy's Multiple Vehicle Communications System (MVCS) aboard the LCS, which handles communications between the LCS surface ship and different mission packages, including the UISS, that involve mine countermeasures, anti-submarine warfare, and surface warfare.

For the MVCS the Navy is using the AB3100H embedded computer from Astronics Ballard Technology in Everett, Wash. The AB3100H rugged computer is part of the company's AB3000 line of small, lightweight embedded computers with the Intel E680T processor, MIL-STD-1553 and ARINC 429/708/717 interfaces, Ethernet, USB, video, audio, and PMC expansion.

The AB3000 series from Astronics Ballard Technology comes with factory-installed PCI mezzanine card (PMC) modules that enable designers to add an Ethernet switch, synchronous and asynchronous serial interfaces, and isolated double-throw relays.

The Textron CUSV and its uncrewed maritime command and control station use a modular architecture that accommodates platform reconfiguration and interchangeable payloads.

This CUSV uncrewed boat can handle mine warfare; anti-submarine warfare; communications relay; intelligence, surveillance and reconnaissance; anti-surface warfare; and UAS/UUV launch and recovery missions.



Textron Systems will support and maintain the U.S. Navy Unmanned Influence Sweep System (UISS) uncrewed surface vehicle (USV) as part of a recent contract.

On this order Textron will do the work in Hunt Valley, Md., and Slidell, La., and should be finished by April 2023. For more information contact Textron Autonomy & Control Systems online at www.textronsystems.com/capabilities/autonomy-control-systems, Astronics Ballard Technology at https://www.astronics.com/subsidiary?subsidiaryItem=astronics%20ballard%20technology, or Naval Sea Systems Command at www.navsea.navy.mil.



Software models to help transfer decision making from humans to uncrewed vehicles

BY **John Keller**

NEWPORT, R.I. – U.S. Navy undersea warfare experts needed a company to model potential underwater battlefields to help practice the transfer of human decision making to automated systems that control uncrewed underwater vehicles (UUVs). They found their solution from Systems Planning and Analysis Inc. in Alexandria, Va.

New software models will help Navy leaders learn how to transfer control and deployment of uncrewed underwater vehicles from humans to uncrewed control systems.

Officials of the Naval Undersea Warfare Center (NUWC) in Newport, R.I., has announced plans to award a sole-source contract to Systems Planning and Analysis to design a prototype decision authority delegation software models.

Systems Planning and Analysis experts will expand a virtual model of the battlespace that exercises a wide range of operational and tactical elements to stress transfer of tactical control decision-making. The value of the upcoming contract has yet to be negotiated.

These kinds of models are important for Navy researchers to continue with software design for transferring tactical control from humans to uncrewed vehicles in tactical decision aids.

These models will help Navy experts exercise varied mission priorities, commander's intent, and rules of engagement that help commanders set priorities for deploying uncrewed systems from distributed control stations.

For this project Navy experts particularly are interested in including more sophisticated decisions than those used in previous decision authority delegation tests.

Systems Planning and Analysis is the only source with the expertise and experience necessary to do this job quickly enough to keep up with Navy planning. The company is the performer on the NUWC Decision Authority Delegation project's first phase from August to December 2020 and on its second phase from July to December 2021.

For more information contact Systems Planning and Analysis online at https://spa.com, or the Naval Undersea Warfare Center at www.navsea.navy.mil/Home/Warfare-Centers/NUWC-Newport. More information about this specific program is online at https://sam.gov/opp/a2dc66a3fd45440da9675d1c1c4e61fc/view.

Verizon Robotics selects Pendleton Range to test uncrewed tech solutions

BY **Jamie Whitney**

PENDLETON, Ore. - Officials of Verizon Robotics in Basking Ridge, N.J., have announced plans to advance testing and proof-of-concept capabilities at Pendleton UAS Test Range in Pendleton, Ore.

Pendleton UAS Test Range, a division of the City of Pendleton, Ore., is a FAA-designated test range that offers a variety of testing environments for drones and ground robotics.

Company officials say they plan to expand operations, and base their advanced air research, drone partner, and long-range robotics at the Pendleton Range. This includes training Pendleton Range staff to control a rapid-response command mobile unit vehicle, capable of deploying mission-critical communications, applications and advanced computing solutions that can address robotics use-cases in the air and on the ground.



Researchers at Verizon Robotics will test the use of 5G wireless communications for uncrewed vehicle control at the Pendleton UAS Test Range in Pendleton, Ore.

"The Pendleton Range is excited to be working with Verizon Robotics to provide state-of-the-art situational awareness technology to one of the busiest UAV test ranges in the U.S.," says Darryl Abling, manager of Pendleton UAS Test Range.

"This investment will help to develop technologies and processes that will help accelerate overall aviation innovation as robotics become more integrated into the National Airspace System," Abling says.

The Pendleton range has more than 14,000 square miles of FAA-approved airspace for advanced drone flight operations and testing, and hosts between 400 and 1,000 operations a month.

"The operations we are deploying at Pendleton Range will help advance R&D initiatives for customers," says Mariah Scott, president of Verizon Robotics. "The range's location helps create a local innovation testbed that can emulate real-life conditions, helping to bring products and services to market faster."

Verizon Robotics is developing software that helps to integrate drones safely into the National Airspace System so that piloted aircraft and drones can operate safely together.

