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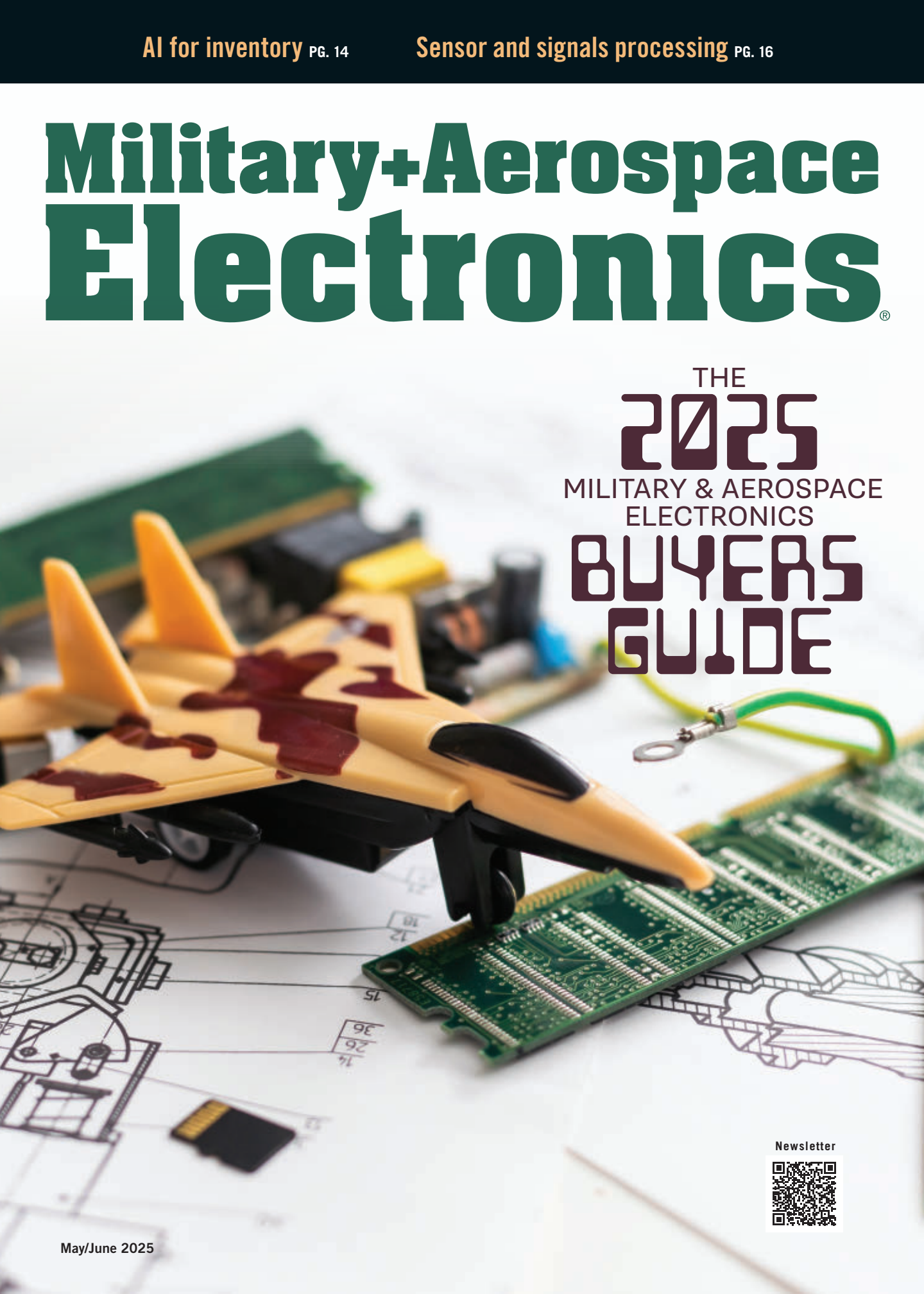

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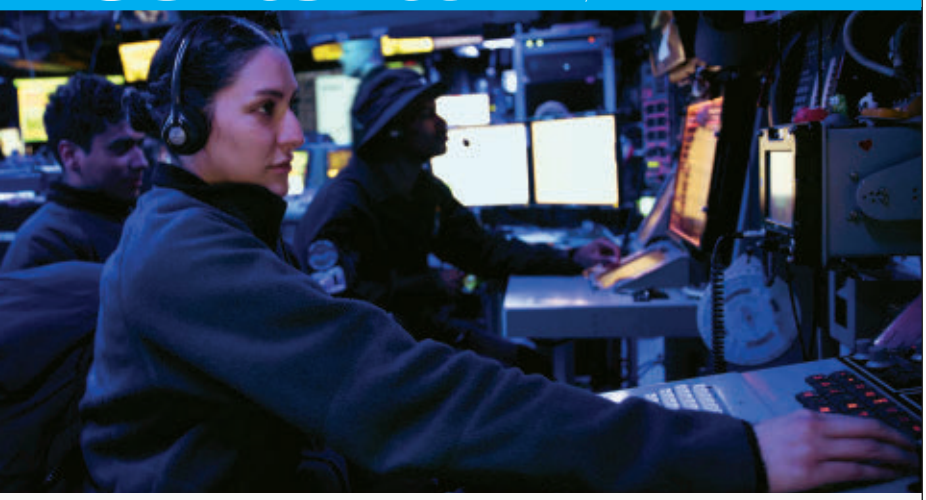

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Military investigates revolutionary approaches to generating electricity at the edge

BY **John Keller**
EDITOR IN CHIEF

U.S. military researchers are zeroing-in on new ways to generate electricity from unconventional sources for aerospace and defense applications, in an all-hands effort to enhance the efficiency of military power generation and consumption.

Over the past couple of months, the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., sent out solicitations to industry to generate electricity from microelectronics waste heat, as well as to generate electricity directly from nuclear radiation.

These projects, if successful, could help computers provide electric power to help run themselves, and also could be one of the first steps in revolutionizing nuclear power generation by enhancing safety and efficiency.

On 30 April 2025 DARPA issued a request for information (DARPA-SN-25-70) for the Embedding Electricity Generation from Heat in Microsystems project, which seeks to capture waste heat from microelectronics at the chip, substrate, and package levels, and convert it into electricity.

The agency also wants industry suggestions on how to use electricity converted from dissipated heat in chips and microsystems. This project is closely related to program announced earlier in April, called Microsystem Electricity Generation (DARPA-SN-25-69), which seeks to develop technologies for microsystem packages that can capture waste heat and reclaim it as useful electricity.

The waste heat from commercial and defense microelectronics today is transported through pathways to a heat sink and rejected into the atmosphere. Instead, these projects seek to gather and transport electronics waste heat from its sources to an embedded reclamation device that provides electricity for later use.

In another revolutionary approach to power generation, DARPA in late May announced an upcoming project to convert nuclear radiation directly to electricity for long-term unattended power in military applications.

The future Rads To Watts project will explore approaches for converting energy from nuclear radiation directly into electricity, without taking the interim step of converting radiation to heat. Today's nuclear power plants use radiation to heat water into steam, which turns turbines that generate electricity.

Rads To Watts, on the other hand, will focus on radiation voltaics — also called radiovoltaics — which converts the energy from ionizing radiation directly into electricity using semiconductor materials.

Rads to Watts seeks to convert high-power nuclear radiation into kilowatts of electricity for long-term high-power generation in military applications that must operate in harsh and remote areas.

So how might these projects influence the long-term future of power generation? That's an open question now, but the results could be profound. The world is in an energy crunch today, with the rise of power-hungry hyperscale data centers, electric cars and aircraft, and related applications; it's clear we'll need a lot more power in the near future.

Hyperscale data centers consume massive amounts of electricity, and generate huge amounts of heat. Imagine if they could help power themselves by converting their waste heat to electricity?

Also, imagine a clean, safe source of nuclear power that first could provide electricity to remote military bases and battlefields, but eventually might be able to scale-up to make big contributions to the power grid. In a world desperate for more electric power, these projects might be heading in the right direction.

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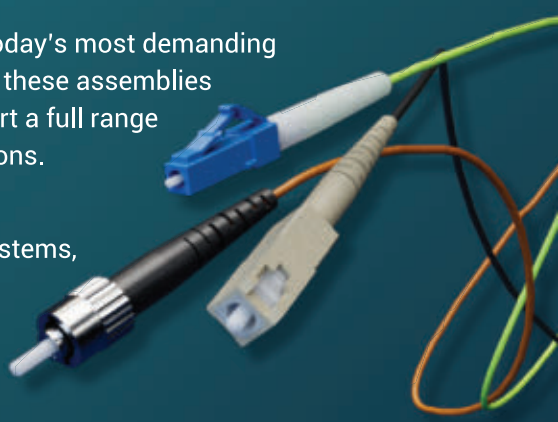

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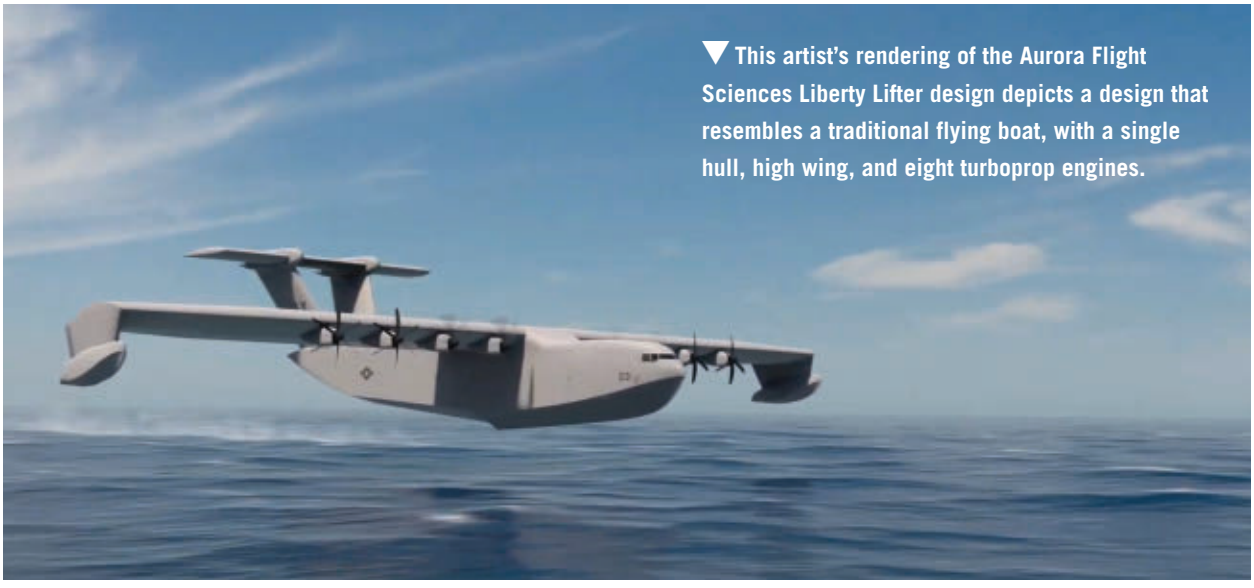

▼ This artist's rendering of the Aurora Flight Sciences Liberty Lifter design depicts a design that resembles a traditional flying boat, with a single hull, high wing, and eight turboprop engines.

Aurora Flight Sciences photo

Aurora to build large seaplane with complex controls and ability to fly combat vehicles

BY **John Keller**

ARLINGTON, Va. – Aircraft designers at Aurora Flight Sciences Corp. in Manassas, Va., are moving forward with a U.S. military research project to design a futuristic seaplane able to operate in rough seas for weeks at a time, and carry payloads as heavy as 45 tons for distances between 4,000 and 6,500 miles.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., announced a $25 million order to Aurora in March to extend the company's current Liberty Lifter work to phase 1C.

Liberty Lifter will be a heavy-lift, long-range seaplane that operates efficiently at very low altitudes in ground effect. Aurora and General Atomics Aeronautical Systems Inc. in Poway, Calif., had been working on Liberty Lifter, but General Atomics was eliminated from the program last May.

Liberty Lifter aims to demonstrate a leap-ahead in operational capability by designing, building, floating, and flying a long-range, low-cost X-Plane capable of seaborne strategic and tactical heavy lift. The program is in phase 1C in which Aurora will progress the technical maturity of the aircraft configuration, structure, and systems.

The phase 1C work also will start procurement of long-lead components and accelerate manufacturing development to ease the company's transition into the program's second phase. The program is scheduling a preliminary design review for next fall, and first flight is scheduled for 2029.

For the Liberty Lifter project, the Aurora is focusing on designing a seaplane with extended maritime operations in high sea states that is affordable to produce, and involves complex controls for flight and for operating on the ocean's surface.

Aurora is working with Gibbs & Cox, a Leidos company in Arlington, Va., and ReconCraft in Clackamas, Ore., to develop designs for the Liberty Lifter Seaplane Wing-in-Ground Effect full-scale demonstrator. The team is working

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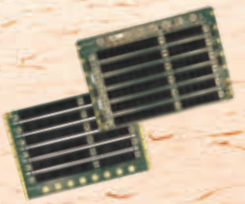

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on a design that resembles a traditional flying boat, with a single hull, high wing, and eight turboprop engines.

The Liberty Lifter long-range seaplane will provide smooth operations in ground effect and in waves that are four to eight feet high. Ground effect describes the added aerodynamic buoyancy produced by a cushion of air below an aircraft moving closely to the ground or surface of the water.

The program aims at smooth flight with high lift at low speeds to reduce wave impact loads during takeoff and landing. The seaplane is expected to accommodate wave impact loads and be able to operate in high-traffic areas, and operate at sea for weeks at a time with long periods between land-based maintenance.

DARPA researchers are emphasizing low cost, easy-to-fabricate designs, with Liberty Ship-style manufacturing. The seaplane also should have complex aero and hydrodynamic interactions during takeoff and landing, with advanced sensors and controls to avoid rogue wave impacts.

The Liberty Lifter seaplane should be able to fly at altitudes from ground effect to 10,000 feet, and operate for four to six weeks at a time.

On-water amphibious payload deployment and retrieval should be via nose and tail ramps; the seaplane should be able to carry at least two U.S. Marine Corps Amphibious Combat Vehicles, and cargo in 20-foot container units.

Aurora will use high-performance computing and multi-disciplinary analysis and optimization tools to model and analyze complex aerodynamic and hydrodynamic interactions; focus on affordable design and manufacturing approaches; use novel manufacturing approaches; and use industry best practices from commercial high-speed vessels.

The program consists of a three-phase developmental cycle with each phase building on the previous phase. On this order Aurora Flight Sciences will do the work in Manassas and Arlington, Va.; Auburn Hills, Mich.; Fairhope, Ala.; Wilmington, Del.; and Indianapolis, and should be finished by October 2025.

For more information contact Aurora Flight Sciences online at www.aurora.aero, General Atomics Aeronautical Systems at www.ga-asi.com, or DARPA at www.darpa.mil/program/liberty-lifter.

Rune Aero uses AI-powered virtual wind tunnel to cut aircraft design costs

Aircraft developer Rune Aero in Atlanta sought to reduce early design costs as it developed its uncrewed aircraft by utilizing an artificial intelligence (AI)-powered virtual wind tunnel and digital twin technology. They found their solution from Luminary Cloud in San Mateo, Calif. The company, founded in 2023, is developing an autonomous cargo aircraft for the middle-mile air freight market. By leveraging interactive computational fluid dynamics (CFD) simulations from Luminary Cloud and NVIDIA's Omniverse Blueprint digital twin technology, Rune Aero engineers can assess aerodynamic effects in real time, shortening the design process. Digital twins–virtual replicas of physical systems–allow engineers to simulate and analyze aircraft performance under real-world conditions without physical testing. Rune Aero's system integrates Luminary Cloud's GPU-accelerated CFD solvers, NVIDIA CUDA-X libraries, and AI-driven PhysicsNeMo models to create high-fidelity aerodynamic simulations. These digital environments provide immediate feedback on design modifications, reducing reliance on costly wind tunnel tests. By shifting wind tunnel testing to an *continued on page 12*

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Researchers want smart bandage with embedded sensors for battlefield wound infection control

Bandage will monitor wounds for infection and employ closed-loop control when infection is predicted, or to treat an existing infection.

BY **John Keller**

ARLINGTON, Va. – U.S. military researchers are asking industry to develop a smart bandage able to predict, prevent, and treat wound infections and be deployed at all levels of military medical care — including on the battlefield.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., have issued a program solicitation (DARPA-PS-25-12) for the BioElectronics to Sense and Treat (BEST) project.

This bandage should perform wound monitoring for infection and employ closed-loop control to intervene when infection is predicted or to resolve an existing infection. Ultimately, the project seeks to develop a prototype smart bandage, with an eye to advanced development and production.

