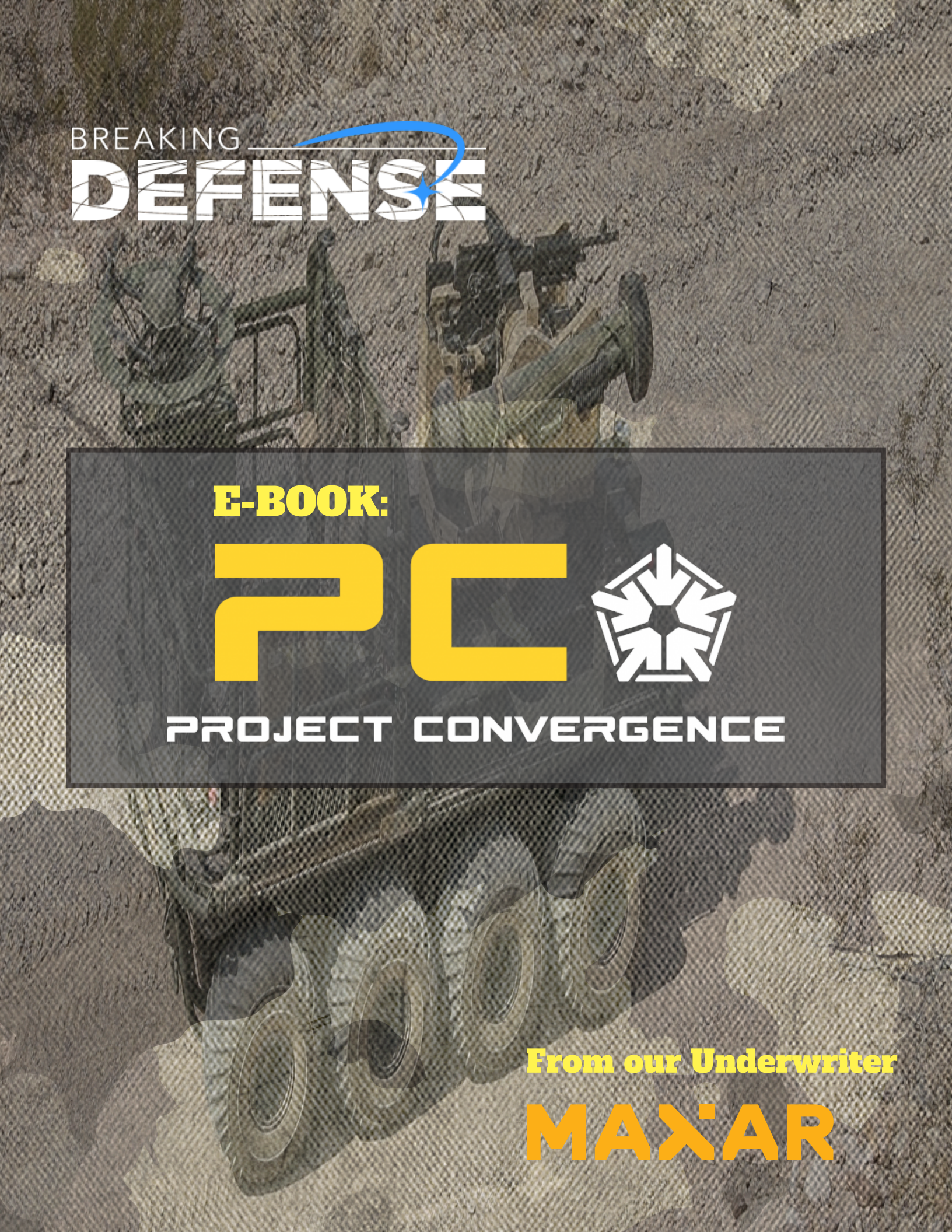
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Editor's Letter

BREAKING DEFENSE

When the Army ran its first full-length Project Convergence exercise during the summer of 2020, it served as a major milestone that the service could connect decades-old systems to new modernized systems. The massive experiment - which one four-star compared to the Army's massive pre-World War 2 exercise called the Louisiana Maneuvers - proved that the Army was getting serious about networking and future technology investments that Pentagon planners believe are vital moving forward as it prepared to square off against the Russian or Chinese militaries.

In essence, Convergence is how the Army intends to fill out its part of the Pentagon's Joint All Domain Command and Control (JADC2) concept. These major exercises, now officially to be held annually, are a testing ground for the various concepts and technologies the Army expects to rely on in the coming decades - new helicopters, robotic vehicles, tiny drones, augmented reality goggles, all connected by a secure and robust network. If you're feeling optimistic, you could say it's a live look-in on the future battlefield.

For this year's edition, PC21, the exercise expanded even further, with additional operations units from the Army operating alongside each of the other military services. Held between early October and mid-November at Yuma Proving Ground in Arizona, the effort represented a less kinetic, more network-focused event.

It also brought Breaking Defense Army reporter Andrew Eversden, who traveled to Yuma twice to get a sense of what the service is doing. On his first trip in late October, Eversden saw an event focused on Future Vertical Lift technologies that will define the Army's next rotorcraft designs. On the second trip, in early November, Eversden was one of a handful of reporters who travelled with Army Secretary Christine Wormuth to check out the meat of this year's exercise. Throughout both trips, he interviewed several senior Army leaders overseeing the service's modernization effort and making the service's day-to-day decisions to hear their thoughts on the direction the service's modernization is heading.

Inside this eBook you'll find in-depth reporting about what the service did during PC21, what it found, and how much further it still has to go.

