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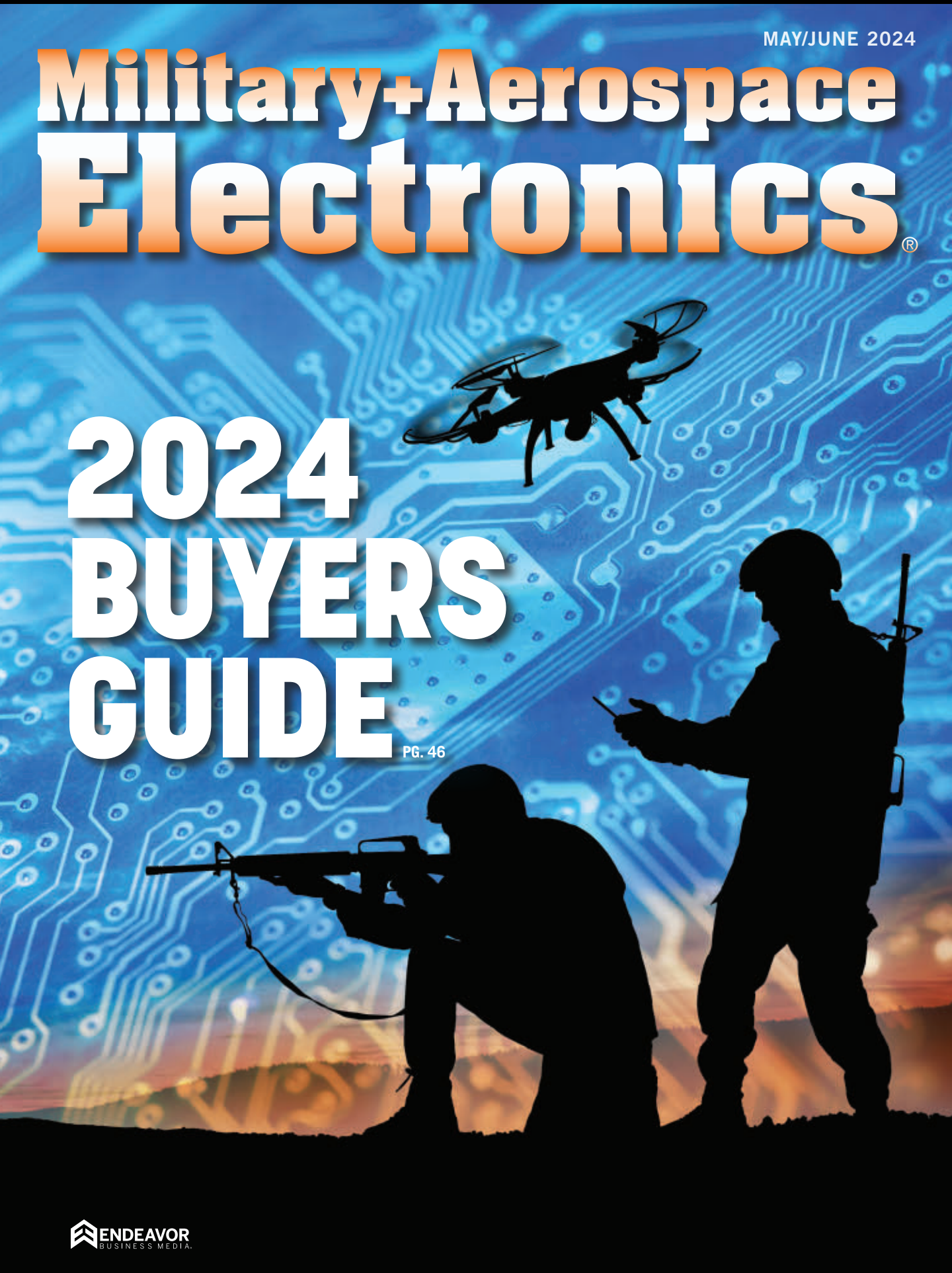

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Fabric that helps warfighters hide from infrared sensors

BY **John Keller**
EDITOR IN CHIEF

Deceiving the enemy on the battlefield is as old as the ancient world and the Trojan Horse. Among the most common modes of deception today is camouflage, which makes it difficult to see infantry warfighters, combat vehicles, and command posts by blending into their surroundings.

Yet for each approach to battlefield deception is a countermeasure; this cat-and-mouse game has been going on for millennia. One of the surest ways to defeat battlefield camouflage involves electro-optical sensors — particularly longwave infrared that senses heat from the human body or vehicle engine exhaust.

To the naked eye or visible-light sensors like cameras, traditional camouflage can make people and vehicles all but invisible, yet infrared sensors go beyond the visible-light spectrum to see what's not visible to the human eye. To infrared sensors, a human looks like a hot spot against a relatively cool background; these sensors are not fooled.

So what's preventing military researchers from inventing a new kind of camouflage to hide humans from infrared sensors? Turns out, perhaps not much. The Army Natick Soldier Systems Center Soldier Protection Directorate in Natick, Mass., is reaching out to industry for new kinds of camouflage fabric to enable foot soldiers to conceal themselves from a wide variety of enemy electro-optical sensors.

The Army Contracting Command at Aberdeen Proving Ground, Md., sent out a source-sought notice in April on behalf of the Natick Soldier Systems Center for the Prototype: Reversible Signature Management Overwhite Garments project, which seeks to develop reversible camouflage-printed fabrics with infrared-mitigating properties.

The idea is that soldiers wearing clothing made from this infrared-mitigating fabric might be able to hide from infrared sensors on the battlefield in the same way that traditional camouflage uniforms hide them from the human eye.

Researchers want to develop an overgarment made from fabric that is reversible with and operational camouflage pattern on one side and snow marine pattern camouflage on the other — except with visible through infrared camouflage properties.

This next-generation fabric could help the military make trousers, jackets, ponchos, and pack cover prototypes for spectral mitigation against battlefield EO/infrared sensor threats. The contractor or contractors chosen will apply thermal signature management onto different fabrics that are reverse camouflage printed.

Each side of the IR-camouflage fabric will have its own pattern that cannot be seen or bleed through to the other side, and provide thermal signature-mitigating properties while maintaining or improving today's snow overwhites in spectral performance, durability, weight, and drying rate.

From the winning contractor, the Army wants 15 to 20 yards of fabric samples to determine its comfort, durability, strength, water repellency, oil repellency, drying rate, and signature properties.

The fabric will incorporate shortwave infrared (SWIR) reflectance on fabrics; as many as two functional finishes; be fire resistant; have no toxicity characteristics; shall weigh no more than four ounces per square yard; be water repellent and durable and should dry quickly.

The Army wanted responses by 22 May 2024 emailed to Justin Murphy at justin.a.murphy16.civ@army.mil and Mary Prebensen at mary.k.prebensen.civ@army.mil. Email questions or concerns to Justin Murphy at justin.a.murphy16.civ@army.mil and Mary Prebensen at mary.k.prebensen.civ@army.mil. More information is online at https://sam.gov/opp/6d99f224828f45f39440b875568d9865/view.

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Lockheed Martin eyes extended-range sensor-fusion-equipped LRASM anti-ship missile

BY **John Keller**

PATUXENT RIVER NAS, Md. – U.S. Navy anti-ship weapons experts are taking another step to creating an extended-range version of the Lockheed Martin AGM-158C subsonic Long Range Anti-Ship Missile (LRASM).

▲ Experts say the range of the AGM-158C-1 LRASM variant is in excess of 200 nautical miles.

Officials of the Naval Air Systems Command at Patuxent River Naval Air Station, Md., announced a potential $288 million order to the Lockheed Martin Corp. Missiles and Fire Control segment in Orlando, Fla., for work closely related to creating a AGM-158C-3 extended-range LRASM.

LRASM is for use against high-priority enemy targets like aircraft carriers, troop transport ships, and guided-missile cruisers. The LRASM anti-ship missile contract will support missiles for the U.S. Navy, Air Force, and U.S. allies.

LRASM 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).

The contract asks Lockheed Martin to provide enabling technologies to establish a new AGM-158C-3 extended-range by extending the missile's range beyond the existing AGM-158C-1 variant. Enabling technologies will include advanced communications and survivability while supporting maritime strike missions for the Navy.

Experts say the range of the AGM-158C-1 LRASM variant is in excess of 200 nautical miles. Extending the missile's range could give it a maximum distance envelope of 500 nautical miles or farther.

LRASM 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.

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.

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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 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.

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

LRASM is a joint project of the U.S. Defense Advanced Projects Agency (DARPA) in Arlington, Va., the Navy, and the U.S. Air Force to design an advanced anti-ship missile that can launch from B-1B Lancer jet bombers, F/A-18E/F Super Hornet jet fighter-bombers, F-35 Lightning II strike fighters, P-8A Poseidon maritime patrol aircraft, and surface vessels via the Mark 41 Vertical Launching System (VLS).

The BAE Systems Electronic Systems segment in Nashua, N.H., is providing next-generation missile seekers LRASM to enable the missile to strike high-value maritime targets from long range in aggressive electronic warfare (EW) jamming environments.

The seeker comprises long-range sensors and targeting technology that help the stealthy missile find and engage protected enemy ships amid attempts to jam or spoof the missile, BAE Systems officials say.

The BAE Systems LRASM seeker uses sensor fusion to blend information from the missile's on-board radar, semi-autonomous guidance, Global Positioning System (GPS) satellite navigation, high-speed secure tactical networking links, and nearby sensors to strike high-value targets from long range while avoiding shipboard missile counter-fire.

The missile guidance sensor uses semi-autonomous guidance and target cueing data to locate and attack targets precisely and reduce reliance on airborne intelligence, surveillance, and reconnaissance (ISR) aircraft, networking links, and GPS navigation.

BAE Systems designers also are working to make the seeker system smaller, more capable, and more efficient to produce. Building LRASM is the Lockheed Martin Missiles and Fire Control segment in Orlando, Fla. Lockheed Martin is in charge of LRASM overall development, and the BAE Systems is developing the LRASM onboard sensor systems.

On this contract Lockheed Martin will do the work in Orlando and Ocala, Fla.; and Troy, Ala., and should be finished by August 2026. For more information contact Lockheed Martin Missiles and Fire Control online at www.lockheedmartin.com/en-us/who-we-are/business-areas/missiles-and-fire-control/products.html, or Naval Air Systems Command at www.navair.navy.mil.

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Axiom Electronics

Wanted: digital signal processing to help detect and locate electromagnetic events

BY **John Keller**

WASHINGTON – U.S. intelligence experts are reaching out to industry for new signal processing approaches to analyze the so-called D-region of the atmosphere to detect and locate variations in the Earth's magnetic field caused by humans.

Officials of the U.S. Intelligence Advanced Research Projects Activity (IARPA) in Washington have issued a request for information (IARPA-RFI-24-05) for the Opportunities for Observing and Sensing Atmospheric Electromagnetic Anomalies project.

The D-region of the atmosphere exists at altitudes of about 37 and 56 miles; remote sensors characterize this region by comparing very low frequency (VLF) signals with modeling results. The problem today is poor accuracy in efforts to detect and locate electromagnetic events.

▲ Intelligence researchers are looking for digital signal processing to help pinpoint high-altitude electromagnetic events that could precede widespread disruptions in sensitive electronics.

This approach is considered to be an ill-posed nonlinear problem; it's difficult to solve, and does not yield a unique one-to-one correspondence between electron density profiles in the Earth-ionosphere waveguide and receiver signals.

Scientists have tried to resolve these shortcomings with machine learning and artificial neural networks using information from sensors that are uncoordinated and loosely networked, yet this cannot provide real-time estimates of the D-region, which is necessary for accurate electromagnetic event detection, geolocation, and classification.

IARPA researchers seek to characterize and better understand the D-region and its interaction with electromagnetic anomalies typically caused by space weather, lightning, and human-caused electromagnetic events. One objective is to characterize the D-region to help identify, map, and track these electromagnetic anomalies.

Today's capabilities do not divide the D-region quickly into neat parameters, and any methodology that could do this is of interest, IARPA researchers say.

Low-frequency radio signals below 30 MHz are useful for strategic communications because these radio waves propagate at global distances, and can reach underground facilities and submarines.

While the electrical properties of the Earth's surface and Earth's magnetic field are reasonably stable and well-understood, the electrical and

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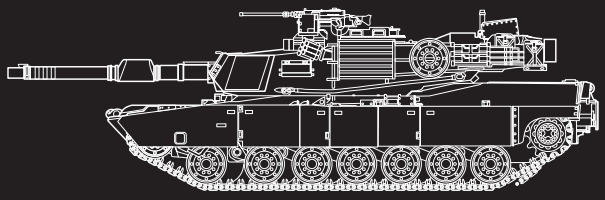

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magnetic properties of the D-region are not, because of electron density irregularities.

The D-region is unpredictable, and contains irregularities that occur across latitude, longitude, and elevation, and are time-varying across the day and time of year. The D-region also reacts to electromagnetic anomalies from electron density irregularities.

Despite the difficulty, developing the ability to characterize the volatility of the D-region could help improve real-time identification and geolocation of variations in the Earth's magnetic field caused by humans.

Signal processing approaches that use data from various uncoordinated ionospheric sensors can help study electron density irregularities, yet today's signal processing is unlikely to help characterize the D-region quickly enough for real-time domain awareness of manmade electromagnetic anomalies.

Instead, IARPA researchers are asking industry for new signal-processing approaches that could separate the D-region quickly into understandable parameters.

Of particular interest are existing or newly proposed signal processing techniques; networked ground sensors; RF sensors able to detect signals at 3 MHz and below; electrostatic discharge, electric field perturbations, magnetic field perturbations, and radio waves that interact with the surrounding regions of the ionosphere and the Earth's surface; specialized sensor collection; low-signal detection techniques; and improved resolution of data assimilation.

Companies interested were asked to email white papers by 17 June 2024 to dni-iarpa-rfi-24-05@iarpa.gov. Email questions or concerns to dni-iarpa-rfi-24-05@iarpa.gov. More information is online at https://sam.gov/opp/493b59609a5a43808ff0b48155ade2c7/view.

Air Force orders EW jammers to foil efforts to defeat GPS-guided smart munitions

U.S. Air Force smart munitions experts needed add-on sensor kits to enable the GPU-31 Joint Direct Attack Munition (JDAM) guided bomb to attack jammers that degrade the performance of GPS-guided weapons. They found their solution from Scientific Applications & Research Associates Inc. (SARA) in Cypress, Calif. Officials of the Air Force Life Cycle Management Center, Hill Air Force Base, Utah, announced a $23.6 million contract to SARA for Home-on GPS Jam seekers intended for use by the Ukrainian military. SARA experts will integrate the Home-on GPS Jam seekers on JDAM wing kits, which are being sold to Ukraine in that country's continuing war with Russia. This contract involves Foreign Military Sales to Ukraine, U.S. military leaders say. The SARA Home on Jammer passive RF seekers have been demonstrated have been demonstrated on several different smart munitions to help them attack RF signals from radar and electronic warfare (EW) jammers. The Home-on GPS Jam seekers will enable JDAM and other smart weapons to detect, pinpoint, and attack jammers intended to disrupt and degrade satellite Global Positioning System (GPS) signals that help guide bombs, missiles, and guided artillery shells to their targets. This capability can help transform the JDAM smart bomb into a counter-EW system able to seek and destroy jammers that degrade weapons guidance, communications, and sensors. On this contract SARA will do the work in Cypress, Calif., and St. Louis, and should be finished by October 2025. For more information contact Scientific Applications and Research Associates online at https://sara.com/rf-sensors-and-seekers/, or the Air Force Life Cycle Management Center, Hill Air Force Base, Utah at www.hill.af.mil/About-Us/Fact-Sheets/Display/Article/1583368/air-force-life-cycle-management-hill-afb-site.

ESA taps Kuva Space to test rapid hyperspectral sensors for orbiting satellites

Kuva Space, a Finnish hyperspectral satellite and technology company in Espoo, has secured a 1.8 million euro contract to participate in the European Space Agency's (ESA) Civil Security from Space (CSS) program, which aims at advanced hyperspectral situational awareness information to monitor and mitigate civil crisis events. As part of the three-year research and development program, Kuva Space will focus on testing and refining onboard hyperspectral data processing, satellite-to-satellite, and sat-to-Internet of Things (IoT) mobile communication capabilities. The company will collaborate with Finnish authorities in a field study dedicated to enhancing border surveillance along the Baltic Sea area between Finland, Estonia, and Sweden. Under ESA's SMART-CONNECT initiative, which involves contributions from Austria, Belgium, Finland, Portugal, and Switzerland, Kuva Space is part of a consortium aiming to enable swift data exchange and timely provision of actionable information in emergency situations. Kuva Space will collaborate *Continued on page 13*

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U.S. Navy to explore use of Electra.aero's commercial-focused eSTOL for logistics

BY **Jamie Whitney**

MANASSAS, Va. - The U.S. Navy has awarded Electra.aero Inc. in Manassas, Va., a contract to explore the use of Electra's hybrid-electric short takeoff and landing (eSTOL) aircraft for airborne logistics in contested environments.

Officials of the Naval Air Systems Command (NAVAIR) at Patuxent River Naval Air Station, Md., are asking Electra to define use cases and aircraft designs to evaluate how the company's hybrid-electric eSTOL aircraft could help the Navy provide personnel and supplies in difficult-to-reach places.

Contested logistics, a key national security topic, refers to transporting military personnel or supplies to and from areas that are challenging to reach or support, such as remote air fields and carrier on-board delivery (COD) applications.

Last fall, Electra.aero completed the first flights of its EL-2 Goldfinch eSTOL hybrid aircraft, which uses eight electric motors to increase wing lift and enable ultra-short takeoffs and landings more quietly and efficiently than conventional aircraft and helicopters. Hybrid-electric power provides long ranges without the need for frequent recharging.

Electra is developing a nine-passenger version of the aircraft for commercial and government applications that can take off and land with ground rolls as short as 150 feet and fly at speeds of 200 mph for distances of 500 miles.

▲ **Electra.aero will design prototype electric aircraft to enable Navy experts to transport military personnel and suppliers to difficult areas, such as carrier on-board delivery (COD) applications.**

Electra will develop a full-scale prototype eSTOL aircraft under a previously announced $85 million contract with the U.S. Air Force AFWERX Agility Prime Program. Certification and entry into commercial service under FAA Part 23 regulations is set for 2028.

"We're honored to add the U.S. Navy to our portfolio of U.S. Department of Defense customers, including the U.S. Air Force and U.S. Army," said Ben Marchionna, Electra's director of technology and innovation.

"Electra's eSTOL has all the right technology-enabled capabilities to help the Navy address next-generation aviation logistics challenges," Marchionna continues. "With our differentiated combination of hybrid-electric propulsion and a blown fixed wing, we can offer Pacific theater-relevant payloads and ranges, and the ability to operate from rough soccer field-sized spaces as well as many naval vessels and adjacent assets, all from day one."

