SPECTRUM

L3Harris Communication Systems Publication | Fall 2022 Edition



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FEATURED 14

ON COVER 14 BREAKING THE BARRIERS TO DELIVER JADC2

L3Harris is making investments in disruptive technology solutions that enable Joint All-Domain Command and Control by leveraging decades of innovations trusted by militaries around the world and designing systems that meet the needs of today while anticipating the needs of tomorrow.

Spectrum is an L3Harris Communication Systems publication. The magazine provides the most-up-to-date information about innovative technologies, products and customer solutions through interactive features and in-depth story telling.

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L3Harris Technologies is an agile global aerospace and defense technology innovator, delivering end-to-end solutions that meet customers' mission-critical needs. The company provides advanced defense and commercial technologies across space, air, land, sea and cyber domains. L3Harris has approximately \$17 billion in annual revenue and 47,000 employees, with customers in more than 100 countries. L3Harris.com

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RESILI PERSE

L3Harris integrates leading-edge solutions from across its businesses to deliver resilient communications and connected sensors for emerging Joint All-Domain Command and Control ecosystems.

CELEBRATING 60

L3Harris Technologies, provider of assured communications for the E-4B airframe, joined the U.S. Air Force at Offutt Air Force Base, Nebraska, Aug. 6 to celebrate the 60th anniversary of the National Airborne Operations Center (NAOC) mission.

OPERATIONAL EXCELLENCE THROUGH DIGITAL INNOVATION

The COVID-19 pandemic has accelerated the digital transformation of business out of sheer necessity. L3Harris has taken this disruption as a catalyst to evolve our manufacturing operations into a modern, lean and connected ecosystem.

THE TECHNICAL INTEROPERABILITY ADVANTAGE

L3Harris is delivering a layered approach to interoperability for public safety via a full line of specialized systems and converged communication solutions.

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NEWS BRIEFS

L3HARRIS, INMARSAT-LED **INDUSTRY TEAM DEMONSTRATES REAL-WORLD JADC2 CONNECTIVITY**

L3Harris Technologies, Inmarsat Government and industry partners demonstrated an unparalleled level of Satellite Communications (SATCOM) connectivity in support of representative Joint All-Domain Command-and-Control (JADC2) operations at this year's Special **Operations Forces Industry** Conference (SOFIC) in Tampa, Florida.

"Our JADC2 demonstration at SOFIC further demonstrated the enabling capabilities we can provide the Special Operation Forces community today, and the Inmarsat connectivity with our DarkWing terminal was a critical element of the network architecture," said Dana Mehnert, president, Communication Systems, L3Harris. "We look forward to furthering this partnership and continuing to deliver solutions to SOF operators that enable cognitive overmatch."

Those in attendance, specifically the international community, expressed how impressive the demonstration was in showcasing the seamless integration of the various technologies to meet their needs in enabling critical operations, Mehnert added.



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L3HARRIS LAUNCHES NEXT-GENERATION TWO47™ BASE STATION FOR PUBLIC SAFETY AND PROFESSIONAL COMMUNICATIONS

L3Harris Technologies is launching a new portfolio of next-generation solutions, services and systems tailor-made to meet the demands of public safety officials in the 21st century.

The Two47™ portfolio responds to the evolving needs of public safety and professional communications, from law enforcement and fire departments to utilities and transportation. Two47 delivers the latest in critical-communication solutions, including cloud-enabled software, compact and modular hardware and systems designed to withstand the challenges of today and tomorrow, including natural disasters and advanced cybersecurity threats.

The initial entry into the next-generation portfolio is the Two47 Base Station. Leveraging the latest in telecommunication technology, the base station allows customers to save space, lower operating costs and reduce energy use at the site. As with all future solutions within the Two47 portfolio, the base station is designed for redundancy and interoperability with open networks and point-to-point security, all backed with all-in, 24/7 L3Harris technical support.



VIASAT AWARDS L3HARRIS SMALL TACTICAL TERMINAL ORDER

L3Harris Technologies will provide 1,100 Small Secure Data Link radios to Viasat under a recent contract to support the Small Tactical Terminal (STT) program – the only multi-channel radio capable of performing Link 16 communications in a small form factor.

The two companies have partnered for the last 12 years to provide the two-channel radio, which provides seamless interoperability and improves communications between U.S. and coalition forces requiring critical information from multiple networks. More than 2,500 STT systems have been sold to date to the U.S. armed forces and international allies, and the STT is operated on more than 30 platforms.

The STT was co-developed and designed with Viasat to deliver Link 16 connectivity on a wide variety of Size, Weight and Power (SWAP)-constrained platforms, such as helicopters, unmanned aircraft and highly mobile platforms. Viasat provides the Link-16 channel while L3Harris provides the second channel supporting other tactical VHF/UHF waveforms, equivalent to the capabilities offered by the AN/PRC-152A.

The STT received Link 16 Crypto Modernization Initiative certification in 2020, and Link 16 Enhanced Throughput has been supported since 2018. Within the next 12 months, software upgrades are planned to enable Concurrent Multi Net, Concurrent Contention Receive and Advanced Anti Jam capabilities. When upgraded, the STT will provide warfighters with Link 16 Advanced Capabilities increasing their effectiveness on the battlefield.

This award continues our successful partnership with Viasat over the years in providing leading-edge tactical network solutions to the U.S. Department of Defense and allied nations. As technology advances and areas of operation become more congested and faster paced, the multidomain interoperability Link 16 provides becomes crucial for success. The small form factor of the STT is a force multiplier when you consider the breadth of its enduring platform applicability without sacrificing space for other needed capabilities.

- Chris Aebli, President, Tactical Communications, L3Harris

L3Harris Technologies has been awarded \$176 million in orders for multi-channel handheld and vehicular radio systems by the U.S. Marine Corps to enable interoperability across U.S. Department of Defense, Special Operations Command and key allies.

The orders are the first under a recently awarded 10-year, \$750 million IDIQ contract for the L3Harris Falcon IV[®] family of manpack and handheld radios. The Falcon IV family has also been broadly adopted by the U.S. Army, U.S. Special Operations Command, U.S. Air Force and a growing number of key allies.

"The battle-proven radios to be delivered within these orders will extend Marines' speed and agility by providing secure and resilient communications to meet their unique mission needs," said Chris Aebli, president, Tactical Communications, L3Harris. "Our multi-channel handheld radios are the most advanced systems available today, offering true resilience against peer adversary threats and enabling Joint All-Domain Command and Control."



The F-PANO features a 97-degree field of view and fuses image intensification technology with thermal imagery to provide operators with enhanced situational awareness in all battlefield conditions and light levels. The system communicates to the end user device to display Android Tactical Assault Kit (ATAK) information within the field-of-view of the goggle.

After introducing the F-PANO at SOFIC in 2019, L3Harris was awarded an \$7.9 million LRIP contract earlier this year to deliver the advanced night vision technology as a solution for special operations teams serving in low or no-light conditions in multiple theaters. The complete system facilitates a hyper-enabled operator with the ability to interface with multiple sensors and delivers critical battlefield information directly to the eye of the operator. Delivery of the goggles is planned to begin later this year.

RIS SECURES STRATEGIC JADC2 WIN WITH U.S RATIVE ENGAGEMENT CAPABILITY CONTRACT

The U.S. Navy awarded L3Harris Technologies a contract worth up to \$380 million for the production, repair, and sustainment of the Cooperative Engagement Capability (CEC) system.

The CEC system enables high-quality situational awareness and integrated fire-control capability for the battle force. It is designed to enhance the anti-air warfare (AAW) capability of U.S. Navy ships and aircraft, U.S. Marine Corps Composite Tracking Network (CTN) and allied nation units and is a key element of the naval service's integrated sensors and networked communications solution set.

"L3Harris is the trusted global provider of resilient, all-domain communications networks, and, with this CEC agreement, the Navy has affirmed we deliver best-in-class capabilities to employ mission-critical data for their most important missions," said Brendan O'Connell, president, Broadband Communications Systems, L3Harris. "The CEC enables the Navy, Marine Corps and Coalition forces to sense, defend and strike earlier than the threat, increasing the survivability of the battle force and the overall speed of communication as they maneuver in a complex, multi-domain battlespace."

L3HARRIS BEGINS PRODUCTION OF NEXT-GENERATION PANORAMIC NIGHT-VISION SYSTEM FOR USSOCOM

L3Harris Technologies has begun low-rate initial production (LRIP) of the Fused Panoramic Night Vision Goggle (F-PANO), which will provide the U.S. Special Operations Command with unprecedented situational awareness for improved mobility, targeting and lethality.