Thanks for reading

Aaron Mehta
Editor in Chief, Breaking Defense

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BREAKING DEFENSE

Project Convergence 2021 Kicks off; Showcases 110 New Technologies

"Unfortunately, some of the Army's signature modernization efforts, as spectacular as they are, don't work with the other signature modernization efforts," said Ed Mornston, G2 at Army Futures Command.

The Zephyr high-altitude drone (Airbus)

By THERESA HITCHENS on October 12, 2021 at 8:19 AM

GEOINT 2021: The Army's Project Convergence 2021 wargame launches today at Yuma Proving Grounds in Arizona and White Sands Missile Range in New Mexico, where the service will test out new technologies, capabilities and operational concepts for future All Domain Operations.

"The Army's taking 110 technologies to the field for six weeks to figure out: do they do what we think they can do? Will they interoperate?" Ed Mornston, head of intelligence and security (G2) at Army Futures Command, told the annual GEOINT Symposium last week.

Over the past year, the Army has been running a serious of "communications exercises," or "COMEX," that have revealed some of the issues the service has with simply getting its own weapon systems to talk to each other, Mornston said last Thursday. The most recent iteration had just finished at Ft. Leonard Wood in Eagleton, Mo., he noted. The Army also has been testing out each of the technologies at its Joint Systems Integration Laboratory at Aberdeen Proving Grounds in Maryland.

"Unfortunately, some of the Army's signature modernization efforts, as spectacular as they are, don't work with the other signature modernization efforts," he said. (The service has a portfolio of 35 modernization priorities, that range from from 1,725-mile hypersonic missiles to augmented-reality targeting goggles.)

The kickoff of Project Convergence 2021 happens to coincide with the start of annual Association of the United States Army (AUSA) trade show in Washington, DC, where Army officials will be bringing industry up to speed on the flagship effort. The massive wargame is aimed at developing the next-generation capabilities the Army will need to implement DoD's Joint All Domain Command and Control (JADC2) strategy, and the evolving Joint Warfighting Concept for taking on Russia and China in globe-spanning future conflicts.

The wargame will involve the 82nd Airborne Division, along with the Army's Multi-Domain Task Force as the key operational units, Mornston said, running through seven different "use cases," i.e. tactical scenarios.

It also will involve representatives of the Air Force, Navy and Marine Corps, he explained, making the wargame "truly a joint effort." Of the 110 new technologies being reviewed, some 35 of them come from the other services, he explained.

Next year's Project Convergence will go further, he added, inviting allies.

While Mornston did not reveal specifics about the technologies themselves — noting that the service, and DoD writ large must remember that US competitors, especially China, are masters of open-source research — the Army has previewed some capabilities over the past year in smaller wargames, such as the EDGE21 aviation exercise in the spring.

During EDGE21, the service field-tested a number of new systems ranging from jamming pods to infantry goggles to software that allowed battlefield operators to take over the controls of a drone and task it to gather targeting data — all made possible by a prototype Modular Open Systems Architecture, the invisible, digital backbone of the Army's future air fleet.

A Focus On Army's Own ISR

Key to Project Convergence, and to the Army's overarching plan for high-speed future warfare, is the ability for taskable, over-the-horizon sensors that provide the intelligence, surveillance and reconnaissance (ISR) to enable targeting of the service's developing arsenal of very long-range weapons, or in Army-speak, long-range precision fires.

For example, Army leaders, which for decades have complained that they does not receive the battlefield-ready ISR it needs in a timely manner from either the Air Force or the Intelligence Community (IC), are now seeking to develop their own ISR satellite payloads that they can task for themselves.

And in that arena, but short of space, Project Convergence will include testing of the Zephyr very-high altitude spy drone, according to industry officials.

Zephyr, developed by Airbus, is a solar-electric High Altitude Platform System (HAPS) with a wingspan of 25m and weighing less than 75kg, the the company's website says. It flies at around 70,000 feet (21 kilometers) in altitude, which is about double the height of conventional air traffic and above storm clouds.

Variants of the drone have been undergoing Army testing at Yuma for about a decade. Zephyr in 2010 broke the world record for the longest autonomous drone flight; and in 2019 it stayed aloft day and night for almost 26 days.

Airbus completed another testing campaign at Yuma with the latest version of the drone, Zephyr S, last month, according to an Oct. 11 press release. During that test it successfully streamed Earth observation imagery from the new Optical Advanced Earth Observation system for Zephyr (OPAZ) system. Zephyr also has now received approval from the Federal Aviation Administration to fly in US national airspace, the release noted.

Army To Field Project Convergence Tech 'As Quickly As Possible'

The autonomous system, Origin, prepares for a practice run during the Project Convergence capstone event at Yuma Proving Ground, Arizona, Aug. 11 – Sept. 18, 2020. (U.S. Army photo by Spc. Carlos Cuebas Fantauzzi, 22nd Mobile Public Affairs Detachment)

By ANDREW EVERSDEN on October 12, 2021 at 1:51 PM

AUSA: As the Army puts scores of cutting-edge technologies and capabilities through the ringer at its Project Convergence experiment the deserts of Arizona over the next four weeks, top Army officials are watching closely to see what survives and to get it into the hands of soldiers "as quickly as possible."

"If it works, we're going to transition quickly," Lt. Gen. James Richardson, deputy commander of Army Futures Command and Project Convergence director, told the Association of the United States Army (AUSA) conference. To do so, Richardson said the Army has greased the acquisition wheels in order to bridge the "valley of death," where many a promising project has met its end.

Among the steps taken, before the Project Convergence started in Arizona started this week, Richardson said the Army ensured that advanced capabilities tested at the experiment were already connected with programs of record at acquisition offices across the service, paving a direct transition path.

