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ADVANCED HELICOPTER TECHNOLOGIES

Future U.S. military helicopters will have avionics that reflect the latest electronic technologies. PG. 14



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[Form Factors]

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Intelligent Aerospace combines forces with Military & Aerospace Electronics



BY John Keller
EDITOR IN CHIEF

Military & Aerospace Electronics and *Intelligent Aerospace* are combining forces to give readers expanded coverage of electronic and electro-optical enabling technologies for military, commercial aviation, and space applications. Readers no longer must go to two separate websites; they will find everything of interest in the *Military & Aerospace Electronics* website at www.militaryaerospace.com.

In addition, *Military & Aerospace Electronics* magazine, starting with this issue, offers expanded coverage of enabling technologies for commercial aviation and space applications, including Global Navigation Satellite System (GNSS) aircraft navigation, air traffic control, radiation-hardened integrated circuits, airport security, automated baggage handling, digital communications, urban air mobility, sensors and signal processing for perimeter security, and more.

This doesn't mean any changes to the *Military & Aerospace Electronics* content you're used to seeing, such as electronic warfare (EW); shipboard electronics; artificial intelligence and machine learning; sensors, signal processing, and guidance for future hypersonic munitions; satellite communications (SATCOM); additive manufacturing for aerospace and defense; unmanned vehicles; and trusted computing.

You may have noticed a new addition to the navigation bar on the homepage of *Military & Aerospace Electronics*: Commercial Aerospace. That tab and the main page will be the hub for our coverage of the commercial technology side of aerospace. This includes: new space, satellite communications, avionics, passenger and uncrewed aircraft, air traffic control and airports.

This move to combine forces didn't just come out of nowhere. Research has shown a significant

overlap between the audiences of *Military & Aerospace Electronics* and *Intelligent Aerospace* such that it would work to the benefit of our readers to include *Intelligent Aerospace's* commercial-focused aviation and space technology news to the *Military & Aerospace Electronics* website plus our print and digital editions of the magazine.

The weekly newsletter of *Intelligent Aerospace* has been renamed Commercial Aerospace, and will continue to provide readers with the latest technology news and analysis of commercial aviation and New Space.

Other periodic newsletter of *Military & Aerospace Electronics* — Defense Executive, the *Military & Aerospace Electronics* weekly and week wrapup, embedded computing, unmanned vehicles, electronic warfare, and trusted computing will continue publishing on their normal schedule.

Staffers John Keller and Jamie Whitney will continue their normal beats. Keller will concentrate on the military side of enabling technologies, while Whitney — from his new headquarters in Sheridan, Wyo. — will handle the lion's share of commercial aviation and New Space coverage.

Our overall goal of combining *Military & Aerospace Electronics* and *Intelligent Aerospace* is to serve our readers better. In fact, this brings us back to our roots of our first issue in January 1990 when we sought to cover military electronics and aerospace electronics equally — hence the name: *Military & Aerospace Electronics*.

Let us know how we're doing, and if you'd like to see more of any kind of enabling technologies for military, commercial aviation, and space applications. John Keller can be reached at jkeller@endeavorb2b.com, and Jamie Whitney gets his emails at jwhitney@endeavorb2b.com. ◀

Programmable Linear InGaAs Balanced Optical Receiver Lab Buddy with Automatic Gain Control up to 56 Gbaud

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- Coherent PON
- Direct detection for DPSK and DQPSK
- Analog and RF photonics applications to 33GHz
- Free space communications links





France orders the Airbus H160M for the nation's military Joint Light Helicopter program

BY Jamie Whitney

MARIGNANE, France – The French Armament General Directorate (DGA) has signed a contract with Airbus Helicopters in Marignane, France, to build the H160M for the French Light Joint Helicopter program (HIL).

The contract includes several prototypes and a first batch of 30 helicopters — 21 for the French army, eight for the navy, and one for the air force. French military leaders say they plan to order 169 H160M helicopters, with first in 2027.

The first of a new generation of helicopters, the H160M is derived from the EASA-certified H160. It offers low cost of operations and is optimized flight safety.

The H160 was designed as a modular helicopter for missions ranging from commando infiltration to air intercept, fire support, and anti-ship warfare. Airbus Helicopters will guarantee a high level of availability through a maintenance contract.

Trials conducted in the Moroccan desert in July 2021 demonstrated the efficiency of the H160's inlet barrier filtration system in protecting the Safran Arrano engines from sand and dust.

▲ **The H160M Guépard French military helicopter will have the Safran Euroflir 410 electro-optical system, the Thales FlytX cockpit avionics suite, and AirMaster C radar.**

The tests in the desert also demonstrated the efficiency of the automatic flight control system during the takeoff and landing operations with limited visibility from sand clouds.

The military version of the H160 will have a reduced acoustic signature from its Blue Edge blades. The H160's stability, maneuverability, and an automatic flight control system will be key assets for the military version.

The H160M will have the Airbus Helicopters HForce weapon system that enables use of a large choice of weapons. Equipment will also include a hoist and a fast roping arm.

The H160M Guépard will be equipped with the Safran Euroflir 410 electro-optical system, the Thales FlytX

cockpit avionics suite, and AirMaster C radar.

The pilots will use the Thales TopOwl helmet-mounted sight & display. The Guépard will also carry a self-protection suite, a satellite communication system, and tactical data link system. ◀

The weapon package will include the MBDA ANL anti-ship missile, as well as pod- and door-mounted guns. For more information contact Airbus Helicopters online at www.airbus.com/en/products-services/helicopters.



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◀ **Lockheed Martin is ready to integrate future hypersonic missiles aboard the Navy's three stealthy Zumwalt-class (DDG 1000) destroyers.**

Lockheed Martin set to deploy hypersonic missiles aboard Zumwalt-class destroyers

BY John Keller

WASHINGTON – U.S. Navy surface warship experts are asking engineers at Lockheed Martin Corp. to start integrating future hypersonic missiles aboard the Navy's three stealthy Zumwalt-class (DDG 1000) destroyers.

Officials of the Navy Strategic Systems Programs in Washington announced a \$22.8 million contract to the Lockheed Martin Space Systems segment in Littleton, Colo., for missile production long-lead materials, program management, and system engineering for the Navy Conventional Prompt Strike Weapon System Platform-Specific Development and Production project.

Lockheed Martin will integrate hypersonic weapons aboard the destroyers USS Zumwalt (DDG 1000), the USS Michael Monsoor (DDG 1001), and the USS Lyndon B. Johnson (DDG 1002). Long-lead items are difficult and time-consuming to obtain, and are funded early in the design process to keep overall production on schedule. Contracts to build Conventional Prompt Strike weapons will come later.

The three Zumwalt-class destroyers are multi-mission stealth ships that focus on land attack, with secondary roles of surface warfare, anti-aircraft warfare, and naval gunfire support. The label destroyer is somewhat of a misnomer because the Zumwalt-class vessels are about the size of small World War II battleships.

Installing hypersonic weapons aboard these three vessels is part of the Navy's Conventional Prompt Strike project to launch

attacks against targets around the world in less than an hour. The focus is on attacking high-value, or fleeting targets, with extremely fast hypersonic weapons, which can fly faster than five times the speed of sound.

Lockheed Martin will focus on systems architecture; subsystem, component, and test requirements; design analysis, and design integration; system integration, verification, and validation testing to support initial operating capability.

Other areas of the project seek to increase today's industrial base capability for Navy and Army long-range hypersonic weapons; build ready-to-fire hypersonic weapons with diameters larger than 30 inches. This would consist of an encapsulated missile with a hypersonic glide body provided as government furnished equipment; and canister to support the Navy Zumwalt-class ship and future Army weapon systems.

The project will build an advanced payload module with weapons in a three-pack configuration, with interfaces between the ship and the weapons, with support structure, protection, compressed-air ejectors, and environmental control to support the Zumwalt-class destroyer. ◀

On this contract Lockheed Martin will do the work in Littleton, Colo., and should be finished by May 2022. For more information contact Lockheed Martin Space Systems online at www.lockheedmartin.com, or the Navy Strategic Systems Programs office at www.ssp.navy.mil.

Russian passport control using artificial intelligence (AI) technology

The Smart Engines AI-driven software was equipped in passport e-gates Sapsan at Sheremetyevo International Airport SO for contactless border control on international flights. Passport e-gates will also be expanded for use in most Russian airports under the plans in an attempt to significantly improve the efficiency of Border Force officials' services by reducing the manual identity and security checks. OCR technology scans data from passports, allowing to automate the process of checking documents. The advanced AI software eliminates security breaches and is completely secure for both passengers and airports' border control systems. This solution helps border force officials to comply with the local & international security standards (GDPR, CCPA, and others) for personal data processing to satisfy the strict demands of regulators. SDK doesn't transfer data and images for processing to Smart Engines or to any third-party services, doesn't save data or images (the processing is carried out in the e-gates' local RAM) and doesn't require internet access. The automated system for passport control Sapsan with built-in Smart Engines OCR was developed by GazIntech. As of now, Smart ID Engine has been installed in 20 Sapsan passport e-gates. Based on the latest biometric recognition algorithms and high-tech hardware, Sapsan accelerates passenger control to help reduce waiting time at borders.

International Space Station connected via the SpaceDataHighway

The Airbus SpaceDataHighway – developed with the support of the European Space Agency (ESA) – provides broadband connectivity services between

the International Space Station (ISS) and the Earth. With the Columbus Ka-band (ColKa) terminal now installed and fully tested on-board the ISS, a SpaceDataHighway satellite will start to relay data via a bi-directional link in real time between the ISS Columbus Laboratory and the Columbus Control

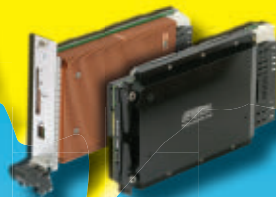
Center located at the German Aerospace Center DLR near Munich as well as research centers across Europe. ESA will now have a direct and sovereign access to the ISS, thus increasing the operational flexibility allowing more astronauts, scientists and researchers to

Continued on page 9

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BAE Systems to design radiation-hardened microelectronics for military and space

BY John Keller

ROCK ISLAND ARSENAL, Ill. — U.S. Army microelectronics experts needed a company to develop next-generation radiation-hardened microelectronics components for military and space applications. They found their solution from the BAE Systems Electronic Systems segment in Merrimack, N.H.

Officials of the U.S. Army Contracting Command at Rock Island Arsenal, Ill., have announced a \$60 million contract to BAE Systems to develop next-generation, radiation hardened by design (RHBD) microelectronics that use the Intel Corp. commercial foundry, Intel Foundry Services.

The goal is to expand onshore access to state-of-the-art microelectronics technology for the U.S. government and aerospace community, BAE Systems officials say.

This type of technology is available today through limited sources in the U.S., which can lead to supply chain challenges and time lags for delivering next-generation microelectronics for space.

With this contract, the BAE Systems FAST Labs research organization will harness Intel's commercial foundry process to build a new design library to develop advanced high-reliability microelectronics and expand the domestic supply of this technology for the defense and aerospace community.

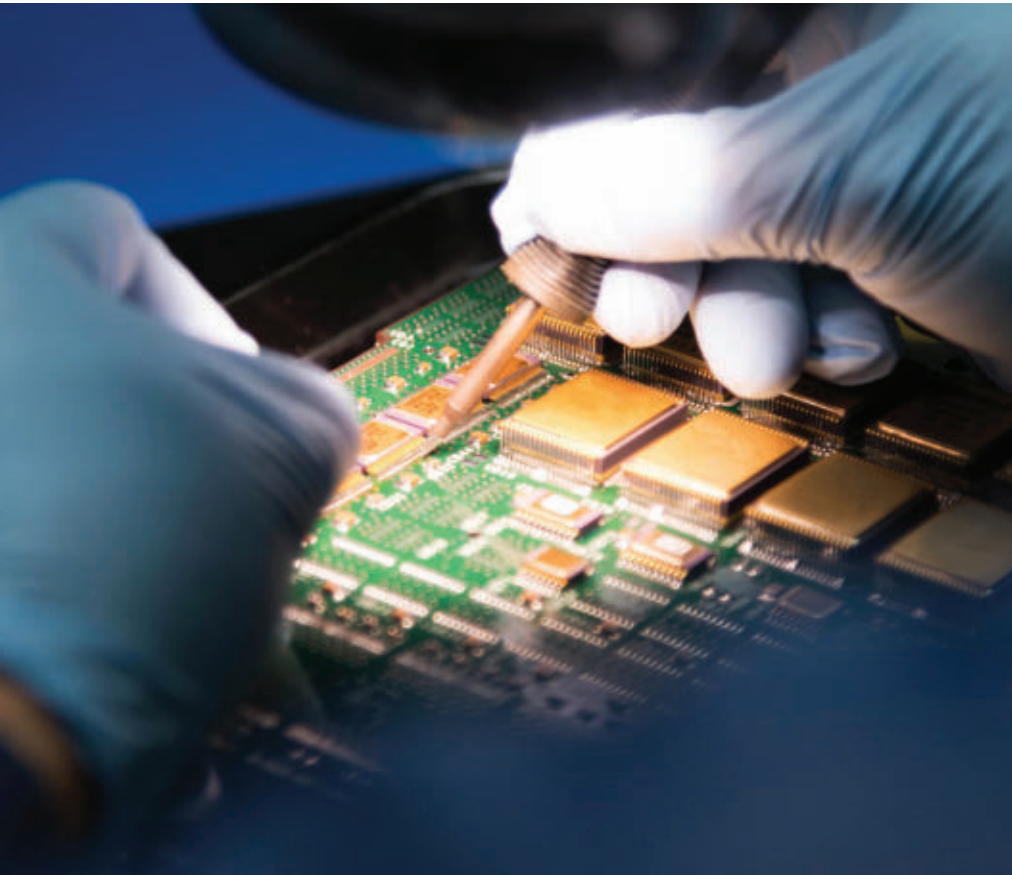
"Leveraging Intel's commercial foundry to manufacture this technology can speed up the production of next-generation technology and help resolve supply chain challenges so we can maintain our country's technological edge," says

Chris Rappa, director at BAE Systems FAST Labs.

This award enables U.S. defense and aerospace companies to access advanced processes for application-specific integrated circuits (ASICs). Currently, development of RHBD ASICs uses a 45-nanometer process, but now there is potential to deploy more advanced technologies and enable faster processing in smaller areas and at lower power.

