A-02: Arizona Flyer

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022

PROJECT INFORMATION

Organization Name:	University of Arizona
Principal Investigator:	Sergey Shkarayev
Technology Readiness Level:	TRL 7: System prototype demonstration in an operational environment.
Research Area of Interest:	A) Unmanned Aerial Systems
Experiment Location:	NPS Field Laboratory at Camp Roberts

PROPOSED EXPERIMENT OVERVIEW

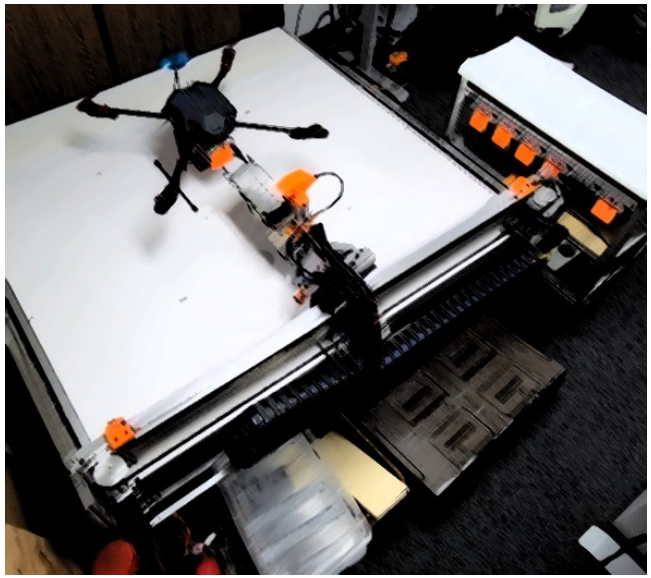
- Launch and recovery:
  - Launch Glider using scientific weather balloon - Successful release of Glider
  - Flight stabilization after release
  - Successful controlled return to launch site at end of mission
  - Smooth landing (autonomous or piloted)
- Flight experiments
  - Steady glide
  - Loiter with deviation below one radius
  - Soaring
    - Updraft exploitation ~40%
    - Dynamic soaring ~60%"

SYSTEM DESCRIPTION

Aerial Vehicle: The unmanned glider to be tested. Its span is 3 m (9 ft) and the length is 1.5 m (4.5 ft). The takeoff mass and payload are 3 kg and 0.2 kg. Maximum flight speed is 35 m/s.

A-04: Autonomous Deployable Drone Station with Rapid Battery Swapping

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022



PROJECT INFORMATION

Organization Name:	Airrow Inc.
Principal Investigator:	Menachem Fehler
Technology Readiness Level:	TRL 5: Component and/or breadboard validation in relevant environment.
Research Area of Interest:	A) Unmanned Aerial Systems
Experiment Location:	NPS Field Laboratory at Camp Roberts

PROPOSED EXPERIMENT OVERVIEW

Run multiple sequential UAS aerial missions with completely autonomous ground operations and control via RF, as well as redundant encrypted cell connections.

SYSTEM DESCRIPTION

The Airrow Dronehub is an autonomous Drone station that support sUAS and VTOL operations by removing the need for humans in the field and automating the takeoff, mission execution, Precision landing and battery swapping (and charging) using computer vision guided robotics for precision in dynamic conditions.

A-05: Tethered/Untethered BVLOS via the Geocast Air Operations Framework (GAOF)

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022

PROJECT INFORMATION

Organization Name:	AT&T Drone Operations
Principal Investigator:	Art Pregler
Technology Readiness Level:	TRL 7: System prototype demonstration in an operational environment.
Research Area of Interest:	A) Unmanned Aerial Systems
Experiment Location:	NPS Field Laboratory at Camp Roberts

PROPOSED EXPERIMENT OVERVIEW

AT&T Drone Operations will bring our Flying COW¬Æ and XCountry to Camp Roberts to conduct a Beyond Visual Line of Sight (BVLOS) Control Link experiment with tethered and untethered drones utilizing AT&T Geocast Air Operations Framework (GAOF) which will allow for the secure and reliable operations of sUAS at distances beyond line of sight over the AT&T Network allowing drones to be piloted remotely from a centralized location.

SYSTEM DESCRIPTION

AT&T Flying COW is a drone used to provide cellular coverage during events, disasters, etc. We will also be operating our XCountry which is a hybrid drone for long duration flights. The purpose of this experiment is to to test out the Geocast Air Operations Framework (GAOF), one of the pillars of the AT&T Geocast Framework.