Continued from page 10

with Finnish authorities to demonstrate the automatic detection of marine vessels using hyperspectral imaging and its advanced AI platform. Kuva Space plans to launch two hyperspectral satellites and its initial services in 2024, starting with Hyperfield-1 scheduled for launch in July 2024. The company aims to deploy up to 100 satellites by 2030 to provide comprehensive monitoring capabilities.

How NASA's new supersonic jet replaced the boom with a quiet thud

Imagine leaving work in L.A. or San Francisco a little early on a Friday afternoon and winding up with a drink on the beach in Maui before cocktail hour is over. Imagine Seattle to Tokyo in four hours, and New York to London in three-plus hours. NASA's 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. NASA is working closely with Lockheed Martin to create a large database of computational fluid dynamics simulations to verify the aircraft's supersonic performance. The database includes simulations for all possible combinations of settings that a pilot uses to control the aircraft and the flight conditions that may be encountered. This database is crucial for supplying data for a flight-planning tool that is being used to assist and teach pilots how to fly the X-59, before it even flies. .

House approves Federal Aviation Administration reauthorization bill

The U.S. House of Representatives has approved a major federal aviation bill that aims to improve aviation safety, enhance protections for passengers and airline workers, and invest in airport and air travel infrastructure nationwide. The legislation would provide $105 billion for the Federal Aviation Administration (FAA), as well as $738 million for the National Transportation Safety Board (NTSB) for 2024 through 2028. The bill, which funds the FAA and NTSB through 2028 includes $66.7 billion for FAA operations to fund key safety programs, from aircraft certification reform to air carrier oversight, and enable hiring, training, and retention of safety-critical staff like air traffic controllers and technical engineers; $17.8 billion for FAA facilities and equipment to fund modernization of key technologies and systems to ensure the resilience and development of the world's most complex airspace system.; and $19.35 billion for FAA airport infrastructure improvement grants to support more than 3,300 airports nationwide in meeting increasing demand and integration of emerging technologies. This includes $4 billion a year for boost authorizations for the Airport Improvement Program to improve aviation infrastructure, a major increase for a program that's been authorized at $3.4 billion annually for the past decade.

Radar and help military leaders shoot for the high ground

These sensors use radio waves and lasers to detect, track, and classify targets, and are moving to ever-higher levels of resolution for surveillance and reconnaissance.

BY **Jamie Whitney**

Radar, short for radio detection and ranging, has long been a crucial technology in military operations. Using radio waves that bounce off objects, radar systems proved adept at recognizing and tracking objects from transmitter antennas and widely came into military use during World War II.

A primary military use for radar is in surveillance and reconnaissance. Radar systems monitor airspace, land, and sea areas to detect and track enemy movements — including aircraft, ships, and ground vehicles. This constant monitoring aids in maintaining situational awareness and gathering vital intelligence.

In air defense, radar detects incoming aircraft, missiles, and other aerial threats. It provides early warning and targeting information for anti-aircraft and missile defense systems. Additionally, radar plays a critical role in target acquisition and fire control. It locates and tracks targets, guides missiles, and ensures accuracy in artillery fire for air-to-air and surface-to-air engagements.

Radar also aids in the navigation and guidance of military aircraft, ships, and ground vehicles, especially under poor visibility conditions. This capability extends to precision-guided munitions, ensuring they reach their intended targets accurately. Furthermore, military radar systems often include weather monitoring capabilities, which are vital for planning operations and ensuring the safety of personnel and equipment.

In electronic warfare, radar detects and jams enemy radar systems and communications, disrupting enemy operations and protecting friendly forces from detection. Naval radar systems are particularly important for surface search, navigation, and targeting. They detect and track surface ships and submarines, assisting in maritime surveillance and combat operations.

Counter-battery radar systems are designed to detect and track the trajectory of incoming artillery shells, mortars, and rockets. This allows for counter-battery fire to neutralize enemy artillery positions effectively. Additionally, radar is employed in search and rescue missions to locate downed aircraft, ships in distress, and missing personnel.

Speed of light

Less than two decades after militaries found ground-breaking uses for radar, the U.S. Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA) harnessed lasers to use light in place of radio waves to determine distance with lidar [LIght Detection and Ranging].

In terrain mapping and reconnaissance, lidar creates high-resolution 3D maps of terrains, aiding in mission planning, navigation, and operational strategies. These maps offer insights into topography, obstacle identification, and route planning for troops and vehicles.

Mounted on drones, piloted aircraft, or ground vehicles, lidar systems assist in target identification and tracking. By delivering accurate distance measurements and detailed imagery, lidar

lidar

Radar systems monitor airspace, land, and sea areas to detect and track enemy movements — including aircraft, ships, and ground vehicles.

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aids in recognizing and distinguishing between various objects, including enemy equipment and personnel.

Lidar technology is instrumental in obstacle detection and avoidance for autonomous vehicles such as drones and ground robots. Real-time obstacle detection enables these vehicles to navigate complex environments safely by adjusting their paths in response to detected obstacles.

Lidar also proves invaluable for identifying potential hazards like improvised explosive devices (IEDs). By scanning the ground surface and analyzing reflected light, lidar can identify anomalies indicative of hidden threats, enabling safer operations in hazardous environments.

Military engineers use lidar to assess the structural integrity of critical infrastructure like bridges and buildings. By generating detailed 3D models, lidar aids in evaluating damage, planning repairs, and ensuring the safety and functionality of infrastructure.

Integrated into surveillance systems, lidar contributes to gathering intelligence over large areas. Its ability to operate in various weather conditions and provide precise measurements enhances the effectiveness of surveillance operations.

Lidar-generated data is utilized in combat simulation and training programs, leveraging virtual reality (VR) and augmented reality (AR) technologies to create realistic combat scenarios. This immersive training improves soldiers' preparedness and tactical skills by allowing them to train in environments closely resembling real-world conditions.

In range

Radar and lidar help military and civilian personnel keep an eye on what's above, below, and in front of them, but using each comes with benefits and drawbacks.

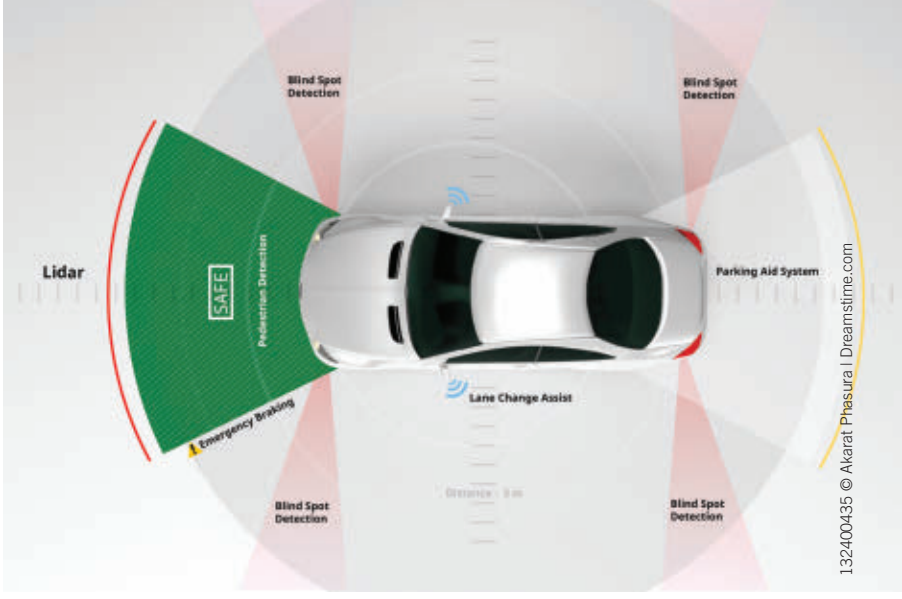
Radar offers significant benefits because it works well in adverse weather conditions. Unlike lidar, radar remains effective in rain, fog, and snow to render reliable data even in low visibility. Additionally, radar waves can penetrate obstacles like foliage, dust, and even walls to detect objects through barriers.

However, radar has some drawbacks — primarily its lower spatial resolution compared to lidar. This limitation means radar is less capable of generating detailed 3D maps and distinguishing between closely spaced objects. Additionally, radar is generally less effective at classifying objects, providing good information about the presence and distance of objects but less detailed data about their shape and size. Radar also can be susceptible to electromagnetic interference from other devices operating on similar frequencies, which can affect its accuracy and reliability.

Lidar excels in providing high-resolution 3D mapping to offer detailed spatial information about the environment. This high resolution makes lidar highly effective for applications

requiring precise object detection and mapping. lidar also excels at accurate object classification, distinguishing between different types of objects based on their shape and size. lidar offers precise distance measurements with high accuracy, which is crucial for applications needing detailed and accurate spatial data.

Despite its strengths, lidar has its own set of disadvantages. Its performance can be significantly degraded by adverse weather conditions such as heavy rain, fog, and snow, which scatter the laser light and reduce accuracy and range. lidar generally has a shorter effective range compared to radar.



Vehicles using autonomous driving technology use vision systems, radar, and lidar to provide situational awareness to aid safe operation.

Getting higher

Lidar generally has a much shorter range than radar, yet by taking a top-down approach from high altitudes or even from space, lidar can make precise electro-optical quickly.

Last decade, the U.S. Defense Advanced Research Projects Agency (DARPA) developed the High-Altitude lidar Operations Experiment (HALOE), which collected data more than ten times faster than radar. HALOE was able to map 50 percent of Afghanistan in 90 days.

The HALOE project used arrays of Geiger-mode avalanche photodiode (GmAPD) detectors, which are capable of detecting one photon. This extreme sensitivity enables lidar sensors to operate at unprecedented altitudes and achieve area collection rates exceeding 1,000 square kilometers per hour, equivalent to about 620 square miles.


Credit: U.S. Army Corps of Engineers, Photo by David Marquis.

Technicians assemble a newly engineered automated terrestrial laser scanning system (A-TLS) on a 12-foot-tall tower affixed with multiple lidar laser scanners, meteorological sensors, and solar panels to map where components go prior to the tower being disassembled and shipped to Alaska.

Beyond military applications, the technology developed for HALOE is expected to benefit civil mapping, monitoring of critical infrastructure, and disaster relief efforts.

Using lidar at altitude also is helping the U.S. National Weather Service (NWS) to research how to improve upper-air weather observation.

This spring, Honeywell in Phoenix and U.S. National Oceanic and Atmospheric Administration (NOAA) joined to explore the utility and value of data from Honeywell's High Altitude lidar Atmospheric Sensing (HALAS) system. HALAS is a remotely operated, ground-based weather information system that uses laser pulses to provide near real-time, high-altitude atmospheric data with greater accuracy and spatial relevance than traditional weather balloons. This system will allow NOAA to collect atmospheric measurements at much faster intervals, leading to a better understanding of rapidly changing weather patterns and potentially improving the accuracy of weather forecasts.

"Understanding the atmosphere above the surface is vital to predicting the evolution of weather phenomena, from local afternoon thunderstorms to expansive blizzards and hurricanes," says Jordan Gerth, a meteorologist at the National Weather Service Office of Observations. "Through our partnership with Honeywell, this research project could help us identify a new way to gather the weather observations we need."

HALAS provides forecasters with weather data on wind speed and direction, humidity, temperature, and density from altitudes exceeding 100,000 feet above the Earth's surface.

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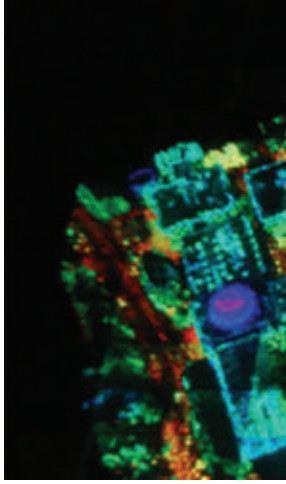


This new, location-specific atmospheric column of data available to NOAA meteorologists could enhance their ability to understand weather patterns and improve existing weather prediction models.

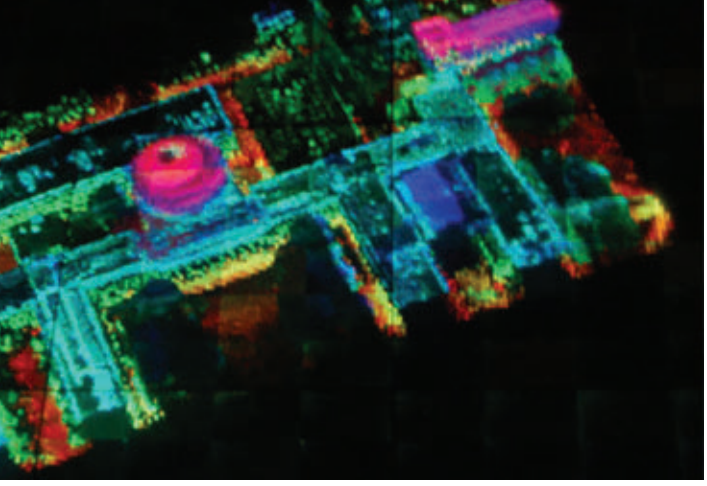
Even higher

Like DARPA's HALOE, space-based lidar is also for topographical mapping. This technology enables the creation of high-resolution maps of planetary surfaces, including Earth, the Moon, Mars, and other celestial bodies. For example, the National Aeronautics and Space Administration's (NASA's) Mars Global Surveyor used lidar to map the topography of Mars. Additionally, space lidar is used in vegetation and forest analysis by measuring forest and vegetation structures to assess biomass, carbon stocks, and land cover changes. The Global Ecosystem Dynamics Investigation (GEDI) mission on the International Space Station (ISS) uses lidar to create 3D maps of Earth's forests.

Space lidar also plays a part in atmospheric studies by measuring parameters such as aerosols, clouds, and gas concentrations. NASA's Cloud-Aerosol lidar and Infrared Pathfinder Satellite Observations (CALIPSO) mission used lidar to study cloud and aerosol layers in the Earth's atmosphere.

Radar has also been embraced in space by civilian-commercial interests as well as government and military. One of the most common applications of space radar is synthetic aperture radar (SAR), which creates high-resolution images of the Earth's surface by synthesizing a large aperture as the radar antenna moves along the orbital path. SAR is for topographical mapping, vegetation analysis, and monitoring natural disasters. Interferometric Synthetic Aperture Radar (InSAR) enhances insights using multiple SAR images taken at different times to measure ground deformation and topography, detecting subtle changes in the Earth's surface caused by earthquakes, volcanic activity, and subsidence.

Last year, Umbra, a Santa Barbara, Calif.-based company specializing in advanced space radar technology, created a SAR image with a resolution of 16 centimeters, purportedly the highest-resolution commercial satellite image ever released.



The DARPA-developed High-Altitude lidar Operations Experiment (HALOE) technology was able to leverage lidar to aid warfighters in Afghanistan by quickly and accurately mapping the country's rough terrain.

Umbra's capacity to enhance its data offerings for commercial clients stems from NOAA's removal of the temporary licensing conditions that previously governed Umbra's operations. Following the update in NOAA licensing, Umbra integrated 25-centimeter imagery, incorporating the newly unlocked phase history data into the Open Data Program.

Space radar systems also are altimetry to measure the height of the Earth's surface, including ocean topography, ice sheets, and land elevations. By emitting radar pulses straight down to the surface and measuring the return time, radar altimeters provide precise altitude data used for sea level monitoring and climate research. In planetary exploration, radar systems map the surfaces and subsurfaces of other planets and moons.

Because SAR allows for observing time-critical applications and changes, in 2022 DARPA announced its Fiddler program to improve automatic object recognition in SAR images. Object recognition often requires significant examples to train machine learning classification algorithms. Obtaining training data can be time-consuming, expensive, and even impossible in dynamic conditions.

Additionally, space radar systems monitor and track space debris and other objects in Earth's orbit to mitigate the risks of collisions with satellites and space stations. Space radar can penetrate clouds, rain, and dust, providing reliable data regardless of weather conditions. Their ability to detect objects over long distances makes them suitable for large-scale and remote sensing applications.

Fieldwork

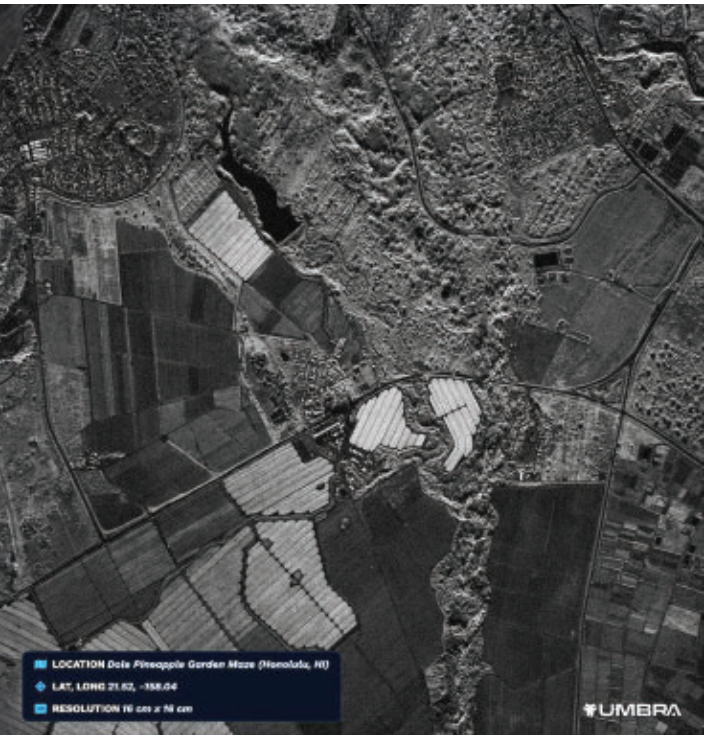
Lidar and radar sensors, alongside vision systems, have proven incredibly useful in allowing for air, sea, and ground vehicles to operate in varying degrees of autonomy.

dSPACE in Wixom, Mich. provides development and testing solutions for electronic control units (ECUs) and mechatronic systems. Their primary focus is on the automotive industry, although their technology is also utilized in other sectors such as aerospace, robotics, and industrial automation.

Vivek Moudgal, sales and marketing vice president for dSPACE, explains that the company provides software development and testing tools including hardware-in-the-loop (HIL) simulators. These simulation tools help automotive engineers evaluate the performance, handling, and safety of vehicles under various driving conditions and scenarios in the lab much before the vehicles are on the road.

With autonomous systems proliferating in military and civilian environments, lidar, radar, and vision systems are crucial not only for successful missions but safely operating in dynamic environments like driving at highway speeds.

Moudgal notes that in automated vehicles, the environment sensors work with internal vehicle signals to provide a holistic view around the vehicle. "You need to have a 360-degree view of what's happening around you, both in the near distance - basically close to the vehicle - as well as further distance, especially if you're driving at highway speeds," Moudgal says. "When you look at every individual sensor, cameras give you really vivid information, but can be prone to failures either if driving into the sun when you have overexposure, in dust storm, or snow, etc. or if there is dirt on the lens."



▲ **Umbra's high-resolution Synthetic Aperture Radar shows the Dole Pineapple Garden Maze in Honolulu, Hawaii.**

The dSPACE executive notes that radar, on the other hand, is much less affected by dirt, dust, and glare and enables systems to better accurately gauge the vehicle's distance from any object around it.