THE RASOR EDGE

The Rapidly Adaptable Standards-compliant Radio (RASOR™), L3Harris' new Modular Open System Approach (MOSA) solution, is the culmination of years of investment and research to deliver next-generation JADC2-enabling capability to the U.S. military.

As the U.S. military builds more complex mission-enabling technologies, individual components become tightly coupled to these systems-of-systems, adding unneeded complexity when inserting new capabilities into the architecture.

Traditional development strategies are unable to rapidly adapt to changing battlespace dynamics. As such, the U.S. Department of Defense is moving toward a modular system approach, promoting interchangeability and interoperability with a wide variety of sources.

"Having an open-systems architecture allows for more innovation," Douglas Bush, Assistant Secretary of the Army - Acquisition, Logistics & Technology, said, according to The National Interest. "Ten years from now, there might be a whole new company with a whole new technology, for example, that would have a kind of radar or kind of sight for a tank, say, or some kind of new communications gear, that wasn't even thought of when we designed the system and procured it. Really what you want is a way to bring in new things like that, without having to kind of start from scratch on the design."

Modular Open Systems Approaches (MOSA) are gaining traction within the DoD. Requirements aligned to MOSA are being included in new industry requests for information and proposals. Individual military branches are beginning to converge on agreements regarding best practices and standards to increase total-force alignment.

"If you think of the war of yesteryear and the next peer-to-peer conflict – where the United States will go up against highly sophisticated adversaries that might have the ability to challenge or defeat our communication capabilities – our military manager. One step toward mitigating the needs to rapidly adapt in the field to meet new requirements," said Brendan O'Connell, president of L3Harris' Broadband Communications business.

Additionally, 70 percent of typical procurement costs are reserved for outyear support and sustainment; a modular approach significantly reduces the financial burden of these considerations due to the on-the-fly insertion capabilities it offers.

"We are applying a new software and hardware approach to our MOSA offering to the military that includes designs and architectures that can be adapted in a third of the time," O'Connell said. "Our new system, the Rapidly Adaptable Standards-compliant Radio (RASOR™), is our strategic technology solution that helps address this new shift in our customers' needs. It's the genesis of a truly modular open systems approach that postures the United States and its allies for the next-generation fight in a revolutionary way."

RASOR[™] aligns to major U.S. DoD and industry-adopted technical standards and embraces an innovative design to enable rapid insertion of capabilities fit for the near-peer fight and Joint All-Domain Command and Control operations.

We are applying a new software and hardware approach to our MOSA offering to the military that includes designs and architectures that can be adapted in a third of the time. Our new system, the Rapidly Adaptable Standards-compliant Radio (RASOR™), is our strategic technology solution that helps address this new shift in our customers' needs. It's the genesis of truly modular open systems approach that postures the United States and its allies for the next-generation fight in a revolutionary way.

OPEN SYSTEMS ARCHITECTURE

There are numerous complex integration challenges involved in designing open systems architecture, according to Matt Tuttle, L3Harris Product Management complexity is L3Harris' RASOR, a system within a system that enables third-party technologies to interface within the ecosystem.

RASOR's small form factor, flexible design meets the unique size and space limitations of manned and unmanned aerial, ground and naval platforms.

"Because of our unique design approach, we have minimized the time in which we can customize RASOR to meet bespoke requirements," Tuttle added.

The L3Harris RASOR chassis, known as RARE[™] (Rapidly Adaptable Ruggedized Enclosure), brings a highly innovative additive manufacturing approach leveraging various advancedmanufacturing technologies, such as 3D-printing. RARE can scale from three to 12 slots with customized modules, including L3Harris-proprietary technology as well as third-party solutions. The individual modules provide a wide breadth of crossdomain capabilities, from resilient line-of-sight and beyond-line-of-sight communications to Intelligence, Surveillance and Reconnaissance, Command and Control. Assured Positioning, Navigation and Timing and Electronic Warfare, all with multilevel security.

Continued

- Brendan O'Connell, President, Broadband Communications, L3Harris

The company is "quickly pacing to become" the industry leader in providing cross-domain security and encryption, an imposing challenge for modular systems, according to Tuttle. Moreover, the innovation in the adaptability of the chassis design is "very pivotal" and is strengthened by the core ecosystem software known as Dynamic Software Capability Orchestrator, or DSCO™.

DSCO unites the entire ecosystem of once dissimilar capabilities through task, chassis and resource management functions, Tuttle added. The approach also enables rapid capability insertion via software development kits and open-source Docker and Kubernetes, empowering third parties to leverage L3Harris' hardware and ecosystem with a software approach that "containerizes" native code and runs it through an agnostic process to deploy or undeploy at needed scale.

RASOR DEVELOPMENT

RASOR builds upon a strong pedigree of earlier generation open systems, such as the Advanced Signal Processing Engine (ASPEN™), fielded on the U.S. Army UH-64 Apache, and several programs within the classified space. L3Harris started fielding open systems last decade and continues to build on the lessons learned while integrating new industry standards.

EXPANDABLE

3-12 SLOTS

As industry has learned more about how to solve open-system integration challenges, and as standards bodies have better defined requirements and approaches, there has been more traction in developing true open-systems architectures, Tuttle said.

"Because we have invested heavily in this technology, we are quickly on pace to be the de facto market leaders for open systems," he said. "RASOR is the trusted disruptor technology for the DOD. We're really providing Communications as a Service by applying robust software and resource management within the chassis and ensuring it interoperates with all connected capabilities with ease."

The company invested internal research and development into studies on how to implement the technology and conducted rigorous study and analysis to prove its battle-readiness. The company is also leveraging best practices from its long-standing relationship with the U.S. National Security Agency in developing RASOR's security architecture, he added.

THE CMFF SOLUTION

When the U.S. Army looks at large-scale combat operations moving forward, the integration of electronic warfare and assured resilient communications is essential. Key to providing that capability is characterizing the RF radiofrequency environment to help operators understand the battlespace so they can automatically move between resilient networks to counteract cyber threats, according to Tom Kirkland, L3Harris vice president and general manager of Army and SOCOM programs.

The Army began down the open systems architecture path late in the last decade with Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Modular Open Systems Standards, or CMOSS for short. Since, the service has been requiring CMOSS-compliance for integration on all platforms within its inventory.

"The Army is fully committed to open systems with the CMOSS Mounted Form Factor (CMFF) program," Kirkland said, noting the service has adopted a three-block approach that aligns to their capability set fielding schedule, allowing them to iteratively add capability over time until they reach an integrated communications and EW system. "L3Harris is the leader in resilient communications and EW, and our investment into RASOR will help accelerate and field an integrated system."

The service is taking a "unique approach" by officially chartering one program executive office to purchase all CMOSS Form Factor solutions to standardize and ensure interoperability across all ground and air assets, according to Kirkland, noting that modernization efforts under the CMFF umbrella – formalized as a Program of Record in January 2022 – will help the Army find cost synergies across their platforms while rapidly adding new capabilities.

L3Harris' RASOR solution keys in on three of the major considerations for the CMFF program, according to Kirkland: enabling interoperability; deploying more advanced capabilities onto platforms more expeditiously; and a convergence of communications and electronic warfare capabilities for large-scale combat operations and multi-domain operations. "RASOR is designed to meet and exceed the requirements for CMFF," Kirkland said. "The best part of RASOR is it's a result of collaborating with all the of the key stakeholders of CMFF to ensure we are providing the capabilities they need on time or ahead of time."

L3Harris further enables interoperability via RASOR by combining the bestof-breed, battle-proven capabilities from across the enterprise to deliver fully integrated solutions with the manufacturing capability to meet customers' speed of need.

"No one in the industry has a wider, more-expansive inventory of resilient waveforms than we do," Kirkland said. "Customers can go straight to L3Harris, and we have all the ground-to-air, air-toair and resilient waveforms they would need to conduct any operation within their scope."

MESHING AIR AND GROUND

L3Harris' investment in the technology is warranted, given the U.S. military's appetite for this capability; the U.S. Air Force is "all in" on open systems, according to Ron Fehlen, vice president and general manager or Air Force and Unmanned Aerial Systems. Fehlen added that the air service typically pays for standards development around the Sensor Open Systems Architecture (SOSA™) concept.