In addition to working with Intel Foundry Services, BAE Systems will work with Cadence Design Systems, Carnegie Mellon University, Movellus, Reliable MicroSystems, and Sandia National Laboratories. ◀

For more information contact BAE Systems Electronic Systems online at www.baesystems.com, or the Army Contracting Command at Rock Island Arsenal at https://acc.army.mil/contractingcenters/acc_ri.



BAE Systems is developing next-generation radiation-hardened microelectronics to expand onshore access to rad-hard microelectronics for military and aerospace applications.

Continued from page 7

benefit from a direct link with Europe. This will also enable ESA to create slots for ad-hoc experiment access and interaction with European astronauts. The ColKa data service provision has been contracted between ESA and Airbus. As part of this new SpaceDataHighway service, Airbus has adapted its Ka-band inter-satellite link to ensure data will be channeled via the ground station at Harwell Campus, UK.

Allegiant Air orders as many as 100 Boeing 737 MAX passenger jets

Boeing and Allegiant Air announced an order for 50 737 MAX jets, with options for 50 additional airplanes. In Boeing's first U.S. ultra-low cost carrier (ULCC) deal, Allegiant selected two models – the 737-7 and 737-8-200. "Our approach to fleet has always been opportunistic, and this exciting transaction with Boeing is no exception," said Maurice J. Gallagher, Jr., Allegiant chairman and CEO. "While the heart of our strategy continues to center on previously-owned aircraft, the infusion of up to 100 direct-from-the-manufacturer 737s will bring numerous benefits for the future – including flexibility for capacity growth and aircraft retirements, significant environmental benefits, and modern configuration and cabin features our customers will appreciate." Boeing and Allegiant will partner on entry-into-service support. Allegiant will also utilize a suite of Boeing Global Services digital tools to further enhance operational efficiency. Allegiant currently operates a fleet of 108 Airbus A319 and A320 airplanes.

DroneUp acquires AirMap to broaden offerings in real-time airspace information

Unmanned aerial vehicle (UAV) services provider DroneUp LLC in Virginia

Beach, Va., is acquiring AirMap Inc. in Santa Monica, Calif., to broaden DroneUp's offerings real-time airspace information and services. AirMap is a digital airspace and automation company best known for its unmanned aircraft system traffic management service. The acquisition comes on

the heels of DroneUp's recent partnership with Walmart to offer drone delivery to consumers from a growing network of drone airports, called DroneUp hubs. This acquisition will aid DroneUp's unmanned traffic management pilot network and growing ground

Continued on page 11





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DARPA SCEPTER seeks to develop battle planning for engagements at machine speed

BY John Keller

ARLINGTON, Va. – U.S. military researchers are asking industry to develop enabling technologies for computer-aided battle planning systems with performance as good as humans, but that work at machine speed.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., released a broad-agency announcement (HR001122S0013) for the Strategic Chaos Engine for Planning, Tactics, Experimentation and Resiliency (SCEPTER) program.

The SCEPTER machine-generated campaign-scale planning and analytics project seeks to develop analytic engines that will produce machine-generated strategies that can compete with humans in the planning of real warfare as evaluated within trusted simulation environments.

SCEPTER will discover new courses of action by exploring complex military engagements at machine speed. Enabling high speed will come from tailorable abstraction of trusted expert-informed models. Researchers will validate a few of the best performing solutions in high-fidelity trusted simulators and with thorough human review.

The SCEPTER program's first phase will address two key technical focus areas: developing unscripted goal-oriented agents able to discover relevant and interpretable solutions; and managing growth of threats to achieve fast exploration of large-scale military scenarios.

SCEPTER is planned as a two-phase three-year battle planning program. This solicitation is for only an 18-month first phase. Phase 2 proposal instructions will be released to the Phase 1 performers prior to the end of Phase 1. The Phase 2 proposal instructions and program execution will be classified.

DARPA researchers say they plan to spend \$39 million on the SCEPTER program over the next three years. Companies interested should upload proposals no later than 11 March 2022 to the DARPA BAA Website at <https://baa.darpa.mil>. ←

▲ **The SCEPTER machine-generated campaign-scale planning and analytics project seeks to develop analytic engines that will produce machine-generated strategies that can compete with those of humans.**

Email questions or concerns to DARPA at HR001122S0013@darpa.mil. More information is online at <https://sam.gov/opp/abd275dd39dc4ab6a845a15ab469df6e/view>.

MARSS and Thales collaborate to protect infrastructure against enemy UAVs

BY Jamie Whitney

LONDON — MARSS Group Ltd. in London has is working together with Thales Group in Paris to design systems to protect critical infrastructures against several kinds of enemy threats such as attacks from unmanned aerial vehicles (UAVs).

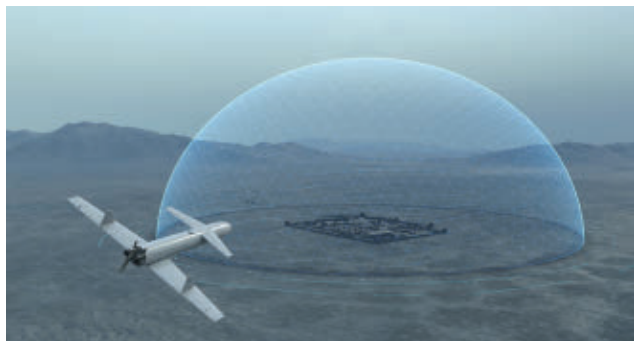
This collaboration will focus on the integration of the MARSS NiDAR C2 security platform and Thales drone neutralization systems. The partnership will focus on deploying proven systems to face new threats.

The Thales-MARSS platform aims at providing an enhanced understanding of UAV situational awareness and safely to defeat emerging threats.

"Customers needed to augment their C2 security systems with C-UAS neutralization means, to combat a vast variety of threats over their facilities," says Phil McBride, managing director of the Thales Integrated Airspace Protection Systems.

"The neutralization phase in C-UAS is a critical step," says Rob Balloch, vice president of sales at MARSS. "NiDAR finds and verifies the threat. We wanted an equally credible solution to help defeat this threat." ←

Deployment of systems should come in the next few months, officials say. For more information contact MARSS online at <https://marss.mc>, or the Thales Group at www.thalesgroup.com.



Thales and MARSS Group are working on ways to defend military bases and other installations from attacks from unmanned aircraft.

Continued from page 9

infrastructure, which provides services for as many as 100,000 global daily UAV flights. AirMap's flight data will help DroneUp advance safe last-mile drone services, company officials say. As drone flight volume increases, safely managing flights often is beyond human scale and requires an automated system to plan, request clearance, and factor-in potential hazards and airspace restrictions. DroneUp operates commercially throughout the U.S. and is an authorized government drone services provider for 13 states serving public sector organizations. It has more than 190 active waivers and authorizations with the U.S. Federal Aviation Administration (FAA). AirMap is one of three unmanned traffic management providers deployed internationally and provides drone traffic management in Switzerland, North America, Europe, Southeast Asia, and Australia. For more information contact DroneUp online at www.droneup.com, or AirMap at www.airmap.com. *Continued on page 13*

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Wanted: wearable sensors to detect fatigue and stress in warfighters and astronauts

BY John Keller

WRIGHT-PATTERSON AFB, Ohio – U.S. Air Force researchers are asking industry to develop wearable computers and sensors to detect and counter fatigue and stress among warfighters, doctors, nurses, and first-responders.

Officials of the U.S. Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio, have issued a solic-

itation (FA8650-22-S-5006) for the Real-Time Assessment and Augmentation of Cognitive Performance in Extreme Environments project.

That's where the Real-Time Assessment and Augmentation of Cognitive Performance in Extreme Environments project comes in. This initiative seeks to develop wearable systems that continuously monitor biometrics of fatigue and stress using elec-

trophysiological sensors and biomarkers of stress such as cortisol, DHEA-s, epinephrine, and NPY in interstitial fluid (ISF).

The project also seeks to develop wearable technologies to counter fatigue and stress while considering and addressing austere environmental challenges, resulting in wearable electronics that are low power, flexible, affordable, and manufacturable at scale.

These kinds of wearable technologies would be appropriate not only for military warfighters, but also for civil firefighters, emergency responders, astronauts, expedition crews, and medical personnel to assess, augment, and optimize mental and physical performance.

Air Force researchers say they plan to spend about \$23 million on this project over five years, and expect other government agencies to provide additional money after contract award.

Companies interested were asked to submit five-page white papers online at

www.grants.gov and by email at rxa.afrl.submissions@us.af.mil by 28 Feb. 2022. Submit white papers to the attention of the Air Force's Ashton Kiplinger. Those submitting promising white papers will be asked to submit full proposals. ◀

Email technical questions or concerns to The Air Force's Lt. Suren Uswatta at suren.uswatta@us.af.mil, Matthew Dalton at matthew.dalton.6@us.af.mil. Email contracting questions to Ashton Kiplinger at ash-ton.kiplinger@us.af.mil. More information is online at <https://sam.gov/opp/6fe8cd39b80e4490bd060425f663990f/view>.



Industry is being asked to develop wearable computers and sensors to help detect harmful fatigue and stress in warfighters, astronauts, first responders, and medical personnel.

itation (FA8650-22-S-5006) for the Real-Time Assessment and Augmentation of Cognitive Performance in Extreme Environments project.

Mental and physical fatigue and stress are significant problems that affect the physical and mental performance of warfighters, astronauts, and medical personnel due to long-duration missions, mental exertion, and cognitive overload.

The austere environments impose unique causes of fatigue that not only limit countermeasures, but also that could become chronic, leading to reduced health and compounded stress.

Airbus establishes subsidiary to pioneer new commercial aviation technologies

BY Jamie Whitney

TOULOUSE, France - Passenger jetliner giant Airbus in Toulouse, France, has launched the Airbus Atlantic subsidiary in Colomiers, France, to boost Airbus capabilities in the commercial aerospace supply chain.

Airbus Atlantic, was established on 1 Jan 2022 to combine the resources of Airbus's sites in Nantes and Montoir-de-Bretagne, France, as well as the STELIA Aerospace sites worldwide. This unification is part of the transformation project announced in April 2021.

Airbus officials say their Airbus Atlantic subsidiary will play a key role in the aerostructure supply chain, with more than 500 direct suppliers for flying products and more than 2,000 indirect suppliers for general procurement products.

"Airbus Atlantic aims at meeting the great challenges linked to a sustainable aviation industry, pioneering new technologies," says Cédric Gautier, CEO of Airbus Atlantic. "Our first mission will be to ensure the satisfaction of all our customers and to establish new standards of excellence in terms of quality and operational efficiency." ◀



Airbus Atlantic will play a key role in the aerostructure supply chain, with more than 500 direct suppliers and more than 2,000 indirect suppliers.

Continued from page 11

Loft Orbital signs agreement with Airbus to procure more than 15 Arrow satellites

Airbus has been contracted to supply space start-up Loft Orbital with more than 15 satellites derived from the Airbus Arrow — the satellite of the OneWeb constellation. There are 394 Airbus Arrow spacecraft in orbit for the OneWeb constellation and a further 254 are being produced to complete the 648 spacecraft required by OneWeb. Loft Orbital also has contracted Airbus to modify the Arrow for a wider range of long-lifetime missions and applications. The improvements to the Arrow, including all the engineering, qualification, test, and production of the first few spacecraft will be performed by Airbus in Toulouse. The production at scale of the remaining Arrow-derived will be performed by Airbus OneWeb Satellites (AOS). ◀

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A V-22 Osprey tiltrotor aircraft is shown in flight, banking to the left. The aircraft is dark grey with a white tail code 'N280BH'. The background is a blurred green field, suggesting high speed. The title 'Advanced TECHNOLOGY' is overlaid on the top half of the image, with 'Advanced' in white and 'TECHNOLOGY' in yellow.

Future U.S. military helicopters will take design inspiration from the V-22 Osprey tiltrotor, but will be faster, quieter, and will have avionics that reflect the latest electronic technologies.

BY Megan Crouse

Developing a new generation of advanced helicopters is a long process. Customer requirements and available technologies are changing all the time, while the work itself is time-consuming. With projects starting in the last few years targeting a 2030 operational date, how do today's designers and builders define 'advanced'?

Today's designers are working on giving military designers what they're asking for: helicopters of the future that can fly faster, lower, and with more agility than these rotorcraft can today.

They're also intended to be quieter — physically and in terms of their electronic signatures. Enhanced navigation and guidance will improve acquisition and satellite navigation performance. Tomorrow's aircraft will use the best of both worlds when it comes to helicopter and airplane technology.

A brief history of helicopters

Flying machines using rotors have been the subject of engineering curiosity and achievement since the 1700s. Jules Verne used them in his fiction before they were common in reality. In the very early days, the greatest challenge to their adoption was the limited power of available propulsion. Other mechanical developments — such as the inclusion of a tail rotor by gramophone inventor Emile Berliner — accelerated progress in the 1900s. A different species of bird, the gyrocopter, split off this family with a different principle behind the way its rotors function.

When German progress on helicopters in World War II encouraged Congress to contribute U.S. federal money to helicopter development, the race was on. Radar consideration was a concern at the same time as flight time was being improved and prohibitive vibrations smoothed out. Companies around the

Helicopter TECHNOLOGIES



▲ A demonstration of the Bell V-280 Valor.

Image credit:
Bell Textron Inc.

world, including French, British, and South African, also worked on creating what would become the groundwork for the modern helicopter in the 1960s.

The first U.S. production helicopter, Igor Sikorsky's brain child the XR-4, sold to the U.S. and British militaries. This marked the beginning of the modern era, but this age of invention also generated its spinoffs. Vertical takeoff and landing vehicles and the idea of a working 'jet pack' using helicopter technology still have a sheen of the futuristic around them today, even as they remain mostly in the realm of novelty. These were also of interest to the military in the '40s and '50s.

The Black Hawk

In the 1970s, the Black Hawk emerged on the scene. Commissioned to replace the UH-1 Iroquois helicopter, otherwise known as the Huey, the UH-60A Black Hawk entered Army service in 1979. Since then, it has been involved in almost every major Army operation. As a medium-lift, multi-role helicopter, its versatility explains some of its enduring popularity. Over the years, improvements were made to the original, including an improved turbine engine, upgrades to the airframe to increase crash worthiness, and a lighter, composite all-moving tail.

The Army holds about 2,100 UH-60 Black Hawks in inventory in the contemporary era, with multiple versions. They're likely to stay in service in some capacity until at least 2054, according to an Army post on the occasion of the platform's 40th anniversary.



