National DEFENSE

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FUELING THE ARMY

SERVICE ENDS DEBATE OVER ALL-ELECTRIC COMBAT VEHICLES — FOR NOW PAGE 28

OCTOBER 2021

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The Business and Technology Magazine of NDIA

OCTOBER 2021 VOLUME CVI, NUMBER 815

National DEFENSE

NDIA'S BUSINESS AND TECHNOLOGY MAGAZINE
WWW.NATIONALDEFENSEMAGAZINE.ORG

Cover Story 28

■ The Army for years has been making investments into the electrification of vehicles, but the widespread use of such technology won't be feasible until the 2030s — or perhaps ever. Officials and experts say that while the platforms offer benefits, they also pose several challenges.

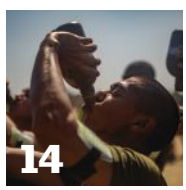
Cover: Defense Dept. photo

Marine Corps 24

■ The island-hopping campaign against Japanese forces during World War II was perhaps the U.S. Marine Corps' finest hour. Today, Marines are trying to ready themselves for a potential conflagration against another Indo-Pacific adversary that has emerged as a great power competitor in the 21st century — China.

Space 22

■ Countries from around the globe — including the United States, United Kingdom, Germany, Finland, Japan, Chile and France — are closely collaborating in space, with the U.S. Space Force leading the way. The first step toward a safer domain is to establish common rules, officials say.



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National DEFENSE
OCTOBER 2021
VOLUME CVI
NUMBER 815

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BPA WORLDWIDE
National Defense (ISSN 0092–1491) is published monthly by the National Defense Industrial Association (NDIA), 2101 Wilson Blvd., Suite 700, Arlington, VA 22201–3060. TEL (703) 522–1820; FAX (703) 522–1885. **Advertising Sales:** Kathleen Kenney, 2101 Wilson Blvd., Suite 700, Arlington, VA 22201–3060. TEL (703) 247–2576; FAX (703) 522–4602. The views expressed are those of the authors and do not necessarily reflect those of NDIA. **Membership rates** in the association are $40 annually; $15.00 is allocated to *National Defense* for a one-year association basic subscription and is non-deductible from dues. Annual rates for NDIA members: $40 U.S. and possessions; District of Columbia add 6 percent sales tax; $45 foreign. A six-week notice is required for change of address. Periodical postage paid at Arlington, VA and at additional mailing office. **POSTMASTER:** Send address changes to National DEFENSE, 2101 Wilson Blvd, Suite 700, Arlington, VA 22201–3060. The title *National Defense* is registered with the Library of Congress.

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Small Businesses Should Choose Defense

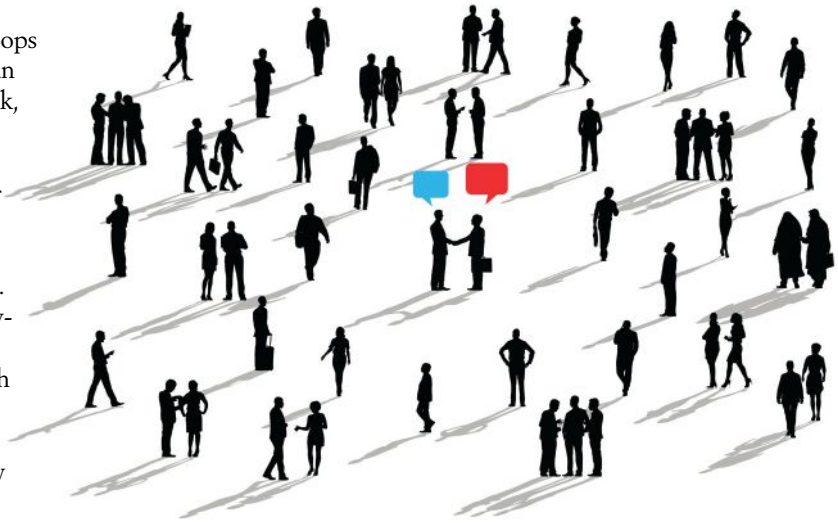
■ Why would a small business innovator choose to participate in the defense sector?

If you are a small business developing dual-use technology — a product that can be used in both defense and commercial environments — there are three compelling reasons why you may want to develop your product within the defense marketplace.

The first and perhaps most important reason is innovation. The culture of cutting edge innovation is inherent to the government research-and-development strategy. While many commentators and experts point to disruptive innovation within America's commercial sector, the commercial world has a need to know where the profit will come from prior to significant investment in new ideas and products.

If decision makers don't see a clear path to profit, they will cut their losses and move onto an idea or product with more certain marketability.

The Pentagon — on the other hand — boasts R&D leaders with a strong tolerance for risk. They will take investment risks in early technology readiness level programs if they believe the innovation may deliver strategic or operational advantage to U.S. warfighters. In conflict, better capabilities operated by well-trained troops play an enormous role in reducing operational risk, and therefore Defense Department leaders will always trade higher investment risk to reduce operational risk to U.S. and allied forces.



For these reasons, government R&D funding provides businesses with resources and a viable way to explore innovations for which a purely commercial business model — bootstrapped and customer financed — does not provide.

The Defense Department's commitment to innovation is driven by an underlying willingness to push the envelope to deliver decisive advantage across the spectrum of conflict. This commitment requires effective communication with the department's "board of directors" — Congress — to ensure elected representatives share the Pentagon's vision for pursuing promising high-value technology.

Second, small businesses operating in defense are given access to the world's most committed and engaged end users. These end users, the women and men who volunteer to serve our nation, have unique needs dictated by rigorous demands of their everyday work. The rigor and mission critical demands of the defense marketplace are what enables companies to shape and deliver meaningful and successful technology.

As frontline workers have an exceptionally high interest in ensuring they can successfully accomplish their missions, they will work closely with vendors to ensure the developers fully understand their requirements. For these end users, helping innovators define what they need is a matter of utmost importance, concerning security and safety. They will also help iterate to ensure the small business delivers equipment or capabilities to give them the tools they need to win rapidly at the lowest possible cost.

Driven by truly mission critical needs and demands, military end users ensure that companies can deliver the best outcomes and products. And in collaborating to get it right as fast as possible, these end users can help small companies refine products and technology with potential dual-use applications.

Finally, while for any good company it is satisfying to meet the needs of their customers, working in defense is particularly gratifying. After all, it is about taking care of the people who take care of us — the warriors who put themselves in harm's way to make sure the rest of us are safe. By protecting troops and providing them competitive advantage across the spectrum of conflict, companies help defend our way of life.

If, while being a small business, you can tolerate and survive the inordinate delay, if you have the patience for a different, slower cadence than the commercial sector, then the defense marketplace is a great place to develop your dual-use technology.

Innovation that increases capability and capacity enhances U.S. military readiness and ensures the United States is well-prepared to meet both expected and unexpected challenges. In today's world of peer competition, we know other countries actively work to limit American influence and opportunities. These countries threaten our protection of the liberal world order created after and sustained since the end of World War II.

Supporting defense helps small businesses sustain families, friends and the nation as we continue to pursue the ideals enshrined in the country's founding documents. For small innovative companies, choosing to operate in the defense ecosystem, despite its challenges, is the right choice. **ND**

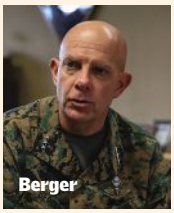
ML Mackey is chair of NDIA's Small Business Division and retired Army Maj. Gen. Jim Boozer is NDIA's executive vice president.

iStock illustration

UP FRONT COMPILED BY STEW MAGNUSON

Marine Corps Commandant: Indo-Pacific Doesn't Need a 'NATO'

■ Marines Corps Commandant **Gen. David Berger** said it is "impractical" to create a NATO-like body for partners in the Indo-Pacific, despite the communication challenges the military faces in the region.


Berger

Relationships with strategic allies can be built on a bilateral basis, he said at a CSIS and U.S. Naval Institute event.

With the "nature of the countries" in the region, there is not a NATO-equivalent organization and developing one would not solve information-sharing needs, he said.

"As the U.S., we just want the one size fits all," he said. "Well, if you've never been operating there for 20, 30 years, you realize that's an impractical approach."

In the past 18 to 24 months, the emerging partnership between India, Japan, the United States and Australia — also known as the Quad alliance — is "a great thing" and could be an example for other Indo-Pacific relationships, he added.

Berger pointed to an upcoming exercise this fall where the Marine Corps F-35B joint strike fighter will fly off a Japanese ship as the "beginning steps" of building a solid communication architecture.

For more on the Marines, see article on page 24.

Spacecom Invokes 'Dr. Strangelove'

■ Over-classification of the Pentagon's space capabilities undermines deterrence, suggested **Rear Adm. Michael Bernacchi**, director of strategy, plans and policy, J5, at U.S. Space Command.

"On a submarine, everybody knows we have torpedoes," he said at the recent Space Symposium. "That's not a secret. Obviously, we have some highly classified systems on a submarine, but the enemy understands that we have advanced torpedoes that will kill them. In space, I can't say anything" about U.S. capabilities.

"We have to get to the point where at least we can say, you know, there is something," he added, invoking the need for "a little Dr. Strangelove" — a reference to the iconic film character who said deterrence requires nations to tell adversaries about the types of weapons they possess. There needs to be a "happy medium" between preserving necessary secrecy and revealing what kind of punch the United States can deliver in space, Bernacchi said.

Number of Active Satellites Doubled During Pandemic


Raymond

■ Thousands of satellites have been launched over the course of the pandemic, the Space Force's chief of operations said.

The last time the annual Space Symposium in Colorado was held in person in April 2019 there were about 2,100 active satellites on orbit, **Gen. John "Jay" Raymond** said in August 2021.

"Today there's over 4,900 — that is astounding that while we've all been wearing masks the number of active satellites has doubled," Raymond said.

For more on Space Command, see article on page 22.

HASC Chairman Decries Parochial Support for Weapon Systems

■ The U.S. government needs to spend its defense dollars wisely, which is why lawmakers shouldn't back costly military programs simply because they benefit their constituencies, the chairman of the House Armed Services Committee told his colleagues.

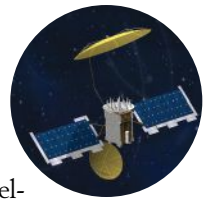
"Let me say this loud to every other member of Congress and particularly to members serving on the Armed Services Committee: It is not your job to bring home every last dollar you can to your district," **Rep. Adam Smith**, D-Wash., said at a Brookings Institution event. "Believe it or not, that is not what your constituents elected you to do. Maybe in a given instance, you'll have two [or] three hundred of them that would like you to do that. But [for] the broader group … you represent, it is not."

The view that "if the program is in my district, it's good — that is not the way to do your job," he added. — *Reporting by Jon Harper, Mandy Mayfield and Meredith Roaten*

FURTHER READING

Satellite Communications: DoD Should Explore Options to Meet User Needs for Narrowband Capabilities

By the Government Accountability Office



■ It's the same old song. The Defense Department launches multimillion dollar satellites but doesn't get much use out of them for the first few years because no one has synchronized the development of the terminals needed to connect to them.

The Navy originally developed the narrowband Mobile User Objective System to provide secure, cell-phone-like connectivity to warfighters on the ground.

"The full constellation of MUOS satellites has been on orbit for over four years, but DoD has not been able to use the system's advanced capabilities — such as its 10-fold increase in communications capacity," the report stated.

Officials will claim that these are not in fact orbiting white elephants because users can connect with their legacy systems. However, they are not able to take advantage of all the new capabilities that taxpayers paid for — $7.4 billion in the case of MUOS.

The crux of the problem is that satellites are developed and fielded by one service — historically the Air Force and in this case, the Navy — and the ground, air and handheld or backpackable radios are developed by the individual services. The Navy has since transferred the satellite program to the Air Force and it will eventually reside with the Space Force.

The original plan was to have 85 percent of the needed terminals fielded by 2013. GAO found that as of 2019, only 10 percent of the MUOS-ready terminals were operating. The government watchdog had warned of these problems as early as 2007, but development delays for both the spacecraft, the terminals and waveforms sent schedules on widely divergent paths. — *Stew Magnuson*

Defense Dept. photos

By The Numbers

Current and Potential Navy Surface Combatant Force-Level Goals

	CURRENT FORCE-LEVEL GOAL WITHIN 355-SHIP PLAN	DECEMBER 9, 2020, SHIPBUILDING DOCUMENT	JUNE 17, 2021, SHIPBUILDING DOCUMENT
Large surface combatants (LSCs — cruisers and destroyers)	104	73 to 88	63 to 65
Small surface combatants (SSCs — frigates and littoral combat ships)	52	60 to 67	40 to 45
SUBTOTAL: LSCs and SSCs	156	133 to 155	103 to 110
Large and medium unmanned surface vehicles (LUSVs and MUSVs)	0	119 to 166	59 to 89

SOURCE: CONGRESSIONAL RESEARCH SERVICE

Hello, Goodbye

■ Say goodbye to the office of the Chief Management Officer. Deputy Secretary of Defense **Kathleen Hicks** ordered that the responsibilities of the office be transferred to other Pentagon entities on Oct. 1. The fiscal year 2021 National Defense Authorization Act called for its demise.


Toman


Burris

Amanda Toman is now the Office of the Undersecretary of Defense for Research and Engineering's acting principal director for the 5G initiative after the departure of **Joseph Evans**.

Brig. Gen. Larry Q. Burris Jr. took command of the U.S. Army Infantry School at Fort Benning. The dual-hatted role means he also has responsibility for the soldier lethality cross-functional team. He took over from **Maj. Gen. David Hodne**, who assumed command of the 4th Infantry Division at Fort Carson.


Feldman

Boeing appointed **Alexander Feldman** as the president of the company's Southeast Asia business. Feldman will be based in Singapore and oversee the firm's strategy and operations as the company plans to expand its regional presence. Feldman will also become director and chairman of Boeing Singapore Pte. Ltd. and president director of PT. Boeing Indonesia.

The Center for Strategic and International Studies named **Dr. Eliot A. Cohen** as the Arleigh A. Burke Chair in Strategy. Cohen has spent more than three decades at Johns Hopkins University's School of Advanced International Studies.

Lockheed Martin completed construction of an advanced manufacturing facility at its Palmdale, California, campus and headquarters of Skunk Works. The 215,000-square-foot facility can accommodate 450 employees and will feature an intelligent factory framework; a technology enabled advanced manufacturing environment; and a flexible factory construct.

Raytheon Technologies' Collins Aerospace business has signed a definitive agreement to acquire privately held FlightAware, a leading digital aviation company providing global flight tracking solutions, predictive technology, analytics and decision-making tools. FlightAware is based in Houston, Texas, and has some 130 employees. **ND**

Coming Soon

■ After the year's biggest Navy, Air Force and space conferences finally went ahead with in-person attendance in 2021, it's the Army's turn next as the Association of the United States Army's annual meeting and exhibition returns to Washington, D.C., Oct. 11-13.

However, proof of COVID vaccinations will be required to attend.

The magazine will also be attending NDIA's Future Force Capabilities Conference in Columbus, Georgia, Oct. 18-21. The show combines the association's Armaments, Robotics, Munitions Technology Divisions and the Global Explosive Ordnance Disposal community. **Maj. Gen. Patrick Donahoe**, commanding general of the Army Maneuver Center of Excellence, will be delivering remarks.

NDIA will also hold in person the 32nd annual Special Operations/Low Intensity Conflict Symposium in Washington, D.C., Nov. 3-4. **ND**

Defense Dept. photos, Boeing photo, Wiki commons photo

Learning to Lob Ideals Over the Horizon

■ Aug. 20 was the day pundits flooded my email inbox with their opinions.

While Aug. 31 was the final day of the U.S. withdrawal from Afghanistan, that point 11 days earlier seemed to be when everyone came to the conclusion that America had lost a war.

So the condemnation inundation began.

Lawmakers and pundits. Right wing and left. Democrats, Republicans and libertarians. Think tankers, veterans groups, retired generals and colonels — everyone had an opinion about the 20-year war. Some wanted to score political points against the current administration. Some pleaded for the lives of Afghans left behind. Several armchair quarterbacks claimed to know exactly what went wrong.

They quoted the lives lost. They quoted the money spent.

I confess that I read few of these press releases. The subject line usually told me all I needed to know about their point of view.

There was one piece that stood out, though. It was a first-person account of one retired Air Force special operator's experience in Afghanistan listening in on Taliban fighters as he circled them in an AC-130 gunship. Ian Fritz in *The Atlantic* provided several anecdotes from the 600 total hours he spent monitoring Taliban communications. Trained to speak Dari and Pushto and presumably outfitted with the best eavesdropping equipment available, Fritz listened to the everyday conversations of his opponents.

If I were to recommend only one article to sum up "what went wrong in Afghanistan," this would be it.

He concluded while circling the skies above Afghanistan that this was a foe who would be willing to wait out the United States if it took 10 years, 20 years or 50. They had an unshakable will to continue their jihad and retake their country.

I pair that article with my experience in Vietnam, which came two decades after the war there ended when I visited the southern part of the country.

As a journalist in Southeast Asia, I read every book about the U.S involvement in Vietnam, Cambodia and Laos that I could put my hands on. One of the best I read was *The Tunnels of Cu Chi* by Tom Mangold and John Penycate. Along with interviewing the so-called American "tunnel rats" ordered to go into the structures, the authors spoke to many of the Viet Cong who built and lived in these tunnels, which were used to both hide from U.S. forces and to attack them.

The Cu Chi tunnels are now a tourist attraction, so I traveled there to see them for myself.

What I found was basically a military camp located underground. Larger rooms such as the mess hall and an infirmary were dug up and exposed for modern day tourists.

As for the tunnels, some had been left buried for visitors to crawl through. But first, the tour guides offered everyone the opportunity to crawl through the "expanded" version, which were tunnels enlarged and widened to accommodate Western tourists and their — to put it bluntly — larger girths.

I did that, which was a sweaty, taxing experience.

Then I was given a choice to crawl through a typical, unenlarged tunnel.

It was a harrowing and extraordinarily claustrophobic experience, although it only went for 20 or 30 yards.

I emerged from the ground stunned that the Viet Cong spent weeks and months in those tunnels without seeing daylight, with bombs dropping on them and Americans and South Vietnamese forces looking for them on search and destroy missions.

Yet nothing provoked them to abandon the tunnels or their cause.