A-06: Autonomous ISR and Tracking with Collaborative sUAS

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022

PROJECT INFORMATION

Organization Name:	Anduril Industries
Principal Investigator:	Alexander Chang
Technology Readiness Level:	TRL 8: Actual system completed and qualified through test and demonstration.
Research Area of Interest:	A) Unmanned Aerial Systems
Experiment Location:	NPS Field Laboratory at Camp Roberts

PROPOSED EXPERIMENT OVERVIEW

We propose to conduct an experiment utilizing two autonomous sUAS working collaboratively to execute an ISR mission that detects, classifies, and tracks multiple objects of interest (vehicle, human) through onboard computer vision algorithms. We plan to collect data and measure this experiment through a variety of metrics, to include but not limited to: ability to establish CV-generated tracks at an unfamiliar site (in electro-optic and thermal modes), the quality of the track and the distance at which it can be generated, ability to maintain track custody on mobile objects, ability to hand off tracks between assets, and the ability to control two assets from a single GCS.

SYSTEM DESCRIPTION

Ghost is an autonomous Group 2 VTOL sUAS that provides a versatile, organic ISR capability given its ability to operate longer and farther than small quadcopters and carry multiple payloads (up to 10 lbs), without the launch and recovery footprint and manpower requirements of existing fixed-wing assets. Ghost automates flight operations and advanced functions to include ISR missions through AI-enabled fixed and mobile object detection, classification, tracking.

A-07: Testing Multi-Use Heavy Lift Tactical Drone

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022

PROJECT INFORMATION

Organization Name:	RotorX
Principal Investigator:	Dmitry Bershadsky
Technology Readiness Level:	TRL 6: System/subsystem model or prototype demonstration in a relevant environment.
Research Area of Interest:	A) Unmanned Aerial Systems
Experiment Location:	NPS Field Laboratory at Camp Roberts

PROPOSED EXPERIMENT OVERVIEW

There are two tasks that we wish to complete during these experiments. The first is the ability of the vehicle to autonomously deliver 100 lbs of cargo to a destination less than five miles away. The second is the vehicle's ability to use a novel control system (Direct Force Control) to point a laser at a target without the use of a gimbal. These tasks cannot be performed in public airspace because the vehicle has an empty weight of 170lbs.

SYSTEM DESCRIPTION

The system that will be used is a heavy-lift, multi-use tactical resupply drone that has the ability to lift 100 lbs for 5 miles. The vehicle also has the ability to conduct surveillance missions and maneuver in unique ways using a novel control system, which allows the vehicle to be more controllable when flying in high winds than traditional vehicles. This control system also allows the vehicle to rotate with changing its position, thus allowing the vehicle to point items (lasers,kinetics,etc.) without the use of a gimbal.

B-01: Collaborative Mixed Reality C2 for Unmanned Fleets

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022

PROJECT INFORMATION

Organization Name:	vRotors
Principal Investigator:	Neil Malhotra
Technology Readiness Level:	TRL 7: System prototype demonstration in an operational environment.
Research Area of Interest:	B) Unmanned Systems (UxS) Design, Deployment, Operation, Networking and Control
Experiment Location:	NPS Field Laboratory at Camp Roberts

PROPOSED EXPERIMENT OVERVIEW

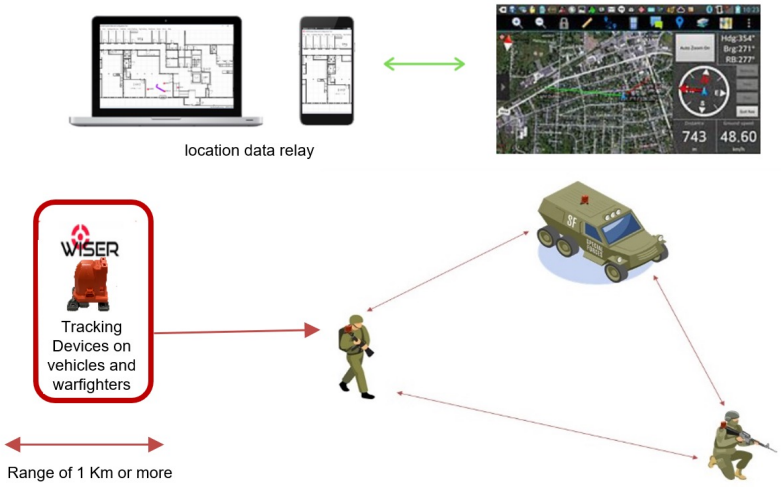
This is an experiment in C2 unmanned vehicle operations with human-machine-interface (HMI) mixed reality to improve team performance. The goal is in evaluating a distributed team's ability to coordinate a multi-unmanned vehicle fleet in pursuit of the enemy target and keep cursor-on-target (CoT). Base metrics will be established without the enhanced HMI features for target discovery time, continuous CoT, and total CoT. Then the vRotors platform features will be enabled for operator collaboration including 3D AR market placement and AI assisted targeting. The mixed unmanned vehicle fleet will include ground-based vehicles with controllable gimbals at height to emulate aerial vehicles.

