

Energizing the Technology of Tomorrow

*Naval Postgraduate School (NPS)
Jumpstarts Defense Innovation at JIFX*

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Joint Interagency Field Experimentation
(JIFX) events continue to advance and
accelerate the development of new
technologies that are vital across the
joint force for readiness and battlefield
advantage in contested
environments.

Autonomous swarming, artificial
intelligence (AI) and machine learning
(ML), uncrewed drones by land, sea,
and air, counter-drone detection, high-
energy laser weapon systems, GPS
denied navigation, C5ISR (command,
control, communications, computers,
cyber, intelligence, surveillance, and
reconnaissance) systems, advanced
energy systems, and expeditionary
additive manufacturing are just some
of the wide-ranging technologies that
have undergone experimentation and
development at JIFX.

During a week of experimentation held
in August 2026, nearly 200 uncrewed
aerial vehicle (UAV) sorties executed
experimental flight tests throughout
the vast airspace accessible through
JIFX. This brings the tally up to 635 sorties flown during the past year at the [Naval Postgraduate School](#)'s (NPS) quarterly JIFX events, held in southern Monterey County at the California National Guard's Camp Roberts.



The Combined Arms Collective Training Facility at Camp Roberts is one of several training sites where experimenters can test and evaluate emerging technologies during NPS' Joint Interagency Field Experimentation (JIFX) events.



Of the 269 participants at JIFX from industry, defense, and academia organizations, 60 are mid-career officers who study at Naval Postgraduate School.

The sorties pushed the boundaries of new UAV designs and upgrades to existing UAV hardware, software, controls, and operations. Though the aim for each sortie differed, one immediate factor underscored each experiment — how energy and innovation drive advantage in the future.

DRONE DOMINANCE FUELED BY JIFX

ModalAI, Firestorm (watch slow motion [impact of its jet-powered Tempest](#)), and Greensight (watch drone launch from its WeatherHive) participated in the U.S. Department of War's Drone Dominance Program (DDP) competition, set to wrap up in 2027. Firestorm and Greensight are frequent JIFX attendees. And ModalAI, which attended JIFX twice, made it into the final DDP selection and is still in the running. So far, it has shipped over 2,000 drones to DDP.

Back at JIFX, a small fleet of ModalAI quadcopters, operated by Gambit Defense, also made an appearance. The Gambit test flights hit the radar of JIFX director and NPS faculty member Michael Richardson.

"The experiments with autonomous swarming activity by Gambit have been very powerful," said Richardson, who is also a retired U.S. Army colonel and former special operations officer. "Gambit is a great example of the many companies that come to JIFX and show incredible promise, particularly with respect to advancing the drone warfare doctrine of Pacific Command."

Gambit experimented with its AI/ML mesh network system under contested electronic warfare



Inside the Technical Operations Center at JIFX, experimenters use AI and machine learning to drive command, control, communications, computers, cyber, intelligence, surveillance, and reconnaissance (C5ISR) technologies.

