



JIFX
Joint Interagency Field Experimentation



NPS Joint Interagency Field Experimentation 22-4

Event Dates:

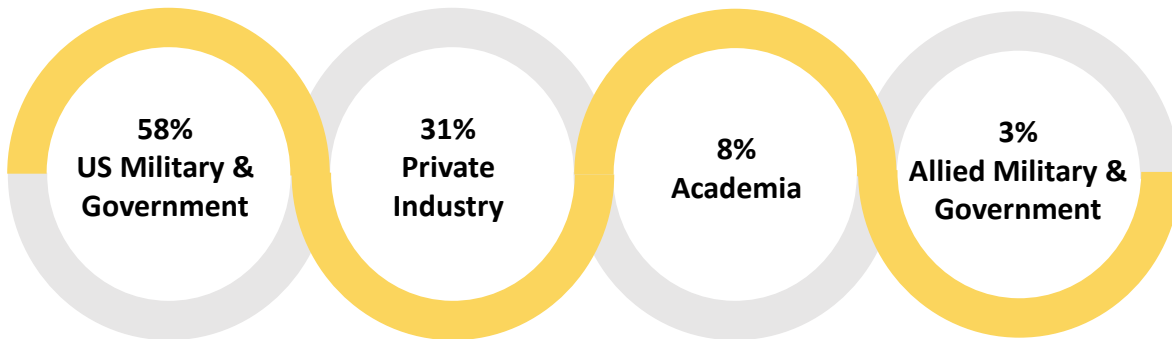
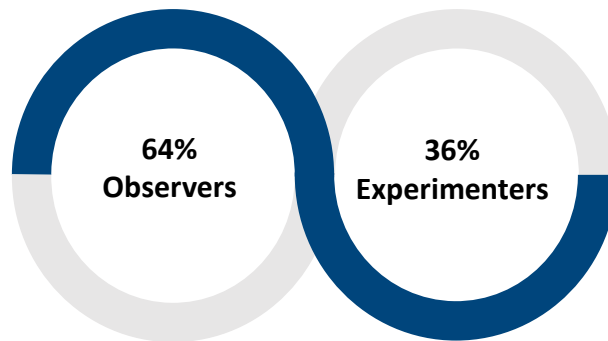
15 – 19 August 2022

Event Focus Area:

Navigation in GPS-Denied Environments & Subterranean Communication

Event Location:

McMillian Airfield at the Camp Roberts Army National Guard Base



13

Experiments

153

Total Participants

4

Cyber Vulnerability Assessments Completed

55

Total Aerial Sorties



nps.edu/fx



@jifx



@thejifx

All opinions expressed are those of the authors and do not represent the official policy or positions of the Naval Postgraduate School, the United States Navy, the Office of the Secretary of Defense, or any other government entity. Nothing contained herein should be viewed as an endorsement of any product or service.

Approved for public release. Distribution is unlimited.



JIFX
Joint Interagency Field Experimentation



NPS Joint Interagency Field Experimentation 22-4

Experiment Number	Experiment Name	Organization
A-01	Navigation in a GPS Denied Environment utilizing visual positioning system, SLAM, Digital optometry and IMU	Vermeer
A-02	AeroVironment GPS-Denied	AeroVironment
A-03	Shifting CG, Kickback, and Launching/Catching Drones	Rhoman Aerospace
A-04	AZ Flyer	University of Arizona
A-08	Alt-Nav using VIO and LASER range-finder	USASOC SOTF-CDD
B-03	Bat Mode Add-On Module for Existing UAS Enabling Persistent ISR, Mothership Swarms & Auto Recharging	VRR (dba VR Robotics & VR Rehab)
B-05	Multi-Institutional All Domain Command and Control (MIAD-C2)	The MITRE Corporation
B-06	Unobstructed Area Detection Sensor	DropDrone
B-07	MIAD C2 of IAS	Naval Postgraduate School (IS Dept/CRUSER)
F-02	Expeditionary Artificial Intelligence and Behavior Analysis at-the-edge for Tactical Surveillance during Multi-Domain Operations	Gantz-Mountain Intelligence Automation Systems, Inc.
F-03	Tactical Edge HPC to support real time and near real time AI, ML and Intelligence Modeling in support of Government Operations	TMGcore Inc.
G-02	Dismounted Position & Navigation System (DPNS)	Stucan Solutions Corporation

All opinions expressed are those of the authors and do not represent the official policy or positions of the Naval Postgraduate School, the United States Navy, the Office of the Secretary of Defense, or any other government entity. Nothing contained herein should be viewed as an endorsement of any product or service.