SYSTEM DESCRIPTION

The vRotors technology architecture consists of 3 layers: operator client applications, a centralized edge computing platform for data processing including AI, and an adaptive API for integration to any unmanned vehicle. The applications across PC, Mac, mobile, and VR platforms provide 3D mixed reality visualization in virtual cockpits in which distributed operator teams collaborate. The ultra-low latency data streams allow for joystick vehicle control during supervised autonomous missions. The edge compute combines data from all fleet vehicles for global augmented vision and object tracking, using a combination of algorithmic and AI solutions. Projected target movement is visualized with AR markers geo positioned in the live vehicle video views. Derived from real-time multi-player gaming, all team members engage in real-time vehicle operations collaboratively with individual permission engagement to the vehicle & sensors.

D-03: WISER Mobile Mesh

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022



PROJECT INFORMATION

Organization Name:	WISER Systems
Principal Investigator:	Logan Maxwell
Technology Readiness Level:	TRL 3: Analytical and experimental critical function and/or characteristic proof of concept.
Research Area of Interest:	D) Communication and Networking
Experiment Location:	NPS Field Laboratory at Camp Roberts

PROPOSED EXPERIMENT OVERVIEW

WISER Mobile Mesh nodes will be placed on vehicles/warfighters/roleplayers/UAV's and move around a subterranean environment. Accuracy and range of the mobile mesh nodes will be recorded.

SYSTEM DESCRIPTION

WISER has a commercially sold sensor system comprised of fixed nodes. These fixed nodes are installed in manufacturing/warehousing environments to track parts/work-orders/pallets etc. and use a proprietary meshing to synchronize and track location. The concept is to take those fixed nodes, and use the same meshing protocol to have them all communicate while in motion on warfighters and vehicles. This would allow for alt-PNT in GPS denied environments. An additional ancillary use-case for the technology is to use the same mesh network to send data, like text.

E-01: LPI/LPD Communications, AI/ML sensing, and EW Technologies for UxS and Personnel Communications and Situational Awareness

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022

PROJECT INFORMATION

Organization Name:	IoT/AI
Principal Investigator:	Kevin Montgomery
Technology Readiness Level:	TRL 5: Component and/or breadboard validation in relevant environment.
Research Area of Interest:	E) Cyber, Cyber Security, and Electronic Warfare
Experiment Location:	NPS Field Laboratory at Camp Roberts SLAMR Facility at NPS

PROPOSED EXPERIMENT OVERVIEW

In this JIFX experiment, we wish to perform:

- Autonomous UAV employing our LPI/LPD and meshing tech to demonstrate inability to jam or disrupt communications
- Personnel communications via ATAK that mesh with UAV and on-ground sensor assets, including testing in subterranean/tunnel environments
- Testing our 5G connectivity for our sensor network
- Test and Eval of an AI-enabled, edge computing SmartCamera that recognizes what it sees and alerts via ATAK
- Covert ISR sensors (SmartRock) for EW detection, deception, and attack
- Smart asset tags utilizing meshing and LPI/LPD comms for contested far-forward logistics