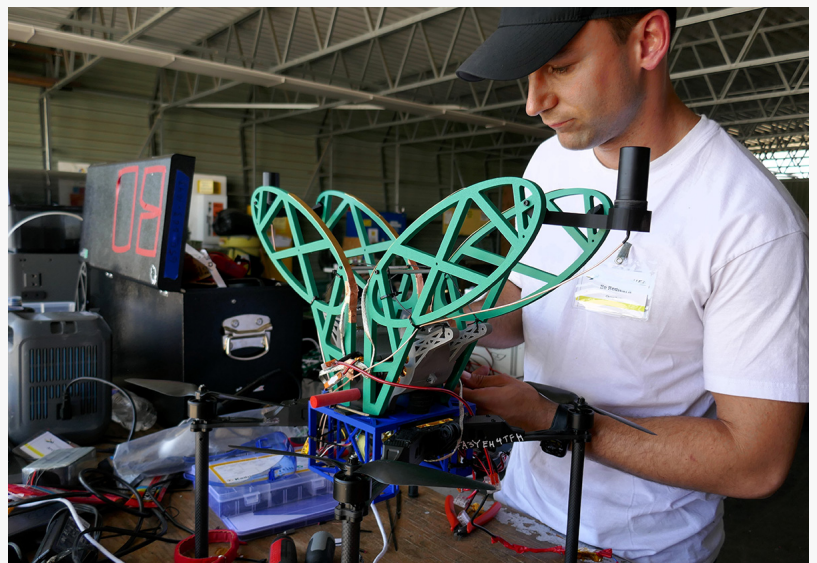


Two researchers from the U.S. Army Combat Capabilities Development Command (DEVCOM) Army Research Lab operate extended reality heads up displays (HUD) to interface with a robot inside a Combined Arms Collective Training Facility at JIFX.

conditions. It flew dozens of sorties for autonomous target detection, follow, patrol, and swarm missions. When jammed, its drones automatically maintained communication.

Like Gambit, Rhoman Aerospace is a frequent participant at JIFX providing software solutions for different drone platforms. During a separate field experimentation effort, it provided a system for GPS-denied navigation over open water to NPS researchers and Naval Special Warfare operators.

Had it not been for experiments by Rhoman at previous JIFX iterations, this collaboration with NPS would not have happened.



For test flights, a Chargebotic engineer builds the clamping system for a parasitic, energy harvesting UAV from 3D-printed parts made on the spot at JIFX.

“From JIFX to JIFX, we see industry make iterative development as we poke and push them in different directions,” Richardson emphasized. “JIFX is shaping change. It facilitates more effective connections between what emerging technologies can offer and the pressing needs of national security and defense.”

INNOVATIONS IN OPERATIONAL ENERGY

Reliant on batteries and liquid fuels, participants mobilized in hangars, on the tarmac, and along the flightline of Camp Roberts’ McMillan Airfield. From rows of workstations inside the Technical Operations Center, they also ran C5ISR experiments.

On a remote hill further across the base at the Combined Arms Collective Training Facility (CACTF), other experimenters interfaced systems with human operators to investigate urban structures from the air and ground. And, in between, GArmor’s experimental armored crew transport roved the surrounding terrain.

As UAVs buzzed above, new counter-UAV sensor technology scanned the sky to spot them with radiofrequency, passive radar, acoustic, and other forms of drone detection. These, too, needed reliable energy sources.

Optimizing the energy used by these technologies, through testing at JIFX, directly improves their application and longevity in operational environments.

“We see a lot of value in JIFX because energy is part of every technology, whether it requires energy, produces energy, or just absorbs energy,” said Michael Davis, associate chair of NPS’ Energy Academic Group and, like Richardson, a retired U.S. Army colonel and former special operations officer.

The Under Secretary of War for Acquisition and Sustainment’s Operational Energy-Innovation (OE-I) Directorate recently began providing support to JIFX. Davis is tasked with scoping out technological trends at JIFX and determining how these trends could potentially impact tomorrow’s battlefield.

“JIFX expedites technology transition. It helps technologies quickly become operational. With energy technologies, this can be challenging across the landscape of the joint force,” said Davis. Of much interest to him were the burgeoning technologies of Chargebotic and Haylon Technologies.

Chargebotic came to experiment at JIFX with its energy harvesting system. It used a UAV, modified with additive manufactured components printed on the spot, to clamp a tether onto a powerline to parasitically extract energy, extending its operational utility. After flight tests that dialed in the UAV’s altered performance characteristics, Chargebotic successfully attached to a live powerline suspended on a test rig and drew electricity from it.

This source of parasitic energy was just the kind of emerging energy trend Davis keeps an eye out for. Similarly, at JIFX in February 2026, Davis applauded Reach Power’s use of radio frequency waves to wirelessly beam energy that recharged the battery of a hovering UAV, increasing its station time by nearly ten-fold.

Haylon took a different approach to energy provision. Its multiple battery chemistry switching system allowed a device, such as a UAV, to receive uninterrupted energy from more than one type of battery. Switching depends on the device’s current performance requirements and the various strengths and optimal uses for different battery sources.

In the case of a UAV, which requires a large amount of energy for a short time during takeoff, it is powered by a battery type that can provide a boost of energy up front. But these types of batteries are quickly depleted.