"Cameras are good at the perception of perceiving objects, classifying objects, doing things like that, [but] where cameras tend to be weak is distance measurements - that's what radar's really good at," Moudgal says.

Like cameras, Moudgal explains that lidar can also be negatively impacted by environmental factors like rain or snow, saying "they will be blinded in many cases." The executive also says that lidar is capable of producing higher resolution images than radar, but there are significant size and cost concerns for vehicles built to a price.

John Gagnon, who heads dSPACE's business development and field application initiatives for radar test systems, says that radar - specifically advancements brought about by 4D radar - can provide improved and more accurate awareness around vehicles compared to previous technologies.

"Four-D radar can come in ten [times] less the cost of lidar and you're getting good enough point data where these new 4D imaging radars are getting good at elevation measurements, which is typically where previous generation of radars always had a problem with."

Conventional radar systems function in three dimensions, furnishing spatial data about object locations relative to the radar transmitter/receiver. However, 4D radar systems augment this spatial information with the temporal dimension, enabling the tracking of objects as they traverse through space. This capability enhances the accuracy of forecasting trajectories and behaviors of moving targets, proving particularly advantageous for applications like air traffic control, maritime surveillance, weather monitoring, and military operations.

4D radar systems achieve this functionality by continually emitting radar pulses and examining the Doppler shift in the frequency of the returning signals. Through monitoring frequency alterations over time, these systems ascertain the velocity of moving objects concerning the radar, along with their direction of movement. This data is subsequently amalgamated with spatial information to construct a comprehensive

depiction of the target's motion in three-dimensional space across time.

"So, if you can get that data for a cheaper per unit cost and you're also filtering out a lot of the noise by having less points, that can become a good thing," Gagnon says.

His colleague Moudgal agrees and says, "I think that's an important aspect...if you look at it a camera, you can increase the resolution, you can increase the frame size and you can increase the frames per second. But all that comes at a cost of how much the back-end connection has to be to the computer to transfer the data, and at the same time, once the data is in the computer, how quickly can it be computed?"

While military vehicles also must contend with concerns with size, weight, power, and cost (SWaP-C) like their civilian counterparts, the ability to carry more sensors and embedded systems to process data allows even greater redundancy and situational awareness. Lidar and radar are frequently integrated to capitalize on the strengths of both technologies. Lidar offers high-resolution 3D mapping and precise obstacle detection, while radar provides reliable detection and tracking capabilities in all weather conditions. Together, they enhance a vehicle's ability to operate autonomously, navigate complex terrains, and accurately detect threats.

Combining data from both lidar and radar systems results in improved situational awareness and decision-making. This integrated approach ensures a comprehensive understanding of the environment and significantly boosts the vehicle's overall operational effectiveness.

LIDAR

For more information on lidar, search for "lidar" at www.militaryaerospace.com

RADAR

For more information on radar, search for "radar" at www.militaryaerospace.com

Radiation-hardened electronics keep orbital satellites functioning

Rad-hard designers turn efforts to fabricating and screening ever-more-complex microprocessors and other electronic components to keep space projects on the cutting edge.

BY **John Keller**

Today's technological revolution in space, ranging from long-term harsh-environment military space applications to commercial space telecommunications and internet access, is driving new trends in electronics components that can withstand varying levels of radiation.

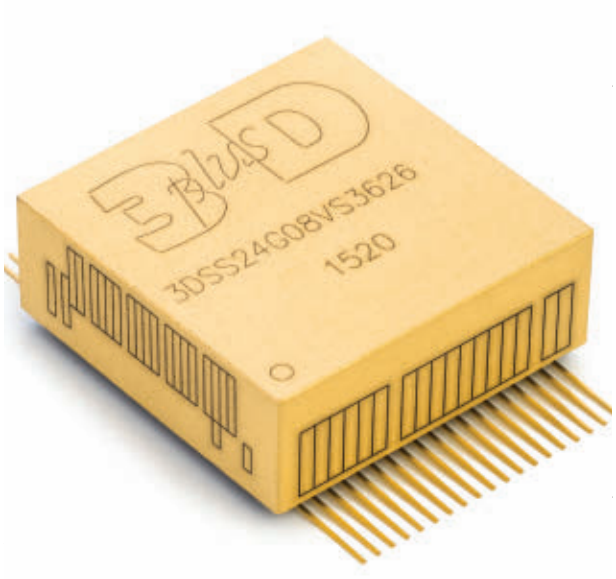
Radiation-hardened and radiation-tolerant electronics are designed or upscreen-tested to withstand the effects of ionizing radiation such as gamma rays and cosmic rays, which can disrupt or damage electronic circuits. These components are crucial not only for orbital space, but also for space exploration, nuclear power plants, and particle accelerators.

Radiation-hardened and radiation-tolerant electronics typically share several different traits, such as shielding, redundance, rad-hard-by-design components, and testing and upscreening.

Shielding made from materials like lead, tungsten, or other heavy metals can protect sensitive components from radiation, while redundant systems and circuits often are built into radiation-hardened electronics to ensure continued operation even if parts of the system suffer disruption or damage from radiation.

Some space applications — especially those in high-Earth orbits for long-duration military missions, require components that are specially manufactured for heavy resistance to radiation-induced damage. This can involve different materials or designs compared to commercial-grade components, which can be time-consuming and very expensive to design. Rad-hard-by-design electronics typically are more expensive than commercial-grade components because of the specialized design, manufacturing, and materials involved.

Extensive testing under simulated radiation can help verify the performance and reliability not only of radiation-hardened



▲ **The 3D Plus NAND Flash Radiation Tolerant and Intelligent Memory Stack (RTIMS FLASH) is a user-friendly, plug-and-play, radiation protected high-density NAND Flash Memory.**

New space

The biggest part of today's radiation-hardened and radiation-tolerant applications involves so-called "New Space," or commercial applications for telephone service, Internet access, and streaming data for video and sophisticated sensor applications. These services typically come from commercial satellite constellations composed of spacecraft typically expected to survive in space only for a short time, such as five years.

New-space applications pose big rad-hard design challenges because they are extremely cost-sensitive, so require just the right amount of radiation hardening for their specific

orbits and expected lifetimes. Excess capability increases costs, yet not enough rad-hard capability risks unanticipated on-orbit failures, which can require additional rocket launches to provide replacement spacecraft.

There's always risk involved in New Space applications, as well as a delicate balancing act between rad-hard components, upscreened commercial off-the-shelf (COTS) components, and pure commercial-grade parts.

"We need to meet the spec, but not overdo the spec," says Timothée Dargnies, chief executive officer of rad-hard supplier 3D Plus in Buc, France. "We maintain the level of radiation that the customer needs, but we bring a lot more capability to help compete with pure COTS for space applications that last three to four years," Dargnies says.

3D Plus covers the entire spectrum of the radiation-hardened electronics market, Dargnies says, but doesn't find the job any easier because of New Space competition from pure-COTS electronic components. "We are seeing bigger and bigger competition from the COTS market, from New Space, to commercial, to military applications."

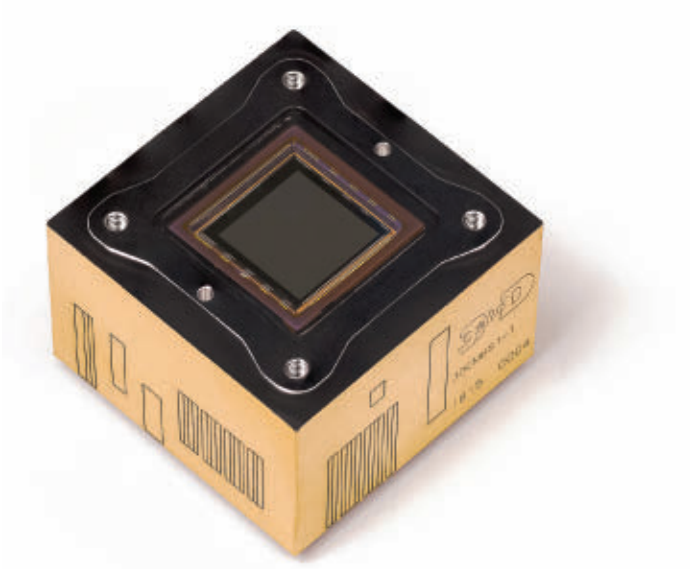
Often the problem comes from a lack of available rad-tolerant parts on the market, which can force spacecraft designers to use pure-COTS. "Because of sensors and processing, designers don't find pure rad-hard parts that fit their requirements, so they use commercial parts," Dargnies says. "It's getting harder and harder to compete with pure COTS."

In response, 3D Plus seeks to add value not available with pure COTS parts. "We can package everything inside of a smaller package," he says. "We are building components to put in more features and capability, and in the future we will bring new products that are easy to use from the outside, but complex from the inside, to bring more features and capability to our customers."

The difference between electronic parts designed for New Space and pure-COTS components is the reason that Apogee Semiconductor in Plano, Texas, originally entered the space market. "We started this in 2017 to go after New Space market," says Anton Quiroz, chief revenue officer at Apogee. "We saw a big gap between commercial semiconductors and radiation-hardened semiconductors in price and performance."

New Space risks also can involve a willingness to chance suffering a potentially catastrophic radiation-induced event that is unlikely to happen, such as a cosmic ray hit from distant stars, Quiroz says.

Even so-called inexpensive short-duration cubesats can risk cosmic ray hits coming into Earth orbit from stars,



▲ The 3D Plus 4 Mpx CMOS Space Camera Head is a high-density and high-resolution CMOS Camera Head for space applications.

Quiroz points out. "New Space also has the galactic cosmic rays coming from stars," he says. "They are heavier and I think of them like sniper shots; those can happen as a probabilistic event in space. The further you are out in space, the more likely that is to happen."

Test and upscreening

One way to specify commercially developed electronic components for space applications is lot-by-lot upscreening of the parts to demonstrate they can withstand space radiation for a given amount of time. Several public and private test laboratories exist that can simulate the kinds of environments that commercial parts will encounter in space.

Where upscreening for single-event effects are concerned, parts designers typically rely on three labs: The Texas A&M University Cyclotron Institute in College Station, Texas; the Lawrence Berkeley National Laboratory in Berkeley, Calif.; and the National Superconducting Cyclotron Laboratory at Michigan State University in East Lansing, Mich.

At these facilities, technicians show semiconductors with heavy-ion particles at rates that customers choose to simulate their expected space environments most closely. "Depending on the facility, you can pick whatever element you want to hit, and the energy level you're looking for," says Apogee's Quiroz. "They bombard the device to make sure there are no anomalous events."

Other public and private labs are available to screen test for total ionizing dose, as well as for exposure to neutron displacement damage.

Rad-hard market trends

Just a few years ago it was popular among space electronic systems designers to use pure-COTS parts as frequently as possible, with the promise of readily available spacecraft replacements. After some bad experiences, however, some spacecraft designers are starting to rethink their original assumptions.

We're starting to notice people looking at designing for more radiation resilience for low-Earth orbit (LEO)," says Apogee's Quiroz. LEO is getting so crowded, and medium-Earth orbit (MEO) has harsher radiation environments. This is leading to people to use more radiation-tolerant parts instead of pure commercial and doing some testing."

Even designers of short-duration cubesats are giving radiation-hardened parts a second look. "Even the companies that started as building commercial cubesats, they are getting questions about higher radiation levels," Quiroz says. "They are trying to figure out how to get those more radiation resilient."

▲ Apogee Semiconductor's GEO Logic Family of 300 krad products was developed to withstand demanding radiation environments.

Recent trends also saw much of the nation's space electronics parts fabricated outside U.S. borders, yet that may be starting to change, Quiroz says. "Semiconductors over past decade has seen a lot of off-shoring, but now we're trying to bring some back. We are in desperate need of U.S. plastic packaging facilities, because most of that has gone overseas — specifically to China. There have been a few government solicitations to bring packaging back, but is under the umbrella of advanced packaging. We don't know how to do that cost effectively in the U.S."

Radiation-hardened products

Radiation-hardened electronics specialists are bringing out several new products in response to current space market trends. 3D Plus is offering space-qualified systems-in-module with high-capacity sensors that integrate different electronic parts into a package, such as solid-state memory, sensors, field-programmable gate arrays (FPGAs), discrete power, and analog parts.

The company also has started offering components that company officials call companion parts. These are SRAM-based powerful FPGAs that also need circuitry to mitigate the radiation effects in the SRAM cells. The companion chip fits next to the FPGA to provide the features that the customer needs, Dargnies says.

"We are moving from component supplier to a function and systems provider, by taking-on subfunctions that nobody wants to deal with, as a function. The customer always needs more computing performance, capacity, density, and radiation performance," Dargnies says.

Apogee Semiconductor is helping space systems designers blend COTS electronic components with some rad-hard parts in robust systems in a family of parts called RelBridge. "The idea is to give customers a bridge between using less radiation-hardened parts, but in a more robust system, Quiroz says.

"You take out the critical components, like the watchdog timer, which is a failsafe for the satellite," Quiroz says "We developed a stand-alone voter for our customers who are walking the tightrope between cost and reliability. You have three microcontrollers performing the same function, and before doing something critical to the satellite, two of the three have to agree. Otherwise, which components do you trust to do arbitration or voting? We have a single-event-immune voter, which is more cost-effective way of handling triple-mode redundancy, which costs less than rad-hard microcontrollers."

Rad-hard projects

This spring U.S. military researchers chose the Northrop Grumman Corp. Aerospace segment in Redondo Beach, Calif., and RadiaBeam Technologies LLC in Santa Monica, Calif., to develop new testing methods for radiation-induced

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single-event effects (SEE) of high-reliability next-generation electronics.

Northrop Grumman won an $18.1 million contract in April, and RadiaBeam won a $10.6 million for Advanced Sources for Single-event Effect Radiation Testing (ASSERT) project of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va. The 4.5-year ASSERT program seeks develop new capabilities for SEE testing of 3D heterogeneously integrated (3DHI) electronic components and circuits, and transform today's radiation-hardened electronics design process to enable rapid deployment of next-generation electronics for space and nuclear warfare applications.

Goals for Northrop Grumman and RadiaBeam include generating energetic particles with penetration as deep as 5 millimeters in silicon with high-radiation-relevant linear energy transfers and beam diameters of less than 0.2 microns. Northrop Grumman and RadiaBeam engineers will take-on one ASSERT program technical area for 3DHI radiation-hardened technologies which addresses two technical challenges: deep penetration depths in 3DHI components with space-radiation linear energy transfers; and charge tracks with fine spatial resolution. Proposals must respond to both technical challenges.

Radiation effects threaten electronic systems from three main natural sources: galactic cosmic rays; charged particles trapped by planetary magnetic fields; and solar particle events.

Emerging advanced electronics are complex and integrated than previous generations, and can combine digital, analog, and optical functions using 3D topologies and several material types. 3D components are expected to reach several millimeters in vertical extent with a complexity and level of integration that will make it difficult, if not impossible, to de-package and disaggregate into parts to perform radiation testing using current heavy-ion sources.

SEE testing of integrated components will require an irradiation source that provides a combination of multi-millimeter penetration depths, space-radiation-relevant linear energy transfers, and fine spatial resolution and control to provide the linear and angular precision necessary to probe sensitive areas and to isolate faults.

Current SEE testing is unable to meet all of these requirements simultaneously, necessitating new sources to qualify next-generation microelectronics for nuclear and space applications that require high reliability in radiation environments.

The process of testing with ion beams is slow and laborious, and problems worsen with the increasing complexity of electronics. As a result, ASSERT sources must be compact and cost-effective so they can be incorporated into the development process.

In this way, radiation qualification will be integrated throughout the design and fabrication flow, with ASSERT sources providing the means to identify radiation design flaws rapidly and to facilitate swift correction and design

Orbiting spacecraft are subject to many sources of radiation, depending on the spacecraft orbit and distance from the Earth.

optimizations. A key program goal is to reduce the time from design to radiation-qualified component by a factor of 10. DARPA researchers particularly are interested in technologies like short-pulse relativistic electron beams and ultrashort pulse X-rays.

Rad-hard data storage

Last fall spacecraft experts at the U.S. Air Force Research Laboratory's Space Vehicles Directorate at Kirtland Air Force Base, N.M., announced a $35 million contract to Western Digital Corp. in San Jose, Calif., next-generation radiation-hardened non-volatile memory chips as part of the Advanced Next Generation Strategic Radiation hardened Memory (ANGSTRM) project.

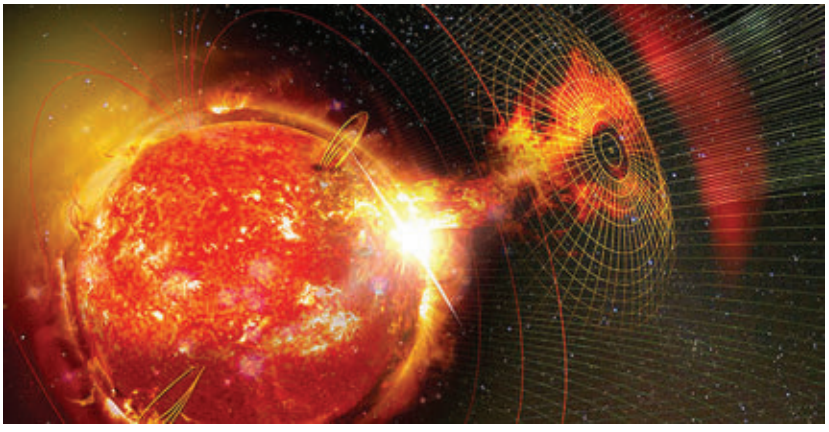
ANGSTRM seeks to develop a strategic rad-hard non-volatile memory device with near-commercial state-of-the-art performance by using advanced packaging and radiation-hardening techniques with state-of-the-art commercial technology for space and strategic systems. The Air Force Research lab awarded the contract on behalf of the U.S. Space Force.

Advancing strategic rad-hard non-volatile memory technologies is critical to support strategic missiles, missile defense, and military space systems, researchers say. Non-volatile memory devices retain their data even when they lose power.

Ideally, the military would have access to non-volatile memories with the performance and density of commercial state-of-the-art devices; unfortunately today's commercial technologies are not able to withstand the radiation and thermal environments where the military deploys systems. Many military systems, moreover, must use trusted on-shore electronics manufacturing.

The U.S. Space Force researchers are interested in combining radiation hardening to state-of-the-art CMOS and memory technologies to scale density beyond the levels of a single chip, and create qualified strategic rad-hard non-volatile memory for use across military space and strategic systems.

Researchers want Western Digital to develop rad-hard memories with monolithic memory densities of 4 to 16 gigabits, and with multichip module densities of 32 to 128 gigabits that will last without refresh for 10 to 15 years. These memory devices should operate with no more than



▲ **Satellites must be able to withstand radiation that emanates from the Sun, the Earth itself, and from distant stars. Radiation-hardened designs, shielding, and screening can help mitigate radiation's effects.**

10 milliwatts of power, and operate in temperatures from -40 to 125 degrees Celsius, and eventually down to temperatures of -55 C.