Sikorsky UH-60M Black Hawk.
Image credit: Lockheed Martin

Despite this longevity and record of performance, Black Hawks are getting old, and that's hitting their use in civil operations. Some civil aviation companies buy dozens for parts just to keep a few in their fleets working. As of December 2021, new production S-70M Black Hawk helicopters in the latest configuration now have Federal Aviation Administration ratings, meaning they're available for select commercial operators to buy right off the line.



One of the first viable helicopter designs was the Sikorsky XR-4, which first flew in 1942.

Fly-by-wire

As in the urban air mobility space, some experimentation has been done with automated robotic helicopters, and the Black Hawk in particular has been the focus for an Army initiative to deploy a fully uncrewed vehicle like this, with no backup pilots. Experts at the U.S. Defense Advanced Research Projects Agency (DARPA) say they plan to demonstrate the solo UH-60 in as early as this month.

The end goal is to allow the 'autonomous brain,' the Aircrew Labor In-Cockpit Automation System, to fly one its own without backup pilots for safety and oversight. This has the obvious advantage of not putting crew members in danger, for example, on missions to fly supplies to other troops already under fire.

There has also been some chatter about what Maj. Gen. Walter Rugen, head of the Army's Future Vertical Lift Cross Functional Team (FVL CFT) called "optimally manned." That means the vehicle would have a human pilot or pilots, but those people would be able to turn their attention to particular tasks necessary for optimal efficiency.

Twice as far, twice as fast

The leading American military helicopter today remains the Black Hawk, which has held the top spot for more than 40 years. Now, Army planners are aiming for a replacement by 2030.

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To find it, they gave two requests for proposals for the Future Long-Range Assault Aircraft (FLRAA) program to the giants of the helicopter world. This program itself is part of the broader Joint Multi-Role Technology Demonstration, or JMR-TD, an acquisitions push for next-generation capabilities supported by both the Army and industry partners.

These requests outline what the Army means by advanced.

"FLRAA will have increased speed, range, and survivability to overmatch enemy forces in contested and ever-changing environments," Army officials say. The plan is for Army combat aviation brigades to roll the chosen vehicles out in 2030.

The chosen design will need to clock with an objective cruise speed of 280 knots, or roughly 320 miles per hour and to maintain 100 percent maximum continuous power. It must carry as many as 12 passengers, endure flying at 6,000 feet in 95-degree heat, and fly roughly 1,725 nautical miles one-way without refueling. Another requirement is the ability to perform a 500-foot per minute vertical rate of climb. The selected aircraft also must include medical evacuation capabilities.

"The Army aviation's vision necessitates next-generation vertical lift capabilities that can deter, fight, and win as part of

the joint force, in increasingly dangerous and complex environments," Army officials say.

Other advancements being discussed in military and consumer spaces include more automated fly-by-wire capabilities, and improvements in manufacturability and sustainability.

The V-280 Valor

To get their contender off the ground, Bell Textron Inc. in Fort Worth, Texas, had a good precedent on which to look back: the Bell Boeing V-22 Osprey. This aircraft, which in part inspired Bell's FLRAA entry, also was a tiltrotor vehicle. The V-22's range of 860 nautical miles and speed of 266 knots shows the kind of performance improvements being made between generations.

While the tiltrotor itself is far from a brand-new concept (the V-22 took its first flight in 1989 and served in Iran and Afghanistan), Frank Lazzara, director of sales and strategy for Future Long Range Assault Aircraft at Bell, says this half-airplane, half-helicopter concept still is the right direction for the agility and stability a next-generation aircraft needs.

Lazzara described the meaning of 'advanced' today as "Higher performing, further, faster more efficiently; has greater availability, easier to work on, requires less maintenance ... adhering to the Army's modern open systems approach is advanced. That would essentially net, down the road after the aircraft is fielded, an easier path to upgrade the aircraft quicker. It would also keep the market competitive."

A modular open systems approach (MOSA) and fly-by-wire still are considered advanced and in development.

Another challenge is "Can you do this at a reasonable cost? Can you do this and ensure a good sustainment, a good sustainability percentage? Do you have good ways to maintain aircraft tools derived from the digital thread technology?" Lazzara says.

As far as tiltrotors go, the V-280 has several elements that make it an improvement on the V-22 as far as taking advantage of the hybrid wing-rotor design. One requirement of FLRAA was that it will be able to fit in roughly the same size landing zones as the Black Hawk, which necessitates the V-280 be smaller than the V-22. In addition, Bell has given it increased agility in the prop rotor system and faster response.

The tiltrotor and wing setup means that the aircraft has the agility of a machine with a wing, but the hovering and vertical landing capabilities of a helicopter.

"There's also tactical or operational or strategic agility," Lazzara points out. "The way you can now plan missions so you can fly further, faster, do it very efficiently and does not sacrifice the high speed... The tiltrotor can get to that target and when it gets there function at low speed."



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Put simply, this design brings the best of both worlds, Lazzara says. “Pure rotor craft also have a lot of drag, and you have to overcome drag with power. Whereas when you fly on a wing it’s a very efficient way to create lift.”

More adjustable rotors also mean more ways to cut down on audible noise. V-22 and V-280 demonstrations could show this very dramatically, Lazzara says. “We would talk to a crowd and talk about how quiet the aircraft was and it would come up behind them and they wouldn’t have noticed.”

That’s because of the direction in which the noise travels. “The noise you hear from a helicopter comes from two things: one is the tail rotor. You have a small rotor that’s spinning very, very fast. The second thing is the main rotor,” Lazzara says. “As the main rotor turns, noise is propagated edgewise.



The V-22 Osprey tiltrotor, shown above, has been the inspiration for several next-generation U.S. military helicopter designs.

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Concept image for the DEFiant X.

Image credit: Lockheed Martin

Where the tips of the blades are, the noise goes in that direction. ... In a tiltrotor you have the same edgewise noise but the direction at which it is projected is basically reconfigurable or different. When it's in helicopter mode the noise goes out ... but when you bring the pylons down so the prop rotors become propellers, now that noise is going out to the side and behind, and because of the speed of the aircraft the aircraft is out in front of the noise."

To return to the idea of digital, Lazzara emphasizes that while Bell is far from the only company to include today's interactive, 3D digital models in the design-for-manufacturability stage, its approach has a very specific angle. They design for a less linear manufacturing process. If the aircraft can't pass through one particular station because a part isn't in yet, someone else can work on it without disrupting the schedule.

They also used the a shared digital space to do walkthroughs with the stakeholders who are actually going to be working on and using the aircraft. Maintainers do virtual walkthroughs at the design stage of the procedures they can expect to perform on the aircraft in the field.

"Not only the primary designers but the Valor teammates in our case or even suppliers can function in the design space," Lazzara says.

As a former V-22 pilot, Lazzara sees that while they are both based on the tiltrotor, the V-280 is a leap forward. "Not only it

will be able to perform superbly right away, but it's going to have a long-term value. The aircraft is not going to get bogged down by upgrades and changes," he says.

Defiant X

Black Hawk parent company Sikorsky, a Lockheed Martin company in Stratford, Conn., is working together with the Boeing Co. on a prototype on the metaphorical runway that might be posed to take the FLRAA spot, Defiant X.

"Defiant or the FLRAA competition is really designed to be the next aircraft after the Black Hawk in the long-range assault role and this aircraft really delivers, it goes twice as far, twice as fast and twice the capability," says Jay Macklin, Sikorsky business development director, Future Vertical Lift.

The SB>1 DEFiant, the technology demonstrator for the Defiant X weapons system, boasts speed as fast as 230 knots in level flight, according to a Lockheed Martin promotional feature. It also demonstrated lifting an external load of 5,300 pounds, with use cases including carrying rations, medical supplies or weapons systems into otherwise hard-to-reach or contested areas. Boeing clocked the Defiant X at 247 knots in level flight and 50 knots in side flight.

"DEFiant X is a fly-by-wire aircraft and has a very responsive rigid rotor system, which simplifies performance

and increases responsiveness, helping DEFiant X respond to control inputs more like a fighter jet than a helicopter,” says Heather McBryan, Boeing business development director, Future Vertical Lift. “DEFiant X also has exceptional power margins that enable rapid acceleration and directional changes. The propulsor adds a third dimensional element which enables acceleration and deceleration along the longitudinal axis.”

Defiant X was made with a compound co-axial rotor system and pusher prop to reach the required maneuverability, which itself adds to survivability.

“We designed Defiant X to excel in arenas ... which require a precise combination of speed and agility,” says McBryan. “The propulsor on the back of the aircraft plays a large role in that. Approaching the objective, Defiant X can engage the prop on the back of the aircraft for max speed and can disengage as needed for a quieter approach (the aircraft can still maintain 150 knots without the prop) – all while getting to the landing zone safely and quickly. Fly-by-wire controls, rigid main rotor and hover power also enable high agility for safer operations in complex environments.”

This is all part of what they’re calling X2 technology, a rotor setup and combination of different systems designed for a single-engine, single-pilot aircraft with improvements on vibration reduction, weight reduction and blade technology from previous models.

To address blade stall, the “dual coaxial rotor design has two rotor blades rotating in opposite directions, so there is an advancing blade on both sides of the aircraft which reduces the effects of retreating blade stall,” Macklin says. “Defiant X also has that propulsor on the tail of the aircraft to provide significant forward thrust to achieve very high speeds.”

As far as automatic systems go, Defiant X includes a built-in optionally piloted flight control system, designed to make the most of safety and effectiveness in “low altitude, obstacle-rich environments or in degraded, uncertain conditions,” according to Lockheed Martin.

Other operational advantages exist at the intersection of agility and speed. In regards to radar detection and audible noise, McBryan says “The ability of Defiant X to maintain speed below radar is a stealth feature that we designed into the aircraft, and continue to validate in flight test. We also fly with and without

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Concept image for the DEFiant X.

Image credit: Lockheed Martin

the propulsor engaged to help manage acoustic footprint based on the environment.”

Like the Bell team, the Defiant X design was produced with the idea of digital thread for better manufacturability, interoperability and maintenance. The idea is that the digital mapping will be able to provide predictable “maintenance-free operating periods,” reducing the amount of work and money that goes into upkeep. The team also kept in mind that this needed to be put in place while not requiring the customers to invest in rebuilding any additional infrastructure. Instead, Sikorsky used their extensive

military customer experience to make sure the new design fits within existing U.S. Army aviation support infrastructure.

“These tools enable analysis and optimization of component capability at much higher levels of fidelity than were employed on previous helicopters, reducing weight and cost,” says Macklin. “Finally leveraging the synergy between our digital design tools and manufacturing techniques such as metal and composite additive manufacturing offers the ability to develop and manufacture parts with revolutionary structures and capabilities that are unique and superior to legacy components.”

Macklin also points out that “the idea of semi-autonomous flight is not new to the military,” although it “figures to have even more relevance in the future as missions get more complicated.”

“This transformational technology [as shown with the Defiant technology demonstrator so far] will change the way that the Army conducts large scale air assaults from significant operational distances,” says McBryan. “That’s why we chose this design, and why we’ll continue to refine it as the Army gets closer to making its decision on the FLRAA competition.”

You might also notice another project often spoken about in the same breath as this one, Raider X. While Defiant X is made specifically for FLRAA, the



Northrop Grumman's Integrated Avionics Suite for the UH-60V helicopter.

Image credit: Northrop Grumman

Raider X attack craft fulfills the specifications for another Army prototype competition, Future Attack Reconnaissance Aircraft (FARA).

Other projects

While the FLRAA provides a good look at what is considered 'advanced' in military helicopters today, the two companies propositioned for it are of course not the only ones involved in making strides. Northrop Grumman worked on integrating new avionics into the UH-60L Black Hawk in summer 2021, with a glass cockpit, including an integrated computational system, visual display system and Control Display Units replacing analog gauges. They also have a modular open systems architecture (MOSA) as mentioned above, contributing to the trend of avoiding vendor-specific architectures. For several years, Northrop Grumman has also been working on showing how digital upgrades to an aircraft's avionics can extend the life of older models.

Naturally, the Air Force has its own efforts, with Boeing delivering a new model Apache helicopter — the version known as AH-64E v6 — to U.S. Air Force customers in February 2021.

WHO'S WHO IN MILITARY HELICOPTER DESIGN

Bell Textron Inc.
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<https://www.bellflight.com>

The Boeing Co.
Chicago
<https://www.boeing.com>

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

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

Sikorsky, a Lockheed Martin company
Stratford, Conn.,
<https://www.lockheedmartin.com/en-us/capabilities/sikorsky.html>

Customer connection

Lazzara also noted that relationships with customers are changing. The customer is now more likely to tell the OEM what they need instead of the other way around. For Bell, which hasn't worked this closely with the military in some time, the philosophy is to go to the customer and listen, Lazzara says.

"We're going to listen. We're going to develop trust again with you," he says. ←

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Industry standards and guidelines such as MOSA, SOSA, CMOSS, SAVE, and FACE are driving the latest developments in enclosures, chassis, and backplane databases, as small form factors are ready to take center stage.

The embedded computing chassis, enclosures, and backplane databus industry is on the verge of a technology revolution every bit as significant as the industry's transition to VPX nearly two decades ago, as standard architectures and small-form-factor designs are poised to become major players in this market.

As SOSA-aligned enclosures, chassis, and backplane databuses become widely available, not only will the industry see an increase in compatible products among third-party suppliers, but the industry also will start seeing small-form-factor bus-and-board architectures in places they've never been seen before, such as air-launched missiles, handheld test and measurement equipment, unmanned vehicles, and sensor pods.

In addition to SOSA-aligned and **used in air-flow-t** small-form-factor chassis, enclosures, and backplane databuses, industry trends also include the addition of RF and microwave coax interfaces for boards and enclosures, a new crop of no-slot interfacing, innovative thermal-management

Not only does SOSA have a big influence on chassis and backplane databus design today, but the Modular Open Systems Approach (MOSA), The C5ISR/EW Modular Open Suite of Standards (CMOSS), Future Airborne Capability Environment (FACE), the Hardware Open Systems Technologies (HOST), and similar established or emerging electronics-design standards also are taking-on important roles.

SOSA is evolving into the dominant standard, with other military service-specific established and emerging standards flowing toward the SOSA banner. “There is customer

It's all based on SOSA. The Army, Navy, and Air Force have their pieces of it, and they are bringing it under SOSA."



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The Pixus 4U horizontal mount OpenVPX chassis is in a front-to-rear cooled configuration, and has a 6-slot, 6U OpenVPX backplane that is available in various routing options.

It's becoming difficult even to avoid the mention of SOSA in embedded computing discussions. "SOSA is still the story of the day," says Mark Littlefield, senior manager of embedded computing product and system solutions at chassis and enclosure specialist Elma Electronic in Fremont, Calif. "Every day I get asked questions about SOSA and how to use SOSA. There continues to be growth and interest in that, and SOSA 1.0 made people believe SOSA is on a growth path. There is a lot of product out there and more every day."