It all comes down to the human will — the "hearts and minds."

We're told that the next phase of the Afghanistan War may be an "over-the-horizon" conflict. If ISIS or the Taliban use the country to spread terror beyond its borders, then U.S. forces may launch attacks from long distances.

The U.S. military is very skilled at lobbing bombs over borders to strike targets. It has the best technology available to execute those missions.

But the government has lost its ability to lob ideals and ideas over borders that can influence hearts and minds.

The nation was once good at countering the Soviet Union's messages on the alleged benefits of communism, but those skills have atrophied.

China today is globally promoting its autocratic, mercantile style of ruling — where individuals have no rights — as a superior form of government. It is ready and willing to sell its "Big Brother" surveillance technology to any would-be dictators.

Russia flagrantly interferes in U.S. elections and uses our own internet and social media to foment political schisms. Divide and conquer is its goal.

It's hard to discern what the U.S. government is doing to promote American ideals and undermine extremism. Who is responsible for the battle of ideas? Is it the intelligence community? Is it the State Department? The Cold War era U.S. Information Agency, which was charged with doing that mission, is long gone.

Is it the Special Operations psychological ops community? It seems more suited to battlefields than large-scale wars of ideas.

The Afghanistan War is over and the era of great power competition is here. The competition for hearts and minds now shifts to Russia and China.

It looks like we are woefully unprepared for this battle. **ND**

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 BY SEAN DACK

Ransomware: The Pirate's Perspective

■ When President Thomas Jefferson went to war with the Barbary States in 1801, he redefined U.S. national security to encompass the economic security and prosperity of private U.S. citizens.

Despite the occasional resurgence of conventional pirating, the pirates of today do not sail the high seas. Rather, they sit behind keyboards, conduct cyberattacks and hold stolen information for ransom.

As defined by international law, piracy takes place outside of any state's jurisdiction, is conducted without any state's authority and is not driven by political motives. Ransomware mirrors this definition.

Recent events like the Colonial Pipeline hack that caused gas shortages along the eastern seaboard of the United States and the attack on the world's largest meat processor that threatened U.S. beef and poultry supplies prove ransomware attacks are hitting closer to home.

Much like the Barbary pirates, cybercriminals employing ransomware have found safe havens in countries that are either unwilling or unable to curtail their actions. Once again, the United States must redefine national security, demarcate where ransomware fits within the broader national defense strategy and provide the Defense Department with a clear understanding of its role.

Ransomware is an ever-evolving form of malware designed to encrypt files on a device and render any files, and the systems that rely on them, inaccessible to the owner. Malicious actors then demand a ransom in exchange for decryption. Ransomware is a criminal enterprise, conducted primarily by non-state actors targeting governments and private businesses, but with murky connections between state actors and ransomware gangs.

Despite the threat that ransomware poses to commerce and national security, the Pentagon has not previously had a clear role to play in response due to ransomware's criminal nature. Consequently, the FBI and Department of Justice take the lead in investigating incidents, identifying perpetrators and prosecuting them in U.S. courts.

However, the inclusion of cyber as a defense modernization priority marks a clear opportunity for the Pentagon to act and for industry — including NDIA's Emerging Technologies Institute — to make recommendations to shape its approach.

To date, court indictments, public shaming, diplomacy and sanctions have failed to deter ransomware attacks on major U.S. businesses and infrastructure, leading President Joe Biden to directly raise the issue with Russian President Vladimir Putin in Geneva in June. Biden attempted to define reasonable action in cyberspace, outlined which areas of U.S. infrastructure were off-limits to attacks, and stated his expectations of Russian government responses to attacks originating from Russia.

However, ransomware gangs continue to target the United States, necessitating a shift in how the government understands ransomware — not just as a criminal threat, but as a national security challenge necessitating Defense Department involvement. To this end, a mix of long- and short-term policies are recommended.

Like the pirates of the 19th century, ransomware gangs operate from states that either cannot or will not limit their activities. The Pentagon's 2018 Cyber Defense Strategy adopted "defend forward" as its guiding principle in cyberspace. The Defense Department would "defend forward to disrupt or halt malicious cyber activity at its source, including activity that falls below the level of armed conflict."

This doctrine should be expanded, and U.S. Cyber Command should work to disrupt major ransomware gangs before they target U.S. companies.

During the 2018 U.S. midterm elections, the Pentagon targeted the servers of the Internet Research Agency, an infamous Russian bot farm, and took it offline for the days surrounding the election. In 2020, Microsoft and the Defense Department both took uncoordinated actions to eliminate a bot network that could have launched ransomware attacks against state voting systems.

These two instances demonstrate that the U.S. military has the capacity to target and temporarily disable cyber threat actors operating abroad. They should do it again and target the major ransomware gangs wreaking havoc today, providing the breathing space needed to implement long-term deterrence policies.

The Office of the National Cyber Director was formally established in the fiscal year 2021 National Defense Authorization Act to coordinate a whole-of-government strategy for cyberspace, but its responsibilities need to be clarified to prevent interagency turf wars. As the Defense Department adjusts its "defend forward" doctrine to include major criminal gangs, it will be increasingly important that the Pentagon does not become the de facto leader in everything cyber-related.

The department should support a strong national cyber director who takes a broad understanding of their authorities as outlined in the 2021 NDAA. A strong director will have the capability to lead a whole-of-government response to ransomware, incorporating both law enforcement and the intelligence community alongside the Defense Department. This will ensure a balanced government response that does not rely solely on the Pentagon's offensive capabilities.

Ransomware, reminiscent of the pirates of the 19th century, represents a rapidly growing threat that challenges national security. At scale, such attacks can cripple U.S. infrastructure and supply chains, but they also facilitate other espionage attacks by diverting the focus of security professionals, creating new blind spots and vulnerabilities. If the Biden administration does not develop a comprehensive and proactive strategy, the ransomware threat will continue to metastasize. ND

Sean Dack is a graduate student at the Johns Hopkins School of Advanced International Studies and a former ETI research intern.

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BUDGET MATTERS

BY JON HARPER

Continuing Resolutions Could Extend Well into 2022

Once again, the federal government has started the new fiscal year under a continuing resolution because Congress failed to pass a full-year appropriations bill by Oct. 1. However, this time around, the CRs may last much longer than usual, Hill observers are warning.

Continuing resolutions are problematic for federal agencies like the Defense Department as well as contractors because they generally freeze spending levels and prevent new-start programs. Last year, the final appropriations bill for 2021 was passed about three months late. For 2022, the delay could be much longer, said Mackenzie Eaglen, a defense budget expert at the American Enterprise Institute and a former Hill staffer.

"I'm even more pessimistic about the length of a CR now for a variety of reasons," she told *National Defense* in late August when it was apparent there would be a continuing resolution. "Odds grow by the week that the CR will be longer than half a year. No real talks have started between the two parties on any sort of overall federal spending deal for defense and non-defense discretionary" programs.

"Debt bombs" like the trillions of dollars in new non-defense spending proposed by Democrats will exacerbate the political divide between the two parties, she said.

"But the biggest reason the CR could last a long time is that a spending freeze through a continuing resolution is more palatable to many conservatives than a budget deal since it avoids additional non-defense double digit increases and prevents many divestments and retirements of equipment, which is politically popular," she added.

John Lucio, a staffer for the Senate Appropriations defense subcommittee, said "the signals are there" indicating the government could be in for a long CR.

Unlike in recent years, there is no previously agreed upon topline for defense. Additionally, the principle of "parity" — whereby Democrats' insistence on increases in non-defense spending are accompanied by similar boosts in defense spending to meet Republican demands — will be difficult to achieve after the Biden administration proposed a whopping 16 percent bump in funding for non-military agencies in 2022, Lucio said during a panel at the Navy League's Sea-Air-Space conference.

Meanwhile, a lack of a future years defense program from the Biden administration, combined with politically fraught Pentagon proposals to cut legacy equipment, are also complicating the budget picture, he noted.

"Shaking the magic eight-ball, I … would say that maybe early spring, mid-spring, maybe a year-long [CR] isn't really out of the question," Lucio said.

"Anything can happen, but … it may be an extended period of time," he added. "Logic would say that that's probably where we're headed."

In July, Sen. Kirsten Gillibrand, D-N.Y., told reporters she anticipated the final 2022 National Defense Authorization Act and appropriations bills wouldn't be wrapped up until December.

Rear Adm. John Gumbleton, deputy assistant secretary of the Navy for budget, noted that Pentagon officials have come to expect three-month CRs, and often plan to have to wait until the second or third quarter of each new fiscal year to issue new contracts.

"Three months we're kind of used to, unfortunately," he said at the Sea-Air-Space conference. "A year-long CR is the worst possible scenario [and] a six-month CR is not good," he added.

As an example of the negative consequences, Gumbleton said a full year of continuing resolutions would prevent the Navy and Marine Corps from spending nearly $8 billion on planned buys of new equipment, $2.5 billion on operations and maintenance activities, and $2 billion on personnel. **ND**

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Classified Space Programs Poised for Budget Boost

■ Classified space program funding is slated for significant growth, even as some defense officials are pushing for more transparency on capabilities that have been closely guarded secrets, according to one analyst.

President Joe Biden requested $17.5 billion for the Space Force in fiscal year 2022, a 13 percent bump over what was enacted for 2021. About 27 percent of that is for classified efforts, according to Russell Rumbaugh, systems director at the Aerospace Corp.'s Center for Space Policy and Strategy.

"The Space Force continues to grow and consolidate, but it still exhibits several long-standing features of defense space: high classification levels and large programs," he wrote in a recent issue brief, "The FY22 Defense Space Budget Request Analysis."

Total spending on classified defense space programs was first revealed last year. Previously, it was "buried" in other toplines, he noted.

"Because of that new transparency, the Space Force's continued growth is obvious," Rumbaugh said. That includes proposed spending for procurement as well as research, development, test and evaluation.

In the president's 2022 fiscal blueprint, classified RDT&E program spending for the Space Force would increase by 22 percent — a significantly higher rate than the service's overall budget growth, he noted.

Classified procurement would nearly double from $78 million to $142 million, he said.

"While some of these increases may reflect transfers from elsewhere in DoD as with the unclassified funding, those increases are nevertheless real increases in the Space Force's authority and control of resources," Rumbaugh said.

Approximately 40 percent of the service's RDT&E program funding is classified — about the same number as the Air Force — whereas for the Navy and Army it amounts to only 8 percent and "just a small fraction of a percent," respectively, he said.

"Some of that comes from the Space Force's disproportionate focus on hardware because of the nature of space operations," he added. "However, the heavily classified activities make it difficult for the Space Force leaders to explain what they do — including to adversaries."

Meanwhile, some Defense Department leaders have been pushing for more transparency into military space programs, he noted.

At the recent Space Symposium hosted by the Space Foundation, Army Gen. James Dickinson, commander of U.S. Space Command, said ensuring deterrence will require demonstrating new capabilities and the will to use them, to include the development and adaptation of "game-changing" technologies, suggesting that the Pentagon may soon unveil some of its counter-space capabilities that have been closely guarded secrets. ND


ABMS exercise

Will the Military Waste Billions on JADC2 Efforts?

■ The Pentagon wants to connect the military's sensors and shooters into a single network as part of its joint all-domain command and control concept, also known as JADC2. However, the Defense Department is at risk of spending billions of dollars without achieving its aims, officials and analysts are warning.

The Departments of the Air Force, Army and Navy each have their own projects that are expected to contribute to JADC2 but are funded and managed separately.

For fiscal year 2022, the Air Force requested $204 million for its Advanced Battle Management System, also known as ABMS, according to a Congressional Research Service report, "Joint All-Domain Command and Control: Background and Issues for Congress." The Army requested about $107 million for Project Convergence, and the Navy requested an undisclosed amount of funding across three classified program elements for Project Overmatch. The Pentagon is expected to spend billions more on these efforts in coming years.

"Some analysts take a … skeptical approach to JADC2," the report noted. "They raise questions about its technical maturity and affordability."

Todd Harrison, director of defense budget analysis at the Center for Strategic and International Studies, said the current approach risks creating "stovepiped" networks that aren't as interoperable as they would be with a more coordinated approach to program management.

"While many programs and activities are simultaneously underway across DoD, a major impediment to making meaningful progress is that no one 'owns' the overall JADC2 mission area," he wrote in a recent CSIS issue brief, "Battle Networks and the Future Force."

"Each of the military services owns their respective programs, platforms and battle networks — and the budgets that fund them — but there is no effective forcing function that ensures the services' systems will be able to work together," he added.

As a result, efforts to connect the networks may end up on unfunded requirements lists and not be included in budget requests, Harrison warned.

"You've got to make sure you don't mess it up," House Armed Services Committee Chairman Rep. Adam Smith, D-Wash., said of JADC2 at a recent Brookings Institution event.

Networks and other systems will not only need to be interoperable, but also secured against cyber attacks, he noted.

"How do you actually implement it? How do you buy the right software? How do you make it upgradable? How do you get the right people?" he asked. "The goal is correct, but do not underestimate the difficulty of achieving it." ND

iStock illustration, Defense Dept. photo

NEWS BRIEFS

BY MANDY MAYFIELD AND MEREDITH ROATEN

Marines to Deploy New Water Purifiers

To quench Marines' thirst, an Ohio-based engineering company is delivering a high-speed water purifier that will not only provide fresh water to troops, but also shrink the Marine Corps' carbon footprint.

Parker Hannifin has delivered 70 of its water purifier systems, the H20 PRO, to the service so far this year to help the military hydrate in austere environments. Just one purifier — which is smaller than many other available reverse-osmosis filtration systems — could replace 107,000 plastic water bottles a month, according to company executives.

"You want to get people out and mobile," said Kelly Sullivan, engineering manager at the water purification branch of the company. "This really lends itself to that because it's a very mobile piece of equipment, whereas the other ones — they're huge."

The unit weighs about 130 pounds and has wheels like a suitcase. It can easily be stored in the back of a truck or aircraft, unlike other systems that are so large they require a separate transport platform, he noted.

Additionally, the company kept ease of use at the forefront of the system, Sullivan said.

"One thing we really strove for with this system in the design was absolute simplicity of operation and simplicity of maintenance," said Andrew McClelland, defense industry market manager at Parker Hannifin.

Marines are often accustomed to drinking from water bottles to hydrate on missions, and it can be difficult for them to trust the efficacy of a purifier that resembles "a chemistry set" and requires specialized training to operate, he said.

H20 PRO water purifier

First, water flows through a high pressure pump, then through an energy recovery device that pushes the liquid through a 3-pound motor — lighter than a traditional water filtration motor, according to McClelland. The final step involves sending the water through a filter to eliminate contaminants before it's ready to be consumed.

Only a few switches need to be turned on to operate the system, and the gauges to monitor the purifier's pressure are color-coded, which eliminates the need for specialized training, he noted. The filter can be cleaned instead of replaced, and there are no speciality tools required for maintenance.

"[We're] really trying to incorporate that initial feedback that we had received into the design to make it as user friendly as possible," McClelland said.

The Marine Corps awarded Parker Hannifin a $6 million contract in 2020 for 600 systems over a three-year time period. The company expects to deliver 160 systems by the end of 2023. **- MR**

Marine Corps photo by Cpl. Jesula Jeanlouis; Parker Hannifin Corporation photo

5G Tower Designed To Protect Battlefield Communications

■ A Washington, D.C.-based digital infrastructure company has developed new encrypted 5G towers that could boost speed and security for military communications.

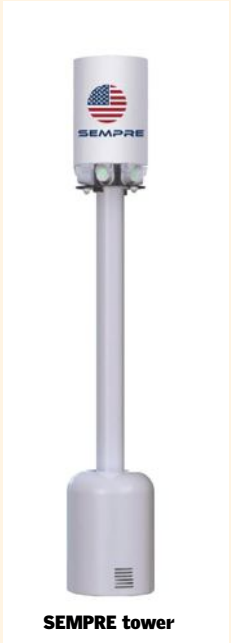
The company, Secure Electromagnetic Pulse Resistant Edge, or SEMPRE, launched over the summer. Its flagship product, the SEMPRE tower, could allow the military to securely use 5G to transmit data, said CEO Robert Spalding, a retired Air Force brigadier general.

Though 5G offers speed, reliability and convenience, it has too many weaknesses which adversaries could leverage, Spalding said.

The SEMPRE tower is currently going through electromagnetic pulse testing to be certified by the military as resistant to an EMP attack, he noted. An EMP is an intense burst of energy that can be released by a nuclear weapon detonated high in the atmosphere, or by a geomagnetic disturbance caused by natural phenomena such as solar flares.

Spalding pointed to a 2020 Nashville bombing that froze wireless communications as an example of what could happen if a terrorist managed to target an unprotected cell tower. The SEMPRE system has a "virtualized" core, which means that communications won't go down if one tower is taken out, he said.

"Our tower can continue to function because we have a functional core — the brains of the system — on every tower that we have," he said.



SEMPRE tower

The tower features low-latency capabilities, which could process high volumes of data generated by the military's machine learning and artificial intelligence technology, Spalding said. This could be particularly useful as the Pentagon pursues information and decision dominance through its joint all-domain command-and-control concept, he added.

Meanwhile, the tower's ability to incorporate different software platforms will ensure the military is able to integrate the latest upgrades and systems on the battlefield, he said.

"The most cost effective means for DoD to adopt that would be to say, 'Hey, help us ... plug-and-play different hardware with other hardware, but also more importantly, give us the ability to bring different software loads into that platform,'" he said.

Additionally, the SEMPRE tower works with existing cell tower infrastructures, which means the military wouldn't have to invest in an entirely new set of towers, Spalding noted. **- MR**

SEMPRE illustration, JetPack Aviation illustration


Digital rendering of the JetPack Aviation HSVTOL Speeder

Air Force in Pursuit of High Speed Hovercraft

■ A new challenge sponsored by the Air Force's innovation incubator, AFWERX, aims to help the service and Special Operations Command find and develop a hovercraft.

The High-Speed Vertical Take-Off and Landing, or HSVTOL, Concept Challenge imagines an aircraft that can take off from any location and operate at speeds comparable to much larger platforms.

The aircraft will need to maximize speed, range, survivability, payload, size and flexibility. The Air Force could use it for various applications. It has the potential to revolutionize special ops, personnel recovery, aeromedical evacuation and tactical mobility, according to AFWERX.