Wound infections are prevalent among combat injuries., and can take otherwise able-bodied military personnel out of operations and risk complications and death. Current practice relies on identifying infection-inducing microbial pathogens using complicated genetic assays or multi-day cell culture approaches — neither of which can be done quickly or simply on the battlefield.

Initial wound treatment typically involves trained medical personnel and high-dose antibiotics and surgical debridement, with the risk of toxic side effects. DARPA researchers are looking for a better way.

BEST seeks to improve wound infection management technologies by developing wearable, automated, bioelectronic systems that can predict and prevent a wound infection before it can occur, or eliminate an infection that has already taken hold.

The program seeks to develop smart bandages with wound infection sensor and treatment modules. The sensors will be high-resolution and provide real-time, continual wound monitoring for infection.

The treatment module will use biological and electronic approaches to eliminate infection, with an option to deliver antibiotics on the battlefield.

This smart bandage should be able to adapt to variations in the wound microbes; variations in the host's injury and infection response; continually update the status of a wound to determine treatment; use treatments to which microbes cannot develop resistance; and does not interfere with a wound predicted to heal on its own.

The goal is to combine sensor and treatment elements into a low size, weight, and power (SWaP) closed-loop device that can provide rapid predictions and precise treatments at all roles of military medical care, including the battlefield.

Technologies developed in the BEST program ultimately could be submitted to the U.S. Food and Drug Administration (FDA) for commercialization.

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The BEST program has two parts: a two-year phase for sensor and treatment development; and a one-year phase to integrate the sensor and treatment technologies into a combined, closed-loop, smart bandage.

Companies were asked to submit abstracts in March, and full proposals no later than 6 May 2025, to the DARPA BAA Tool online at https://baa.darpa.mil. Email questions or concerns to Leonard Tender, the BEST program manager, at BEST@darpa.mil. More information is online at https://sam.gov/opp/e2f29ccf8e0347449b-275667f4c465e5/view.

continued from page 8

early-stage virtual environment, Rune Aero aims to lower technical risks, optimize aerodynamics, and reduce operating costs for cargo operators by 70%.

Physical Sciences to generate power from carbon dioxide for battlefield battery charging

U.S. military researchers needed a way to generate fuel from local sources of carbon dioxide to provide electric power and battery charging on the battlefield. They found a solution from Physical Sciences Inc. in Andover, Mass. Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., announced a $2.1 million contract to Physical Sciences for the Expeditionary Carbon Utilization for Energy Resilience and Stabilization (ExCURSion) project. Batteries and fossil fuels dominate today's technologies for portable energy storage and use by expeditionary forces, DARPA researchers explain. Although hydrocarbon-based fossil fuels have much higher energy density, they still require regular, costly, and dangerous resupply. Instead, DARPA researchers are asking Physical Sciences to find ways to generate fuel from local sources of carbon dioxide to combine the high energy density of fossil fuels with the energy-source-agnostic advantage of electric systems to revolutionize expeditionary energy logistics. More companies could receive contracts. For more information contact Physical Sciences online at www.psicorp.com, or DARPA at www.darpa.mil/research/programs/expeditionary-carbon-utilization-for-energy-resilience-and-stabilization.

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Defense Logistics Agency considers AI for financial reporting and inventory management

BY **John Keller**

PHILADELPHIA – The U.S. Defense Logistics Agency (DLA) is reaching out to industry for artificial intelligence (AI) approaches to enhance the efficiency and accuracy of its financial reporting and audit processes.

Officials of the DLA Contracting Services Office (DCSO) in Philadelphia issued a solicitation for the Artificial Intelligence (AI) For Financial Reporting And Audit Processes project.

These AI solutions will be for the DLA's annual financial statement and control-based audits, which today are long and expensive, often requiring manual review and analysis of large volumes of data. DLA is trying to streamline these processes to improve audit quality and reduce the workload on its personnel.

DLA manages the end-to-end global defense supply chain — from raw material to end user disposition — for the five military services, 11 combatant commands, other federal, state and local agencies, and U.S. allies.

With the increasing complexity of financial reporting requirements and the massive amount of data to be managed, DLA is looking to incorporate AI into its financial reporting, enhance decision-making, and identify cost-savings.

From industry, DLA officials want to develop a prototype that resolves potential pain points, addresses operational capabilities, or presents a new approach.

Pain points are time-consuming and resource-intensive; involve manual review and analysis of large volumes of data; have the potential for human error. Proposed solutions are at Impact Level 4 (IL 4), which describes storing non-public, unclassified data, including controlled unclassified information (CUI), and requires compliance with FedRAMP High baseline and additional DoD-specific controls.

Proposed AI solutions should help identify unresolved accounting issues; modernize policies on procurements, shipments, and inventory management; perform physical counts; accumulate cost of inventory; update financial systems; design internal controls for access, configuration Management, segregation of duties, security management, and information technology interfaces.

Proposals also should consider managing and reporting the Joint Strike Fighter program; support the accuracy of environmental liabilities; monitor, report, and ensure that military components have complete and accurate beginning balances; correct problems from unsupported journal vouchers; eliminate excessive manual preparation; and aggregate all DLA inventory data into one system.

An Army soldier checks inventories refrigerated storage units, and supervises supply trucks.

U.S. Army photo

Companies interested were asked to email solutions briefs by April to Thomas Walsh Thomas.Walsh@dla.mil and Lauren Runowski lauren.runowski@dla.mil. Those with promising solutions will be invited to give presentations or submit full proposals.

Email questions or concerns to Thomas Walsh Thomas.Walsh@dla.mil and Lauren Runowski lauren.runowski@dla.mil. More information is online at https://sam.gov/opp/bcd40f5f-210d4951abda6c36ba218296/view.

Electro-optical sensors and signal processing merge for new capabilities

High-energy lasers, infrared sensors, artificial intelligence, and machine learning converge in the latest challenges to high-performance digital signal processing.

BY Jamie Whitney

The modern battlefield is a sensing environment — dense with signals, signatures, and data. Electro-optical sensors, once isolated tools for targeting and surveillance, have become part of tightly integrated systems that support rapid decision-making at the tactical edge. Their evolution and advanced digital signal processing (DSP), embedded computing, and radio frequency (RF) technologies enable warfighters to perceive, understand, and act faster than ever.

From mounted systems on fifth-generation jet fighters and autonomous drones, to wearable electro-optical devices in the hands of infantry, sensors are shrinking in size while growing in capability. Speed is paramount: today's sensors not only must detect, but also process and interpret information in real time — often autonomously or semi-autonomously — amid increasing demands for resilience in denied or contested environments.

The convergence of electro-optical, RF, and embedded systems create systems that see more, process more, and support operations across air, land, sea, space, and cyber space. At the center of this transformation is a new generation of enabling technologies, ranging from

◀ A U.S. Navy Cryptologic Technician monitors shipboard sensors aboard the amphibious assault ship USS Makin Island (LHD 8). Cryptologic technicians conduct electronic warfare by operating and maintaining electronic sensors and computer systems in accordance with fleet and national tasking. U.S. Navy photo

high-energy lasers to artificial intelligence (AI)-focused processors.

Directed energy integration

Across the services, high-energy lasers are being fielded for applications ranging from short-range air defense and counter-UAS (CUAS) to precision target designation and active sensing. And as solid-state and fiber laser technologies improve, the size, weight, and power (SWaP) barriers that once limited deployment are quickly eroding.

In the directed energy domain, industry leaders integrate lasers with infrared sensors and advanced beam control systems to enable real-time target engagement with minimal collateral damage. For example, the U.S. Army's Directed Energy Maneuver-Short Range Air Defense (DE M-SHORAD) program has already demonstrated a 50-kilowatt class laser system aboard a Stryker vehicle capable of engaging drones and incoming projectiles with precision and repeatability.

In March 2023, the Army conducted a live fire demonstration of the DE M-SHORAD prototypes at Yuma Proving Ground, Ariz. Soldiers from the 4-60th Air Defense Artillery Regiment (ADAR) worked with the DE M-SHORAD team to showcase the laser system's potential.

▲ **An unmanned surface vehicle is craned aboard the Independence-variant littoral combat ship USS Canberra (LCS 30) during the first embarkation of the mine countermeasures (MCM) mission package. The MCM mission package is an integrated suite of unmanned maritime systems and sensors which locates, identifies, and destroys mines in the littorals while increasing the ship's standoff distance from the threat area. U.S. Navy photo**

"The delivery of DE M-SHORAD prototypes to the 4-60th ADAR represents a transformational milestone in the Army's modernization campaign. It is an achievement that adds what was often thought of as a next generation capability, now," said Col. Steven D. Gutierrez from the DE M-SHORAD project management office. "These high energy laser systems will be a game-changer on the contemporary battlefield, a critical component of an integrated, layered, and in-depth air missile defense for division and brigade maneuver formations."

On the maritime side, the U.S. Navy's Layered Laser Defense (LLD) prototype integrates electro-optical sensors with high-energy lasers for use on surface ships, offering both ISR and kinetic strike capabilities in a single system. These systems leverage real-time sensor fusion to identify and prioritize threats, directing laser energy with pinpoint accuracy and without relying on kinetic ammunition.

"Innovative laser systems like the LLD have the potential to redefine the future of naval combat operations," said then-Chief of Naval Research Rear Adm. Lorin C. Selby in 2022. "They present transformational capabilities to the fleet, address diverse threats, and provide precision engagements with a deep magazine to complement existing defensive systems and enhance sustained lethality in high-intensity conflict."

Computer challenges

Integrating laser systems into operational environments isn't just about optics and power levels; it's also a computing challenge. Beam control, thermal management, and adaptive optics all depend on high-speed embedded processing systems capable of handling enormous data volumes in real time.

To meet these demands, developers are turning to ruggedized graphics processing units (GPUs), field-programmable gate arrays (FPGA), and hybrid processor architectures that can survive harsh battlefield conditions while maintaining low-latency performance.

Another growing trend is using lower-power lasers in sensing roles, particularly in lidar-based systems for

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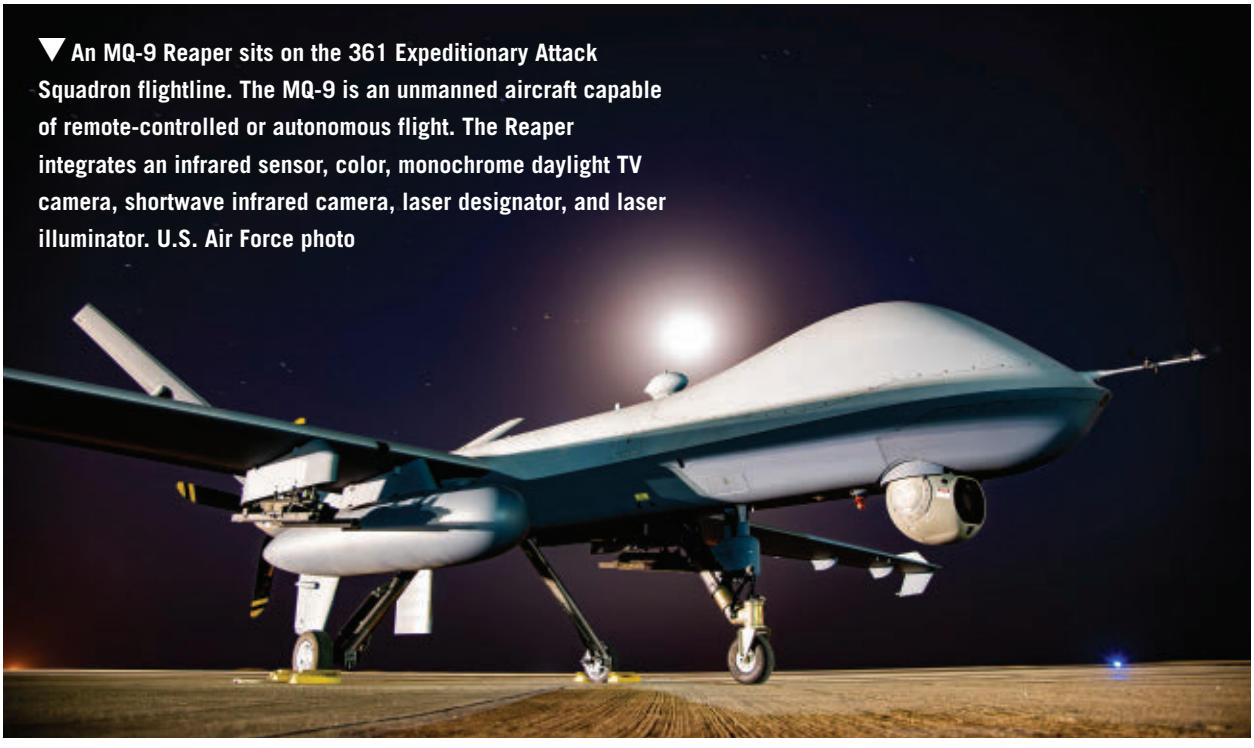


▼ An MQ-9 Reaper sits on the 361 Expeditionary Attack Squadron flightline. The MQ-9 is an unmanned aircraft capable of remote-controlled or autonomous flight. The Reaper integrates an infrared sensor, color, monochrome daylight TV camera, shortwave infrared camera, laser designator, and laser illuminator. U.S. Air Force photo

mapping, target acquisition, and object recognition. These sensors are increasingly embedded in autonomous vehicles and loitering munitions, where precise depth perception and real-time scene analysis are critical to mission success.

Directed energy is becoming an essential component of layered defense architectures in both lethal and non-lethal roles. As laser technology matures, the integration of electro-optical sensors with high-speed signal processing and adaptive beamforming is pushing directed energy from the lab to the front lines — changing not just how the military sees the battlefield but also how it shapes it.

Sensor fusion and DSP

In a contested battlespace, no single sensor can provide the complete picture. That's why sensor fusion — integrating data from multiple modalities like infrared, radar, lidar, and RF — has become a cornerstone of modern military systems. At the heart of this fusion is DSP, which enables the real-time analysis, correlation, and interpretation of vast streams of sensor data into actionable intelligence.

"New sensor fusion initiatives include cross-domain data fusion to integrate radar, IR, electro-optical, sonar, and SIGINT data for a comprehensive

▶ The U.S. Army Combat Capabilities Development Command Aviation & Missile Center and Ground Vehicle Systems Center's combined Autonomous Multi-domain Launcher (AML) team conducted a successful live fire of a Reduced Range Practice Rocket fired from the AML at Yuma Proving Ground in 2024. AML is an initiative to develop and demonstrate an autonomous, unmanned, highly mobile, C-130 transportable launcher. U.S. Army Photo.

battlefield picture," says Rodger Hosking, director of sales at Mercury Systems in Andover, Mass. "Distributed sensing networks help swarm UAVs and smart sensor grids share real-time data for collaborative targeting. Automated anomaly detection exploits AI-assisted correlation of sensor feeds to detect hidden threats, like stealth aircraft and cyber intrusions.

He continues, "Sensor fusion imposes many technical and operational challenges. Sensors operate at different frequencies, resolutions, and bandwidths, often delivering diverse data formats, sampling rates, and coordinate systems because of the many different protocols across different military platforms and coalition forces.

"Real-time fusion of large-scale, high-dimensional sensor data requires high-performance computing. AI/ML models for fusion demand extensive training datasets and may be computationally expensive. Edge computing aboard UAVs/satellites is limited by power and processing constraints.

"Multiple sensors may provide contradictory data, and false alarms from one sensor can bias the entire fusion system. Accurate object association is difficult when tracking multiple entities across sensors with different fields of view. Sensor spoofing, such as GPS jamming or radar deception, can inject false data, and hacked or compromised sensors could provide misleading fusion results. Securing distributed sensor networks from cyber and electronic warfare attacks is critical," Hosking says.

As Hosking notes, today's signal processors must do more than just simple filtering or amplification. They're performing multi-domain data fusion, applying complex algorithms for object detection, classification, and tracking — all under extreme SWaP constraints. In airborne ISR platforms, for instance, fused electro-optical and synthetic aperture radar (SAR) feeds must be processed simultaneously to deliver high-confidence target information, even in poor visibility or electronically contested environments.

Emerging systems are going beyond traditional rule-based DSP and incorporating machine learning (ML) models that can adapt to evolving threat signatures. For example, deep learning

algorithms trained on electro-optical and IR imagery can now distinguish between similar-looking targets, reducing false positives and enabling faster target prioritization. This is particularly critical in applications like C-UAS or missile warning, where seconds matter and operator overload is a constant concern.

DSP also plays a key role in spectral analysis and electronic warfare (EW). Military platforms are increasingly required to detect and characterize signals across wide RF bandwidths. Modern processors can sift through an enormous amount of RF and microwave signal data in real time, often autonomously identifying hostile emitters and enabling electronic attack or countermeasure deployment.