"That's a little bit different way we've done in the past, but what to avoid is is this valley of death," Richardson said.

Project Convergence is the Army's annual weeks-long exercise beginning outside Yuma, Ariz., where it links future technologies to test interoperability and prepare for multi-domain operations. This year, Convergence is going inter-service, bringing in the Air Force, Navy and Marines to connect disparate systems and help inform the Pentagon's Joint Warfighting Concept.

The service is testing seven different use cases this year and is centered on soldiers from the 82nd Airborne Division and the Multi-Domain Task Force, Richardson said. The more than 100 technologies that the Army is bringing to Project Convergence 21 will also be tested in denied and degraded environments — conditions in which Army expects to have to fight in the future.

"What Project Convergence has done is it has allowed everyone to have a warfighter establish an operational scenario, in this case, from a joint perspective, to take this technology and link it to the network to basically conduct this tactical scenario," Richardson said.

Lack of future helo doesn't stop Army's Future Vertical Lift experiments in the desert

Project Convergence 21 showed off new, networked, autonomous capabilities to be added to next-gen helicopters.

The Future Vertical Lift Cross-Functional Team used the UH-60 Blackhawk as a surrogate for its Modular Effect Launcher. (Courtesy of FVL CFT)

By ANDREW EVERSDEN on November 10, 2021 at 1:08 PM

YUMA, Ariz.: A small solar-powered unmanned aircraft flies above in the clear blue skies of the Arizona desert for hours, doing its invisible work to extend network range.

Another small air-launched drone blasts off autonomously from a helicopter, spreading its wings and soaring across the battlefield to provide airborne reconnaissance.

Elsewhere, a MedEvac software platform automatically transmits wounded soldier information back to a field hospital across the network, so medics can be ready when they arrive.

Those are a few of the 28 "firsts" touted by the Future Vertical Lift Cross-Functional Team (FVL CFT) here at Project Convergence 21, the Army's annual experiment in connecting "sensors to shooters" to prepare for the next-generation battlefield, despite not actually having the helicopters.

They also demonstrate how the team views well-tuned enabling technologies — far beyond just flying — as critical for the fight when the FVL CFT's future helicopters are finally available at the end of the decade. In future wars, the Army choppers' will be tasked with providing network resiliency and launching ISR drones, among other high-tech missions, in addition to their more traditional roles like troop transport and covering fire.

The Army isn't expected to actually field its next-generation helicopters — the Future Attack Reconnaissance Aircraft and the Future Long-Range Assault Aircraft — until later this decade, so in the meantime the cross-functional FVL team is using Project Convergence 21 as a test bed for future capabilities that could one day be integrated into the helos. The team plays a role in five of Project Convergence's seven use cases, each one simulating a different phase of multi-domain operations.

"All the use cases have stressed us to prove that we have the adaptive command and control networks to operate at the speed and the depth of a future battlefield," said Maj. Gen. Walter Rugen, director of the the Future Vertical Lift Cross-Functional Team.

Ultimately, the future vertical lift team, based in Huntsville, Ala., aims to develop capabilities that allow the Army to dominate the lower-tier of the air domain and is responsible for developing the network at that level.

In experiments, the FVL CFT was able to nearly triple the reach of its lower-tier aerial network over last year's Project Convergence, several CFT officials told reporters, while using fewer assets. While the CFT declined to cite specific numbers on distance citing security concerns, that added network length will allow for data from high-value targets to be transmitted across the battlefield.

"We're doing that and we're better at it than we were," Rugen said. "Decision dominance, the way I look at that is I'm inside … the enemy's circle. I'm turning inside them, versus the opposite. And so how do I do that at a speed and a range that stretches the enemy to a breaking point and that's really what we're flexing on out here."

To 'extend the eyes'

Thump.

Suddenly, a small drone shoots out of a tube on the back of a Polaris DAGOR land vehicle. The drone wings spread and within seconds it quietly soars out of sight.

This is part of a Project Convergence demonstration of the service's Air-Launched Effects capability – a small autonomous drone that can carry various payloads, including ISR capabilities to enhance situational awareness.

ALEs were a prevalent part of the future vertical lift team's "firsts" at PC21, making up eight of the 19 unclassified firsts the FVL team shared. During Project Convergence, it launched off the back of light ground vehicles, in addition to UH-60 Blackhawks serving as a surrogate for the Future Attack Reconnaissance Aircraft, including one autonomous launch as part of a project by DARPA.

U.S. Army Soldiers assigned to 82nd Airborne Division, conduct checks on an ALE Small before launch in preparation for Project Convergence at Yuma Proving Grounds, Az. October 14, 2021. (Sgt. Marita Schwab/US Army)

The ALE-S can carry an ISR payload to allow soldiers to see in areas they don't have eyes on and autonomously identify and notify soldiers of threats.

"It's an unmanned system that's launched to extend the reach of the manned platform, extend the eyes of the manned platform to do recon of areas of interest and other missions," said Nate Bordick, intelligent teaming branch chief at Army Futures Command.

Three firsts included the 82nd Airborne soldiers charging, loading and launching the small ALEs off the ground vehicles. Other firsts included tripling its communications distance and other advanced command and control networking capabilities with a Blackhawk.

During one experiment at Project Convergence 21 simulating an IVAS-enabled air assault, the small drone identified a threat on the ground and communicated its position back to pilots, prompting them to divert to their alternative route.

"It's going to cause a dynamic change in flight and have us make a decision as the air mission commander or the battlespace commander of how we're going to get to that objective using the whole integration of that system," said Capt. Roberta Woronowicz, a commander with the 82nd Airborne Combat Aviation Brigade.

