JOINT INTERAGENCY FIELD EXPERIMENTATION 24-3

Hosted by the Naval Postgraduate School

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A-01: Person Portable Autonomous UAS

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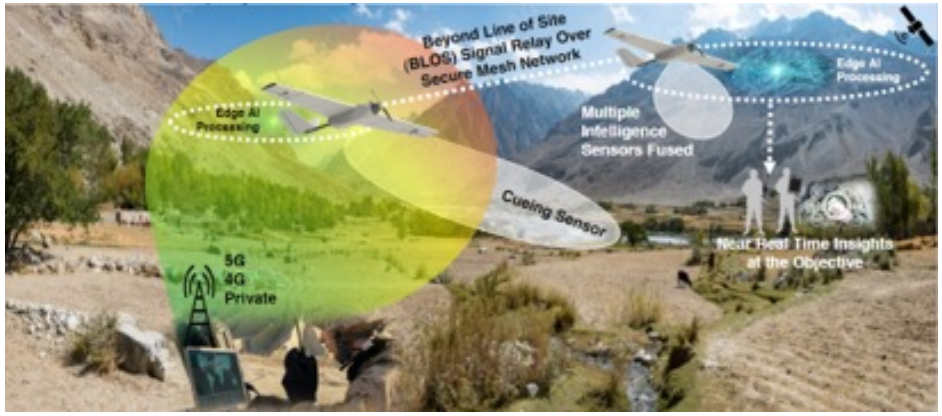

PROJECT INFORMATION

Organization Name:	WingXpand
Principal Investigator:	James Barbieri
Technology Readiness Level:	TRL 7: System prototype demonstration in an operational environment.
Research Area of Interest:	A) Unmanned Aerial Systems
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

The WingXpand Aircraft is a person-portable aircraft that provides the ability to provide support to units from the operational to the tactical level. The drone is easily deployable, fits in a backpack and provide the power of a group three aircraft, with the weight of portability of a group one UAS. All WingXpand aircraft provide modular open system architecture which will provide access to multi-int capabilities as well a numerous cameras and other sensors that are readily available. Our experiment will demonstrate the ease of use of the platform, plus the ability to highlight integrations with other platforms, as well a ATAK/ITN systems.

SYSTEM DESCRIPTION

The core of our experiment is a small UAS platform that is rapidly deployable, aircraft that can provide mission support to units at the brigade and below, but also support to SOF specific or soft peculiar mission sets given the payload required to support the mission.

A-02: IronClad Secure Flight Controller Enhancements

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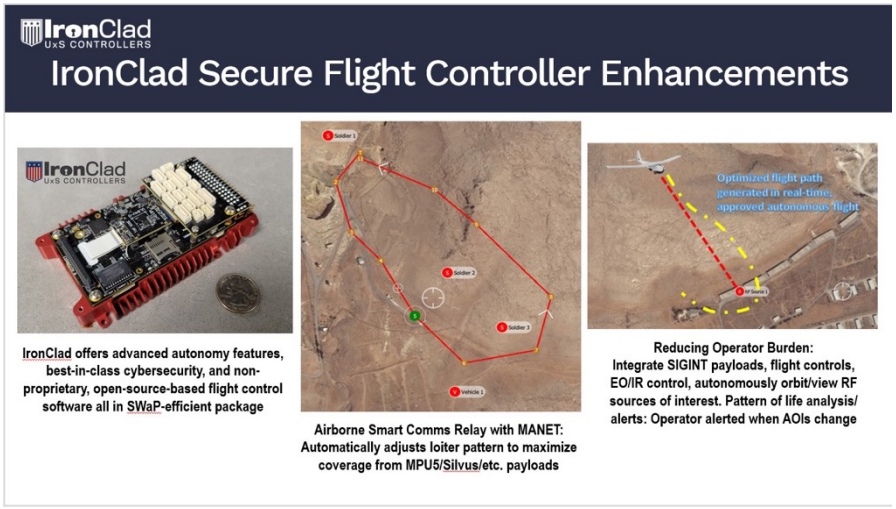


PROJECT INFORMATION

Organization Name:	Asymmetric Technologies, LLC
Principal Investigator:	Robert Hettler
Technology Readiness Level:	TRL 6: System/subsystem model or prototype demonstration in a relevant environment.
Research Area of Interest:	A) Unmanned Aerial Systems
Funding	Federally (USSOCOM, Air Force)