On the hardware side, advances in chip technology are bringing more processing power to the edge. Multi-core processors, high-throughput FPGAs, and system-on-chip (SoC) architectures are being ruggedized for deployment on small UAVs, handheld devices, and front-line vehicles. These platforms often use open standards like OpenVPX and Sensor Open Systems Architecture (SOSA) to streamline integration and maximize program reuse.

Sensor fusion isn't just about connecting more sensors — it's about reducing the time from detection to decision. Engineers are now building systems where sensors feed directly into onboard DSP engines, which can trigger automated responses or flag human operators only when necessary. In an era of electronic clutter and peer adversaries with advanced jamming capabilities, this ability to rapidly filter signal from noise is essential.

Ultimately, it's the processing — not just the sensing — that determines a system's effectiveness. The integration of advanced DSP into multi-sensor architectures is allowing the military to detect threats sooner, react faster, and operate more confidently in an increasingly complex electromagnetic environment.

RF and microwave systems

While electro-optical sensors provide visual and thermal intelligence, RF and microwave systems offer range, speed, and penetration, making them essential in environments where visibility is limited or stealth is crucial. The integration of RF and electro-optical sensors enables defense systems to function across the entire electromagnetic spectrum, providing both redundancy and a more comprehensive operational picture.

▲ Soldiers of the 4th Battalion, 60th Air Defense Artillery Regiment are positioned alongside four Directed Energy Maneuver-Short Range Air Defense (DE M-SHORAD) prototype systems in 2023. (4th Battalion, 60th Air Defense Artillery Regiment. U.S. Army Photo.

Military platforms today are increasingly deploying wideband RF and microwave transceivers capable of operating across multiple frequency bands simultaneously. These systems support everything from radar and electronic warfare to communications and signals intelligence (SIGINT). When paired with electro-optical sensors and fast signal processing, they enable warfighters to correlate visual cues with RF signatures in real time — enhancing target identification and reducing the risk of fratricide.

Microwave and millimeter-wave technologies are also integrated into next-generation fire control and ISR systems. High-frequency radar sensors are now compact enough to be mounted on small UAVs or man-portable devices, offering all-weather target detection and high-resolution mapping. The real challenge lies in managing the high data

throughput these systems generate, necessitating fast, ruggedized processors that can operate at the tactical edge.

Open-systems standards are playing a key role in this integration. Architectures like CMOSS (C5ISR/EW Modular Open Suite of Standards) and SOSA help defense contractors align RF, electro-optical, and digital processing systems on a common hardware and software backbone. This not only speeds development and deployment but also improves system interoperability across platforms and services.

Additionally, the convergence of RF and electro-optical sensing drives innovation in electronic attack. Systems that once relied on pre-programmed jamming now dynamically adjust waveforms and beam patterns based on real-time sensor data. By using fused electro-optical and RF inputs, modern EW suites can detect threats, identify them by type, and tailor jamming or deception responses with surgical precision.

As adversaries invest heavily in anti-access/area-denial (A2/AD) systems and electromagnetic countermeasures, the U.S. and its allies are responding with sensors and systems that can operate across modalities and adapt on the fly. RF and microwave systems — especially when integrated with electro-optical sensors and advanced signal processing — are key to that response.

Embedded computing at the edge

Modern electro-optical and RF sensor suites generate torrents of data that must be processed in real time to be tactically useful. That's driven a shift toward robust, edge-deployed computing architectures — placing GPUs, FPGAs, and AI accelerators directly on platforms from UAVs to armored vehicles and soldier-worn systems. By moving processing as close as possible to the sensor, engineers reduce latency, minimize data links, and improve system resilience in contested or communications-denied environments.

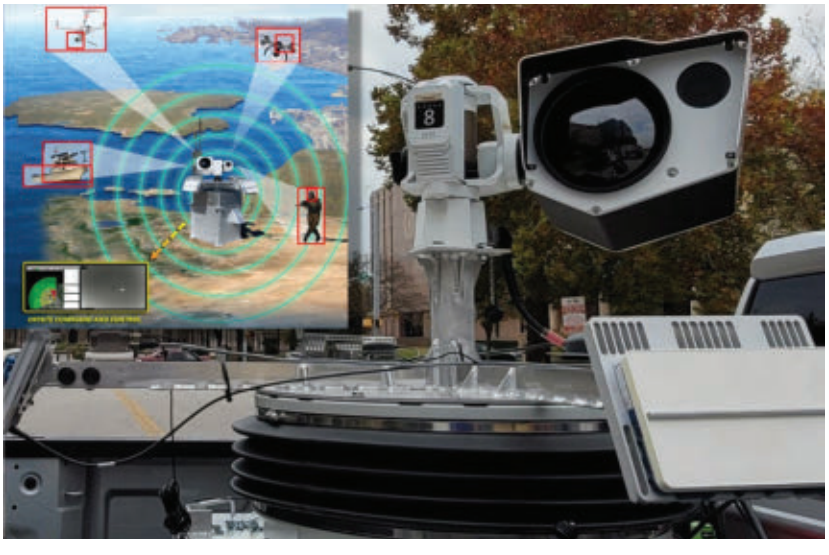
Key to this trend are ruggedized, standards-based hardware modules. OpenVPX and SOSA-aligned backplanes provide the mechanical, electrical, and thermal infrastructure needed

to integrate diverse processing elements — whether it's a high-throughput FPGA for real-time beamforming or a discrete GPU handling convolutional neural networks for target classification. These modules are designed to withstand extreme shock, vibration, and temperature swings, ensuring edge processors stay online during hard-use operations.

Software stacks and development frameworks have evolved in parallel. Containerized and virtualized environments allow field-programmable hardware and general-purpose CPUs to host multiple processing pipelines side by side — enabling, for example, simultaneous electro-optical image enhancement, RF spectral analysis, and sensor-fusion algorithms on a single chassis. Real-time operating systems (RTOS) and hypervisors ensure that high-priority tasks like threat detection receive guaranteed CPU cycles, while less time-sensitive functions — such as logging or remote system updates — run in parallel.

Power and thermal management remain critical design considerations. Edge systems often run from mobile power sources or vehicular generators, where wattage is at a premium. Innovative cooling solutions—heat pipes, embedded liquid loops, and advanced thermal interface materials—help maintain optimal performance without adding excessive bulk. In many cases, adaptive power-scaling techniques throttle processor utilization dynamically based on mission phase, extending operational endurance without sacrificing critical processing capability.

By embedding powerful compute resources directly on the front line, defense engineers are ensuring that next-generation sensors don't just see the battlespace — they understand it. Edge computing transforms passive data collection into actionable intelligence, empowering warfighters with faster targeting, enhanced situational awareness, and autonomous decision support exactly where and when it's needed.



Threat Tracker is an autonomous threat detection system developed by a small team of engineers and scientists at the Coastal and Maritime Security branch at Naval Surface Warfare Center Panama City Division. Threat Tracker is an autonomous, multi-platform threat detection system that uses radar and sensor technologies coupled with video analytics and machine learning algorithms to detect, track and classify potential threats. U.S. Navy illustration.

Autonomy and AI target recognition

Autonomy is no longer limited to pilotless aircraft or self-navigating ground vehicles — it's becoming a defining feature of sensor systems themselves. At the heart of this transformation is AI and ML, which are enabling electro-optical, IR, and RF sensors to not only detect and track targets but to identify, classify, and even prioritize them with minimal human intervention.

The U.S. Department of Defense continues to push for greater autonomy at the tactical edge through programs like Joint All-Domain Command and Control (JADC2) and the Replicator initiative, both of which rely heavily on smart sensing technologies. These systems use embedded AI models trained on massive datasets to recognize patterns in real time—distinguishing between a commercial UAV and a hostile loitering munition, or between a civilian vehicle and a fast-moving armored threat.

In the infrared domain, neural networks are being deployed to perform tasks such as scene segmentation, facial recognition, and behavior analysis. This allows systems to flag unusual activity or detect concealed threats that human operators might overlook. These capabilities are particularly useful in urban warfare, perimeter defense, and force protection missions where visual clutter and rapid movement are the norm.

Autonomous target recognition also reshapes kinetic systems. Loitering munitions and autonomous strike platforms now leverage electro-optical and RF sensor data combined with onboard

AI to identify and confirm targets before engagement. While human-in-the-loop protocols remain in place for lethal actions, the ability of a munition to navigate, search, and designate targets independently dramatically shortens the kill chain and reduces operator burden.

At the systems level, engineers are building sensor networks that learn and adapt. AI-driven signal processing engines can optimize sensor behavior based on mission context. Some systems even use reinforcement learning techniques to improve performance over time, learning from both successes and near-misses in live or simulated operations.

However, autonomy brings new challenges, particularly in validation, trust, and accountability. Ensuring that an AI system performs reliably under real-world conditions requires extensive testing and ongoing refinement, especially in mission-critical applications. That has led to a rise in hybrid systems, where AI handles initial processing and classification, but final decisions are deferred to human operators or supervisory control algorithms.

As AI algorithms become more capable and compact, and hardware accelerators continue to mature, autonomous sensor systems are moving from the lab to the field. Whether mounted on a drone, integrated into a helmet, or embedded in a missile, these systems give warfighters faster, more accurate information — and in many cases, allow machines to act before humans even realize a threat exists.

Challenges and the road ahead

Despite rapid progress across electro-optical sensors, lasers, RF systems, and embedded processing, significant challenges remain in bringing fully integrated, real-time sensor systems to the warfighter. From data overload and SWaP constraints to cybersecurity and interoperability, engineers face a complex matrix of design and deployment hurdles as they push sensing and processing capabilities closer to the edge of combat operations.

Lockheed Martin announced in 2022 that its Layered Laser Defense (LLD) laser weapon brought down a surrogate subsonic cruise missile by focusing a high-energy laser beam. The system uses myriad sensors to point the laser beam with enough precision to destroy the target. Lockheed Martin photo.

One of the biggest technical challenges is managing the sheer volume of data generated by modern sensor suites. High-resolution electro-optical and IR imagery, wideband RF spectrum monitoring, and continuous signal processing generate terabytes of data in a single mission. Without advanced compression, filtering, and AI-driven prioritization, these data streams can overwhelm onboard processors and backhaul links, especially in bandwidth-constrained environments.

Interoperability is another critical concern. With services pursuing joint, all-domain operations, sensor systems must conform to open standards and communicate across platforms and networks not originally designed to work together. Initiatives like MOSA (Modular Open Systems Approach), SOSA, and CMOSS are helping, but legacy systems and platform-specific designs still create integration bottlenecks.

Security and resilience are equally pressing issues. electro-optical and RF sensors — especially those linked to autonomous systems — are becoming high-value targets for cyber and electronic attacks. Engineers must harden hardware and software against spoofing, jamming, and cyber intrusion, while ensuring mission-critical systems can still function under degraded or contested conditions.

Power and thermal limits continue to define the edge of what's possible. As more compute is pushed into smaller, more mobile platforms, managing power draw and heat dissipation without compromising performance or ruggedization is a key system-level design constraint. This is particularly true for AI-enabled sensors, which often require dedicated accelerators that draw significant power under load.

Looking ahead, the defense industry is focusing on convergence — bringing electro-optical, RF, signal processing, AI, and communications into cohesive systems that operate faster and more autonomously. Future systems will be expected to detect and track a swarm of threats, synthesize data across domains, and either cue human operators or act independently in milliseconds. That will require not only technical innovation but deep coordination between sensor developers, embedded computing engineers, and military program managers.

Ultimately, the goal is clear: to give the warfighter better awareness, faster decision-making, and greater operational effectiveness. From low-earth orbit to ground combat, sensor processing technologies are at the center of modern warfare, and the future battlefield will belong to the force that can see, understand, and act the fastest.

Radiation-hardened branches out from New Space

Chip manufacturers are responding to growing demand for radiation-hardened and radiation-tolerant devices for low-Earth orbits, as well as for high-altitude geosynchronous orbits and future missions beyond Earth.

BY **John Keller**

Technologies for enabling electronic components to survive the radiation environment of space are evolving beyond today's demand for affordable electronics for low-Earth-orbit satellites, as spacecraft designers look beyond commercial satellites toward future moon, Mars, and deep-space missions.

While historic technologies for radiation hardening have involved expensive and rugged ceramic packaging and special bottom-up designs to ensure performance in the naturally occurring radiation of space, recent years have seen a shift in emphasis from radiation-hardened to radiation-tolerant processors, power controllers, and other electronic components.

The primary market driver from radiation-hardened to radiation-tolerant electronics has been so-called "New Space," in which satellite lifetimes are shortened, and designers are as concerned with overall costs and time to market as they are with reliability in space.

How to achieve radiation tolerance that is affordable and good-enough for low-Earth-orbit satellites can vary. Systems designers often substitute affordable plastic-packaged integrated circuits for bullet-proof and expensive ceramic parts. SpaceX, for example, often relies on triple-redundant parts to ensure spacecraft performance even if one or two components fail.

These kinds of design tradeoffs essentially have defined the New Space market now for several years, as commercial satellite constellations are sensitive to costs and fast delivery schedules. Solutions can involve redundant plastic-packaged parts, special shielding for sensitive components, software voting schemes to keep functions working amid radiation strikes, and a battery of tests and upscreening to choose the most reliable commercially available electronic parts.

"There's been more of a call to action in the last year or two, based on the success of SpaceX in low-Earth-orbit," says Josh Broline, senior director of strategic

◀ Silhouette view of a fleet of Internet Starlink satellites in orbit. A line of Starlink satellites providing internet connection from space with the sun in the horizon.

marketing and applications engineering at rad-hard specialist Renesas Electronics America in Palm Bay, Fla. "We're asking, is there more of an opportunity to use radiation-tolerant or automotive parts for these applications? Various companies are going at that challenge different, based on what SpaceX has put out there."

Beyond New Space

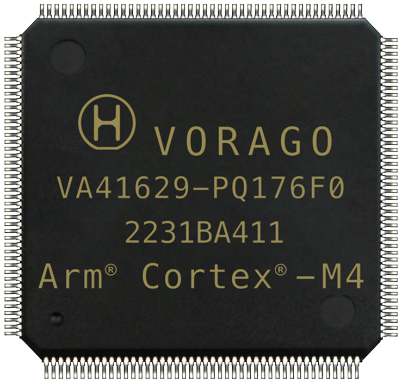
Yet spacecraft designers and rad-hard electronics suppliers are looking beyond New Space to encompass applications like medium-Earth-orbit (MEO), high-attitude geosynchronous orbit, and beyond Earth orbit like deep-space probes and future missions to the moon and Mars.

"New Space is a piece of the rad-hard market," Renesas's Broline explains. "There are six market segments: U.S. government, NATO, other governments, commercial GEO, and New Space. GEO and MEO is in that mix."

Broline says additional rad-hard space markets are emerging, such as non-terrestrial networking and direct-to-device applications like satellite signals that go directly to cell phones without using land-based cell towers. "Those applications are attaching themselves to New Space, as well," Broline says.

Each market segment has different requirements, and has different electronics on-board, Broline says. "As direct-to-mobile applications gain more traction, they basically outfit their satellites to do multiple functions. One of the main thrusts of LEO is to reduce latency so as to do streaming, voice, and data. But in reality you need more satellites, and it becomes a very capital-intensive endeavor; it fits really well into the MEO and LEO markets.

New Space finds itself among two camps in the space market, says Sean MacDonald, director of technical sales at Spirit Electronics in Phoenix, a specialist in electronics upscreening and testing for space applications.



Vorago Technologies

▲ Vorago Technologies in Austin, Texas, offers HARDSIL technology process enhancement that hardens devices against the effects of radiation and temperature.

"We have the historical primes, who have a legacy mindset," MacDonald says. "Those processes take a long time. Now we have the New Space market that is moving really fast. Now the primes are trying to figure out how to compete in the same market as these Tier 2 and New Space players. The primes want to move as quickly as the New Space market does, and they need a third party to do that."

Each market has its own attributes. "In the New Space camp we are seeing a focus on more integration," MacDonald says. "People are out there buying subsystems and modules, instead of developing them themselves. It is opening the door to subsystem and module providers who are ready to bring this to the New Space market."

Make-versus-buy

Component manufactures have room to move in this market, he continues. "It is a make-versus-buy decision. They want to buy it and get to space as quickly as they can. People have leaned on FPGAs [field-programmable gate arrays] to drive and power their devices. Now a lot of people look at building their own FPGAs and do custom work. Chip foundries are opening up and becoming more accessible. As soon as you can own and manage your supply chain, it becomes much more palatable to make your own devices; on the subsystems and modules, people want to buy, but in FPGAs people want to design their own."