The key is the autonomy. Where soldiers would have to do reconnaissance in the past and relay threat information, now the small drone can do.

To make all these "firsts" work together in concert, much less the rest of the Army's technology, the service depends on its Modular Open Systems Approach, or MOSA, to ensure that capabilities are built with open standards so they can easily plug in with other capabilities.

One of the primary examples of FVL's MOSA approach is the Modular Effects Launcher, which can carry and launch multiple different types of missiles and ALEs. At PC21, the launcher was both successfully employed and launched the ALE-S.

"It's flying true capability and it's truly open," Rugen said. "That is the USB port for our lethal and non-lethal, our kinetic and non-kinetic effects."

The unmanned systems designed to work in tandem with the FVL can also be designed for endurance, like the Kraus Hamdani Aerospace fully electric, solar-powered bird that flew for hours overhead providing network coverage — a capability that could come in handy over the vastness of a potential Pacific theater of operations.

A Kraus Hamdani ultra long endurance drone in flight during Project Convergence. (Spc. Cody Rich/US Army)

According to the company website, one of its drones recently flew more than 26 hours straight and can carry different types of payloads, including electronic warfare, communications tech or spectrum deception capabilities. In Yuma, the drone also successfully bridged disparate networks and was launched by soldiers off a light vehicle.

The FVL CFT is testing eight waveforms at PC21, with different functions depending on which phase of MDO its employed in.

As the FVL-CFT tests future capabilities on surrogate platforms, those networking capabilities must be able to communicate with the soldiers on the ground. To achieve that, the FVL team works closely with the Network Cross-Functional Team to field interoperable systems that can communicate with each other.

Rugen said the primary challenges with connecting the air and ground domain are in formatting and translating the data properly. Another challenge is getting data to report at a reasonable and manageable rate. One problem, for example, is getting the data to report back the network "as much as we need, not "here I am, here I am, here I am,'" Rugen said.

"Those rates are important, too, and we're playing with that so the data doesn't just flood the network with superfluous things," Rugen said.

Army lost telemetry tracking data with its Precision Strike Missile at 499km

"So we're confident we get past 499 and probably further if we hadn't lost telemetry," Gen. Mike Murray said at Project Convergence.

Lockheed's prototype Precision Strike Missile (PrSM) fires from an Army HIMARS launcher truck. (US Army)

By ANDREW EVERSDEN on November 10, 2021 at 1:08 PM

YUMA PROVING GROUND, Ariz: The October test flight of the Army's Precision Strike Missile flew just over 499km, or 310 miles, before the service lost contact with it, according to Army Futures Command's top general.

"We say 499-plus — we lost telemetry at 499.2 [km]," Gen. Mike Murray, commanding general of Futures Command, said Tuesday at the Project Convergence media day. "So we're confident we get past 499 and probably further if we hadn't lost telemetry."

The flight of the Lockheed Martin-made weapon, called PrSM, beyond the 499km (310-mile) threshold would be significant because it breaks a previously restricted distance barrier set by the now-expired Intermediate-Range Nuclear Forces (INF) treaty.

Murray's specificity also clarifies some confusion surrounding the test results last month. Ahead of the Oct. 13 flight test, a Lockheed Martin executive in October described the test as a max-range test, suggesting 499km was the goal, but afterward the company would only say that the "successful" test saw the PrSM missile fly beyond 400km, a new flight record at the time. The missile was fired from Vandenberg Space Force Base in California out into the Pacific Ocean.

The Precision Strike Missile is part of the Army's Long-Range Precision Fires portfolio, the service's top modernization priority. The missile is supposed to replace the service's Cold War-era Army Tactical Missile System, which has a maximum range of 300km, or 186 miles. The program is scheduled for fielding in fiscal 2023 with the delivery around 20 missiles.

The PrSM program is led by the Long Range Precision Fires Cross-Functional team and Program Executive Office Missiles and Space. Spokespeople for PEO Missiles and Space and Lockheed Martin confirmed the details of the flight test but declined to comment further.

PrSM participated at Project Convergence 21, including the launch of two missiles from the same High Mobility Artillery Rocket System launcher. Murray told reporters during a roundtable that the Project Convergence PrSM flights didn't stress the missile's max ranges because of "range limitations" at Yuma Proving Ground, Murray said.

At Project Convergence, Army 'struggling' to see joint battlefield as it heeds 'hard' lessons

Where success meant identifying failures, top Army officials said desert experiment revealed problems in "situational awareness" that will be critical in future fights.

Soldiers from the 82nd Airborne Division take part in an IVAS-enabled air assault exercise on Nov. 3, 2021, on Yuma Proving Ground, Arizona, as part of Project Convergence 21. (US Army/Jacob Lang)

By ANDREW EVERSDEN on November 17, 2021 at 9:11 AM

YUMA PROVING GROUND, Ariz.: In next-generation warfare, the ability of a joint force commander to "see" the battlefield — a single vision with data from disparate battlefield sensors owned by different services — will be crucial, according to today's military leaders. But in the desolate Arizona desert, some of those Army leaders found out first hand just how challenging that vision is to achieve.

It turns out that such joint "situational awareness" that the Army "thought was going to be the easiest one […] turned out the hardest one," said Gen. John Murray, commanding general of Army Futures Command.

Or as Col. Andre' Abadie, co-lead for the Project Convergence operational planning team, put it: "We're struggling there."

But failure — and, most importantly, learning from it — is exactly the point at Project Convergence 21, the Army's annual experiment in connecting sensors and shooters. Over the last few weeks here, the US military gathered to stress test 110 technologies to their limits, and learn how they can be improved for future wars.