Approved for public release. Distribution is unlimited.



JIFX
Joint Interagency Field Experimentation



NPS Joint Interagency Field Experimentation 22-4

Experiment Collaboration Highlight

Two companies, Rhoman Aerospace and Virtual Reality Rehab (VRR), conducted a collaborative experiment at JIFX 22-4. The experiment was under development for months based on a relationship established and nurtured over two years of participation in the JIFX program. Beginning in 2020, JIFX adopted capabilities to facilitate virtual participation opportunities. During one of those early virtual events, VRR presented about their company's R&D with virtual reality training systems, augmented reality operations systems, small unmanned aircraft systems, and human-robotics interfaces. Rhoman, specializing in heavy lift stabilized platforms, reached out to VRR after the presentation. Since that first conversation in 2020 the two small businesses maintained a dialogue about their mutual interest in providing next level unmanned autonomous aircraft solutions. Those discussions evolved into virtual exchanges that led the companies to identify opportunities for collaboration.

JIFX 22-4 proved to be the first opportunity for VRR and Rhoman to execute a collaborative experiment in a field environment. Sponsored by DTRA, VRR began work on a proof of concept requiring a large UAS "mothership" to transport and deploy the company's containerized stacked drone swarm system payload known as HellHive.™ The Rhoman Carrier 300 heavy lift drone proved to be a great fit for the experiment. Kevin Hernandez, COO at VRR, says "since VRR is located in Florida and Rhoman Aerospace in California, it made sense to meet at JIFX where we could safely and legally conduct experimentation with our swarm deployment from HellHives on top of Rhoman's mothership, and [also] test recovery of the smaller drones enabled by VRR's Bat Mode Modules (BMM). The BMM add-on enables disruptive capabilities in swarm warfare, persistent ISR for days on a single charge, and automated recharging of swarms from ground stations and/or flying motherships like the Rhoman Carrier 300."

Thomas Youmans, CEO at Rhoman Aerospace, said "The collaborative experiment between Rhoman and VRR has set the baseline feasibility of the VRR HellHive combined with the Rhoman Carrier 300 to show us that the project works, and to showcase to stakeholders that the concept is ready to move to a Phase II. The collaboration showed VRR HellHive Bee drones launching off and landing back on the Carrier 300. Future iterations of our collaboration will include additional situational awareness, mission control, and autonomy without GPS for operating in unmapped and unknown terrain using VRR's HoloWarrior and Rhoman's Synthetic GPS systems."

What's next for VRR and Rhoman? Mr. Youmans says Rhoman is "excited to launch more HellHive Bee drones from the Carrier 300 and make the entire system deployable." And Mr. Hernandez said, "the next steps for VRR would be to use the visual and telemetry data collected at JIFX to continue training our AI algorithms to do autonomous Bat Mode landings" on the Rhoman aircraft. Stay connected with JIFX to learn where this effort goes.

JIFX is committed to facilitating the rapid advance of technology by fostering collaborative endeavors like this one.



[nps.edu/fx](https://www.nps.edu/fx)



[@jifx](https://twitter.com/jifx)



[@thejifx](https://www.instagram.com/thejifx)

All opinions expressed are those of the authors and do not represent the official policy or positions of the Naval Postgraduate School, the United States Navy, the Office of the Secretary of Defense, or any other government entity. Nothing contained herein should be viewed as an endorsement of any product or service.

Approved for public release. Distribution is unlimited.



JIFX
Joint Interagency Field Experimentation



NPS Joint Interagency Field Experimentation 22-4

Rhoman Carrier 300, a 5ft x 9ft hexacopter drone, executes a low, stable hover in California.