These conditions will expand the number of players in the New Space market -- especially at the component level," MacDonald says. "Then more of them will wake up and realize space is where they want to play."

As the space market increases in popularity, electronic component designers are looking for new ways to get the most out of space applications across the board. "Most companies out there are looking for something in the middle, between radiation tolerant and more commercial-like," says Renesas's Broline. "We are trying to meet that trend with multiple flows of plastic and ceramic. We have three different grades, and have introduced the ability to meet different mission profiles, from LEO or military at GEO, or the moon and Mars."

This is driving a coalescence of New Space and beyond orbital space applications. "New Space historically is about people getting their satellites in space, especially in the LEO orbit," says Spirit Electronics's MacDonald. "It's been about getting satellites in space and proving your technologies can survive. Now it's more business-case-centric."

That is, rad-hard suppliers are trying to cover a broader segment of the market than simply New Space. "In the past year, we've seen a shift where people want to get to MEO and GEO orbits. There also are lot of lunar applications coming up for mining on the moon," MacDonald says. "The market will expand, and will become space, not just new space."

In fact, MacDonald says he sees in the future that commercial space communications will become nearly an exclusive domain of private business like SpaceX, while NASA and the U.S. Space Force will focus on high-altitude, more-difficult missions.

Renesas

The Renesas ISL73849SEH PWM controller offers digital and scalable power management for end-to-end digital control and telemetry-perfect for next-gen software-defined satellite architectures.

The SpaceX turning point

"SpaceX is the turning point in my mind," MacDonald says. "They reduce the launch costs and it opens the door to a lot more experiments you can run and prove out your science. NASA, AFRL [the Air Force Research Laboratory], and the Space Force will shift their focus to bigger and better things, like the next big thing, in moon shots, and the other companies will focus on space as a business. NASA will focus on deep space and laboratories in space; that's what NASA will see more work in."

One approach that electronics suppliers are taking to broaden the markets they serve is to combine radiation-hardened and radiation-tolerant parts in one architecture. "We offer as much flexibility between rad-hard and rad-tolerant as we can," says Ken Obuszewski, vice president of business development and products at Vorago Technologies in Austin, Texas.

"Customers like mission flexibility," Obuszewski continues. "They need something that could scale across all orbits, so you don't have to invest in multiple platforms, and make one investment in hardware and software. Space X builds in triple redundancy; they also are willing to have satellites fail. Most new-space folks really can't take that risk so they have to balance the right level of reliability."

Vorago, a specialist in designing semiconductors and special electronics packaging for radiation environments, is seeing success with deploying the company's HARDSIL technology in different wafer fabs. We enable our radiation-hardened technology and apply it to industrial and robotics applications," Obuszewski says.

"What will really be of value, and what we will be enabling, is to support rad-hard and rad-tolerant in the same architecture so our customers don't have to double their investment in the two designs," Obuszewski says. "Once HARDSIL is deployed there, you don't have to redesign the parts; you can have rad-hard and rad-tolerant coming of the same line at once."

HARDSIL is a process enhancement to standard Bulk CMOS manufacturing that hardens devices against the effects of radiation and temperature. HARDSIL can be used to harden any CMOS device using standard manufacturing equipment with no negative impact on performance or yields. This approach is a cost-effective alternative to current high-reliability techniques that use specialized manufacturing techniques, up-screened commercial products, redundant systems, or exotic packaging.

Not only can HARDSIL help manufacture electronic parts with several different resistances to radiation, but the technology also can apply to some of the latest and most advanced semiconductor technologies, such as general-purpose graphics processors (GPGPUs) for high-performance parallel processing in space, or in any other applications that could be susceptible to radiation.

"We see coming, with so many autonomous life-critical applications coming, these device will be more and more susceptible to ground-level radiation," Obuszewski says. The ability to protect those devices will become very critical."

Beyond Earth orbit

A renewed NASA emphasis on space exploration beyond Earth is creating limited-yet-growing demand for electronic parts with super-rugged resistance to space radiation. Several NASA projects are in progress for exploration missions to the moon, Mars, and Jupiter's moon Europa.

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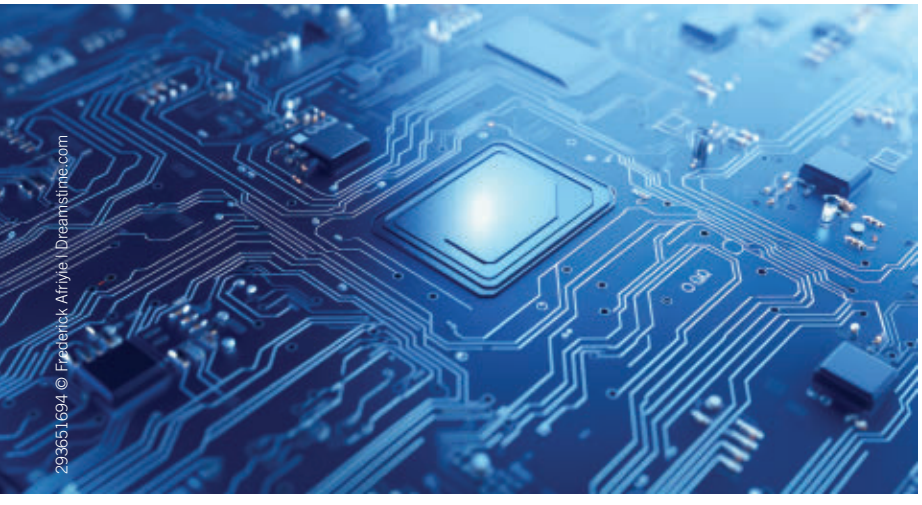
"The moon is closer to a GEO orbit for defending against total ionizing doses, and is closer to GEO," Renesas's Broline says. These high-altitude geosynchronous-orbit spacecraft are subject to much higher exposure to space radiation than is low-Earth orbit, where the Earth and its atmosphere can provide some protection from radioactive charged particles.

Future missions to Mars will increase exposure to radiation further still. "Mars is a much different ball game from geosynchronous or lunar missions," Broline continues. "There was a study recently that says humans could only survive on Mars with infrastructure built below ground, or using very thick walls, if you have infrastructure on the surface. These are harsh environments. If we were to colonize the moon, they would need the appropriate infrastructure."



Broline points out that Renesas has provided electronic parts to every space rover sent to the moon and Mars. "These parts will have many years of survivability without additional shielding, and have met the requirements there."

Electronics component manufactures are getting creative with building radiation-hardened and radiation-tolerant microelectronics on the same fab line.

Missions beyond Mars likely will require even more resistance to space radiation than do geosynchronous or moon missions. The NASA Europa Clipper space probe, launched last October to conduct a detailed study of Jupiter's moon Europa, requires protection to 300 kilorads of total-dose radiation, which is three times what is necessary for Mars.

Europa Clipper will travel 1.8 billion miles to reach Jupiter in April 2030. The spacecraft will orbit Jupiter, and conduct 49 close flybys of Europa. The spacecraft carries nine science instruments, and a gravity experiment that uses the telecommunications system. All science instruments will operate simultaneously on every pass.

"Beyond Earth is an important market segment," says Renesas's Broline. "It takes quite a while to get hardware launched, and is an add-on type of market. It's not necessarily driving our decisions on a daily basis. Sometimes you need shielding, or put a particular component deeper on the satellite, but it's still an important segment." ←

▲ A SpaceX Falcon 9 rocket launches Starlink communications satellites, as seen from the beach in Melbourne, Fla., on 6 Jan. 2020.

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COMMUNICATIONS AND PERIPHERALS

AUDIO EQUIPMENT

ASAP 3Sixty
ASAP Fasteners
Aviation Spare Source
Buy NSN
Plane Parts 360
PRYME

COMMUNICATIONS EQUIPMENT - LASER COMMUNICATIONS

ASAP 3Sixty
DLS Electronic Systems Inc
EXFO America

COMMUNICATIONS EQUIPMENT - MICROWAVE COMMUNICATIONS

ASAP 3Sixty
Connectronics Inc
Flexiguide Ltd
Ironwood Electronics
Kratos Microwave USA (Formerly CTT, Inc.)
KRYTAR
Nanning Xionghua Photoelectric Technology Co.
Pendulum Instruments Inc
Perceptive Components Ltd
PIC Wire & Cable
Southwest Antennas

COMMUNICATIONS EQUIPMENT - MILITARY TELECOMMUNICATIONS

AFR Enterprises
ASAP 3Sixty
Aviation Opolis
Buy Marine Components
Dawn VME Products
See ad on page 21
DLS Electronic Systems Inc
Flexiguide Ltd
Gateworks
Holt Integrated Circuits
Industrial Parts Services
Ironwood Electronics
Kontron America
Kratos Microwave USA (Formerly CTT, Inc.)
Military Spares Hub
Milpower Source
Nanning Xionghua Photoelectric Technology Co.
NAVWAR
New Wave Design
North Atlantic Industries Inc
Perceptive Components Ltd
PIC Wire & Cable
Plane Parts 360
Prime NSN Supplies
PRYME
Southwest Antennas
Spectrum Control
SynQor Inc
Tech Driven EMS
TopFlite Components
Viking Technology

COMMUNICATIONS EQUIPMENT - RADIO

DLS Electronic Systems Inc
PRYME
Quality Two-Way Radios
Sealevel Systems Inc
Southwest Antennas

COMMUNICATIONS EQUIPMENT - SATELLITE EQUIPMENT AND TELEMETRY

Deposition Sciences Inc (DSI)
Diamond USA Inc
Kontron America
PIC Wire & Cable
Silicon Sensing Systems Ltd
Southwest Antennas
SynQor Inc

DATA BUSES AND NETWORKING - HIGH-SPEED SWITCHED FABRICS

Acromag Inc
Aitech
Curtiss-Wright Defense Solutions
Dawn VME Products
See ad on page 21

Elma Electronic
See ad on page 12

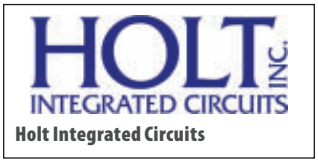
Extreme Engineering Solutions (X-ES)
Kontron America
New Wave Design

DATA BUSES AND NETWORKING - NETWORK INTERFACE CONTROLLERS

Acromag Inc
Aitech
ASAP 3Sixty
Axiomatic Technologies Corp
Buy NSN
Cleanroom Connection
Dawn VME Products
See ad on page 21

Elma Electronic
See ad on page 12

Extreme Engineering Solutions (X-ES)



Holt Integrated Circuits

Kontron America
New Wave Design
PICO Electronics Inc
See ad on page 29

DATA BUSES AND NETWORKING - TACTICAL NETWORKS

ASAP 3Sixty
Extreme Engineering Solutions (X-ES)
Kontron America
New Wave Design
Sealevel Systems Inc

DATA BUSES AND NETWORKING - WIRED NETWORKS

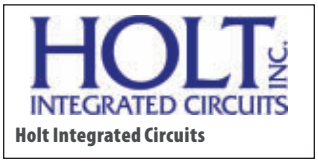
ASAP 3Sixty
Aukua Systems Inc
Axiomatic Technologies Corp
Extreme Engineering Solutions (X-ES)
New Wave Design
PIC Wire & Cable

DATA BUSES AND NETWORKING - WIRELESS NETWORKS

ASAP 3Sixty
Extreme Engineering Solutions (X-ES)
Flexiguide Ltd
PIC Wire & Cable
VIAVI Solutions Inc

DATA STORAGE - DATA RECORDERS

Acromag Inc
Aitech
Ampex Data Systems, a Delta Information Systems Company
Annapolis Micro Systems Inc
See ad on page 14
Barco Inc
Conduant Corporation
Curtiss-Wright Defense Solutions
EIZO Rugged Solutions
Greenliant



Holt Integrated Circuits

MEMKOR
New Wave Design
Palmer Wahl Instruments Inc
Phoenix International
ZMicro Inc

DATA STORAGE - OPTICAL MEMORY

BOC Sciences
Solid State Disks Ltd

DATA STORAGE - RAID/COMPUTER FARMS

Curtiss-Wright Defense Solutions
Phoenix International
Solid State Disks Ltd

DATA STORAGE - SOLID-STATE MEMORY

Aitech
Ampex Data Systems, a Delta Information Systems Company
ASAP 3Sixty
Buy NSN
Curtiss-Wright Defense Solutions
Extreme Engineering Solutions (X-ES)
Greenliant
McObject
MEMKOR
Phoenix International
Solid State Disks Ltd
Viking Technology
WIN SOURCE Electronics Inc
ZMicro Inc

DATA STORAGE - TAPE MEMORY

ASAP 3Sixty
Phoenix International
Solid State Disks Ltd

COMPONENTS/POWER ELECTRONICS/SENSORS

ADHESIVES, ENCAPSULANTS AND BONDINGS

Bakelite Synthetics
First Sensor Inc

Master Bond
See ad on page 8

Purchase Aero Parts
YINCAE Advanced Materials LLC

COMPONENTS - ALTIMETERS

ASAP 3Sixty
ASAP Aviation Procurement
ASAP Buying
ASAP Components
ASAP Logistic Solutions
TJR Global

COMPONENTS - BACKPLANES

Aitech
ASAP Components
ASAP Logistic Solutions

Atrenne Computing Solutions
See ad on page 7

Buy NSN

Dawn VME Products
See ad on page 21

Elma Electronic
See ad on page 12

Extreme Engineering Solutions (X-ES)
General Micro Systems Inc
See ad on inside front cover
LCR Embedded Systems
See ad on page 3
Pixus Technologies
Smiths Interconnect
TJR Global
TopFlite Components

COMPONENTS - CIRCUIT BREAKERS

Aero Logistic Support
ASAP Buying
ASAP Components
ASAP Electromechanical Parts
ASAP Fasteners
ASAP Logistic Solutions
Buy NSN
Essential Electric Supply
Industrial Automation Procurement
Instantaneous Delivery
Plane Parts 360
Prime NSN Supplies
Redler Technologies

COMPONENTS - CONNECTORS

Aero Logistic Support
Aerospace Aviation 360
AFR Enterprises
AirBorn – A Molex Company
See ad on page 9
ASAP Aviation Procurement
ASAP Buying
ASAP Components
ASAP Fasteners
ASAP Integrated
ASAP Logistic Solutions
ASAP Part Services
Buy NSN
Connectronics Inc
Diamond USA Inc
Electromechanical Hub
Fairview Microwave Inc
See ad on page 19
Instantaneous Delivery
Ironwood Electronics
NSN Gamut
NSN Sphere
ODU USA
OFS
Pasternack Enterprises
See ad on page 5
Perceptive Components Ltd
PIC Wire & Cable
Pickering Interfaces
Plane Parts 360
Prime NSN Supplies
QPC Fiber Optic Inc
Smiths Interconnect
Spectrum Control
SV Microwave
TJR Global
TopFlite Components
Trexon
WIN SOURCE Electronics Inc
WOLF Advanced Technology
See ad on page 11

COMPONENTS - CONTROL HEADS

ASAP Buying
ASAP Components
TJR Global

COMPONENTS - ENCLOSURES AND CHASSIS

ASAP Components

Atrenne Computing Solutions
See ad on page 7

Curtiss-Wright Defense Solutions

Dawn VME Products
See ad on page 21

Elma Electronic
See ad on page 12

Extreme Engineering Solutions (X-ES)

General Micro Systems Inc
See ad on inside front cover
Kontron America
LCR Embedded Systems
See ad on page 3
Pickering Interfaces
Pixus Technologies
Projects Unlimited
TJR Global

COMPONENTS - FASTENERS

Aero Logistic Support
Aero World 360
Aerospace Aviation 360
AFR Enterprises
Ai Aviation Purchasing
ASAP Aerospace
ASAP Aviation Procurement
ASAP Buying
ASAP Components
ASAP Fasteners
ASAP Logistic Solutions
ASAP Part Services
ASAP Semiconductor
ASAP Supply Chain
Aviation Opolis
Bellows Systems Inc
Buy Aero Spares
Buy Marine Components
Buy NSN
Industrial Spares Distribution
Instantaneous Delivery
Jet AM Spares
Part Miner
Part Supply Partner
Plane Parts 360
Prime NSN Supplies
Purchase Aero Parts
Stacked Fasteners
TJR Global
Veritable Aerospace
World of Fasteners

COMPONENTS - FIBER OPTICS

AirBorn – A Molex Company
See ad on page 9
Alfa Chemistry
ASAP Buying
ASAP Components
Aviation Opolis
Diamond USA Inc
EXFO America
Instantaneous Delivery
Kontron America
Lumispot Tech
Nanning Xionghua Photoelectric Technology Co.
OFS
Photonchina Co Ltd
Spectrum Control
TJR Global

COMPONENTS - FILTERS/GASKETING

ASAP Components
Aviation Opolis
Spectrum Control
TJR Global
TopFlite Components
WIN SOURCE Electronics Inc

COMPONENTS - FLIGHT INSTRUMENTS

Aerospace Exchange
ASAP Aerospace
ASAP Aviation Procurement
ASAP Buying
ASAP Components
ASAP Fasteners
ASAP Logistic Solutions
ASAP Parts 360
ASAP Supply Chain
Aviation Purchasing Platform
Buy Marine Components
DLS Electronic Systems Inc
Meteoric Aviation
Plane Parts 360
Projects Unlimited

COMPONENTS - GYROSCOPES

ASAP Buying
Silicon Sensing Systems Ltd

COMPONENTS - HUMAN-MACHINE INTERFACES

AbraxSys Corp
Elma Electronic
See ad on page 12
OTTO Controls

COMPONENTS - LATCHES AND HINGES

ASAP Components
ASAP Logistic Solutions
Pixus Technologies

COMPONENTS - MEMS AND NANOTECHNOLOGY

Apex Microtechnology
See ad on page 15
First Sensor Inc
Ironwood Electronics
Silicon Designs Inc
Silicon Sensing Systems Ltd

COMPONENTS - RADIATION-HARDENED COMPONENTS

Apex Microtechnology
See ad on page 15
International Rectifier
HiRel Products Inc
Kontron America
MEMKOR
Sensitron Semiconductor
Silicon Designs Inc
Spectrum Control
Spirit Electronics
State of the Art Inc
See ad on page 23
Trexon
VORAGO Technologies
See ad on page 30

VPT, Inc.