"In the ecosystem of open-architecture systems, RASOR is targeting systems that require cost versus capability trades," Fehlen continued. "If the service needs an unmanned aerial vehicle with a per-unit cost under \$30 million, they want as much capability as they can afford, realizing they will need to make trades. RASOR allows them to choose now and add later in a cost-effective approach across the lifecycle."

Without moving toward open systems, the service risks both "vendor lock" as well as the inability to respond at the "pace of threat" and technology, according to Fehlen.

L3Harris has already demonstrated the capability of RASOR for the Air Force, including a recent exercise proving aerial connectivity of the service's new MeshONE waveform between air and ground surrogate vehicles hosting the company's new solution.

DISTRIBUTED MARITIME OPERATIONS

L3Harris is developing key technologies to enable the Navy Tactical Grid as well as capabilities required under the Navy's service-specific JADC2 acquisition program known as "Project Overmatch," according to Brenna Baker, L3Harris vice president and general manager of Navy and Advanced Unmanned Aerial Systems programs.

The Navy awarded L3Harris a contract under the Landing Autonomous Navigation Technology for Enhanced Recovery to Navy Ship (LANTERNS) in June 2022, which will modernize the Joint Precision Approach and

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- Matt Tuttle, Manager, Product Management, L3Harris



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Landing System (JPALS) on all aircraft carriers with improved ship-to-aircraft communications technology. Ultimately, U.S. Naval Air Systems Command will include this vital technology in the entire air wing of the future.

As the naval service modernizes its fleet across domains, the open architecture standards and modular hardware and software offered by RASOR will be required to address rapid, affordable integration and fielding, according to Baker.

Our RASOR solution will replace heritage single-point solution radios with a modular approach able to host heritage analog waveforms, along with our newer digital and resilient waveforms, preserving interoperability."

RASOR's ability to be air- or liquidcooled mitigates size, weight and power constraints related to the unique environmental challenges of maritime operation, she added. RASOR will accelerate resilient communications and networking to the future fleet, including both manned and unmanned systems.

With 60 years of proven history partnering with our customers to solve their most-challenging missions, L3Harris is now positioned to enable a network from space to undersea, with an affordable and modular approach to integration.

> Scan to learn more about the capabilities of RASOR



STRENGTHENING SATCOM

Current conflicts around the world are proving the need for more robust protection of Satellite Communications against adversary interference. The combination of L3Harris VSATs, modems and advanced waveforms delivers the effect needed for future integrated combat operations.

As the world dives deeper into the age of strategic competition, reliance upon more traditional communications solutions is being threatened by highly capable peer adversaries.

Satellite Communications (SATCOM), for example, have provided the connectivity backbone for allied counter-insurgency campaigns over the past two decades. But, Russia's invasion of Ukraine on February 24, 2022, illustrated an emerging threat disrupting Ukrainian Armed Forces' tactical SATCOM.

The realization that armed forces need to better protect SATCOM connectivity has "been around for a while," according to Jerry Adams, L3Harris Technologies general manager of SATCOM programs.

"The biggest fear is to have your communications jammed," Adams said, noting the ongoing conflict in Ukraine has illustrated the "urgency of bringing more secure technology into the broader SATCOM terminal fleets." At the tactical level. small-unit teams can benefit from a variety of solutions to better protect SATCOM, even in contested environments.

The combined capabilities of protected Verv Small Aperture Terminals (VSATs). secure modems and resilient waveforms allow warfighters to communicate via satellites while minimizing electronic signatures and interference by nearpeer adversaries.

This need aligns with the U.S. Space Force's "Vision for Enterprise Satellite Communications," which provides the foundation for a hybrid space architecture for the future.

"Initial force designs have focused on the large-scale topology of the space-tospace and ground-to-space information transport framework to avoid previous traps of building dedicated, nonintegrated networks to service specific users," Space Force's Space Warfighting Analysis Center spokesperson Maj. Sarah Babcock told Breaking Defense in July. "Subsequent force designs are focusing on the particular elements of this integrated architecture, to include narrowband and broadband users."

As such, L3Harris is integrating its VSAT, modem and waveform technologies into a unified solution designed to deliver protected SATCOM services at the tactical edge.

"Bringing advanced L3Harris modems to our terminals provides customers with robust and resilient communications needed for mission success," Adams said.

EXPEDITIONARY TERMINALS

L3Harris has delivered more than 10,000 deployable VSATs to the U.S. Department of Defense and its international partners over the last decade, typically with commercial and unprotected modems.

"This stems from their operational needs over the past 20 years, where there hasn't been a focus on near-peer type conflicts, meaning units have been able to broadly and successfully use commercial modem platforms," Adams said. "But the times are changing, and the U.S. Army, Marines and 'Five Eyes' partners are looking at the scenarios in the near future that necessitate a broader protected modem capability to prevent jamming and introduce orbital diversity to take advantage of cutting-edge, low-latency, high-throughput services."

The latest L3Harris VSAT offerings include Panther II manpack and Hawkeye 4 Lite (H4L) flyaway terminals. Both terminals are available as manual point or motorized auto-acquisition. These terminals feature modular X-, Kuand Ka- frequency band kits, certified for both government and commercial networks with a wide selection of fieldswappable and rugged modem modules.

"On the terminal side, Panther and Hawkeye give the warfighter the flexibility to use multiple services; if there isn't capacity available on one service, or a commercial frequency is jammed, they can quickly and easily switch to another," Adams said.

MULTIPLE MODEMS

L3Harris provides customers a range of software-defined modems that can be embedded into the company's family of VSAT solutions to support a myriad of operational requirements.

For example, the Air Force and Army Anti-jam Modem (A3M), through multiple software-defined waveforms, can provide anti-jam through the Protected Tactical Waveform and mesh capabilities via the Network Centric Waveform.

In April 2020, U.S. Space Force's Space and Missile Systems Center awarded L3Harris a five-year contract to provide A3M's secure, wideband, anti-jam satellite communications terminal capabilities for tactical satellite communication operations.

The Multi Constellation Modem (MCM) can provide military-standard-compliant Enhanced Bandwidth Efficient Modems (EBEM), DVB-S2X second-generation satellite extensions and transceiver cards for proprietary commercial networks.

These L3Harris software-defined modems enable seamless networking between Geosynchronous, Middleand Low-Earth Orbit constellations. Upcoming Active Electronically Scanned Array (AESA) antenna kits are used in conjunction with the MCM to enable future LEO, MEO and Highly Elliptical Orbit services, according to Adams.

"Warfighters often need to use specific types of approved hardware for each of the various commercial services, but customers don't want to carry around a specific terminal for every service," he said. "They want a flexible terminal that can be used on multiple different constellations."

The company has already proved the concept of connecting the MCM with Space X's Starlink LEO satellites, and further integration with Amazon's Project Kuiper and OneWeb LEO satellites is planned between 2024 and 2026.

However, the U.S. military is years away from using LEO in an operational context, Adams said, noting there is "a lot of work to do on constellations and algorithms" but also potential for enabling high-capacity and low-latency communications.

"What we've heard from the customer is that they don't just want protected waveforms, they don't want just orbital diversity, they don't want just GEO capability - they want a flexible terminal that allows them to access a broad range of services, Adams said. "That's how they see bringing diversity into their capability set because they don't want to be locked into using only one type of technology. They want a terminal that works on the legacy commercial and GEO offerings but can also easily accommodate a protected modem or possibly an antenna kit to enable LEO and MEO."

Demonstrations on both the A3M and MCM will be available in 2023 onward, according to Adams. Both A3M and MCM modems will be available to customers within the next two years, with MPM variants available today, he added. Further, L3Harris offers a portfolio of waveforms specifically designed to enable secure communications in the worst conditions.

The Multi Constellation Modem (MCM-500)

A3M Modem

The combination of L3Harris VSAT, modem and waveform technologies provides superior levels in protection and incorporate automated processes to reduce physical and cognitive burdens on the modern warfighter.

"In Ukraine, commercial terminals were pulled back from the front line; the likes of A3M and MCM coupled with AESA kits have a much lower chance of being jammed by a near peer adversary, which is the major concern in the contemporary operating environment," Adams said.

VSATs also feature a common user interface, easing the warfighter to transition between terminals, modems and waveforms, he added.

"Our role is to take the commercial solutions and package them in a way that is useful for our government customers," Adams said. "This means robust terminals with flexible interfaces to switch between modems and satellites as required. That's the difference between the capability we deliver and those of commercial solutions."