California-based JetPack Aviation is one of 35 winners of the challenge, said CEO David Mayman. The company's offering, the VTOL Speeder, can approach speeds approaching 300 mph when operated in unmanned mode, Mayman said.

The platform is designed like a flying bike, which can be operated manually, remotely or fully remotely-controlled with no rider to reach top speeds.

Because of its envisioned speed and lift capabilities, the HSVTOL will be able to deliver cargo in environments where a slower-moving helicopter could be a target for enemy defenses, he noted.

"It could be used for very rapid delivery of lifesaving cargo … [where] a helicopter is too slow and has crew on board and you're risking the life of the people," he said.

The Speeder's autonomous capabilities enable flight in any weather conditions and its compact size allows for take off from a location as small as a parking space. Multiple Speeders could be deployed as a drone swarm, Mayman added.

The Air Force and SOCOM "are seeking groundbreaking ideas that will further strengthen operational effectiveness and efficiency in contested, resource-constrained, and runway-independent settings," Reid Melville, chief innovation officer at the Air Force Research Laboratory's Transformational Capabilities Office, said in a statement.

The military has been working on the concept for fast VTOL for years. The Defense Advanced Research Projects Agency invested in a vertical takeoff and landing experimental aircraft program, known as the X-Plane, in 2016. **- MR**

Vulcan Centaur rendering

ULA Wants Blue Origin Engine By End of Year

COLORADO SPRINGS, Colo. — United Launch Alliance is hoping to receive Blue Origin's BE-4 engine — which will be used as the engine for ULA's new Vulcan Centaur rocket for an upcoming national security space launch — before the end of 2021, the organization's CEO said in August.

The Space Force — in partnership with the National Reconnaissance Office — is managing the National Security Space Launch program, which enables the acquisition of launch services aimed at ensuring continued access to space for critical military and intelligence-gathering missions.

Through the program, the service has assigned seven launches to United Launch Alliance — a joint venture between Lockheed Martin and Boeing.

As part of the effort, ULA bid and intended to fly its new Vulcan Centaur rocket for national security space launch mission USSF-51.

However, the rocket is not on track to be certified by the Space Force to fly by the late 2022 deadline. One issue with the Vulcan rocket is its engine, the Blue Origin-built BE-4.

According to a report released by the Government Accountability Office in June, "Weapons System Annual Assessment: Updated Program Oversight Approach Needed," the Vulcan has been "experiencing technical challenges related to the igniter and booster capabilities required."

Tory Bruno, president and CEO of ULA, said working on the technology is "a tough job."

"The most complicated thing on a rocket is actually a rocket engine," he said at the Space Foundation's annual Space Symposium in Colorado Springs, Colorado. "I hope to have engines before the end of the year."

The system is currently in pre-qualification testing, Bruno said.

"The rocket engine has thousands of seconds of test time to get through all the operating conditions," he said. "It is performing great — more thrust than we expected." **- MM**

Purdue to Host New Hypersonics Test Facility

A facility to test hypersonic capabilities will be built at Purdue University's Research Park Aerospace District adjacent to the university's campus, the school announced in August.

The Hypersonic Ground Test Center, or HGTC, was announced during a two-day Hypersonics Summit hosted by Purdue and the National Defense Industrial Association.

The academic institution was chosen to be a "neutral host" for HGTC, which will be an independent consortium created and defined by industry members, said Mung Chiang, executive vice president of Purdue University and the dean of the College of Engineering.

"Purdue has the highest concentration of hypersonic talent in terms of professors and students in the country, and also a great relationship with DoD, industry and NDIA," Chiang told *National Defense* in an interview.

The facility will support multiple test cells and laboratories. At the time of the announcement, the consortium had eight members with more joining since, Chiang said.

"Rolls-Royce is a founding member, for example, that has already decided to invest in some of the facilities that will enable the HGTC to function," he said.

Purdue also invested in additional facilities that will bolster the center.

"The next step is to get together with all the members of the consortium to scope out the specs of the shared facilities and the modality of operation in this nonprofit consortium setting," he said. "After that, we will know exactly the timetable of the construction itself."

ULA illustration, Second Bay Studios illustration

Prior to the announcement, Purdue — which is based in West Lafayette, Indiana — made news for a number of hypersonics-related activities including a $41 million investment to create a facility that will house the nation's first Mach 8 quiet wind tunnel, a Northrop Grumman-donated hypersonic pulse tunnel and secure manufacturing facilities, Chiang noted.

"We had a summer trifecta of hypersonics at Purdue," he said. **- MM**

AI Key to Unlocking New Space Applications

■ Experts say artificial intelligence — which has wide applications across the military, civil and private sectors — will be critical to furthering space technology as the cosmos becomes more contested.

"The space environment continues to rapidly evolve," said Melanie Stricklan, CEO of Slingshot Aerospace, a space simulation and analytics company based in Austin, Texas, and El Segundo, California. "We continue to proliferate with new users and capabilities, new sensors both on orbit looking down, and on the Earth looking back up at space."

Artificial intelligence can improve space domain awareness, accelerate command-and-control decisions as well as inject resiliency into satellites and their corresponding networks, she said during an online panel discussion hosted by Booz Allen Hamilton.

"There's a lot of limitations for space today, but I think AI solutions really offer a transformative opportunity for ... the protect-and-defend mission on the defense side [and] for improving operations on the commercial side," Stricklan said.

Officials with the burgeoning Space Force — which will soon celebrate its second birthday — have said artificial intelligence will be a key future technology.

To enhance efficiency, the service plans to establish a digital foundation that will support rapid, data-driven decision-making and "unburden" its workforce from legacy staffing and coordination activities that could be better accomplished through automation, the Space Force said in its "Vision for a Digital Service" document, which was released in May.

"We will exploit machine learning and augmentation where appropriate, allocating monotonous staffing activities to artificial intelligence routines or robotic process automation and thus freeing up Guardians to train, educate and wargame as part of their drive to become a world-class fighting force," the document said.

Quentin Donnellan, general manager for space and defense at Hypergiant, an enterprise AI company with several offices in Texas, said the United States needs to leverage the uniqueness of its orbital assets as it considers how to apply AI to space systems.

Satellites "collect data globally, in real time, all the time, persistently, intermittently, in different wavelengths [and] above the clouds," he said. Adding a layer of artificial intelligence into the systems will allow the military and critical infrastructure entities to glean new insights, he added.

Shayn Hawthorne, space technology lead at Amazon Web Services, said there are many applications for artificial intelligence and machine learning in space that have yet to be conceived.

"We all know we want to do AI/ML on orbit," he said. "We know that we want to connect to everything, but we're not sure of all of the different missions that we want to use it for yet."

Engineers are not limited by technology but rather by concepts of operations, he said.

"We're right at the point where the wave is cresting, and pretty soon we're going to be able to start to surf," Hawthorne said, using a water sport analogy. Developers will "start thinking of all the cool things we can actually do with the technology, instead of just thinking about how do we get that capability onto the spacecraft."

Enabling satellites with artificial intelligence presents a number of challenges, experts say.

"You don't have a persistent connection to your assets in space," Donnellan said. "If you've got a low-Earth orbit satellite, you've got maybe seven to 10 minutes to talk to it and then it's gone for 90 minutes or more."

Another difficulty is figuring out what data will be used with the system, said Pat Biltgen, principal at Booz Allen Hamilton.

"We haven't really defined all the missions that we want to use," he said. Once developers determine those mission sets, the next question is, "do I have any data to solve that problem?"

There has been a general focus on applying computer vision — a sub-division of AI where algorithms automatically recognize objects — in space, but that poses challenges, he noted.

"People always kind of compare that to … identifying pictures of cats," Biltgen said. "There aren't a lot of cats in space. The things that we're trying to find from space are usually hard to find — they're hard for people to find, so it's even harder for algorithms to find them."

That makes it difficult to condition data and build the models necessary for the algorithms, he said. "We really need to have a discussion about what data is available and how do we use it to build models we can trust," he added.

But Donnellan said there is a long road ahead for gaining trust in AI algorithms, especially in a domain such as space where data sets are limited.

"That road is paved with simulation and synthetic data," he said. "We're going to have to really double down on human-in-the-loop training events where you can actively reinforce the agents involved in ML decision-making or AI decision-making."

Synthetic data is information created from simulations or models to fill in gaps for algorithms and is usually applied for activities that do not occur often, Biltgen explained.

It "also allows us to simulate things that are essentially completely impossible, just to see how the system would respond in those instances," he said. "It's a very powerful enabler to train your models." **ND**

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Viewpoint BY DANIEL SENNOTT AND HEATH TAYLOR

Congress Should Move to Establish and Strengthen a Permanent SBIR Authority

■ Victory in war is not always guaranteed to the biggest force, but more often it's the military with more innovative capabilities and a commitment to utilizing modern technologies.

Recent advancements by near-peer competitors, such as Russia and China, have called for historic funding levels for Pentagon research, development, test and evaluation. President Joe Biden's budget request for fiscal year 2022 includes the largest ever funding for RDT&E at $112 billion, and, based on the House and Senate Armed Services Committees markups of the National Defense Authorization Act, that number is certain to grow by several billion dollars.

While the challenges from emerging threats are new, the necessity for utilizing innovation on the battlefield is not. From the Union Army's use of the telegraph in the Civil War, the machine guns employed in the trenches of World War I, the Higgins boats carrying troops to storm the beaches of Normandy in World War II, to the current multibillion-dollar push for a more lethal and technically integrated military, innovation has been and will remain at the heart of the capabilities that give warfighters a winning edge on the battlefield.

Like the military and the service members who fill its ranks, if a small business is not competitive and adaptive, it fails. Driven by competitiveness and agility, small businesses are an essential source of innovative technology. The U.S. military has long recognized the critical role small businesses play in this regard.

The Small Business Innovation Research (SBIR) program, established in 1982, was designed to ensure the scientists and innovators so prevalent in small business have a meaningful way to access federal funding. It has been a tremendous pipeline for ingenuity, and the defense marketplace has been a particular beneficiary of this program. Success stories abound regarding the mutual benefit the program has for both the small business community and the federal government.

SBIR graphic

ML Mackey, chair of NDIA's Small Business Division and chief executive officer of Beacon Interactive Systems, noted: "As the CEO of a nontraditional defense contractor, we found the SBIR program to be a small business friendly gateway into the defense marketplace, enabling us to successfully bring our commercial sector expertise to bear on DoD needs."

Although the program has been reauthorized in the National Defense Authorization Act periodically, now is the time to make it permanent and improve aspects of this vital program.

The goal of the SBIR program is to encourage competitive small businesses to work in coordination with the federal government on agency research-and-development needs and expand private sector commercialization of the innovations stemming from this research.

The program is structured into three different phases of funding. The objective of Phase I is to establish the concept's feasibility to government agencies. Phase II is initial prototype development. And Phase III includes any follow-on non-SBIR funds that extend, derive, or complete the prior SBIR investment. By supporting small business competition for these contracts, the program inspires technical innovation and injects an important sense of entrepreneurship into the defense enterprise.

Since its inception, Congress has reauthorized and extended the program several times. Most recently, the 2017 NDAA extended SBIR and related programs through September 2022.

Nearly 40 years after the program was first authorized in law, its value is clear. As of 2019, the program has provided over 179,000 awards totaling over $54.3 billion to small businesses. Just within the Defense Department, the SBIR and the Small Business Technology Transfer programs have resulted in a 22:1 return on investment, and it has had a significant impact on the economy.

By all accounts, the federal government and small businesses have benefitted immeasurably from SBIR; establishing it as a permanent program is the next logical step. The temporary nature of the current program sends a distinct message to both the federal agencies who administer it and small businesses hoping to participate.

To federal agencies, the current situation may discourage them from investing time and money into these initiatives. Government Accountability Office statistics show that, despite statutory minimum expenditure requirements, the majority of agencies participating in the SBIR program failed to comply with mandatory minimum expenditure levels. Given the uncertainty of federal funding, agencies naturally focus more on permanent programs over temporary programs that may or may not survive the next legislative cycle. This is a dynamic recognized by the congressionally chartered Section 809 Panel in their report released in 2018.

Making the program permanent will make clear that SBIR is a priority of Congress and should be a priority for federal agencies.

Similarly, the temporary nature of the program sends a discouraging message to small businesses. Current issues relating to budget uncertainty and the ever-increasing regulatory burdens already make small companies think twice before doing business with the federal government.

Firms continue to leave the defense sector each year. The National Defense Industrial Association's 2021 "Vital Signs"

data around this trend is concerning. This year's report graded innovation conditions within the defense industrial base a C-, revealing a two-point drop from previous reports. From fiscal years 2019 to 2020, the number of new entrants into defense federal contracting went from 6,000 to 3,000. Permanency for the SBIR program creates the certainty to encourage small business participation in the industrial base, a direct counter to this disturbing trend.

The potential for SBIR to be discontinued adds to uncertainty and may dissuade small businesses from participating. Specifically, small businesses owners who have had to make hard decisions about whether to invest their finite resources in commercial versus defense markets may see the temporary nature of the program as a major risk.

Given the Pentagon's current headwinds in keeping pace with technology, a program whose goal is to link small business innovation to the Defense Department and other government agencies should be made permanent.

Additional improvements to SBIR could help.

When making the program permanent, Congress should also consider strengthening it to ensure optimal use. The last several NDAAs have included modifications to the program, but there are a couple of additional improvements that should be made as a part of this year's legislation.

One would be to enforce compliance.

The success of the SBIR program depends largely on federal agencies' willingness to use it. To be compliant with SBIR's statutory requirements, certain federal agencies are required to spend 3.2 percent of their extramural R&D accounts on SBIR projects. Despite this relatively modest standard, the majority of participating federal agencies do not meet these minimum spending requirements, according to the Small Business Administration.

The Defense Department, which accounted for 42 percent of SBIR spending in fiscal year 2018, had several components that did not comply, including the Air Force, Army, Missile Defense Agency, Defense Health Agency, Joint Task Force on Chemical and Biological Defense and the Office of the Secretary of Defense. In addition, the Small Business Administration was unable to determine whether the Navy complied with requirements.

Given these dismal results, additional enforcement mechanisms may be warranted. For example, Congress may consider placing additional oversight on the program, including further reporting or certification requirements to help lawmakers understand why the Defense Department in particular is unable to meet SBIR statutory obligations.

Another recommendation is to bridge the gap between Phase II contracts and programs of record.

As a part of the SBIR program, the Pentagon and other participating federal agencies are required to work with SBIR contract awardees to transition their Phase II technology to commercial production through Phase III contract awards. However, small companies do not always have the resources to stay adequately engaged when awaiting results and funding between the phases. This lack of timeliness is detrimental to both the department and small businesses, resulting in a product no longer relevant when it reaches commercialization and contributing to the lack of participation from small businesses.

A permanent authority would allow for authorizations that have previously been underutilized by the government, such as Section 1710 of the 2018 NDAA. This section authorizes a contract vehicle that would provide a pilot program for subsequent work from Phases I and II, allowing for a more standardized Phase III.

However, the Defense Department has a mixed record of successfully helping Phase II awardees obtain additional federal contract awards. In fact, some small business participants have reported being overlooked for Phase III contracts in favor of larger companies.

In a recent study on the SBIR/STTR program, the department found that of the Phase II contracts that resulted in sales, just 23 percent of the sales were to the military. Congress has taken notice, with the 2021 NDAA requiring the Pentagon to provide detailed reports on how often it transitions SBIR Phase II contracts to programs of record. This oversight is helpful, but lawmakers should also consider establishing goals for the percentage of Phase II contracts successfully transitioning to Phase III.

Given the stringent vetting of small businesses and their technology proposals when awarding Phase I contracts, it is not unreasonable to expect a good percentage of the resulting technology should transition to commercial production.

A permanent, strengthened Small Business Innovation Research program can drive the innovative potential and competitive nature of small businesses towards a more coordinated partnership with the federal government. As the U.S. military works to modernize and increase lethality, collaboration with small business innovators is essential. We must leverage all of our resources. Our adversaries certainly will. **ND**

Daniel Sennott is NDIA's senior fellow for small business and a partner at Holland and Knight LLP. Heath Taylor is NDIA's legislative policy associate.

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Viewpoint BY MIKE MILLER

The Rise of Edge Computing in Defense

The past year was a time of rapid change for government technology. While bolstering information technology infrastructure that could sustain remote work was a major priority, there's also been an ongoing revolution at the more remote network edge.

By bringing computational data storage and connectivity resources closer to where it's being gathered, edge computing saves bandwidth and accelerates response times.

The approach has been around since the 1990s but has gained traction in recent years thanks to advances in data processing and computing and emerging technologies such as virtual reality and 5G.

Edge computing advances life-saving possibilities for warfighters and the defense community. Thanks to edge computing, troops have access to insights in remote locations with little connectivity. Weather conditions, machine performance data and other sensitive information can now be turned into actionable decision-making. As possibilities at the edge advance, these applications continue to expand.

At the same time, with millions of remote workers and strained networks, there's a greater need for computer power, capacity, and storage closer to another new network edge — home offices. The result is a boom in edge-related hardware, software and applications.

To fully take advantage of possibilities at the edge, the first step is determining how best to deploy such solutions for each unique situation. As an emerging technology, there may not be a prior example or tested solution, and each branch of the department has different circumstances and needs. It is important for senior leaders to evaluate where edge computing is most needed and how to utilize it most efficiently.

For example, how can warfighters in theater — operating under the most extreme of circumstances — have the ability to utilize actionable intelligence where asynchronous operations and connectivity are to be expected?

Once the mission is clear, it's critical to think about data protection at the edge. As the Defense Department explores new applications, data protection needs to advance along with the possibilities. Considering cyber basics, a smart backup strategy, connectivity and unique requirements for the technology's footprint at the edge can ensure sensitive data information is reliable and secure.

To ensure security at the edge, strong governance programs are key — beginning with an understanding of what data is being generated as well as how it is processed and transferred. All edge devices must be properly secured despite their less-central location and data should be encrypted at rest and in flight.

The implementation of edge can be an opportunity for the department to place strong cybersecurity practices at the onset. It can use this opportunity to assess its own risk appetites and where it can manage those risks accordingly. For example, if the department continues to move toward a zero-trust model, the approach should be integrated into edge computing applications versus implementing edge and then trying to change it to fit zero trust afterwards.

Additionally, IT security teams can choose to keep certain data at the endpoints, limiting the amount of information that gets sent back to the network and potentially keeping threats away from the data center. Edge computing may provide more endpoints for attack, but it can also prohibit bad actors from reaching the data center and mission-critical resources.