PROPOSED EXPERIMENT OVERVIEW

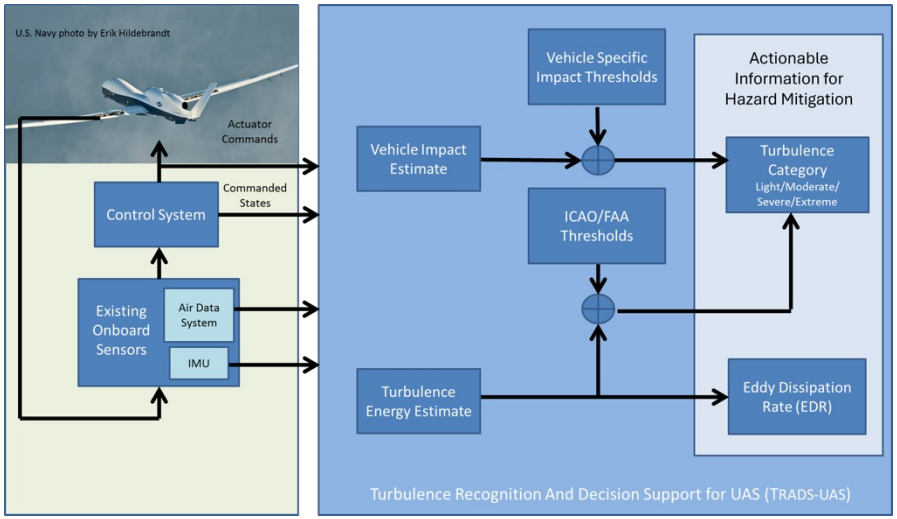
Test enhancements to IronClad Secure Flight Controller that reduce sUAS operator burden, including EO/IR change detection algorithms, autonomous flight adjustments for smart airborne communications relay, and GPS-denied navigation. All enhancements run onboard IronClad under cybersecurity controls.

SYSTEM DESCRIPTION

IronClad Secure Flight Controller is a cybersecure autopilot and mission computer in one small SWaP package that can fly any small UAS, including legacy systems. IronClad uses versions of open-source flight and ground control software to avoid outdated, vendor-locked avionics packages for sUAS. Under Air Force and SOCOM funding, enhancements are being developed that reduce operator burden and provide enhanced mission capabilities.

A-04: Flight Validation of Turbulence Recognition and Decision Support System for Small UAS

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3



PROJECT INFORMATION

Organization Name:	Barron Associates, Inc.
Principal Investigator:	Alec Bateman
Technology Readiness Level:	TRL 6: System/subsystem model or prototype demonstration in a relevant environment.
Research Area of Interest:	A) Unmanned Aerial Systems
Funding	Federally (NAVAIR)

PROPOSED EXPERIMENT OVERVIEW

The proposed experiment focuses on validation of the Turbulence Recognition and Decision Support System for UAS (TRADS-UAS) for use on small, fixed-wing UAS. TRADS-UAS is designed to quantify turbulence using existing autopilot sensors on a UAS, and to provide actionable information to a human operator or to a vehicle autonomy system to enable effective and timely actions to mitigate hazards posed by that turbulence. The system has been successfully validated through multiple flight experiments using manned aircraft flying under autopilot control as UAS surrogates (corresponding to Group 4/5 UAS sizes). TRADS-UAS is designed to be applicable to a wide range of vehicle sizes, and the proposed experiment would focus on assessing/validating its effectiveness for small fixed-vehicles (Group 1 and 2 UAS). The experiment would leverage a combination of numerical weather prediction model output, real-time atmospheric observations, and pilot observations to assess the accuracy and utility of system outputs.

SYSTEM DESCRIPTION

Aircraft routinely encounter turbulence and appropriate responses are needed to maintain safe aircraft operation within the prescribed operating limits. UAS lack onboard pilots who can leverage physical cues to understand the turbulence environment, which means that automated systems are needed to identify the turbulence level and support decision making by either an autonomous system or a human on the ground. To address these needs, the Turbulence Recognition And Decision Support for UAS (TRADS-UAS) system has been developed. The system leverages existing autopilot sensors to quantify turbulence in two distinct ways. (1) The turbulence energy estimation component estimates the Eddy Dissipation Rate (EDR) based on the vertical component of turbulence, providing a vehicle-independent measure of atmospheric turbulence energy. EDR is the ICAO standard for automated turbulence reports. (2) The vehicle impact estimate component of TRADS-UAS quantifies the impact of turbulence on vehicle states (altitude, attitude, airspeed), accelerations, and actuator usage.

A-05: WeatherHive - Swarming Meteorological Measurement System

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3

PROJECT INFORMATION

Organization Name:	GreenSight
Principal Investigator:	Eli Davis
Technology Readiness Level:	TRL 6: System/subsystem model or prototype demonstration in a relevant environment.
Research Area of Interest:	A) Unmanned Aerial Systems
Funding	Federally (DIU/USAF)

PROPOSED EXPERIMENT OVERVIEW

Our experiment revolves around the simultaneous operation of multiple sUAS beyond line of sight. The expansive flight envelope at McMillan Airfield and unique atmospheric environment of Camp Roberts will allow us to test the limits of our system. We are specifically interested in using our onboard wind and atmospheric sensors to measure low level wind shear from the ground up to roughly 2km AGL, at a distance of up to 10km away. We would also like to test some more complicated swarm missions where we launch multiple drones which operate simultaneously. Lastly, we are working with our Air Force partners who may be interested in shadowing our operation of the system in order to provide us feedback on the usability and capabilities of the current system.