Coupled with The Low Altitude Authorization & Notification Capability (LAANC), customers can gain access to U.S. controlled airspace to create unique and differentiated airspace intelligence for their operations.

For more information contact Verizon Robotics online at www.verizon.com/about/news/verizon-launches-robotics-business-technology, or the Pendleton UAS Test Range at https://pendletonuasrange.com.



SRI eyes infrared search and track (IRST) technology for airborne target detection

BY **John Keller**

WRIGHT-PATTERSON AFB, Ohio – U.S. Air Force researchers needed a company to push the bounds of infrared search and track (IRST) technology to enable U.S. and allied aircraft to search for airborne targets without giving away their presence by emitting RF and microwave energy. They found their solution from SRI International in Menlo Park, Calif.

▲ MuSTeR seeks to enhance the state-of-the-art in U.S. military sensor system research by using the entire electromagnetic spectrum to deliver next-generation capabilities.

Officials of the Multispectral Sensing & Detection Division of the Air Force Research Laboratory Sensors Directorate at Wright-Patterson Air Force Base, Ohio, announced a $299,868 contract to SRI International as part of the Multi-Spectral Sensing Technologies R&D (MuSTeR) program.

MuSTeR seeks to enhance the state-of-the-art in U.S. military sensor system research by using the entire electromagnetic spectrum to deliver next-generation capabilities for global persistent awareness. SRI International is a nonprofit research institute.

For this contract SRI International experts will look into low-cost infrared search and track (LC-IRST) system design tradeoffs, cloud clutter suppression algorithms and processing,

and machine learning techniques with the potential to improve overall IRST detection performance.

SRI International's work revolves around electro-optical target detection and surveillance. SRI experts will develop an advanced long-range and wide-field-of-view staring IRST system that provides state-of-the-art performance.

Currently fielded IRST systems are based on longwave scanning sensor technology in which the scan dwell time and revisit rate dictates typical performance. Instead, SRI International will try to develop an IRST sensor that operates at video rates to quicken track initiation.

This research area potentially leverages the latest in large infrared focal plane array technology with high operating temperatures and uncooled thermal detectors to eliminate a large cooler to reduce system size, weight, and power consumption (SWaP).

Company experts also will focus on small pixel pitch to provide better image resolution, and digital readout integrated circuits versus analog. The challenge is to provide range resolution to aid in a robust, precise weapons quality track, Air force researchers say.

The overall goal is to develop an IRST design that generates fire-control solutions at range along clear atmospheric paths and in cluttered air-to-air and air-to-ground environments with a low false alarm rate while staring over the entire system field of regard.

SRI International also will look into current and future advancements in large format focal plane arrays, read-out architectures, sensor chip assembly designs, wide-field-of-view optical designs, and advanced processing methods for target detection and tracking at range and in clutter that exploits the high frame rate advantages of a staring system.

Company experts will consider total system life cycle costs and identify alternatives to high cost, high failure rates, and high maintenance items such as thermal infrared transparent conformal window materials.

Additionally, SRI International will investigate basic algorithms and supporting processing architectures that could validate the system and its target detection, such as tracking and clutter rejection algorithms.

Other focus areas of the MuSTeR program are multiband multifunction radio frequency sensing; laser radar technology; passive radio frequency sensing; and distributed radio frequency sensing.

On this contract SRI International will do the work in Menlo Park, Calif. For more information contact SRI International online at www.sri.com, or the Air Force Research Laboratory at www.afrl.af.mil.

Rugged 19-inch outdoor sunlight-readable display introduced by TRU-Vue

TRU-Vu Monitors Inc. in Arlington Heights, Ill., is introducing the SRMW-19U-24 19-inch outdoor sunlight-readable monitors to withstand the effects of blazing sunlight, extreme heat, sand, and pounding rain in military applications. The SRMW-19U-24 rugged monitors offer 1,000 nits of brightness, and is viewable in direct, bright sunlight. Its automated ambient light sensor dims the screen at night to conserve energy, and extends the life of the liquid crystal display (LCD) panel. This display is built with a sealed stainless steel weatherproof enclosure, with no entry points for water, dirt, dust, sand, or airborne particles, and operates in temperatures from -30 to 85 degrees Celsius. All video and power connections are protected within the rear watertight cable-entry compartment. For more information contact TRU-Vu Monitors online at https://tru-vumonitors.com.

Army evaluating Rafael anti-tank missile for helicopters, combat vehicles, and UAVs

U.S. Army anti-tank missile experts are enlisting the help of Lockheed Martin Corp. to evaluate the Israeli Spike lightweight anti-armor missile for potential use by infantry warfighters, and on combat vehicles, helicopters, and perhaps unmanned aerial vehicles (UAVs). Officials of the Army Contracting Command at Redstone Arsenal, Ala., announced a $138.9 million contract to the Lockheed Martin Missiles and Fire Control segment in Orlando, Fla., for federation, testing, and user operational assessments of the Spike Missile. The Spike non-line-of-sight (NLOS) missile is the product of Rafael Advanced Defense Systems Ltd. in Haifa, Israel. It is a fire-and-forget anti-tank and anti-personnel missile with a tandem-charge high-explosive warhead that is available in man-portable, vehicle-launched, and helicopter-launched variants. The Spike's operator tracks targets optically through the trailing fiber-optic wire or RF link while the missile is climbing to altitude after launch. The weapon's seeker and wireless datalink provide operators with real-time video imagery and control throughout the missile's flight. For more information contact Lockheed Martin Missiles and Fire Control online at www.lockheedmartin.com, or the Army Contracting Command-Redstone at https://acc.army.mil/contractingcenters/acc-rsa/.