The department also needs to continue to evolve effective data backup and management strategy.

The "3-2-1-1-0" rule suggests three copies of all data sets and information are kept on at least two different media. In addition, the locations should be distributed, with one copy stored offsite in case an entire region or facility is impacted. At least one copy of the data must be immutable, which is essential given the undetected, lingering threats that can be hidden on agency networks and the growth in ransomware.

In choosing a solution, reliability, ease of use and versatile restore options are crucial features for backup — the moment data is lost in a remote location isn't the right time to discover a backup solution is overly complex. The right solution will include all recovery mechanisms including backup, replication, storage snapshots and continuous data protection.

For the Defense Department, the definition of "edge" may vary from forward operating bases, through operating in theater, to naval vessels and beyond. In these remote locations, connectivity can become a major barrier.

No matter where they are in the world, defense forces need correct and up-to-date information. Mission success depends on it. If a warfighter becomes disconnected from crucial information, there could be a lag in decision-making or lack of vital information while government workers try to reconnect. Every moment disconnected is critical.

This is another place where backup comes in. If the necessary information is available reliably and separately from the network at the edge, defense forces won't need to depend on connectivity to be productive and complete missions. When warfighters become disconnected, they can operate offline and batch changes at the edge, then connect back to the network when possible. Depending on the need, edge-based deployment can asynchronously or sporadically back up at the edge. This flexibility cuts down disconnect times and increases agility in situations where network connectivity isn't reliable.

For special operations or forward operating bases, data backup can't add hardware — more equipment and additional bulk limits room for other mission-critical essentials. In some cases, cloud computing can cut down on additional hardware, but the Defense Department must ensure that the agency has a clear understanding of what the cloud provider is responsible for in terms of backup and protection.

At the edge, software-based solutions can make backup accessible in situations where there is no space to spare. Ideally, this is a complete software platform that provides benefits like scalability and the flexibility to change components whenever needed. **ND**

Mike Miller is vice president of federal at Veeam.

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Industry Perspective BY FELIPE FERNANDEZ

Federal Agencies Can Strike a Balance Between 5G's Risks and Benefits

U.S. Customs and Border Protection is the largest law enforcement agency in the country, with more than 60,000 employees. Some 20,000 of those employees are Border Patrol agents, responsible for thousands of miles of U.S. borders with Canada and Mexico, U.S. shorelines and more than 300 ports.

It's a big job, to say the least. One that agents must perform while chronically understaffed, according to officials. But what if technology could help shore up staffing shortages with "smart borders," high-speed data processing and edge computing?

The federal government is on the cusp of 5G-driven transformation that, while aligned with broader modernization efforts, could fundamentally change operations at the edge. And that edge could be a U.S. port or border, a battlefield, disaster zone, or inspection locations across the country. Regardless of locale, 5G's ability to transfer data and communications faster is a game-changer — and in some cases, a lifesaver.

Real-time visibility and real-time control of a remote system — say, drones that augment border security, or automated capabilities that accelerate health care services — can provide agencies with capabilities that heretofore required humans onsite, making decisions with comparatively limited information. With high-speed connectivity, sensor data can fast-track operational agility and decision-making. This compounds the effectiveness of the government's field operators, improving situational awareness and alleviating delays and bottlenecks that mount amid poor or no connectivity.

More data, from streams of video and other sources, will create even greater demand on the agency's networks. It's a challenge CBP leadership alluded to in their 2021-2026 strategy, which outlines broader plans to increase situational awareness, integrate and analyze interagency data, and invest in tactical and operational mobility.

"We do want to increase our mobility position, take advantage of 5G for those edge devices that rely on wireless connectivity, [and get] the data in real time to our officers out in the field. Our strategy is to move as much of that computing power out to the device itself," Christopher Wurst, CBP's executive director for enterprise networks and technology support, said at a recent event. "What we can do to move some of that data processing out to the edge is definitely in our roadmap."

But amid heightened supply chain concerns and high-profile cyberattacks, edge computing and 5G present new vulnerabilities and potential threats.

5G technology "represents a complete transformation of telecommunication networks, introducing a vast array of new connections, capabilities and services," officials from the National Security Agency, the Office of the Director of National Intelligence, and the Cybersecurity and Infrastructure Security Agency wrote in a recent joint threat analysis. "However, these developments also introduce significant risks that threaten national security, economic security, and impact other national and global interests. Given these threats, 5G networks will be an attractive target for criminals and foreign adversaries to exploit for valuable information and intelligence."

A thriving internet-of-things no doubt looks like a goldmine in the eyes of a malicious actor. But potential dangers aren't a reason to pass up opportunities to multiply forces by integrating and leveraging better communications, sensor data, intelligence and myriad other advancements. It would be like never crossing a street because a car might come.

While we can't forego the technological advantage and resulting societal benefits just because there may be hazards, we also can't go into 5G blindly. Agencies employing this capability must do so with a full understanding of potential dangers based on a thorough risk-benefit analysis. Armed with a risk-management approach and a comprehensive security stance, agencies can harness 5G to accelerate and amplify a range of critical missions.

That security stance might vary by department and mission, but effective strategies include tailored applications and policies, appropriate security controls, adequate tools and training, and effective standards that establish a foundation. From there, agencies can execute according to an agile framework employing evolving solutions — adjusting based on changing risk tolerance, emerging tools and technologies, shifting threats and other factors. A layered security fabric might not be impenetrable, but it makes it much tougher for the adversary.

Much like you can't take an aspirin before knowing you'll get a headache, you can't eradicate every threat before moving forward. Amid continuing advances in 5G, protection capabilities will also progress. This is where public-private partnerships will be especially critical in moving the ball forward on capabilities and services that could revolutionize government operations.

5G will provide the speed for the United States to confidently deploy cutting-edge tools like automation and remote capabilities. In turn, the data gleaned in the process of those deployments will further advance and refine the tools in the nation's arsenal. When combined with industry partnerships, this process of continuous improvement can expand in both breadth and depth — more efficiently and more effectively enhancing detection and response to anomalies in human health or network health, in geopolitics or in geological events, in technological systems or in countless other kinds of systems.

In a landscape that continues to gain momentum, partnerships that mutually benefit from cooperative research, development, innovation, acceleration and deployment will maximize 5G's impact across sectors. From national security to critical infrastructure to agriculture to technology to health care and many areas in between, we all benefit from these burgeoning capabilities. Whether public sector, private sector or private citizen, we all have skin in this game. **ND**

Felipe Fernandez is director of systems engineering at Fortinet Federal. He previously served for more than a decade as a cybersecurity engineer for the U.S. Marine Corps.

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Allies Collaborate to Further Space Security, Situational Awareness

BY MANDY MAYFIELD

COLORADO SPRINGS, Colo. — The U.S. Space Force recently gathered its international allies in August to discuss how it can further global collaboration as it seeks to maintain order in a critical warfighting domain.

Space leaders from the United States, United Kingdom, Germany, Finland, Japan, Chile and France took part in the discussion, which was hosted by the Space Foundation during its annual Space Symposium confab in Colorado Springs, Colorado.

Air Chief Marshal Michael Wigston, chief of the air staff for the Royal Air Force, said the United Kingdom believes the first step toward successful collaboration is to establish common rules in the space domain.

"The U.K. believes strongly that an open and resilient international order is fundamental to all of our security and prosperity, and that means people playing by the rules," he said. "The first bit of collaboration I would point to is actually not military collaboration, it's [collaboration] between our governments and our diplomats working in the United Nations to establish rules and norms of responsible and safe behavior in space."

Countries such as Russia and China are acting "increasingly reckless" in space by fielding systems that are designed to interfere with, harm, or destroy space platforms, he noted. "So, establishing international norms and rules of behavior in space is a fundamental path to cooperation."

The U.S. Space Force's Chief of Space Operations Gen. John "Jay" Raymond concurred with Wigston.

"In every warfighting domain there are rules for safe and professional behavior, and we don't have that today in space," he said. "It's the wild, wild West."

To understand what is occurring in space, there needs to be better situational awareness, he said. Over the course of the last year or so, the Space Force — which will soon celebrate its second birthday — has had conversations with partner nations about the need for norms of behavior in space and to increase awareness in the domain.

The dialogue has picked up pace recently as leaders have become aware of behavior that is "less than safe or professional," Raymond said.

"Over the years, as we train together, as we exercise together, as we play more games together, we exercise these types of things together, … we [also] tend to have a common understanding of what's safe and professional," he said. "It has been very valuable to have not just one country messaging, but multiple countries messaging, because I think it's important that we set those standards of what is safe and professional and we operate that way on a day-to-day basis."

Several countries are already collaborating on operations to expand space domain awareness. Efforts such as the United States-led Operation Olympic Defender aims to strengthen allies' abilities to deter hostile actions. The United Kingdom was the first nation to sign up for the coalition, Wigston noted.

"I would also flag up the Combined Space Operations [Center] initiative" which brings together the United States, United Kingdom, Australia, New Zealand, Canada, France and Germany, he

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said. The effort, known as CSpOC, is led by the United States and includes a multinational space operations center that provides command and control of space forces for U.S. Space Command's Combined Force Space Component Command, which is located at Vandenberg Space Force Base, California.

The organization "is working in a number of areas, not just operations ... but around the policy and the approach to international rules of behavior, [and] also around the capabilities and the architectures that we need in space and making sure that we are all able to work together," Wigston said.

He added: "I would say that building the expertise and the experience among our people is the most important thing we can do working together. … It is about operational collaboration, it's about capability and equipment collaboration, but it's also about getting our people working together."

To further these conversations, Raymond was slated to host a meeting in August to confer with senior officials from nearly two dozen allied nations. The gathering was part of a broader push by the Space Force to bolster international partnerships.

A number of countries that were slated to be represented at the meeting are currently training with the Space Force, Raymond noted.

Additionally, more than 300 international experts recently participated in the Schriever Wargames, a two-day training event focused on critical space operations.

The Space Force is also increasing its number of international exchanges and liaison officers, as well as creating more slots for foreign personnel at its professional military education programs, Raymond said.

"While we in the U.S. are busy establishing Space Command [and] the Space Force, many of our allies and partners have elevated space in their militaries as well, including the U.K., France, Australia, Japan and Germany, to name a few," Raymond said.

The Space Force is already developing and utilizing capabilities with other countries, he noted.

"Although we've leveraged about $2.7 billion of partner funding in space capabilities through 40 different international agreements with 19 different nations, that's just the beginning," he said. "We would like to see more."

However, there are some hurdles to collaboration. One includes data sharing and the classification of information, Wigston noted.

"People recognize that there are some aspects of what goes on in space that have probably been too highly classified for too long and there is a need to share that information," he said. "And in particular, share that information around domain awareness and what is going on."

Another challenge is that global militaries have yet to find an effective way to collaborate on equipment and capability programs, he said.

"I've pointed to that in some of the things we are doing in CSpOC, but we know what we need to do," Wigston said. "There are a lot of good people working really hard at it and I've personally seen significant progress in the last 18 months, and it looks to me like it's accelerating."

Col. Luis Felipe Saez, subdirector of the space affairs operations directorate at the Chilean air force, said he believes the South American nation should have its own national space service similar to its air force — a move that would prioritize the space domain and allow it to boost collaboration with partner nations.

The best way to prioritize space "is to try to have a multilateral or bilateral national space program in order to match the air force and be able to create a synergy," he said.

"This is a team building effort," he added. "There is no country that will face the challengers alone."

By building its own space program, Chile can contribute more to evolving issues in the domain, he added.

Space situational awareness is also a major priority for Chile, and the country would like to build its own equipment to track objects, Saez said.

"The idea is to develop our own system — [the] ground segment first. Then the system will be able to collect, analyze and provide our own data to the international catalog system," he said.

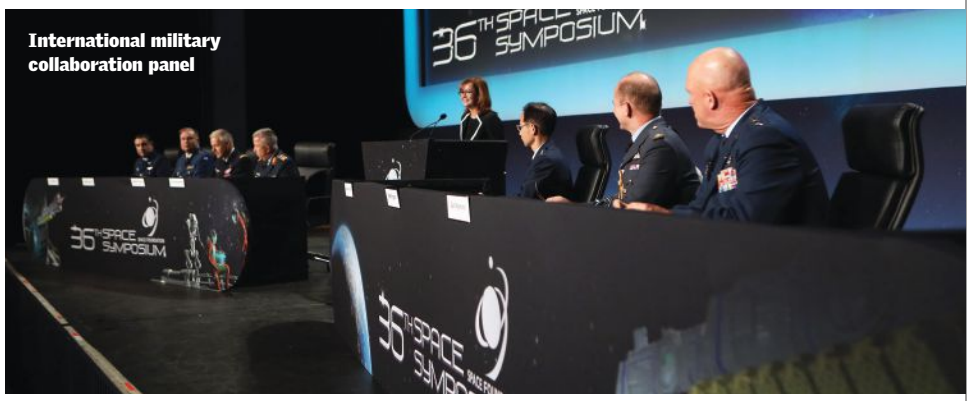
Meanwhile, the U.S. Air Force Research Laboratory — which supports both the Air Force and Space Force — will soon expand its international locations to include Australia and Brazil, said Maj. Gen. Heather Pringle, the commander of the organization.

The lab already has international sites in the United Kingdom, Japan and Chile, "which build our basic research program partnerships in pursuit of high-risk, high-reward endeavors," she said. "Coming soon is Australia and Brazil."

ARFL is currently engaged in nine international research project arrangements with "five eyes" partners the United Kingdom, Canada, Australia and New Zealand as well as Spain, Sweden, Japan and Israel, Pringle noted.

"In addition to collaborations with 12 other nations, AFRL is seeking a new flexible project arrangement with Australia to allow for the rapid kickoff of technical space research collaborations," she said. "That is a lot that AFRL can leverage or build on in the end," she added.

AFRL also has a large domestic presence, Pringle noted.



International military collaboration panel

Space Symposium photo

It "has locations in nearly 10 states and three international locations and our outreach spans the globe," she said. "The return on investment for this posture is really high — you count them all together — we have about 6,000 partnerships."

These relationships allow the organization to deliver transformational, multi-domain capabilities, she added. "Building on [those] partnerships is just the beginning." ND

SLAYING THE DRAGON: Marines Retooling for Potential War with China

BY JON HARPER

The island-hopping campaign against Japanese forces during World War II was perhaps the U.S. Marine Corps' finest hour. Today, Marines are trying to ready themselves for a potential conflagration against another Indo-Pacific adversary that has emerged as a great power competitor in the 21st century — China.

After the 9/11 attacks and the U.S. invasions of Afghanistan and Iraq, counterinsurgency became the service's main focus. But not anymore.

The Corps has been conducting "a lot of COIN ops for the last two decades," Lt. Gen. Mark Wise, deputy commandant for aviation, noted at the Navy League's Sea-Air-Space conference in August.

However, "the potential adversaries that we have out there have been watching closely and not standing idly by," he said. "They have been increasing in complexity, they've been increasing in capacity, and they've been doing all of that over the last 20 years. And it's only accelerating right now."

ROGUE Fires system

Who are these potential adversaries?

"The pacing threat is China," said Lt. Gen. Eric Smith, commanding general at Marine Corps Combat Development Command and deputy commandant for combat development and integration. "We shouldn't sugarcoat that and talk in vague terms. We're talking about China as a pacing threat because of their bellicose actions and language."

The Corps is not as well postured as it should be to address the challenge, officials say. To get after the problem, the service is pursuing new technologies, force structure changes and operating concepts.

Operating concepts that the Marines are looking to apply in the Indo-Pacific region include distributed maritime ops, littoral ops in a contested environment, and expeditionary advanced base operations.

Marines must be able to employ mobile, low-signature, operationally relevant, and easy to maintain and sustain naval expeditionary forces from a series of austere, temporary locations ashore or inshore within a contested or potentially contested maritime area in order to conduct sea denial, support sea control, or enable fleet sustainment, according to a service news release.

Employing these concepts in the Indo-Pacific is no easy task, Wise noted.

"When you look at an archipelago that's greater than 1,000 islands and you're looking at how you're going to posture in a theater like that … that adds a level of complexity to the challenge you're trying to solve," he said. "How are you going to operate in that theater? ... It [is] really hard when you're looking at the distances we're covering to do that."

The Marine aviation community envisions a "defense-in-depth approach," according to Wise.

Under this construct, F-35B joint strike fighters — which have a short-takeoff/vertical-landing capability— can be deployed from "big-deck" amphibious warships or other locations and operate on the "outer edge" of the battlespace as both sensors and shooters, he said. Drones such as the MQ-9 Reaper could provide intelligence, surveillance and reconnaissance support. And transport aircraft such as the V-22 Osprey tiltrotor platform — which can take off and land vertically like a helicopter and then fly faster in fixed-wing mode — would quickly move Marines where they need to go to conduct assaults or perform other missions.

To boost the lethality of aircraft, the service is developing new air-to-air and air-to-surface weapons.

However, "the key and operative piece here is the network that supports it," Wise said. That will enable warfighters to "take longer-range shots" and better control weapons.

The Marine Corps is working with the Navy on an initiative known as Project Overmatch, the sea services' contribution to joint all-domain command and control. The aim is to better connect sensors and shooters and "integrate the kill chains out there and make sure that we can put steel on target," said William Williford, executive director at Marine Corps Systems Command.

During joint exercises, the Corps has been practicing the ability to shoot weapons from one platform and guide them from another. It has done so "with great success," Wise said. "But there's some work still to do."

In a contested environment, Marines want to have multiple pathways to transmit data between sensors and weapon systems such as loitering munitions and long-range fires.

"What we're trying to do on the acquisition side is making sure that we look at all those new capabilities and we integrate those with the naval force … utilizing legacy systems throughout the process — and making sure that we're integrating [all of] those capabilities across the battlespace," Williford said.

Brig. Gen. David Odom, director of expeditionary warfare, N95, compared the Corps to a Swiss Army knife that must provide capabilities across the spectrum of conflict.

Williford noted that Marines are getting new equipment to make them more lethal and survivable. That includes: an enhanced combat helmet system with better communications capabilities; squad monocular night vision goggles; the M27 infantry automatic rifle; an enhanced 5.56 round; new suppressors; and Carl Gustaf multipurpose anti-armor/anti-personnel weapon systems.