Wearable sensors including physiological monitors

SYSTEM DESCRIPTION

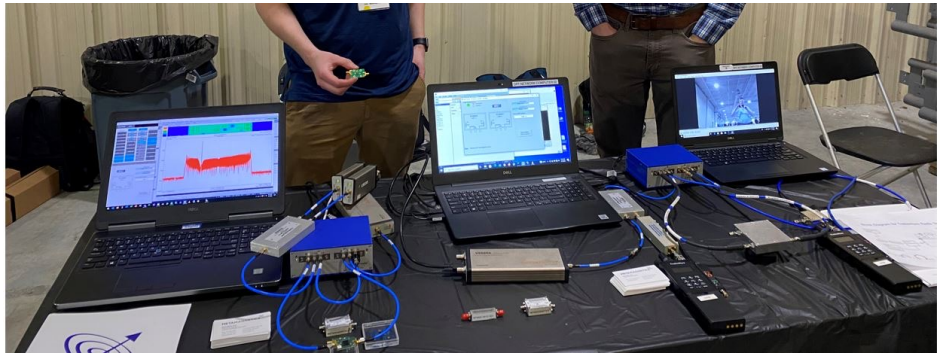
Pico supports a series of processor and radio options (including LPI/LPD), and supports over 4000 sensor types to enable existing sensor or medical devices to transmit data ultra-securely.

Pico devices can automatically form a next-generation self-organizing, self-healing, distributed mesh network covering hundreds of square miles/km. Pico sensor networks are extremely scalable, extremely dynamic, extremely secure, and easily/remotely configurable.

Pico is designed to enable a sensor or personnel communications device to transmit its data securely and reliably from any location through the use of its advanced mesh networking.

E-02: RF Interference Mitigation in Wideband Receivers

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022



PROJECT INFORMATION

Organization Name:	Metamagnetics Inc.
Principal Investigator:	Piotr Kulik
Technology Readiness Level:	TRL 6: System/subsystem model or prototype demonstration in a relevant environment.
Research Area of Interest:	E) Cyber, Cyber Security, and Electronic Warfare
Experiment Location:	NPS Field Laboratory at Camp Roberts

PROPOSED EXPERIMENT OVERVIEW

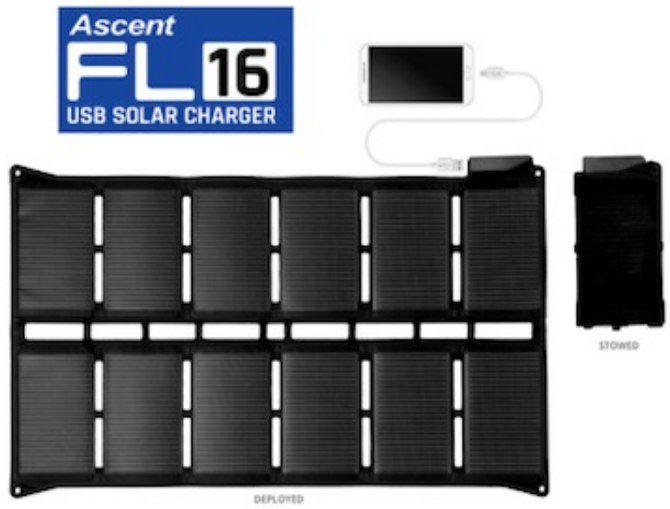
Two tactical radio (i.e. PRC-163/7, Trellisware 950 Shadow, or similar) will be outfitted with Metamagnetics' Interference Resilient Module and various types of interference will be injected into the signal path from 900 to 2600 MHz. The ability for these radios to maintain communications links in the presence of interferers utilizing Metamagnetics Interference Resilient Module will be characterized using methods (i.e. error vector magnitude, SINAD, SNR, etc.)

SYSTEM DESCRIPTION

Metamagnetics' AtF is a fast-reacting, adaptive (in terms of frequency selectivity and power levels), passive, miniature, low-cost component technology that can simply be placed after the antenna, to enable radio receivers to continuously operate in the presence of interference. Being passive, it does not require any power supply, which is extremely advantageous for size, weight, and power-constrained platforms such as satellites and hand-held radios.