"The stipulation we've been given is, it's okay to fail as long as you're learning," Abadie said at the exercise's conclusion last week. "So you need to show what that failure taught."

Given that prerogative, Project Convergence 2021 (PC21) greatly expanded upon last year's inaugural event, adding participation from all the military services. PC20 focused on the close fight, but PC21 played with longer distances, imitating the operating environment of the Indo-Pacific. Last year relied heavily on scientists, while PC21 centered on soldiers from Fort Bragg and Joint Base Lewis-McChord. (One unfortunate change: the Army didn't conduct live demonstrations during the media day, a capstone event during PC20 that publicly displayed the progress of capabilities the service is spending billions on.)

Perhaps most notably, the 2020 event included six sensor-to-shooter links, whereas PC21 experimented with 27 connections — using 15 different types of sensors and 19 shooters. It included more scenarios, more people and more problems to solve.

"So the level of complexity from what we did last year to this year has been fairly significant, but fairly exciting […] in terms of 'What can I offer a joint force commander, as these technologies make their way to being delivered to the force?'" Abadie said.

A member of the 82nd Airborne Division uses the tactical robotic controller during PC21. (U.S. Army/Marita Schwab)

As each service currently develops their own contributions to the Pentagon's overarching Joint All Domain Command and Control (JADC2) concept, Project Convergence provided a large-scale environment to link disparate systems and attempt to share data vital to situational awareness, command and control, and joint fires, while collecting feedback from soldiers.

Results from the exercise will feed into the Joint Chiefs of Staff to inform its work on the Pentagon's Joint Warfighting Concept and JADC2 — the high-level concepts that define how the military will fight in the future.

"I've seen exponential progress since last year," said Gen. James McConville, chief of staff of the Army.

But while the participation of the different services might've been pleasing, the Army quickly realized that pulling in all kinds of data from dozens of sensors belonging to other services to make battlefield decisions is a complicated task they're still figuring out.

"The thing I'm most pleased about and most surprised about is the level of joint participation," Secretary of the Army Christine Wormuth told reporters on the plane back to Washington, D.C., last week. "What you really saw in Project Convergence today is the services working together against a common challenge."

Jointness, And Trying To Bring Four Screens Into One

Since late last year, the Army has focused on augmenting Project Convergence from a service-specific event to a joint experiment with a focus on connectedness, a top priority for JADC2 across the military.

Last year incorporated flyovers from Marine Corps F-35s and tests with special forces. This year included all the military services.

The joint nature of this year's Project Convergence started with the establishment of a three-star level joint board of directors, including all the services and representatives from the Joint Chiefs, that molded the sensor-to-shooter event. Of the more than 100 technologies tested, 35 originated with other services.

"So this whole exercise design, the data collection plan, from what technologies were going to participate, to how we were going to do things, was a joint decision," Murray said.

Project Convergence consisted of seven scenarios, three of which centered on joint operations: joint situational awareness, joint air and missile defense, and joint fires.

For joint situational awareness, the teams in Yuma worked to integrate the various service's systems for a common battlefield vision for commanders. What they found were "some challenges with this idea of how do we, as services, share information and maintain a single view of what that common operational picture will look like," said Abadie.

Murray told reporters it was a challenge because each service has developed their own disparate situational awareness tools. Right now, if a commander wanted a joint common operating picture, they would need four different screens, he said.

A soldier takes part in an IVAS-enabled air assault exercise during PC21. (US Army/Elijah Ingram)

"I don't think it's a technology problem. It is a process and procedure issue," Murray said. "Each of the services have systems to maintain situational awareness. Getting them to integrate and talk together, how the procedures [and] policies that different services use, when to display what, was really the problem."

Trouble with data and message formats, for instance, was one of the major takeaways from the event, Murray said. When leaders on the ground reached out to the Joint Staff to discuss the challenges with integrating the service's common operating pictures, they sent a team to Yuma.

"So we're hoping to see that in a future experiment, we can take whatever output the Joint Staff gives us with these new message formats, and then do the experiment again, and see if we can bridge the gap that we had," Abadie said.

The Guam Question: How To Coordinate Missile Response Across Services, Much Less Sensors

A joint air and missile defense scenario raised particularly potent questions for the military, Abadie said, because high latency between joint force sensors means commanders don't have the accurate location of a missile threat. The scenario involved two incoming ballistic missiles with joint force sensors tracking, coordinating and ultimately deciding who takes the missiles down.

"If it's over the water, the Navy knows they're the ones who shoot it down. If it's over the land, maybe the Army knows they're the ones that shoot down. But if I'm on an island, is it maybe confusing? I don't know," Abadie said.

"I'm sure there's processes and procedures, but we just wanted to play with that idea. And that idea of, can we link the services together? Can we work through something to where they can share that information? And when we go back to a lesson we had in PC20, how do I go from all sensors to the best shooter?"

Project Convergence was an opportunity for the joint force to make progress on tying together the services' disparate fires networks, Abadie said. In a media roundtable at the end of the exercise, air and missile defense was an area McConville highlighted as an example of where successful fusion of services' sensors would provide increased protection.

"You can bring to bear all the capabilities of the joint force, where prior we looked at maybe a Patriot missile system only being able to use the Patriot radar to engage targets," McConville said. "But there's multiple radars and sensors on the battlefield and if we can capture all of them we have much, much more capability."

Unmanned Aerial Systems were part of the PC21 events at Yuma, (US Army/Marita Schwab)

The third scenario centered on the military's response to the missile attack after the fact, with the US force using joint fires to respond to track and strike the missile's point of origin.

