Lasers Destroy Drones as Additive Manufacturing Builds Them: NPS Accelerates Emerging Technology at JIFX to Fulfill U.S. Navy and DOD's Critical Needs

From Dan Linehan, March 21, 2025

MONTEREY, Calif. – Rapidly fielding emerging technologies and prioritizing investments in AI, drones, and counter-drone systems, among other technologies, are key to military modernization and remaining the strongest, most lethal force in the world.

The Joint Interagency Field Experimentation (JIFX) team at the Naval Postgraduate School (NPS) is meeting this challenge by

executing another highly collaborative week of rapid prototyping and defense demonstrations with dozens of emerging technology companies. Conducted alongside NPS' operationally experienced warfighter-students, the event is a win-win providing insight to accelerate potential dual-use applicationtops.

Conducted in partnership with Camp Roberts, the California Army National Guard post in southern Monterey County, and occurring quarterly, February's weeklong JIFX featured innovative technologies that directly addressed many of the needs designated within DOD's Critical Technology Areas, including: Directed Energy, Trusted AI and Autonomy, Advanced Materials, Integrated Sensing and Cyber, Operational Energy Generation and Storage, and much more.

Even though downpours from a week of heavy storms made for less-than-ideal flight conditions in the unrestricted airspace available for use during JIFX, a single-day record for sorties flown by uncrewed autonomous systems (UAS)—or drones—was broken. On the third day, 85 sorties were flown by 11 different drones at three different tactical locations—McMillan Airfield, the Combined Arms Collective Training Facility (CACTF), and the Forward Operating Base (FOB).

According to JIFX Director, retired U.S. Army Special Forces Col., Michael Richardson, "This February event was the most engaging experimentation week since before the pandemic. Part of that was the weather. The periodic heavy rain and strong winds gave our participating firms the same challenging conditions their technologies will be expected to perform if part of the fleet or force.

"I'm happy to report that all of them rose to the challenge. Several firms accomplished firsts with their systems and nearly everyone collaborated in an ad-hoc experiment or two that demonstrated their capacity to address operational

challenges more effectively together.”

The hard rain and wind did not even deter a laser weapon system (LWS) from zapping a steady stream of static and towed Group 1 UAS. This was the first use of an LWS at JIFX over the course of its nearly two decade-long history.

During the week, 23 industry partners conducted experiments with 24 unique technologies that represented the following research areas:

– Communication and networking

– Countering uncrewed systems (including by laser weapon systems)

– Cyber, cyber security and electronic warfare

– Expeditionary operations (including with additive manufacturing)

– Infrastructure and power

– Precision strike, non-lethal weapons and information operations

– Situational awareness

– Uncrewed aerial systems

– Uncrewed systems design, deployment, operation, networking and control

These technologies were evaluated by DOD stakeholders from Air Force Special Operations Command (AFSOC), Army Futures Command (AFC), Department of the Navy Small Business Innovation Research Experimentation Cell (DON-SEC), Defense Threat Reduction Agency (DTRA), Joint Special Operations Command (JSOC), Navy Special Warfare (NSW), U.S. Central Command (USCENTCOM) and U.S. Transportation Command (USTRANSCOM).

JIFX lowers barriers for emerging technology companies, industry, academia, and researchers to collaborate with the fleet/DOD on solving real-world problems in a DevOps environment with the warfighter. Attending JIFX were 18 NPS officer-scholars and faculty, some of whom were researching counter UAS technology in preparation for an upcoming international exercise.

LASERS VS. DRONES, BATTLEFIELD POWER, AND EXPEDITIONARY ADDITIVE MANUFACTURING

Perched on a firing range hilltop, an LWS fielded by Aurelius Systems blasted Group 1 quadcopters at ranges of 50 and 110 meters—the longest distance that Aurelius had ever engaged a target.

“We’re demonstrating that if there’s a drone out there, then we can enter a sentry mode, scan an area of the sky or backdrop against the ground or a mountain, identify the drone, continue to track it as it moves around and bring the laser to bear on it,” said Michael Laframboise, Aurelius’ founder and chief executive officer (CEO).

The LWS used near-infrared fiber lasers, and the targeted drones were initially affixed to static mounts then later towed along by a moving target gunnery line.

JIFX plays an important role in the steps of Aurelius’ LWS development. “It can be difficult to get access to firing ranges if you’re a small company like ours,” added Laframboise. “We can come out here to test and do live destructive firing.”

Aurelius intends to bring their LWS to the next JIFX event in May. Based on their successes this go-around, they’re planning to use more powerful lasers and live fire at free-flying drones.