COMPONENTS - RELAYS

AFR Enterprises
ASAP Aviation Procurement
ASAP Buying
ASAP Components
ASAP Logistic Solutions
Buy NSN
International Rectifier
HiRel Products Inc
Pickering Interfaces
Sensitron Semiconductor

COMPONENTS - SWITCHES

AFR Enterprises
ASAP Aerospace
ASAP Aviation Procurement
ASAP Components
ASAP Logistic Solutions
Aviation Opolis
Elma Electronic
See ad on page 12
Essential Electric Supply
Extreme Engineering Solutions (X-ES)
Fairview Microwave Inc
See ad on page 19
First Sensor Inc
International Rectifier
HiRel Products Inc
Kontron America
OTTO Controls
Pasternack Enterprises
See ad on page 5
Pickering Interfaces
Prime NSN Supplies

COMPONENTS - WIRE AND CABLE

AirBorn – A Molex Company
See ad on page 9
AMWEI Thermistor Sensor
ASAP Aviation Procurement
ASAP Buying
ASAP Components
ASAP Logistic Solutions
Connectronics Inc
Fairview Microwave Inc
See ad on page 19
Fine Test
Instantaneous Delivery
Pasternack Enterprises
See ad on page 5
PIC Wire & Cable
Pickering Interfaces
Projects Unlimited
Purchase Military Parts
SV Microwave
TJR Global
Trexon

DISPLAYS - CATHODE RAY TUBES

AbraxSys Corp

DISPLAYS - COCKPIT DISPLAYS

AbraxSys Corp
ASAP AOG
ASAP Components
ASAP Logistic Solutions
Aviation Spare Source
Barco Inc
Buy NSN
Curtiss-Wright Defense Solutions
Integrated NSN
ViewPoint Systems
ZMicro Inc

DISPLAYS - ELECTROLUMINESCENT (EL) DISPLAYS

Alfa Cytology

DISPLAYS - ENHANCED/ SYNTHETIC VISION SYSTEMS

ZMicro Inc

DISPLAYS - HEADS-UP DISPLAYS

AbraxSys Corp
Kontron America
Reynard Corp
RTX Collins Aerospace

DISPLAYS - HELMET-MOUNTED DISPLAYS (HMD)

Kontron America

DISPLAYS - IN-FLIGHT ENTERTAINMENT SYSTEM DISPLAYS

AbraxSys Corp
DLS Electronic Systems Inc

IMPERX Inc

DISPLAYS - LIQUID CRYSTAL DISPLAYS

AbraxSys Corp
Barco Inc
Crystal Image Technologies
EIZO Rugged Solutions
RTX Collins Aerospace
ViewPoint Systems

DISPLAYS - ORGANIC LIGHT-EMITTING DIODE (OLED) DISPLAYS

AbraxSys Corp
Barco Inc
RTX Collins Aerospace

INTEGRATED CIRCUITS, ANALOG - BIPOLAR TRANSISTORS

ASAP Components
International Rectifier
HiRel Products Inc

INTEGRATED CIRCUITS, ANALOG - IGBTS

Rochester Electronics LLC
See ad on page 30
Sensitron Semiconductor

INTEGRATED CIRCUITS, ANALOG - MOSFETS

Holt Integrated Circuits

Infineon Technologies AG
International Rectifier
HiRel Products Inc
Rochester Electronics LLC
See ad on page 30
Sensitron Semiconductor
Spirit Electronics
WIN SOURCE Electronics Inc

INTEGRATED CIRCUITS, ANALOG - PASSIVE COMPONENTS

ASAP Logistic Solutions
Esterline Leach International
Holt Integrated Circuits
Merrimac
Peaco Support Transformer
PICO Electronics Inc
See ad on page 29
San Francisco Circuits
Smiths Interconnect
Spectrum Control
State of the Art Inc
See ad on page 23
WIN SOURCE Electronics Inc

INTEGRATED CIRCUITS, ANALOG - POWER DISCRETE DEVICES

Apex Microtechnology
See ad on page 15
ASAP Components
International Rectifier
HiRel Products Inc
Rochester Electronics LLC
See ad on page 30
Sensitron Semiconductor
Spectrum Control
Spirit Electronics

INTEGRATED CIRCUITS, ANALOG - POWER INTEGRATED CIRCUITS

Aerospace Orbit
Apex Microtechnology
See ad on page 15
ASAP Logistic Solutions
Holt Integrated Circuits
International Rectifier
HiRel Products Inc
Ironwood Electronics
PICO Electronics Inc
See ad on page 29
Rochester Electronics LLC
See ad on page 30
Sensitron Semiconductor
Spectrum Control
Spirit Electronics

SynQor Inc

VPT, Inc.

WIN SOURCE Electronics Inc

INTEGRATED CIRCUITS, ANALOG - RECTIFIERS

ASAP Components
ASAP Logistic Solutions
ELDEC

GAIA Converter
See ad on page 31
International Rectifier
HiRel Products Inc
Sensitron Semiconductor
Voltage Multipliers Inc
WIN SOURCE Electronics Inc

INTEGRATED CIRCUITS, DIGITAL - A-D CONVERTERS

General Micro Systems Inc
See ad on inside front cover
North Atlantic Industries Inc
Rochester Electronics LLC
See ad on page 30
SMX Power
Spirit Electronics
TJR Global

INTEGRATED CIRCUITS, DIGITAL - ASICS

Apex Microtechnology
See ad on page 15
Rochester Electronics LLC
See ad on page 30
Spectrum Control
Spirit Electronics
TJR Global
VORAGO Technologies
See ad on page 30

INTEGRATED CIRCUITS, DIGITAL - COMMUNICATIONS/ NETWORKING ICS

Holt Integrated Circuits
New Wave Design
PICO Electronics Inc
See ad on page 29
Rochester Electronics LLC
See ad on page 30
TJR Global
WIN SOURCE Electronics Inc

INTEGRATED CIRCUITS, DIGITAL - D-A CONVERTERS

North Atlantic Industries Inc
Rochester Electronics LLC
See ad on page 30
Spirit Electronics

INTEGRATED CIRCUITS, DIGITAL - DIGITAL SIGNAL PROCESSORS

Aerospace Orbit
Ironwood Electronics
Rochester Electronics LLC
See ad on page 30
VORAGO Technologies
See ad on page 30
WIN SOURCE Electronics Inc

INTEGRATED CIRCUITS, DIGITAL - FPGAS

Ironwood Electronics
New Wave Design
Rochester Electronics LLC
See ad on page 30
Spirit Electronics
VORAGO Technologies
See ad on page 30
WIN SOURCE Electronics Inc
Xenics | EXOSENS Group

INTEGRATED CIRCUITS, DIGITAL - GENERAL-PURPOSE ICS

Apex Microtechnology
See ad on page 15
Spirit Electronics
Teledyne e2v HiRel
VORAGO Technologies
See ad on page 30

INTEGRATED CIRCUITS, DIGITAL - GRAPHICS ICS

Rochester Electronics LLC
See ad on page 30

INTEGRATED CIRCUITS, DIGITAL - IP CORES

New Wave Design
Rochester Electronics LLC
See ad on page 30
VORAGO Technologies
See ad on page 30

INTEGRATED CIRCUITS, DIGITAL - MEMORY ICS

Aerospace Orbit
Greenliant
Infineon Technologies AG
Perceptive Components Ltd
Spirit Electronics
Teledyne e2v HiRel
VORAGO Technologies
See ad on page 30
WIN SOURCE Electronics Inc

INTEGRATED CIRCUITS, DIGITAL - MICROPROCESSORS/ MICROCONTROLLERS

Aerospace Orbit
Axiomatic Technologies Corp
Ironwood Electronics
Part Miner
Rochester Electronics LLC
See ad on page 30
Spirit Electronics
VORAGO Technologies
See ad on page 30
WIN SOURCE Electronics Inc

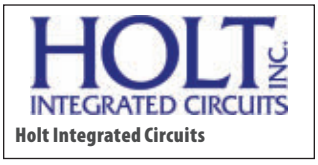
INTEGRATED CIRCUITS, DIGITAL - MIXED-SIGNAL ICS

Apex Microtechnology
See ad on page 15
Holt Integrated Circuits
Rochester Electronics LLC
See ad on page 30
VORAGO Technologies
See ad on page 30

INTEGRATED CIRCUITS, DIGITAL - NETWORK INTERFACE ICS

Holt Integrated Circuits
New Wave Design
North Atlantic Industries Inc
PICO Electronics Inc
See ad on page 29

INTEGRATED CIRCUITS, DIGITAL - PERIPHERAL/SUPPORT ICS



Holt Integrated Circuits

VORAGO Technologies
See ad on page 30

INTEGRATED CIRCUITS, DIGITAL - SOLID-STATE MEMORY

Greenliant
MEMKOR
Rochester Electronics LLC
See ad on page 30
Spirit Electronics
VORAGO Technologies
See ad on page 30

POWER ELECTRONICS - ACTUATORS

Aerospace Orbit
ASAP Aerospace
ASAP Components
DLS Electronic Systems Inc

POWER ELECTRONICS - AUXILIARY POWER UNITS (APUS)

Aerospace Orbit
ASAP AOG
Nova Electric
SynQor Inc

POWER ELECTRONICS - BATTERIES

Aerospace Orbit
BOC Sciences
Buy NSN
Nova Electric
SynQor Inc

POWER ELECTRONICS - CIRCUIT BREAKERS

Aerospace Orbit
Buy NSN
Purchase Military Parts

POWER ELECTRONICS - EMERGENCY POWER UNITS

ELDEC
GAIA Converter
See ad on page 31
Nova Electric
SynQor Inc

POWER ELECTRONICS - GENERATORS

Aerospace Orbit

POWER ELECTRONICS - INVERTERS/CONVERTERS

Aerospace Orbit
Axiomatic Technologies Corp

Behlman Electronics
See ad on back cover

GAIA Converter
See ad on page 31
General Micro Systems Inc
See ad on inside front cover
Jasper Electronics
Nova Electric
Peaco Support Transformer
PICO Electronics Inc
See ad on page 29
Spectrum Control

SynQor Inc

VPT, Inc.

POWER ELECTRONICS - MOTOR CONTROLLERS

Apex Microtechnology
See ad on page 15
Axiomatic Technologies Corp
GAIA Converter
See ad on page 31
International Rectifier
HiRel Products Inc
North Atlantic Industries Inc
Redler Technologies
Sensitron Semiconductor
SynQor Inc

POWER ELECTRONICS - MOTORS

ASAP AOG

POWER ELECTRONICS - POWER DISTRIBUTION SYSTEMS AND EQUIPMENT

Aerospace Orbit
AirBorn – A Molex Company
See ad on page 9
ASAP Semiconductor

Behlman Electronics
See ad on back cover

ELDEC
GAIA Converter
See ad on page 31
International Rectifier HiRel Products Inc
Milpower Source
Nova Electric
Peaco Support Transformer
PICO Electronics Inc
See ad on page 29
Redler Technologies
Sensitron Semiconductor
Spectrum Control
Steptransformer.com

SynQor Inc

VPT, Inc.

POWER ELECTRONICS - POWER SUPPLIES

AirBorn – A Molex Company
See ad on page 9
Analog Modules Inc
ASAP Components
Axiomatic Technologies Corp

Behlman Electronics
See ad on back cover

Dawn VME Products
See ad on page 21

ELDEC
Elma Electronic
See ad on page 12
Extreme Engineering Solutions (X-ES)
GAIA Converter
See ad on page 31
Jasper Electronics
Lumispot Tech
Milpower Source
North Atlantic Industries Inc
Nova Electric
Peaco Support Transformer
Perceptive Components Ltd
PICO Electronics Inc
See ad on page 29
Sensitron Semiconductor
Spectrum Control
Steptransformer.com

SynQor Inc

Technology Dynamics Inc
VersaLogic Corp
Voltage Multipliers Inc

VPT, Inc.

Wavelength Electronics Inc
WIN SOURCE Electronics Inc

POWER ELECTRONICS - TRANSDUCERS

Aerospace Orbit
Buy Marine Components
Palmer Wahl Instruments Inc
Purchase Aero Parts

POWER ELECTRONICS - TRANSIENT VOLTAGE SUPPRESSORS

Axiomatic Technologies Corp
GAIA Converter
See ad on page 31
High Energy Devices LLC
Sensitron Semiconductor
SynQor Inc
Technology Dynamics Inc
VPT, Inc.

SENSORS - CHEMICAL ANALYZERS

Amerigo Scientific
BOC Sciences
Electro Optical Components Inc (EOC)

SENSORS - INERTIAL

First Sensor Inc
Silicon Designs Inc
Silicon Sensing Systems Ltd

SENSORS - INFRARED/ULTRAVIOLET

Deposition Sciences Inc (DSI)
Electro Optical Components Inc (EOC)
Iscan Inc
McObject
MoviTHERM
Palmer Wahl Instruments Inc
WIN SOURCE Electronics Inc
Xenics | EXOSENS Group

SENSORS - LADAR/LIDAR

Analog Modules Inc
Avantier Inc
Diamond USA Inc
First Sensor Inc
LightGage Inc
McObject
RPMC Lasers Inc
Wavelength Electronics Inc

SENSORS - RADAR

DeTect Inc
Diamond USA Inc
Kontron America
McObject
Milpower Source

SENSORS - SONAR

Kontron America
McObject

SENSORS - TACTILE

American Laser Spares LLC
Diamond USA Inc
McObject

SENSORS - VISIBLE-LIGHT CAMERAS

Canon Medical Components USA Video Sensing Division (VSD)
Deposition Sciences Inc (DSI)
First Sensor Inc

IMPERX Inc

Iscan Inc
Kontron America
LightGage Inc
MoviTHERM
Radiant Vision Systems

COMPUTERS

AIR DATA COMPUTERS

Cleanroom Connection
Plane Parts 360
Projects Unlimited
TJR Global
ZMicro Inc

DESKTOP COMPUTERS

AbraxSys Corp
NextComputing
TJR Global

EMBEDDED COMPUTERS

AbraxSys Corp
Acromag Inc
Annapolis Micro Systems Inc
See ad on page 14

Atrenne Computing Solutions
See ad on page 7

Barco Inc
Cincoze Co Ltd
Dawn VME Products
See ad on page 21

EIZO Rugged Solutions

Elma Electronic
See ad on page 12

Extreme Engineering Solutions (X-ES)

GAIA Converter
See ad on page 31
Gateworks
Konsulko Group
Kontron America
LCR Embedded Systems
See ad on page 3
MEMKOR
Neousys Technology Inc
NextComputing
North Atlantic Industries Inc
Pixus Technologies
Projects Unlimited
Sealevel Systems Inc
TJR Global
VersaLogic Corp
Viking Technology
VORAGO Technologies
See ad on page 30
ZMicro Inc

FLIGHT DIRECTORS

Integrated NSN
Purchase Military Parts

LAPTOPS/NOTEBOOKS/ HANDHELD COMPUTERS

AbraxSys Corp
Darveen
DURABOOK
NextComputing

MULTICOMPUTER SYSTEMS

AbraxSys Corp
Kontron America
Pixus Technologies
Projects Unlimited

RACK-MOUNT COMPUTERS

AbraxSys Corp
Ampex Data Systems, a Delta Information Systems Company
Annapolis Micro Systems Inc
See ad on page 14