Lockheed Martin chooses Raytheon to build second space infrared sensors payload

BY **John Keller**

LITTLETON, Colo. – Spacecraft designers at Lockheed Martin Corp. needed a second infrared sensors mission payload for the Next Generation Overhead Persistent Infrared Geosynchronous Earth Orbit Block 0 missile-warning satellite system - also known as NGG. They found their solution from Raytheon Technologies Corp.

Officials of the Lockheed Martin Space Systems segment in Littleton, Colo., have chosen Raytheon to provide a second NGG mission payload for the third Next Generation Overhead Persistent Infrared (OPIR) Geosynchronous Earth Orbit constellation.

▲ Raytheon will provide an infrared sensor mission payload for the third Next Generation Overhead Persistent Infrared (OPIR) Geosynchronous Earth Orbit constellation.

Raytheon and Northrop Grumman Corp. each are on contract to provide one space mission payload for the three-satellite procurement. With this announcement, Raytheon will provide a second mission payload.

Lockheed Martin is under contract with the U.S. Space Force Space Systems Command (SSC) to build three survivable NGG satellites with enhanced missile warning and resiliency capabilities.

Lockheed Martin selected Raytheon and a team of Northrop Grumman and Ball Aerospace to develop mission payload designs, which have completed critical design and are on track to fly on the first two NGG satellites. It has yet to be determined which payload will be aboard the first NGG satellite launched in 2025.

For more information contact Lockheed Martin Space Systems online at www.lockheedmartin.com/en-us/capabilities/space.html, Raytheon Technologies at www.rtx.com, or Northrop Grumman at www.northropgrumman.com.



Air Force asks industry for electro-optical sensors for attritable uncrewed aircraft

BY **John Keller**

WRIGHT-PATTERSON AFB, Ohio – U.S. Air Force researchers are asking industry to develop small and affordable electro-optical and infrared sensors for small attritable uncrewed aircraft.

Officials of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio, have issued a broad-agency announcement (FA8650-22-S-5009) for the Low-Cost Optical Systems Technology (Low-COST) program.

The Air Force wants industry to develop small and affordable electro-optical and infrared sensors for small attritable uncrewed aircraft.

Low-COST seeks to develop compact integrated sensors employing optical component technologies for attritable and low-cost small uncrewed aircraft, and identify applications of emerging industrial capabilities in low-cost planar optics for infrared target identification, missile warning, or other cueing sensor applications.

The goal is to explore high-performance and small size, weight, and power consumption (SWaP) planar optical designs that would not impose a large financial burden if their uncrewed aircraft were to be destroyed in performing their missions.

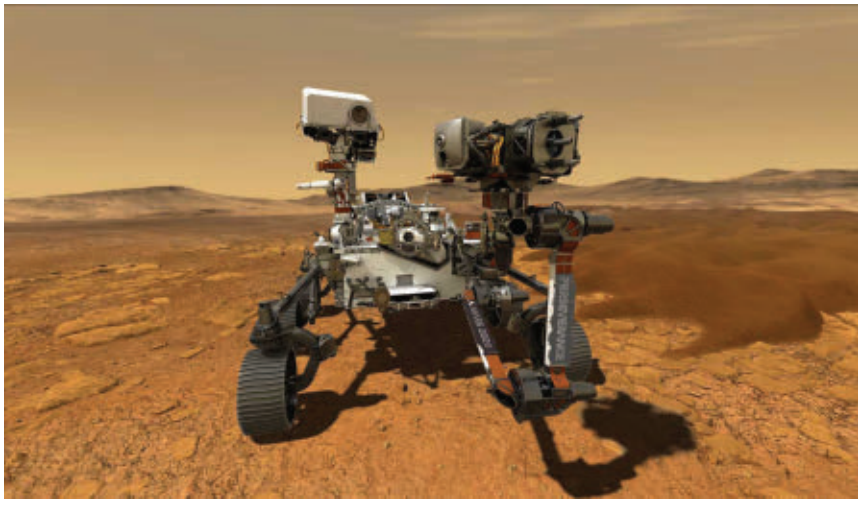
Planar optics technology, including diffractive optical elements and metasurface optical elements, appears to offer optical design capabilities that are different from those of conventional mirror and bulk optical refractive elements.

Planar optics and planar image intensifiers could enable direct vision of several infrared bands through one common aperture. Structured materials such as diffractive optics and metamaterials enable one to embed optical functionalities far beyond those of traditional refractives into one optical element.

While wide field of view, broad bandwidth, and high imaging quality all are achievable individually, combining these traits in practice remains a challenge. In addition to planar optics, image intensification is necessary to convert the often weak infrared light into visible photons detectable by the naked eye.

The goal of this effort is to explore to what extent any new developments in these areas could increase design flexibility in optical systems. Another goal is to explore how such capabilities could help reduce the costs of optical sensors with scaled manufacturing approaches.