On that same hilltop, Chariot Defense pulled up in a pickup

truck with its advanced high-voltage battery system, which only took up half the space in the pickup's bed. To reduce the detectability of the LWS' presence and demonstrate improved portability, the three large, heavy, noisy, inefficient, and high-thermal signature generators running on fossil fuel and powering Aurelius' LWS were disconnected.

"We provided expeditionary power solutions for a number of different experiments," said Adam Warmoth, founder and CEO of Chariot. "More and more, on today's modern battlefield, there's a demand for power—to power computers for AI, to power sensors, to power electronic warfare equipment. That's the kind of equipment you need in today's environment."

Chariot's low-signature battery system emitted very little heat and was smaller, quieter, lighter, and more efficient than just one of the three generators used by Aurelius. It not only powered successful shots of the LWS, but it also had enough remaining juice to fire over 1,000 more blasts.

Several miles away, at McMillan Airfield, Firestorm Labs had set up its mobile expeditionary additive manufacturing station called xCell. Within its two, 20-foot-long shipping container-like sections, equipment fabricated the airframe components of Firestorm's Tempest, a modular Group 2 multimission UAS.

"The idea for xCell came to fruition so that we could manufacture our drone at the edge in a contested logistics environment," said Bill Buel, vice president of hardware at Firestorm. "But during development, we realized there's also a much broader need for xCell as producer for spare parts and other drones. It doesn't even have to be our drones. So, we really embrace that."

The concept of flexibility continued to be exercised with Firestorm's Tempest. It carries payloads of 10–20 pounds over ranges of 100–675 miles at speeds of 75–150 mph, depending on its variable configuration and plug-and-play engine—turbojet

(high speed) or pusher prop (extended range).

“We have taken an operator first approach, and we want to empower the operator to make this truly modular,” Buel continued.

Inside the xCell miniature factory, the interchangeable airframe components piled up—a nosecone with a camera port, fuselage segments for payloads, wing and tail segments. But outside, Chariot arrived on the scene ready to collaborate. A large, bulky generator ran both the printing and assembly sides of xCell.

While the generator could power three to four xCells, the technologists understood that one xCell would require more power output for the complete drone making operations than a single Chariot battery could provide. But Chariot was still able to make a high voltage connection to the assembly side and provide power to run some of its components.

“We were able to power Firestorm’s mobile manufacturing station off our battery, providing increased reliability, decreased fuel usage and the ability to power it at the edge where it matters,” Warmoth added.

NPS OFFICER-SCHOLARS INTEGRATE JIFX

It wasn’t all just high energy lasers, drones (one of which was rocket-assisted), and other wide-ranging, cutting-edge technologies. In preparation for the Bold Machina (BOMA) exercise run by Allied Special Operations Forces Command (SOFCOM) later this year, NPS officer-scholars, who are participating in a BOMA-directed studies program at NPS, visited JIFX as part of their coursework.

NPS Vice Provost of Research and Innovation, Kevin Smith, helped develop the BOMA program and escorted the NPS officer-scholars and faculty members to JIFX.

“JIFX is a tremendous asset to the DON, DOD, and industry partners,” said Smith. “More than simply a field experimentation venue, JIFX provides a low-cost option for industry to receive real-time feedback on emerging tech, both on technology readiness as well as operational relevance. Seeing these types of direct engagements between the warfighters and the companies pursuing solutions to support them is extremely valuable.

“The BOMA-directed study class benefited greatly from the opportunity to directly engage during these JIFX tests to better understand the processes by which technologies can be rapidly evaluated and accelerated for adoption, and is a great example of how JIFX fits into the NPS innovation operating concept.”

A total of 18 NPS officer-scholars attended JIFX, though not all were affiliated with BOMA.

“JIFX was a great opportunity for us to get a deeper understanding of how industry is connected to the military,” said U.S. Navy Lt. Charlotte Lohr, a surface warfare officer studying operations research.

Like the others, she joined the BOMA program at NPS on top of her existing studies. She was especially interested by the synchronized operation of the five drones flown by Gambit Defenses on patrol, follow-the-leader, and follow-the-target missions at JIFX.

“No matter your background, we come to NPS with subject matter expertise in our community,” said Lohr. “So, it’s cool to be able to offer our insights to industry. Even though I’m not highly involved with them, I was able to have conversations about how their products could impact the future of my community.”

The NPS officer-scholars in the BOMA program with Lohr are tasked with developing a technological solution for countering

drones that can potentially be fielded during the BOMA exercise, which will be run off the coast of the Netherlands this fall. By attending JIFX, they got firsthand exposure to innovative technology well before it has a chance to become available to the fleet, and they learned about the process of turning emerging technology into operational technology.