Atrenne Computing Solutions
See ad on page 7

Dawn VME Products
See ad on page 21
Extreme Engineering Solutions (X-ES)
Kontron America
LCR Embedded Systems
See ad on page 3
Neousys Technology Inc
NextComputing
Pixus Technologies
Sealevel Systems Inc
ViewPoint Systems
ZMicro Inc

SERVERS

AbraxSys Corp
Ampex Data Systems, a Delta Information Systems Company
Atrenne Computing Solutions
See ad on page 7
Cleanroom Connection
Extreme Engineering Solutions (X-ES)
Fine Test
Kontron America
Neousys Technology Inc
NextComputing
TeamEDA Inc
ZMicro Inc

SPECIALIZED COMPUTERS - TEMPEST

Atrenne Computing Solutions
See ad on page 7
Projects Unlimited

WEARABLE COMPUTERS

Ironwood Electronics
Projects Unlimited

DIAGNOSTICS AND CONTROL

AVIONICS HEALTH MANAGEMENT

Dawn VME Products
See ad on page 21
New Wave Design

ENGINE CONTROLS

ASAP AOG
GAIA Converter
See ad on page 31
Ironwood Electronics
Projects Unlimited
Purchase Aero Parts

ENGINE MONITORING

Advanced Inspection Technologies
Xenics | EXOSENS Group

FUEL MANAGEMENT SYSTEMS

First Sensor Inc
Projects Unlimited

HEALTH AND USAGE MONITORING (HUMS)

Creative Biolabs
Dawn VME Products
See ad on page 21
TeamEDA Inc

OVERHEAT DETECTION

Dawn VME Products
See ad on page 21
MoviTHERM
Palmer Wahl Instruments Inc
Xenics | EXOSENS Group

ELECTRO-OPTICS

BONDING AND ADHESIVES

Bakelite Synthetics
First Sensor Inc

Master Bond
See ad on page 8
Tech Driven EMS

CAMERAS

Advanced Inspection Technologies
Canon Medical Components USA Video Sensing Division (VSD)
First Sensor Inc
GAIA Converter
See ad on page 31
Guernsey Coating Laboratories Inc
IMPERX Inc
MoviTHERM
Photonchina Co Ltd
Sierra Pacific Innovations
Xenics | EXOSENS Group

ELECTRO-OPTIC MATERIALS AND SUBSTRATES

Alfa Chemistry
American Laser Spares LLC
Cleanroom Connection
H B Fuller Co
Matexcel
MOK Optics Co Ltd
PG&O Precision Glass & Optics
Walthy Precision Co Ltd

EQUIPMENT MANUFACTURING

Clear Align
Diamond USA Inc
Fine Test
LightGage Inc
NP Aerospace Ltd
Prime Aircraft Hardware Supplies
SurClean Inc

INFRARED SYSTEMS

Clear Align
Reynard Corp

LASER COMPONENTS

American Laser Enterprises LLC
American Laser Spares LLC
Analog Modules Inc

Avantier Inc

Cleanroom Connection
Diamond USA Inc
Kugler of America Ltd
Lacroix Precision Optics
Lumispot Tech
MOK Optics Co Ltd
OFS
Photonchina Co Ltd
PICO Electronics Inc
See ad on page 29
Reynard Corp
RPMC Lasers Inc
Wavelength Electronics Inc

LASERS

American Laser Enterprises LLC
American Laser Spares LLC
Cleanroom Connection
Electro Optical Components Inc (EOC)
Guernsey Coating Laboratories Inc
LightGage Inc
Lumispot Tech
OFS
RPMC Lasers Inc
SurClean Inc
Walthy Precision Co Ltd
XCEL Laser

LEDS

AbraxSys Corp
Cleanroom Connection
Electro Optical Components Inc (EOC)
Elma Electronic
See ad on page 12
EPIGAP OSA Photonics GmbH

LIGHTING

Aerospace Orbit
Guernsey Coating Laboratories Inc
Reynard Corp

NIGHT VISION

AbraxSys Corp
Firebird Optics
GAIA Converter
See ad on page 31
Guernsey Coating Laboratories Inc
LightGage Inc
MOK Optics Co Ltd
MoviTHERM
Reynard Corp
Sierra Pacific Innovations
Xenics | EXOSENS Group

OPTICAL AMPLIFIERS

OFS
Reynard Corp
RPMC Lasers Inc

OPTICAL COATINGS/ TREATMENTS

Alfa Chemistry

Avantier Inc

Bakelite Synthetics
Deposition Sciences Inc (DSI)
Electro Optical Components Inc (EOC)
Guernsey Coating Laboratories Inc
H B Fuller Co
Lacroix Precision Optics

Master Bond
See ad on page 8

MOK Optics Co Ltd
PG&O Precision Glass & Optics
Reynard Corp

OPTICAL DETECTORS

Analog Modules Inc
Canon Medical Components USA Video Sensing Division (VSD)
Electro Optical Components Inc (EOC)
First Sensor Inc
Guernsey Coating Laboratories Inc
Optical Scientific Inc
Radiant Vision Systems
Reynard Corp
Xenics | EXOSENS Group

OPTICAL FIBER

Advanced Inspection Technologies
Alfa Chemistry
Diamond USA Inc
Guernsey Coating Laboratories Inc
InnovaQuartz LLC
Lumispot Tech
Nanning Xionghua Photoelectric Technology Co.
OFS

OPTICAL FILTERS

Avantier Inc
Deposition Sciences Inc (DSI)
Electro Optical Components Inc (EOC)
Guernsey Coating Laboratories Inc
Lacroix Precision Optics
MOK Optics Co Ltd
Omnitron Systems
PG&O Precision Glass & Optics
Reynard Corp

OPTICAL IMAGING

Avantier Inc

Canon Medical Components USA Video Sensing Division (VSD)
Guernsey Coating Laboratories Inc

IMPERX Inc

Iscan Inc
Lacroix Precision Optics
LightGage Inc
Radiant Vision Systems
Reynard Corp
Walthy Precision Co Ltd
Xenics | EXOSENS Group

OPTICAL SWITCHES

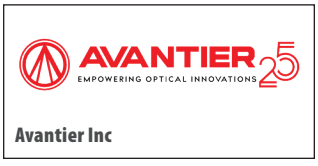
Nanning Xionghua Photoelectric Technology Co.
Omnitron Systems
Pickering Interfaces

OPTICAL TRANSCEIVERS

Omnitron Systems

OPTICS

Alfa Chemistry
American Laser Spares LLC



Avantier Inc

Cleanroom Connection
Deposition Sciences Inc (DSI)
Diamond USA Inc
Electro Optical Components Inc (EOC)
Firebird Optics
Guernsey Coating Laboratories Inc
InnovaQuartz LLC
Kugler of America Ltd
Lacroix Precision Optics
MOK Optics Co Ltd
PG&O Precision Glass & Optics
Photonchina Co Ltd
Radiant Vision Systems
Reynard Corp
Walthy Precision Co Ltd

THERMAL IMAGING

Avantier Inc
Firebird Optics
Guernsey Coating Laboratories Inc

IMPERX Inc

MoviTHERM
Reynard Corp
Sierra Pacific Innovations
Wavelength Electronics Inc
Xenics | EXOSENS Group

ULTRAVIOLET LIGHT SOURCES

Reynard Corp
RPMC Lasers Inc

NAVIGATION

AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST (ADS-B) EQUIPMENT

Crystal Image Technologies

GPS SYSTEMS

ASAP Aerospace
Aviation Spare Source
Concurrent Technologies
Crystal Image Technologies
Ironwood Electronics
PIC Wire & Cable

TERRAIN

Crystal Image Technologies
Silicon Sensing Systems Ltd

PLATFORM SYSTEMS/ SUBSYSTEMS

AUTOPILOTS

UAV Navigation-Grupo Oesía

AVIONICS

Aerospace Unlimited
AFR Enterprises
Annapolis Micro Systems Inc
See ad on page 14
ASAP 360 Unlimited
ASAP AOG
ASAP Part Services
Atrenne Computing Solutions
See ad on page 7
Aviation Parts Fulfillment
Barco Inc
Diamond USA Inc
DLS Electronic Systems Inc

EIZO Rugged Solutions

ELDEC
Extreme Engineering Solutions (X-ES)
Holt Integrated Circuits
IMPERX Inc
Integrated NSN
Ironwood Electronics
Just NSN Parts
Merrimac
New Wave Design
North Atlantic Industries Inc
NSN Stream
PIC Wire & Cable
PICO Electronics Inc
See ad on page 29
Pixus Technologies
Plane Parts 360
PNA Technologies LLC
Purchase Aero Parts
Sensitron Semiconductor
Shadin Avionics
SynQor Inc

CABIN MANAGEMENT SYSTEMS

DLS Electronic Systems Inc
PICO Electronics Inc
See ad on page 29
SynQor Inc

COUNTERMEASURES

Annapolis Micro Systems Inc
See ad on page 14
IMPERX Inc
Kratos Microwave USA (Formerly CTT, Inc.)
SynQor Inc

ELECTRONIC FLIGHT INSTRUMENT SYSTEMS (EFIS)

Aerospace Exchange
Aviation Gamut
GAIA Converter
See ad on page 31
Pixus Technologies
SynQor Inc

LANDING SYSTEMS

SynQor Inc

LIGHT MANAGEMENT SYSTEMS

Avantier Inc
MoviTHERM
Radiant Vision Systems
SynQor Inc

LIGHTING

Avantier Inc
DLS Electronic Systems Inc
SynQor Inc

NAVIGATION EQUIPMENT

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Dawn VME Products
See ad on page 21
Diamond USA Inc
Kratos Microwave USA (Formerly CTT, Inc.)
Milpower Source
RTX Collins Aerospace
Silicon Sensing Systems Ltd
SynQor Inc
UAV Navigation-Grupo Oesía

SATELLITE SYSTEMS

Aitech
Annapolis Micro Systems Inc
See ad on page 14
Diamond USA Inc

IMPERX Inc

PICO Electronics Inc
See ad on page 29
Silicon Sensing Systems Ltd
SynQor Inc

SECURITY SYSTEMS

Clear Align
IMPERX Inc
MoviTHERM
SynQor Inc

SHIPBOARD/MARITIME ELECTRONICS

Ampex Data Systems, a Delta Information Systems Company
Annapolis Micro Systems Inc
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Atrenne Computing Solutions
See ad on page 7
Axiomatic Technologies Corp
Dawn VME Products
See ad on page 21
Diamond USA Inc
EIZO Rugged Solutions
ELDEC
Extreme Engineering Solutions (X-ES)
Merrimac
Milpower Source
New Wave Design
North Atlantic Industries Inc
PIC Wire & Cable
PICO Electronics Inc
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Pixus Technologies
PNA Technologies LLC
Smiths Interconnect
SynQor Inc

TRAINING AND SIMULATION

Ampex Data Systems, a Delta Information Systems Company
Barco Inc
InVeris Training Solutions
Modelithics, Inc.
New Wave Design
North Atlantic Industries Inc
Pixus Technologies
RTX Collins Aerospace
Solid State Disks Ltd
SynQor Inc

UNMANNED VEHICLES

Ampex Data Systems, a Delta Information Systems Company
Annapolis Micro Systems Inc
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Atrenne Computing Solutions
See ad on page 7
Barco Inc
Dawn VME Products
See ad on page 21
EIZO Rugged Solutions
ELDEC
Elma Electronic
See ad on page 12
Extreme Engineering Solutions (X-ES)
High Eye
Holt Integrated Circuits
IMPERX Inc
Kratos Microwave USA (Formerly CTT, Inc.)
New Wave Design
PICO Electronics Inc
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Pixus Technologies
PNA Technologies LLC
Sensitron Semiconductor
Solid State Disks Ltd
SynQor Inc

VETRONICS

Atrenne Computing Solutions
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Barco Inc
Dawn VME Products
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EIZO Rugged Solutions
Elma Electronic
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Holt Integrated Circuits
Sensitron Semiconductor
SynQor Inc

WEATHER SYSTEMS

Columbia Weather Systems Inc
Optical Scientific Inc
Pixus Technologies
SynQor Inc

WEIGHT AND BALANCE SYSTEMS

SynQor Inc

RF AND MICROWAVE

AMPLIFIERS

AMETEK PDS
Analog Modules Inc
Cleanroom Connection
Empower RF Systems
Fairview Microwave Inc
See ad on page 19
Industrial Automation Procurement
Kratos Microwave USA (Formerly CTT, Inc.)
Merrimac
Pasternack Enterprises
See ad on page 5
Pickering Interfaces
Southwest Antennas
Spectrum Control
Teledyne e2v HiRel

ANTENNAS

Aerospace Orbit
ASAP Aerospace Hub
Cleanroom Connection
Fairview Microwave Inc
See ad on page 19
Modulinx Microwave Ltd
Pasternack Enterprises
See ad on page 5
PIC Wire & Cable
Southwest Antennas
Spectrum Control
Tech Driven EMS

BONDING AND ADHESIVES

Bakelite Synthetics

Master Bond
See ad on page 8

DIPLEXERS/MULTIPLEXERS

Fairview Microwave Inc
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Pasternack Enterprises
See ad on page 5
Pickering Interfaces
Southwest Antennas
Spectrum Control

DISCRETE COMPONENTS

ASAP Aerospace Hub
Fairview Microwave Inc
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Infineon Technologies AG
KRYTAR
Pasternack Enterprises
See ad on page 5
State of the Art Inc
See ad on page 23
Wavelength Electronics Inc

FILTERS

ASAP Aerospace Hub
Fairview Microwave Inc
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Merrimac
Modulinx Microwave Ltd
Pasternack Enterprises
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Southwest Antennas

SynQor Inc

TopFlite Components

FREQUENCY SYNTHESIZERS

Fairview Microwave Inc
See ad on page 19
Merrimac
Pasternack Enterprises
See ad on page 5

HYBRIDS

Cleanroom Connection
Fairview Microwave Inc
See ad on page 19
KRYTAR
Merrimac
Pasternack Enterprises
See ad on page 5

MICROWAVE SUBASSEMBLIES

Diamond USA Inc
Empower RF Systems
Fairview Microwave Inc
See ad on page 19
Flexiguide Ltd
Kratos Microwave USA (Formerly CTT, Inc.)
KRYTAR
Merrimac
Northeast Precious Metals
Pickering Interfaces
Trexon

MIXED-SIGNAL DEVICES

Fairview Microwave Inc
See ad on page 19
Merrimac

MMICS

Fairview Microwave Inc
See ad on page 19

OSCILLATORS/SYNTHESIZERS

ASAP Aerospace Hub
Fairview Microwave Inc
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Merrimac
Pasternack Enterprises
See ad on page 5
VIAVI Solutions Aeroflex

RF ATTENUATORS

Fairview Microwave Inc
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Merrimac
Pasternack Enterprises
See ad on page 5
Pickering Interfaces

Smiths Interconnect
State of the Art Inc
See ad on page 23
SV Microwave
Teledyne e2v HiRel
VIAVI Solutions Aeroflex

RF PACKAGING

Fairview Microwave Inc
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Pasternack Enterprises
See ad on page 5
Pixus Technologies
Smiths Interconnect
Trexon

RF SWITCHES

Fairview Microwave Inc
See ad on page 19
Merrimac
Pasternack Enterprises
See ad on page 5
Pickering Interfaces
Teledyne e2v HiRel

SIGNAL GENERATORS

ASAP Aerospace Hub
Fairview Microwave Inc
See ad on page 19
Pasternack Enterprises
See ad on page 5
Pickering Interfaces
VIAVI Solutions Aeroflex

TRANSMIT/RECEIVE MODULES

ASAP Aerospace Hub
Discovery Semiconductors Inc
Empower RF Systems
Fairview Microwave Inc
See ad on page 19
Kratos Microwave USA (Formerly CTT, Inc.)
Merrimac
Modulinx Microwave Ltd
Pasternack Enterprises
See ad on page 5
Sciens Innovations

UP/DOWN CONVERTERS

Behlman Electronics
See ad on back cover
Fairview Microwave Inc
See ad on page 19
Ironwood Electronics
Kratos Microwave USA (Formerly CTT, Inc.)
Merrimac
Pasternack Enterprises
See ad on page 5
PICO Electronics Inc
See ad on page 29
Southwest Antennas

SAFETY EQUIPMENT AND COMPONENTS

ALARM SYSTEMS

Aerospace Orbit
AIRE Environmental
Bulletproof Zone
MoviTHERM
Plane Parts 360

ALTITUDE ALERTS

Aviation Spare Source

ANTI-ICING EQUIPMENT

Plane Parts 360
SprayWorks Equipment Group

EMI/RFI

EMC PARTNER AG
Fairview Microwave Inc
See ad on page 19
GAIA Converter
See ad on page 31
SynQor Inc