VRR tests performance of the HellHive™ - Bat Mode Module combination for persistent military related activities in Florida.



Experiment iterations 1 & 2 - VRR's HellHive™ attached to the Rhoman Aerospace Carrier 300.



nps.edu/fx



@jifx



@thejifx

All opinions expressed are those of the authors and do not represent the official policy or positions of the Naval Postgraduate School, the United States Navy, the Office of the Secretary of Defense, or any other government entity. Nothing contained herein should be viewed as an endorsement of any product or service.

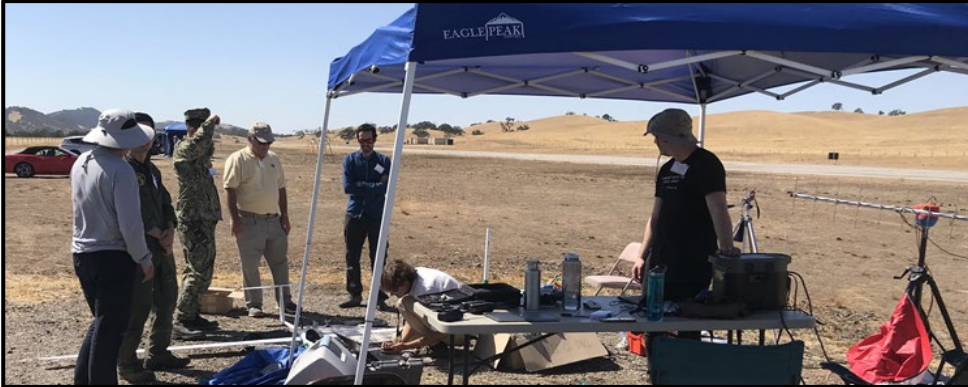
Approved for public release. Distribution is unlimited.



JIFX
Joint Interagency Field Experimentation



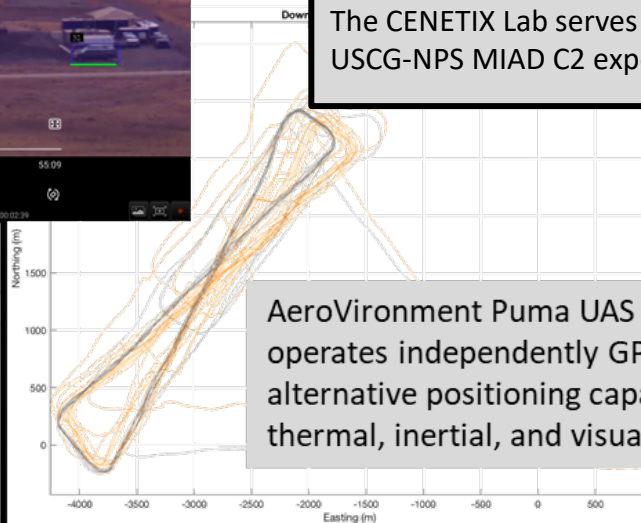
NPS Joint Interagency Field Experimentation 22-4



University of Arizona talks with stakeholders about the merits of high-altitude balloon deployment of their AZ Flyer UAS.



The CENETIX Lab serves as headquarters for the USCG-NPS MIAD C2 experiment.



AeroVironment Puma UAS successfully operates independently GPS utilizing an alternative positioning capability combining thermal, inertial, and visual methods.

nps.edu/fx

@jifx

@thejifx

All opinions expressed are those of the authors and do not represent the official policy or positions of the Naval Postgraduate School, the United States Navy, the Office of the Secretary of Defense, or any other government entity. Nothing contained herein should be viewed as an endorsement of any product or service.