> Scan to learn more about **VSAT Satcom**



CONNECTING THE JOINT FORCE

L3Harris is supporting U.S. Army efforts to bring multidomain operations to fruition through continued capability demonstrations in Project Convergence and the delivery of network-expanding software-defined communications solutions.

The year is 2027, and a U.S. Army unit has been tasked to seize a foothold in a dense urban environment.

Before troops deploy into the area of operations, Low-Earth Orbit (LEO) satellites pass overhead to collect intelligence using electro-optical, infrared, synthetic aperture radar and other electronic intelligence payloads. This data is fused into a shared, connected common operating picture. Simultaneously, fixedand rotary-wing aircraft, operating at safe distances, deploy air-launched effects to answer specific intelligence requirements while conducting electronic warfare operations in support of the ground team.

Decision makers benefit from resilient and robust levels in connectivity supported by anti-jam waveforms, artificial intelligence and machinelearning algorithms to optimize situation awareness, determine appropriate tactics based on real-time data and, ultimately, drive mission success.

Although theoretical, this operational vignette illustrates just some of benefits the U.S. Army expects from the Joint All Domain Command and Control (JADC2) – the U.S. Department of Defense's concept to converge multi-domain network platforms, sensors and personnel into a single operating environment.

And U.S. Department of Defense acquisition officials are pushing to transition JADC2 from concept to operational as guickly as possible.

"We're seeing feasibility of connecting across the joint force using current systems and future systems," Doug Bush, assistant secretary of the Army for acquisition, logistics and technology said at a National Defense Industrial Association symposium in July. "Scale is really important, taking it to the next level to actually understand what the network could support in a contested environment."

The Army is just beginning its radio fleet modernization journey, and the service is limited in how fast it can deploy nextgeneration assets by where it can and needs to allocate its budget.

One of the land service's most notable annual JADC2-targeted exercise is

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Project Convergence, a "discovery experiment" comprising a series of demonstrations showcasing innovations that accelerate speed, range and decision dominance of soldiers to achieve overmatch and the service's vision for the total Army to be a multidomain force by 2035.

L3Harris has increased its participation in Project Convergence since the inaugural event in 2020.

The Army plans to enhance the complexity of the scenarios each year, to include more partner services and allied forces and various mission environments. The company in turn has bolstered the number of capabilities it provides for the demonstration each year to meet the demands of the specific challenges and to introduce new technology.

This has provided the Army the opportunity to review more options for multi-domain communications and intelligence transport that can meet their needs and budget.

MULTI-DOMAIN OPERATIONS: PERSPECTIVE FROM THE GROUND

Underpinned by flexible network architectures and cloud computing, JADC2 and Multi-Domain Operations (MDO) enable every element of a joint force to move huge amounts of data around the battlespace securely, resiliently and at pace.

L3Harris Technologies is already supporting multiple Army tactical communications modernization efforts in support of the DOD's objective for "integrated deterrence" in the age of strategic competition.

"Fully embracing multi-domain operations gives the Army the ability to operate faster than a peer adversary," Jeff Smith, L3Harris vice president of Business Development, said. "Whatever effect we want to bring to bear, we must collect and process information, make decisions on it,



choose an effect, and execute the effect all much faster than a peer adversary. The ongoing Project Convergence exercises provide further insights to expedite this capability's delivery."

Continued conflict in Eastern Europe continues to provide important lessons for future exploitation of MDO, Ken Harrison, L3Harris senior director of Business Development, added.

"The fundamental premise of military operations is 'shoot, move, communicate, execute on the target and move again if necessary,' because you've compromised your position – this is actually the same premise as JADC2 and MDO, and you have to execute very fast and understand your RF signature or risk being targeted faster," Harrison said. "Lessons learned from Ukraine clearly illustrate this."

L3Harris plays a wide role in providing converged technology, delivering spacebased and airborne sensors to the Army, as well as various communications networks, including the Broadband Resilient Aerial Interoperable Network (BRAIN™), the company's potential solution for the U.S. Air Force's High Capacity Backbone program.

"This is where you really get an idea of the whole picture that identifies the company's end-to-end role in JADC2 and how each piece fits together," Smith said. "Identifying each of these pieces and how they fit together is the most important thing."

However, as DOD seeks to roll out its JADC2 concept, it also faces something of a dilemma, Smith said: "Does it decide to move large amounts of data, which can be jammed or tracked, or deploy a better, protected network that shares data at a much slower pace? A network presenting hundreds of megabits of data can get you shot, because it's been tracked by a peer adversary – is that useful?"

But, by the same token, he continued, if an anti-jamming network does not move data fast enough for Artificial Intelligence to make intelligent, targeting decisions, is that effective? There is no "turnkey solution," and the combination of fast and resilient networks has yet to come to fruition.

ENABLING MDO

One of the most-prevalent gaps facing the successful implementation of multi-domain operations is line-of-sight networking across the 100-mile zone that comprises the tactical edge, according to Smith. This is where the interconnection between sensors and soldiers is critical for real-time decision making.

In response, L3Harris is already successfully demonstrating capabilities in line with the ultimate vision of JADC2, including delivery of data right up to the tactical edge, allowing warfighters to make decisions faster than peer adversaries.

"We're going to continue to enhance resilient, multi-function network communications by bringing more flexibility, more anti-jam and AI/ML into the equation," Smith said. "The expectation of our customers is that the software-upgradeable capability they're buying will get them on the glide path to being JADC2-capable."

L3Harris' broad portfolio of softwaredefined radios, from the AN/PRC-163 -167 and -171 radios to the exportable RF-7850 radio, delivers seamless transition to new capabilities, including on-the-fly incorporation of a wide portfolio of specialist waveforms and machine-learning algorithms, all which enable MDO.

Further, waveform technologies, Smith said, represent the "magic dust" that enhances networking performance through anti-jam and low probability of intercept and detection. L3Harris' wider enterprise also delivers Satellite Communications with multi-constellation modems and airborne data link technologies; and helmet- and riflemounted integrated vision solutions, which bring battlespace intelligence right to the eyes of soldiers at the tactical edge.

"True joint-force collaboration requires integrating a wide variety of hardware and software into a single network," Smith said. "Artificial Intelligence and Machine-Learning technologies speed the data delivery within the cohesive JADC2 network, and L3Harris is working across all the business divisions to deliver that capability."

THE 'BILLION-DOLLAR QUESTION'

"JADC2 and multi-domain operations are complete rethinks of how we execute intelligence collection, tactical movements, tactics and procedures, and communication efforts," Smith said. "Every week, there's activity moving toward the 'billion-dollar question' that is 'what exactly do we truly mean by JADC2?'"

Project Convergence represents one effort in a "continual set of small and big actions" that are helping shape that answer, he added. Over the next three or so years, the U.S. military will pinpoint the right balance between tactical communications speed and resilience that will lead to mission success.

"Armed forces need to have both," Smith said. "That lands you in a place where you talk about cognitive, hyper-intelligent communications networks that conduct intelligent routing and transition between covert and high-throughput networks, which can adapt in real time. That's where we are in the MDO market."

BREAKING THE BARRIERS TO DELIVER

L3Harris is making investments in disruptive technology solutions that enable Joint All-Domain Command and Control by leveraging decades of innovations trusted by militaries around the world and designing systems that meet the needs of today while anticipating the needs of tomorrow.

Sinking ships on the modern battlefield is a difficult proposition. Joint forces must flawlessly execute each step of the joint targeting process, known as Find, Fix, Target, Track, Engage, Assess, or F2T2EA. Adversaries maintain layered and integrated anti-access/aerial denial (A2/AD) systems that challenge each step of this process, while holding traditional platforms at risk just beyond the range of our offensive weapon systems.

Enemy A2/AD weapons have been purposely designed to defeat single-service or single-domain solutions. U.S. forces and their closest partners and allies must rely on novel, unexpected, cross-domain sensing and shooting capabilities to effectively dismantle A2/AD networks. This realization has inspired collaboration across the five services to design, develop, experiment and field technologies that enable Joint All-Domain Command and Control (JADC2).

JADC2 is a tenet of the Joint Warfighting Concept that outlines how the Joint Force will orchestrate complex, multi-domain kill webs. JADC2 is not a tangible capability; rather, it is a philosophy of how U.S. forces can seamlessly pass data at machine speed to and from the tactical edge to achieve unprecedented interoperability. The concept demands the seamless integration of sensors and weapons systems – regardless of which service owns them – through reliable networks and assured communications capable of operating in disconnected, degraded, intermittent or limited environments. Finally, JADC2 leverages real-time, correlated data backed by artificial intelligence and machine learning algorithms for streamlined filtration and dissemination.