Companies interested were asked to submit proposals by 21 April 2022 via DoD SAFE at https://safe.apps.mil and by email to the Air Force's Brad Kneisly at brad.kneisly@us.af.mil mark.merrifield@us.af.mil. Email technical questions to Joseph Burns at Joseph.Burns.9@us.af.mil, or contracting questions to Brad Kneisly at brad.kneisly@us.af.mil. More information is online at https://sam.gov/opp/82ce224a7e0943cbb266f33c0462671d/view.



SPACECRAFT

▲ NASA selects Lockheed Martin to lift samples off of Mars surface

The U.S. National Aeronautics and Space Administration (NASA) needed a specialized vehicle to collect surface and atmospheric samples off of Mars. They found their solution from Lockheed Martin Space of Littleton, Colo.

NASA says that Lockheed Martin's Mars Ascent Vehicle (MAV) will be the first rocket fired off of another planet. The MAV will help retrieve samples collected by NASA's Perseverance rover and return them to Earth to study.

Once it reaches Mars orbit, the container would be captured by an ESA (European Space Agency) Earth Return Orbiter spacecraft outfitted with NASA's Capture, Containment, and Return System payload. The spacecraft would bring the samples to Earth safely and securely in the early- to mid-2030s.

Lockheed Martin Space will provide multiple MAV test units and a flight unit. Work under the contract includes designing, developing, testing, and evaluating the integrated MAV system, and designing and developing of the rocket's ground support equipment.

The cost-plus-fixed-fee Mars Ascent Vehicle Integrated System (MAVIS) contract has a potential value of $194 million. The performance period begins no later than Feb. 25 and will extend six years.

To learn more about the Mars Sample Return program, visit NASA at https://mars.nasa.gov/msr/.

ARTIFICIAL INTELLIGENCE

▼ DARPA tasks Northrop Grumman with developing prototype AI assistant for rotorcraft

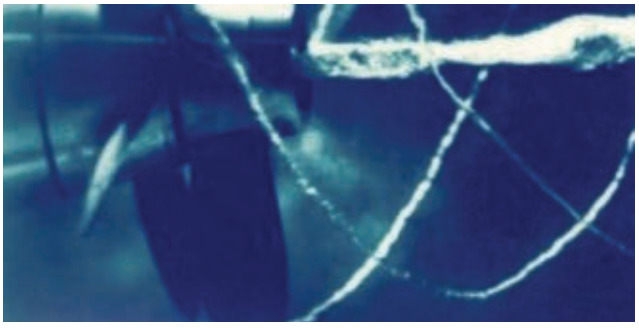
The U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., has awarded a contract to Northrop Grumman Corp. Mission Systems segment in Baltimore to develop a prototype artificial intelligence (AI) assistant for UH-60 Black Hawk helicopter pilots.

The prototype will be embedded in an augmented reality headset to help rotary pilots perform expected and unexpected tasks. Rotorcraft aircrews face numerous demands particularly when flying in close proximity to buildings, terrain, people and from the threat of adversary RADAR systems.

Today, simple warning systems are the most common means for aiding a rotorcraft aircrew, such as auditory alerts to increase altitude. These warning systems are limiting and can induce unanticipated cognitive burdens on pilots. Studies have shown that inattentional blindness to such warnings can occur, often making them ineffective for the aircrew.

DARPA's Perceptually-enabled Task Guidance (PTG) program aims to develop AI technologies to help users perform complex mental and physical tasks. The goal is to provide users of PTG AI assistants with wearable sensors that allow the assistant to observe what the user perceives and know what the user knows.





Using advanced information processing and an augmented reality interface, the goal of the program is to have the AI assistant provide feedback and guidance through speech and aligned graphics at the right place and time to augment the aircrew.

"The goal of this prototype is to broaden a pilot's skillset," says Erin Cherry, senior autonomy program manager at Northrop Grumman. "It will help teach new tasks, aide in the recognition and reduction of errors, improve task completion time, and most importantly, help to prevent catastrophic events."

In addition to a long service life in the U.S. and allied militaries, a civilian version of the venerable Black Hawk is also available. For more information contact Northrop Grumman Mission Systems online at www.northropgrumman.com/who-we-are/business-sectors/mission-systems/, or DARPA at www.darpa.mil/program/perceptually-enabled-task-guidance.

UNDERSEA PROPULSION

▲ Navy asks Penn State to help quiet U.S. missile and attack nuclear submarines

U.S. Navy submarine designers are asking engineers at the Applied Research Laboratory at Penn State University at State College, Pa., to develop enabling technologies for quieting next-generation submarines under terms of an $18.1 million contract.

Officials of the Office of Naval Research in Arlington, Va., are asking Penn State to develop undersea technologies in multi-material propulsor prototypes; Virginia-class submarine propulsor bearing; flow noise; station keeping; and acoustic monitoring.

The goal is to develop enabling technologies for super-quiet submarine propulsion and submarine quieting to improve existing systems significantly beyond the today's state-of-the-art, and meet the needs of future undersea systems, Navy researchers say.

Multi-material propulsor prototypes and submarine propulsor bearings involve propeller and propulsion technologies to keep U.S. ballistic-missile and fast-attack nuclear submarines even quieter to enemy sonar than they are today.