Resistance to total-ionizing-dose radiation should be as low as 300 kilorads, and as high as 1,000 kilorads, with fewer than 10 to 12 single-event upset errors per bit day. Single-event latchup resistance should be more than 72 MeV-Cm2/mg, with single-event gate and dielectric rupture of 72 to 100 MeV-Cm2/mg.

Ultimately, the ANGSTRM project seeks to develop a full-scale prototype device, provide device characterization and radiation test reports, and provide a qualification plan with a path to achieve a QML-standard product.

Space optical communications

Last February the U.S. Space Development Agency (SDA) in Chantilly, Va., released a broad agency announcement (FA240124S0001) for the Systems, Technologies, and Emerging Capabilities project to develop new kinds of space-based optical communications, navigation, target tracking, and similar capabilities for the warfighter.

The project is looking for new enabling technologies in efficient beyond line-of-sight data transport and warfighter

communications; advanced and alternate position, navigation, and timing (PNT); advanced target custody, warning, tracking, and defeat; and global battle management — most of which will require radiation-hardened electronics.

SDA officials are asking for architecture studies, concepts of operations (CONOPS), modeling and simulation, system designs, key technologies, and risk-reduction prototypes related to these capabilities. Efficient beyond line-of-sight data transport and warfighter communications features capabilities that enable global access to low-latency communications and space data transport for joint warfighting systems.

These capabilities involve enabling technologies in small lightweight free-space optical communications terminals that can operate at low, medium, and geostationary orbits and handle space-to-space, space-to-air, space-to-ground, and space-to-maritime applications. In particular, SDA experts are looking for emerging capabilities to improve modem performance, increase data rate, reduce optical communications terminals acquisition time through automation, and reduce complexity and manufacturing requirements.

Enabling technologies of interest include photonic integrated circuits; small lightweight terrestrial optical communications terminals; transportable optical ground stations; and simple low-cost ways to mitigate atmospheric effects on optical links.

Companies interested should email unclassified executive summaries and abstracts no later than 1 Dec. 2024, and full proposals no later than 15 Jan. 2025, to ussf.pentagon.sda.mbx.FA240124S0001@mail.mil. Email questions or concerns to ussf.pentagon.sda.mbx.FA240124S0001@mail.mil. More information is online at https://sam.gov/opp/f34e7a9d6f9d42008c7bf2874742316b/view.

RADIATION-HARDENED ELECTRONICS

For more information on rad-hard tech, search for "radiation hardened" at www.militaryaerospace.com

L3Harris to enhance shipboard and land-based communications networking technologies

BY **John Keller**

SAN DIEGO – U.S. Navy tactical networking experts needed enhancements to Navy communications networks. They found their solution from L3Harris Technologies Inc. in Camden, N.J.

▲ The U.S. Navy is asking L3Harris to enhance a variety of shipboard and land-based communications networks to keep links open in degraded or challenging conditions.

Officials of the Naval Information Warfare Center Pacific in San Diego has announced a $7.9 million contract to L3Harris for enhancements to communications networks.

L3Harris-Camden has performed military networking infrastructure work such as the Navy Multiband Terminal (NMT) multiband capable satellite communications (SATCOM) system that provides protected and wideband communications.

The NMT is a next-generation SATCOM system for the U.S. and allied navies provides seamless assured connectivity between a ship's or submarine's computer network and the Global Information Grid.

L3Harris-Camden also builds the AN/USG-2B and AN/USG-3B sensors and weapons tactical networking equipment for the Navy Cooperative Engagement Capability (CEC) program aboard Navy surface warships and carrier-based aircraft.

The CEC is a tactical sensor and weapons network that uses Navy ships and aircraft for anti-air warfare. It combines information from sensors operating over wide geographic areas in a common tactical picture for battle groups at sea. It improves overall situational awareness, and enables fleet commanders to work closely together to attack enemy forces from long ranges.

L3Harris-Camden also handles the Navy Wideband Anti-Jam Modem (WAM), the Navy's next-generation wideband SATCOM modem that integrates with the Navy Multiband Terminal (NMT) on ships and submarines, and with the Modernization of Enterprise Terminal (MET) on shore for communications over the Wideband Global SATCOM (WGS) satellite constellation.

The company also is involved in the high-frequency (HFK) portion of the Battle Force Tactical Network (BFTN-HF) system. BFTN-HF works together with SATCOM and other global communications technologies to provide network connectivity for ships, submarines, aircraft, and naval shore sites via HF radio.

This HF communications mode uses radio frequencies between 2 and 30 MHz to bounce radio signals off the ionosphere to achieve over-the-horizon global voice and data communications. HF radio can be tricky to use because it is affected by constant changes in the ionosphere, by the seasons, and by the presence of thunderstorms. The BFTN system also has an ultra-high-frequency component called BFTN-UHF) for line-of-sight voice and data communications.

L3Harris-Camden also is involved with the Navy Consolidated Afloat Networks and Enterprise Services (CANES) project to provide computer hardware, software, spare parts, maintenance, cyber security, and laboratory equipment for ships and submarines.

On this contract L3Harris-Camden will do the work in Camden, N.J.; Salt Lake City; and San Diego, and should be finished by February 2025. For more information contact L3Harris online at www.l3harris.com, or the Naval Information Warfare Center Pacific at www.niwcpacific.navy.mil.

Navy needs help in developing ship-defense electromagnetic weapons and anti-electromagnetic pulse (EMP)

BY **John Keller**

WASHINGTON – U.S. Navy researchers are asking for industry's help in developing electromagnetic weapons for use against anti-ship threats, small-boat terrorists, military swarm attacks, high-seas pirates, and aircraft.

Officials of the Naval Research Laboratory in Washington have issued a solicitation (N0017324RGA01) for the High Power Electromagnetic Systems Development, Application, and Test project.

NRL needs contractor support for designing prototype electromagnetic weapons systems and to evaluate RF and millimeter wave effects and technologies. Of primary interest are ship-defense directed-energy technologies like high power radio frequency (HPRF), high energy and high power lasers, and electrostatic discharge (ESD) systems.

Needed are large- and small-vessel stopping technologies and sensor-blinding and damage effects; protection for electronic devices in naval and civilian infrastructure; and defenses against high-altitude electromagnetic pulse (EMP) weapons.

Efforts involve countermeasures in the RF, millimeter wave, electro-optic, and infrared bands that address missile threats, hidden explosives, UAVs, and small boat swarm attacks.

The contractor chosen will provide research, systems engineering, test and evaluation, and contractor management for projects in high-power microwaves to counter electronic sensors; UAV detection and defeat; anti-ship cruise missiles threat analysis and evaluating the use of electromagnet weapons against those threats.

The contractor will provide research personnel in directed-energy development and test; electronic attack; high-power microwaves; directed-energy sources; high-power microwaves; directed energy; and ultra-short-pulse lasers.

Companies were asked to email proposals by March 2024 to the NRL's Brent Robinson at Brent.Robinson@nrl.navy.mil and Rick Savelli at Rick.Savelli@nrl.navy.mil. Email questions or concerns to Brent Robinson at Brent.Robinson@nrl.navy.mil and Rick Savelli at Rick.Savelli@nrl.navy.mil. More information is online at https://sam.gov/opp/69018c95b14f4ce3a01c-4f56ea260fa6/view.

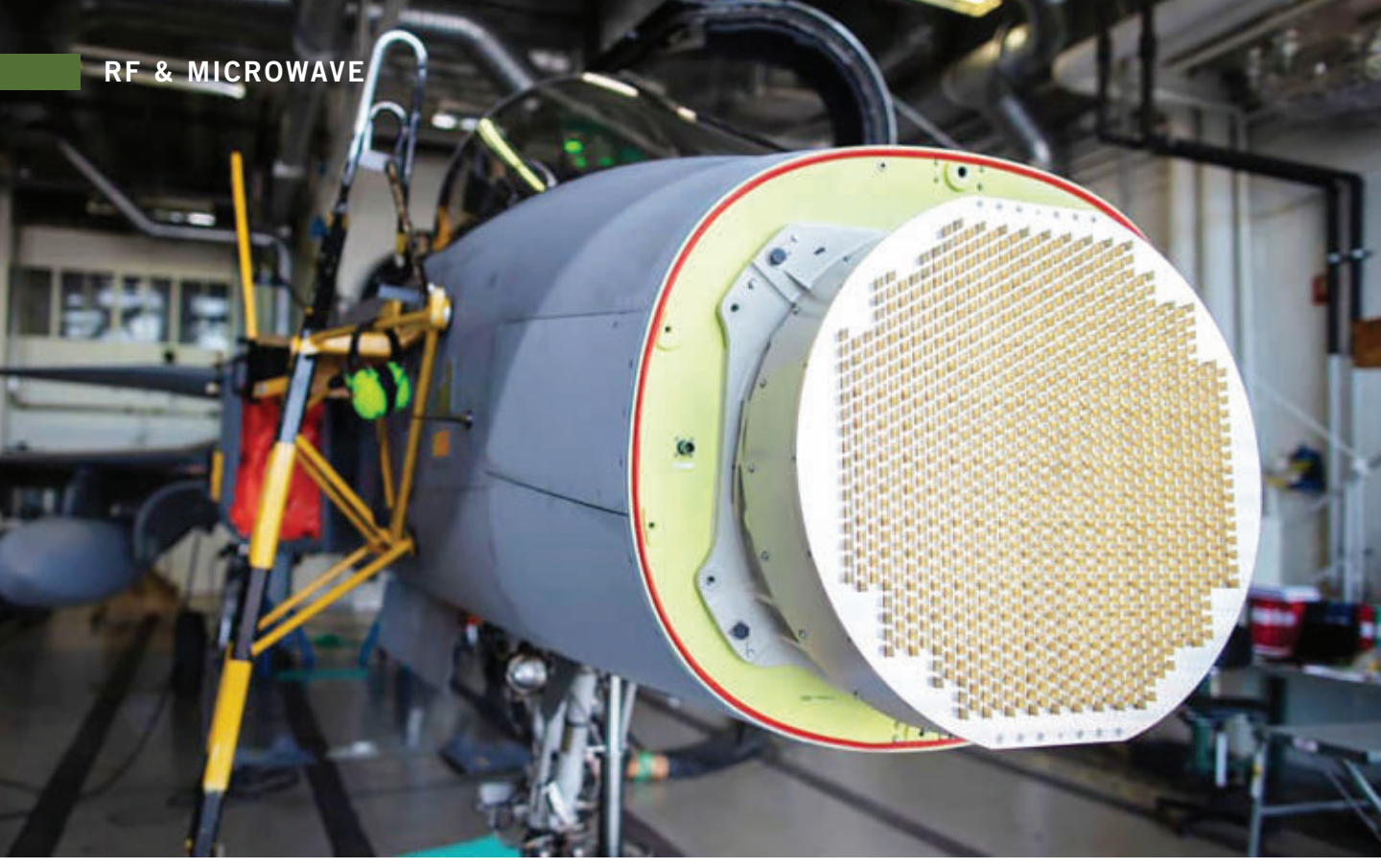
NRL needs contractor support for designing prototype electromagnetic weapons systems and to evaluate RF and millimeter wave effects and technologies.

DARPA eyes HF radio waves ionospheric test instruments for over-the-horizon radar

U.S. military researchers have briefed industry on an upcoming project to create test instruments suitable for high-frequency (HF) surface-wave and sky-wave over-the-horizon radar (OTHR). Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., has launched the Transponders for Ionospheric Measurement (TIM) program. TIM seeks to create distributable channel sounding and test instrumentation that will measure and respond to HF radio waves. The vision for TIM is to coordinate several test instrumentation nodes to help improve understanding of HF radio propagation across a wide geographic area. Email questions or concerns to DARPA's Frank Robey at DARPA-PS-24-07@darpa.mil. More information is online at https://sam.gov/opp/5aac901d6a3746eca-b6914e5e2a12331/view.

Lockheed Martin to provide submarine EW and digital signal processing

Submarine combat systems experts at Lockheed Martin Corp. will design and test U.S. Navy AN/BLQ-10 electronic warfare (EW) systems for Navy submarines under terms of an $43.4 million order. Officials of the Naval Sea Systems Command in Washington are asking the Lockheed Martin Rotary and Mission Systems segment in Syracuse, N.Y., for the design, prototyping, and qualification testing of submarine electronic warfare equipment. The order involves a modification to a potential $970.1 million 10-year contract announced in February 2019 for Lockheed Martin to design, upgrade, and support the AN/BLQ-10 submarine EW system. It provides threat warning to avoid counter-detection and collision; and determines the number and location of targets for subsequent prosecution. The program is adopting an open-architecture, incremental development process that fields hardware and software technology insertions every two years. For more information contact Lockheed Martin Rotary and Mission Systems online at www.lockheedmartin.com/en-us/who-we-are/business-areas/rotary-and-mission-systems.html.



Industry asked to demonstrate RF filtering and interference suppression for AESA antennas

BY **John Keller**

ARLINGTON, Va. – U.S. military researchers are pursuing new RF and microwave technologies to suppress RF interference, and want to demonstrate these technologies for future military use.

▲ Industry is asked to demonstrate advanced RF filters for interference suppression in the 2 to 18 GHz frequency range, and integrate RF filters with compact size and high performance.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., issued a broad agency announcement last week (HR001124S0027) for technical area 2 of the agency's COmpact Front-end Filters at the ElEment-level (COFFEE) program.

While the COFFEE program is developing interference-mitigating RF and microwave technologies for active electronically scanned array (AESA) transmit-and-receive antennas, the project's technical area 2 seeks to demonstrate COFFEE-developed technologies in military applications.

COFFEE seeks to create a new class of high-frequency filters with low loss and high power handling. COFFEE contractors are Northrop Grumman Corp., Raytheon Technologies Corp., Akoustis, BAE Systems, Metamagnetics, Georgia Institute of Technology, Columbia University, Carnegie Mellon University, University of Michigan, University of Texas at Austin, and University of California at Los Angeles.

An AESA antenna's ability to reconfigure radar beams dynamically and communicate across a range of frequencies is especially important in congested environments, DARPA researchers explain. This helps resist signal jamming and interception while mapping, navigating, sensing, tracking and creating high-bandwidth data links.

The COFFEE program seeks to create RF and microwave filter technology to mitigate AESA interference and enhance performance in 2 GHz to 18 GHz frequency ranges. These filters will distill signals while operating within

an 18 GHz half-wavelength array pitch, and account for digital-at-every-element advances.

The primary focus of the COFFEE program is on emerging microelectronics materials for integrable filters; new classes of miniaturized resonators; millimeter-wave frequencies beyond 18 GHz; and future communications for the 5G era.

Now, the COFFEE technical area 2 seeks to demonstrate the newly expanded potential of COFFEE technology by integrating COFFEE filters to demonstrate interference suppression in all or parts of the 2 to 18 GHz frequency range; incorporate frequencies above 8 GHz; and create RF and microwave filters with compact size and high performance.

COFFEE technical area 2 also seeks to demonstrate acceptable manufacturability of COFFEE RF filters; and develop disruption potential that departs from current practices in filter design and manufacture.

Proposers should show clearly how they will achieve the disruptive potential of COFFEE technology and how the effort supports switching enabling technologies to current and future military programs.

COFFEE filters will be integrated into systems and external components such as switches, controls, interconnects, interposers, and tuning elements that risk degrading system performance and increasing overall filter size.

COFFEE technical area 2 will apply COFFEE filter technology currently under development. The effort will highlight technical risks, mitigation strategies, and recent innovations. Solutions that use domestic manufacturing are preferred.

COFFEE technical area 2 is an 18-month effort, starting in 2025, that will validate COFFEE technologies by integrating 2–18 GHz filters with switches, controls, interconnects, and interposers into a filter tile. Several contract awards are expected.

The effort will culminate with delivery of integrated filter tiles to demonstrate the potential for scalable manufacturing and interference suppression.

Companies interested should were asked to submit abstracts by June 2024, and full proposals no later than 2 Aug. 2024, to the DARPA Broad Agency Announcement Tool (BAAT) online at https://baa.darpa.mil/Public/SecurityAgreement. Email questions or concerns to Tood Bauer, the DARPA COFFEE program manager, at HR001124S0027@darpa.mil. More information is online at https://sam.gov/opp/eb034f8d6017452ca0cc3ba3054a8a0a/view.

Lockheed to build long-range missile with imaging infrared sensors and RF signals guidance

BY **John Keller**

REDSTONE ARSENAL, Ala. – Precision missile designers at Lockheed Martin Corp. are moving ahead with building U.S. Army long-range Precision Strike Missile (PrSM) systems with multi-mode guidance to destroy enemy targets as far away as 300 miles.

▲ The future PrSM missile will combine electro-optical sensors and RF and microwave sensors to guide the munitions to their targets.

Officials of the Army Contracting Command at Redstone Arsenal, Ala., announced a $219.7 million contract on 5 March 2024 to the Lockheed Martin Missiles and Fire Control segment in Grand Prairie, Texas, for PrSM early operational capability lot 3.

The PrSM, which is ready to enter service, is a surface-to-surface, all weather, precision-strike guided missile fired from the M270A1 Multiple Launch Rocket System (MLRS) and the M142 High Mobility Artillery Rocket System (HIMARS).

The missiles use Global Positioning System (GPS) satellite navigation and inertial gyro navigation to reach the

vicinity of their targets. Once the missiles reach their target areas, they listen for radio signals from enemy radar or communications to refine their targeting, and finally use imaging infrared sensors to pinpoint their targets before impact.

Lockheed Martin won a $67.5 million contract last September for PrSM early operational capability lot 3. The company won a $23.9 million order in late 2021 for engineering and manufacturing development (EMD), and early operational capability of PrSM lot-one missiles that are in milestone B. EMD is the last developmental stage before full-scale production.

The long-range PrSM precision missiles that use imaging infrared sensors for terminal guidance are to replace non-insensitive and cluster munition versions of the Army MGM-140 Army Tactical Missile System (ATACMS).

PrSM will provide Army and Marine Corps field artillery units with long range and deep strike capability. The PrSM will destroy, neutralize, or suppress targets at ranges from 43 to 250 miles using indirect precision fires.

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

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

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

On this order Lockheed Martin will do the work in Grand Prairie, Texas, and should be finished by March 2026. For more information contact Lockheed Martin Missiles and Fire Control online at https://www.lockheedmartin.com/en-us/who-we-are/business-areas/missiles-and-fire-control.html, or the Army Contracting Command-Redstone at https://acc.army.mil/contracting-centers/acc-rsa/.