Last September The Open Group in San Francisco — the standards organization that oversees SOSA — published the first official version of the SOSA technical standard to help reduce development and integration costs for military capabilities and to reduce time to field.

SOSA 1.0 seeks to streamline U.S. military capabilities by enabling rapid, affordable, cross-platform capabilities based on best practices of system, software, hardware, and electrical and mechanical engineering.

The new standard encapsulates fundamentals of Modular Open Systems Approach (MOSA) design to develop embedded computing solutions for military applications that involve a unified set of sensor capabilities.

The SOSA Consortium aims to create a common framework for moving electronics and sensor systems to an open-systems architecture based on key interfaces and open standards established by industry and government consensus.

The open architecture supports aerospace and defense applications for manned and unmanned surface vessels, submarines,

aircraft, land vehicles, and spacecraft. The goal is to reduce development and integration costs and reduce time to field new sensor capabilities.

With the new SOSA 1.0 standard in place, The Open Group is formalizing compliance testing to enable embedded computing manufacturers to meet guidelines of the SOSA standard. Those introducing products intended to meet the standard but that have not gone through compliance testing will be considered SOSA-aligned.

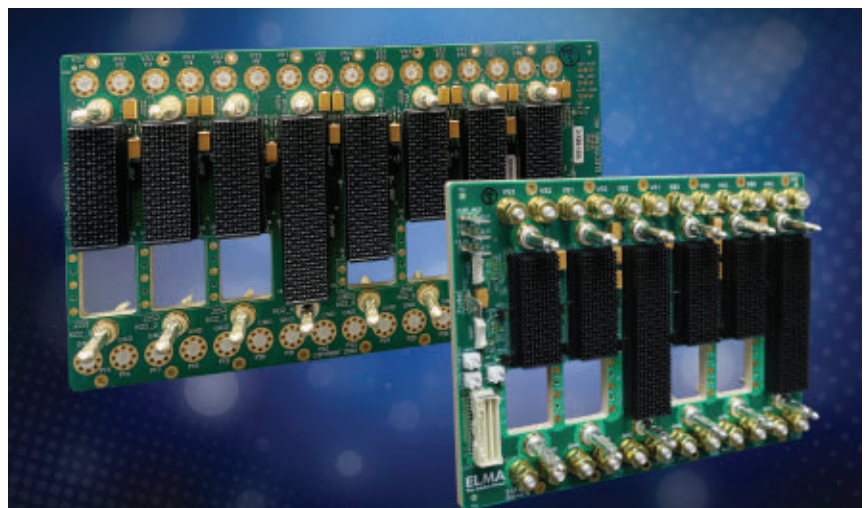
One large trend in the embedded computing chassis and backplane industry

"certainly is the evolution of SOSA," says Justin Moll, vice president of sales and marketing at chassis and enclosure specialist Pixus Technologies Inc. in Waterloo, Ontario.

"All these companies out there that typically have some sort of proprietary solution for RF and signal process are all trying to develop SOSA-based solutions, and that will continue as these are evolving into MOSA," Moll says. That certainly is a trend."

MOSA is a technical and business strategy — not an actual industry standard — for designing an affordable and adaptable system, and is the Pentagon's preferred way to design open systems solutions. MOSA encourages a modular design that uses major system interfaces between a system platform and a major system component, between major system components, or between major system platforms.

MOSA uses a system architecture that enables systems designers incrementally to add, remove, or replace major system components throughout the life cycle.



Elma's latest backplanes aligned to SOSA are 6-slot and 8-slot systems.

MOSA enabling standards are widely accepted, supported, and consensus based standards, such as SOSA, that support interoperability, portability, and scalability. Falling within the MOSA umbrella are standards such as SOSA, CMOSS, FACE, and Vehicle Integration for C4ISR/EW Interoperability (VICTORY).

The move to MOSA-like open-systems standards is likely to continue indefinitely, “and we will ride this SOSA wave for a while,” Pixus’s Moll says. “Certainly the higher speeds for the backplane, like 100 Gigabit Ethernet, optical, and RF will provide very high performance. We will be riding that wave for a bit.”

More standardization

MOSA and its companion standards are not the only areas where military embedded computing designers are looking to capitalize on standards. The U.S. Army Program Executive Office for Ground Combat Systems (PEO-GCS) in Warren, Mich., oversees a standard for the size of vetronics components called

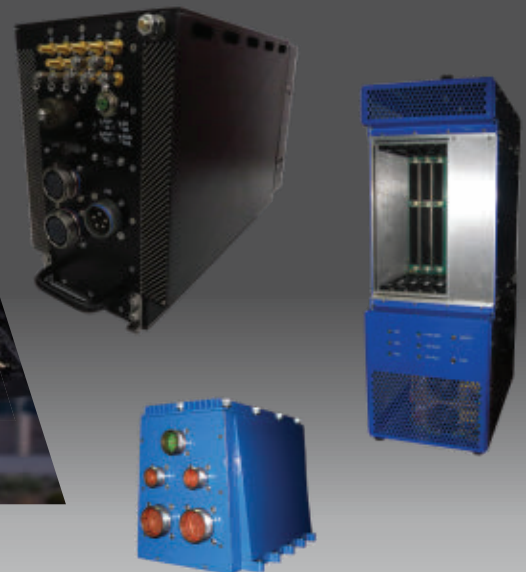


The Elma JetSys-5320, Small Form Factor, rugged AI inference platform is based on NVIDIA Jetson

the Standard A-Kit Vehicle Envelope (SAVE), which concerns mounting size and power needs, explains Jason DeChiaro, system architect for the Curtiss-Wright Corp. Defense Solutions division in Ashburn, Va.

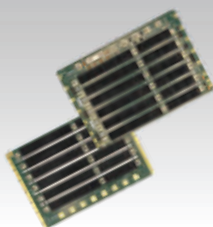
“The idea is the Army wants standard sizes for electronics boxes in vehicles,” DeChiaro says. The idea is that like building a house and kitchen with standard openings for stoves, refrigerators, and dishwashers, the SAVE approach reserves standard sizes in vetronics architectures for subsystems like radios, displays, and mission computers.

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The PacStar MDC-NR, Curtiss-Wright's recently introduced Modular Data Center supports more than 8 terabytes of NVMe data storage and Intelligent Platform Management Interface (IPMI) remote management.

SAVE is targeting new platforms, and existing platforms as they are upgraded, DeChiaro says. "This reflects to momentum to MOSA," he continues. By defining a space claim in connectivity, you are defining a space for these components. It defines a maximum envelope for systems, and what you can put in the box."

SAVE does not specify other standards such as CMOSS or SOSA; it simply defines standard spaces for electronics boxes. "It can be limiting in some ways, because we can't do these larger solutions, but it does give us a known size target to hit," says Dominic Perz, chief technical officer at Curtiss-Wright. "It provides a known footprint for upgrades."

In addition, SAVE "makes it easier for us to be CMOSS and SOSA compliant, which is the goal of MOSA," DeChiaro says. It's the need to cram as many electronic systems in to military land vehicles today that is driving Army experts toward standards and guidelines like SAVE, CMOSS, and SOSA. "The ground vehicle is the command post of today and the future," Perz says. "We are pushing a lot of electronics into those vehicles, which also pushes for communications networks."

Small form factors

Following closely in importance behind the move to open-systems standards are trends in small-form-factor chassis, enclosures, backplane databuses, and circuit boards. At center stage of this assault on size, weight, and power consumption (SWaP) is the so-called VITA 74 VNX form factor, which calls for circuit boards about the size of a deck of playing cards — or

roughly one-third the size of 3U VPX cards and enclosures. VITA is the Open Standards, Open Markets trade association in Oklahoma City.

"Small form factors like VNX have started up again in earnest," says Elma's Littlefield. "VNX is a little less than one-third the size and volume of 3U VPX, and you will see first products before the end of the year. It's still not taken off yet, but enough people are interested in the standard that there will be traction."

While VNX went up on the drawing board a decade ago as a smaller, less powerful, and more power-efficient version of

VPX, industry experts say early indications are that VNX soon not only will be able to accommodate some of the most powerful embedded computing processors, but also handle advanced cooling and thermal management designs to enable this form factor to handle upwards of 100 Watts per card.

"VNX was originally envisioned as a way to make small mission computers," Littlefield explains. "That is still very much the model. Also, designers are finding there are some applications that require a substantial amount of processing that 3U VPX just doesn't fit."

Among those potential applications for VNX are three-inch tubes that house tactical missiles; small unmanned vehicles for land, sea, and air; high-performance sensor pods for fixed-wing aircraft, helicopters, and unmanned aerial vehicles (UAVs); and handheld flight-line test and measurement instruments that could replace two-person-carry and rolling systems.



Curtiss-Wright's PacStar Tactical Fusion System (TFS) delivers a deployable solution for sensor fusion and edge data processing in disconnected, limited, intermittent (DIL) environments.

“For VNX there are projects envisioned that are 5.5 inches in diameter, which is too small for 3U VPX,” Littlefield says. “You could put eight or ten modules in a common launch tube.” One area of particular interest for VNX involves so-called New Space applications and cubesats for limited-duration space flight.

Among the original developers of the VNX form factor is Bill Ripley, director of embedded computing consultant Brame Technologies in Albuquerque, N.M. Ripley says VNX has been picked up by SOSA. To get SOSA acceptance “we took VNX and redefined it to use the same tenets as VPX to go relay out to its connector interface. While we were there, we decided to revise VNX to be SOSA compliant by re-evaluating the pin assignments we had for the best-possible signal integrity to guarantee higher bus speeds.”

In addition, Ripley and his colleagues at VITA were able to redefine the VNX interconnect interface to accommodate a family of connectors to bring RF coaxial cable and optical interconnects into the VNX specification. VNX cards are smaller than 3U VPX, but use the same bus structure.

VNX was designed originally about eight years ago to accommodate the mid-level Intel Atom processor, yet industry designers are working on versions today that eventually will be able

to handle high-end processors approaching the performance of the Intel Xeon.

If that happens, then the next question is will VNX be able to accommodate the thermal management and electronics cooling necessary for the most powerful processors? Ripley says it will. “We’re looking at significantly higher power than we had in the original standard,” he says. “The VNX module was built from the ground-up to be conduction cooled, but we don’t use wedge locks in the system. We can move heat out to heat sinks along the card’s left face, right face, and handle face. All paths can carry heat away from a system using fins, cold plate, liquid cooling, or forced air.”

So with all this going for it, will VNX be able to replace 3U VPX altogether. Ripley says the answer is no. “There is so much momentum going on with VPX, and VNX is not intended to replace VPX, but is intended to bring VPX-like capabilities down to the small-form-factor market.

One advantage of designing VNX and 3U VPX to be so closely related is the ability

to use VNX and 3U VPX boards together in one hybrid enclosure. “Over time they could shrink the box down to a VNX size,” Ripley says. “The connectivity is close enough to 3U VPX to be able to change it from VPX to VNX.” ◀



This Pixus chassis is a SOSA-aligned development chassis with 4x VITA 67.3c apertures and 4x OpenVPX power and ground slots for a high degree of versatility.

WHO'S WHO IN EMBEDDED COMPUTING CHASSIS AND ENCLOSURES

Abaco Systems Inc.

Huntsville, Ala.
www.abaco.com

Aitech Defense Systems Inc.

Chatsworth, Calif.
www.rugged.com

Annapolis Micro Systems

Annapolis, Md.
www.annapmicro.com

Atrenne Integrated Solutions Inc.

Littleton, Mass.
www.atrenne.com

Brame Technologies

Albuquerque, N.M.
<https://www.brame-tech.com>

Crystal Group Inc.

Hiawatha, Iowa
www.crystalrugged.com

Curtiss-Wright Defense Solutions

Ashburn, Va.
www.curtisswrightds.com

Elma Electronic Inc.

Fremont, Calif.
www.elma.com

ECS Case

Grants Pass, Ore.
www.ecscase.com

Extreme Engineering Solutions (X-ES)

Verona, Wis.
www.xes-inc.com

FiberQA

Old Lyme, Conn.
<https://www.fiberqa.com>

Finisar Corp.

Sunnyvale, Calif.
www.finisar.com

General Micro Systems (GMS) Inc.

Rancho Cucamonga, Calif.
www.gms4sbc.com

Kontron America Inc.

San Diego
www.kontron.com

LCR Embedded Systems Inc.

Norristown, Pa.
<https://www.lcrembeddedsystems.com>

Mercury Systems Inc.

Andover, Mass.
www.mrcy.com

North Atlantic Industries

Bohemia, N.Y.
www.naii.com

Pentek Inc.

Upper Saddle River, N.J.
www.pentek.com

Pixus Technologies

Waterloo, Ontario
www.pixustechnologies.com

Reflex Photonics

Kirkland, Quebec
<https://reflexphotonics.com>

Systel Inc.

Sugar Land, Texas
www.systelusa.com

TE Connectivity

Harrisburg, Va.
www.te.com/usa-en/home.html

Ultra Communications Inc.

Vista, Calif.
www.ultracomm-inc.com

VadaTech Inc.

Henderson, Nev.
www.vadatech.com

Verotec Inc.

North Haven, Conn.
www.verotec.co.uk

ZMicro

San Diego
<https://zmicro.com>



Lockheed Martin is integrating the BAE Systems ASQ-239 electronic warfare and electronic countermeasures system on the F-35 jet fighter-bomber.

Lockheed Martin and BAE Systems to integrate electronic warfare (EW) into F-35

BY John Keller

PATUXENT RIVER NAS, Md. – Military avionics experts at Lockheed Martin Corp. are will integrate new electronic warfare (EW) systems into the avionics systems of U.S. F-35 jet fighter-bombers for the U.S. Navy, Air Force, Marine Corps, and U.S. allies.

Officials of the U.S. Naval Air Systems Command at Patuxent River Naval Air Station, Md., announced a \$585.8 million order to the Lockheed Martin Aeronautics segment in Fort Worth, Texas, to provide systems integration engineering for new ASQ-239 electronic warfare and electronic countermeasures hardware on the F-35 aircraft.

The AN/ASQ-239 EW avionics is designed and manufactured for the Lockheed Martin F-35 combat jet by the BAE Systems Electronic Systems segment in Nashua, N.H. The system provides the F-35 with 360-degree situational awareness and end-to-end capabilities.