However, in many cases Marines may find themselves in a supporting role rather than as trigger pullers.

"Marines all want to be out there slinging lead, they want to be out there dropping targets," Smith said. "We have not gone away from that."

However, "when you're talking about a pacing threat, our largest contribution may be that we sense and make sense of what's going on and that we gain and maintain custody of targets and pass that data to the naval and Joint Force," he said. "We may do that more than we

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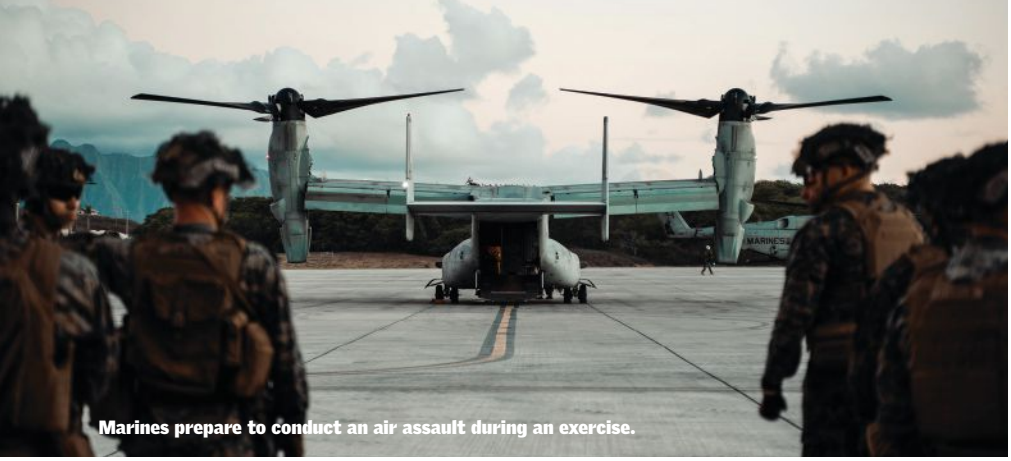

Marines prepare to conduct an air assault during an exercise.

Defense Dept. photo

prosecute targets, because that's how the Joint Force goes after a pacing threat. We are not going after … a peer competitor solo. That is not the future."

An example of how the Marine Corps could support its sister services is by employing anti-ship missiles from mobile, ground-based platforms that are difficult to locate. Such weapons, at a cost of about $1.7 million, could sink a $2 billion enemy warship and contribute to "sea denial" operations, Smith said.

Work is underway to bring that capability online. Oshkosh Defense's Remotely Operated Ground Unit for Expeditionary Fires platform recently participated in sink-at-sea exercises known as SINKEX in Hawaii.

The company's unmanned ROGUE Fires system leverages the Joint Light Tactical Vehicle's off-road mobility and payload capacity and Oshkosh's advanced autonomous vehicle technologies, the contractor said in a press release.

As part of the demonstration, a Navy-Marine Expeditionary Ship Interdiction System, based on a ROGUE Fires chassis, successfully launched a Naval Strike Missile and scored a direct hit on a target at sea, Oshkosh said.

"When you put a remotely operated ground unit expeditionary road vehicle … and the Naval Strike Missile together and you put it in the First Island Chain — good luck finding that [if you're the enemy], because you won't," Smith said, referring to a strategic area in the Asia-Pacific theater. "You have to respect that if you're a peer adversary. That is a game-changing capability for the combatant commander."

Meanwhile, the Corps wants to upgrade the vessels that would be needed to transport Marines and their equipment.

"The development of a robust inventory of traditional amphibious ships, new light ships, alternate platforms and littoral connectors is required to create a true naval expeditionary stand-in-force and force-in-readiness," Commandant Gen. David Berger said in a recent update to his planning guidance.

Senior leaders are exploring various options for the amphibious fleet structure and overall requirements, Odom said.

The sea services currently aim to acquire 35 new light amphibious warships, known as LAWs, to support other L-class vessels and Marine littoral regiments.

"We'll need that organic lift, that maneuverability, that mobility and survivability inside the web" of adversaries' targeting capabilities, Odom said.

Officials are looking at the connector fleet that carries troops from ship to shore. Landing craft utility and landing craft air cushion vehicles are aging, Odom noted. The Navy and Marine Corps want new LCUs and LCACs that are more capable and reliable.

The service is transitioning to a more advanced LPD Flight II amphibious transport dock, but Berger is already looking ahead at what comes next.

"It is also time to begin seeking a replacement for the LPD-17 Flight II whose fundamental design elements were conceived more than 25 years ago," Berger wrote. "We must answer the question — what is LXX? While we do not have an answer to that question yet, we do know that the most lethal capability on a non-big deck amphibious ship of the future cannot be the individual Marine."

Ashore, the Corps wants Marines to be more self-sufficient when forward deployed in austere locations. That requires being able to forage for food, purify water from local sources and use nontraditional energy technology.

"If you're working on things that are small [such as] reverse-osmosis water purification units, you're probably on the right track," Smith told members of industry. "If you're working on wearable power generation, solar power that can be used at scale by a unit that can power up squad radios, platoon radios — those kinds of things — you're probably on the right track."

Those types of capabilities would reduce dependence on logistics ships to move nonlethal materiel, thereby freeing up assets to move weapon systems and "bring more lethality" to the battlefield, he added.

Meanwhile, officials are keen on the potential of robotic systems and artificial intelligence to augment the force.

"With unmanned and AI, I think we're sort of at the tip of the iceberg," Odom said. Platforms and individual Marines can be equipped with such technologies, he noted.

"Right now, we're starting to see a combined arms approach of both of those capabilities … which I think is a force multiplier for our fleet commanders," he said.

To better prepare for a potential future battle against China, the Corps is looking to get rid of some legacy systems to free up money to buy new equipment that would be more relevant in that type of fight.

"You must divest of something to generate those assets, to then begin the process of experimenting, testing, procuring," Smith said. "The sooner we accelerate that, the sooner we'll get to where we need to be against the pacing threat."

Smith noted that the Corps has taken a lot of heat over its decision to get rid of its tanks, but he argued those platforms wouldn't have as much utility as other systems in a war against China.

"Hate the game, not the player," he said. "I love tanks. They're awesome. [But] they are not of the same value as long-range precision fires in the Indo-Pacific theater."

To achieve Berger's goals and vision for the future force, Smith said the Marine Corps needs sufficient funding from Congress for modernization and transformation.

"Doing this is going to be wicked hard for the next several years," he said. ND

U.S. Agencies Working To Recapitalize Strategic Sealift Capabilities

BY MANDY MAYFIELD

To project and sustain power overseas, the U.S. military must maintain a robust strategic sealift capability, to include the Merchant Marine. The Defense Department and civilian agencies are now teaming up to recapitalize an aging logistics fleet.

The Navy's Military Sealift Command has a critical role to play in providing ocean transportation and sustainment for U.S. forces during a conflict or crisis.

While some equipment and personnel can be transported via aircraft, major movements overseas are dependent on shipping.

"Our strategic sealift fleet must have the capability and capacity to accommodate 90 percent of the required military equipment expected to deploy during a major conflict," Erica Plath, director of the strategic mobility and combat logistics division within the office of the chief of naval operations, said during a panel discussion at the Navy League's annual Sea-Air-Space conference in National Harbor, Maryland.

Christopher Thayer, director of maritime operations at Military Sealift Command, said the service needs to be prepared to operate in a contested environment.

"To make the difference, we will need a workforce of mariners trained and ready now to go forward into a contested maritime environment in order to accelerate improved outcomes," he said.

To do so, the Navy needs the support of not just the Pentagon, but also the civilian agencies responsible for providing and facilitating these key assets.

The Department of Transportation is working closely with the Defense Department and the sea service to advance a strategy to repair and replace dozens of ships in the coming years, said Transportation Secretary Pete Buttigieg.

"This department is committed to supporting the maritime industry in all the details, including our cargo preference and maritime security, which are critical to supporting our mission," he said. "We also need a generational investment in our infrastructure."

As of press time, the Senate had passed a $1 trillion-plus bipartisan infrastructure bill. According to Buttigieg, the legislation contains funding for several strategic sealift priorities.

"That bill includes $17 billion to improve our ports and waterways, [and] the funding will go to everything from working our way out of the repair backlog to adding new capabilities and resources," Buttigieg said. It "is going to create millions of good-paying union jobs in the maritime sector and across the country."

Buttigieg reiterated his commitment to working with Pentagon leaders and members of industry to help "transform our maritime infrastructure for the future, so that the next generation [of] sailors, Marines, guardsmen and Americans can rely on them," he said.

Douglas Harrington, deputy associate administrator for federal sealift at the Maritime Administration — which falls under the Department of Transportation — said its programs are in a significant period of recapitalization.

"We see new construction, and we're building a new class of training vessels never built before in the U.S.," he said. They will "provide mariners with the most up-to-date training that we have for the future of the Merchant Marine," he said.

The Maritime Administration uses government and commercial vessels to provide sealift capabilities in times of national emergency and to meet the military's strategic sealift needs.

In 2019, then-Maritime Administrator retired Rear Adm. Mark Buzby announced TOTE Services, Inc., a Jacksonville, Florida-based company, as the vessel construction manager for the newest class of training ships, the National Security Multi-Mission Vessel. The contractor will oversee the selection of a shipyard and ensure that commercial best practices are utilized to deliver the NSMV on time and on budget, according to the administration.

The agency is also working on a new contract approach for the recapitalization of its National Defense Reserve Fleet, Harrington said. "We're going to ... replace the existing Ready Reserve Force, or RRF, vessels using our vessel acquisition manager contract approach," he said.

The Ready Reserve Force is a subset of vessels within the Maritime Administration's National Defense Reserve Fleet. The ships enable the support of the rapid global deployment of U.S. military forces by conducting sealift operations.

The RRF provides nearly 50 percent of government-owned surge sealift capability, according to the administration.

The Maritime Administration awarded Crowley Maritime Corp. a multiyear, $683 million contract for vessel acquisition management in late July.

Crowley, which is also based in Jacksonville, Florida, will utilize its strategic acquisition and vessel management services to assist the administration in

Military Sealift Command's Combat Logistics Force ship USNS William McLean and the ship's 96 civil service mariners return to Naval Station Norfolk after a seven-month deployment.

Military Sealift Command photo

the enhancement of the Ready Reserve Force by helping reduce the total age of the fleet and increase ship reliability, the company said in a press release.

Through the contract, Crowley will use a new information technology system to assess, research and make purchasing recommendations. Once the vessels are acquired, the company will oversee re-classification, modification and maintenance.

The contractor has a 20-year history managing Maritime Administration programs and other government and Navy vessels. It will provide recommendations based on essential service requirements, the company said.

At the same time, the administration is managing a comprehensive strategy for sealift, Harrington said.

"We're working on maintaining the current ships that we have," he said. Issues the organization is facing include obsolete equipment and new regulations that are affecting the commercial maritime industry as well, he added.

The agency is also reorganizing its personnel, Harrington noted.

"We have some changing roles within the organization, … and we have the reassignment of responsibilities," he said.

Meanwhile, the Maritime Administration is aware that technology is changing quickly and becoming more digital. "That affects us in every element of ship operations — from how the ship communicates, how we [perform] maintenance to how we monitor vessels," he said.

The administration needs to modernize its fleet, and that includes not only ships, but to better equip merchant marines with the skills they need, he added. "We need to regain or refocus on our proficiency," Harrington said.

Meanwhile, Thayer, of Military Sealift Command, noted that a number of merchant ships have recently been attacked in the Middle East — an issue that the Defense Department and mariners need to remain vigilant about.

Such vessels are being attacked by "drones and all kinds of capabilities from these folks that want to do harm," he said.

Crews need to be prepared for attempted hijacking, spoofing and jamming, Harrington noted.

"Merchant mariners that crew our ships across the MSC enterprise … must be ready now," Thayer said. "They must be prepared, and we are committed … [at] Military Sealift Command to support the development and sustainment of this workforce."

Cybersecurity is imperative for ship operators, he noted. Mariners are dealing with conditions where adversaries can hack into both commercial and military satellites while trying to operate in an environment with limited bandwidth, he said. The issue becomes even more complicated when operating on certain ships in contested areas, Thayer noted.

To get at the issue, "we've developed some capabilities … and are going with other technologies that limit the adversary's ability to intercept our communications," he said.

Military Sealift Command is currently looking at anti-jamming capabilities for GPS.

"These are the types of capabilities that we're going to introduce into the MSC fleet and need to be looked at as well" to help secure communications, he said.

Harrington concurred that increased cybersecurity protocols onboard vessels are needed.

"We're going to use cybersecurity at a much lower level where it's pervasive in the fleet … and every operator on the shores is doing it," he said.

However, resources are limited, officials noted.

"We have to have the right amount of resources for the capability that we can afford, and that's always a challenge," Thayer said.

The service is concerned about adversaries' capabilities, as well as potential supply chain issues.

"There are other countries out there that put a more significant importance on the maritime industry and the logistics behind that," he noted. "It's not only the vessels that we are concerned about, but it's the logistics supply chain."

The service wants assistance from industry as it pursues these efforts, Thayer said.

We are "always looking to the industry on how you can support [us] and what we need … to make sure that we are resilient and capable of going forward in that contested maritime environment we've been talking about," he said. **ND**

CHARGING UP

ELECTRIC VEHICLES FOR THE MILITARY STILL A PIPEDREAM

BY YASMIN TADJDEH

The Army for years has been making investments into the electrification of vehicles, but the widespread use of such technology won't be feasible until the 2030s — or perhaps ever.

In a sprawling study, the National Academies of Sciences, Engineering and Medicine, said battlefields of the future will require the Army to invest in a mix of energy sources, including jet propellant 8, diesel and renewable diesel, but all-electric vehicles are not yet practical — at least through 2035.

The study — which was sponsored by the deputy assistant secretary of the Army for research and technology — tasked the Academies' Committee on Powering the U.S. Army of the Future to analyze the energy needs of dismounted soldiers, manned and unmanned vehicles, and forward operating bases on future multi-domain battlefields.

The report — which was unveiled in June — examined technological innovations regarding energy storage, power conversion and fuel efficiency.

Despite the Army showing interest in electric vehicles, the study, "Powering the U.S. Army of the Future," noted that all-electric ground combat platforms and tactical supply vehicles are not practical now or in the foreseeable future.

Several reasons accounted for its findings.

First, the energy density of batteries today is roughly two orders of magnitude less than JP-8, the report said. That results in excessive package weight and volume to meet maneuver requirements.

"Advances in battery energy density will undoubtedly take place, but not enough to offset that magnitude of a disadvantage," the report noted.

Additionally, recharging all-electric vehicles in a short period of time would require massive quantities of electric power that are not available on the battlefield, the study said.

"We believe that electrification of ground vehicles is highly desirable," said John Luginsland, the committee's co-chair and senior scientist and principal investigator at Confluent Sciences.

"There are all kinds of advantages in terms of torque ... as well as fuel efficiency," he said during a webinar unveiling the report. However, the committee concluded that the service's future inventory "should be hybrid-electric vehicles with internal combustion engines, not all battery electric vehicles."

While commercial vehicle companies have made strides in electric technology, the military has unique challenges, said John Szafranski, division chief for vehicle electrification at the Army's Ground Vehicle Systems Center.

With "silent watch and the off-road usage, we would typically consume twice the energy of an equivalent commercial vehicle," he said in an interview with *National Defense*. "That means that with the battery technology today, we wouldn't meet our range requirement or operational duration requirement."

Recharging would also be a major obstacle for electric platforms, he added. "We can't rely on an electrical grid to tap into."

The numbers aren't on the side of electric vehicles, Szafranski said. For example, if the Army had six 300-kilowatt hour battery trucks and officers needed to refuel them in 15 minutes — the same amount of time it takes to refuel vehicles with JP-8 — it would require a 7-megawatt mobile charging system, he said.

"We don't have anything like that," he said. "Today, our largest mobile generator is less than a megawatt and it doesn't have vehicle charging capability. So, that would have to be developed, and then all the logistics of moving those generators around and fielding them would be very complex."

The report noted that some observers have pondered whether nuclear power could offer the energy needed to recharge vehicles. While such a method would offer strong energy density, a mobile nuclear-based power source is not feasible in the coming years, Luginsland said.

"Mobile nuclear power plants charging all-electric battery combat vehicles will not be ready in 2035," he said.

According to the report, the "latest design proposals indicate that such a device would weigh 40 tons, require delivery of two 20-foot ISO containers to the battlefield, and have set-up and cool-down times of three days and two days, respectively."

Those constraints would not be consistent with the Army's multi-domain operations strategy, it added.

Szafranski said the startup and teardown times are especially prohibitive for the technology.

"We're an expeditionary Army," he said. "If we stay in one place too long, the enemy can take us out. So, we've got to be very mobile."

Dr. Peter Schihl, senior research scientist for ground vehicle propulsion and mobility at the Ground Vehicle Systems Center, said conversations about electric vehicles can sometimes become "convoluted" because combat vehicles, tactical trucks and specialty vehicles often get lumped together.

"Those are all different sectors across the spectrum, and it gets more difficult [to do electrification] the heavier" the platform is, he said. "Sometimes people extend across the spectrum and say, 'Hey, we're going to have an electric tank' — and that's not the intent."

While commercial industry has made great improvements in electric vehicle technology, Szafranski noted that applying

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National DEFENSE
COVER STORY

those systems to the military requires significant modifications.

"We can't apply the commercial technology directly as is," he said. "Commercial vehicles don't typically get shot at on the highway, but our vehicles do. So, if you have a lithium-ion battery system you need to be able to take rounds without starting a fire or explosion."

That could mean integrating an enclosure of some sort to protect the battery system, he noted. Vehicles will also need to be designed to withstand extreme temperatures and significant vibrations.

Mark Cancian, a senior adviser at the Center for Strategic and International Studies, said that while the National Academies' report examined the technology through 2035, he believes widespread use of electric vehicles on the battlefield even beyond that time frame is unlikely.

"Most theaters we would go into just don't have the electrical grid that would allow us to recharge all of our vehicles," he said. Powering up an armored brigade, for example, would require an immense amount of energy. Battery technology will also not be mature enough yet, he added.

However, there could be a few niche uses for fully electric vehicles, particularly for Special Operations Command, Cancian said.

"There may be a few specialized SOCOM vehicles where you need the stealth," he said. Such systems could be plugged into generators to power them.