While the scenario worked to integrate different fire options for a joint force commander to provide them with that "optionality" the Pentagon wants leaders to have with JADC2, it also scrutinized "simultaneity," Abadie said.

"We tried to evolve that idea of optionality to simultaneity. So now instead of saying, 'Hey, there's four options,' now let's say, 'Hey, you can do two of them at the same time,'" Abadie said. "Now I'm realizing this idea of providing the enemy multiple dilemmas — simultaneity. And so we want to explore that. That's hard too. It's hard to be able to say two different services are going to do something similar at the same time."

What's ultimately important for the joint force, McConville said, is accelerating the decision-making process for a combatant commander. The military needs to use the joint infrastructure to find targets, pass that data to the right command and control system, and quickly into the best weapons system to fire, he said.

"We want to provide the combatant commander with multiple options of different types of forces that can work together, really to deter any strategic competitors in the region," McConville said. "And that's what I'm seeing."

What's Next? Going Global

As Army and Joint Staff leaders now sift through the results of this year's event, Project Convergence 22 is already in the early stages of planning. Next year's event is going even broader and will focus on connecting the advanced warfighting systems and concepts to coalition partners — a scenario certain to reveal even greater technological complexity issues.

"Next year, we'll have coalition partners," Abadie said. "The Army doesn't fight alone … So we need to work the ability to partner."

There are already known challenges to linking joint force networks with allied networks that the Army will have to work through. US military officials have acknowledged that security classification poses a major issue in passing data from US battlefield networks to allies because tactical networks run on the classified level.

Wormuth said that including Five Eye partners — Australia, Canada, New Zealand, and the United Kingdom — for PC22 would be a good starting place for next year because of the intelligence sharing relationship the US already maintains with those countries.

As for how long Project Convergence will go on, Army officials stressed that the event will continue to hold value as long as the service is continuing its modernization effort amid its pivot to more advanced warfare against near-peer threats.

Crew members with 2nd Battalion, 82nd Aviation Regiment Assault Helicopter Battalion, 82nd Airborne Division, take part in an air assault exercise during PC21. (US Army/Destiny Jones)

Wormuth said that there will be an endpoint one day, perhaps even in less than 10 years, but for now, the annual experiment needs to continue as concepts develop and technology advances.

"Frankly, we went for 20 years as a joint force without a lot of experimentation, without paying a lot of attention to innovation because we were so busy with the COIN [counterinsurgency operations] and the counterterrorism fight," Wormuth said. "As a result countries like China made a lot of progress in those intervening years. So I think we have quite a bit still of experimentation and innovation to do.

"My own sense coming out of this cycle is that, you know, certainly I think we need to continue Project Convergence for a while longer."

Robotic vehicles, drones coordinate recon at Army's Project Convergence 21

"It's this idea of collaborative sensing," said Col. Andre' Abadie, referring to one autonomous system talking to another to, say, confirm enemy positions or equipment.

A Robotic Combat Vehicle navigates in the field during Project Convergence at Yuma Proving Ground, Arizona, on October 20, 2021.(Spc. Destiny Jones/US Army)

By ANDREW EVERSDEN on November 22, 2021 at 11:51 AM

YUMA PROVING GROUND, Ariz.: Four small quadcopters equipped with ISR gear search the battlefield for the enemy. On the ground, four robotic combat vehicles drive across the terrain doing the same. During the mission, the pair are communicating and coordinating the unmanned recon mission.

"It's this idea of collaborative sensing," said Col. Andre' Abadie, co-lead for the Project Convergence 2021 operational planning team. "It's one thing to have one sensor do aided target recognition and say, 'I see an enemy tank.' It's another thing when a sensor can say 'I see an enemy tank. Hey, guy from the air, tell me, is that a tank? Hey, other guy from another angle tell me is that a tank?'"

On the future battlefield, the Army plans to use combinations of autonomous platforms from future land vehicles to high-endurance drones to provide situational awareness and to undertake missions often perilous to soldiers, including target identification, reconnaissance and resupply — hopefully talking together the whole time. The new methods were tested in seven broad scenarios at Project Convergence, the Army's annual sensor to shooter experiment, meant to recreate specific challenges in future, complicated joint warfighting.

"The common perception is that robots remove a human from the battlefield and take them out of harm's way potentially," said Lt. Col. David Olsen, operations officer for the Next-Generation Combat Vehicle Cross-Functional Team, during a media day earlier this month. "We look at an additional aspect of that is that a robot can bring more capability to the battlefield that a soldier can put on their back, or that we can necessarily mount on every single vehicle."

At the exercise the Army also experimented with targeting and engaging targets using its Firestorm technology, which ingests battlefield data passed from ISR platforms and recommends to human operators which weapon system should take a shot. PC21 this year involved more platforms and increased its focus on linking them together, Olsen said.

"Last year, we had more so individual platforms that were sensing and engaging targets," Olsen said. "Now we're sharing it across that whole formation."

For autonomous land vehicles, PC21 pushed them in a new direction: off road. Last year, Abadie said the service gave autonomous vehicles waypoints to drive. This year, vehicles were told what their area of reconnaissance was and were left to operate on their own.

"Those robotic vehicles and their ability to collaboratively sense decided how to recon that area on their own, and then decided how to report back those threats to the C2 [command and control] node," Abadie said.

That's a significant development, Olsen said, because it "reduces the task load on the soldiers and puts it on those autonomous systems to increase our capability overall." Next year, the Army wants to test those capabilities at night, Abadie said.

However, the Army is still contending with a unique challenge not seen in the civilian world of self-driving cars. Some self-driving cars can use LiDAR, a type of radar sensing, to see stop signs, pedestrians or street lights. The Army can't because LiDAR can easily be detected on the battlefield.