The AN/ASQ-239 provides offensive and defensive options to enable the F-35 to identify, monitor, analyze, and respond to threats like radar-guided anti-aircraft missile batteries and air-search radars.

The system makes the most of detection ranges and gives the F-35 pilot evasion, engagement, countermeasures, and jamming

options. The AN/ASQ-239 provides broadband protection to help the F-35 reach well-defended targets and suppress enemy anti-aircraft radar systems.

This system can operate in signal-dense environments and provide the F-35 with radio frequency and infrared countermeasures, and rapid response capabilities. The AN/ASQ-239 has an electronics architecture that enables designers to add new capabilities.

The AN/ASQ-239 on the F-35 fighter-bomber has Integrated radar warning, targeting support, and countermeasures; reduced long-term life cycle cost; increased situational awareness; rapid response capabilities to protect the aircrew; threat warning; and ability to reach well-defended targets.

On this order Lockheed Martin and BAE Systems will do the work in Nashua, N.H.; Fort Worth, Texas; Linthicum Heights, Md.; Balderstone, England; and other locations, and should be finished by April 2026. ←

For more information contact Lockheed Martin Aeronautics online at www.lockheedmartin.com, BAE Systems Electronic Systems at www.baesystems.com, or Naval Air Systems Command at www.navair.navy.mil.

Epirus moves into new facility to develop electromagnetic warfare weapons

Epirus Inc., a venture-backed startup that builds electromagnetic warfare systems capable of taking down enemy drones, has opened a 100,000-square-foot headquarters in Torrance, Calif. The facility will employ about 150 people in engineering, business operations, and research and development. Its founders have seen growing demand for its electromagnetic pulse (EMP) weapon Leonidas, which is designed to defend against enemy drone attacks. Epirus combines RF and microwave technology and artificial intelligence (AI) to create an electromagnetic pulse that can disrupt, disable, and destroy the electronic components of an enemy drone. Epirus officials say their targeted microwave bursts can cast a wide net and take out swarms of drones all at once instead of just one at a time, or neutralize one drone in crowded spaces.

Israel Aerospace introduces electronic warfare (EW) for soft kill

Israel Aerospace Industries (IAI) in Lod, Israel, has unveiled two new additions to its electronic warfare (EW) systems portfolio, designed to protect against threats on land and at sea. The latest iterations of the Scorpius EW system are based on active electronically scanned array (AESA) technology to provide what the company says is a new type of soft kill capability on land and sea. IAI announced the ground-based Scorpius G and maritime Scorpius N systems last month. The latest products are derived from technologies used in two previous airborne pods, the Scorpius SP (self-protection) and SJ (standoff jammer), as well as a ground-based training version, the Scorpius T. The

Scorpius EW systems can track several land and sea threats at once, using jamming to disrupt radio signals. Because of the AESA technology behind it, these kinds of systems are scalable and can provide a defensive bubble around a much wider area to defend a warship against long-range anti-ship missiles or to protect a land-based armored column on the move.

Voltage-controlled programmable attenuator for test introduced by BroadWave

BroadWave Technologies Inc. in Greenwood, Ind., is introducing the model 651-038-020 20-decibel single-step voltage-controlled programmable attenuator for use in scientific test and measurement instruments.

The model 651-038-020 offers a RF and microwave frequency range is DC to 2.5 GHz, with attenuation range of 0 to 20 decibels in a 20 decibel step with plus-or-minus 0.6 decibels of attenuation accuracy. Insertion loss is 0.6 decibels maximum while voltage standing wave ratio (VSWR) is a maximum of 1.40:1. Input power is 1 Watt average with supply voltage 15 volts DC at 30 milliamps nominal. The RF connectors are SMA female, and the control solder terminal features a feed-thru capacitor to prevent leakage. Other attenuation values and RF connector types are available. For more information on this single-step voltage-controlled programmable attenuator contact BroadWave Technologies online at www.broadwave-technologies.com. ←

SOSA Aligned OpenVPX Chassis With Advanced Cooling



- Designed specifically for high-wattage applications
- Various SOSA aligned profile options
- Speeds to PCIe Gen4 and 100GbE
- Modular MIL Rugged design for versatility
- SlotSaver SOSA aligned chassis manager mezzanine



www.pixustechnologies.com

Army Precision Strike Missile (PrSM) enters engineering and manufacturing development (EMD)

BY John Keller

REDSTONE ARSENAL, Ala.—Tactical missile designers at Lockheed Martin Corp. are moving ahead with developing some of the first U.S. Army long-range Precision Strike Missile (PrSM) systems to destroy enemy targets as far away as 300 miles.

Officials of the Army Contracting Command at Redstone Arsenal, Ala., has announced a \$23.9 million order to the Lockheed Martin Missiles and Fire Control segment in Grand Prairie, Texas, for PrSM full-scale development and early operational capability.

missiles that are in milestone B. EMD is the last developmental stage before full-scale production.

The long-range precision-attack PrSM is to replace non-insensitive and cluster munition versions of the Army MGM-140 Army Tactical Missile System (ATACMS).

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

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

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

The new targeting seeker has completed a captive carry test wherein it flew aboard an aircraft against repre-

sentative targets in preparation for further testing and ultimate deployment. ◀

On this order Lockheed Martin will do the work in Grand Prairie, Texas, and should be finished by April 2025. For more information contact Lockheed Martin Missiles and fire control online at www.lockheedmartin.com, or the Army Contracting Command-Redstone at <https://acc.army.mil/contractingcenters/acc-rsa>.



The Army long-range Precision Strike Missile (PrSM) is set for advanced targeting technology to enable the munition to hit moving targets more than 300 miles away.

The PrSM, which should enter service in 2023, will be a surface-to-surface, all weather, precision-strike guided missile fired from the M270A1 Multiple Launch Rocket System (MLRS) and the M142 High Mobility Artillery Rocket System (HIMARS).

The order is for engineering and manufacturing development (EMD), and early operational capability of PrSM lot-one

Northrop Grumman to provide networking data link for Marine Corps helicopters

BY John Keller

PATUXENT RIVER NAS, Md. — Northrop Grumman Corp. avionics experts will provide U.S. Marine Corps combat helicopters with additional sensor networking capability under terms of a \$24.3 million order.

Officials of the U.S. Naval Air Systems Command at Patuxent River Naval Air Station, Md., are asking the Northrop Grumman Mission Systems segment in Woodland Hills, Calif., for 25 Link 16 production B kits, three Link 16 B kit spares, and two Link 16 flight training device B kits for UH-1Y and AH-1Z helicopters.

Link 16 is a military tactical data link network used by the U.S. military and its NATO allies that enables military aircraft, ships, and ground forces to exchange their tactical picture in near-real time. Link 16 also supports the exchange of text, imagery, and digital voice messages.

The AH-1Z Viper is a twin-engine attack helicopter based on the AH-1W SuperCobra that features a four-blade rotor system, uprated transmission, and a new target sighting system. It has upgraded avionics, weapons, and electro-optical sensors designed to find targets at long ranges and attack them with precision weapons.

The UH-1Y Venom helicopter — also called the Super Huey — is a twin-engine, medium-sized utility helicopter designed to replace the U.S. Marine Corps UH-1N Twin Huey light utility helicopters, first introduced in the early 1970s.

Link 16 is based on time-division multiple access (TDMA) communications technology, and is a secure, jam-resistant, high-speed digital data link that operates at RF and microwave frequencies from 960 to 1,215 MHz.

This frequency range limits information exchange directly to line-of-sight distances, although satellite communications (SATCOM) and ad-hoc protocols can pass Link 16 data over long-haul protocols such as TCP/IP using MIL-STD 3011 (JREAP) or STANAG 5602 (SIMPLE). Information typically passes at rates of 31.6, 57.6, or 115.2 kilobits per second.

The AH-1Z and UH-1Y are party of the Marine Corps

H-1 upgrades program to build new helicopters, as well as rebuilding legacy AH-1W SuperCobra attack helicopters and UH-1N Twin Huey utility helicopters with state of the art designs. The program seeks to upgrade AH-1Ws to AH-1Zs, and UH-1Ns to UH-1Ys.

The AH-1Z can carry a payload of 5,764 pounds, can fly as fast as 222 knots, has a range of 370 nautical miles, and can fly as high as 20,000 feet. It has a crew of two, and carries a 20-millimeter Gatling gun, and can fire 70-millimeter Hydra rockets, AIM-9 Sidewinder air-to-air missiles, and AGM-114 Hellfire air-to-ground missiles.



Northrop Grumman will provide 25 Link 16 production B kits, three Link 16 B kit spares, and two Link 16 flight training device B kits for Marine Corps UH-1Y and AH-1Z helicopters.

The UH-1Y can carry a payload of 6,660 pounds — including as many as 10 crashworthy passenger seats and six litters or equivalent cargo. It has a range of 260 nautical miles, and can fly as high as 20,000 feet. It can fly with one or two pilots, has two external stations for 70-millimeter Hydra 70 or APKWS II rockets, and has two pintle mounts for M240D machine guns or Gatling guns. ←

On this order Northrop Grumman will do the work in Woodland Hills and San Diego, Calif., and should be finished by June 2024. For more information contact Northrop Grumman Mission Systems online at www.northropgrumman.com, or Naval Air Systems Command at www.navair.navy.mil.



Unmanned ground vehicle for sensors and weapons introduced by Elbit and Roboteam

BY John Keller

HAIFA, Israel – Elbit Systems Ltd. in Haifa, Israel, and Roboteam Inc. in Rockville, Md., are introducing the ROOK multi-payload military 6-by-6 unmanned ground vehicle (UGV) to deliver supplies, evacuate casualties, perform intelligence gathering, and support remote weapons.

The Rook has built-in autonomy, meets military standards, and accommodates on-field components replacement, modifications, and upgrades with no need for qualified technician or OEM lab maintenance.

A built-in TORCH-X robotic and autonomous application enables the ROOK UGV to navigate rough terrain during the day and at night. The UGV weighs 2,645 pounds, has a

▲ **The ROOK military 6-by-6 unmanned ground vehicle (UGV) from Elbit Systems and Roboteam Inc. is for intelligence gathering and supporting remote weapons.**

low center of gravity and a 9.5-inch ground clearance.

It can carry as much as 2,645 pounds of payload, such as sensors and weapons, and uses a modular hybrid

energy configuration of batteries and optional internal generator. It provides endurance as long as eight drive hours and a speed of 19 miles per hour.

ROOK is operated either via the TORCH-X application or through an all-weather 7-inch ruggedized display to enable one operator to control several unmanned systems. ◀

For more information contact Elbit Systems online at <https://elbitsystems.com>, or Roboteam at <https://robo-team.com>.

Northrop Grumman to develop technologies for long-endurance unmanned underwater vehicles

BY John Keller

ARLINGTON, Va. — U.S. military researchers are moving forward with a project to develop enabling technologies for future large-size unmanned underwater vehicles (UUVs) with long endurance and large payload capacity.

Officials of the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., announced a \$41.2 million contract in December to the Northrop Grumman Mission Systems segment in Linthicum, Md., for phase two of the Manta Ray program.

Manta Ray is to open a design space for future long-endurance unmanned submersibles that are capable of long-duration missions and large payload capacity, as well as to advance key technologies that will benefit other naval designs such as low-cost UUV operations, long duration undersea power management, biofouling reduction, and long-duration navigation.

Northrop Grumman was among Manta Ray phase-one contractors, which included Lockheed Martin Corp., Martin Defense Group, and Navatek LLC. Martin Defense in Honolulu won a \$54.8 million contract in September for the second phase of the Manta Ray project.

The program is developing enabling technologies in energy management and harvesting; low-power high-efficiency propulsion; efficient navigation; mission management; command, control, and communications during long-duration deployments; and techniques to mitigate biofouling, corrosion, and other material degradation.

Phase one was to develop enabling technologies and subsystems for the future Manta Ray large UUV, and phase two focuses on systems integration, based on overall risk posture, maturity of critical subsystems, and technical performance. The future third phase also will involve early testing to reduce program risk, as well as integration testing of Manta Ray energy-management techniques.

UUVs that operate for extended durations without the need for logistic support or maintenance from humans offer the potential for persistent operations in forward environments, DARPA officials explain. Such systems could enhance the flexibility of traditional manned host vessels by providing servicing ports and reduced workloads, officials say.



Northrop Grumman is developing technologies for large long-endurance unmanned underwater vehicles as part of the DARPA Manta Ray program.

The Manta Ray program seeks to demonstrate critical technologies for a new class of long-duration, long-range, payload-capable UUVs to give extra capacity to military commanders without disrupting their operations. Key aspects of the Manta Ray program are classified.

The Manta Ray program seeks to develop key technologies in energy management for UUV operations; energy harvesting at submerged depths; low-power and high efficiency undersea propulsion; and low-power underwater detection and classification of hazards or counter detection threats.

Manta Ray also will investigate mission-management technologies for extended UUV operations; high-efficiency undersea navigation; and new ways to mitigate biofouling, corrosion, and other material degradation for long-duration missions.

The Manta Ray project will include at-sea demonstration of critical technologies to define program goals and identify enabling technologies necessary for future systems.

On this Manta Ray phase-two contract, Northrop Grumman will do the work in Linthicum and Baltimore, Md.; Woods Hole, Mass.; Grandview, Mo.; North Kingstown, R.I.; and Gulfport, Miss., and should be finished by December 2023. ◀

For more information contact Northrop Grumman Mission Systems online at www.northropgrumman.com, Martin Defense Group online at <https://md-defensegroup.com>, or DARPA at www.darpa.mil/program/manta-ray.

Moog to provide electromechanical actuators for DARPA Gremlins unmanned aircraft

BY John Keller

EAST AURORA, N.Y. — U.S. military researchers needed electromechanical actuators for launching and retrieving an experimental unmanned aerial vehicle (UAV) that seeks to overwhelm enemy air defenses. They found their solution from Moog Inc. in East Aurora, N.Y.

and reconnaissance missions from standoff ranges, and then use other C-130 utility aircraft to recover as many of these drones as possible.

The program relies on relatively inexpensive UAVs in volley quantities to saturate enemy defenses. The Gremlins approach

would launch swarms of UAVs with a variety of surveillance and electronic warfare (EW) payloads from aircraft beyond enemy air defenses, and then recover surviving UAVs when they have completed their missions.

The idea is to design UAVs that are inexpensive enough so that occasional losses would not compromise the overall mission. Furthermore, the drones would communicate and cooperate with one another, so surviving drones could assume the roles of those unmanned aircraft lost during the mission. Moog is working with Dynetics Inc. in Huntsville, Ala., on the Gremlins project.