Flow noise involves reducing the amount of sound the submarine produces as it flows through the water at different speeds. Station keeping involves how a submarine remains motionless at submerged depths without emitting any noise, and acoustic monitoring involves ways to track and reduce the amount of sound a submarine makes during normal and super-quiet operations.

On this contract Penn State will do the work in State College, Pa.; Washington; Newport, R.I.; and Gorton, Conn., and should be finished by February 2027.

For more information contact the Penn State Applied Research Laboratory online at https://arl.psu.edu, or the Office of Naval Research at www.onr.navy.mil.

SMART MUNITIONS

▼ Australia to arm fighter-bombers with multi-mode sensors and anti-ship missile

U.S. Navy airborne weapons experts are helping the armed forces of Australia arm that nation's F/A-18 E/F Super Hornet jet fighter bombers with the Lockheed Martin multi-mode sensor-equipped Long-Range Anti-Ship Missile (LRASM) for use against high-priority maritime targets.

Officials of the Naval Air Systems Command announced a $49.3 million order to the Lockheed Martin Corp. Missiles and Fire Control segment in Orlando, Fla., for LRASM integration and test for Royal Australian Air Force F/A-18 E/F aircraft.

The Lockheed Martin AGM-158C LRASM is a subsonic anti-ship missile for use against high-priority enemy targets like aircraft carriers, troop transport ships, and



guided-missile cruisers. Australia is acquiring LRASM capability as part of foreign military sales agreements.

LRASM is a joint project of the U.S. Defense Advanced Projects Agency (DARPA) in Arlington, Va., the U.S. Navy, and the U.S. Air Force to design an advanced anti-ship missile that can launch from the Navy F/A-18E/F Super Hornet jet fighter bomber, as well as from the Air Force B-1B Lancer long-range strategic bomber.



In the future LRASM also will launch from the F-35 Lighting II joint strike fighter, the P-8A Poseidon maritime patrol jet, as well as from the Navy Mark 41 shipboard Vertical Launch System. The missile travels at high subsonic speeds, and likely will give way in the future to expected new generations of hypersonic missiles. Submarine-launched versions are under consideration.

LRASM for Australia is designed to detect and destroy high-priority targets within groups of ships from extended ranges in electronic warfare jamming environments. It is a precision-guided, anti-ship standoff missile based on the Lockheed Martin Joint Air-to-Surface Standoff Missile-Extended Range (JASSM-ER).

Lockheed Martin has been designing LRASM for more than a decade, primarily under DARPA supervision. The advanced anti-ship missile is intended to replace the ageing Harpoon anti-ship missile. It has a multi-mode radio frequency sensor, a new weapon data-link and altimeter, and an uprated power system.

The LRASM can be guided toward enemy ships from as far away as 200 nautical miles by its launch aircraft, can receive updates via its datalink, or can use onboard sensors to find its target. LRASM will fly towards its target at medium altitude then drop to low altitude for a sea skimming approach to counter shipboard anti-missile defenses.

The LRASM uses on-board targeting systems to acquire the target independently without the presence of intelligence or supporting services like Global Positioning System (GPS) satellite navigation and data links. Lockheed Martin is designing he missile with advanced counter-countermeasures to evade hostile active defense systems.

The Lockheed Martin LRASM has a 1,000-pound penetrator and blast-fragmentation warhead, multi-mode sensor, weapon data link, and enhanced digital anti-jam global positioning system to detect and destroy selected surface targets within groups of ships.

Lockheed Martin is in charge of LRASM overall development, and the BAE Systems Electronic Systems segment in Nashua, N.H., is developing the LRASM onboard sensor systems.

LRASM development is in response to a gap in Navy anti-ship missile technology identified in 2008. Before LRASM, the standard Navy anti-ship missile had been the subsonic Harpoon, which has been in the inventory since 1977.

Since LRASM started development, however, hypersonic cruise missiles able to fly faster than five times the speed of sound have become one of the Pentagon's top priorities. This has the potential to limit overall LRASM production numbers.

On this order Lockheed Martin will do its work in Orlando and Ocala, Fla.; California, Md.; and other U.S. locations, and should be finished by March 2026. For more information contact Lockheed Martin Missiles and Fire Control online at www.lockheedmartin.com, Naval Air Systems Command at www.navair.navy.mil, or the Royal Australian Air Force at www.airforce.gov.au.

ELECTRONIC WARFARE

▲ SRC eyes enabling technologies for artillery-delivered electronic warfare (EW)

U.S. Army researchers needed the ability to deliver electronic warfare (EW) spoofers and jammers by field artillery in contested corners of the world. They found their solution from SRC Inc. in Syracuse, N.Y.

Officials of the U.S. Army Team Picatinny at Picatinny Arsenal, N.J., have chosen SRC for a research project to develop the artillery-delivered ability to go after enemy formations, as well as to conduct control and disruption missions.

SRC engineers are capitalizing on the company's Silent Impact technology, which uses a 155-millimeter artillery shell as a delivery mechanism to extend navigation warfare (NAVWAR), NAVWAR situational awareness, and EW capabilities deep into contested territory to overwhelm and overmatch an adversary.

The system can deliver cyber electromagnetic attack payloads in-flight, using parachutes to stay aloft for extended periods, and on the ground after it lands. The system also provides advanced cyber and non-traditional intelligence, surveillance, and reconnaissance for identifying and exploiting adversaries.