Motorized pan-tilt stages for optics, laser scanning, and positioning introduced by OIS

Optimal Engineering Systems Inc. (OES) in Van Nuys, Calif., is introducing the PT60 series of motorized dual-axis pan-tilt stages to meet the precision and speed of travel requirements of different motion-control applications. The dual-axis pan-tilt stages are for optics, laser scanning, reverse engineering, inspection, tracking, positioning, assembly, camera mounts, and measurements. These four compact high-precision pan-tilt stages integrate two 60-millimeter-diameter rotary stages capable of 360 degrees of continuous rotation set at 90 degrees to each other. The PT60-01 features a resolution of 0.001 degrees (3.6 arcsec) with a 10 microsteps-per-step micro stepping driver and has a knob on the motor for manual adjustments. The motor option -02 is driven by three phase brushless servo motors with quadrature optical encoders. The option -03 uses DC brushed servo motors with quadrature optical encoders, and the -04 option is stepper motor driven with quadrature optical encoders for position verification. The servo motor options -02 and -03 *Continued on page 38*

Army eyes reversible camouflage fabric to enable infantry to hide from infrared sensors

BY **John Keller**

NATICK, Mass. – U.S. Army infantry experts are reaching out to industry for companies able to develop special camouflage fabric to enable foot soldiers to conceal themselves from a wide variety of enemy electro-optical sensors.

Officials of the Army Contracting Command Aberdeen Proving Ground Natick activity in Natick, Mass., has issued a sources-sought notice (RFIForPrototypeReversibleSignature ManagementOverwhiteGarments) for the Prototype: Reversible Signature Management Overwhite Garments project.

This initiative seeks to develop reversible camouflage-printed fabrics with infrared-mitigating properties. The Army Contracting Command issued the notice on behalf of the Army Natick Soldier Systems Center Soldier Protection Directorate (SPD) in Natick, Mass.

Researchers are seeking information on the capabilities and willingness of prospective offerors to generate novel reversible multi-spectral camouflage fabrics that are invisible to infrared sensors in wavelengths ranging from visible light to longwave infrared.

With today's advanced battlefield sensors, the infantry soldier is at increased risk of detection from electro-optical and infrared (EO/infrared) sensors ranging from visible through longwave infrared wavelengths, researchers explain.

Continued from page 36

offer the greatest resolution, repeatability, positional accuracy, and speed of travel in closed-loop operation. For more information contact OES online at www.oesincorp.com.

CMOS imaging sensor for challenging lighting introduced by Teledyne e2v

Teledyne e2v, a Teledyne Technologies company in Grenoble, France, is introducing the Topaz5D full-HD CMOS imaging sensor designed to combine 2D vision with the generation of 3D depth maps. One Topaz5D used in challenging lighting conditions delivers 3D object visualization based on the contrast detected for logistics applications, augmented- and virtual-reality headsets, access control devices, household vacuum robots, and autonomous mobile robots. Topaz5D CMOS imaging sensor combines a 2.5-micron global shutter pixel with a post-processing diffraction layer to create angular sensitive pixels. This helps generate and process 3D angular signal raw data. Topaz5D is a 3D-enabled variant of Teledyne e2v's Topaz 2M, which is used in logistics, retail, and smart factories. Topaz5D has a 2 megapixel resolution and is available in both monochrome and color. Its 7.65-by-4.45-millimeter form factor helps it integrate into space-constrained optical engines or modules. It generates 3D depth maps and displays contrast details even black or very shiny, and through sheets of glass or transparent organic materials like Plexiglas or plastic bottles. For more information contact Teledyne e2v online at www.teledyne-e2v.com.

Rugged LCD monitor for naval, ground, and airborne applications introduced by EIZO

EIZO Rugged Solutions Inc. in Orlando, Fla., is introducing the Talon RGD2443W 24-inch 4K rugged liquid crystal display (LCD) monitor for high-detail rugged naval display, ground control, and airborne applications. The Talon RGD2443W display is designed to meet demanding size, weight, power consumption, and cost (SWaP-C) requirements, measures 599 by 369 by 70 millimeters, and weighs less than pounds. The Talon RGD2443W monitor displays at 3840-by-2160-pixel resolution, and offers a high-resolution display in a minimal physical footprint. LCD flicker can cause user eye fatigue. EIZO has developed a flicker-compensation algorithm called E-LFC to ensure that sonar images are clear and details are discernible to the operator. For more information contact EIZO Rugged Solutions online at www.eizorugged.com.

Researchers want to develop an overgarment made from fabric that is reversible with operational camouflage pattern (OCP) on one side and snow marine pattern (MARPAT) camouflage on the other, with visible through infrared camouflage properties. Overwhite systems today do not meet the requirements of this project.

This next-generation fabric could be made into trousers, jackets, ponchos, and pack cover prototypes for spectral mitigation against battlefield EO/infrared sensor threats.

Of interest is the proposed fabric's technology readiness level, concept, materials, methodology, and technology. The contractor chosen will apply thermal signature management technology onto different fabrics that are reverse camouflage printed.

One side of the fabric shall be printed in traditional camouflage and provide infrared-mitigating properties, while the reverse side of the fabric shall be snow marine pattern and provide additional infrared-mitigating properties.

The Army is surveying industry for suppliers of special camouflage fabric to help warfighters conceal themselves from infrared sensors.

Each side shall be its own pattern that cannot be seen or bleed through to the other side, and provide thermal signature-mitigating properties while maintaining or improving on the performance of the current fielded snow overwhites in respect to spectral performance, durability, weight, and drying rate.

Contractor chosen shall provide 15 to 20 yards of fabric samples for evaluation of comfort, durability, strength, water repellency, oil repellency, drying rate, and signature properties. Technology shall be scalable to produce several hundred yards of material if proposals are promising.

The fabric should incorporate shortwave infrared (SWIR) reflectance on fabrics; as many as two functional finishes; be fire resistant; have no toxicity characteristics; shall weigh no more than four ounces per square yard; be water repellent and durable; should dry quickly; and retain spectral performance after laundering.

Companies interested were asked to email pre-proposals 22 May 2024 to the Army's Justin Murphy at justin.a.murphy16.civ@army.mil and Mary Prebensen at mary.k.prebensen.civ@army.mil. Email questions or concerns to Justin Murphy at justin.a.murphy16.civ@army.mil and Mary Prebensen at mary.k.prebensen.civ@army.mil. More information is online at https://sam.gov/opp/6d99f224828f45f39440b875568d9865/view.

SPACE INTERNET

▲ Northrop Grumman taps Viasat for Air Force commercial space internet

Northrop Grumman Corp. in Falls Church, Va., needed a space internet service provider to support the company in its contract from the U.S. Air Force Research Laboratory to test how defense contractors and commercial SATCOM providers could integrate space internet services into existing military systems. They found their solution from Viasat in Carlsbad, Calif.

Northrop Grumman originally was selected for a four-year contract by the Air Force Research Lab as part of the Defense Experimentation Using Commercial Space Internet (DEUCSI) Call 003 program – also known by its nickname "Global Lightning."

As part of its contract with Northrop Grumman, Viasat will provide its ViaSat-3 Satellite Communications Network to enable military users to easily access high-bandwidth satellite internet connectivity from existing USAF aircraft or ground vehicles.

Under the deal, Viasat will integrate its ViaSat-3 modem into Northrop Grumman's open-systems processors and antenna solutions to conduct experiments demonstrating its use on multiple platforms.

The modem is aligned with open communications and IP-protocol standards in use by the military, for example, OpenAMIP, CMOSS, and SOSA. Open standards have been identified as a top priority for the Department of Defense because they enable faster adoption of new communications technologies so military users can keep up with industry innovation. The ViaSat-3 modem is a low-size weight and power embeddable module that can seamlessly integrate with multiple mission systems by operating with open standards.

In October, Viasat announced it expanded its Ka-band constellation to include eight advanced new satellites currently under construction. These will provide additional capacity focused on the most highly trafficked routes and over the busy hubs. Additionally, with the unique ability to steer capacity to where it's needed, passengers are ensured consistent high speeds wherever they fly

"Global Lightning is about delivering flexibility and agility for military users," said Victor Farah, Head of Viasat Government Systems. "Our reliable satellite services - coupled with the open source optimized ViaSat-3 modem - are designed to be able to offer game-changing communications capability so they can connect with ease and deliver mission success. We are delighted to be working on the program to offer our expertise across USAF's defense platforms."

UNMANNED SENSORS

▼ General Atomics eyes detect-and-avoid radar and algorithms MQ-9A to fly in civil airspace

U.S. Navy unmanned aerial vehicle (UAV) experts needed a detect-and-avoid system to enable the U.S. Marine Corps MQ-9A Reaper attack UAV to fly safely near other crewed and uncrewed aircraft. They found their solution from General Atomics Aeronautical Systems Inc. in Poway, Calif.

Officials of the Naval Air Systems Command at Patuxent River Naval Air Station, Md., announced a $30.9 million order to General Atomics to develop and certify the MQ-9A Detect and Avoid System for the Marine Corps.

This detect-and-avoid system will enable the Marine Corps MQ-9A to meet the "see and avoid" requirements of flying in controlled U.S. airspace. It is an alternative means of compliance, known as detect and avoid.

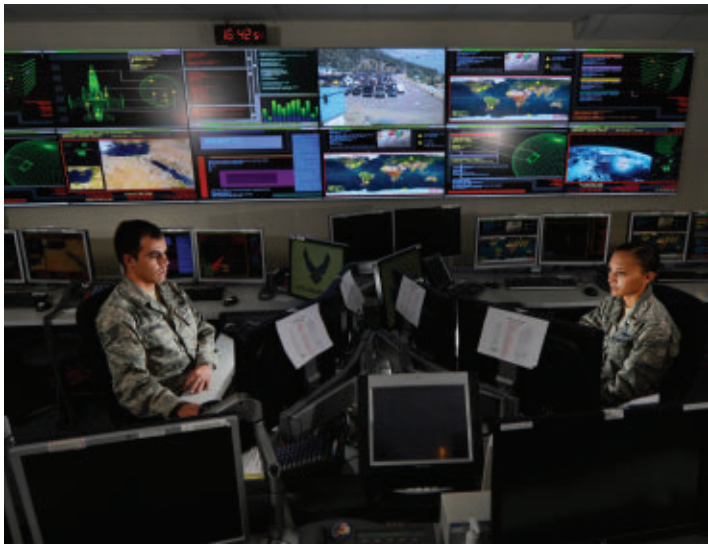
The General Atomics detect-and-avoid system for the Reaper UAV uses the company's air-to-air radar (ATAR) and a detect-and-avoid software algorithm. The certified detect-and-avoid system, began in 2018, uses a Traffic Collision Avoidance System (TCAS) II, and meets the "see and avoid" requirements in the United States and eventually in Europe.

The latest General Atomics detect-and-avoid radar is called the Due Regard Radar (DRR) to fly in international airspace. The radar has a two-panel active electronically scanned array (AESA) antenna and a radar electronics assembly (REA) that enables the Reaper's remote pilot to detect and track aircraft.

The AESA radar can track several targets at once while scanning scan for new aircraft. The detect-and-avoid system for the Reaper UAV has an air-cooled antenna and radar electronics; can detect and track within its field of view; enables due regard operations in international airspace; and helps integrate the Reaper UAV into U.S. civil controlled airspace.

On this order General Atomics will do the work in Poway, Calif., and at Patuxent River NAS, Md., and should be finished by April 2026.

For more information contact General Atomics Aeronautical Systems online at www.ga-asi.com, or Naval Air Systems Command at www.navair.navy.mil.



CYBER SECURITY

▲ Air Force taps Akima for cyber security, intrusion detection, and communications

U.S. Air Force computer experts needed a wide variety of information technology (IT) services at three Air Force and Air National Guard bases. They found their solution from Akima Global Technology in Herndon, Va.

Officials of the Air Force Life Cycle Management Center at Wright-Patterson Air Force Base, Ohio, announced a three-quarter-billion-dollar contract to Akima for communications and enterprise IT support.

Akima prevailed in this competition over 15 other bidders. Under terms of the $750 million 10-year contract, Akima will provide the Air Force with support for network hardware; physical and virtual servers, workstation deployment, laptop computers, and peripherals; facility access control and intrusion-detection IT; data storage and backup systems; Linux, Solaris, and RedHat

software administration; RedHat operating systems; IT infrastructure installation and maintenance; data storage and backup administration; IT asset management; software vulnerability and testing; and information assurance and circuit management.

On this contract Akima will do the work at Springfield Air National Guard Base in Springfield, Ohio; Joint Base Anacostia-Bolling in Washington; and Wright-Patterson Air Force Base, Ohio, and should be finished by February 2034.

For more information contact Akima Global Technology online at www.akima.com/opcos/agt, or the Air Force Life Cycle Management Center at www.aflcmc.af.mil.

SENSORS

▼ Draper Lab to design microbe-based sensors to detect chemical warfare agents

U.S. military researchers needed the ability to use microbes to sense harmful agents like heavy metals, organic pollutants, explosives, chemical warfare agents, and poison gases for long-duration standoff applications. They found a solution from the Charles Stark Draper Laboratory Inc. in Cambridge, Mass.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., announced a $9.3 million contract to Draper for the Tellus program to design and build microbial sense-and-respond devices for environmental monitoring.

Draper scientists will map-out the modular design of microbe-based sensors, and determine the environmental conditions in which these sensors can operate.

The lab will determine options for biologically encoded information processing, types of output signals these sensors can generate, and stand-off distances at which they are effective.

DARPA especially is interested in chemical and physical stimuli, with emphasis on using sensors across many different environmental conditions for monitoring military threats, pollutants, or changing conditions.

Current approaches to environmental monitoring rely on distributed sensor nodes on the ground or in the water, as well as on remote sensing using satellites or unmanned systems. Improvements to existing microbial sensors could enable more rapid development of sensors for new threats; spatial resolution and confidence in sensor results; and help reduce power consumption and maintenance.

Microbial sense-and-respond devices could help detect analytes such as heavy metals, organic pollutants, energetic compounds, chemical warfare agents, and gases, with sensitivities comparable to conventional sensors.

Microbes are able to detect and discriminate between several chemicals of interest, as well as respond to ultraviolet to near-infrared light, electrical potential, low frequency ultrasound, magnetic fields, temperature changes, and RF and microwaves.

Some environmental microbes are effective in corrosive or high-radiation conditions, and can use biologically encoded digital, analog, neural network processing. They also may be able to harvest energy to self-power.

Draper Lab scientists will develop six unique microbial sense-and-respond devices that will function in a range of environments to enable an end user to specify the kind of stimuli to detect; preferred output signal; distinguish between different stimuli; and anticipated environmental conditions.

Draper experts will focus on lowering limits-of-detection without increasing background; employing more sensitive receptors with small dynamic ranges that suffer from saturation at higher concentrations; use in realistic environmental conditions; receiver integration to collect and measure output signals; and determine whether to use single cells vs. several cells or consortia. ←

For more information contact Draper Lab online at www.draper.com, or DARPA at www.darpa.mil/program/tellus.

DATA ENCRYPTION

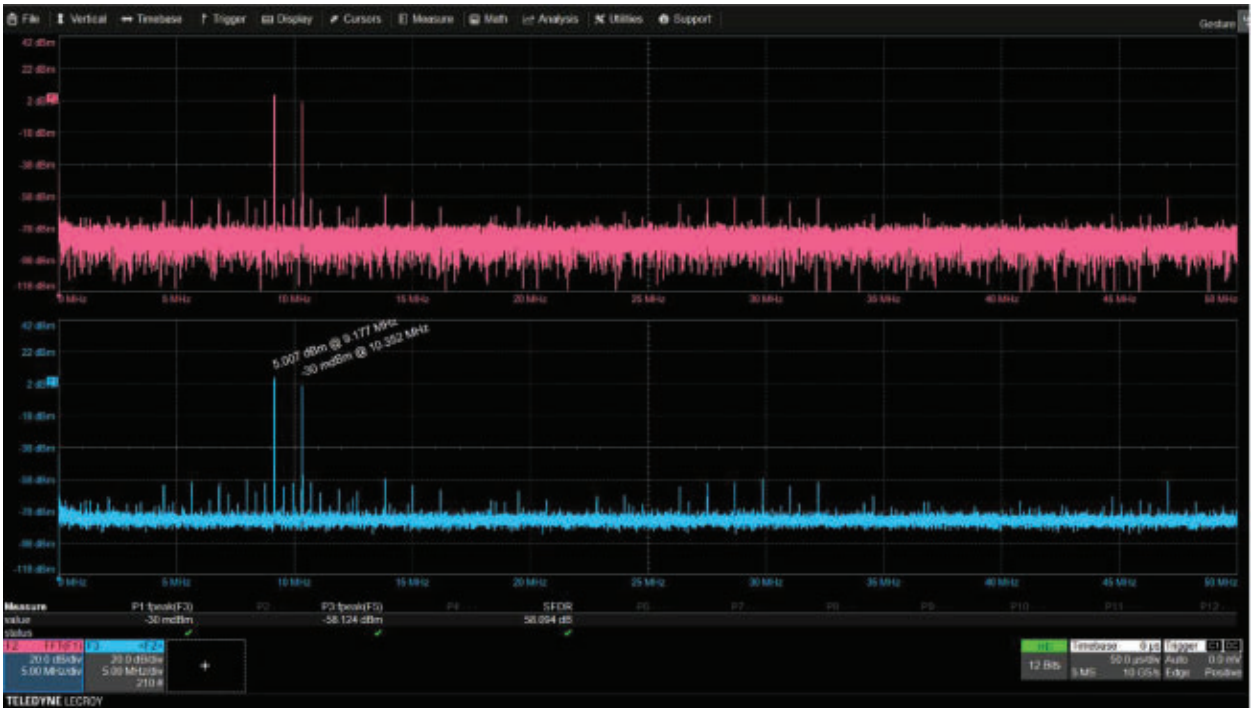
▲ 32-terabyte NVMe secure data storage with full-disk encryption offered by Curtiss-Wright

The Curtiss-Wright Corp. Defense Solutions Division in Ashburn, Va., is introducing the HSR10 deployable secure data storage for military intelligence, surveillance and reconnaissance (ISR) systems that generate large amounts of highly sensitive data. The HSR10 10 gigabit Ethernet high-performance, high-capacity network attached storage (NAS) device features an NVMe in-line hardware full-disk encryptor. The HSR10's NVMe in-line hardware encryptor delivers higher throughput than SATA drives, while providing a path to National Security Agency (NSA) Commercial Solutions for Classified (CSfC) Components List security approval. The HSR10's NVMe hardware encryption technology provides near line-rate data throughput, and comes with as much as 32 terabytes of removable data storage, and is for storing and protecting critical data-at-rest (DAR) on deployed aircraft, ground vehicles, surface ships, and submarines. The HSR10 provides two layers of full-disk encryption(FDE). For system designers that require NSA-approved encryption, the HSR10 will be submitted for National Information Assurance Partnership (NIAP) and Common Criteria Recognition Arrangement (CCRA) certification to achieve CSfC Components List approval. For more information contact Curtiss-Wright Defense Solutions online at www.curtisswrightds.com.

TEST AND MEASUREMENT

▼ Software for NBase-T Ethernet compliance validation introduced by Teledyne LeCroy

Teledyne LeCroy in Chestnut Ridge, N.Y., is introducing the QPHY-NBASE-T software for testing and validating NBase-T Ethernet compliance as defined by the IEEE 802.3bz-2016 specification. This easy-to-use automated software streamlines testing by eliminating the need for a separate spectrum analyzer and reducing measurement complexity. Key features of this test and measurement software are



automated and easy use for IEEE 802.3-2018 NBASE-T compliance testing; physical layer test package with test fixture, couplers and cables; support for PMA transmitter tests; no additional spectrum analyzer needed for linearity tests; and support for adding MDI return loss results into the report. For more information contact Teledyne LeCroy online at www.teledynelecroy.com/testtools.