F-02: Expeditionary Power

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022



PROJECT INFORMATION

Organization Name:	Ascent Solar Technologies
Principal Investigator:	Joe Kigin
Technology Readiness Level:	TRL 7: System prototype demonstration in an operational environment.
Research Area of Interest:	F) Intelligence, Surveillance, and Reconnaissance (ISR)
Experiment Location:	NPS Field Laboratory at Camp Roberts

PROPOSED EXPERIMENT OVERVIEW

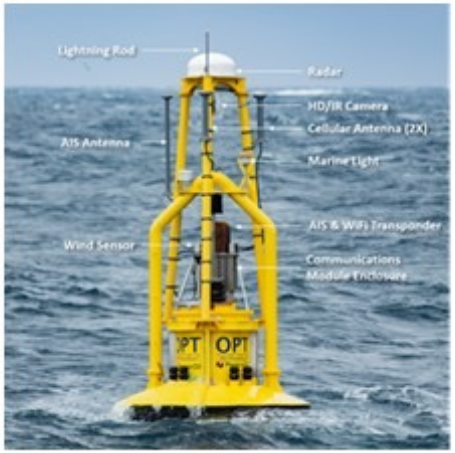
The FL16 would be issued on a one-to-one basis to all operators equipped with USB-powered devices or EUD's powered by small rechargeable batteries. The FL16 will recharge smartphone, tablets, and most EUD's. Using small rechargeable battery chargers, the FL16 will recharge CR123/AAA/AA/18650 batteries used in issued devices such as lasers, thermal sights, NVGs/NODS, flashlights, headlamps, and other Physiological Status monitoring (PSM) devices. The FL16 can be deployed in less than 10 seconds and can be connected to a device any time soldiers are in daylight, while moving or stationary.

SYSTEM DESCRIPTION

- Individually provides 16W USB (5V, 2.4A) power in ruggedized portable format (TRL 7/8) to the warfighter in direct sun, and usable power in low-light/overcast skies
- Charges USB EUD's (eg. ATAK) at the same or faster rate as the wall
- Can provide more than enough power in 1 day's charge for 24hrs of navigation and communication
- Significant weight savings vs. BB-5590 & PRC148
- Allows continuously-replenished power for EUD's, with no ongoing logistics demands; allows units to move faster and with more resilience in all logistics scenarios

F-03: Buoy-based Maritime Domain Awareness Solution to Detect and Track Potential Threats

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022



PROJECT INFORMATION

Organization Name:	Ocean Power Technologies
Principal Investigator:	David Goldstein
Technology Readiness Level:	TRL 7: System prototype demonstration in an operational environment.
Research Area of Interest:	F) Intelligence, Surveillance, and Reconnaissance (ISR)
Experiment Location:	Virtual Participation

PROPOSED EXPERIMENT OVERVIEW

- Buoy system installed and calibrated.
- Vessel(s) enters a defined exclusion zone
- System identifies vessel on radar and tracks
- Software analysis if AIS is on/off and activates daytime or IR camera to slew on target for vessel information.
- Data sent to shore station or US DoD vessel in the area for threat analysis.

SYSTEM DESCRIPTION

An autonomous buoy-based Maritime Domain Awareness Solution (MDAS) with capabilities to provide early detection and timely intervention with undesirable vessel activities in and around sensitive and congested marine traffic areas.

This system combines radar, camera, and AIS data to provide offshore sensing capabilities.

F-04: Expeditionary Artificial Intelligence and Behavior Analysis at-the-edge for Tactical Surveillance for Multi-Domain Operations

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022

PROJECT INFORMATION

Organization Name:	Gantz-Mountain Intelligence Automation Systems, Inc.
Principal Investigator:	Greg Wilson
Technology Readiness Level:	TRL 7: System prototype demonstration in an operational environment.
Research Area of Interest:	F) Intelligence, Surveillance, and Reconnaissance (ISR)
Experiment Location:	NPS Field Laboratory at Camp Roberts

PROPOSED EXPERIMENT OVERVIEW

Gantz-Mountain is continuing to experiment with its tactical intelligence automation system with smart unattended ground surveillance systems that feature artificial intelligence and behavior analysis at-the-edge for expeditionary surveillance in support of multi-domain operations (MDO). Note: objectives involve potential integration with SOCOM S&T Project BeWARE which is still in coordination.

Capability Experimentation goals:

- Tip and cue UAS
- C2 and data flow to UAS ground station
- SOF Deep Battle Autonomous SR applications
- Expeditionary power sources - with Ascent Solar
- AI target hand-off to autonomous ISR systems - to compress targeting cycle

SYSTEM DESCRIPTION

Gantz-Mountain Intelligence Automation Systems Inc. has pioneered revolutionary turn-key smart-edge surveillance and intelligence automation systems to answer this call. This rapidly deployable technology pushes Artificial Intelligence and Behavior Analysis to the tactical edge to provide manpower savings, improve decision making and enhance early warning during multi-domain operations. Additionally, Gantz-Mountain is using this revolutionary technology to make legacy sensors smart by developing Intelligence Automation Systems Adaptors for PTZ cameras along with other camera systems. This technology has received sponsorship and is in use by a variety of USG organizations.