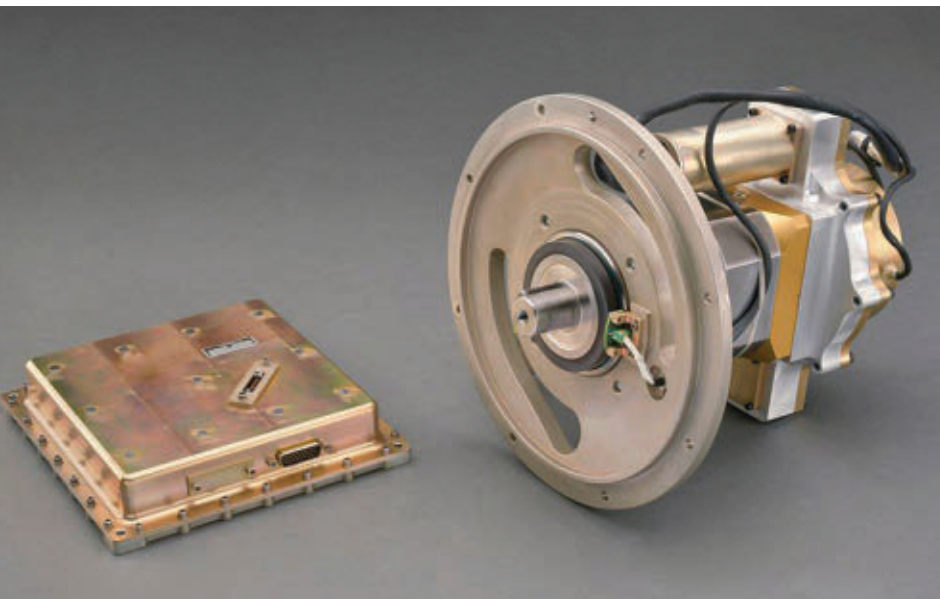
Moog's electromechanical actuation systems provide precision motion control for several elements of the Gremlins demonstration system including Gremlin

tail fin control, Gremlin wing deploy, and fin control for the attitude-controlled "Bullet" which is a key element in the recovery system.

These actuation systems work in a collaborative environment with Dynetics to achieve the rapid integration and flight test schedule that is expected for DARPA programs.

The solutions leverage previously flight-qualified elements and commercial off-the-shelf (COTS) components striking a balance between reliability and cost. The electromechanical actuation system enables flying several different sorties, enabling Dynetics to meet the critical goal of 24-hour refurbishment for return to flight. ◀

For more information contact Moog online at www.moog.com, Dynetics at www.dynetics.com, or DARPA at www.darpa.mil.



Moog Inc. will provide actuators for launching and retrieving the Gremlins experimental unmanned aircraft being designed to overwhelm enemy air defenses.

Moog officials announced that the company's hardware played a critical role in a U.S. Defense Advanced Research Projects Agency (DARPA) X-61A Gremlins Air Vehicle during the program's fourth flight test event in October at Dugway Proving Ground, Utah.

The Gremlins demonstration system flew three Gremlins to conduct four individual flight sorties for a combined 6.7 hours of flight, including the 1.4-hour airborne recovery mission.

The overarching goal of the Gremlins Program, managed by DARPA's Tactical Technology Office, is to demonstrate aerial launch and recovery of multiple low-cost, reusable, unmanned aircraft.

The DARPA Gremlins program seeks develop the ability to use C-130 military aircraft to launch drone swarms of networked and cooperating unmanned aircraft for electronic attack

EHang 216 autonomous aerial vehicle completes debut flight demo in Bali, Indonesia

BY Jamie Whitney

GUANGZHOU, China – EHang, a Chinese manufacturer of autonomous aerial vehicles (AAVs), announced that its EHang 216 model has completed its debut flight demonstration for aerial sightseeing in Bali, Indonesia.

This demonstration flight was conducted under EHang's cooperation with an Indonesian local partner Prestige Aviation, a subsidiary of Prestige Corp.

The EHang 216 demonstrated a five-minute autonomous flight at Villa Blackstone Beach, Bali. VIP guests who witnessed the flight demo include Bambang Soesatyo, Chairman of the Indonesian People's Consultative Assembly, Putu Astawa, Head of the Bali Tourism Office and Rudy Salim, CEO and Founder of Prestige Corp.

Before the flight demonstration, the Directorate General of Civil Aviation of the Republic of Indonesia issued the Special Certificate of Airworthiness for the EHang 216 AAV, enabling it to be the Indonesia's first passenger-grade AAV approved for a public unmanned flight demo.

Hu Huazhi, Founder, Chairman and CEO of EHang, said, "The successful flight demo fully showcased EHang 216's potential



The EHang 216 autonomous aerial vehicle has completed its debut flight demonstration for aerial sightseeing in Bali, Indonesia.

for efficient island hopping and air transportation. We are pleased to join hands with Indonesian local partners to bring our leading AAVs and UAM solutions to Indonesia, one of the most promising UAM markets in Southeast Asia. Our global network of renowned and reliable partners continues to expand, and we believe this is a significant step for our sustainable, consistent success. We look forward to long-term business development prospects in Indonesia." ◀

Avionics to enable unmanned aircraft to operate in GPS-denied environments offered by Honeywell

Honeywell Aerospace in Phoenix is introducing the Honeywell Compact Inertial Navigation System and Honeywell Radar Velocity System for commercial and military aviation applications in small and medium-sized unmanned aerial vehicles (UAVs) — especially those flying beyond visual line of sight missions. These avionics systems offer aviation navigation with low size, weight, and power consumption (SWaP), and enable continued operations even in Global Navigation Satellite Systems (GNSS)-challenged or -denied environments. Globally, GNSS-based systems have become the primary source of navigation for vehicles across air, land, and sea. However, that has led to a significant increase in intentional and unintentional disruptions including jamming and spoofing. Today systems must be able to handle signal disruption and

maintain access to critical navigation and timing. For more information contact Honeywell Aerospace online at <https://aerospace.honeywell.com>.

Using AI to enable unmanned combat vehicle to navigate and locate the enemy

The arrival of artificial intelligence (AI)-powered ground vehicles is set to gradually transform Israel's ground combat capabilities in the face of adversaries deeply embedded in urban settings, which are difficult to detect and respond to in time. In October, Israel's Ministry of Defense announced that Israel Aerospace Industries subsidiary Elta was chosen as the prime contractor for the Carmel future combat vehicle program after a two-year selections process. In August 2019, the Defense Ministry held a demonstration in northern Israel of the three competing platforms for the Carmel *Continued on page 38*

Zenith AeroTech, VIRTEX join forces to build tethered heavy-lift unmanned helicopters

BY John Keller

AFTON, Va. — Zenith AeroTech, a tethered unmanned aerial vehicle (UAV) designer in Afton, Va., is partnering with contract manufacturer VIRTEX in Austin, Texas, to ramp-up production of tethered heavy-lift UAVs for civil and military applications.

Zenith AeroTech and VIRTEX are forming a strategic partnership to meet increasing customer demand for quick-turnaround tethered UAVs that comply with U.S. military and congressional guidelines.

“Zenith brings years of custom-made tethered UAV and free-flight drone design and manufacturing experience, while VIRTEX contributes its sought-after advanced electronics design, manufacturing, and testing capabilities,” says Kutlay Kaya, chairman of Zenith AeroTech. “VIRTEX will allow Zenith to scale-up production to meet larger volume orders in a shorter timeframe.”

Zenith AeroTech offers three different customizable tethered UAV platforms for industry, federal government,

first responder, telecommunications, and military applications.

A tethered UAV connects to a ground station via a cable that passes power and control commands to the aircraft, and transmits live video and other information to operators on the ground.

Zenith AeroTech offers the Hexa, Quad 8, and Quadro tethered heavy-lift UAVs, with the Zenith Ground Power-Tether Management System that enables these unmanned helicopters to stay aloft for days at a time for persistent surveillance.

VIRTEX provides engineering services, design, system level-integration, printed circuit board assembly, and life cycle management services for the aerospace, military, and commercial applications.

Zenith will help VIRTEX enter the small unmanned aircraft market, with introductions to new defense and law-enforcement customers. “We offer leading-edge custom solutions that support multiple channels, including defense,” says Dana Pittman, executive vice president of VIRTEX. ←



Zenith AeroTech is joining with VIRTEX to speed production of tethered heavy-lift UAVs for civil and military persistent surveillance and communications applications.

For more information contact Zenith AeroTech online at <https://zenithaerotech.com>, or VIRTEX at www.virtex.us.

Continued from page 37 program, created by IAI-Elta, Rafael, and Elbit. Yoav Turgeman, CEO of Elta,.

Researchers reach milestone in recovering Gremlins unmanned aircraft

The U.S. Defense Advanced Research Projects Agency (DARPA) has hit a milestone in its Gremlins program to develop an unmanned aerial vehicle

(UAV) to overwhelm and neutralize enemy forces. During a DARPA-led test in 2021 one of the Gremlins drones was recovered in flight by a C-130 aircraft. If the Gremlins drones can perform the mission the U.S. military has in mind, Gremlins might revolutionize warfare, helping the U.S. ensure air superiority in a war with sophisticated adversary like China or Russia. An October test began with two X-61 Gremlins

flying in formation. The Gremlin slowly approached the C-130 from below — like an F-22 Raptor fighter jet would approach a KC-135 aerial tanker — and hooked itself onto a tangling cable. The drone was then reeled inside the C-130, marking the first time one has been successfully retrieved in flight. After inspecting the recovered Gremlin, the testers sent it on another mission within 24 hours. ←



Wanted: 300-kilowatt laser weapons for aerial defense of soldiers and bases

BY John Keller

REDSTONE ARSENAL, Ala. – U.S. Army aerial defense experts are asking industry to develop prototype 300-kilowatt laser weapons to protect soldiers and installations from rockets, artillery shells, mortar rounds; unmanned aerial vehicles (UAVs); helicopters, fixed-wing aircraft, and even more stressing threats.

Officials of the Army Rapid Capabilities and Critical Technologies Office (RCCTO) at Redstone Arsenal, Ala., have issued a call for white papers for the three-year Indirect Fire Protection Capability-High Energy Laser (IFPC-HEL) Prototypes project.

High-energy laser weapons significantly help the Army defend against low-cost threats on the modern battlefield, such as drones. The IFPC-HEL project will develop enabling technologies to help Army leaders protect fixed and semi-fixed sites from rockets, artillery, mortars, UAVs, helicopters, fixed-wing aircraft, and similar threats.

From industry, Army leaders want white papers that outline capabilities to build prototype 300-kilowatt laser weapons to disable or destroy these kinds of battlefield threats. Laser weapons prototypes must be at least as powerful as 250 kilowatts.

This effort will provide as many as four complete laser weapons that comprise beam control, beam director, battle

management, power, and thermal management integrated onto an Army-furnished platform that incorporates an Army-directed laser weapon that will be identified by next October.

▲ **Army experts want to move laser weapons power up to 300 kilowatts to defend against rockets, artillery, mortars, UAVs, helicopters, and fixed-wing aircraft.**

The aerial defense laser weapon systems prototypes must be delivered by summer 2024 for live range testing. Army leaders say they expect to award contracts to one or more companies to deliver high-energy laser weapons prototypes.

Companies interested should email white papers no later than 4 March 2022 to the Army's Joshua Flinn at joshua.e.flinn.civ@army.mil; James Bedsole at james.e.bedsole.civ@army.mil;

and Barbara Cantrell at barbara.a.cantrell2.civ@army.mil. Only U.S. companies with the ability to process and store secret information and hardware are eligible to submit a white paper.

Email questions or concerns to Joshua Flinn at joshua.e.flinn.civ@army.mil; James Bedsole at james.e.bedsole.civ@army.mil; and Barbara Cantrell at barbara.a.cantrell2.civ@army.mil. Companies that submit promising white papers will be invited to submit full proposals. ◀

More information is online at <https://sam.gov/opp/fe1cce00fde64c328b5234be24c795b1/view>.

Raytheon to provide multispectral sensors for Triton unmanned surveillance aircraft

BY John Keller

CRANE, Ind. — U.S. Navy maritime surveillance experts are ordering multispectral targeting sensors for the Northrop-Grumman MQ-4C Triton long-range unmanned aerial vehicle (UAV) for maritime patrol applications.

Officials of the Naval Surface Warfare Center Crane Division in Crane, Ind., announced a \$23.2 million order late last month to the Raytheon Technologies Corp. Intelligence & Space segment in McKinney, Texas, for AN/DAS-3 Multispectral Targeting System (MTS) sensors for the Triton maritime surveillance UAV.

enables mission commanders to use high-definition data from an airborne tactical sensor to identify and engage targets with much greater accuracy, Raytheon officials say.

The DAS-4 includes four high-definition cameras covering five spectral bands; a three-color diode pump laser designator and rangefinder; laser spot search and track capability; automated sensor and laser bore sight alignment; three-mode target tracker; and built-in provisions for future growth.

This advanced electro-optical and infrared (EO/IR) system

provides tracking and laser designation for the Griffin and Paveway missiles, as well as all tri-service and NATO laser-guided munitions. MTS sensors offer several fields of view, electronic zoom, and multimode video tracking.

Multispectral sensors divide images and video into several light wavelengths — typically three to 15 spectral bands — across the electromagnetic spectrum, including light from frequencies beyond the visible light range such as infrared and ultra-violet.

Dividing images into several different wavelengths enables the sensor to extract additional information the human eye fails to capture with its receptors for red, green and blue.

The L3Harris Technologies Advanced Laser Systems Technology segment in Orlando, Fla., is providing the eye-safe



Raytheon will provide multispectral targeting sensors for the U.S. Navy Triton long-range maritime patrol unmanned surveillance aircraft.

The AN/DAS-4 is the latest variant of the Raytheon MTS family of electro-optical sensors, and incorporates greater fire control and target location accuracy for precise targeting coordinates, Raytheon officials say. The Triton is a maritime version of the Northrop Grumman RQ-4 Global Hawk.

The Raytheon MST provides intelligence, surveillance, and reconnaissance (ISR), detection, identification, and targeting capability in day and nighttime operations on manned and unmanned aircraft.

MTS sensors provide detailed intelligence data from the visual and infrared spectra. The new AN/DAS-4 MTS variant

laser rangefinders for the Raytheon MTS.