Without an overarching Concept of Operations for JADC2, however, there is a question on how the U.S. Department of Defense and industry can move "in the right direction" in focusing, targeting, building, testing and delivering the required capabilities, Sean Stackley, L3Harris vice president of Strategy & Growth, said in a JADC2 panel discussion hosted by the National Defense Industrial Association in July.

"Currently, each U.S. military service is operating under its own JADC2 Concept of Operations, its own data formats, its own protocols – even its own communication systems and frequencies," Dana Mehnert, L3Harris president of Communication Systems, said. "Even though they may seem like it's the same thing, using two different data formats makes systems incompatible."

The joint force needs a system that translates, correlates and simplifies the data fabric to create clear lines of communications across all services and platforms.

"L3Harris is exceptionally well positioned to advise customers as to which investments will provide the most resilience and capability in support of their Concept of Operations," Mehnert said. "We have multiple options for various size, weight and power requirements that deliver the technology and skills that



bring disparate nodes into a single network, leveraging modern crypto and cross-domain solutions, and employing multiple layers of security."

SITREP

The main hurdle for the U.S. Department of Defense to overcome in creating a true JADC2 operational environment is the siloed and incompatible information-sharing systems the disparate services currently use, according to Ken Harrison, L3Harris Technologies senior director of Business Development. While creating a piece of equipment to ensure compatibility with other service's systems might seem tempting, that sort of "forced entry" is not true interoperability.

To ensure all sensors in the battlespace can communicate with every weapons platform available, "everyone needs to be on the same sheet of music."

"The services are not there yet, and it will take some change and adaptation by service elements to restructure how they disseminate information so that it makes sense and allows commanders to make decisions and provide action with the information they receive," Harrison said.

The U.S. Army, for example, is just starting its radio fleet modernization effort, and the service is limited in how fast it can deploy next-generation assets by where it can and needs to allocate its budget.



L3Harris is exceptionally well positioned to advise customers as to which investments will provide the most resilience and capability in support of their concept of operations. We have multiple options for various size, weight and power requirements that deliver the technology and skills that bring disparate nodes into a single network, leveraging modern crypto and cross-domain solutions, and employing multiple layers of security.

- Dana Mehnert, President, Communication Systems, L3Harris

The U.S. Air Force, meanwhile, is projecting a force posture for the future that extends the battlespace to longer ranges. This is because "the next high-end fight will be an 'away game,'" Ron Fehlen, L3Harris vice president and general manager of Air Force and Advanced Unmanned Aerial System programs, said.

"Not only do we have to counter their air assets, they're going to have a significant amount of ground capability that is part of their infrastructure that we would have to overcome," he continued. "Their advances in those ground and air and cyber systems are on par with the kind of things that we have. Our traditional big-wing airborne command and control nodes will need to be farther away from the fight, requiring more networked warfare."

In consideration of its needs to face such a threat, the air service is keenly aware that DOD-wide engagement and collaboration is necessary.

"As the Air Force develops [Advanced Battle Management System] in our effort to achieve information and decision advantage by delivering relevant data, information and capabilities to warfighters at all echelons, we must work together with our sister services and the DOD to ensure we connect our sensors and platforms and share our data as part of a joint force," Air Force Chief of Staff Gen. CQ Brown, Jr. said in June, according to ExecutiveGov.

This will necessitate an inventory of large, expensive platforms operating in tandem with small expendable assets, Drake said. It further requires both receiver and transceiver capabilities on those disposable vehicles to relay time-critical information across the battlespace.

To that end, the Air Force assembled a consortium of industry partners to define the requirements and standards that will inform the development of ABMS' digital infrastructure. L3Harris, as a member of the consortium, will address the secure processing, resilient communications, data management and open-architecture design criteria that will lay the foundation for enabling the system.

In the maritime realm, L3Harris is supporting the U.S. Navy and Marine Corps' contributions to JADC2, the Navy Tactical Grid and "Project Overmatch."

"The blueprint is there; the fundamental programs exist individually," Brenna Baker, L3Harris vice president and general manager of Navy and Unmanned Aerial Systems, said. "L3Harris is adding resilient communications and command and control to connect all the nodes in the network as one thrust of Project Overmatch. This will address the INDOPACOM threat and enable the Navy's Distributed Maritimes Operations network to provide freedom to maneuver and communicate without being detected or interfered with by an adversary." The Navy awarded L3Harris a contract worth up to \$380 million in July for the production, repair and sustainment of the Cooperative Engagement Capability system. The system enables high-quality situational awareness and integrated fire control capability and will be the backbone of the naval service's JADC2 architecture and integrated fires capability for years to come, she added.

ACHIEVING JADC2

In order to achieve true Joint All-Domain Command and Control, each military branch must bring to fruition its own multi-domain operations architecture, opines Harrison, noting it is not feasible to move toward a truly "one size fits all" solution, given the various requirements across the services.

"L3Harris delivers secure, resilient capability across the spectrum that enables the warfighter to operate effectively within extremely diverse threat environments," Fehlen said.

The services must break down the silos in requirement development and acquisition and move from servicespecific mindsets to those focusing on platform-centric discussions to realize the full potential of these multidomain solutions, he added. The U.S. Armed Forces is increasing its crossbranch integration in JADC2 exercises and demonstrations, and industry is supporting efforts in identifying requirements-solutions synergies that can fulfill multiple service roles.

GATEWAY TO MULTI-DOMAIN OPERATIONS

A key enabler to creating a Joint All-Domain Command-and-Control ecosystem is developing open-systems architecture to allow for interoperability, scalability and modularity. As the U.S. military push for more such architectures to connect the highest levels of strategic headquarters down to the soldier at the tactical edge, L3Harris is making investments to meet those requirements.

"Where we come in is providing primarily the transport – the connectivity allowing sensors to connect to the weapons platforms to take out targets," Harrison said. "Our transport allows the information flow to cut across all of the platforms and get to what the services need, and we provide that with our software-defined radios, our SATCOM terminals and our resilient waveforms."

For example, the company's Transport Aggregation Gateway ensures missioncritical communications by providing access to a swath of integrated commercial and military satellite communications solutions, exploiting multiple network links simultaneously through a single data stream to ensure maximum levels of data throughput – even in denied or degraded commandand-control environments.

"L3Harris is engaged across all three segments with all the current JADC2 initiatives within the U.S. Department of Defense," Harrison said. "We keep our finger on the pulse of all the JADC2branded thrusts within the services and inform them of the enabling capabilities we can provide to solve their interoperability challenges once they determine their way forward in data fabric infrastructure."

For example, L3Harris' WESCAM MX-Series of multi-sensor, multi-spectral, electro-optic and infrared (EO/IR) surveillance and targeting systems support intelligence, surveillance, reconnaissance and target acquisition missions from platforms across the air, land and maritime domains. Combined with the company's high-capacity tactical radios, smart antennas and control systems, operators have a C5ISR solution leveraging a robust spectrum of sensors backed by resilient waveforms to speed decision-making processes.

The WESCAM MX-Series enhances battlespace situational awareness with overlapping fields-of-view, progressive on-the-move imaging capabilities – even in extreme temperatures, excessive speeds or varying altitudes.

THE L3HARRIS ADVANTAGE

Compatibility still does not guarantee effectiveness if it can be compromised or degraded, however – networking solutions must be resilient.

And L3Harris designs some of the mostresilient waveforms in the world that are easily upgradeable into the company's communications solutions.

L3Harris delivers secure, resilient capability across the spectrum that enables the warfighter to operate effectively within extremely diverse threat environments.

- Ron Fehlen, Vice President and General Manager of Air Force and Advanced Unmanned Aerial System Programs, L3Harris "We enable the information flow for JADC2," Harrison said. "We can get it there in real time and in a contested environment, whether it's resilient SATCOM, line of sight or beyond line of site, High Frequency or our Transport Aggregate Gateway – there are multiple solutions we provide that enable JADC2 to disseminate information across the battlefield."

L3Harris' Handheld, Manpack and Small Form Fit (HMS) radios connect the Integrated Tactical Network to the tactical edge and are upgradeable with cutting-edge, truly resilient waveforms, Harrison added; the company's Hawkeye[™] III Lite Very Small Aperture Terminal provide Expeditionary Signal Battalions - Enhanced with beyond-lineof-sight connectivity. High-frequency radios and the Rapidly Adaptable Standards-compliant Open Radio (RASOR[™]) solution further provide air and ground connectivity to a robust suite of waveforms, consolidating communications and other features needed in aircraft and next-generation ground combat vehicles.