SOCOM is currently building two Ground Mobility Vehicle 1.1 hybrid prototypes to explore the usefulness of hybrid-electric technology, a spokesperson told *National Defense* earlier this year.

However, besides these niche applications, it seems as if very few commercial electric vehicles are going to make a transition to a military market in the near- or mid-term, or maybe ever, Cancian said.

Overall, there are few major tactical military benefits for electric vehicles, he said. They "may be a little quieter and that might be helpful, but technically they don't give you a whole lot."

However, despite officials and experts throwing cold water on the idea of an all-electric vehicle fleet, the Army is making targeted investments in some electric technology, including the electric light reconnaissance vehicle or eLRV.

Earlier this year, Mike Sprang, project manager at the joint program office for joint light tactical vehicles, said the eLRV is an emerging requirement for the service.

"We're really in that learning phase right now … of what is in the realm of possible relative to commercial industry and where they've taken electrification, and how can electrification fill a military requirement," he said during a webinar hosted by the National Defense Industrial Association. Contractors such as GM Defense and its parent company have made major investments into electric vehicle technology, for example.

Szafranski said he couldn't share when the eLRV would be ready to field but noted that there has been progress in its development.

"We've been working with our requirements people within the Army," he said. "There have been industry demonstrations. And so, between our technical [subject matter experts] providing input, and what they're getting from industry, they're able to make informed requirements."

Demonstrations took place over the summer and a handful of companies took part, he added.

Additionally, Army Futures Command's next-generation combat vehicle team also has been working on electrification technologies. Earlier this year, the command — alongside the Ground Vehicle Systems Center, Army Applications Laboratory and Alion Science and Technology — awarded $100,000 grants to six companies to design power technology concepts for future electric vehicles through the service's Power Transfer Cohort.

Awardees included: Coritech Services, Inc. of Royal Oak, Michigan; Czero, Inc. of Fort Collins, Colorado; Fermata Energy of Charlottesville, Virginia; PC Krause and Associates of West Lafayette, Indiana; Tritium Technologies, LLC of Torrance, California; and Wright Electric of Albany, New York.

The cohort will support the Army's modernization strategy by developing electric vehicle infrastructure in remote locations for the Army's 225,000 vehicle fleet, the organization said in a statement announcing the winners.

While an all-electric fleet is not yet feasible, the National Academies' report was supportive of hybrid-electric vehicles. Szafranski said this is where the sweet spot is.

A hybrid-electric system would offer the Army increased operational duration through fuel efficiency, added on-board power for technologies such as directed energy weapons, advanced sensors and high-powered communications, and silent watch operations, he said.

Schihl said lighter trucks have the best chance of moving to the next level of development. However, "we need years of [research and development] to really get serious about a production conversation," he said.

Meanwhile, when it comes to liquid fuel, the National Academies' report noted that while the Army prefers to use a single fuel across its vehicles, generators and turbine-powered aircraft, diversifying its options would be beneficial.

"JP-8, diesel and biodiesel will be the primary source of battlefield energy and power for the foreseeable future," Luginsland said. "The combination of energy density and power is unmatched."

However, the right mix would depend on whether it was war or peacetime, the study noted.

Diesel is a reasonable choice for powering military vehicles and could be pre-

Army photo

ferred over JP-8 in select climates during wartime conditions, according to the report. "It is readily abundant in many locations, which in certain situations would enable local resupply."

Diesel has a 9 percent higher volumetric energy density than JP-8, making it possible to reduce the number of supply trucks dedicated to fuel by an equivalent amount, the report said.

During peacetime operations, biodiesel may be preferred to address environmental concerns associated with the continued use of fossil fuels, it added.

However, the study noted that the use of multiple fuels could present logistical challenges given the Army's long-standing policy on using a single fuel type.

"The advantages of using multiple fuels … need to be balanced against the logistic complexity challenges associated with their distribution," the report said. "If such logistics proves to be excessively challenging in certain situations, then JP-8 use remains the preferred method of transporting energy to the battlefield, to remain compatible with aircraft needs."

However, Schihl said the fuel conversation is "extremely complicated."

Both diesel and biofuels pose problems for the Army, he said. For example, with diesel, there is no world standard. The Army is currently avoiding biofuels, he noted.

"We tend to store fuel for quite a long time, and biofuels have a little bit of a problem with shelf time," he said. There are concerns about the effect on storage units and propulsion systems as biofuels degrade.

David Haines, senior fellow for climate security at the American Security Project think tank, said diversification of fuel sources is important so the military can utilize whatever is available to them.

"If you've got technology that can … [offer the capability to] utilize fuel sources in a contingency situation where you're not sure what you're going to get, then you should pursue that," he said.

If it makes sense for a commander to use a different fuel source, then they should be able to, he said.

"Diversification of fuel sources is something that is … a tactical consideration," Haines said. "If I'm going to a place which I'm not familiar [with], I want to be able to utilize whatever I can find on the ground." ND

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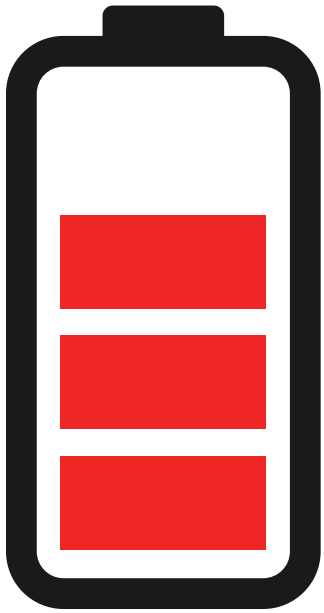
Army Researchers Tackling Soldier Power Problems

BY YASMIN TADJDEH

Army scientists and researchers are taking on a perennial problem for soldiers on the battlefield: powering up the many devices they are required to carry.

In recent years, troops have had to lug more and more devices in their rucksacks, from radios to remote controls to tablets, which has resulted in increased soldier load. To tackle the issue, the Army's Command, Control, Communications, Computers, Cyber, Intelligence, Surveillance and Reconnaissance — or C5ISR — Center is investing in new battery and power management technologies that officials hope will unburden warfighters and improve efficiency.



The C5ISR Center's power management branch — which is nestled under the Army's Combat Capabilities Development Command — is developing cutting edge tactical systems that can be handheld or soldier-worn.

Dr. Ashley Ruth, a research chemical engineer at the center, noted that power is a cross-cutting technology that is relevant across each of the Army's six modernization priorities that Futures Command has been spearheading for the past three years. These include long-range precision fires; next-generation combat vehicles; future vertical lift; the network; air-and-missile defense; and soldier lethality.

"Power is instrumental for all of these," Ruth said during an interview with *National Defense*. "Every single weapon system needs power."

The office is developing a myriad of new technologies, including its small tactical universal battery system, an interoperable family of batteries that will enable standardization for soldier-worn and handheld equipment, officials said.

As the Army has outfitted soldiers with modernized systems over the past several years, "we've really seen where these different pieces of equipment would tend to bring their own either proprietary or unique power sources onto the battlefield," said Dr. Nathan Sharpes, a research mechanical engineer with the C5ISR Center. "We were seeing this future where a soldier is going to have to carry 10 different types of batteries … even though they all push the same electrons."

All these systems may have slightly different user interfaces and feature varying voltages and chemistries, he noted.

It's difficult to pin down how many batteries the typical soldier carries today, Sharpes said. What an infantryman carries will be different from what a radio operator has on hand.

It's hard to even grasp how many of these types of technologies the Army has in its inventory, Ruth added. "In fact, we've tried, and the Army doesn't have a means to access information on how many individual battery packs we actually use," she said.

Ideally, all the gadgets a soldier carries — from GPS trackers to radios to night-vision goggles — would all be powered with the same type of battery, Ruth said. However, there are a multitude of energy sources being developed individually throughout the service.

"It's logistically burdening, as well as then cognitively burdening on the soldier to keep track of all this," Sharpes said.

By simplifying the batteries troops

carry, a soldier no longer must worry about whether he or she inserted them the right way into their device, whether they are mixing old and new cells, or if they are combining chemistries, Ruth said.

"When you're getting shot at, it's much easier to just unscrew the battery and stick a new one on," she said. "Then you're done and you're up and running again."

To achieve both simplicity and interoperability among different equipment, the center has been developing for the last year and a half the small tactical universal battery, or STUB, Sharpes said.

"It's just the best, most advanced USB power bank that you can't buy yet," he said. The system contains some proprietary military protocols in it, he added.

STUB works by determining the voltage needed for a particular system, making the device interoperable with different equipment, he said.

Researchers are looking beyond Army needs and are also working with the Navy, Special Operations Command and even NATO partners to make sure STUB is interoperable with their devices as well, Sharpes and Ruth noted.

"Now, the types of cells, the chemistry, all of that that inside of the battery doesn't matter as much … because the battery can make whatever voltage it needs," Sharpes explained.

The STUB family of systems features eight different form factors, but the same interface and attachment features, he said. The smallest weighs about a quarter of a pound, and the largest weighs about a pound and a half. The initial iteration is powered by lithium-ion cells.

"When you get down into the handheld-size of devices, the size of the power source is just as important as how much energy is in it," Sharpes said. "That's why we rolled out with all these different sizes. They are kind of mix and match to where you could have the bigger one or a smaller one and the soldier essentially could decide on the fly what battery they want to take for a particular mission."

For example, if an infantryman wants to have a lighter load, he or she could grab a smaller version of STUB, he said.

"Essentially, it's all kind of plug and play," he said. The center is "trying to simplify power for the soldier, [so] they're not worrying about what type of battery or interface or chemistry" a battery has.

"A soldier doesn't need to worry about any of that sort of stuff," he added. "We're just giving them a power brick that can be interoperable."

STUB will help alleviate burdens for soldiers, as well as vendors and government program offices, Ruth said.

"Because program offices and vendors may not have a lot of experience involving battery [technology], chances are they tend to fall short in performance" when they build their own, she said. These performance issues could include safety concerns, a lack of ruggedness or even electromagnetic interference vulnerabilities, she added.

Additionally, once a program office invests in a battery technology for a particular system, officials will have to sustain that product over the long term, she noted. "It becomes a lot easier when it's only one type of battery … in the field."

Having one system consolidates demand signals and allows for companies to manufacture the same battery at scale, she added.

"It makes the Army a better customer in the battery space," Sharpes said. "Traditionally, the Army has been a very bad customer in that we want a very particular solution, and the manner in which we go about ordering these batteries isn't always the best and it stresses the supply chain."

A standard battery means overall lower costs, while also offering increased availability and reliability, he said. ND

Small tactical universal battery (STUB)

See the STUB battery in action

Army photo

ARMY INVESTING IN HYBRID POWER MICROGRIDS

■ The Army is looking at new technology, such as microgrids, that can more efficiently power command posts and division tactical operations centers.

These systems can be in the 10s to 100s of kilowatts range, said Frank Bohn, an electronics engineer at the the Army's Command, Control, Communications, Computers, Cyber, Intelligence, Surveillance and Reconnaissance — or C5ISR — Center. The center falls under the Army's Combat Capabilities Development Command.

"What we're doing in this space is looking at not necessarily how to standardize a specific component, but how do we standardize the components that are being developed?" he said. "How do we standardize the communications between these systems? And how do we standardize the data so that way we can enable these things … to work together to share power, optimize for fuel efficiency and resiliency, and how do we control that?"

Soldiers test the hybrid power system microgrid at Fort Bragg, North Carolina.

Army photo by Spc. Jacob Ward, 82nd Airborne Division Public Affairs

The backbone of the concept is the tactical microgrid standard, or TMS, Bohn said. TMS is a data and communications standard that categorizes the various power devices that are located on a microgrid. These include different groups of systems such as equipment that produces power — like generators or solar panels — and items that consume power or store energy.

"Through the TMS, we're enabling these systems to communicate with one another, and then we're enabling microgrid controllers to come in [and] understand immediately and autonomously what these different systems are on the microgrid," Bohn said. "Then it's able to smartly, or intelligently, decide, 'This is how I'm going to use this system and optimize my microgrid.'"

The center is developing a hybrid power system, or HPS, microgrid, which it has been working on for about two and a half years, he said. It offers increased resiliency compared to the way that command posts and division tactical operations centers are traditionally powered, he noted.

"Right now, what they're using is primarily what they call spot generation," Bohn said. "This is a single generator or generators running in parallel to service a load."

These are typically oversized, and they have a second generator for redundancy in case a generator fails.

"What we're looking at doing with microgrids, and particularly hybrid microgrids, is increasing that resiliency so that way you don't have to run generators in parallel and you're immediately reducing … fuel consumption, but still maintaining that resiliency," he said.

Joseph Vitale, an electronics engineer at the C5ISR Center, said the HPS — which features an inverter battery system, which can be thought of as an energy storage system — can give an entire microgrid an interoperable power supply.

"If a generator goes down, the inverter system will catch the grid," he said.

Other benefits include the option to run silent watch operations and increased fuel efficiency, he added. Based on simulations, Vitale estimated there could be fuel savings of more than 30 percent, and that is expected to increase over time.

HPS also offers a hands-off, plug-and-play capability because of its use of the tactical microgrid standard, he said. "Soldiers really just have to plug it in and turn it on, and as long as it speaks TMS, a microgrid controller can utilize it," he said.

While the HPS is more complex, it can be compared to the popular Nest smart thermostat that monitors users' homes, Bohn noted.

"Our microgrid controller is doing a very similar thing," he said. "It's watching what the load is on the microgrid, how much power is actually being drawn from all your different components that are requiring this power, and it's trying to understand what do I need to do to make the microgrid more effective, more resilient and more energy efficient."

The Army Corps of Engineers' Construction Engineering Research Laboratory originated the hybrid power system, Bohn said.

"CERL identified the need to introduce energy storage into Army power systems for increased fuel savings and has been working over the past few years to develop the capability," he said. "The CERL work created a standalone hybrid system with the energy storage unit paired with a generator."

In parallel, the C5ISR Center had been developing microgrid capabilities with the tactical microgrid standards.

"The partnership between CERL and C5ISR Center has furthered the HPS capabilities and allows it to connect with a microgrid of generators for increased fuel savings and power resilience," Bohn said. "Working together has combined the capabilities for improved power system capabilities for the warfighter."

The HPS underwent testing with the Army's 82nd Airborne Division over the summer and is slated to be demonstrated during Project Convergence '21 in the fall, he added. Project Convergence is the Army's annual "campaign of learning" event where new technologies are put through their paces.

"We're going to demonstrate all the benefits that it has," Bohn said. **- YASMIN TADJDEH**

Army Shifting Training Priorities, Investments For Multi-Domain Ops

BY MEREDITH ROATEN

ORLANDO, Fla. — To reach the Army's goal of building a force that excels at multi-domain operations, officials are making some tough decisions about which capabilities to prioritize for soldier training.

In 2018, the service released its doctrine for a modernized future force, "The U.S. Army in Multi-Domain Operations 2028." The plans for MDO cited emerging technologies such as hypersonics and machine learning as well as great power competition with China and Russia as catalysts to update the Army's priorities.

"Should conflict come, [adversaries] will employ multiple layers of stand-off [capabilities] in all domains — land, sea, air, space and cyberspace — to separate U.S. forces and our allies in time, space and function in order to defeat us," then-Army Chief of Staff Gen. Mark Milley wrote in the document. Milley is now chairman of the Joint Chiefs of Staff.

Shifting the service's priorities starts with how it trains, officials said. They are working to define the Army's needs for multi-domain operations and identify the capabilities necessary for future fights as soon as possible.

Ivan Martinez, director of the Army's Simulation and Technology Training Center, said reorganizing procurement and acquisition has been a major focus.

Starting in 2020, the office began to realign its programs to become MDO centric and to be in alignment with where the Army wants to go, he said in June at the annual Training and Simulation Industry Symposium in Orlando, Florida, which was hosted by the National Training and Simulation Association. NTSA is an affiliate of the National Defense Industrial Association.

Much of the service's science and technology funding was going toward capabilities that support the Army's near-term goals and not enough on mid- and far-term objectives, Martinez said. Initially, his team was unsure what multi-domain operations would look like and they took what he called "a pause" to assess the state of play.

"We realized that we needed to have a basic program that was very well synced with the user and our stakeholders," he said.

Army officials pulled together a group to develop a new science and technology portfolio for soldier training and included input from the training and simulation industry, he noted.

Joseph Sottilare, technology area manager for Army Combat Capabilities Development Command's Soldier Center, said the team collaborated to discover 59 capability gaps prioritized by the user community. They then laid out 12 science and technology efforts based on those gaps.

They are a "high priority for the Army focused on MDO-capable objectives for 2028," he said.

Mid-term goals focus on cyber, live training, simulation architecture and training effectiveness, he said. However, there is enough flexibility to shift them to near-term objectives as the situation evolves.

However, "this strategy really keeps the focus on the long-term, current challenges that aren't being addressed by industry, aren't being addressed by anybody else in the government, or we have limited knowledge with what they've done," Sottilare said.

The next step is creating a "competency framework" for multi-domain operations, which will identify ways to measure readiness and provide performance objectives for soldiers, he said.

"That's something that we have to start now because it takes a very long time to define all the elements," he said.

Augmented reality and virtual reality simulation tools for medical care is one area of focus, he said. It is often difficult to teach troops how to perform prolonged medical care in austere environments, but the capability will be critical in multi-domain operations, Sottilare added.

"We're going to have people deployed overseas in … environments where they won't have access to a medical hospital and have to perform prolonged care," he said.

Meanwhile, soldiers also need to train for missions such as cyber and information warfare, officials said.

For multi-domain operations, "where it's even a greater, more dynamic environment for training, it becomes almost impossible for us to train that outside of very specific use cases," he said.

"We're looking at how we can enhance our ability to build up these simulation architectures, and then deploy them and sustain them over the next 10 to 15 years," he added.

Additionally, the Army is looking for opportunities to flesh out its Synthetic Training Environment, which is still in development.

The Synthetic Training Environment, or STE, is a 3D soldier training tool that converges live, virtual and constructive — or LVC — training as well as gaming environments to help troops better prepare for high-end warfare. It's the service's latest training advancement for modernizing the force and is one of the service's top priorities being spearheaded by Army Futures Command.

Earlier this year, officials announced plans to replace training technology known as the Instrumentable-Multiple

Soldiers test out a prototype for the Reconfigurable Virtual Collective Trainer.