Therefore, Haylon’s system would switch the battery type after takeoff. During the flight phase, the UAV would then be powered by a battery that cannot deliver high energy but instead provides a steady stream of energy over a prolonged duration. By mixing the best qualities of two different batteries, the UAV maximizes its energy efficiently, extending its operational range.

“We also want to make sure that we’re not adding to the logistical burden as we build new technologies, especially facing future challenges like constrained logistics and contested

environments,” added Davis. “So, by helping technologists understand this from early in their development and experimentation, we can help them avoid later slowdowns or complications as they get to higher transition readiness levels.”

JIFX BY LAND TO BOMA BY SEA

U.S. Navy Lt. Cmdr. Max Leutermann, an NPS and Special Operations Command (SOCOM) researcher, continued experimenting on a compact and mobile counter-drone system for boats used by special operations forces. As NPS students in 2025, Leutermann and Swedish Armed Forces Maj. Patrik Liljegard rapidly developed the system from scratch and used JIFX to field test an early-stage prototype that they mounted in a pickup truck’s bed.

“NATO required us to create a system that was passive so that operators who were on a small boat wouldn’t give off any sort of detectable signatures or emissions,” said Leutermann.

“While companies and other NPS students at JIFX flew their drones all around, we tried to detect them,” he continued. “Different types of drones at different altitudes, distances, directions, angles of attack. Our second goal at JIFX was processing what we detected and representing it on the navigation display.”

Building upon JIFX, they also successfully demonstrated the operation of their prototype aboard a proper boat at the Bold Machina (BOMA) 2025 exercise in the Netherlands, which was run by NATO Allied Special Operations Forces Command (SOFCOM).

The results were so promising that Leutermann and Liljegard reteamed months after having graduating from NPS, with SOCOM, NATO SOFCOM, and the Swedish Armed Forces providing support and funding for the continued development of the system.

At the latest JIFX, Leutermann and three Swedish programmers experimented on a much-refined version of their counter-drone system in preparation for NATO’s next BOMA exercise, held in September 2026 in Portugal.

In addition to collaborations with Latent AI (AI dataset generation), Haylon (dual battery chemistry), and Bellum Systems (passive radar), Leutermann’s counter-drone system was powered by Chargebotic using an expeditionary battery from Chariot Defense.

Last year at JIFX, Chariot had experimented with mobile, low-signature, and high energy battery development and powered Aurelius’ laser weapon system for drone defense and Firestorm’s expeditionary additive manufacturing station for drone building.

During the September BOMA — weeks after JIFX in August — Leutermann reported that he was making excellent progress on the Operational Data Integration Node (ODIN) of the c-UAV system. ODIN is an AI-driven, sensor fusion engine that collects and centralizes all data from the various

sensor platforms connected to the system.

“BOMA showed that the core ODIN architecture works in the field,” said Leutermann from Portugal. “We demonstrated passive RF cueing, autonomous visual search and tracking — including an RF-dark drone with no operator interaction — and ingested RADAR data into ODIN.”

AN ADVANCED TECHNOLOGY PROVING GROUND LIKE NO OTHER

What separates JIFX from field exercises and demonstrations focused on developing defense science and technology is that JIFX focuses on experimental campaigns — not the sales and marketing campaigns often seen at other venues. Participants conduct experiments with work-in-progress technology. They do not demonstrate polished products like at a tradeshow.

Over 30 experiments were successfully completed at the August JIFX by different organizations. Three focus areas emerged from these campaigns:

- AI-enabled decision advantage: experiments aimed at helping operators rapidly transform large volumes of data into actionable information.
- Autonomous systems in contested environments: experiments sought to improve the resilience and effectiveness of autonomous systems operating in denied, degraded, and contested conditions.
- Expeditionary sustainment and edge operations: experiments addressed the challenges of sustaining distributed forces in austere environments.

As a proving ground, JIFX affords a safe and secure environment with an infrastructure that allows participants to operate under real-world conditions and push their technology to the limits — and often beyond. Stakeholders from across the joint force with operational knowledge and experience provide the experimenters with insights into the actual needs of those in the field.