"We have products and solutions that meet the vision and intent of what the military is trying to do, and we already provide software-defined radios to all of the services," Harrison said. "The faster the services field the modernized solutions we provide, the quicker they'll realize their JADC2 vision."

> Scan to view our JADC2 virtual experience



TURNING NIGHT TO DAY

L3Harris' solution for the U.S. Army's Night Vision Device-Next requirements provides Close Combat Force Direct Support personnel advanced night-vision capability to keep pace with operations at the front lines.

Over recent years, the U.S. Army has focused on the development of next-generation helmet-mounted systems to "own the night" and enhance the mission effectiveness of Close Combat Forces (CCFs) operating in limited-visibility conditions.

L3Harris' Enhanced Night Vision Goggle-Binocular (ENVG-B) and Ground Panoramic Night Vision Goggle are notable examples that enhance the Army's mission success and operator safety in low- and nolight environments.

However, the service is now considering how to equip CCF Direct Support (CCF-DS) units with their very own next-generation night vision systems to keep up with combat units at night.

CCF-DS covers a wide variety of formations operating at the brigade level and below that provide direct support to CCF while not engaging in offensive closecombat operations themselves.

Distance from the front lines, wherever that may be on the modern battlefield, does not provide the measure of the worth of the soldiers in these units and the capability they need to be successful, according to Leith Ames, L3Harris Business Development director. DS units must keep pace with infantry and armored formations on the battlefield in order to successfully conduct their mission.

"Close-combat teams can't move fast if the support guys can't keep up," he said.

NVD-NEXT

As a result, the Army is pursuing the Night Vision Device-Next (NVD-Next) program, looking to provide CCF-DS units with enhanced night vision in limited visibility conditions, increasing their ability to recognize and engage threats at longer ranges.

Selected NVD-Next solutions will replace legacy night vision devices currently in service for CCF-DS, such as L3Harris' 20-year-old AN/PVS-14 system.

"The importance of night vision on the modern battlefield has been reinforced by lessons learned in recent global conflicts, such as Ukraine," Ames said.

NVD-Next will ensure every CCF-DS unit can move at the same speed across the battlefield as a CCF in limited visibility conditions.

To date, the service has already conducted a number of Soldier Touch Points as part of an ongoing research and development phase to confirm specific requirements for the program moving forward. L3Harris envisions its offering to be a cost-effective, lightweight, rugged and reliable helmetmounted and binocular design to meet the future needs of the service.

The importance of night vision on the modern battlefield has been reinforced in Ukraine, especially early on when Ukrainians held the Russian forces back in many cases because of Russia's inability to operate at night. Russians were relegated to having to work during the day versus doing anything in the limited visibility. So that's a big deal.

- Leith Ames, Director, Business Development, L3Harris

L3HARRIS SOLUTIONS

With a rich history in supplying a range of night-vision goggles to militaries around the globe, L3Harris is ideally positioned to support the Army's NVD-Next requirement.

L3Harris' commercial off-the-shelf solutions include AN/PVS-31A or BNVD-1531, both of which feature white-phosphor technology.

However, L3Harris is also considering the design and development of a brand-new binocular night-vision goggle that would match specific service requirements in a cost-effective manner.

"At the top of their list, the U.S. Army is looking for a very costeffective goggle, so they want to squeeze every little bit of cost out of this program," Ames said. "I think the manufacturing process of night-vision goggles has continued to improve over recent years, which helps control the cost."

L3Harris is identifying ways to upgrade proposed solutions in the future, to include scalable options that allow the goggle to further enhance operators' situational awareness capabilities.

"We're definitely looking at scalable options that allow the goggle to feature heads-up display components for enhanced situational awareness," Ames said.

Scan to learn more about Integrated Vision Solutions



RESILIENT NETWORKS FOR PERSEVERING NATIONAL DEFENSE

L3Harris integrates leading-edge solutions from across its businesses to deliver resilient communications and connected sensors for emerging Joint All-Domain Command and Control ecosystems.

Erupting conflict that broke out in Eastern Europe in early 2022 captivated global attention and demonstrated a direct connection between mission success and the ability to assure resilient communications across the battlespace.

While the size of - and technology investments made by – the Russian forces were overwhelming compared to the indigenous Ukrainian national defense, intelligence has suggested that Russian communications infrastructure was poor from the inception of the attacks in February. According to a report published in March by the Royal United Services Institute, this led to "makeshift solutions" including unencrypted high-frequency radio and mobile phones to relay information and battle orders.

Lessons learned from this year's military operations renewed efforts throughout the world to bolster both sovereign communications network and defensive electronic warfare infrastructures. A pronounced message has been received by military decision makers: the next conflict will require resilient interoperability across domains, services and coalition forces.

"If we're looking to see how a modern battlefield is impacted by EW and cyber warfare, we need to look no further than what is going on right now" in Eastern Europe, Lt. Gen. Maria Gervais, deputy commanding general at U.S. Army Training and Doctrine Command, said, according to Defense News. "Everything that we are seeing in Ukraine has implications for a unified network, and almost certainly represents the type of threats we will see."

This reality comes as no surprise to L3Harris Technologies, which has been providing a portfolio of advanced solutions into Ukraine and other countries to enable coalition force cooperation across land, air, sea and space.

(C5ISR) shelters combine tactical area communications systems, radio transceivers, Satellite Communications (SATCOM) Very Small Aperture Terminals (VSAT) and tactical radios into a robust, secure network. The networks are configured with industry-standard or flexible networking kits for specific mission sets, including border security, aerial surveillance and communications network extensions.

Surveillance and Reconnaissance

For land troops, both stationed and mobile, L3Harris' battle-proven line of tactical radios deliver complete solutions for proper Primary, Alternate, Contingency and Emergency (PACE) plans, from small form factor, singleand multi-channel radios to answer every mission challenge.

In areas of conflict, we combine best-of-breed solutions from across our businesses to deliver tailored, end-to-end systems, purpose-built to meet specific mission requirements. Our systems lower the risks to soldiers while increasing the speed and value of design and delivery – because of the inherent vertical integration of our solutions. We build the hardware and software, so we're well-aware of the capability and are best positioned to offer the appropriate solution to partner nations.

- Faisal Munir, Vice President, International Business Development, L3Harris

The company further partners with incountry companies of its customers to establish integration services, support, infrastructure and sovereign capabilities for larger systems, Faisal Munir, L3Harris vice president of International Business Development, added.

ENABLING INTEROPERABILITY

Unique situations such as the Ukraine conflict require the deployment of tailored solutions. L3Harris' end-toend systems integration capability is best displayed in solutions such as the Converged Networking Gateway. These Command, Control, Computers, Communications and Cyber Intelligence, A complementary and industry-leading waveform portfolio ensures coalition and legacy interoperability and resilient communications in contested environments.

"I like to refer to this as 'graceful degradation.'" Munir said. "No matter how difficult the environment becomes, forces can always communicate."

The company's latest solution, Wraith™, is a first-of-its-kind frequency-hopping Mobile Ad Hoc Network (MANET) waveform for wideband voice and data with advanced, multi-layer anti-jam capabilities to support multi-domain interoperability.

Wraith provides connectivity for ground-to-ground, ground-to-air, airto-air, Beyond Line of Sight and other applications. The self-forming, selfmanaging Wraith network provides wireless high-capacity data connectivity to users, enabling real-time applications, such as video surveillance, target and ground reporting and command and control for information superiority.

L3Harris' Tactical Network ROVER® handheld transceivers support both analog and digital links with a bidirectional datalink capability for dismounted ground troops. ROVER transceivers provide real-time, full-motion video and other network data for situations that require eves on target. Leveraging L3Harris' waveforms, such as Wraith, ROVERs are interoperable with virtually all large airframes, unmanned aerial systems and targeting pods in theater today.

A robust suite of line-of-sight and beyond-line-of-sight weapon datalinks extend interoperability and penetrate adversarial anti-access, area-denial defense with capabilities including inflight target updates.

Difficult terrain and complex geography can sometimes hinder line-of-sight communications. In these circumstances, L3Harris also has a wide array of Satellite Communications terminals to broaden PACE plan options, from VSATs to the new Wide Multi-Band Terminal (WMBT) solution, which provides twice the bandwidth of existing wideband terminals without extending the station's footprint. As a scalable terminal, WMBT can seamlessly grow to support emerging missions.