F-05: Tactical Edge HPC to support real time and near real time AI, ML and Intelligence Modeling in support of Government Operations

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022

PROJECT INFORMATION

Organization Name:	TMGcore Inc.
Principal Investigator:	Seamus Egan
Technology Readiness Level:	TRL 7: System prototype demonstration in an operational environment.
Research Area of Interest:	F) Intelligence, Surveillance, and Reconnaissance (ISR)
Experiment Location:	SLAMR Facility at NPS

PROPOSED EXPERIMENT OVERVIEW

For JIFX 22-3 TMGcore has built an ISU-90 expeditionary containerized version of our HPC platform while materially increasing the compute deployed from our EdgeBox 30kW system. The systems will be fully contained with its own generator, chiller, UPS, HPC compute platform and network connectivity. We will test for performance, operating and environmental temperatures and any related impacts, remote network management, and continual system health while deployed cross country.

SYSTEM DESCRIPTION

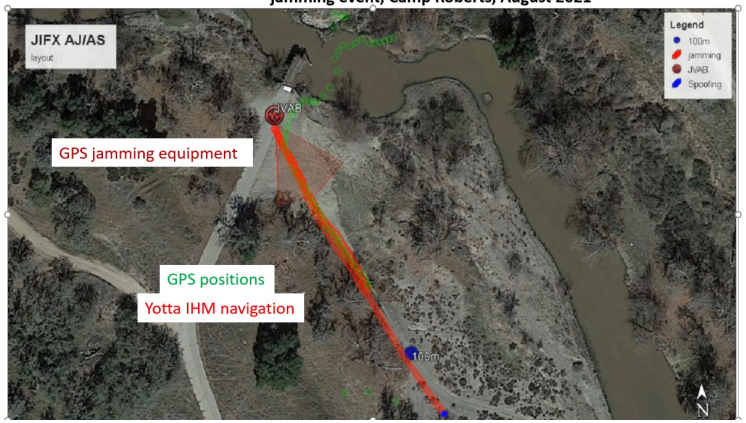
TMGCore is a platform development company for High-Performance Computing (HPC) with Two Phase Liquid Immersion Cooling (2PLIC) “HPC 2PLIC” using the OTTO Platform which if fully deployable & mobile. Our systems allows for tactical Edge computing in support of C4ISR needs for big data analytics, AI, and provide large data storage capabilities while reducing targetability through reduced RF transmission, alleviate latency and data link bottlenecks of cloud computing, and reduced costs related to traditional logistics footprints of air-cooled data centers. This capability is achieved through the HPC 2PLIC system built into each customizable EdgeBox or OTTO Platform which can be operated out of an ISU-90 or on the back of of moving vehicle while in operation.

G-01: Intelligent Human Motion GPS Denied Trials

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX)
NPS JIFX 22-3 | 23 – 27 May 2022

yotta

Video of IHM performance during DoD GPS denied jamming event, Camp Roberts, August 2021



GPS jamming equipment

IHM 1.1m horizontal accuracy

Legacy DAGR, no position fix

PROJECT INFORMATION

Organization Name:	Yotta Navigation
Principal Investigator:	Andrew Hazlett
Technology Readiness Level:	TRL 5: Component and/or breadboard validation in relevant environment.
Research Area of Interest:	G) Situational Awareness
Experiment Location:	NPS Field Laboratory at Camp Roberts

PROPOSED EXPERIMENT OVERVIEW

Yotta Navigation plans to experiment testing alternative navigation systems in GPS denied environments. GPS denied navigation will be conducted in mock operational environments at Camp Roberts training facilities. Subterranean, tunnel, indoors and GPS RF denied positioning tests will be conducted.

SYSTEM DESCRIPTION

Intelligent Human Motion is Yotta Navigation Corporation's latest advancement in real-time dismounted human motion tracking and positioning. IHM provides real-time human motion event profiles for both time series and spacial analysis. The IHM Nav based positioning engine fuses motion sensors, radio frequency (RF) positioning and geographical data to provide an accurate and robust navigation system. IHM Nav provides continuous positioning in GPS denied conditions, including indoor and subterranean environments, and GPS jamming/spoofing attacks.