Raytheon has delivered more than 3,000 MTS sensors to U.S. and international armed forces and integrated 44 variants on more than 20 manned helicopters, fixed-wing aircraft, and UAVs. ◀

On this order Raytheon will do the work in McKinney, Texas, and should be finished by March 2023. For more information contact Raytheon Intelligence & Space online at www.rtx.com/our-company/our-businesses/ris, or the Naval Surface Warfare Center-Crane at www.navsea.navy.mil/Home/Warfare-Centers/NSWC-Crane.

L3Harris to provide electro-optical sights to keep surface ship guns on target

BY John Keller

WASHINGTON – Military electro-optics experts at L3Harris Technologies Inc. will provide shipboard gun sights for the fire-control necessary for U.S. Navy warships to hit enemy ships and aircraft with naval gun fire under terms of a potential \$8.8 million order.

Officials of the Naval Sea Systems Command in Washington are asking the L3Harris KEO segment in Northampton, Mass., to produce additional MK 20 electro-optical sensor systems (EOSS), radar cross sections kits, and repair kits.

The EOSS electro-optics system is a check sight and targeting sensor for anti-surface and anti-air warfare and naval gun fire support missions aboard Navy destroyers and cruisers.

The MK 20 EOSS is a major component of the MK 34 5-inch guns aboard Navy Arleigh Burke-class destroyers and Ticonderoga-class cruisers for use against enemy ships, boats, and aircraft.

L3Harris KEO and its predecessor L3-KEO have been building the EOSS since 2005. That year L3-KEO won a Navy contract to provide the EOSS for the Ticonderoga-class Cruiser Modernization Program. Company electro-optical engineers built on the MK 46 Optical Sight System to blend new technologies into the MK 20 shipboard MOD 0 EOSS, as well as integrate the system into the MK 34 5-inch deck guns.

The MK 20 EOSS for naval surface warships has digital stabilization with fiber-optic gyros, a separate eye-safe laser rangefinder with diode-pumped laser, enhanced built-in test, and improved sensor-to-sensor boresight alignment. The EOSS meets MIL-S-901D heavyweight and large-displacement shock tests.

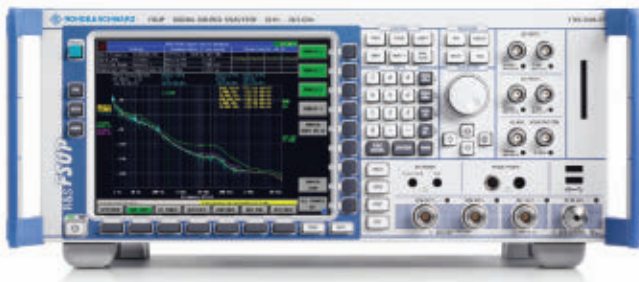


L3Harris KEO is providing electro-optical shipboard gun sights for the fire-control necessary for U.S. Navy warships to hit enemy ships and aircraft with naval gun fire.

The MK 20 MOD 0 incorporates several technology improvements over the MK 46, and new features that support integration with the MK 34 Gun Weapons System (GWS).

To integrate with the MK 34 deck gun, the EOSS has a new interface electronics unit (IEU) that interfaces with as many as two deck gun computers and three deck gun consoles to provide video, target bearing and range, and system status data to all three, while taking commands from any one, L3Harris officials say. ←

On this order L3Harris will do the work in Northampton, Mass., and should be finished by April 2024. For more information contact L3Harris KEO online at www.l3harris.com/all-capabilities/naval-platform-imaging, or Naval Sea Systems Command at www.navsea.navy.mil.



TEST AND MEASUREMENT

▲ Air Force chooses signal source analyzers from Rohde & Schwarz

U.S. Air Force metrology and calibration experts needed signal source analyzers for calibrating phase noise analog and digital modulation test and measurement. They found their solution from Rohde & Schwarz GmbH in Munich.

The Air Force Metrology and Calibration Authority in Heath, Ohio, has ordered signal source analyzers from Rohde & Schwarz for operations in AFMETCAL's precision measurement equipment laboratories and Air Force primary standards laboratory.

The signal source analyzers are for calibration of phase noise analog (AM, FM and PM) and digital modulation measurements. For phase noise measurement Rohde & Schwarz also has provided cross-correlation for sensitivity, flexibility and fast measurement speed all in one box.

The signal source analyzers are based on the Rohde & Schwarz FSWP, a phase noise and voltage-controlled oscillator tester with high sensitivity thanks to extremely low-noise internal sources and cross-correlation.

Due to the low-noise internal local oscillator and a second receive path enabling cross-correlation, it is capable of measuring the phase noise of most commercially available synthesizers and oscillators. The sensitivity increases depending on the number of correlations used. With the analyzer meets the US Air Force's requirements.

The signal source analyzer has a sensitivity of -166 dBc/Hz at 10 kHz offset at 1 GHz, and measures amplitude noise and phase noise, and displays results simultaneously in a diagram or in separate windows.

The signal source analyzer also is a high-end signal and spectrum analyzer with a pre-selection to 50 GHz and an 80

MHz signal analysis bandwidth for analysis of analog or digital modulated signals like required by the Air Force.

The RF and microwave test and measurement device enables users to switch between different measurement channels. Additional options include pulsed phase noise, noise figure, or ILS/VOR measurements.

For more information contact Rohde & Schwarz at www.rohde-schwarz.com, or the Air Force Air Force Metrology and Calibration Authority at www.aflcmc.af.mil/WELCOME/Organizations/Agile-Combat-Support-Directorate/Air-Force-Metrology-and-Calibration.

MILITARY RADIOS

▼ L3Harris to integrate HF and VHF avionics radios for SATCOM-denied environments

Radio communications experts at U.S. Special Operations Command at MacDill Air Force Base, Fla., needed HF manpack radios for MH-47 and MH-60 helicopters. They found their solution from the L3Harris Technologies Inc. Communications Systems segment in Rochester, N.Y.

Special Operations Command (SOCOM) officials announced a \$45.8 million contract to L3Harris to integrate the AN/PRC-160 high frequency manpack radio aboard the MH-47 and MH-60 helicopters. AN/PRC-160(V) wideband HF/VHF radio delivers resilient communications in SATCOM-denied environments.

This wideband system also meets U.S. National Security Agency (NSA) crypto-modernization standards, and offers a software-defined architecture that enables encryption updates to safeguard mission-critical information.

The AN/PRC-160(V) offers data speeds are as much as 10 times faster than existing HF radios, and features software-programmable L3Harris Sierra II encryption, providing secure NSA Type 1 interoperability among U.S. and allied forces.

The wideband system is small and lightweight, increases battery performance, and helps reduce warfighter battle load and fatigue.

The radio supports top secret and below voice and data wideband data rates as fast as 120 kilobits per second. It also is compatible with Harris AN/PRC-150(C) power amplifiers, antenna couplers, vehicular mounts, and accessories.





This SWaP-optimized manpack delivers continuous coverage from 1.5 to 60 MHz on one battery while providing 20 Watts of HF and 10 Watts of VHF power. With its high-speed wideband waveform, the AN/PRC-160(V) transmits data in bandwidths from 3 kHz to 24 kHz.

The Boeing MH-47 Chinook is an American twin-engine, tandem rotor, heavy-lift helicopter that is among the heaviest lifting of Western helicopters. The Sikorsky MH-60 is a special operations variant of the standard UH-60 Black Hawk helicopter that has defensive countermeasures such as infrared and radar jammers and decoy launchers, along with a multi-mode radar and infrared sensor.

The special forces MH-47 and MH-60 helicopters are for the U.S. Army's 160th Special Operations Aviation Regiment, also known as Task Force 160 and the Night Stalkers. These helicopters are designed to survive in hostile airspace while inserting and extracting special forces.

On this contract L3Harris will do the work in Rochester, N.Y. For more information contact L3Harris online at www.l3harris.com, or U.S. Special Operations Command at www.socom.mil.

REAL-TIME SOFTWARE

▲ Air Force chooses real-time software from Green Hills software for C-130J avionics

U.S. Air Force aviation experts needed real-time operating system (RTOS) software for an open-systems aircraft mission processor avionics intended to replace outdated equipment aboard U.S. Air Force C-130J utility aircraft. They found their solution from Green Hills Software Inc. in Santa Barbara, Calif.

Air Force officials have chosen the Green Hills INTEGRITY-178 RTOS for the Special Mission Display Processor (SMDP) aboard the Air Force Lockheed Martin C-130J.

The SMDP requires the RTOS to meet the U.S. National Security Agency (NSA)-defined separation kernel protection profile (SKPP) for high robustness security, which provides the ability to host multi-level security (MLS) software applications.

Security is a top priority for the SMDP because it controls the flow of secure and unsecure information between aircraft systems, and incorporates Link 16 situational awareness into the C-130J.

The Lockheed Martin C-130J Super Hercules is the latest and most technologically advanced version of the C-130 four-engine turboprop military transport aircraft. Compared to the first versions of the C-130 that entered service in the mid 1950s, the C-130J has new engines, flight deck, avionics, and other systems, and is the latest in the longest continuous production run of any military aircraft in history.

The plane's SMDP is a centralized, scalable, high-performance processing system based on an open-systems architecture that runs the INTEGRITY-178 RTOS. In addition to meeting the SKPP and hosting MLS applications, INTEGRITY-178 provides an ARINC 653 partitioning software environment that runs OpenGL ES-SC 1.0 graphics for the displays.

The SMDP can combine video input from the mission computers with Link 16 data to output Link 16 graphics overlaid onto the video. INTEGRITY-178 meets DO-178C DAL A airborne safety requirements and the NSA-defined Separation Kernel Protection Profile. INTEGRITY-178 provides application programming interfaces (APIs) for use by multi-level security applications within a secure partition. For more information contact Green Hills Software online at www.ghs.com.

COMMUNICATIONS NETWORKING

▼ South Carolina National Guard picks Persistent Systems for networking in natural disasters

Humanitarian assistance experts at the South Carolina National Guard in Manning, S.C., needed deployable communications networking in case of hurricanes and other natural disasters. They found their solution from Persistent Systems LLC in New York City.



Persistent Systems demonstrated in November how the rapidly deployable All-Domain Network can enable U.S. National Guard humanitarian assistance and disaster relief operations—even if a hurricane had knocked out local communications infrastructure, such as cell phone towers and internet service.

The field demonstration, which was conducted with industry partners Klas Government, NexTech Solutions, and Tampa Microwave for South Carolina Army and Air Force National Guard units, serves as a follow-up to a tabletop exercise conducted in May.

“We are starting to see — especially those of us living in coastal areas — increasingly powerful storms coming with increasing frequency,” says Adrien Robenhymer, vice president for business development at Persistent Systems.

“These storms not only threaten human life; they also take out communications, making it difficult for state governments to coordinate relief efforts, Robenhymer says. Persistent Systems specializes in mobile ad-hoc networking (MANET) technologies.

In the wake of a devastating storm, the All-Domain Network (previously called the Emergency Response Integrated Edge Network) provides a unified communications network to enable National Guard units to establish internet, radio, video, and messaging capabilities.

The field demonstration had the South Carolina National Guard units set up the All-Domain Network (contained within a Tactical Radio Integration Kit, or TRIK, from Klas Government and supported with the NexTech Solutions MANTLE automated deployment software) at a local base acting as the central Emergency Management Division.

Persistent Systems has powered similar lean, over-the-horizon communications networks with the U.S. Air Force and its Civil Air Patrol (namely, the Airborne Extensible Relay Over-Horizon Network (AERONet)). Likewise, during a Michigan demonstration, it helped land four Air National Guard A-10 Thunderbolt II and two Air Force Special Operations Command C-146 Wolfhound aircraft on a U.S. highway.

For more information contact Persistent Systems online at www.persistentsystems.com, or the South Carolina National Guard at www.scguard.ng.mil.

TEST AND MEASUREMENT

► Lockheed Martin to provide 29 ODIN maintenance kits to keep F-35 jets flying

Aviation logistics experts at Lockheed Martin Corp. will build 29 Operational Data Integrated Network (ODIN) base kits

to speed upgrades, maintenance, and sustainment of U.S. F-35 combat jets under terms of an order worth as much as \$40.9 million.

Officials of the U.S. Naval Air Systems Command are asking the Lockheed Martin Aeronautics segment in Fort Worth, Texas, to build the 29 ODIN base kits, including software installation and integration, for the F-35 in support of the U.S. Navy, Air Force and allies.

ODIN will be a cloud-native computer logistics sustainment system with a new integrated data environment and user applications that will improve F-35 sustainment and readiness.

The order also asks Lockheed Martin to perform on-aircraft tests on Multi-Path Support Equipment (MPSE) candidates to demonstrate MPSE functionality for aircraft support requirements.

ODIN is being designed to decrease F-35 administrator and maintainer workload, increase mission capability all F-35 variants, and enable engineers to develop and deploy software updates rapidly.

ODIN is set to supersede Lockheed Martin’s troubled Autonomic Logistics Information System (ALIS) by December 2022 when all F-35 units should have the new ODIN computers and software.

F-35 pilots, maintainers, and support personnel have been using ALIS to track and order spare parts, conduct repairs, support mission planning and training, and store technical data. Still, ALIS was designed with the jet in the early 2000s, and some of its technology has become outdated; today it creates a system that is slow and difficult to use.

For more information contact Lockheed Martin Aeronautics online at www.lockheedmartin.com, or Naval Air Systems Command at www.navair.navy.mil. ◀



BOARD PRODUCTS

► Rugged 3U OpenVPX single-board computers introduced by General Micro

General Micro Systems (GMS) in Rancho Cucamonga, Calif., is introducing the X9 SPIDER 3U OpenVPX single-board computers for deployed military, aerospace, or rugged applications. The X9 SPIDER offers 455-gigabit-per-second I/O throughput, alignment to the Sensor Open Systems Architecture (SOSA) technical standard, and patented cooling technology. The two scalable modular Intel-based OpenVPX single-board computers are developed with the Modular Open Standards Approach (MOSA), and are based on an Intel 11th gen Tiger Lake-H 8 core Core i7 CPU with 64 gigabytes of memory. Rugged X9 SPIDER VPX boards are available in conduction- and air-cooled versions, and offer I/O bandwidth via several sealed USB 4 and 100-Gigabit Ethernet ports to free designers from the bottlenecks of the OpenVPX backplane. As many as four on-board solid-state drives SSDs for embedded RAID data storage, two PCI Express-Mini sites, plus an add-in NVIDIA RTX5000GPGPU artificial intelligence (AI) co-processor and a 12-volt DC scalable architecture. For more information contact General Micro Systems online at www.gms4sbc.com.