On the high seas, the L3Harris Broadband C5ISR Maritime Communications System combines bestof-breed technologies from across the company to deliver a robust spectrum of sensors with a resilient L3Harris highcapacity waveform, speeding decisionmaking processes for unmanned surface vessel operations.

The combination of the L3Harris Tactical Communications business's Falcon III® RF-78x0W high-capacity radio and the RF-7800W-AT30X electronically





beam-steered Smart Antenna provides low-latency, real-time data sharing with over 230 Mbps ISR video and IP data throughput during a realistic operational environment. When combined with the L3Harris Automated Surface Vessel (ASV) business's ASView[™] Control System and the L3Harris WESCAM MX[™]-10 MS maritime electro-optical/ infrared imaging system, operators have the best-in-the-industry control system with added infrared and thermal imagery.

MODULAR OPEN SYSTEMS ARCHITECTURE

Since emerging needs cannot wait for traditional, elongated design and integration processes, L3Harris is developing solutions to future-proof interoperable capability insertion by embracing modular open-systems architecture approaches.

The company's first entry into the market is the Rapidly Adaptable Standardscompliant Radio, or RASOR™. RASOR's innovative design enables rapid technology insertion and capability deployment fit for the near-peer fight and Joint All-Domain Command-and-Control operations.

The L3Harris RASOR chassis, known as RARE[™] (Rapidly Adaptable Ruggedized Enclosure), comprises a highly innovative additive manufacturing approach leveraging 3D-print technology. RARE can scale from three to 12 slots with

customized modules, which include L3Harris proprietary technology as well as third-party solutions, making it applicable for a plethora of platforms, from multi-role unmanned aircraft to tanks.

CONNECTING THE TACTICAL EDGE

Soldiers on the ground rely on multiple sources of information and are often in situations where vision may be degraded.

Not only are L3Harris fused-goggle devices capable of connecting to a coalition network via tactical radios, the company's integrated vision solutions, such as Binocular Night Vision Device -Fused (BNVD-Fused), incorporate the latest in night-vision capabilities by fusing image intensification technology with thermal imagery. This provides operators with enhanced situational awareness, targeting and identification capability in all battlefield conditions and light levels.

"This is an unprecedented era of conflict," Munir said. "As technology has evolved, sensors throughout the battlespace now have the right capability to provide data and networks have the capacity to sustain the capability - from anywhere in the operating environment directly to tacticaledge soldiers, regardless of where they might be. This network-enabled capability enables sensor-to-shooter capability that allows troops to act quickly and decisively."

CELEBRATING

L3Harris Technologies, provider of assured communications for the E-4B airframe, joined the U.S. Air Force at Offutt Air Force Base, to celebrate the 60th anniversary of the National Airborne Operations Center (NAOC) mission.

On August 6, 2022, L3Harris was a platinum sponsor for Offutt AFB's 60th anniversary celebration of the NAOC mission, for which former U.S. Secretary of Defense Chuck Hagel served as the keynote speaker.

"The U.S. Air Force is also celebrating its 75th anniversary this year, and 80 percent of the Air Force's existence has been supporting the National Emergency Airborne Command Post and National Airborne Operations Center missions," said 595th Command and Control Group Commander, Col. Brian Golden. "It's an impressive capability; the only other longer-standing platform is the B-52."

The E-4B, a militarized version of the Boeing 747-200, serves as the NAOC and is a key component of the National Military Command System for the President, the Secretary of Defense and the Joint Chiefs of Staff. In case of national emergency or destruction of ground command and control centers, the aircraft provides a highly survivable command, control and communications center to direct U.S. forces, execute emergency war orders and coordinate actions by civil authorities. Additionally, the E-4B provides outside the continental United States travel support for the Secretary of Defense and his staff to ensure Title 10 command-and-control connectivity.

The E-4B is a long-range, high-altitude airplane with a main deck comprising: a command work area, conference room, briefing room, an operations team work area, communications area and rest area. An E-4B can accommodate seating for up to 112 people, including a joint-service operations team, Air Force flight crew, maintenance and security component, communications team and selected augmentees. At least one E-4B NAOC is always on 24-hour alert, seven days a week.

Over time, onboard communications capabilities have been added and enhanced, from 12 voice-only systems to the current 42 systems providing resilient, continuous communications across the entire spectrum of satellite, ground-based and air-to-air capabilities, according to Golden.

"NAOC is a Tier O, no-fail mission," said Golden. "This is a very unique platform – the only one that is on hot-alert at all times. Communications systems are always on, either airborne or on the ground ready to take off."

The 24/7 flight-readiness requirement demands a great deal of dedication from the airmen supporting the mission, and the importance is instilled into new members of the squadron when they join, said NAOC pilot Maj. Daniel Scully of the 1st Airborne Command Control Squadron.

"We all take care of each other, understand our purpose and maintain the big picture – it takes a lot of dedication," said Scully. "It doesn't matter if people are on leave or sick. If we're missing a position, we have to fill it, even if that means someone is on shift for two or three alerts in a row."

The E4-B is a national-level platform tasked with 13 different responsibilities

for separate mission partners. This requires a great deal of coordination to ensure all communications needs for each individual stakeholder is met, said Golden. Industry supports solving capability and integration gaps to move the mission forward, added Golden, noting that fivesixths of the overall platform cost is in communications equipment.

UNITED STATES OF AMERICA

"The E-4B is a very important national asset," said David Béen, L3Harris U.S. Air Force Mission Systems Requirements director. "It has to be able to deliver command-and-control communications across all of the armed forces and facilitate communications between the Joint Staff so they can effectively communicate even on the country's worst day. The national command mission would fail without reliable, secure communications."

L3Harris has delivered resilient wideband communications, both line-of-sight and beyond-line-of-sight, in support of the NAOC mission for the last 15 years. The company began by providing wideband line-of-sight common datalinks, which led into a modernization program seven years ago to enhance the four-aircraft fleet's satellite communications equipment, according to Todd Ovard, L3Harris senior Systems Engineering manager.

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USAF

NAOC's datalink was originally developed by L3Harris for a U.S. Army program but ultimately found its way onto the E4-B first, followed by other programs.

"Over the course of our support, we have also extended the aircraft functions' accessibility to multiple communications links, which enhances the resiliency of its communications capabilities," said Ovard.

A strong government-industry partnership has been extremely important for the NAOC program to keep pace with the changing threats and dynamics on the world stage, said Scully.

As the E-4Bs are nearly as old as the NAOC mission, the air service is in the process

Scan to view the video of the milestone celebration



of identifying requirements for a major acquisition program of its replacement, currently envisioned as the "Survivable Airborne Operations Center (SAOC)."

The Air Force envisions a fleet of eight aircraft, to balance required readiness with upgrade and training schedules, according to Golden.

"With the recapitalization of the nuclear triad, to include the new B-21 bomber, Sentinel Intercontinental Ballistic Missile and the Columbia-class submarine. the Nuclear Command, Control and Communications mission will continue to prove vital in providing an updated command-and-control capability to ensure proper continuity and connectivity of these new capabilities protecting our nation's interests," said Loren Simper, L3Harris vice president of Classified programs. "L3Harris has today the trusted solutions that can further extend line-of-sight and beyond-line-ofsight communications capabilities into the future of the NC3 mission."

OPERATIONAL EXCELLENCE THROUGH

DIGITAL INNOVATION



Balaji Suresh

Vice President, Operations, Communication Systems, L3Harris Technologies

The COVID-19 pandemic has accelerated the digital transformation of business out of sheer necessity. L3Harris Communication Systems has taken this disruption as a catalyst to lean into our efforts to create manufacturing operation ecosystems that are more modern, leaner and integrated.

Looking beyond the pandemic, we are committed to taking Operational Excellence, flawless execution and continuous improvement to the next level. We are harmonizing how our people, processes and technology unite to eliminate waste, shorten lead times and improve product and process quality. We're embracing Industry 4.0 and supercharging foundations in our people and processes with the appropriate use of technologies. The symmetry we're establishing between extremely talented people, Lean principles and the right mix of technology – robotics, Artificial Intelligence, automation and the Internet of Things – will lead to consistent and predictable outcomes in the advanced solutions and capabilities we deliver to our customers. The current industrial revolution in digital transformation provides a plethora of opportunities for the manufacturing floor of the future, and L3Harris is taking full advantage of those that provide us the right utility to bring our manufacturing technology to the same level of our next-generation product technology.