EW systems are designed to fit into existing artillery munition casings to help deliver enhanced situational understanding, giving soldiers the intelligence they need to observe adversaries, move forces to where they are needed most, decide on a courses of action, and carry out mission plans.

SRC's work with the Army is part of the first phase of a spiral capability to go after enemy formations and control and disruption missions. Iterative development, explains Mike Ryan, assistant vice president of Army accounts at SRC.

The project uses non-lethal jamming and spoofing options to control the battlespace, and enhance lethality. SRC experts anticipate that the enabling technologies they develop for the Army eventually become part of a future program of record in as little time as two or three years.

Live-fire testing of Silent Impact technologies are expected by the end of this year, and "it could be three or four years before we see this hit the battlefield," Ryan says.

SRC's work with the Army on this project started in 2018 with a cooperative research and development agreement (CRADA) to study deploying disruption, decoy, and deception effects via artillery.



Disruption can jam enemy radar, communications, and other RF and microwave systems. Decoy and deception can spoof the enemy by mimicking signals of concern to throw-off an adversary's signals intelligence.

"It could look like blue-force signals that are where they should not be," Ryan explains. "It could look like a squad communicating, to create multiple dilemmas for the adversary. This is an overwhelming effect.

Silent Impact technologies also can provide electronic intelligence payloads to the battlefield to listen for an adversary's radio signals to detect, identify, and locate threats on the ground. For more information contact SRC online at www.srcinc.com, or the Army's Team Picatinny at www.pica.army.mil.

SMART MUNITIONS

▲Lockheed Martin to build JASSM-ER air-launched smart munitions

Missile designers at Lockheed Martin Corp. will build 123 advanced air-to-ground missiles under terms of a $128.2 million order. Officials of the U.S. Air Force Life Cycle Management Center at Eglin Air Force Base, Fla., are asking the Lockheed Martin Missiles and Fire Control segment in Orlando, Fla., to build 123 lot-20 AGM-158B Joint Air-to-Surface Standoff Missile – Extended Range (JASSM-ER) stealthy air-to-ground missiles with containers.

The JASSM-ER is a 2,250-pound cruise missile with a 1,000-pound penetrator and blast-fragmentation warhead. It uses precision routing and guidance in adverse weather, day or night, using an infrared seeker in addition to the anti-jam GPS to find a specific aim point on the target. The order includes hardware spares.

JASSM, which has been in service since 2009, is a long-range, conventional, air-to-ground, precision standoff missile for U.S. and allied forces that is designed to destroy high-value, well-defended, fixed and relocatable targets. The JASSM has a range of 230 miles, while the JASSM-ER has a range of 620 miles.

The stealthy JASSM missiles have standoff ranges to keep air crews well out of danger from hostile air defense systems, while their stealthy airframes makes the smart munitions extremely difficult to defeat, Lockheed Martin officials say.

The AGM-158B JASSM-ER is a stealthy cruise missile that flies a preplanned route from launch to a target, using Global Positioning System (GPS) satellite navigation guidance and an internal navigation system. It has an infrared seeker for terminal guidance.

JASSM can be fired from several different aircraft, including the B-1, B-2, B-52, F-16, F/A-18E/F, and F-15E. International JASSM users include the Australian, Finnish, and Polish air forces.

Looking to the future, Lockheed Martin is working on the JASSM to enable the missile to fire from U.S. and international versions of the Lockheed Martin F-35 Lightning II joint strike fighter aircraft and other international military aircraft.

On this order Lockheed Martin will do the work in Orlando, Fla. and Troy, Ala., and should be finished by January 2026. For more information contact Lockheed Martin Missiles and Fire Control online at www.lockheedmartin.com, or the Air Force Life Cycle Management Center at www.aflcmc.af.mil. ←



TEST AND MEASUREMENT

▶ Device power supply and source measure unit for semiconductor test offered by Marvin

Marvin Test Solutions Inc. in Irvine, Calif., is introducing the GX3116e 16-channel device power supply (DPS) and source measure unit (SMU). The GX3116e DPS is a high density flexible multichannel semiconductor device power supply for semiconductor test applications. It has four-quadrant operation, isolated outputs, ganging capabilities for high current, health monitoring, and alarms. Kelvin connection sensing on a per-channel basis, ensures the device under test receives the expected excitation levels, independent of cabling and other interconnects, while over-current sensing and programmable alarms provide protection to the device under test. Electrically isolated outputs grouped in banks of eight channels can connect to increase current levels. The GX3116e comes with a virtual instrument panel to program and control the instrument. The device also comes with a GtLinux software package for Linux 32/64 operating systems. For more information contact Marvin Test Solutions online at www.marvintest.com.