ARTIFICIAL INTELLIGENCE

▲ SOSA-aligned embedded computing board for artificial intelligence offered by Aitech

Aitech Systems in Chatsworth, Calif., is introducing the SOSA-aligned U-C8500 3U VPX single-board computer has passed environmental qualification testing for high-reliability rugged applications. Aligned with The Open Group Sensor Open Systems Architecture (SOSA) technical standard, Aitech's U-C8500 is based on the Intel Tiger Lake UP3(TGL-UP3) system on chip, which combines a high-performing microprocessor with a strong internal graphics processing unit and an advanced image processing unit. The embedded computing board also incorporates LPDDR4X integrated memory for improved graphics processing performance as well as high-speed PCI Express Gen4 and 10-gigabit-per-second Ethernet. The combination of the U-C8500's high-performing technologies facilitates artificial intelligence (AI) and machine learning in rugged military and aerospace data-sensitive applications. Designed with security in mind, the U-C8500 provides a cyber security framework — AiSecure, which includes standard and advanced system protection. The inherent security features enable firmware and data protection and prevent reverse engineering and tampering, while allowing secure transmission and storage of sensitive data. The U-C8500 is part of Aitech's U-C850X series that combines the three pillars of modern data processing on the same board: microprocessor, iGPU and optional large FPGA. Potential future enhanced variants include the U-C8501 (with PCI Express Switch for enhanced Expansion Plane and XMC connectivity), the U-C8502 (with integrated Xilinx MPSoC FPGA) and the U-C8503 (with integrated TSN Endpoint). For more information contact Aitech online at https://aitechsystems.com.

POWER ELECTRONICS

▶ Power integrated circuits (ICs) for motor control introduced by Infineon

Infineon Technologies AG in Munich is introducing the TLE988x and TLE989x embedded power integrated circuits (ICs) for automotive brushed DC and brushless DC motor control applications in body, comfort, and thermal management applications. The power ICs integrate a gate driver, microcontroller, communication interface, and power supply on one chip for small size, weight, and power consumption (SWaP). The TLE988x and TLE989x families feature CAN (FD) as the communication interface, and are AEC Q-100 qualified. The devices use a B4 or B6 bridge N-channel MOSFET driver, respectively, an Arm Cortex M3 microcontroller, and a CAN (FD) controller and transceiver supporting a communication speed of 2 megabits per second for motor control uses. The power ICs offer 60 MHz system frequency, dual flash solid-state memory data storage, are ISO 26262 (ASIL B) compliant, and come in a 7-by-7-millimeter TQFP package. Some variants have built-in cyber security. The MOTIX MCU TLE988x 2-phase bridge driver family and the MOTIX MCU TLE989x 3-phase bridge driver family include multiple devices with flash volumes as large as 256 kilobytes and support temperature ranges to 175 degrees Celsius. The ICs feature Infineon's Adaptive MOSFET Control algorithm, which compensates for the variation of MOSFET parameters in the system by adjusting the gate current automatically. For more information contact Infineon Technologies online at www.infineon.com. ←

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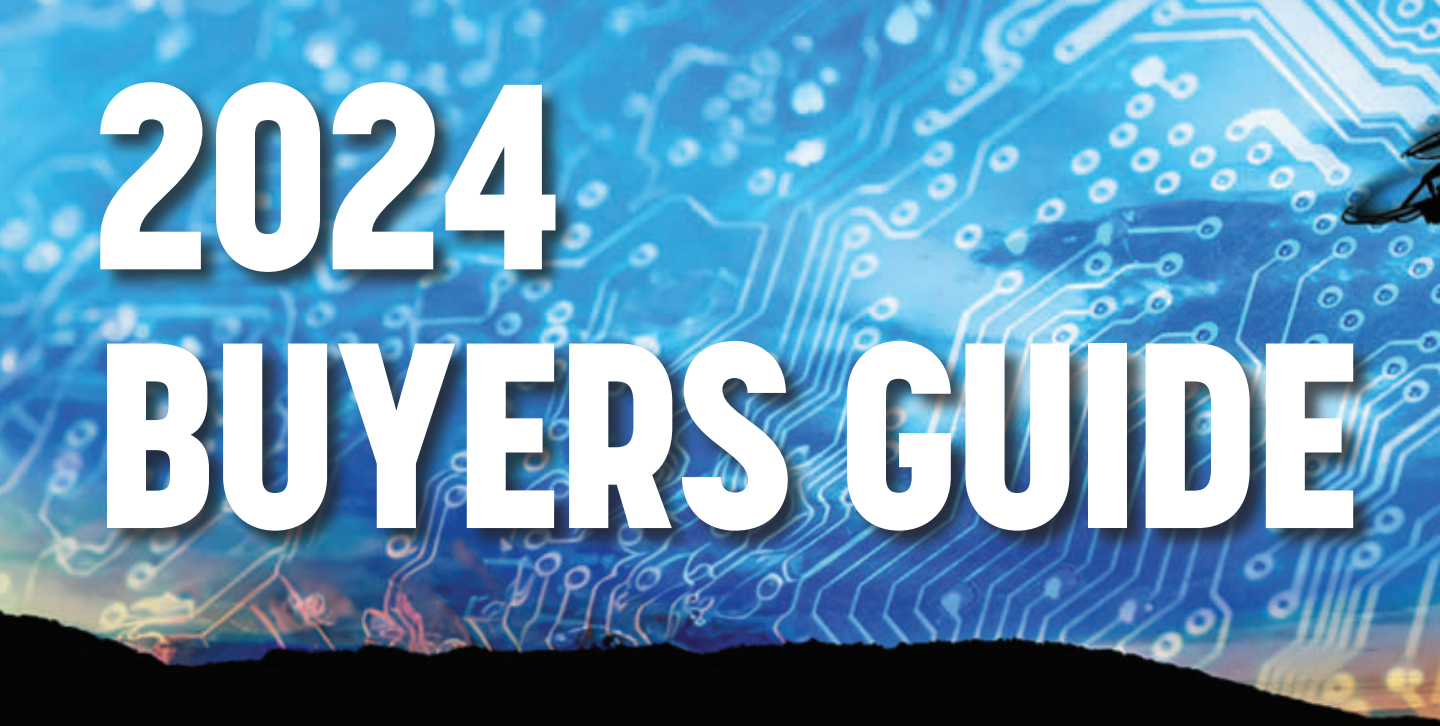

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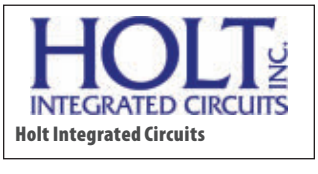

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Ironwood Electronics
Microchip Technology Inc
Rochester Electronics LLC
Spirit Electronics
Trenton Systems Inc
VORAGO Technologies
See ad on page 28

INTEGRATED CIRCUITS, DIGITAL - MIXED-SIGNAL ICS

Global Sourcing OEM Ltd
Holt Integrated Circuits
Microchip Technology Inc
Rochester Electronics LLC
VORAGO Technologies
See ad on page 28

INTEGRATED CIRCUITS, DIGITAL - NETWORK INTERFACE ICS

Device Engineering Inc
Holt Integrated Circuits
Hybrid Electronics
Microchip Technology Inc
New Wave Design
See ad on page 31
North Atlantic Industries Inc

INTEGRATED CIRCUITS, DIGITAL - PERIPHERAL/SUPPORT ICS

Device Engineering Inc

Holt Integrated Circuits

Microchip Technology Inc
VORAGO Technologies
See ad on page 28

INTEGRATED CIRCUITS, DIGITAL - SOLID-STATE MEMORY

Device Engineering Inc
Greenliant
MEMKOR
Microchip Technology Inc

Rochester Electronics LLC
Spirit Electronics
VORAGO Technologies
See ad on page 28

POWER ELECTRONICS - ACTUATORS

AMETEK Haydon Kerk Pittman
ASAP Components
Aerospace Orbit
DLS Electronic Systems Inc
Marotta Controls
Ross Engineering Corp
Velmex Inc

POWER ELECTRONICS - AUXILIARY POWER UNITS (APUS)

Aerospace Orbit
Nova Electric
SynQor Inc
See ad on page 9

POWER ELECTRONICS - BATTERIES

Aerospace Orbit
Nova Electric
SynQor Inc
See ad on page 9

POWER ELECTRONICS - CIRCUIT BREAKERS

Aerospace Orbit
Interstate Connecting Components
Ross Engineering Corp

POWER ELECTRONICS - EMERGENCY POWER UNITS

Allied International
ELDEC
Gaia Converter
See ad on page 35
Marotta Controls
Nova Electric
SynQor Inc
See ad on page 9

POWER ELECTRONICS - GENERATORS

Aerospace Orbit
Highland Technology

POWER ELECTRONICS - INVERTERS/CONVERTERS

Aerospace Orbit
Allied International
Axiomatic Technologies Corp
Crane Aerospace & Electronics
Gaia Converter
See ad on page 35
General Micro Systems Inc
See ad on page 5
Highland Technology
Jasper Electronics
Nova Electric
PICO Electronics Inc
See ad on page 25
Peaco Support Transformer
Spectrum Control

SynQor Inc
See ad on page 9

VPT, Inc.

POWER ELECTRONICS - MOTOR CONTROLLERS

AMETEK Haydon Kerk Pittman
Axiomatic Technologies Corp
Brushless.com
Crane Aerospace & Electronics
Gaia Converter
See ad on page 35
International Rectifier HiRel Products Inc
Marotta Controls
North Atlantic Industries Inc
Ross Engineering Corp
Sensitron Semiconductor
SynQor Inc
See ad on page 9
Velmex Inc

POWER ELECTRONICS - MOTORS

AMETEK Haydon Kerk Pittman
Brushless.com
Velmex Inc

POWER ELECTRONICS - POWER DISTRIBUTION SYSTEMS AND EQUIPMENT

Aerospace Orbit
AirBorn Inc
See ad on back cover
Allied International
Crane Aerospace & Electronics
ELDEC
Gaia Converter
See ad on page 35
International Rectifier HiRel Products Inc
Marotta Controls
Milpower Source
Nova Electric
PICO Electronics Inc
See ad on page 25
Peaco Support Transformer
Ross Engineering Corp
Sensitron Semiconductor
Spectrum Control
Steptransformer.com

SynQor Inc
See ad on page 9

VPT, Inc.

POWER ELECTRONICS - POWER SUPPLIES

ASAP Components
AirBorn Inc
See ad on back cover
Allied International
Analog Modules Inc
Axiomatic Technologies Corp
Beta Dyne
Crane Aerospace & Electronics

Dawn VME Products
See ad on page 27

Dynamic Engineering
ELDEC
Extreme Engineering Solutions (X-ES)
Gaia Converter
See ad on page 35
International Rectifier HiRel Products Inc
Jasper Electronics
Lumispot Tech
Marotta Controls
Milpower Source
North Atlantic Industries Inc
Nova Electric
PICO Electronics Inc
See ad on page 25
Peaco Support Transformer
Rantec
Ross Engineering Corp
Saluki Technology Inc
Sensitron Semiconductor
Spectrum Control
Steptransformer.com

SynQor Inc
See ad on page 9

Technology Dynamics Inc
Tektronix Inc

VPT, Inc.

VersaLogic Corp
Wavelength Electronics Inc

POWER ELECTRONICS - TRANSDUCERS

Aerospace Orbit
Embassy Global
PICO Electronics Inc
See ad on page 25
Palmer Wahl Instruments Inc
Stellar Technology

POWER ELECTRONICS - TRANSIENT VOLTAGE SUPPRESSORS

Axiomatic Technologies Corp
Gaia Converter
See ad on page 35
High Energy Devices LLC
PICO Electronics Inc
See ad on page 25
Ross Engineering Corp
Sensitron Semiconductor
SynQor Inc
See ad on page 9
Technology Dynamics Inc
VPT, Inc.

SENSORS - INERTIAL

Allied International
Embassy Global
First Sensor Inc
Interstate Connecting Components
KVH Industries Inc
Silicon Designs Inc
Silicon Sensing Systems Ltd

SENSORS - INFRARED/ ULTRAVIOLET

Bodkin Design & Engineering LLC
Deposition Sciences Inc (DSI)
Iscan Inc
McObject
MoviTHERM
Opto Diode Corp
Palmer Wahl Instruments Inc
West Coast Tech Ltd
Xenics
Z3 Technology

SENSORS - LADAR/LIDAR

Analog Modules Inc
Avantier Inc
Coherent Logix Inc
Diamond USA Inc
First Sensor Inc
Interstate Connecting Components
LightGage Inc
McObject

RPMC Lasers Inc
Wavelength Electronics Inc
West Coast Tech Ltd

SENSORS - RADAR

Coherent Logix Inc
D-TA Systems Inc
DeTect Inc
Diamond USA Inc
Echodyne
Electromagnetic Technologies Industries Inc
Interstate Connecting Components
McObject
Milpower Source
West Coast Tech Ltd

SENSORS - SONAR

Coherent Logix Inc
Interstate Connecting Components
McObject

SENSORS - TACTILE

American Laser Spares LLC
Diamond USA Inc
McObject
TTI Inc

SENSORS - VISIBLE-LIGHT CAMERAS

Adimec
Bodkin Design & Engineering LLC
Canon Medical Components, USA (CMCU) / Video Sensing Devices (VSD)
Deposition Sciences Inc (DSI)
First Sensor Inc
Iscan Inc
MoviTHERM
Radiant Vision Systems
West Coast Tech Ltd
Z3 Technology

COMPUTERS

AIR DATA COMPUTERS

Cleanroom Connection Inc
Plane Parts 360
Projects Unlimited
Systel Rugged Computers
TJR Global
ZMicro Inc
See ad on page 28

DESKTOP COMPUTERS

NextComputing
TJR Global

EMBEDDED COMPUTERS

ADEK Industrial Computers
Abaco Systems
Acromag Inc
Annapolis Micro Systems Inc
See ad on page 6
Atrenne Computing Solutions
Cincoze Co Ltd
Concurrent Technologies
Dawn VME Products
See ad on page 27
Digital Systems Engineering
EIZO Rugged Solutions

Gaia Converter
See ad on page 35
Gateworks
LCR Embedded Systems
See ad on page 1
MEMKOR
Neousys Technology Inc
NextComputing
North Atlantic Industries Inc
Pixus Technologies
See ad on page 8
Projects Unlimited
Sealevel Systems Inc
Systel Rugged Computers
TJR Global
Trenton Systems Inc
VORAGO Technologies
See ad on page 28
VersaLogic Corp
Viking Technology
Z3 Technology
ZMicro Inc
See ad on page 28

FLIGHT DIRECTORS

Viking Technology

LAPTOPS/NOTEBOOKS/ HANDHELD COMPUTERS

DURABOOK
Darveen
NextComputing
Systel Rugged Computers

MULTICOMPUTER SYSTEMS

Forefronts Defense Systems
Pixus Technologies
See ad on page 8
Projects Unlimited
Systel Rugged Computers
Trenton Systems Inc

RACK-MOUNT COMPUTERS

ADEK Industrial Computers
Ampex Data Systems
Annapolis Micro Systems Inc
See ad on page 6
Atrenne Computing Solutions
Dawn VME Products
See ad on page 27
Extreme Engineering Solutions (X-ES)
LCR Embedded Systems
See ad on page 1
Neousys Technology Inc
NextComputing
Pixus Technologies
See ad on page 8
Sealevel Systems Inc
Systel Rugged Computers
Trenton Systems Inc
ZMicro Inc
See ad on page 28

SERVERS

Ampex Data Systems
Atrenne Computing Solutions
Cleanroom Connection Inc
Extreme Engineering Solutions (X-ES)
Fine Test
Neousys Technology Inc
NextComputing
Systel Rugged Computers
Trenton Systems Inc
ZMicro Inc
See ad on page 28

SPECIALIZED COMPUTERS - TEMPEST

Atrenne Computing Solutions
Forefronts Defense Systems
Projects Unlimited
Systel Rugged Computers

WEARABLE COMPUTERS

Ironwood Electronics
Projects Unlimited
VersaLogic Corp
Z3 Technology

DIAGNOSTICS AND CONTROL

AVIONICS HEALTH MANAGEMENT

Dawn VME Products
See ad on page 27
New Wave Design
See ad on page 31

CLOCKS/TIMERS

ENGINE CONTROLS

Gaia Converter
See ad on page 35
Ironwood Electronics
Projects Unlimited

ENGINE MONITORING

Advanced Inspection Technologies
Crane Aerospace & Electronics
Xenics

FUEL MANAGEMENT SYSTEMS

Crane Aerospace & Electronics
First Sensor Inc
Projects Unlimited

HEALTH AND USAGE MONITORING (HUMS)

Creative Biolabs
Dawn VME Products
See ad on page 27
Scytek Laboratories Inc

OVERHEAT DETECTION

Dawn VME Products
See ad on page 27
MoviTHERM
Palmer Wahl Instruments Inc
Xenics

ELECTRO-OPTICS

BONDING AND ADHESIVES

Bakelite Synthetics
Ellsworth Adhesives
First Sensor Inc

Tech Driven EMS

CAMERAS

Adimec
Advanced Inspection Technologies
Bodkin Design & Engineering LLC
Canon Medical Components, USA (CMCU) / Video Sensing Devices (VSD)
First Sensor Inc
Gaia Converter
See ad on page 35
Guernsey Coating Laboratories Inc
LightGage Inc
MoviTHERM
Photonchina Co Ltd
Sierra Pacific Innovations
West Coast Tech Ltd
Xenics
Z3 Technology

ELECTRO-OPTIC MATERIALS AND SUBSTRATES

Alfa Chemistry
American Laser Spares LLC
Bodkin Design & Engineering LLC
Cleanroom Connection Inc
Embassy Global
Matexcel
PG&O - Precision Glass & Optics
Walthy Precision Co Ltd
West Coast Tech Ltd

EQUIPMENT MANUFACTURING

Bodkin Design & Engineering LLC
Diamond USA Inc
Fine Test
Premier Filters Inc
Snowbird Technologies
SurClean Inc

FORWARD-LOOKING INFRARED SYSTEMS

Bodkin Design & Engineering LLC
Reynard Corp
West Coast Tech Ltd
Z3 Technology

LASER COMPONENTS

American Laser Enterprises LLC
American Laser Spares LLC
Analog Modules Inc

Avo Photonics
Cleanroom Connection Inc
Diamond USA Inc
Lacroix Precision Optics
Lumispot Tech
OFS
See ad on page 13
PICO Electronics Inc
See ad on page 25
Photonchina Co Ltd
RPMC Lasers Inc
Reynard Corp
Wavelength Electronics Inc
West Coast Tech Ltd