FIRE DETECTION

MoviTHERM
Stat-X Fire Suppression

WINDSHEAR WARNING SYSTEMS

Optical Scientific Inc

SERVICES

ASSEMBLY/SUBCONTRACT SERVICES

ANZER

Atrenne Computing Solutions
See ad on page 7
Avantier Inc
Axiom Electronics
See ad on page 13
Connectronics Inc
InnovaQuartz LLC
Kratos Microwave USA (Formerly CTT, Inc.)
Lacroix Precision Optics

Master Bond
See ad on page 8
Nelson Design Services Inc
Northeast Precious Metals
Nova Electric
Photonchina Co Ltd
PIC Wire & Cable
Projects Unlimited

CALIBRATION SERVICES

Eastern Applied Research Inc
EMC PARTNER AG
Radiant Vision Systems

CONSULTANTS

Advanced Inspection Technologies
American Laser Enterprises LLC
Annapolis Micro Systems Inc
See ad on page 14
Avadium Design
Avantier Inc
BIS Safety Software
DeTect Inc
DLS Electronic Systems Inc
dSPACE Inc
Industrial Training Consultants Inc
InnovaQuartz LLC
Integrated NSN
Lacroix Precision Optics
McObject
Nelson Design Services Inc
Northeast Precious Metals
Philpott Ball & Werner
San Francisco Circuits
Sciens Innovations
SI2 Solutions
Sprigstack
TeamEDA Inc
VORAGO Technologies
See ad on page 30
wolfSSL
Zero Nexxus Consulting

DESIGN ENGINEERING

American Laser Enterprises LLC
Annapolis Micro Systems Inc
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ANZER
Apex Microtechnology
See ad on page 15
Avadium Design
Avantier Inc
Barco Inc
Dawn VME Products
See ad on page 21
DLS Electronic Systems Inc
Extreme Engineering Solutions (X-ES)
First Sensor Inc
InnovaQuartz LLC
Lacroix Precision Optics
New Wave Design
OTTO Controls
PIC Wire & Cable
Pixus Technologies
Reynard Corp
Sciens Innovations
Southwest Antennas
Spirit Electronics
Sprigstack
Star Lab
SurClean Inc
TeamEDA Inc
VORAGO Technologies
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VPT, Inc.
WOLF Advanced Technology
See ad on page 11

DISTRIBUTORS

Acromag Inc
Advanced Inspection Technologies
Aerospace Aviation 360
Aerospace Purchasing
American Sun Components (ASC)
ASAP Aero Supplies
ASAP Axis
ASAP Distribution
ASAP Logistic Solutions
Buy NSN
JET PARTS 360
Just Parts Unlimited
Perceptive Components Ltd
Purchase NSN Parts
Purchasing Management 360
RFQ Experts
Spares Universe
Spirit Electronics

SOFTWARE

APPLICATIONS

Annapolis Micro Systems Inc
See ad on page 14
Avantier Inc
Generic Logic Inc
Kontron America
Librestream Technologies
McObject
Sprigstack
TeamEDA Inc
wolfSSL

COMMUNICATIONS/ NETWORKING

Barco Inc
Generic Logic Inc
McObject
New Wave Design
Omnitron Systems

DATA SECURITY

Ampex Data Systems, a Delta Information Systems Company
Annapolis Micro Systems Inc
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Kontron America
McObject
Star Lab
wolfSSL

DATABASE MANAGEMENT

Mayer Group ERP
McObject
TeamEDA Inc

DATABASES

McObject
TeamEDA Inc

DESIGN AND DEVELOPMENT TOOLS

Annapolis Micro Systems Inc
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Generic Logic Inc
Praxis Optics
Radiant Vision Systems
Sciens Innovations
Sprigstack
TeamEDA Inc

DOCUMENT MANAGEMENT SYSTEMS

Arena by PTC
Industrial Training Consultants Inc
TeamEDA Inc

ELECTRONIC DESIGN AUTOMATON (EDA)

SILVACO Inc
TeamEDA Inc

GRAPHICS AND SIMULATION

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Generic Logic Inc
Industrial Training Consultants Inc
Modelithics, Inc.
Sciens Innovations

INFORMATION SECURITY

Annapolis Micro Systems Inc
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Bulletproof Zone
wolfSSL

PRODUCT LIFE CYCLE MANAGEMENT (PLM)

Arena by PTC
TeamEDA Inc

PROGRAMMING LANGUAGES

ControlF5

REAL-TIME OPERATING SYSTEMS (RTOS) AND KERNELS

McObject

SOFTWARE CODE DESIGN, TEST, AND VERIFICATION

ControlF5
dSPACE Inc
Elluminati
Fine Test
McObject
Sciens Innovations
Sprigstack
WebbyCrown Solutions
wolfSSL

TEST AND MEASUREMENT

CALIBRATION EQUIPMENT

Bartington Instruments Ltd
Cleanroom Connection
Cortec Corp
Electro Optical Components Inc (EOC)
Fairview Microwave Inc
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Industrial Automation Procurement
Palmer Wahl Instruments Inc
Pendulum Instruments Inc
Plane Parts 360
Radiant Vision Systems

COTS UPSCREENING

DLS Electronic Systems Inc
Eastern Applied Research Inc
Silicon Designs Inc
Spirit Electronics

EMC COMPLIANCE

ANZER
DLS Electronic Systems Inc
EMC PARTNER AG
IB-Lenhardt AG
Pendulum Instruments Inc

HALT/HASS

DLS Electronic Systems Inc
Projects Unlimited
Screening Systems Inc

HARDWARE-IN-THE-LOOP TESTING

dSPACE Inc

METERS

Cleanroom Connection
KRYTAR
Lumispot Tech
Palmer Wahl Instruments Inc
PCE Instruments
Pendulum Instruments Inc
Plane Parts 360
Radiant Vision Systems

NETWORK ANALYZERS

Aukua Systems Inc
Cleanroom Connection
EXFO America
NextComputing
PCE Instruments
VIAVI Solutions Inc

NETWORK/DATA BUS ANALYZERS

Aukua Systems Inc
New Wave Design
NextComputing
VIAVI Solutions Aeroflex

OPTICAL TEST AND MEASUREMENT

Alfa Chemistry
American Laser Enterprises LLC
Aukua Systems Inc

Canon Medical Components USA
Video Sensing Division (VSD)
Electro Optical Components Inc (EOC)
EXFO America
Kingfisher International Pty Ltd
LightGage Inc
MoviTHERM
Optical Scientific Inc
PCE Instruments
Radiant Vision Systems
Reynard Corp
Walthy Precision Co Ltd

OSCILLOSCOPES

PCE Instruments
VIAVI Solutions Aeroflex

PORTABLE TEST SYSTEMS

Aukua Systems Inc
Cleanroom Connection
EMC PARTNER AG
MoviTHERM
New Wave Design
NextComputing
PCE Instruments
Pendulum Instruments Inc
Pixus Technologies
Radiant Vision Systems
Silicon Designs Inc
VIAVI Solutions Aeroflex

SOFTWARE-DRIVEN INSTRUMENTATION

Curtiss-Wright Defense Solutions
New Wave Design
Radiant Vision Systems
VIAVI Solutions Aeroflex
Wavelength Electronics Inc

SOFTWARE-IN-THE-LOOP TESTING

dSPACE Inc

SPECTRUM ANALYZERS

Alfa Chemistry
Eastern Applied Research Inc
EXFO America
PCE Instruments
VIAVI Solutions Aeroflex

THERMAL MANAGEMENT/ COOLING SYSTEMS

CONDUCTION COOLING

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Atrenne Computing Solutions
See ad on page 7
CELSIA Inc
Coherent Thermal Solutions, Inc
(formerly Marlow Industries)
Dawn VME Products
See ad on page 21
Electro Optical Components Inc (EOC)

Extreme Engineering Solutions (X-ES)
Industrial Automation Procurement
Pixus Technologies
PNA Technologies LLC
Tech Driven EMS

CONVECTION COOLING

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Atrenne Computing Solutions
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CELSIA Inc
Coherent Thermal Solutions, Inc
(formerly Marlow Industries)
Dawn VME Products
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Electro Optical Components Inc (EOC)
Elma Electronic
See ad on page 12
Extreme Engineering Solutions (X-ES)
Pixus Technologies

LIQUID COOLING

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Atrenne Computing Solutions
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CELSIA Inc
Coherent Thermal Solutions, Inc
(formerly Marlow Industries)
Elma Electronic
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Pixus Technologies

AbraxSys Corp; Pipersville, PA, US; https://www.abraxsyscorp.com

Acromag Inc; Wixom, MI, US; https://www.acromag.com

Advanced Inspection Technologies; Melbourne, FL, US; https://aitproducts.com

Aero Logistic Support; Anaheim, CA, US; https://www.aerologisticsupport.com

Aero World 360; Anaheim, CA, US; https://www.aeroworld360.com

Aerospace Aviation 360; Anaheim, CA, US; https://www.aerospace-aviation360.com

Aerospace Exchange; Anaheim, CA, US; https://www.aerospaceexchange.com

Aerospace Orbit; Anaheim, CA, US; https://www.aerospaceorbit.com

Aerospace Purchasing; Anaheim, CA, US; https://www.aerospacepurchasing.com

Aerospace Unlimited; Anaheim, CA, US; https://www.aerospaceunlimited.com

AFR Enterprises; Anaheim, CA, US; https://www.afrenterprises.com

Ai Aviation Purchasing; Anaheim, CA, US; https://www.aiaviationpurchasing.com

AirBorn – A Molex Company; 3500 Airborn Circle, Georgetown, TX, 78626, US; TEL: 512-863-5585; abinfo@airborn.com; https://www.airborn.com
See ad on page 9
AirBorn is an employee-owned company whose core business is engineering and manufacturing specialized connectors and electronic components for OEMs worldwide. We serve companies in industries including military/defense, commercial air, medical, industrial, and space. Our all-inclusive "Model-to-Market®" service shepherds your product from the barest of concepts through to mass production.

AIRE Environmental; Meridian, ID, US; https://www.aireenvironmental.com

Aitech; Chatsworth, CA, US; https://www.aitechsystems.com

Alfa Chemistry; Holbrook, NY, US; https://www.alfa-chemistry.com

Alfa Cytology; Hauppauge, NY, US; https://www.alfacytology.com

American Laser Enterprises LLC; Brownsburg, IN, US; http://www.a-l-e.net

American Laser Spares LLC; Brownsburg, IN, US; https://www.americanlaserspares.com

American Sun Components (ASC); Tamarac, FL, US; https://www.ascglobal.com

Amerigo Scientific; Hauppauge, NY, US; https://www.amerigoscientific.com

AMETEK PDS; Harleysville, PA, US; https://www.ametekpds.com

Ampex Data Systems, a Delta Information Systems Company; Hayward, CA, US; https://www.ampex.com

AMWEI Thermistor Sensor; Shenzhen, Guangdong, China; https://www.amwei.com

Analog Modules Inc; Longwood, FL, US; https://www.analogmodules.com

Annapolis Micro Systems Inc; 190 Admiral Cochrane Dr, Suite 130, Annapolis, MD, 21401, US; TEL: 410-841-2514; https://www.annapmicro.com
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Annapolis Micro Systems maintains a full ecosystem of 3U & 6U 100Gb Ethernet SOSA™ aligned products for challenging data digitization, digital signal processing, and data recording applications. New boards integrate Versal FPGAs or 64 GS/s Direct RF capability. Products take a Modular Open Systems Approach (MOSA), including SOSA™ & CMOSS.

ANZER; Akron, OH, US; https://www.anzer-usa.com

Apex Microtechnology; 5980 N Shannon Rd, Tucson, AZ, 85741, US; TEL: 520-690-8600; https://apexanalog.com
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Apex Microtechnology is a leader for high-performance power op-amps, PWM amplifiers, integrated power modules, precision ICs, and voltage references. Product form factors include monolithic ICs, board "open-frame" modules, and hybrid designs for a wide range of applications in the aerospace & defense, medical, industrial, and semi-cap markets.

Arena by PTC; Boston, MA, US; https://www.arenasolutions.com

ASAP 360 Unlimited; Anaheim, CA, US; https://www.asap360unlimited.com

ASAP 3Sixty; Anaheim, CA, US; http://www.asap3sixty.com

ASAP Aero Supplies; Anaheim, CA, US; https://www.asapaerosupplies.com

ASAP Aerospace; Anaheim, CA, US; https://www.asap-aerospace.com

ASAP Aerospace Hub; Anaheim, CA, US; http://www.asapaerospacehub.com

ASAP AOG; Anaheim, CA, US; https://www.asapaog.com

ASAP Aviation Procurement; Anaheim, CA, US; https://www.asap-aviationprocurement.com

ASAP Axis; Anaheim, CA, US; http://www.asapaxis.com

ASAP Buying; Anaheim, CA, US; http://www.asapbuying.com

ASAP Components; Anaheim, CA, US; http://www.asap-components.com

ASAP Distribution; Anaheim, CA, US; https://www.asap-distribution.com

ASAP Electromechanical Parts; Anaheim, CA, US; https://www.asapelectromechanical.com

ASAP Fasteners; Anaheim, CA, US; https://www.asap-fasteners.com

ASAP Integrated; Anaheim, CA, US; https://www.asapintegrated.com

ASAP Logistic Solutions; Anaheim, CA, US; http://www.asap-logisticsolutions.com

ASAP Part Services; Anaheim, CA, US; https://www.asap-partservices.com

ASAP Parts 360; Anaheim, CA, US; https://www.asapparts360.com

ASAP Semiconductor; Anaheim, CA, US; https://www.asapsemi.com

ASAP Supply Chain; Anaheim, CA, US; https://www.asap-supplychain.com

Atrenne® A Celestica Company

Atrenne Computing Solutions; 10 Mupac Dr, Brockton, MA, 02301, US; 508-588-6110; sales@atrenne-cs.com; https://www.atrenne.com
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Premier vendor of custom and COTS chassis enclosures, backplanes, front panels, and metal extrusions for the military and critical computing markets. Atrenne Computing Solutions offers deep engineering expertise in mechanical design, thermal management, signal integrity, complex interconnection, power management technologies, as well as vertically integrated manufacturing and assembly.

Aukua Systems Inc; Austin, TX, US; https://www.aukua.com

Avadium Design; Scottsdale, AZ, US; https://www.avadiumdesign.com

AVANTIER 25 EMPOWERING OPTICAL INNOVATIONS

Avantier Inc; 1100 US Hwy 22, North Plainfield, NJ, 07060, US; TEL: 732-321-6915; sales@avantierinc.com; https://www.avantierinc.com
Avantier Inc. is a leader in providing high-precision custom optical systems for aerospace and defense, including SiC mirrors and telescopes. We offer advanced optical design, engineering, lens assembly, prototyping, image processing, and manufacturing services. Avantier is ISO 9001:2015 and ISO 13485:2016 certified.

Aviation Gamut; Anaheim, CA, US; https://www.aviationgamut.com

Aviation Opolis; Anaheim, CA, US; https://www.aviationopolis.com

Aviation Parts Fulfillment; Anaheim, CA, US; https://www.aviationpartsfulfillment.com

Aviation Purchasing Platform; Anaheim, CA, US; https://www.aviationpurchasingplatform.com

Aviation Spare Source; Anaheim, CA, US; https://www.aviationsparesource.com

Axiom Electronics; 9845 Northeast Eckert Dr, Suite 200, Hillsboro, OR, 97006, US; TEL: 503-643-6600; info@axiomsmt.com; https://axiomelectronics.com
See ad on page 13
Axiom Electronics assembles and tests complex circuit boards and complete systems for prototype, pilot run and production builds. We can work from your designs using mature or newly-introduced technologies, and we can build to virtually any standards and specifications you choose.

Axiomatic Technologies Corp; Mississauga, ON, Canada; https://www.axiomatic.com

Bakelite Synthetics; Atlanta, GA, US; https://www.bakelite.com

Barco Inc; Duluth, GA, US; https://www.barco.com

Bartington Instruments Ltd; Witney, Oxon, UK; https://www.bartington.com

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Cyber security remains a top priority for airports and airlines

BY **Jamie Whitney**

GENEVA–Airlines and airports are increasing investments in cyber security, biometrics, and sustainable IT to address growing digital threats and rising passenger numbers, according to SITA's 2024 Air Transport IT Insights report.

The Geneva-based company's report found that 74 percent of airlines and 72 percent of airports expect to increase IT spending over the next two years, following a rise in 2024 that brought total industry IT investment to an estimated $37 billion for airlines and nearly $9 billion for airports.