GRAPHICS PROCESSING

▼ FACE-compliant 3U OpenVPX graphics processor introduced by Curtiss-Wright

The Curtiss-Wright Corp. Defense Solutions segment in Ashburn, Va., is introducing the V3-717 rugged 3U OpenVPX high-performance graphics processor module for safety-critical avionics applications like degraded visual environment (DVE) and mission displays. Based on the well-known and proven AMD Radeon E8860 embedded Graphics Processing Unit (GPU) is a DO-254 / DO-178C safety-certifiable commercial off the shelf (COTS) avionics graphics processor that meets Modular Open Systems Approach (MOSA) open-systems standards. This multi-head based graphics card is designed for systems with Design Assurance Level (DAL) A process assurance where AC/AMC 20-152A (RTCA DO-254/EUROCAE ED-80 DAL-A) is the means to compliance. The V3-717 is an active graphics processor product, with no part changes, for which availability is scheduled to continue through 2026, with support from CoreAVI software drivers. These graphics drivers are aligned with the Future Airborne Capability Environment (FACE) standard. Safety-certifiable graphics software APIs supported by the V3-717 include OpenGL SC 1.0.1 and OpenGL SC 2.0. For more information contact Curtiss-Wright Defense Solutions online at www.curtisswrightds.com.



CABLE ASSEMBLIES

▶ Crush-resistant cable assemblies for harsh environments introduced by MilesTek

MilesTek, an Infinite Electronics company in Lewisville, Texas, is introducing rugged Cat6-rated IP68 cable assemblies with metal connectors for military, industrial, government, and broadcast applications. The cable assemblies come in various lengths and connector options, and feature SF/UTP cable with 24-gauge wire that is double-shielded with foil and braid. This prevents crosstalk and provides EMI/RFI protection and grounding. The FR-TPE jacket will survive harsh environments that involve rain, UV rays, oil, chemicals, and weld spatter. The cables come with UL CMX flame rating, and is high-flex rated with a continuous-motion capability of to 10 million cycles. The metal connectors are crush-resistant, IP68-rated, waterproof, and dust-tight; the jack versions are sealed even without a dust cap. Their electroless nickel plating is RoHS compliant. Available configurations include plug to plug, jack to jack, plug to jack, plug to standard RJ45, and jack to standard RJ45. For more information contact MilesTek online at www.milestek.com.





POWER SUPPLIES

▲ AC-DC power supply for communications equipment introduced by TDK-Lambda

TDK-Lambda Americas Inc. in San Diego is introducing the DRB120 and DRB240 three-phase DIN rail mount AC-DC power supplies for industrial machinery and systems, as well as conventional switch cabinets and communications equipment. The models are rated at 120 and 240 Watts with a two-second peak power capability of 144 and 288 Watts, which enables operation with inductive and capacitive loads. On initial start-up the products have a low energy inrush current that helps to avoid nuisance tripping of circuit breakers when multiple units are installed in a system. The AC-DC converter power supplies accept a three-phase 350-to-575-volt AC input, with output voltages of 12 or 24 volts rated at 120 Watts, and 24 or 48 volts rated at 240 Watts. The DRB series has an adjustment range of 11.4 to 15 volts, 22.5 to 29 volts, and 45 to 56 volts to compensate for voltage drops in wiring, O-ring field-effect transistors (FETs) for redundant operation or to accommodate for non-standard output voltages. For larger power systems or N+1 redundant systems, a front panel DIP switch enables droop mode current sharing for parallel operation. For output voltage monitoring, a front panel LED indicator and a DC OK relay contact are available. Remote on/off is possible using a closed relay contact or less than 4-volt input. For more information contact TDK Lambda online at https://product.tdk.com/en/power/drb.

DATA STORAGE

▶ NVMe PCI Express Gen 4 solid-state drives introduced by DIGISTOR



DIGISTOR, a CRU Data Security Group (CDSG) company in Vancouver, Wash., is introducing the commercial-class PCI Express Gen 4 NVM Express (NVMe) solid-state drives for fast data storage in artificial intelligence (AI), video editing, visualization, modeling, and analysis. Available in the M.2 NVMe form factor and offering a capacity ranging from 500 gigabytes to 4 terabytes, DIGISTOR's solid-state drives are for laptops, desktops, workstations, and purpose-built systems. In addition, these solid-state drives use the latest in PCI Express Gen 4 controller technology making them two times faster than their PCI Express Gen 3 equivalent drives. The DIGISTOR PCI Express Gen 4 solid-state drives more than double the throughput speed of DIGISTOR's PCI Express Gen 3 solid-state drives. These data storage drives offer read performance of as much as 7,200 megabytes per second; and write performance of 6,850 megabytes per second. For more information contact DIGISTOR online at https://digistor.com.