"It lights me up like a Christmas tree. I'll die soon," Abadie said. "So we have to use alternative ways of sensing the terrain. And so it is truly a hard problem to do off-road autonomous navigation."

Surrogates for future ground vehicles were included in a third scenario simulated an AI-enabled ground attack. Olsen said that surrogates for future tanks paired with UAS systems and dismounted soldiers to make targeting decisions.

During that scenario, Olsen said, dismounted soldiers identified an enemy vehicle using a small drone and determined they would be unable to defeat it using their own systems. Using the network, soldiers passed the location of the enemy tank to a friendly tank to engage.

The scenario was a "great demonstration of the flexibility that these linkages that that network provides us," Olsen said.

Progress For An Autonomous Helicopter

Soldiers are pinned down and surrounded by the enemy. They are running out of supplies, and any manned resupply mission would be perilous.

But in an Arizona desert earlier this month, the Army showed that the resupply could be done without putting any more troops in harm's way by instead using remote-controlled full-sized choppers like a UH-60 Black Hawk.

"This is a hugely powerful capability," said Stuart Young, program manager at DARPA, at an October media day for Project Convergence 2021. The Black Hawk resupply experiment was done as part of DARPA's advanced autonomous flight program, called the Aircrew Labor In-Cockpit Automation System.

The ALIAS program successfully completed an autonomous resupply mission at Project Convergence, though with safety pilots on board. The demonstration at Project Convergence could prove useful for the Future Vertical Lift Cross-Functional Team as it develops two new future helicopters: the Future Attack Reconnaissance Aircraft and the Future Long-Range Assault Aircraft. Both will have a need for some degree of autonomy.

The ALIAS provides an opportunity for the service to "learn a lot about autonomy and what specific requirements the Army would want," Young said.

The ALIAS program could benefit the service more broadly as it thinks about the future of its Black Hawk fleet.

"We can add autonomy to our enduring fleet," Young said. "So think about all of those Black Hawks that we have in our enduring fleet right now. We have the opportunity to increase their mission endurance and duration of time, and the flexibility of mission sets that [the Army] can do with them."

At the Future Vertical Lift media day at Project Convergence held Oct. 26, Breaking Defense saw in-person the first autonomous launch of an Air-Launched Effect-Small, or a small drone, that carried ISR capabilities. In January, the ALIAS program will complete its first fully autonomous flight without safety pilots.

A manned UH-60 flies at Project Convergence 21. In the future, the helicopter could fly unmanned for missions such as resupply. (Courtesy of FVL CFT)

It's a crucial capability that could save lives on dangerous missions in the future, but it's usefulness extends beyond that, according to Maj. Gen. Walter Rugen, director of the future vertical lift cross-functional team. It could also serve as a massive boon to Army logistics.

"On the logistics front, when you look at what ALIAS is doing [with] the absolute cargo carrying capacity of the Black Hawk and the range, I haven't seen a UAS meet that yet," Rugen said. "Somebody is gonna have to come up with a pretty compelling UAS that's vertical lift that can carry that amount and do it at that range and so I'm excited about that, too."

Networks as 'center of gravity': Project Convergence highlights military's new battle with bandwidth

In desert experiments, Army races to develop tactics for transferring data — and realizes high-def video can create potentially fatal data bottlenecks.

An Unmanned Aerial System is prepped during PSC21. (Marita Schwab/US Army)

By ANDREW EVERSDEN on November 23, 2021 at 8:25 AM

YUMA PROVING GROUND, Ariz: Soldiers are packed into a UH-60 Black Hawk flying to their objective. A small drone carrying ISR sensors launches off the side of the helicopter, buzzing off to scout ahead. The drone streams back a live video feed to the pilots and alerts them to an enemy threat on the ground.

The pilots communicate the threat information to other Black Hawk pilots transporting troops, and the fleet quickly changes its route. As the Black Hawks land at the objective, cameras on the outside of the choppers send live videos to soldiers' augmented reality goggles, giving them a look outside before they even dismount.

This scenario from the Army's Project Convergence, an annual experiment in connecting sensors and shooters that wrapped earlier this month, showcased potentially life-saving and battle-winning equipment — all of which rely squarely on resilient, uninterrupted and invisible network connections to pass all that data back and forth.

But like air dominance, that healthy network is far from assured in future conflicts, especially if it comes under electronic attack from Russian or Chinese forces. That's why, amid testing more than 100 new technologies, Army leaders in the desert recognized the network itself as the backbone of future conflicts and have started grappling with the realities of the coming battle over bandwidth.

"One of the challenges that we saw out here is really the network and bandwidth. What information do you want to pass because you do have limited bandwidth?" Lt. Col. Dave Olsen, operations officer with the Next Generation Combat Vehicle Cross-Functional Team, said at the close of the exercise Nov. 9. "So working on those efficiencies of communicating data quickly, but also not overwhelming the network… that's always going to be something we're going to have to build on."

The network, according to co-lead of the PC21 operational planning team Col. Andre' Abadie , "is the center of gravity… The network is the critical path forward for the joint force."

At Yuma Proving Ground, the Army toyed with different types of data packages, resilient waveforms to withstand interference, battlefield data management tools to strengthen links between joint force systems in combat and network extensions tools to connect ground assets to help in the air or even low-earth orbit. This year's Project Convergence saw 27 sensor-to-shooter links accomplished, 21 more than last year.

"It was very clear to me coming out of this that the network is really going to be foundational at making sure that we can have [an] assured, reliable, resilient network underlying all of the systems that we're using," Secretary of the Army Christine Wormuth told reporters at the exercise's media day.