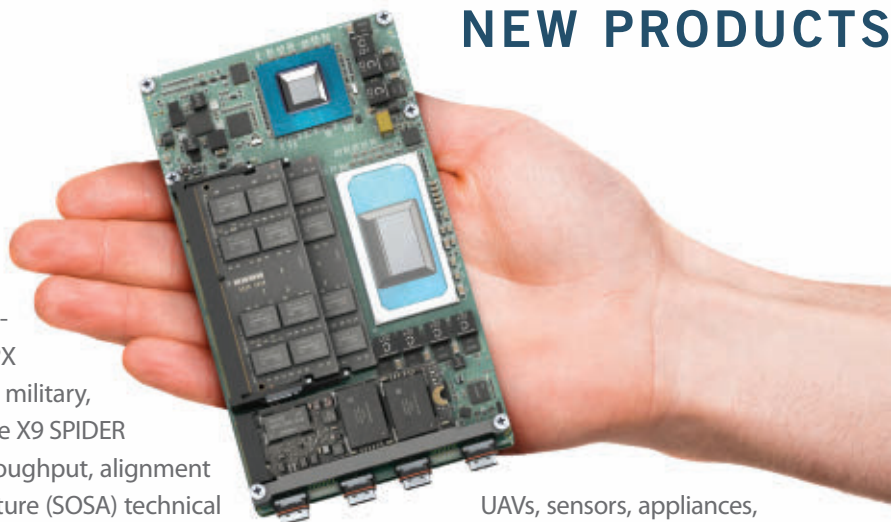
DATA STORAGE

▼ Solid-state drives (SSDs) with cyber security and encryption introduced by DIGISTOR

DIGISTOR, a CRU Data Security Group (CDSG) company in Vancouver, Wash., is introducing the Series C secure solid-state drives (SSDs) with military-grade cyber security and encryption. The Series C adds Cigent D3E cyber security software. DIGISTOR announced its partnership with Cigent Technology, Inc., a leader in embedded cyber security, in late August 2021. The C Series SSDs offer file-level encryption and enable

users to choose whether files are always locked or dynamically locked based on

artificial intelligence (AI)-based threat detection. Once locked, files are available only to authenticated users. The C Series supports multi-factor authentication, including Windows Hello - facial recognition, fingerprint, PIN, Google Authenticator, and third-party authentication solutions like Cisco Duo. The Citadel GL SSD extends pre-boot authentication (PBA) to



UAVs, sensors, appliances, and other headless applications. In addition,

they prevent unauthorized access to data where no monitor or screen is available for user interaction. Additional Citadel SSD data storage devices are available to support multiple SSD (multidrive) installations in tactical servers or PCs. Multidrive allows an authorized user to authenticate to one SSD, unlocking access to all Citadel SSDs in the system. For more information contact DIGISTOR online at <https://digistor.com>.

SENSORS

▼ Tactical-grade MEMS inertial measurement unit (IMU) introduced by EMCORE

EMCORE Corp. in Alhambra, Calif., is introducing the SDC500 micro-electromechanical systems (MEMS) inertial measurement unit (IMU) for high-precision civil aerospace, commercial, industrial, and marine applications. The SDC500 MEMS IMU offers EMCORE's quartz technology, is non-ITAR controlled (ECCN 7A994), and is available with no U.S. export license for most end users throughout the world. The SDC500 is available in accuracy from near tactical grade to high-performance commercial and industrial grade, with precision of a 1-degree-per-hour gyro and 1 milli-G accelerometer to a 20-degrees-per-hour gyro and 5 milli-G accelerometer bias variation over temperature, shock, and vibration environments.

The performance capabilities of the SDC500 are based on the quartz MEMS inertial sensor technology in EMCORE's SDI500 tactical-grade IMU. The SDC500's gyro design retains the sensitivity and linearity of quartz MEMS and improves noise immunity. For more information contact EMCORE online at www.emcore.com.



RUGGED COMPUTERS

► **Small-form-factor (SFF) rugged computers introduced by Abaco**

Abaco Systems in Huntsville, Ala., is introducing the DAGRX and SAYBRX small-form-factor (SFF) line replaceable unit (LRU) computers for avionics, maritime, railway, and industrial automated guided vehicle (AGV) applications. These computers are for ultra-compact, rugged computers for data and I/O processing in 8-to-36-volt DC military, industrial, and commercial, applications. These rugged computers offer Intel processors and modular I/O in rugged and lab variants to optimize size, weight, and power consumption (SWaP). The rugged units are for harsh environments to IP67, and lab variants are for development, test, and full deployment in moderate environments to IP54. The DAGRX embedded computing system incorporates Intel's smallest CPU, the Intel ATOM E3845 Quad Core 1.91 GHz low SWaP-C solution. Power consumption typically is around 13 Watts at 28 volts DC. The lab variant has an operating temperature range of -20 to 60 degrees Celsius at the baseplate, while the rugged variant operates in temperatures from -40 to 85 C. DAGRX can be configured with: MIL-STD-1553, ARINC 429, GPS, serial I/O, Wi-Fi, digital I/O, 12-bit A/D, and CANbus, and as many as five 1000BASE-T ports. For more information contact Abaco Systems online at www.abaco.com.



radiation-hardened semiconductor components, radiation lot acceptance testing (RLAT) of non-hardened components, and analysis. The SVLFL (120 Watts), SVLTR (40 Watts), SVLHF (20 Watts), and SVLSA (6 Watts) will be qualified to MIL-PRF-38534 Class H and Class K pending U.S. Defense Logistics Agency approval. For more information contact VPT online at www.vptpower.com.

SPACE POWER

▼ **Radiation-hardened power electronics devices for space applications introduced by VPT**

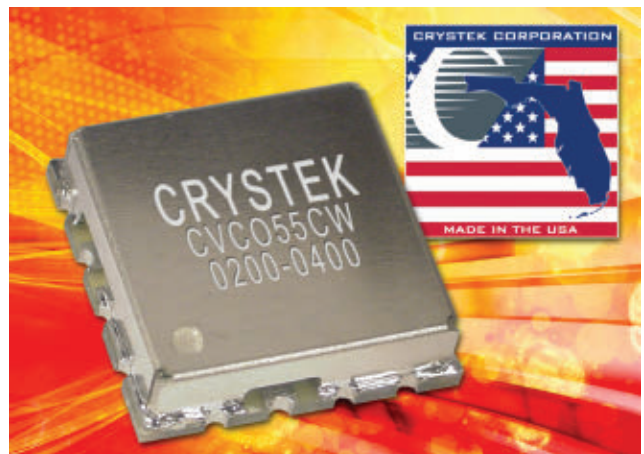
VPT Inc., a HEICO company in Blacksburg, Va., is introducing the SVLFL, SVLHF, SVLTR, and SVLSA series of 50 volt space-qualified DC-DC converters for space applications facing harsh radiation environments. These power electronics devices offer total ionizing dose (TID) performance to 60 kilorads, and operate in temperatures from -55 to 125 degrees Celsius with no power derating. These DC-DC converters are for use in low-Earth orbit (LEO), medium-Earth orbit (MEO), geostationary orbit (GEO), deep-space missions, and launch vehicle programs. These power devices offer an input voltage range of 30 to 60 volts, with guaranteed performance through



RF AND MICROWAVE

▼ **Voltage-controlled oscillator (VCO) for RF and microwave applications offered by Crystek**

Crystek Corp. in Fort Myers, Fla., is introducing the CVCO55CW-0200-0400 voltage-controlled oscillator (VCO) for RF and microwave applications such as digital radio equipment, fixed wireless access, satellite communications (SATCOM) systems, and base stations. The CVCO55CW-0200-0400 operates from 200 to 400 MHz with a control voltage range of zero to 5 volts. This VCO features a typical phase noise of -102 decibels relative to the carrier (dBc) per Hertz at 10 kHz offset and has excellent linearity. Output power typically is 4.0 decibel-milliwatts (dBm). Engineered and manufactured in the USA, the model CVCO55CW-0200-0400 is made for RF and microwave applications in the industry-standard 0.5 by 0.5-inch surface-mount device (SMD) package. Input voltage is 5 volts with a maximum current consumption of 15 milliamps. Pulling and pushing in digital radio equipment, fixed wireless access, satellite communications (SATCOM) systems, and base stations are minimized to 5.0 MHz peak-to-peak and 6 MHz per volt, respectively. Second harmonic suppression is -10 dBc typical. For more information contact Crystek Corp. online at www.crystek.com.



CHASSIS AND ENCLOSURES

► **4U embedded computing chassis for SOSA-aligned boards introduced by Pixus Technologies**

Pixus Technologies in Waterloo, Ontario, is introducing a 4U 19-inch rackmount embedded computing chassis with a horizontal loading configuration for military, aerospace, and industrial applications. The chassis has a side-to-side airflow approach and supports 3U, 6U, or a mix of 3U and 6U OpenVPX boards. The 4U-tall chassis platform supports as many as six SOSA-aligned or OpenVPX 6U boards along with six boards in the 3U form factor. Alternatively, the form factor can be divided into three segments that can host as many as 18 boards in the 3U OpenVPX size. The chassis can accept either a fixed modular power supply or a pluggable version that complies to VITA 62. Rear transition module (RTM) slots are available depending on the enclosure configuration. Backplanes are available that support several OpenVPX and SOSA profiles and speeds as many as 100 Gigabit Ethernet. Versions with VITA 66 optical or VITA 67 RF interfaces also are standard. Pixus offers 1U-to-4U-tall horizontal orientation 19-inch rackmount systems in side-to-side or front-to-rear cooling configurations. The enclosures can be modified to MIL rugged formats. For more information contact Pixus Technologies online at www.pixustechnologies.com.



to exit and protecting the safety of firefighting operations. Halogen-free materials also produce clear and white smoke for better visibility, and do not emit halogen's toxic off-gases.

The PTLs cables are available in 0.2-to-0.6-inch sizes and address all frequencies from HF through K band — including a variant optimized for minimum loss in Ku band. Cable assemblies can be supplied with any type of industry standard RF interface. The assemblies incorporate the proprietary TF5 dielectric for a low loss flexible phase-optimized cable. For more information contact Times Microwave online at www.timesmicrowave.com.

RF AND MICROWAVE

► **Gallium nitride RF amplifier for radar applications introduced by Comtech PST**

Comtech PST Corp. in Melville, N.Y., is introducing the model BMPC9X89X8-8000 gallium nitride (GaN) RF and microwave amplifier for rugged X-band pulsed-radar applications. The AB linear design operates from 9 to 9.9 GHz over any instantaneous bandwidth



of 500 MHz. The amplifier design features self protection for load voltage standing wave ratio (VSWR), duty factor, pulse width, temperature, and graceful degradation in case of a RF power module failure. The RF and microwave amplifier

offers custom configurations and features, as well as specific power levels to 16 kilowatts. Features include high-output power dynamic range; efficiency; RF input and output sample detectors; pulse width and duty factor protection; thermal and load VSWR protection; Ethernet and remote status and control interface; and internal AC power supply. The amplifier offers peak output power of 8000 Watts; nominal power gain of 69 decibels; maximum pulse width of 0.25 to 100 microseconds; maximum duty cycle of 10 percent; pulse droop of one decibel; typical pulse rise and fall time of less than 50 nanoseconds; input VSWR of less than 1.5:1; and output load VSWR of less than 1.5:1. The amplifier operates in temperatures from 0 to 50 degrees Celsius at the baseplate; in non-condensing humidity of 0 to 95 percent; withstands shock and vibration per MIL-STD-810F; operates at altitudes to 12,000 feet; measures 19 by 12.25 by 24 inches; and weighs 90 pounds. For more information contact Comtech PST online at www.comtechpst.com.

CABLING

► **Low-smoke RF cable assemblies for ships and submarines introduced by Times Microwave**

WALLINGFORD, Conn. — Times Microwave Systems, an Amphenol company in Wallingford, Conn., is introducing the PhaseTrack Low Smoke (PTLS) RF and microwave cable assemblies for shipboard applications. These cables provide phase temperature performance to 85 degrees Celsius, and offer a low-smoke zero-halogen (LSZH) jacket for confined spaces where air exchange is minimal such as onboard ships and submarines. Fire is one of the greatest dangers in these environments, as accumulating smoke can obscure visibility for safe evacuation. When burned, low-smoke cables emit a less optically dense smoke that releases at a lower rate, making it easier for occupants



NEW PRODUCTS

EMBEDDED COMPUTING

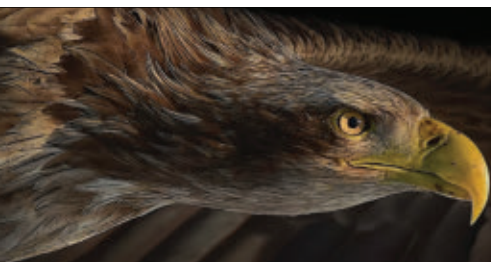
▲ CMOSS-compliant and SOSA-aligned embedded computing introduced by Curtiss-Wright

The Curtiss-Wright Corp. Defense Solutions segment in Ashburn, Va., is introducing two convection-cooled embedded computing systems that comply with the U.S. Army CMOSS standard and align with the SOSA Technical Standard 1.0. Curtiss-Wright announced the CMOSS/SOSA Starter Kit (CSSK) for use on ground combat vehicles. CMOSS stands for Command, Control, Communications, Computers, Cyber, Intelligence, Surveillance, Reconnaissance (C5ISR)/Electronic Warfare Modular Open Suite of Standards, while SOSA stands for Sensor Open Systems Architecture. The CSSK speeds development of CMOSS and SOSA components by providing a pre-integrated four-slot 3U VPX system. It combines a SOSA-aligned network module that complies with Vehicle



Integration for C4ISR/EW Interoperability (VICTORY) standard; a SOSA-aligned assured position, navigation, and timing (A-PNT) module; a SOSA-aligned single-board computer; and a 3U VPX power supply. Curtiss-Wright also announced a rugged eight-slot CMOSS-compliant and SOSA-aligned enclosure for military combat vehicles. The powered chassis has eight 3U OpenVPX slots, one External I/O slot, one I/O-intensive compute slot, four generic payload slots, one data plane/control plane switch slot, and one A-PNT radial clock slot. Curtiss-Wright's CMOSS chassis meet the U.S. Army PEO Ground Combat Systems Standardized A-Kit / Vehicle Envelope (SAVE) — a standard that defines internal mounting and physical interfaces for connecting CMOSS systems and radios to platforms. These fan-free chassis are for combat vehicles and helicopters. For more information contact Curtiss-Wright Defense Solutions online at www.curtisswrightds.com. ←

PRODUCT & LITERATURE SHOWCASE



Zio 2

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