Army photo by Margaret Ziffer

Integrated Laser Engagement System with direct and indirect fire capabilities within the STE in coming years.

One effort — known as the live, virtual, constructive-integrating architecture program, or LVC-IA — is "a cornerstone" of home station training, said Col. Cory Berg, project manager for soldier training.

It will bring "together those different environments, or rotation units, to prepare for a combat training center," he said. Looking into the future, the Army wants a solution that connects all of the LVC-IA's capabilities with the Synthetic Training Environment.

"This becomes the highway. This becomes the connective bond between the current capability and what the future capability is," he said.

The solution needs to be in sync with the next-generation STE until a future capability is ready to replace it, he noted. A draft request for proposals was released in August.

Meanwhile, the Program Executive Office for Simulation, Training and Instrumentation is looking to merge two training contracts in order to find efficiencies, Berg said. The programs — the Common Battle Command Simulation Equipment and the Battle Command Training Capability-Equipment Support — both provide hardware and software for simulation training missions.

The program office wants to cut costs by combining the two efforts which are "parallel and complementary," Berg said. Market research for the move was completed in May, and the office is aiming to award a contract by the first quarter of 2024, he noted.

Brig. Gen. Charles Lombardo, deputy commanding general of the U.S. Combined Arms Center-Training, said virtual environments will give back time to Army commanders by making the training process more efficient.

"It's really an important reflection point in time in the Army," he said. "I tell our team, we're probably in that second training renaissance."

Efficiency starts with improving training management, he said. The Army Training Information System is the replacement for the Digital Training Management System, which has a negative reputation with some company commanders because of the length of time it takes to populate data, he said.

The Combined Arms Center-Training is working on applications to speed up the process for recording data and enabling information to be recorded where training is taking place. But the Army still needs a data repository that makes information about individual soldiers widely available throughout the enterprise, Lombardo said.

Various training systems — including virtual training technologies — should be able to communicate and share data, he noted.

"If we can get them talking to each other, we'll unencumber a lot of our commanders because we'll put our squadron leaders … back in charge of training," he said.

Meanwhile, more efficient training may become fiscally necessary if the service's budget continues to decline in coming years. President Joe Biden's fiscal year 2022 budget proposal would decrease the Army's topline by $3.6 billion, to include cuts to procurement and research-and-development accounts. The Army requested $367 million for the Synthetic Training Environment's cross-functional team, according to budget documents.

"As we define how to train the [multi-domain operations] capable force, it's merging and bringing those joint leaders together, even distributed on multiple locations, to get the most out of our exercises, especially in a time when the downward budget will continue to look like this," Lombardo said.

Col. William Glaser, the director of the Synthetic Training Environment cross-functional team, said there is an urgency to "double down" on training as adversaries rapidly modernize their forces.

"We no longer possess … [the] tactical and operational overmatch that people enjoyed over the last 30 years," he said.

The STE must have an open architecture that is scalable and affordable, he noted. Training scenarios must be delivered to the point of need, which could mean solutions that will enable soldiers to access the environment without leaving their combat vehicles, he said.

As the Army continues to determine exactly what multi-domain operations look like, "the one thing that I'm sure of is, in order to present the commander with the problem sets that MDO is going to provide, we're going to need to use the tools that the STE is going to provide," Glaser said.

The goal should be for commanders to incorporate the training environment into their procedures and rehearsals for missions, which will not happen overnight. The Army needs industry to make improvements to training environments as soon as possible, he said.

"We need incremental improvements over time, many evolutions over a short time, in order to improve our revolutionary capability over the long term," he said.

Defining multi-domain objectives could also be a boon for industry, Sottilare said. Those objectives are going to remain relevant into the distant future, so industry won't have to worry as much about the shelf life of its investments.

"We're not going to lift and shift again every year," he said. "This is what we want to support. We want to get this over and stay focused on it."

Meanwhile, Glaser noted that one silver lining of the ongoing COVID-19 pandemic is that because of the required social distancing, stakeholders met remotely more frequently than they would have in person before the virus swept across the world. The relationship between teams is grounded in that foundation and will remain "synced" to stay the course on long term objectives, he added. ND

Bringing the Hospital to the Field: New Tech Improving Combat Care

The United States has achieved impressively high survival rates for wounded soldiers, with approximately 92 percent of those injured in Iraq and Afghanistan surviving. This is reported to be the highest percentage in the history of warfare, despite the rising severity of battle injuries from increasingly lethal weapons. For context, about 75 percent of soldiers injured in Vietnam made it back alive.

Defense Dept. photo

While this figure is impressive, and military medical personnel should be proud, it is only a part of the larger picture. Take, for example, the story about Abraham Wald and the missing bullet holes.

Wald, born in 1902 in what was then the Austro-Hungarian Empire, was a natural mathematician from a young age and became a member of the Statistical Research Group during World War II.

During the war, the Allied powers realized they were losing many aircraft and wanted to understand how to better arm them to increase their survivability. But this posed a problem, as arming planes increased their weight, and heavier aircraft are less maneuverable and use more fuel. The Statistical Research Group was tasked with finding the optimal amount of armor for a plane so that it was both protected and efficient.

The military brought forward data it thought would be useful: when American aircraft came back from engagements over Europe, they were covered in bullet holes. But the damage wasn't uniformly distributed across the platforms. There were more bullet holes in the fuselage, not so many in the engines.

The officers saw an opportunity for efficiency — you can get the same protection with less armor if you concentrate the armor on the places with the greatest need, where the planes are getting hit the most. But exactly how much more armor belonged on those parts of the aircraft? That was the answer they came to Wald for. But this was not the answer they got. The armor, Wald said, does not go where the bullet holes are; it goes where the bullet holes are not — namely on the engines.

Wald's insight was simply to ask: where are the missing holes that would have been all over the engine casing if the damage had been spread uniformly across the plane? Wald posited that the missing bullet holes were on the missing aircraft. The reason planes were coming back with fewer hits to the engine was not because they weren't being hit there, but because planes that got hit in their engine weren't coming back. Whereas the large number of aircraft returning to base with a tattered fuselage is pretty strong evidence that hits to the fuselage can — and therefore should — be tolerated. This is a phenomenon that psychologists aptly termed "survivorship bias."

So too, the impressively high percentage of survivors of combat trauma are those that survived after making it through the evacuation to the hospital. But what about the ones that do not? These are the human equivalent of missing planes, and the lack of specialized medical equipment in the field are the "holes" in combat care.

Recognizing the reasons behind the high troop survivability in the conflicts in Iraq and Afghanistan is important — U.S. forces had the luxury of air superiority and could evacuate casualties almost at will. A soldier with a head wound in Afghanistan could arrive from the point of injury to Walter Reed National Military Medical Center in Bethesda, Maryland, within 24 hours of being wounded.

But U.S. forces cannot rely on this advantage of air superiority in every theater. Troops may be fighting hundreds of miles from the nearest friendly hospital, or they may be pinned down in a way that makes timely evacuations impossible. It is imperative to improve field combat medicine to ensure the safety of the troops when evacuation is not possible.

The medical world often speaks about the "chain of survival," the series of events that must occur in succession to maximize the chances of survival from injury. However, this concept is sometimes overlooked in the military setting. Evidence suggests that up to 25

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percent of deaths on the battlefield are potentially preventable and that most of these deaths happen in the pre-hospital setting.

Advances have been made on this front, such as arming all soldiers — not just medics — with basic medical tools in the field. More can be done, however, and our goal should be to ensure that no soldier dies without the chance of receiving hospital care. To increasingly protect vulnerable and wounded troops, commanders must consider how else they can close gaps in the chain of survival beginning at the point of injury and continuing through hospital care.

There are two primary medical dangers in the field. The first is hemorrhaging from extremity injuries. Research has shown that of the 90 percent of battlefield deaths occurring in the pre-hospital setting, 90 percent of these deaths are related to hemorrhage. Extremities are the most frequently injured regions of the body, and extremity hemorrhages constitute the leading cause of preventable deaths in the first aid period.

The first step to reducing deaths caused by hemorrhaging has been addressed with the use of a low-tech solution: the tourniquet. If used properly, it is considered the leading lifesaving tool available to soldiers in the field. For instance, over the last decade, every soldier in the Israeli Defense Force has been equipped with a tourniquet, drastically reducing the battlefield mortality rate.

Airway obstruction was the second most common cause of potentially survivable deaths in all U.S. combat casualties from October 2001 to June 2011. Unfortunately, the complications involved in treating this condition prevent simple solutions like the tourniquet from being useful in preventing deaths.

These injuries often require methods to secure the airway and ventilate the patient. Existing low-tech solutions often require constant attention from a combat medic, which is inefficient and can put other soldiers in danger.

Fortunately, there are solutions that have emerged from the medical technology community that can address this issue and could be implemented widely across units just as the tourniquets were.

Let us consider two theoretical scenarios, each demonstrating how arming soldiers with specially designed technology that addresses airway compromise can meet the unique needs of combat injuries:

In scenario No. 1, a unit is pinned down with one ventilated patient. Transport will not be available for the next 7 to 8 hours due to poor visibility. The ventilator used is small with the ability to ventilate the patient using just ambient air without relying on oxygen cylinders. This greatly improves the unit's mobility and agility.

In scenario No. 2, a 20-year-old U.S. Army soldier has sustained serious injuries from a roadside bomb overseas. A U.S. Air Force pararescue team flies him from the point of injury to the nearest forward operating base for immediate medical care. Roughly 19 hours later he is in a hospital bed at Landstuhl Regional Medical Center in Germany — which was the nearest treatment center for wounded soldiers coming from Afghanistan. From there he was transferred on a transatlantic flight to San Antonio Military Medical Center, Texas. Throughout the transport, the soldier is hooked up to a single, durable ventilator that provides continuous ventilation during the whole process.

Taking a lesson from tourniquets, one way to reduce mortality is to arm all medics with lightweight, portable ventilators. Every medic could be fitted with a military standard, medical-grade ventilator that can support continuous invasive and non-invasive ventilation without hindering the mobility of the unit.

Ideally, this ventilator would be lightweight and designed for frontline combat situations, and with additional features such as a night-vision compatibility quick operation mode. Faster, more efficient ventilation would allow patients to be treated from the point of injury all the way to the ICU using only one ventilator.

Understanding battlefield mortality is a vital component of the military trauma system, and research has shown that airway management is often a critical early step in the resuscitation of severely injured soldiers. New airway management strategies and equipment designed for use in the field has the potential to drastically improve combat casualty care.

To successfully implement these strategies, militaries can take advantage of medical technologies that are creating a high level of capability in a small form factor. Doing so will help save lives and allow combat medics to work more efficiently in the field.

Abraham Wald's lesson must stay with us — we must look for the missing "bullet holes" and reinforce our troops where they are most vulnerable. ND

Guye Halpern is vice president of product and clinical research at Inovytec Medical Solutions, which creates innovative and flexible medical solutions for cardiac and respiratory care for militaries, hospitals and emergency medical services.

'Sweating' to Next-Gen Soldier Lethality

BY SCOTT R. GOURLEY

The U.S. Army is preparing to introduce a new arsenal of small arms capabilities to its "close combat force" — the approximately 103,000 soldiers identified as those most directly responsible for closing with and destroying the enemy.

A cornerstone of these new capabilities can be found in the service's Next-Generation Squad Weapons program emerging from Army Futures Command's soldier lethality cross-functional team. Focused on enhancing squad-level lethality for the close combat force, the initiative is a prototyping effort that consists of a rifle (NGSW-R) and automatic rifle (NGSW-AR) with a common 6.8mm cartridge and fire control (NGSW-FC) between the two systems. The goal is to field the NGSW-R to selected units as the planned replacement for the current M4A1 and the NGSW-AR as the planned replacement for the current M249 Squad Automatic Weapon.

The project is not a stand-alone weapons program. Instead, it recognizes that Army close combat capabilities reflect a combination of factors identified as soldier, weapon, enabler, ammunition and training, or SWEAT. That philosophy is one of the things that makes NGSW different from some past weapons programs.

One classic example of previous Army small arms efforts directed toward the introduction of "leap ahead capabilities" nearly three decades ago was the Advanced Combat Rifle program, which explored four candidate designs developed by AAI Corp., Colt Industries, Heckler & Koch Inc. and Steyr-Mannlicher as possible replacements for the M16A2. In addition to fire control and ergonomic enhancements, the ACR prototypes featured four different ammunition technologies: AAI's molded sabot steel flechette in an M855 5.56mm brass case; Colt's 5.56mm "duplex" round, with two projectiles in one cartridge; Heckler & Koch's 4.92mm ball ammunition in a caseless cartridge; and Steyr's 5.56mm synthetic cased flechette ammo.

Following early engineering and safety testing at Aberdeen Proving Ground in 1989, the Army began field testing the four candidates, together with the M16A2, in January 1990. Army testers said at the time that they hoped to find a technology that would "double the hit probability of the M16A2," with the possibility that a "superior technology" could be fielded as early as 1995. The "field experiment" was completed in the fall of 1990 with data analyzed for inclusion in the Army's Small Arms Master Plan, although that process was complicated due to higher priorities that quickly emerged during the Gulf War, which began in mid-January 1991.

However, much of the thought and effort behind those small arms prototypes represented stand-alone industry thinking, rather than platforms viewed through today's SWEAT vision.

The new vision begins with recognition of the critical need to involve the soldier in the development of any new weapon system. In the case of the next-gen squad weapons, those development origins date back to the 2007-2008 time frame, when the Army undertook a small arms capability-based assessment to obtain a holistic view of the combat systems available and what those systems would allow soldiers to accomplish.

NGSW-AR prototype

Sig Sauer photo

Participants in that assessment have acknowledged that it identified some capability gaps, with the Army working hard to address those issues even before the creation of Army Futures Command's cross-functional teams.

Combined with evolving threat analysis, the findings from that assessment pointed to the need for the Army to conduct a small arms ammunition configuration study. One early request for information for that study called for "current and emerging small arm systems, components, and support technologies that would provide significant, enduring, enhanced operational capability to dismounted infantry forces in the 2025+ time frame."

The RFI was "not focused on off-the-shelf solutions; nor [was] it focused on singular niche items that are intended for specific threats and venues," the document clarified. "Rather, we are seeking broad based, innovative technologies which will enable the next generation of warighter to hit harder, farther, faster, and more often than they do now, with minimal consequence to logistics and maneuver."

In a recent interview, Maj. Gen. David Hodne emphasized the importance of that study, observing, "I've got to give a 'shout out' on next-gen weapons to the CDID [Maneuver Capability Development and Integration Directorate] team [at Fort Benning, Georgia], because we're really seeing the benefits of the work that actually preceded Army Futures Command."

Hodne, who served as commandant of the U.S. Army Infantry School and chief of infantry from August 2018 to August 2021, as well as the first director of the soldier lethality cross-functional team, added, "In this case, the small arms ammunition configuration study started here at Fort Benning. And that study essentially paved the way for the next-gen weapons effort, with the most important outcome being that it defined and codified the important relationship between the soldier, the weapon, the enabler, the ammunition and the soldier's training."

In addition to clarifying the critical relationship, the study process also paved the way for initial exploration of new weapon elements within the SWEAT equation.

That exploration featured a prototyping effort led by the office of the program manager for crew served weapons, under the project manager for soldier weapons at Picatinny Arsenal, New Jersey. That effort, which included six

prototype weapon designs from five different vendors, ended in mid-2019 and provided actual hardware to further inform the Army requirement. As such, it provided a foundation for the evolution of today's NGSW program, which currently includes competitive prototyping by three weapons and ammo vendors: SIG Sauer, General Dynamics Ordnance and Tactical Systems, and Textron Systems.

Defense Department program descriptions note that initial NGSW prototype testing, beginning in the third quarter of fiscal year 2020, served as a "diagnostic test" to inform the vendors on their performance and feed a follow-on design iteration.

In addition to reflecting the expanded SWEAT philosophy, this initial soldier feedback to contractors appears to have led to minor changes in some platform designs, such as movement of traditional iron back-up sights 45 degrees from vertical, to allow continuation of tactical engagements without the use of mounted optics.

A follow-on second prototype test phase of the NGSW-R and NGSW-AR began in the second quarter of fiscal year 2021 and is currently informing source selection teams on the performance of the systems.

NGSW source selection to a single vendor is anticipated in the first quarter of fiscal year 2022, with an extremely rapid first unit equipped goal for the fourth quarter of the fiscal year.

The next critical element in the SWEAT equation involves the enabler, with the most obvious being the fire control system. As part of its effort, the Army is conducting a parallel Next-Generation Squad Weapon-Fire Control program with the objective of providing a ruggedized fire control subsystem that will increase accuracy and lethality for the dismounted warfighter on the battlefield.

"Capabilities are achieved through integration of advanced technologies to provide a fire control system consisting of a variable magnification, ballistic calculator, atmospheric sensor suite, and laser range finder," noted one early program announcement. "Combining these features with an in-scope digital display produces an adjusted aimpoint for the soldier within the field of view. The system will provide the weapon system an accurate range to target along with an adjusted aimpoint for the selected weapon/ammunition combination."

In late April 2020, the Army announced its selection of two vendors — L3Harris Technologies and Vortex Optics — to provide competitive NGSW-FC prototypes. The companies provided more than 100 production prototype systems in early 2021 for test and evaluation during subsequent soldier touchpoints.

As of press time, downselection to a single vendor was believed to be imminent, to allow additional coordination between the NGSW-FC element and the NGSW-R and NGSW-AR platforms prior to completion of weapon source selection.

Another key enabler in the SWEAT equation is the "Intelligent Rail" and Rail Operating System. Now called "Picatinny Smart Rail" by the Army, I-Rail was originally developed under Army Small Business Innovative Research funding in 2008 to provide the power and network backbone for weapon-mounted accessories, optics and other enablers.

According to Don McLaughlin, president of Virginia-based T-Worx, the company's I-Rail currently is the only approved smart rail supplier to the U.S. Army and supports multiple Army modernization priorities and cross-functional teams.

"Seeing the need for a connected weapon with the NGSW program, the Army inserted the I-Rail, with the Picatinny Smart Rail ICD [Interface Control Document], as a requirement for the NGSW weapons and NGSW-Fire Control optic programs," McLaughlin explained.

"As a requirement on those programs, the I-Rail contributes to making the NGSW weapons 'next gen,' [since] data sourced from I-Rail-equipped weapons can feed telemetry data, including rounds fired, bearing, and other sensors to IVAS or other displays," he added, referring to the Integrated Visual Augmentation System.