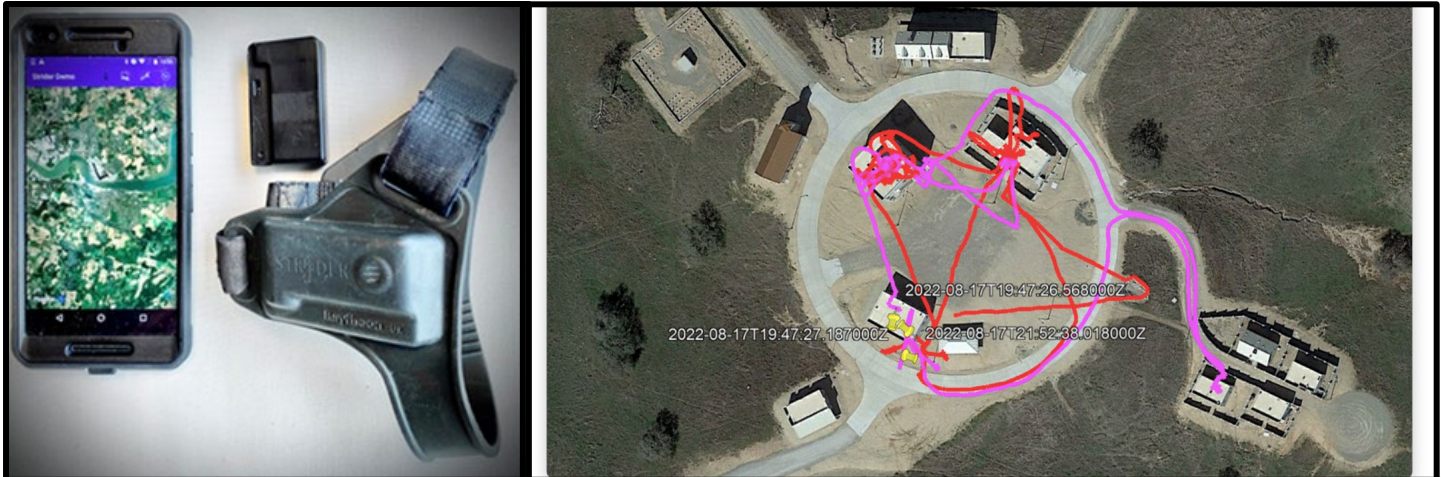
Approved for public release. Distribution is unlimited.



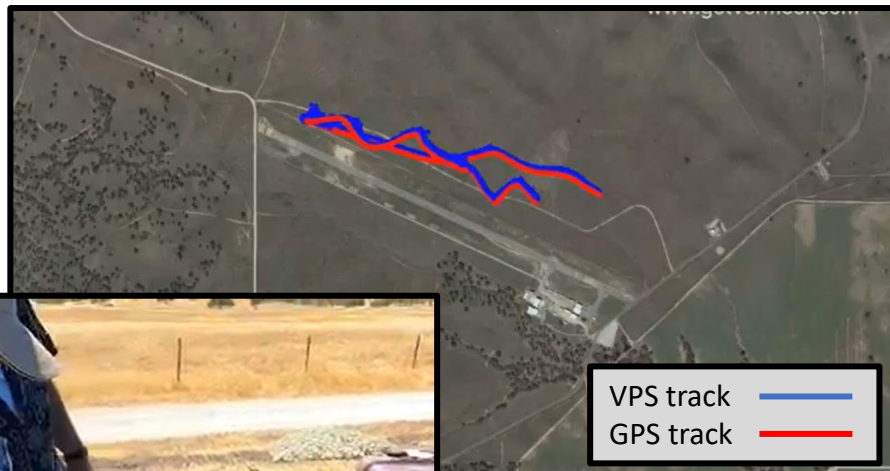
JIFX
Joint Interagency Field Experimentation



NPS Joint Interagency Field Experimentation 22-4



Stucan Solutions Corporation evaluates robustness of their boot-mounted Dismounted Position & Navigation System (DPNS) while operating without GPS inside a tunnel complex.



Vermeer employs their Visual Positioning System (VPS) to explore UAS operations in GPS degraded environments.

www.nps.edu/fx

[@jifx](https://twitter.com/jifx)

[@thejifx](https://www.instagram.com/thejifx)

All opinions expressed are those of the authors and do not represent the official policy or positions of the Naval Postgraduate School, the United States Navy, the Office of the Secretary of Defense, or any other government entity. Nothing contained herein should be viewed as an endorsement of any product or service.

Approved for public release. Distribution is unlimited.