So as the service continues to make tough decisions on budget decisions, Wormuth specifically pointed to the network and as well as assured precision, navigation and timing (APNT) technology, as capabilities the Army will need to protect.

"As I think about the budget, I'm thinking about those are capabilities, I think, we know that we're going to have to make sure that we have resources for," Wormuth said.

When High-Def And 'Oversharing' Is A Problem In Battle

As the military moves forward with the concept of Joint All-Domain Command and Control (JADC2), in which joint force sensors and shooters are linked, the military must be able to pass data to a sister service's sensor. This year's Project Convergence provided a forum for all the military services to experiment with integrating disparate warfighting systems — and they found out how hard it can be.

But beyond integration, and with jets flying overhead, soldiers on the ground and ships at sea — all passing data between each other — the military will have to optimize its use of network bandwidth to keep critical information moving smoothly.

For instance, the air assault scenario using the augmented reality goggles, formally called the Integrated Visual Augmentation System, was the first time the service successfully shared "stabilized video" between aircraft using IVAS. But it revealed pointed network issues, according to Travis Thompson, deputy director for the Soldier Lethality-CFT.

"If you want high fidelity, that's large bandwidth — and was that more valuable than just a picture?" Thompson said. "A picture in many cases did the exact same thing, [it] could go through at a higher resolution, inform the decision better. But we … were going video."

As the service ran those types of experiments, it started "being smarter," Thompson said. "We learned that different wavelengths and which way we share that information also allows us to either move faster, or to inform that decision in a better way."

Cross-functional teams working together also encountered network issues during an experiment involving Future Vertical Lift Cross-Functional Team (FVL-CFT) and NGCV systems, connected by a small drone. In that case some assets were "oversharing and causing problems [and] taxing our network unnecessarily," according to Network-CFT Chief of Staff Col. Eric Van Den Bosch.

Maj. Gen. Wally Rugen, director of the FVL-CFT, echoed Van Den Bosch during an October media day in Yuma, adding "those rates are important … and we're playing with that so the data doesn't just flood the network with superfluous things."

The FVL team has worked on being more efficient with passing small data packages across the network since last year's Project Convergence. Those packages can now be sent automatically, but still required some refining at this year's event.

"They were real rough at first because of the multitude of players here on this network and so there was some complaints that it was a little grainy," deputy director of the FVL CFT Jim Thomson said, referring to a picture of a target that was ultimately fixed. "So we now have a really good baseline to write a requirement based on what we learned over the last 18 months."

As efforts move forward, the Network Cross-Functional Team's common data fabric, known as Rainmaker, may be able to help sift through and route data. Merely in the proof of concept phase last year, this year Rainmaker integrated Army and Air Force systems, merging data from disparate mission command systems.

According to Lt. Col. Stephen Kirchhoff, air to ground lead and lead network planner for PC21, as the technology further matures, the data fabric and artificial intelligence could be used not only to integrate the data, but to prioritize it so both the network and commanders aren't overloaded with information.

"They're not going to need to know the location of your Alpha team leader on the ground," he said. "But as we connect sensors to these edge networks, if something senses a high priority target that piece of information probably is relevant to the division commander. So the challenge becomes how do you identify what information needs to go from edge up through echelons so that the relevant data is getting to your division commander."

Network capabilities were a big part of PSC21. (Destiny Jones/US Army)

Leveraging Air And Space For Network Help

While Project Convergence stretched emerging technologies to its limit, the 82nd Airborne Division brought its new Integrated Tactical Network gear that connects ground troops across the battlefield using new hardware such as radios, waveforms and small satellites terminals. The experiment showed that that gear works against simulated adversary threats at Project Convergence.

"One of the biggest things that we've taken away from this is that the Integrated Tactical Network is very robust. It's living up to what we thought it would be," said Maj. Gen. Chris Donahue, commander of the 82nd Airborne Division. "I think it's a very capable network to go forward as we continue to develop."

But should ground-based systems fail or come under attack, the Army is looking upwards to provide network extension capacity and other communications options when jammed. Using small long endurance drones, for instance, the FVL-CFT tripled the length of its network from PC20. Those drones will be a useful tool over the vast distances of, say, the Indo-Pacific.

"Aerial platforms — if they're in kind of a dedicated communications relay role — we've shown that they can extend the mesh network out to greater distances [and] provide greater coverage," Kirchhoff said.

This year the service also saw improvements in coverage from satellites in low-earth orbit, with just a few minutes available during last year's event to near 24/7 coverage of Yuma Proving Ground, according to Van Den Bosch. The addition of LEO satellites to provide another networking route promises higher throughput and lower latency because they are positioned closer to the earth.

Van Den Bosch said the service successfully demonstrated the ability to automatically "fail over" to an uninterrupted SATCOM path in mid-Earth orbit or geostationary orbit, a valuable communications capability for a jammed environment.

"There's opportunity to move forward, to keep the gas on, bringing that capability to the fore," Van Den Bosch said. "So we're looking for opportunities to partner with operational units to gain more information, how they can leverage those satellite constellations and then come back to PC22 and learn more."

Maj. Gen. Christopher Donahue, commanding general of the 82nd Airborne Division. (Emily Opio/US Army)

Overall, Army leaders said this year's Project Convergence was successful in that it identified weaknesses in its current strategies, from network resiliency to successfully integrating all the data that does come through the network to understanding just how mindbogglingly complex the future battlefield may be.

Next year's Project Convergence, which is expected to involve US allies as well, promises even more complexity.

"What may not be a problem for the Army may be a problem when it goes to the Air Force or vice versa," Thompson said. "We're having to learn that on a much larger scale next year with coalition forces."

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