Cyber security remains a key priority, with 66 percent of airlines and 73 percent of airports ranking it among their top three focus areas. Many airlines and airports are upgrading IT infrastructure, shifting to cloud systems, and strengthening data protection as cyber threats grow more sophisticated. Biometric and artificial intelligence (AI) technologies are also advancing passenger experience and operational efficiency.

"This year's findings highlight a pivotal moment for the aviation industry," said SITA CEO David Lavorel. The company's report is available here: https://www.sita.aero/resources/surveys-reports/air-transport-it-insights-2024/. "As cyber threats become more complex, airlines and airports are taking decisive action to protect their operations and passengers. At the same time, biometrics and AI tech are simplifying the travel experience, helping the industry meet growing demand and build resilience for the future."

Biometric technology is growing in passenger processing, with over half of airports planning to implement biometric check-in and bag drop by 2026. Seventy percent of airlines expect to adopt biometric identity management systems in the same period, which could

reduce congestion and cut wait times by up to 60 percent.

Airlines and airports are also leveraging AI and data analytics for efficiency improvements. Ninety percent of airlines have adopted data platforms, with 42 percent exploring AI-driven data organization. Airlines use AI tools to enhance flight operations, customer service, and fuel efficiency, while airports deploy predictive analytics for real-time decision-making and passenger flow management.

"The air transport industry generates massive amounts of data, but a lot of it isn't fully utilized," Lavorel said. "With AI and machine learning, we can take large steps in improving efficiency, sustainability, security, and cost while enhancing the passenger experience."

Sustainability efforts continue to be a major focus as the industry works towards net-zero emissions by 2050. The report indicated that 75 percent of airlines utilize real-time software for flight optimization and carbon emissions tracking, while 62 percent have partnered with Sustainable Aviation Fuel (SAF) suppliers, signifying significant progress compared to last year. Airports are also advancing their sustainability initiatives, with 54 percent implementing energy management systems, an increase from 29 percent in 2023.

NASA taps Aptima to help define safe human-to-UAV ratios

BY **Jamie Whitney**

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WOBURN, Mass.–The National Aeronautics and Space Administration (NASA) is asking Aptima in Woburn, Mass., to help develop a science-based framework for determining how many uncrewed aerial vehicles (UAVs) a single human operator can safely and effectively control.

NASA awarded Aptima a contract through the agency's Langley Research Center in Hampton, Va. It will address a growing challenge in UAV operations: managing fleets of drones with fewer human operators. The work is part of NASA's Transformational Tools and Technologies project and involves collaboration with an m:N Working Group composed of experts from government, industry, and academia.

"The m:N ratio problem is about minimizing the number of humans that can safely, reliably, and effectively oversee growing numbers of UAVs without undue cognitive overload or stress," said Dr. Samantha Emerson, a scientist in Aptima's Performance Augmentation Systems Division and the project's principal investigator. "The ratio itself, however, is a function of other factors and how they interact."

Unlike traditional manned aviation, which typically involves a one-to-one pilot-to-aircraft ratio, UAV operations are moving toward models where a single operator may control many drones simultaneously. However, Emerson said there is currently no systematic method for defining that ratio.

Key factors in determining the safe ratio include the complexity of the UAV's design and mission, the tasks required of the human operator, and how often the operator must intervene in autonomous operations.

"Even in a world of autonomous machines, the human element remains crucial," Emerson said. "Despite their autonomy, UAVs still require a human to oversee the equipment, sensors, and airspace environment."

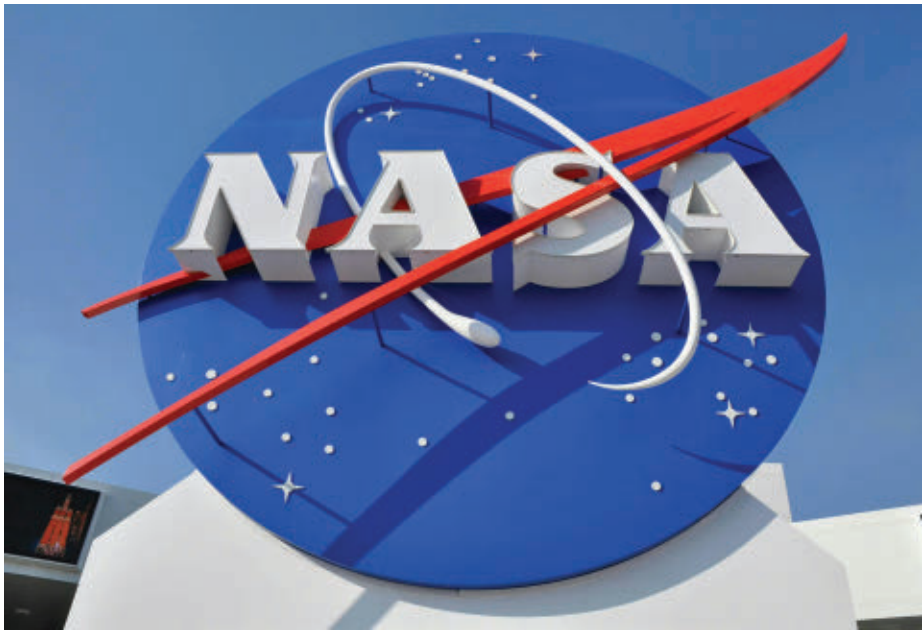
When complete, the framework developed by Aptima and the m:N Working Group is expected to guide commercial, government, and military organizations as they develop and operate UAV systems.

"Companies need a way to show regulators that they've accounted for and evaluated all these factors in a systematic way and that their planned operations are at least as safe as, if not safer than, a 1:1 ratio," Emerson said. "The goal of this joint work is to lay out the factors that need to be considered when determining what that safe ratio of humans to UAVs is."

Aptima is also using an artificial intelligence tool–a large language model agent–to help analyze research and synthesize information for the project.

White House seeks to cut nearly one quarter out of NASA's budget

BY **Jamie Whitney**



▲ **President Trump's latest budget proposal would cut the NASA budget by nearly 25 percent.**

WASHINGTON–The White House's proposed $1.7 trillion federal budget for Fiscal Year 2026 includes a significant reduction in funding for the National Aeronautics and Space Administration (NASA). The budget now must undergo the congressional appropriations process, where lawmakers will ultimately determine funding levels.

The proposal would reduce NASA's 2026 budget from $24.8 billion to $18.8 billion — a 24.3 percent decrease — and eliminate or scale back several high-profile programs, including the Mars Sample Return mission, future Artemis moon missions, and the Lunar Gateway space station.

NASA's Science Mission Directorate would see a 47 percent reduction, impacting missions that monitor climate change, natural disasters, and global food production.

The Trump administration's plan would shift NASA toward greater reliance on commercial partners and prioritize human missions to the moon and Mars. More than $7 billion would be allocated for lunar exploration, and a $1 billion increase would be allocated for Mars-focused programs. NASA would also begin switching the International Space Station to commercial successors by 2030.

The Mars Sample Return mission, which was originally designed to bring Martian rock and soil samples back to Earth, would be canceled. NASA's Space Launch System (SLS) rocket and Orion crew capsule are expected to be retired after Artemis III. The Lunar Gateway—despite its first module arriving in Arizona from Italy in April—would be scrapped. While earlier reports suggested that the Artemis program would be scaled back to include only Artemis II and III, a NASA spokesperson has since clarified that "The Artemis campaign will continue under a different architecture." The spokesperson also told Military + Aerospace Electronics that additional details about the revised program are expected to be released in the coming weeks.

Despite the cuts, acting NASA Administrator Janet Petro emphasized the agency's ongoing goals. "This proposal includes investments to simultaneously pursue exploration of the Moon and Mars while still prioritizing critical science and technology research," she said.

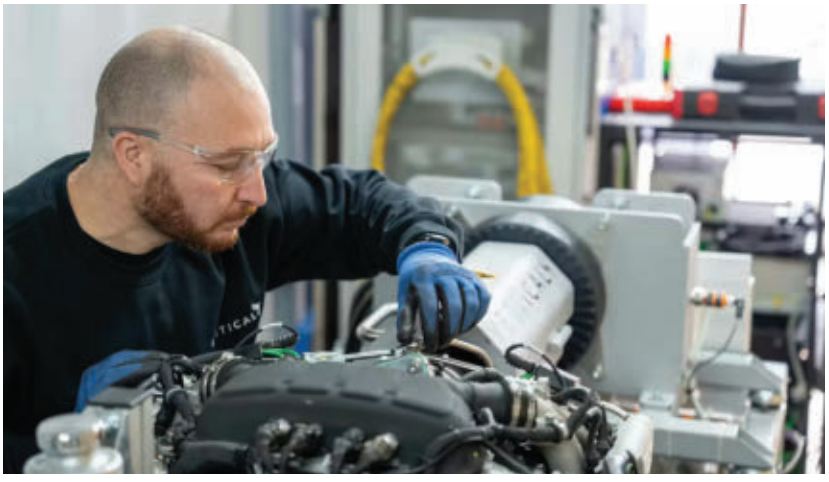
The proposed budget also eliminates funding for climate-focused "green aviation" projects and diversity, equity, inclusion, and accessibility (DEIA) initiatives, redirecting those funds toward what the administration describes as NASA's "core mission."

Critics, including the American Astronomical Society, warn that the broader cuts across federal science agencies–56 percent to the National Science Foundation and 14 percent to the Department of Energy's Office of Science–could cause long-term damage to U.S. scientific leadership.

"These proposed cuts will result in the loss of American leadership in science," the society stated. "The U.S. will lose at least a generation of talent to other countries that are increasing their investments."

Vertical Aerospace developing hybrid-electric VTOL aircraft

BY **Jamie Whitney**



Vertical Aerospace

▲ **A technician works on a Vertical Aerospace propulsion system.**

LONDON–Vertical Aerospace in London is developing a hybrid-electric variant of the company's VX4 vertical take-off and landing (VTOL) aircraft to extend range and payload capacity.

The new plane aims to serve defense, logistics, and emergency medical missions that require longer ranges and heavier loads than current all-electric VTOL aircraft can provide.

The hybrid-electric version builds on the company's existing all-electric VX4. The second-generation hybrid propulsion system has been under development for 18 months at the Vertical Energy Centre. It is expected to be retrofitted into a full-scale VX4 prototype for flight testing in the second quarter of 2026.

Key targets for the hybrid VX4 include a range of as far as 1,000 miles and a payload capacity of as heavy as 1,100 kilograms. Vertical says the platform will offer low acoustic and thermal signatures, crewed and uncrewed flexibility, and increased mission resilience based on the VX4's existing redundancy and damage tolerance.

"The demand for long-range, high-payload, quiet aircraft is growing rapidly–especially across defense and critical logistics," said Vertical Aerospace CEO Stuart Simpson. "Our hybrid-electric VTOL strategy builds on our existing electric platform, world-class battery technology and large, versatile airframe, allowing us to offer uniquely scalable solutions that unlock a new frontier in air mobility."

Vertical's hybrid system includes advanced control algorithms integrated between its proprietary battery and power unit. The battery platform, developed in-house, is designed to meet rigorous safety standards set by the European Union Aviation Safety Agency (EASA) and the UK Civil Aviation Authority (CAA). The hybrid system has already undergone bench testing to validate its architecture and performance.

Vertical says the aircraft's large airframe enables integration of the hybrid system without a major redesign, preserving operational scalability and versatility. The company also positions the hybrid VX4 as a strong candidate for European defense programs, amid rising defense budgets and a focus on sovereign industrial capabilities.

The hybrid aircraft will complement the existing all-electric VX4, which remains on track to receive Type Certification in the UK and Europe by 2028, with global validation to follow.

Natilus announces partnership with Palantir to integrate AI into design

Aerospace manufacturer Natilus in San Diego has entered into a strategic partnership with Palantir Technologies in Denver to accelerate development of its blended-wing-body (BWB) aircraft using artificial intelligence to streamline design, production, and supply chain management. The partnership includes the deployment of Palantir's Warp Speed operating system at Natilus's manufacturing operations. The software platform will use real-time data, AI-driven analytics, and modeling to enhance production efficiency, increase supply chain resiliency, and support long-term goals such as predictive maintenance and in-flight performance monitoring. Natilus is developing a family of efficient BWB aircraft, which it says is designed to reduce fuel consumption by up to 30% and increase cargo volume by 60% compared to traditional tube-and-wing aircraft. The aircraft utilizes advanced carbon fiber composite construction, simplified control surfaces, and embedded electric

taxiing systems to reduce ground emissions. The BWB design also enables shorter runway operations, improving airport compatibility. In addition to Palantir, Natilus has partnered with Janicki Industries in Hamilton, Wash., for composite airframe manufacturing, Collins Aerospace in Charlotte, N.C., for advanced flight control systems, and ZeroAvia in Hollister, Calif., for potential hydrogen-electric propulsion integration in future models. The company is also working with the Federal Aviation Administration (FAA) on type certification pathways and recently completed wind tunnel testing in partnership with the U.S. Air Force through its AFWERX program.

Firefly selects Honeybee Robotics to provide rover for lunar mission

Firefly Aerospace in Cedar Park, Texas, has contracted Honeybee Robotics, a subsidiary of Blue Origin in Longmont, Colo., to provide a lunar rover for NASA's upcoming mission to explore the Gruithuisen Domes, an unexplored region on the Moon's near side. Scheduled for 2028, the mission is part of the National Aeronautics and Space Administration's (NASA) Commercial Lunar Payload Services (CLPS) initiative. Firefly's Blue Ghost lander will deliver the rover to the lunar surface following deployment from the company's Elytra Dark transfer vehicle. The lander will operate for approximately 14 days, during which Honeybee's rover will carry NASA instruments to study the domes' unique geological composition. The rover will transport components of NASA's Lunar Vulkan Imaging and Spectroscopy Explorer (Lunar-VISE) suite, including cameras to document the landscape and spectrometers to analyze gamma ray and neutron emissions. It will traverse the southern edge of the Gruithuisen Gamma Dome, cross a boulder field, and reach the rim of a crater before returning to the lander to capture observations under varying sunlight conditions. This will be Firefly's third lunar mission, following its successful 2025 landing in Mare Crisium and a second mission scheduled for 2026.

ZeroAvia and RVL Aviation partner on hydrogen-electric Cessna Caravan flights in UK

Aviation firm ZeroAvia in Hollister, Calif., announced that it has signed an agreement with RVL Aviation in Derby, U.K., to retrofit Cessna Grand Caravan 208B aircraft with its hydrogen-electric ZA600 powertrain. Following certification of the engine, airframe integration, and services, the aircraft will operate commercial flights within the British Isles. The ZA600 uses hydrogen fuel cells to generate electricity for electric motors, with water as the only byproduct. RVL, based at East Midlands Airport, operates a fleet for government and private sector clients, providing services such as surveillance and airborne survey. It will lease the aircraft through zero-emission specialist MONTE. ZeroAvia has already flight-tested a prototype ZA600 engine aboard a Dornier 228 at its UK site. The engine is currently under certification review by the UK Civil Aviation Authority. The company is also developing the larger ZA2000 powertrain for aircraft seating up to 80 passengers, including the ATR72 and Dash 8-400. The companies said nearly 1,000 Cessna Caravan aircraft operating global cargo routes could eventually be retrofitted with the ZA600 system. Additional routes and aircraft may be added as technology and regulatory conditions allow.

Collins Aerospace joins Airbus-led Digital Alliance to advance predictive aircraft maintenance

Collins Aerospace, an RTX business based in Charlotte, N.C., has joined the Airbus-led Digital Alliance for Aviation, expanding its role in developing predictive maintenance solutions for airlines. The Digital Alliance, powered by Airbus' Skywise data platform, brings together major aerospace firms to create integrated digital tools aimed at improving airline operations and reducing maintenance costs. Collins becomes the fifth group member, joining Airbus in Tolouse, France, Delta TechOps in Atlanta, GE Aerospace in Cincinnati, and Liebherr in Bulle, Switzerland. Collins Aerospace specializes in gathering and analyzing aircraft health data from a variety of systems, including hydraulics, air management, electric power, anti-ice, and landing and navigation systems. The company said its expertise helps airlines use predictive analytics to improve fleet reliability and reduce operational disruptions. Created in 2019, the Digital Alliance aims to use the Skywise platform to support airlines in managing maintenance operations by improving data transparency and enabling data-driven decisions. The addition of Collins Aerospace enhances the group's capabilities across a broader range of aircraft components and fleet types, including Airbus and non-Airbus models. Airbus said the alliance's long-term goal is to develop health-monitoring solutions that increase fleet stability, reduce maintenance costs, and improve overall operational efficiency for airlines worldwide.