He noted that the company has provided enough smart rail components to outfit over 300 weapons and 200 optics during Next-Generation Squad Weapon and NGSW-FC prototype phases.

One of the most noteworthy SWEAT elements involves the introduction of a new 6.8mm ammunition design.

The need for a new ammo caliber reportedly came from the small arms ammunition configuration study, which indicated the need for an "intermediate caliber" between the already fielded 5.56mm and 7.62mm. Supported by science and technology efforts, along with exploration of developments in the commercial ammo market, the Army's ballistic search focused on the realm of 6.5mm to 6.8mm. While U.S. Special Operations Command pursued the 6.5mm Creedmoor cartridge for some of its weapons, the broader Army requirements focused on 6.8mm, where bullet ballistic performance is very similar to the .270 caliber magnum rifle and credited with significant capability improvements over the most modern 5.56mm and 7.62mm ammunition in accuracy, range, signature management and lethality.

But the Next-Generation Squad Weapon is not just an ammunition program. Looking at the broader SWEAT equation, each of the three weapon vendors currently in competition have their own unique cartridge ammunition solution, common to both NGSW-R and NGSW-AR and reflective of issues and tradeoffs ranging from bullet performance to ammo weight reduction.

The Army's Next-Gen Squad Weapon prototype phase approach has been complex and reflective of significant support from a range of Defense Department organizations like the joint program executive office for armaments and ammunition. Together, they developed a solution to the unique cartridge challenge that involved the manufacture of the 6.8mm bullet component at the Lake City Army Ammunition Plant in Missouri, with those bullets then provided to the NGSW competitors for loading in their unique cartridge solutions.

Longer term plans call for the manufacture of complete 6.8mm cartridges at the Lake City plant after the Next-Generation Squad Weapon downselect has been made.

Downselection will also need to occur before the full implementation of weapons training. In the interim, representatives for the Synthetic Training Environment cross-functional team were quick to cite "continuous collaboration and integration efforts with the other CFT's modernization efforts and emerging technologies." ND

BY MICHAEL JOHNS JR.

Building a 21st Century Nuclear Posture

In August, the Pentagon began its Nuclear Posture Review, a six-month process of comprehensively evaluating the U.S. nuclear arsenal and strategic doctrine.

The review, which every U.S. president has discharged since Bill Clinton, is an important opportunity for the Biden administration to revisit the full spectrum of nuclear policy and set out a blueprint for a 21st century posture. In a world returning to great power competition, U.S. security relies more than ever on a robust and sustainable strategic arsenal and nuclear production enterprise.

With this opportunity in hand, the administration should consider and build on the recommendations of the last Nuclear Posture Review in 2018, which noted that the current U.S. nuclear triad — which was largely put into place in the 1980s or earlier — is aging.

"Unlike potential adversaries," the NPR observed, the United States "has not executed a new nuclear weapon program for decades." Instead, ongoing work focuses on life-extension programs for existing weapons and maintaining atrophying production and delivery capabilities.

The primary concern for the upcoming review must be the aging of the triad, which to an alarming extent is at least 30 years old and has not enjoyed steady recapitalization in nearly as long.

Defense Dept. photos

For example, the current land-based intercontinental ballistic missile force exclusively consists of 400 Minuteman III ICBMs, deployed throughout the United States in underground silos. These missiles, first deployed in the 1970s, were designed for a 10- to 20-year lifespan — and yet through life extension have been retained for over two-and-a-half times that intended period.

This trend applies to the other legs of the triad: the most advanced nuclear capable aircraft, B-2A bombers, carry cruise missiles from 1982 that are now more than a quarter century past their design life, and Ohio-class submarines — initially introduced in 1981 for an intended 30-year service life — have been life extended to 42 years, carrying ballistic missiles which have also had their lives extended.

This aging process is a clear and present concern for the security of the United States and its allies, and sustainment cannot continue indefinitely. Although the replacement of these missiles and systems will undeniably be a significantly expensive undertaking, it will have to be done eventually — and without action, will simply become more painful as time passes.

But even if the Biden administration fully addresses the life extension of nuclear weapons, it will also need to take seriously the 2018 review's conclusion that the strategic environment has evolved. As a result, the administration must update the nation's posture to respond to emerging threats. Specifically, the previous review recommended that the United States be able to respond to adversaries with "tailored deterrence options" that specifically address the possibility of adversaries' "mistaken confidence that limited nuclear deployment can provide a useful advantage over the United States and its allies."

Specifically, the U.S. should invest in two new varieties of low-yield weapons: ballistic missiles and sea-launched cruise missiles.

To make good on these objectives — a modernized and innovative nuclear triad that can deter adversaries and assure allies — the new NPR must begin not only a project of steady recapitalization, but also an effort to build a nuclear production enterprise that can sustain a cutting edge force into the future.

Earlier this month, satellite photos indicated that North Korea is at least capable of — if not actively resuming — production of nuclear weapons. In stark contrast, this country is not. The United States lacks the manufacturing capacity necessary to support its own life-extension programs or stabilize the strategic arsenal in the face of uncertainty.

As the secretaries of defense and energy said in 2008, the nation is simply unable to produce nuclear weapons in the way it did in the 20th century, if indeed it can at all. The 2018 review admitted that "the United States largely relies on dismantling retired warheads to recover lithium to sustain and produce deployable warheads," a practice which cannot support the nuclear replacement program, to say nothing of innovations that will be necessary to update the strategic triad.

To maintain an effective nuclear posture, the United States will have to do more than simply execute a new nuclear weapon program, though this is an important step. It must also close the gaps in funding for infrastructure, as well as research and development, in order to revive and sustain the nuclear production enterprise.

One promising pathway to this goal is the bipartisan Stockpile Responsiveness Program of the National Nuclear Security Administration, which attempts to stimulate these capabilities by modernizing production facilities and encouraging new research from weapons scientists and engineers. Additional funding for this program could be an effective way to return the nuclear posture to a clean bill of health.

The upcoming Nuclear Posture Review has an important, and historic, opportunity to bring the U.S. enterprise into the 21st century after decades of neglect. Although there is no doubt that there are many worthy modernization priorities, the administration should remember the previous NPR's conviction that "the highest priority of the Department of Defense is deterring nuclear attack."

The administration owes the American people a Nuclear Posture Review that responsibly and sustainably achieves that goal. ND

Michael Johns Jr. is an NDIA junior policy fellow.

BY ANNA MENZEL, PETER TERENZIO AND MIKE WAGNER

Public Meeting Addresses 'Buy American' Rules

■ On Aug. 26, the Federal Acquisition Regulatory Council and the Office of Management and Budget's Made in America Office held a public meeting to discuss proposed changes to Buy American Act regulations aimed at strengthening domestic preferences while reducing reliance on foreign sources of critical components.

While the general thrust of the proposed rule is clear, the meeting indicated that the precise manner and means by which the government would accomplish its objectives remain to be seen.

The proposed changes can be divided into three main categories: a multi-phase increase in the domestic content threshold used to determine whether an item qualifies as "domestic end product," from its current level of 55 percent to 60 percent, then to 65 percent, and then, ultimately, to 75 percent by 2029; enhanced price preferences for certain "critical items" and "critical components" manufactured in the United States; and new disclosure requirements related to those critical items and components.

The agenda for the Aug. 26 meeting covered each of the proposed changes, as well as other questions raised in the notice of proposed rulemaking related to Buy American Act waivers and certain exceptions.

Celeste Drake, director of the recently established Made in America Office, discussed the office's goals to promote domestic manufacturing and preserve domestic sources of critical items and components. She and the FAR Council then spent the rest of the meeting soliciting input from various stakeholders.

A variety of interests were represented among the commentators including representatives of trade associations, labor union spokespersons, small business owners and concerned individual citizens. Some spoke in favor of the proposed changes while others warned that significant changes could have a range of unintended consequences. For example, some commentators cautioned that the increased domestic content thresholds could cause certain companies to exit the federal market entirely — particularly if federal procurement is not their primary focus — and that Buy American preferences must be weighed against both U.S. international trade relationships and national defense priorities.

Even though the proposal does not affect the Trade Agreements Act regime, the notice on proposed rulemaking asked whether the "substantial transformation" standard under the TAA benefits domestic firms and what the U.S. government should do to acquire information about goods procured pursuant to that act. Importantly, the law's substantial transformation test replaces the Buy American Act domestic content test for most non-defense goods acquisitions over the Trade Agreements Act threshold — generally $182,000. This was the subject of some attention among the commentators at the public meeting, including those that wanted a stronger domestic content test.

Although a FAR rulemaking cannot change trade policy, the Made in America Office conceivably could seek additional information from contractors relying on the TAA exception to the Buy American Act, including, for example, specific country of origin information regarding the components or information regarding the contractors' supply chain. Setting aside whether these types of information requests would be consistent with current trade policies, they certainly would impose additional reporting or certification obligations on contractors, if required.

The notice on proposed rulemaking also included questions relating to the commercial-off-the-shelf partial exception and commercial IT exception to the Buy American Act. Specifically, the notice sought input on the extent to which the exceptions remain relevant and whether they should be narrowed. These questions implicate several issues. As an initial matter, the commercial IT exception has been included in annual appropriations bills since 2004, so the Made in America Office lacks authority to unilaterally modify or eliminate it, though the office could advocate for congressional action to revoke or narrow the exception.

The COTS partial exception, by contrast, is the result of a regulatory action taken by the Office of Federal Procurement Policy in 2009, and, as such, appears more susceptible to modification through rulemaking. Indeed, the exception was previously narrowed in 2020 when the FAR Council revived the cost-of-component requirements for COTS items made predominantly of iron or steel.

Because the commercial IT and COTS exceptions to the Buy American Act traditionally have encouraged commercial contractors to enter the federal marketplace, some commentators have expressed concern that commercial contractors may abandon federal sales if these exceptions were to be revoked or narrowed. This, in turn, has sparked debate over whether, and to what extent, the departure of certain contractors from the federal marketplace may affect competition and, ultimately, the government's purchase price.

The questions regarding the TAA, commercial IT and COTS exceptions almost certainly will not be resolved by the forthcoming final rule. But even absent changes to these provisions, the other changes contemplated by the proposed rule are poised to alter the way federal contractors manage their supply chains. Moreover, the additional discussion questions suggest that the Made in America Office and the FAR Council may be open to further changes going forward as they continue to use the terms and conditions of federal procurements to pursue the administration's mission of maximizing the use of good products and materials produced in the United States. ND

Mike Wagner is a partner and Peter Terenzio and Anna Menzel are associates at Covington & Burling LLP.

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Chem-Bio Division Bestows Top Awards

■ The National Defense Industrial Association's Chemical, Biological, Radiological and Nuclear Defense Division bestowed its top honors to two individuals at its annual conference in Baltimore, Maryland, in August.

Douglas Bryce was presented with the William C. Baugh CBRN Defense Excellence Award. Bryce retired from federal service in December 2020 with over 48 years of service to the United States. He served 38 years with the Marine Corps — 20 years on active duty and 18 years as a Marine civilian — and 10 years with the Army. He retired as the joint program executive officer for chemical, biological, radiological and nuclear defense in 2020. Bryce started a consulting company at the end of last year, offering acquisition, leadership and CBRN defense services.


Bryce


DeCoste

The Joseph D. Wienand NDIA CBRN Division STEM Excellence Award — which recognizes an individual who demonstrated outstanding accomplishments in the areas of STEM — was presented to Dr. Jared DeCoste.

DeCoste is a senior research chemist at Army Combat Capabilities Development Command's Chemical Biological Center and leads a variety of technical projects in the areas of materials chemistry and synthetic biology. His work has led to more than 60 manuscripts, 75 oral presentations and seven patents. His passion for education and developing the future generation of scientists is evident through the more than 20 mentees he has been involved with over the past 11 years. ND

Women In Defense Announces Scholarship Winners

■ Women In Defense — an affiliate of NDIA — selected 10 women studying for careers in national security for its WID Scholars program for the 2021-22 academic year, sharing $103,000 in funds among them.

The finalists are among 87 eligible female students who submitted bids to become WID Scholars, formerly called the Horizons Scholarship program. The funding they receive helps them pursue education on their path to a career in defense or national security.

WID Scholars include: Viviana Angelini, Elliott School of International Affairs at George Washington University; Naomie Baptiste, Howard University; Tam Brewster, Northeastern University; Michaela Coplen, Oxford University; Elizabeth Doughty, University at Buffalo; Roni Fraser, University of Delaware; Allison Owen, Middlebury Institute of International Studies at Monterey and Moscow State Institute of International Relations; Madison Reed, Worcester Polytechnic Institute; Lauren Risany, Purdue University; and Nesrine Taha, George Washington University School of Engineering and Applied Sciences.

Applications for the 2022-23 class of WID Scholars will open in late January 2022. Previous WID Scholars may apply.

To be eligible for the scholarship, applicants must: be female students who will be enrolled at an accredited university or college, full or part time, for the fall semester; be a U.S. citizen; be an undergraduate or graduate student (undergraduates must have at least junior-level status, 60 credits); demonstrate interest in pursuing a career related to national security or defense; demonstrate financial need; and have a minimum 3.25 grade point average. ND

Magazine Staff Honored For Journalistic Excellence

■ Several *National Defense* staff members are among the finalists for the 2021 Defence Media Awards, with a record total of nine nominations for the publication.

Honored for their work are Managing Editor Jon Harper for best military maintenance repair and overhaul submission; best land systems submission; and the John Morrocco Award for best in-depth defense reporting.

Senior Editor Yasmin Tadjdeh has been nominated for best young defense journalist; best training, simulation and readiness submission; best defense electronics submission; and best military rotorcraft submission.

Staff Writer Meredith Roaten has been nominated for best technology submission.

Creative Director Brian Taylor and *National Defense* were nominated for the best digital defense submission for the innovative use of augmented reality in the magazine.

Winners were slated to be announced during an award dinner at the National Press Club in Washington, D.C., in October. ND

Association Updates Key Acquisition Reform Report

■ An updated version of NDIA's "Pathway to Transformation" report, which set several federal acquisition reforms in motion, has been released.

NDIA's Strategy and Policy team revised the document's legislative recommendations for clearer understanding of statutory language as well as important references to the acquisition workforce. The report was originally crafted in support of the 2014 acquisition reform initiative, in which Congress asked NDIA for its input. The first report showed that past efforts to reform the acquisition process did not change the underlying actions behind today's decisions.

This revised document comes ahead of an NDIA upcoming research report on resourcing and the Defense Department's planning, programming, budgeting, and execution process for allocating resources. The report is expected to be released in the fall.

The revised "Pathway to Transformation" report can be found at: https://bit.ly/3BEmLQ6. ND

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NDIA Calendar

■ The National Defense Industrial Association continues to follow all developments regarding COVID-19 and is diligently examining each event to determine the best course of action as we look forward to gathering leaders in government, industry, and academia again to solve the most challenging issues in national security in person.

NDIA will be implementing the following policies for all of our meetings, conferences and events: *(Local and State regulations permitting.)*

■ **PROOF OF VACCINATION:** All attendees will be required to upload proof of vaccination or proof of negative COVID-19 test within three (3) days of arrival. Details for securely uploading documentation will be provided shortly on the event website.

■ **MASKS:** Fully vaccinated attendees are encouraged to wear face masks but, in accordance with CDC guidance, may make that choice for themselves. If you are not fully vaccinated, you are required to wear a face mask in public places.

■ **WAIVER:** All registrants are required to sign the COVID-19 waiver during the online registration process. Attendees may disclose their vaccination status at the time of signing.

The health and safety of all our registrants are our highest priority, and we will continue to follow local, state and CDC guidelines to keep everyone safe.

Visit NDIA.org/events for more information.

Christine M. Klein
Senior Vice President, Meetings, Divisions & Partnerships

OCTOBER

18-21 2021 Future Force Capabilities Conference and Exhibition
Columbus, GA
NDIA.org/FutureForce21

19-21 Precision Strike Technology Symposium (PSTS-21)
Laurel, MD
Classified U.S. Only
NDIA.org/PSTS21

25-27 2021 Undersea Warfare Fall Conference
Groton, CT
NDIA.org/FallUSW

27 NTSA October Webinar
Virtual
TrainingSystems.org

NOVEMBER

2-3 NDIA Gulf Coast Air Armament Symposium
Ft. Walton Beach, FL
NDIAAAS.com

2-4 2021 Aircraft Survivability Symposium
Monterey, CA
Classified U.S. Only
NDIA.org/Aircraft21

3-4 32nd Annual NDIA SO/LIC Symposium
Washington, DC
NDIA.org/SOLIC

8-10 2021 Joint NDIA/AIA Fall Industrial Security Conference
Chantilly, VA
NDIA.org/ISCFall

17 NTSA November Webinar
Virtual
TrainingSystems.org

29-Dec 3 I/ITSEC 2021
Orlando, FL
IITSEC.org

DECEMBER

6-8 24th Annual Systems and Mission Engineering Conference
Virtual
NDIA.org/SME21

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Next Month

Haptics and Simulators
■ The training and simulation industry is investing in haptic technology — a capability that simulates touch and feel. A new lab dedicated to haptics will evaluate the tech for use in medical care and marksmanship training.

Navy Training
■ After nearly two decades of supporting counterinsurgency operations, the U.S. Navy is faced with a potential high-end fight against China. For our next issue, *National Defense* interviews the commander of the Naval Air Warfare Center Training Systems Division to discuss what his organization is doing to aid readiness.

Medical Training
■ The Defense Department aims to leverage augmented reality and virtual reality to train medical personnel and support telehealth. The Pentagon wants industry's help as it pursues the technology.

T-7 Update
■ The Air Force has been working alongside prime contractor Boeing to develop its new T-7A Red Hawk trainer jet. However, bumps in the road have emerged and schedules have begun to slip. What's ahead for the service's next-generation system?

Subterranean Challenge
■ The Defense Advanced Research Projects Agency's "SubT" Challenge — a contest meant to promote tech for underground mapping — is down to its fiercest competitors. Twenty-four teams from all over the world will compete in September using robots and virtual software to find out who comes out on top.

Chem-Bio Defense
■ The Pentagon wants to inject new and emerging technologies — such as artificial intelligence — into its chemical, biological, radiological and nuclear defense portfolio. In our next issue, *National Defense* examines how CBRN defense is changing and shifting.

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