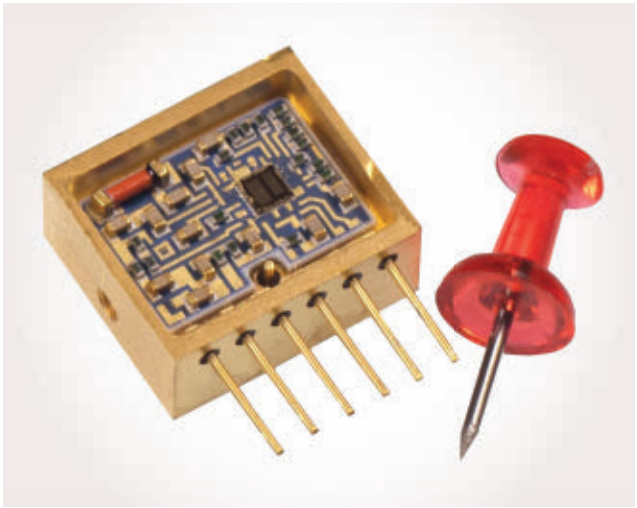
CYBER SECURITY

▲ Hardware to protect 1553 databus traffic from cyber attack introduced by Abaco

Abaco Systems in Huntsville, Ala., is introducing the 1553Guard security technology to protect MIL-STD-1553 avionics databus-based systems from cyber attack in real time. The 1553Guard is built into the 1553 interface, while other technologies require expensive hardware and significant software modification but may not include threat mitigation. Abaco's plug-and-play device detects and alleviates cyber security threats through continual monitoring and protection of equipment. MIL-STD-1553 was released by the U.S. Department of Defense before the advent of modern cyber warfare, and lacks many of the tools that secure modern networks. More recently it was identified as a potential danger that adversaries could leverage to compromise equipment and spread malicious software across a system. Abaco designed 1553Guard to relieve these security issues. The device continuously monitors bus communications traffic, identifies incidents based on user-defined rules and algorithms, then mitigates the threat. The security mechanism implements in hardware that cannot be bypassed or disabled easily by malicious software or users. This can reduce risk for on-platform use or when integrated into avionics test and maintenance equipment. For more information contact Abaco Systems online at www.abaco.com.

RADIATION MONITORING

▶ Microdosimeter for monitoring radiation introduced by Teledyne e2v



The Teledyne e2v HiRel segment of the Teledyne Defense Electronics Group in Milpitas, Calif., is introducing the microdosimeter NuDOS001, NuDOS002, and NuDOS003 radiation dosimeter models for high-altitude aerospace applications and all space applications from GEO satellites and LEO constellations to scientific exploration. Each model occupies minimal volume and adds 0.6 ounces of weight to any mission. For many space and high-altitude aerospace applications, it is of critical importance to know the amount of radiation in which the platform operates. Teledyne's Microdosimeter NuDOS001, NuDOS002 and NuDOS003 measure the total ionizing dose (TID) of low-, medium-, and high-linear-energy-transfer radiation and can be polled in real-time to monitor events as they happen. Deploying a radiation-monitoring system of all three models can provide spectral information about the environment. Devices are shipped from the company's U.S. Department of Defense trusted facility in Milpitas, Calif. For more information contact Teledyne e2v HiRel online at www.tdehirel.com.

PRODUCT & LITERATURE SHOWCASE



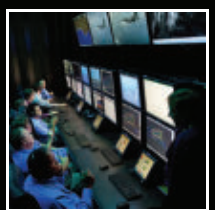
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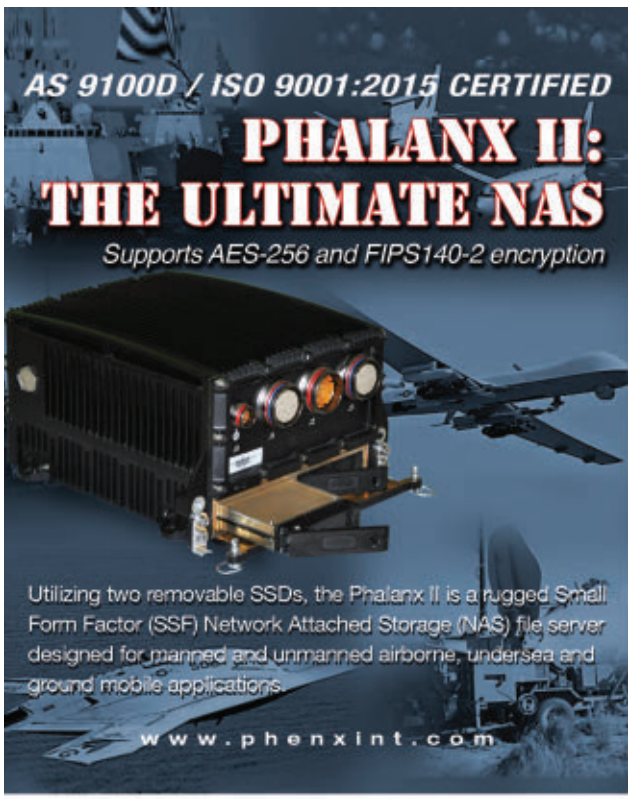
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- RAID-capable, quad M.2 sites for storage or I/O
- 2x USB 3.2 Gen 1 (5 Gbps) via USB-C w/power for console and I/O
- 1x GigE, 8x GPIO, 2x COM, 2x USB, SATA/PCIe to VPX (P2)
- Dual SAM™ I/O add-in modules for MIL-1553, ARINC-429, NTDS, GPS, or legacy I/O
- GMS-patented cooling rails and floating "clamshell" for superior cooling, shock/vibration tolerance and reliability (USPTO: 4456790)
- TPM 2.0 for root of trust, Secure Boot or Windows 10/11
- Display Port/DVI to VPX (P2)
- Embedded System Controller for Control Plane / Intelligent Power
- Operates on single 12 VDC supply from VPX backplane
- VITA 65 profile SLT3-PAY-1F1F2U1TU1T1U1T-14.2.16
- Modular stack (CPU/Carrier/HSIO) for upgradeable processor and OpenVPX pinout/profile changes without changing backplane
- Available as single- or dual-slot air- or conduction-cooled modules (1" pitch for conduction, 0.8" pitch for convection)

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