LASERS

3 micron Laser Technology
4Lasers
American Laser Enterprises LLC
American Laser Spares LLC
Avo Photonics
Cleanroom Connection Inc
Guernsey Coating Laboratories Inc
LightGage Inc
Lumispot Tech
OFS
See ad on page 13
RPMC Lasers Inc
SurClean Inc
Walthy Precision Co Ltd
West Coast Tech Ltd

LEDS

Cleanroom Connection Inc
Elma Electronic
See ad on page 33
Embassy Global
GS PLASTIC OPTICS
OSI OptoElectronics Inc
See ad on page 18
Opto Diode Corp

LIGHTING

Aerospace Orbit
Avantier Inc
Guernsey Coating Laboratories Inc
Reynard Corp

NIGHT VISION

Firebird Optics
GS PLASTIC OPTICS
Gaia Converter
See ad on page 35
Guernsey Coating Laboratories Inc
MoviTHERM
Reynard Corp
Sierra Pacific Innovations
West Coast Tech Ltd
Xenics

OPTICAL AMPLIFIERS

Advanced Photonix Inc
OFS
See ad on page 13
OSI OptoElectronics Inc
See ad on page 18
Opto Diode Corp
RPMC Lasers Inc
Reynard Corp
West Coast Tech Ltd

OPTICAL COATINGS/ TREATMENTS

Alfa Chemistry

Bakelite Synthetics
Deposition Sciences Inc (DSI)
GS PLASTIC OPTICS
Guernsey Coating Laboratories Inc
Lacroix Precision Optics

OSI OptoElectronics Inc
See ad on page 18
PG&O - Precision Glass & Optics
Reynard Corp
West Coast Tech Ltd

OPTICAL DETECTORS

Advanced Photonix Inc
Analog Modules Inc
Canon Medical Components, USA (CMCU) / Video Sensing Devices (VSD)
First Sensor Inc
GS PLASTIC OPTICS
Guernsey Coating Laboratories Inc
OSI OptoElectronics Inc
See ad on page 18
Opto Diode Corp
Radiant Vision Systems
Reynard Corp
Xenics

OPTICAL FIBER

Advanced Inspection Technologies
Alfa Chemistry
Diamond USA Inc
Guernsey Coating Laboratories Inc
InnovaQuartz LLC
KVH Industries Inc
Lumispot Tech
OFS
See ad on page 13

OPTICAL FILTERS

Avantier Inc
Deposition Sciences Inc (DSI)
EXFO
Embassy Global
Guernsey Coating Laboratories Inc
Lacroix Precision Optics
PG&O - Precision Glass & Optics
Reynard Corp
West Coast Tech Ltd

OPTICAL IMAGING

Bodkin Design & Engineering LLC
CAD/CAM Services Inc
Canon Medical Components, USA (CMCU) / Video Sensing Devices (VSD)
GS PLASTIC OPTICS
Guernsey Coating Laboratories Inc
Iscan Inc
Lacroix Precision Optics
LightGage Inc
Radiant Vision Systems
Reynard Corp
Walthy Precision Co Ltd
West Coast Tech Ltd
Xenics

OPTICAL SWITCHES

Applied Avionics
Embassy Global
Lfiber Optic Ltd
OSI OptoElectronics Inc
See ad on page 18
Pickering Interfaces
See ad on page 11

OPTICAL TRANSCEIVERS

Interstate Connecting Components

OPTICS

Alfa Chemistry
American Laser Spares LLC

Avo Photonics
Cleanroom Connection Inc
Deposition Sciences Inc (DSI)
Diamond USA Inc
Embassy Global
Firebird Optics
GS PLASTIC OPTICS
Guernsey Coating Laboratories Inc
InnovaQuartz LLC
Lacroix Precision Optics
Lfiber Optic Ltd
MS Spectral Defense Industry Inc
PG&O - Precision Glass & Optics
Photonchina Co Ltd
Radiant Vision Systems
Reynard Corp
Walthy Precision Co Ltd

THERMAL IMAGING

Avantier Inc
Bodkin Design & Engineering LLC
Firebird Optics
Guernsey Coating Laboratories Inc
MoviTHERM
Reynard Corp
Sierra Pacific Innovations
Wavelength Electronics Inc
Xenics
Z3 Technology

ULTRAVIOLET LIGHT SOURCES

Opto Diode Corp
RPMC Lasers Inc
Reynard Corp

NAVIGATION

AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST (ADS-B) EQUIPMENT

Applied Avionics

GPS SYSTEMS

Applied Avionics

Concurrent Technologies

Ironwood Electronics
KVH Industries Inc

TERRAIN

Applied Avionics
KVH Industries Inc
Silicon Sensing Systems Ltd

PLATFORM SYSTEMS/ SUBSYSTEMS

AVIONICS

Abaco Systems
Annapolis Micro Systems Inc
See ad on page 6
Atrenne Computing Solutions
Crane Aerospace & Electronics
DLS Electronic Systems Inc
Dayton T Brown Inc
Diamond USA Inc
Digital Systems Engineering
Dynamic Engineering
EIZO Rugged Solutions
ELDEC
Extreme Engineering Solutions (X-ES)
Holt Integrated Circuits
Ironwood Electronics
Marotta Controls
Merrimac
New Wave Design
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North Atlantic Industries Inc
PNA Technologies LLC
PartMiner Industries
Pixus Technologies
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Plane Parts 360
Sensitron Semiconductor
SynQor Inc
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CABIN MANAGEMENT SYSTEMS

Crane Aerospace & Electronics
DLS Electronic Systems Inc
SynQor Inc
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COUNTERMEASURES

Annapolis Micro Systems Inc
See ad on page 6

Concurrent Technologies

Electromagnetic Technologies Industries Inc
Kratos Microwave USA (Formerly CTT, Inc.)
SynQor Inc
See ad on page 9

ELECTRONIC FLIGHT INSTRUMENT SYSTEMS (EFIS)

Gaia Converter
See ad on page 35
Pixus Technologies
See ad on page 8
SynQor Inc
See ad on page 9

LANDING SYSTEMS

Crane Aerospace & Electronics
Marotta Controls
PartMiner Industries
SynQor Inc
See ad on page 9
Z3 Technology

LIGHT MANAGEMENT SYSTEMS

Avantier Inc
MoviTHERM
Radiant Vision Systems
SynQor Inc
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LIGHTING

Avantier Inc
DLS Electronic Systems Inc
SynQor Inc
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NAVIGATION EQUIPMENT

Atrenne Computing Solutions
Dawn VME Products
See ad on page 27
Diamond USA Inc
KVH Industries Inc
Kratos Microwave USA (Formerly CTT, Inc.)
Milpower Source
Silicon Sensing Systems Ltd
SynQor Inc
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Z3 Technology

SATELLITE SYSTEMS

Acroamatics Telemetry Systems
Annapolis Micro Systems Inc
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Concurrent Technologies
Crane Aerospace & Electronics
Diamond USA Inc
Marotta Controls
SynQor Inc
See ad on page 9
Viking Technology

SECURITY SYSTEMS

Concurrent Technologies
MoviTHERM
RGB Spectrum
See ad on page 45
SynQor Inc
See ad on page 9
Z3 Technology

SHIPBOARD/MARITIME ELECTRONICS

Ampex Data Systems
Annapolis Micro Systems Inc
See ad on page 6
Atrenne Computing Solutions
Axiomatic Technologies Corp
Concurrent Technologies
Dawn VME Products
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Dayton T Brown Inc
Diamond USA Inc
Dynamic Engineering
EIZO Rugged Solutions
ELDEC
Extreme Engineering Solutions (X-ES)
Marotta Controls
Merrimac
Milpower Source
New Wave Design
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North Atlantic Industries Inc
PICO Electronics Inc
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PNA Technologies LLC
Pixus Technologies
See ad on page 8
Smiths Interconnect
See ad on inside front cover
SynQor Inc
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VersaLogic Corp
Z3 Technology

TRAINING AND SIMULATION

Ampex Data Systems
D-TA Systems Inc
Delta Digital Video
GDP Space Systems
InVeris Training Solutions
New Wave Design
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North Atlantic Industries Inc
Pixus Technologies
See ad on page 8
RGB Spectrum
See ad on page 45
Solid State Disks Ltd
SynQor Inc
See ad on page 9
dSPACE Inc

UNMANNED VEHICLES

Ampex Data Systems
Annapolis Micro Systems Inc
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Atrenne Computing Solutions
D-TA Systems Inc
Dawn VME Products
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Delta Digital Video
EIZO Rugged Solutions
ELDEC
Elma Electronic
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Extreme Engineering Solutions (X-ES)
Holt Integrated Circuits
KVH Industries Inc
Kratos Microwave USA (Formerly CTT, Inc.)
Marotta Controls
New Wave Design
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PNA Technologies LLC
Pixus Technologies
See ad on page 8
RGB Spectrum
See ad on page 45
Sensitron Semiconductor
Solid State Disks Ltd
SynQor Inc
See ad on page 9
Viking Technology
Z3 Technology

VETRONICS

Applied Avionics
Atrenne Computing Solutions
Dawn VME Products
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Digital Systems Engineering
EIZO Rugged Solutions
Elma Electronic
See ad on page 33
Holt Integrated Circuits
Sensitron Semiconductor
SynQor Inc
See ad on page 9

WEATHER SYSTEMS

Columbia Weather Systems Inc
Pixus Technologies
See ad on page 8
SynQor Inc
See ad on page 9

WEIGHT AND BALANCE SYSTEMS

SynQor Inc
See ad on page 9

RF AND MICROWAVE

AMPLIFIERS

AMETEK PDS
Advanced Circuitry International
Analog Devices

Analog Modules Inc
Apex Microtechnology
See ad on page 19
Cleanroom Connection Inc
Empower RF Systems
Fairview Microwave Inc
See ad on page 3
Hybrid Electronics
Interstate Connecting Components
Kratos Microwave USA (Formerly CTT, Inc.)
Merrimac
NuWaves Engineering
Pasternack
See ad on page 17
Pickering Interfaces
See ad on page 11
Pro-Comm Inc
Saluki Technology Inc
Spectrum Control
Teledyne e2v HiRel

ANTENNAS

ASAP Aerospace Hub
Advanced Circuitry International
Aerospace Orbit
Analog Devices
Cleanroom Connection Inc
Deposition Sciences Inc (DSI)
Electromagnetic Technologies Industries Inc
Fairview Microwave Inc
See ad on page 3
Pasternack
See ad on page 17
Radio Design Group Inc
Spectrum Control
Tech Driven EMS

BONDING AND ADHESIVES

Analog Devices
Bakelite Synthetics
Ellsworth Adhesives

Master Bond
See ad on page 37

DIPLEXERS/MULTIPLEXERS

Analog Devices
Electromagnetic Technologies Industries Inc
Fairview Microwave Inc
See ad on page 3
NuWaves Engineering
Pasternack
See ad on page 17
Pickering Interfaces
See ad on page 11
Spectrum Control

DISCRETE COMPONENTS

ASAP Aerospace Hub
Analog Devices
Fairview Microwave Inc
See ad on page 3
Infineon Technologies AG
International Rectifier HiRel Products Inc
KRYTAR
Pasternack
See ad on page 17
Wavelength Electronics Inc

FILTERS

ASAP Aerospace Hub
Advanced Circuitry International
Analog Devices
Anatech Electronics Inc
Coilcraft Inc
Electromagnetic Technologies Industries Inc
Fairview Microwave Inc
See ad on page 3
Hybrid Electronics
K&L Microwave
Merrimac
NuWaves Engineering
Pasternack
See ad on page 17
Radio Design Group Inc

SynQor Inc
See ad on page 9

TopFlite Components

FREQUENCY SYNTHESIZERS

Analog Devices
Anritsu
Fairview Microwave Inc
See ad on page 3
Merrimac
NuWaves Engineering
Pasternack
See ad on page 17

HYBRIDS

Analog Devices
Cleanroom Connection Inc
Electromagnetic Technologies Industries Inc
Fairview Microwave Inc
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KRYTAR
Merrimac
Pasternack
See ad on page 17

MICROWAVE SUBASSEMBLIES

Advanced Circuitry International
Analog Devices
Diamond USA Inc
Empower RF Systems
Fairview Microwave Inc
See ad on page 3
Flexiguide Ltd
KRYTAR
Kratos Microwave USA (Formerly CTT, Inc.)
Merrimac
Northeast Precious Metals
NuWaves Engineering
Pickering Interfaces
See ad on page 11
Pro-Comm Inc
Trexon

MIXED-SIGNAL DEVICES

Advanced Circuitry International
Analog Devices
Anritsu
Fairview Microwave Inc
See ad on page 3
Merrimac

MMICS

Advanced Circuitry International
Analog Devices
Fairview Microwave Inc
See ad on page 3

OSCILLATORS/SYNTHESIZERS

ASAP Aerospace Hub
Advanced Circuitry International
Analog Devices
Device Engineering Inc
Electromagnetic Technologies Industries Inc
Fairview Microwave Inc
See ad on page 3
Merrimac
NuWaves Engineering
Pasternack
See ad on page 17
Pro-Comm Inc
Tektronix Inc

RF ATTENUATORS

Analog Devices
Anritsu
Fairview Microwave Inc
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Merrimac
Pasternack
See ad on page 17
Pickering Interfaces
See ad on page 11
SV Microwave
Smiths Interconnect
See ad on inside front cover
Teledyne e2v HiRel

RF PACKAGING

Advanced Circuitry International
Analog Devices
Fairview Microwave Inc
See ad on page 3
Pasternack
See ad on page 17
Pixus Technologies
See ad on page 8
Ross Engineering Corp
Smiths Interconnect
See ad on inside front cover
Tektronix Inc
Trexon

RF SWITCHES

Advanced Circuitry International
Analog Devices
Fairview Microwave Inc
See ad on page 3
Hybrid Electronics
Interstate Connecting Components
Merrimac
NuWaves Engineering
Pasternack
See ad on page 17
Pickering Interfaces
See ad on page 11
Teledyne e2v HiRel

SIGNAL GENERATORS

ASAP Aerospace Hub
Analog Devices
Anritsu
D-TA Systems Inc
Fairview Microwave Inc
See ad on page 3
Pasternack
See ad on page 17
Pickering Interfaces
See ad on page 11
Pro-Comm Inc
Saluki Technology Inc

TRANSMIT/RECEIVE MODULES

ASAP Aerospace Hub
Acroamatics Telemetry Systems
Advanced Circuitry International
Analog Devices
D-TA Systems Inc
Device Engineering Inc
Discovery Semiconductors Inc
Empower RF Systems
Fairview Microwave Inc
See ad on page 3
GDP Space Systems
Kratos Microwave USA (Formerly CTT, Inc.)
Merrimac
NuWaves Engineering
Pasternack
See ad on page 17
Sciens Innovations

UP/DOWN CONVERTERS

Advanced Circuitry International
Analog Devices
Fairview Microwave Inc
See ad on page 3

Ironwood Electronics
Kratos Microwave USA (Formerly CTT, Inc.)
Merrimac
NuWaves Engineering
PICO Electronics Inc
See ad on page 25
Pasternack
See ad on page 17
Saluki Technology Inc
Tektronix Inc

SAFETY EQUIPMENT AND COMPONENTS

ALARM SYSTEMS

AIRE Environmental
Aerospace Orbit
MoviTHERM
Plane Parts 360

ALTITUDE ALERTS

Applied Avionics
Dayton T Brown Inc

ANTI-ICING EQUIPMENT

Dayton T Brown Inc
Plane Parts 360
SprayWorks Equipment Group

ANTI-STATIC EQUIPMENT

Dayton T Brown Inc

EMI/RFI

Dayton T Brown Inc
EMC PARTNER AG
Fairview Microwave Inc
See ad on page 3
Gaia Converter
See ad on page 35
SynQor Inc
See ad on page 9

FIRE DETECTION

AnD Cable Products Inc
MoviTHERM
Stat-X Fire Suppression

STALL WARNING

Applied Avionics

TERRAIN AWARENESS WARNING SYSTEMS (TAWS)

Applied Avionics

WINDSHEAR WARNING SYSTEMS

Applied Avionics

SERVICES

ASSEMBLY/SUBCONTRACT SERVICES

ADCO Circuits
ANZER
Advanced Circuitry International
Aerospace Maintenance Solutions LLC
AnD Cable Products Inc
Atrenne Computing Solutions
Avantier Inc
Avo Photonics
Axiom Electronics
See ad on page 7
CAD/CAM Services Inc
Concurrent Technologies
Connectronics Inc
GS PLASTIC OPTICS
InnovaQuartz LLC
Kratos Microwave USA (Formerly CTT, Inc.)
Lacroix Precision Optics

Master Bond
See ad on page 37

Nelson Design Services Inc
Northeast Precious Metals
Nova Electric
NuWaves Engineering
PartMiner Industries
Photonchina Co Ltd
Pro-Comm Inc
Projects Unlimited
Titan Circuits

CALIBRATION SERVICES

Anritsu
CAD/CAM Services Inc
EMC PARTNER AG
Eastern Applied Research Inc
Mahr Inc
Mensor
Radiant Vision Systems
Ross Engineering Corp
Tektronix Inc

CONSULTANTS

AEi Systems
Advanced Inspection Technologies
American Laser Enterprises LLC
AnD Cable Products Inc
Annapolis Micro Systems Inc
See ad on page 6
Avadium Design
Avantier Inc
Bodkin Design & Engineering LLC
CAD/CAM Services Inc
DLS Electronic Systems Inc
Dayton T Brown Inc
DeTect Inc
Embassy Global
Forefronts Defense Systems
InnovaQuartz LLC
Lacroix Precision Optics
McObject
Nelson Design Services Inc
Northeast Precious Metals
NuWaves Engineering
Philpott Ball & Werner
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Sciens Innovations
VORAGO Technologies
See ad on page 28
wolfSSL

DESIGN ENGINEERING

AEi Systems
ANZER
Advanced Cooling Technologies Inc (ACT)
Advanced Micro Peripherals
American Laser Enterprises LLC
Annapolis Micro Systems Inc
See ad on page 6
Avadium Design
Avantier Inc
Avo Photonics
CAD/CAM Services Inc
DLS Electronic Systems Inc
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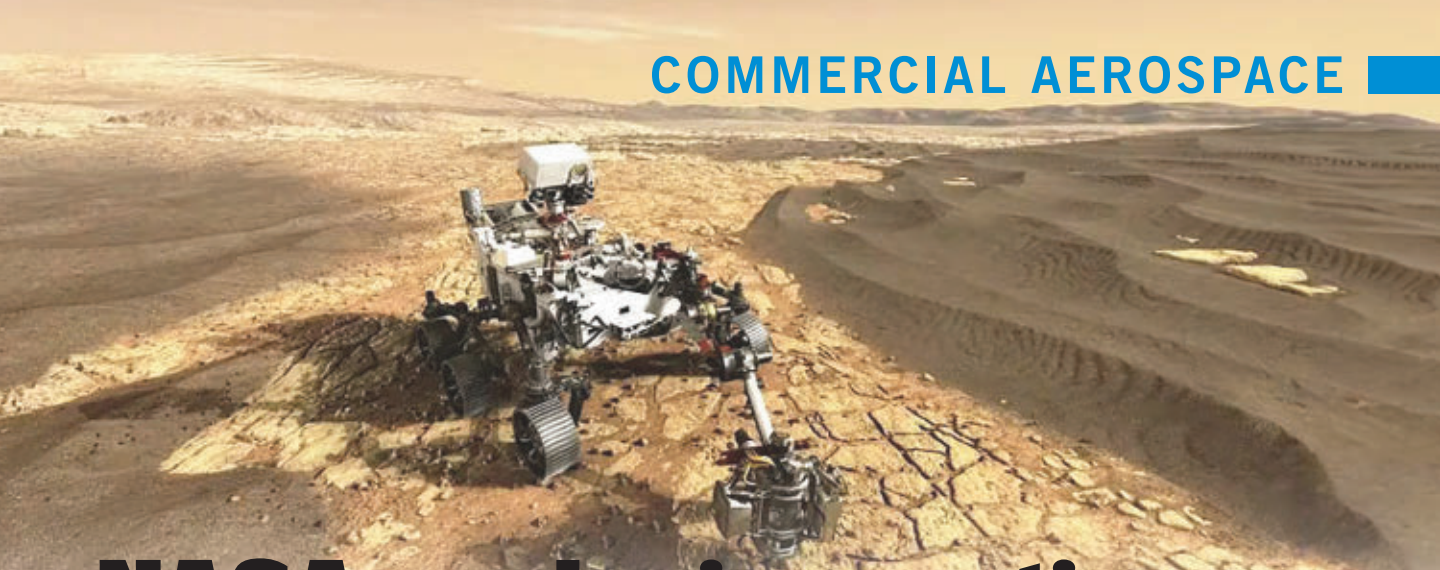


NASA seeks innovative designs for Mars sample retrieval

BY **Jamie Whitney**

WASHINGTON - The head of the U.S. National Aeronautics and Space Administration (NASA), Bill Nelson, recently laid out the agency's path forward on the Mars Sample Return program, including seeking innovative designs to return valuable samples from Mars to Earth.