First, we're driving quality upstream, to the source, to ensure we're designing our products for manufacturability, which also ensures sustainment and maintenance processes go just as smoothly. We're deepening the collaboration between Engineering and Operations to strengthen our Zero Defects mentality, driving quality to the next level.

We're reengineering shop floor management to speed communication and translate real-time data into information and action. We're designing more connected information systems to implement as many automated and zero-touch operations as possible.

Our goal is to create an environment that reduces stress and fatigue on our personnel. Artificial Intelligence and Augmented Reality allow our operators to stay "in the loop" but act more like a coach than a player in the operation – vision equipment with Artificial Intelligence software alerts when it detects slight defects in the assembly, and the location is illuminated by overhead projectors to drive quality at the source and improve the cognitive ergonomics of our operations.

The investments we are making today and going forward are driving enhancements in our ability to deliver the highest quality products to the users who need them most when they need them and assure they will work the first time and every time. Spanning four unique businesses, there isn't a single panacea for the diverse challenges in our segment's manufacturing operations. While elements of our manufacturing system are common, we adapt and tailor technologies to accommodate the nuances in each of our businesses, spanning high-volume commercial to low-volume programs.

For example, a pilot program in our Rochester, New York, tactical radio facility meshes all of these elements to transform a multi-cell production system into a single, mixed-model line that is paced with high utilization rates and Quality at the Source – a first-of-its-kind innovation for the company. All of the systems we are putting together provide real-time feedback to the operator, management and Engineering support teams to deliver the highest value and quality to our customer.

Activities such as this are building upon our robust and aligned ecosystem – from supply chain to manufacturing, test and sustainment – to create true technology disruption within our operations to maintain our ability to be a partner of choice for our customers.

Across our enterprise, novel and broadly applicable process and technology improvements are emerging and gaining acceptance every day. Our advances in revolutionizing the modern manufacturing space for the digital age, aligned with our dedication to continuous improvement in our people and processes, assures our customers will be equipped with the highest-quality, most-advanced solutions exactly when they need it to successfully complete their missions.

THE TECHNICAL INTEROPERABILITY ADVANTAGE

L3Harris is delivering a layered approach to interoperability for public safety via a full line of specialized systems and converged communication solutions.

To keep up with the challenges of protecting and serving local communities, public safety and municipal services personnel must be able to communicate together in real-time to provide the appropriate response.

This need for interoperable communication solutions is evident every day across the United States, from police pursuits that cross jurisdictional lines, to cross-agency mutual-aid support including police, sheriff, fire and other departments, as well as major natural disasters and large-scale incidents involving the U.S. National Guard.

"Without interoperability, everyone's in their own stovepipes," Nino DiCosmo, L3Harris president of Public Safety and Profession Communications, said. "Most of these situations require coordination amongst agencies to solve the problem. If the Sheriff's Office deputies can only talk on their network, and the Fire Department can only talk on theirs, then they're not communicating as a collaborative unit to resolve the incident."

During last year's anniversary of the terrorist attacks on Sept. 11, 2001, former police officials from New York, Los Angeles and Arlington, Virginia, collaborated on an opinion article in The Hill expressing this exact need for interoperable communications to keep personnel and communities safe.

"The fact is, agencies must retain the ability to choose their network, and that freedom of choice should not prevent effective communication in an emergency if another jurisdiction



is on a different network," they said. "The ongoing barrage of natural and manmade disasters that have occurred in the past 20 years are a clear demonstration of the continuing challenge. From Hurricane Sandy in 2012 to a mass shooting in a Colorado movie theater later that year, first responders were extremely hindered in their ability to communicate with one another, thus putting their safety and the people they have sworn to protect in jeopardy."

L3Harris provides interoperable and converged communication solutions in form factors specifically designed for public safety professionals. These capabilities deliver a "clean solution" to connect disparate networks together, according to Jason Burt, L3Harris Public Safety Market manager; talkgroups, for example, can be pre-programmed in devices to avoid cases where outof-network officers would have to call dispatch via a cell phone and be patched into a local agency to connect for mutual aid operations.

The U.S. Department of Homeland Security in 2004 developed what is known as the "Interoperability Continuum" as a standard way of visualizing the requirements for true cross-agency interoperability.

L3Harris supports the technical elements of interoperability by providing

solutions from radios to standardsbased shared systems. The company's radios support multiple frequency bands and waveforms, gateways and shared channels that provide multiple communications pathways for agencies to connect together.

"We provide technology solutions for interoperability, but we also understand our customers and their needs, governance models and standard operating procedures," Jeremy Elder, L3Harris Product Management director, said. "Because we have a deep understanding of how our customers operate, we are able to develop those technology solutions."

A number of L3Harris customers' interest has been trending away from proprietary systems to standards-based shared ones, according to Elder, noting there is a similar new development toward standards-based broadband communications. One example is the State of Florida, which recently announced that it will transition from its aging EDACS[®] system to a Project 25-enabled shared network. These types of networks benefit the customer by providing a standard for multiple vendors to develop solutions for interoperability, providing agencies with more options to deliver their intended effects, he added.

BRIDGING P25 NETWORKS

One step toward extending agency communications and their networks is the ability to connect existing systems.

L3Harris' Inter Subsystem Interface (ISSI) provides such gateways for personnel operating on Project 25 (P25) networks.

When utility companies travel cross country to respond to storm damage, for instance, they need their personnel to talk not only to their on-site team and the local agencies but also to their home base. ISSI acts as "a pipe of interoperability between these networks," allowing dispatchers on one network to field resources from another and vice versa, Rob Butts, L3Harris Professional Communications Market manager, said.

The company is part of a growing alliance of like-minded technology firms, the Mission Critical Alliance (MCA), that is developing system integrations based on these standards to create "an ecosystem where customers can have choices for whatever kind of technology they want to deploy," Elder said.

Through this alliance, L3Harris has partnered to provide a mobile incident command system that connects users in areas where system coverage may be lacking. Commanders can monitor localized communication for emergencies and other events that cannot wait for preprogramming of network talk groups.

ENHANCING INTEROPERABILITY THROUGH CONVERGENCE

Typically, an agency looking to create a local network will deploy its capability to provide interoperability for the agencies within its jurisdiction. When outside departments are required to respond for support, these personnel also need to be integrated into the local network.

By leveraging radios with the added LTE convergence, agencies can now extend the range of interoperability, Burt said. With the same device, officers, firefighters and the like can simply switch the radio mode from LMR to LTE and leverage the coverage available from carrier networks to stay connected.

L3Harris' XL Series of radios provides exactly this capability by embedding connectivity within ruggedized radios built to withstand the harsh conditions that first responders face.

NEW AND EMERGING CAPABILITY

Mission-Critical Push-To-Talk (MCPTT) is the newest emerging standard within public safety communications, to provide an LTE standards based on P25 capabilities over a broadband network, Butts said, noting the technology is completely separated from LMR networks.

We provide technology solutions for interoperability, but we also understand our customers and their needs, governance models and standard operating procedures.

The Inter-Working Function is the latest standards-based interoperability function that will enable connectivity between MCPTT and P25 networks, he added.

"Today, in most instances, our customers utilize a one-to-one network connection, so they end up needing two connections each for three networks to connect to each other, for example," he said. "An emerging technology out of our MCA partnerships, creates a single connection into a fabric of networks so that users are connected to all the networks in the system."

This new technology will extend the capabilities currently on ISSI to a standards-based model in which connections are provided and maintained, with software updates, by the service provider, requiring users to solely maintain their subscription to the service to have access to all other subscribers through a single network connection.

Looking forward, the next major milestone will be pushing MCPTT to also include mission-critical data, video with voice, "like Facetime for first responders," according to Elder.

"It's really about enablement of supporting critical data functions beyond voice," he said. "This can provide a standards-based way to share GPS location information – that our devices currently provide - to others on the network."

With Mission-Critical Push-To-Talk, Data and Video all on a Computer-Aided Dispatch display, users will be able to see not only a map indicating where calls are coming in, but also realtime body cam footage of the officer on the other end of the call, for example.

"In this idea of interoperability as a service, it's all about taking the technical complexity away from the users," Elder said. "Your service partner can help take that complexity off your shoulders as the system owner. You just subscribe to the service and let them know who on the service you need to interop with. This will be the wave of the future, because there is a higher demand for more interoperable services and connections – it's becoming a more connected world."