“I was impressed at JIFX by their practice of bringing together the warfighter, academia and industry in same place. This speeds up the pace of research and development,” said a Swedish special operations officer studying at NPS and participating in the BOMA program, who also noted that the antenna and battery technologies at JIFX were among those that stood out him.

“Today, it’s so much about personal relationships, and JIFX allows you to establish relationships with industry representing different kinds of technologies all in one place,” said the Swedish officer. “I actually heard different companies working together to leverage their respective products. So, I think JIFX is a really good driver for fast development addressing the problem sets that DOD and the different special forces commands have.”

REAL-WORLD TECHNOLOGY EVALUATORS FILL OPERATIONAL GAPS

The February JIFX event was sponsored by NavalX. NavalX is a U.S. Navy and Marine Corps organization that drives collaboration, discovery, learning, experimentation, innovation, and agility to address critical needs of the military community.

“JIFX is a great platform for NavalX and invaluable to DON and DOD. We get the early look at technologies and capabilities on the horizon,” said Troy Clarke, the Inland Empire Tech Bridge Director for NavalX. “It gives us a regular, quarterly drumbeat to iterate more quickly and lets us get developing technologies into the hands of the end users—the

warfighters—faster. It also draws a collection of at least 30 outstanding evaluators from across the government."

Many of these evaluators are active duty or civilians who've already had long careers in the service. It's this brain trust that individually interacts with the technologists and provides them with vital feedback.

Describing a typical interaction at JIFX, Clarke added, "An evaluator says, 'This is what our warfighters are saying they need. Can you fill the gap? Can you make it do this?' The technologist says, 'Yeah, I could do that.' Then you bring the warfighters in, who say, 'This is how we use it in the field. Okay, now can it do that? And can it do that and that?' This real-world feedback coming from our end users really accelerates our technology fielding capability."

The effective exchange of thoughts and ideas between the evaluators and technologists has led to many impressive solutions coming from JIFX.

"I'm in an operational unit, and, throughout the years, I've attended JIFX," said an NSW Sailor, who has been evaluating technologies at JIFX since 2012. While on deployments, he uses technology developed through JIFX, like the ScanEagle, a sweptwing, propeller-pushed UAS that's often used for reconnaissance.

"Insitu brought it to JIFX and showcased it," continued the NSW Sailor. "An NSW team was out there and part of the initial down select."

Since then, for well over a decade, ScanEagle has been an operational mainstay across the armed services. In fact, in 2009, a ScanEagle deployed by the USS Bainbridge (DDG-96) helped the NSW operation to rescue merchant mariner Capt. Richard Phillips, who was held hostage by pirates inside a motorized lifeboat in the Indian Ocean.

Another JIFX success is the Flying Launch and Recovery System (FLARES), a gangly-looking, quadcopter mothership that can—in midair—release and retrieve a ScanEagle, which has a wingspan of about 10 feet.

“We needed an expeditionary launch and recovery system,” added the NSW sailor. “JIFX had Hood Tech bring FLARES. So, a bunch of us came out and learned how to operate it. We went back to our acquisition people and said, ‘We must have this. It addresses our operational deficiency.’ The normal process would have taken three to five years. Because of JIFX, we had it in less than two years.”

As the list of field technology spawned at JIFX continues to expand, NavalX introduced new technology of its own called the Defense Innovation Navigation Assistant (DINA).

“DINA is being developed to help NavalX, evaluators, end users and companies navigate the defense innovation system,” said Clarke. “We wanted to leverage the power of artificial intelligence, machine learning and data science to help the process of accelerating and fielding usable technology.”

An application that can be run on a phone, DINA records conversations and uploads them for transcription and summarization by NavalX’s AI natural language processing. DINA was initially tested during daily briefings with the technologists at JIFX in November 2024. During JIFX last month, some of the evaluators used DINA during their interactions with the technologists. As development continues, more and more information will be integrated, such as technical product specifications provided by the companies.

When fully developed, NavalX envisions DINA will be an effective tool that further helps NPS and JIFX facilitate and improve the rapid transfer of technological solutions to the warfighters. DINA is just another example of JIFX looking to best meet the challenges of equipping them in the face of the

rapidly changing modern battlefield.

The NSW sailor reflected over his years going back and forth between deployments and attending JIFX events. It’s not easy adding or making changes to mission critical equipment in a timely manner.

“We need to get better with our procurement process,” he said. “We need to be able to keep up with peer-to-peer competition, which means we need to get after new technology faster. We need to innovate. And that’s what JIFX is, allowing collaboration to happen in a controlled environment. It’s innovation at its best.”

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Participation in Joint Interagency Field Experimentation (JIFX) events does not constitute endorsement of participating companies or their products or services by the Naval Postgraduate School, the Department of the Navy, or the Department of Defense.