With the sprawling Camp Roberts as its backdrop, JIFX most recently hosted 269 participants from industry, defense, and academia organizations. As with past events, mid-career officers came to observe. They were students from across the service branches and international commands who are studying at NPS.

Most of these students were fresh from military deployments and had highly relevant experience related to the technologies undergoing experimentation at JIFX. They knew what worked well for them, what didn't work, and the operational and technological gaps that still needed to be filled. This gave them valuable perspectives into practical applications and operational uses, which they readily shared with the experimenters.

The experimenters found the knowledge the students shared had helpful impacts on the development of their technologies. This two-way street exposed the students to innovation and emerging technologies at stages of development much earlier than they would have encountered operationally during their regular duties.

U.S. Army Capt. Evan Prince, a Defense Analysis student who's looking to add Information Sciences as a second major, was among the group of 60 students in attendance.

"I was really excited when I saw Watchtower, which is an AI-enabled system that basically ingests intelligence to create most likely and most dangerous courses of action taken by a would-be adversary," he said. "They're working on a solution that can fill a gap that I'm looking at." Developed by Panoptica Technologies, Watchtower helps generate and expedite threat assessments for military intelligence analysts.

"The initial reason why they popped out to me was because of my thesis," Prince added. "Watchtower has great potential, and if its scope is able to expand a bit to cover the actual gap I've seen operationally, then I think it's something that can support our force very well."

Prince is also a Meyer Scholar, an NPS program exposing students to a wide range of technologies operationally relevant to the modern battlespace. He found the program prepared him for an even more meaningful engagement with Panoptica at JIFX.

"It's what equipped me for the conversation I had about Watchtower," he said.

DEFENSE TECHNOLOGY PIPELINE AND RANGE OF THE FUTURE

JIFX does not only foster technology, but it also evolves with it. Exemplifying this was the experimental Defense Innovation Network Assistant (DINA) TAK (Tactical Assault Kit), which integrated data from Gambit, MicroVision, Insignito Solutions, Bellum Systems, and others into a sensor fused, shared operational data environment.

Developed in collaboration between Naval Surface Warfare Center (NSWC) Corona, California Baptist University, NPS, Standard TLM, and other partners, DINA TAK moves JIFX closer into the realm of live-virtual-constructive (LVC) experimentation ranges.

DINA TAK, a government AI tool, is designed to enable future integration and JIFX expansion to a true LVC experimentation range. DINA TAK benefits from the wide range of technologies that help expand and refine the tool, which in turn increases JIFX's ability to support ad hoc integration and coordination among participants.

Troy Clarke, the Inland Empire Tech Bridge director at NSWC Corona, briefed government stakeholders at JIFX about DINA TAK and its connection to LVC experimentation ranges.

"We introduce new technology into the ranges that we could then incorporate into the actual tactical training ranges," Clarke said.

But the initial stage of development simply had experimenters inputting their data from telemetry, sensor networks, and other ISR (intelligence, surveillance, and reconnaissance) sources with ATAK (Android tactical assault kit) devices. DINA TAK then used AI-enabled data aggregation to support visualization, real-time tracking, after-action reconstruction, and more.

Once fully established, the "Range of the Future" could become a resource for others from across industry to also conduct experimentation. And for stakeholders scouting technology, DINA TAK has the potential to provide up-to-date and in-depth assessments backed by proven supporting data.

"JIFX is a very unique and special environment where you can bring early-stage technology and integrate with other innovators who are trying to figure out their niche and how they're going to get their technology across the joint force," said Jason Hay, director of technology at BryceTech.

Hay attended JIFX as contract support to stakeholders, where he soaked in and evaluated DINA TAK and the other technologies. By gaining this understanding, he now looks to leverage JIFX for accelerating technologies.

The rapid pace of experimentation throughout the vast land, sea, and air laboratory and the extensive collaboration between participants impressed him, and he sees JIFX as a vital pipeline for defense science and technology.

"Just like you have to stockpile munitions, you have to stockpile innovation," Hay said. "A supply of intelligence, knowledge, and data is necessary for the development of future technologies. If you don't have people exploring the early stages of technology, then the supply will dry up. The good news is that JIFX is here to keep the experiments running and on course."

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