Mars Sample Return has been a long-term goal of international planetary exploration for the past two decades. NASA's Perseverance rover has been collecting samples for later collection and return to Earth since it landed on Mars in 2021.

"Mars Sample Return will be one of the most complex missions NASA has ever undertaken. The bottom line is, an $11 billion budget is too expensive, and a 2040 return date is too far away," Nelson says.

"Safely landing and collecting the samples, launching a rocket with the samples off another planet – which has never been done before – and safely transporting the samples more than 33 million miles back to Earth is no small task," Nelson continues. "We need to look outside the box to find a way ahead that is both affordable and returns samples in a reasonable timeframe."

The agency also has released NASA's response to a Mars Sample Return Independent Review Board report from September 2023. This includes an updated mission design with reduced complexity; improved resiliency; risk posture; stronger accountability and coordination; and an overall budget likely in the $8 billion to $11 billion range. Given the Fiscal Year 2025 budget and anticipated budget constraints, as well as the need to maintain a balanced science portfolio, the current mission design will return samples in 2040.

▲ **Mars Sample Return has been a long-term goal of international planetary exploration for the past two decades.**

To achieve the goal of returning the key samples to Earth earlier and at a lower cost, the agency is asking the NASA community to work together to develop a revised plan that leverages innovation and proven technology. Additionally, NASA soon will solicit architecture proposals from industry that could return samples in the 2030s, and lowers cost, risk, and mission complexity.

"NASA does visionary science – and returning diverse, scientifically-relevant samples from Mars is a key priority," says Nicky Fox, associate administrator of the NASA Science Mission Directorate in Washington.

"To organize a mission at this level of complexity, we employ decades of lessons on how to run a large mission, including incorporating the input we get from conducting independent reviews," Fox says. "Our next steps will position us to bring this transformational mission forward and deliver revolutionary science from Mars -- providing critical new insights into the origins and evolution of Mars, our solar system, and life on Earth."

NASA seeks industry insight on developing open-systems cloud-based tech for IMPACT program

BY **Jamie Whitney**

HUNTSVILLE, Ala. - The U.S. National Aeronautics and Space Administration (NASA) Marshall Space Flight Center in Huntsville, Ala., is asking industry for an open-systems cloud-based program to enable scientists outside NASA to use the agency's data.

NASA's Inter-agency Implementation and Advanced Concepts Team (IMPACT) is a collaborative, team that works to further NASA's Earth Science Data System (ESDS) program goal of overseeing the life cycle of Earth science data to maximize the scientific return of NASA's missions and experiments. IMPACT's three focus areas are inter-agency collaboration, assessment and evaluation, and research and development of advanced concepts.

IMPACT requires continued development including new dashboard instances of NASA's Visualization, Exploration, and Data Analysis (VEDA) Platform. The VEDA platform provides sustained support to NASA HQ's ESDS Program to advance interactive visualization, exploratory visual data analysis, geographic information system (GIS), and within the cloud computing and high-performance computing environments.

A contract for VEDA development support has been issued, outlining key tasks to be undertaken in collaboration with NASA. The contractor is tasked with providing support across various facets. Firstly, concerning the Data System hosted in the NASA cloud, the contractor is expected to incorporate

▲ IMPACT requires continued development including new dashboard instances of NASA's Visualization, Exploration, and Data Analysis (VEDA) Platform.

a wide array of data types, such as raster, vector, and tabular data, into the system. This includes integrating heterogeneous datasets from diverse sources like satellites and ground measurements while ensuring compatibility with different sensors and resolutions. Additionally, the contractor will develop and implement a data governance framework to manage these integrated datasets effectively.

Secondly, the contractor will develop a uniform data ingestion pipeline for the platform and system within the NASA cloud to streamline data transformation and integration processes. This will be complemented by the implementation of a lightweight metadata catalog to organize and manage metadata efficiently. Furthermore, the contractor will provide application programming interfaces (APIs) for data discovery, access, and visualization, along with a mapping interface for geospatial data visualization and interaction. The establishment of a pipeline to ingest, publish, and display derived insights in a user-friendly manner is also part of the mandate, along with the development of GIS-compatible data services and plugins.

Regarding usability, the system must be designed to cater to different users in both exploratory and explanatory

modes. This includes offering appropriate data visualizations based on data type and narratives, customizable widgets for user personalization, as well as overview information for quick data understanding, with detailed information available on demand.

In a more general sense, a modular design approach is required to allow for the replacement or upgrading of system components as technologies evolve. The platform and system must be performing well and capable of supporting interactivity with large-scale data. Additionally, support for existing projects such as the Earth Information System and the NASA-ESA-JAXA trilateral dashboard is mandated, along with the development of tools to collect and report metrics.

Furthermore, alignment with open science principles is essential. This entails developing the system and its ecosystem as open and reusable software, engaging the community in the development process to encourage buy-in from a diverse pool of developers and users, and aligning design choices, including APIs and data formats, with existing and evolving community standards and best practices.

Finally, the contractor must provide support for analytic platform-based cross-organization collaboration requirements by developing thematic area-specific components and onboarding science teams to thematic-specific environments.

There is no formal solicitation for this project at this time. Interested firms having the required capabilities necessary to meet the are invited to submit a capability statement of no more than ten pages indicating the ability to perform all aspects of the effort. All responses were be submitted by April electronically via email to Iris R. Walter at iris.r.walter@nasa.gov.

Boeing announces its ecoDemonstrator to test 36 new technologies

The Boeing Company in Arlington, Va. is testing 36 new technologies aboard its 777-200ER ecoDemonstrator concerning airport operations, aircraft noise, waste-reducing materials, and weight reduction. Airport operations involves testing to enable single-engine taxi and digital taxi clearances to reduce fuel use and enhance safety by reducing pilot workload. Airport noise involves quantifying the benefits of flight operation procedures, like steeper glide slope and continuous descent approach, to reduce community noise, fuel use and emissions. Waste-reducing materials concerns lightweight, recyclable, and durable floor coverings and recycled carbon fiber ceiling panels made with 25 percent bio-based resin. Noise and weight reduction concerns cabin insulation to reduce noise and regulate humidity and temperature, and fabric-covered acoustic panels for the bulkhead and galley. Future cabin concepts concern economy- and business-class seats with sensors that detect if someone is seated during taxi, takeoff, and landing to improve safety and reduce crew workload. Other technologies involve a touchless water-conservation lavatory; and galley technologies to make cabin service more efficient and reduce food waste.

Iridium signs five-year contract with L3 Harris to provide satellite time and location service for FAA

Iridium Communications Inc. in McLean, Va., won a five-year contract with L3Harris Technologies in Melbourne, Fla., for the Iridium Satellite Time and Location (STL) service. Iridium will provide the STL service to more than three dozen L3Harris-operated communications network backbone nodes and a similar number of Federal Aviation Administration (FAA) facilities throughout the United States. L3Harris owns and operates a private nationwide network for the FAA, providing voice, data, and video communications for the National Airspace System operations and mission support functions. Timing synchronization is essential within the L3Harris communications network as since it supports several critical infrastructure applications. The Iridium STL service is a vital component of the overall network timing architecture that removes dependencies on GPS as a primary timing source. Compact devices provided by Adtran's Oscilloquartz division that receive Iridium STL signals are also included in the solution for L3Harris. This high-performance equipment is easily integrated into the network and helps fulfill network timing synchronization requirements nationwide. Today's communications networks and the applications that run over them have exceptional real-time requirements and are extremely sensitive to delays. For example, keeping database replications perfectly harmonized in a distributed architecture necessitates timing synchronization among servers within a data center as well as between data centers, even those that are thousands of miles apart.

magniX completes first phase of NASA electrified powertrain flight demonstration

Electric aviation company magniX in Everett, Wash. completed the first phase of testing at the NASA Electric Aircraft Testbed (NEAT) facility in Sandusky, Ohio. Testing focused on 800-volt operations and *Continued on page D4*

NASA releases Space Sustainability Strategy

BY **Jamie Whitney**

WASHINGTON - The U.S. National Aeronautics and Space Administration (NASA) has released the first part of its integrated Space Sustainability Strategy which aims to address a rapidly changing space operating environment and ensure its preservation for generations to come.

NASA is taking steps to ensure responsible and sustainable practices in the cosmos. Various divisions within the agency have developed tools and technologies widely adopted by global operators. Now, NASA aims to streamline these efforts with a comprehensive strategy, consolidating resources to address critical challenges.

As part of this strategy, NASA will appoint a new director of space sustainability to oversee coordination across the agency. The initiative emphasizes global leadership in space sustainability, promoting equitable access to space and ensuring that NASA's missions contribute positively to sustainability goals.

The evolving landscape of space includes a surge in commercial capabilities, many of which have been nurtured by NASA. However, this growth has brought about challenges such as increased congestion and debris in Earth's orbit. Understanding these risks and benefits is crucial for long-term sustainability.

Developed with input from a cross-agency advisory board, NASA's space sustainability strategy focuses on measuring and assessing sustainability, identifying cost-effective solutions, promoting sustainable practices, and facilitating information exchange within the global space community.

Continued from page D3

thermal performance. The results confirmed the magni650 electric engine's capabilities at altitudes as high as to 27,500 feet. The testing is part of NASA's Electrified Powertrain Flight Demonstration (EPFD) program. The National Aeronautics and Space Administration (NASA) awarded magniX a $74.3 million contract in 2021 as a partner for the EPFD, which is aimed at accelerating the Entry into Service of electric aviation. Under the program, magniX will retrofit an Air Tindi De Havilland Dash 7 with a magniX electric powertrain. The Preliminary Design Review (PDR) to establish the baseline design for the flight demonstration and retrofit of the Dash 7 was completed in February 2024. The next phase of testing at the NEAT facility will begin in June and focus on expanding the operating envelope for altitude, power, and temperature.

Joby progresses to testing with production prototypes of its eVTOL

Joby Aviation, Inc., a Santa Cruz, Calif.-based developer of electric vertical takeoff and landing commercial passenger aircraft, announced it has completed its pre-production prototype flight test program. The company is now moving to the next phase of flight testing with its production prototype aircraft to prepare for upcoming for-credit flight testing. Joby began flying full-scale pre-production prototype aircraft over four years ago. The two pre-production aircraft completed more than 1,500 flights, covering a total distance of over 33,000 miles, including over 100 flights with a pilot onboard. In November 2023, the second pre-production aircraft conducted the first electric air taxi exhibition flights in New York City, flying from the Manhattan Downtown Heliport over the Hudson River. Completion of the test program has allowed Joby to move forward with production. The second production prototype recently rolled off the line at their facility in Marina, California. Insights from the flight test program have been critical to Joby's certification efforts and to developing regulatory frameworks for electric VTOL aircraft.

American Aerospace's drones granted first FAA waiver for BVLOS commercial operation

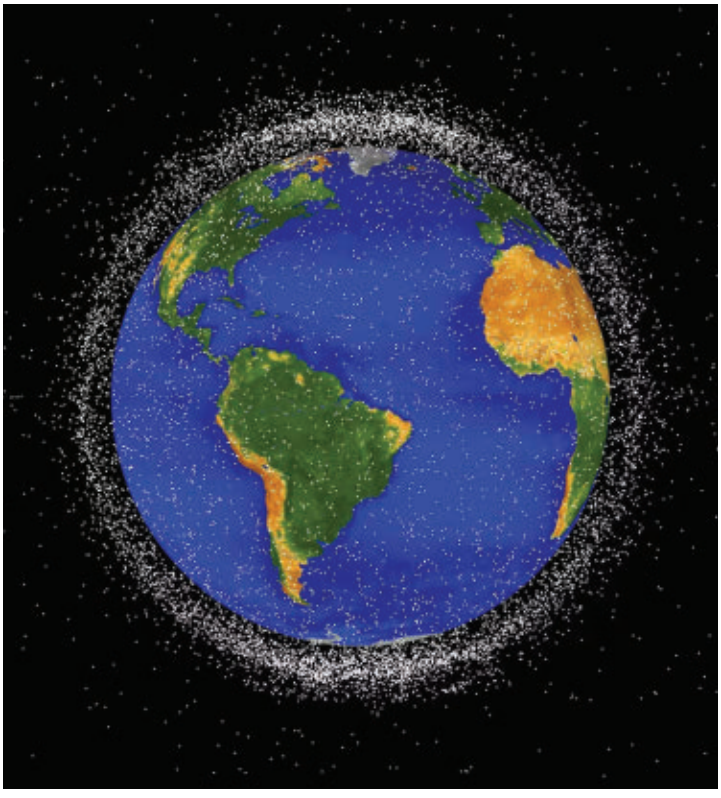
Iridium Communications Inc. in McLean, Va. announced a development in uncrewed aerial systems (UAS) operations beyond visual line of sight (BVLOS). American Aerospace Technologies, Inc., an Iridium partner in

NASA aims to streamline these efforts with a comprehensive strategy, consolidating resources to address critical challenges.

The strategy identifies four operational domains: Earth, Earth orbit, cislunar space (the area around the Moon), and deep space. Initial efforts will concentrate on sustainability in Earth orbit, with plans for subsequent volumes to address other domains.

"The release of this strategy marks true progress for NASA on space sustainability," said NASA Deputy Administrator Pam Melroy. "Space is busy – and only getting busier. If we want to make sure that critical parts of space are preserved so that our children and grandchildren can continue to use them for the benefit of humanity, the time to act is now. NASA is making sure that we're aligning our resources to support sustainable activity for us and for all."

Learn more about the NASA's Space Sustainability Strategy at https://www.nasa.gov/spacesustainability.



Conshohocken, Pa. received a waiver from the Federal Aviation Administration (FAA) to conduct UAS surveillance of critical infrastructure in California's San Joaquin Valley for multinational oil and gas company Chevron. Enabled by Iridium's global L-Band satellite connectivity, AATI's AiRanger drone will perform remote aerial surveillance of the energy company's pipeline and production facilities. Iridium's network provides BVLOS connectivity, including remote Command and Control (C2) and Detect and Avoid (DAA) capabilities. The drones, weighing over 200 pounds, will send information via Iridium satellites to conduct routine inspections. Blue Sky Network, another Iridium partner, customized and integrated its SkyLink 7100 voice, data, and BVLOS terminal on the drones. The SkyLink 7100 enables continuous tracking and C2 capabilities for aviation and UAV operations. The AiRanger is the first UAS to comply with industry standards for the DAA system and meet FAA BVLOS operation requirements. This achievement could pave the way for broader use of BVLOS UAS, enhancing situational awareness, reducing inspection costs, and maximizing value. The waiver illustrates that Iridium's satellite C2 capabilities can meet FAA BVLOS requirements.

Airbus announces new Pléiades Neo Next program to expand its Earth observation constellation

Airbus in Toulouse, France has launched the Pléiades Neo Next program to expand the number of its satellites, capabilities, and native resolution. As a first step of Pléiades Neo Next, Airbus is developing a new satellite for launch in the next few years. The Pléiades Neo Next program is funded, manufactured, and operated by Airbus Defence and Space, with the full image capacity available for a wide range of sectors including defense and intelligence, agriculture, environment, maritime, disaster response, mapping, location-based services, civil engineering, urban planning, and utilities. Users will continue to be able to directly task the Airbus satellites up to a few dozen minutes prior to the satellite over the area of interest. Images will be received through the customer's Direct Receiving Stations (DRS) on the ground, or on the OneAtlas digital platform, swiftly after collection, allowing mission-critical applications. In addition to enhanced native resolution, Pléiades Neo Next development will further improve the ground segment, the DRS, and the OneAtlas platform, resulting in a higher capacity of imagery requests and optimizing the time between request, capture, and reception.

Guidance released for FAA remote identification policy for uncrewed aircraft

BY **Jamie Whitney**

ARLINGTON, Va. - The Commercial Drone Alliance (CDA) has released guidance on how the commercial drone industry can comply with the Federal Aviation Administration's (FAA) unmanned aircraft remote identification (RID) rule.

RID is a digital license plate for drones and enables a drone in flight to broadcast identification and location information that can be received by other parties in the vicinity of where the drone is operating.

Requirements for RID are outlined in Part 89 of the Federal Aviation Regulations and provides the FAA, law enforcement, and other federal agencies with a means to distinguish authorized drone operations from unauthorized drone operations that may present a safety or security threat.

The newly released document answers questions about the RID Rule and shares important information for operators and manufacturers.

The RID rule is now in effect and manufacturers and operators should expect to see increased FAA enforcement of the rule's requirements. The Commercial Drone Alliance is an independent non-profit organization led by key members of the commercial drone industry. The Association for Uncrewed Vehicle Systems International (AUVSI), the non-profit organization dedicated to the advancement of uncrewed systems and robotics.

▲ The RID rule is now in effect and manufacturers and operators should expect to see increased FAA enforcement of the rule's requirements.

"Addressing safety and security is necessary in order to achieve scaled commercial drone operations," says Lisa Ellman, executive director of the CDA. "Ultimately, industry RID rule compliance will enable communities across the United States to fully realize the safety, security, sustainability, public health, and equity benefits of drone technology."

The UAS Remote Identification FAQ document is online at https://pr.report/6Hdlxuj5.