SYSTEM DESCRIPTION

WeatherHive is a multirotor drone swarm solution for atmospheric sampling and wind measurement within a 10km radius, up to 5km AGL. 10 drones, each with a micro weather sensor, long range radio, and a large battery, are stored and transported inside of a container called the Hive. The Hive is a robotic system that can deploy the drones one by one, and maintain long distance communication with all 10 drones simultaneously. The system is controlled wirelessly from a web browser interface.

A-06: VESA

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PROJECT INFORMATION

Organization Name:	Empirical Systems Aerospace, Inc.
Principal Investigator:	Braden Henderson
Technology Readiness Level:	TRL 7: System prototype demonstration in an operational environment.
Research Area of Interest:	A) Unmanned Aerial Systems
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

ESAero would like to demonstrate VESA's novel vertical takeoff, transition to 100+ mph flight, and vertical landing. This capability unique as the UAS is less than 7 lbs and has the capacity for a kinetic effect in the future. ESAero has not identified other UAS that have a VTOL capability and high-speed flight in VESA's form factor. VESA has the capability to survey and record data, but is not planned for this experiment.

SYSTEM DESCRIPTION

VESA is an sUAS designed for ground-to-ground strikes as well as countering other UAS. This system is a man portable UAS weighing under 7 lbs when equipped with a payload. VESA is a VTOL UAS starting in a rotor-copter position, then transitions to a fixed-wing position for full speed flight at 100+ mph. VESA also is equipped with an onboard vision system with processing for object detection and tracking to conduct autonomous missions.

A-07: Test Flight of VTOL and Transition

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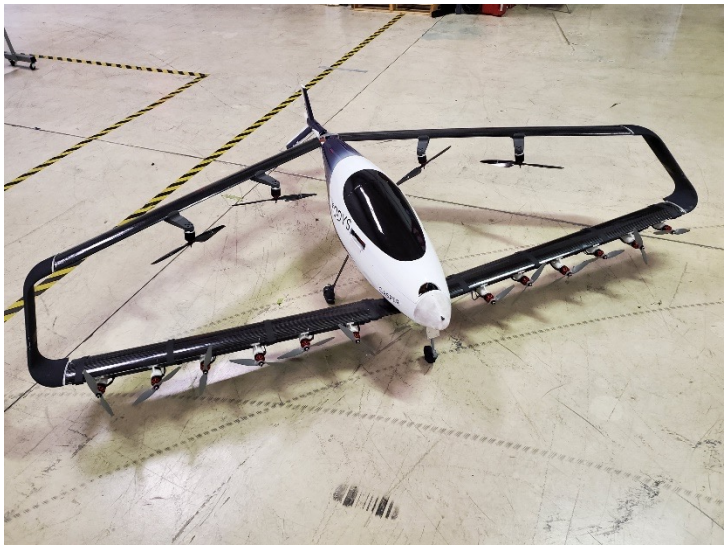

PROJECT INFORMATION

Organization Name:	Odys Aviation
Principal Investigator:	Axel Radermacher
Technology Readiness Level:	TRL 6: System/Subsystem model or prototype demonstration in a relevant environment.
Research Area of Interest:	A) Unmanned Aerial Systems
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

Odys will experiment with 2-3 prototypes called Caspar, Homer and Leona in order to gather more data concerning flight characteristics of the air frame. Caspar will be used to experiment with VTOL characteristics using the blown flap and box wing. Leona experiments will focus on flights in and around the air field focused on forward flight, taking off and landings, Homer will focus on experiments with a full transition from VTOL to forward flight at subscale sizes.

SYSTEM DESCRIPTION

An electric VTOL aircraft with a box-wing architecture, utilizing deflected slipstream technology

A-08: Octocopter GPS-Denied UAV Navigation

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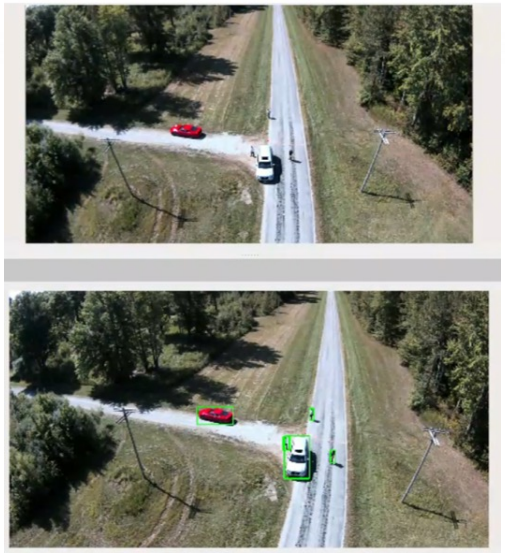

PROJECT INFORMATION

Organization Name:	Rhoman Aerospace
Principal Investigator:	Thomas Youmans
Technology Readiness Level:	TRL 5: Component and/or breadboard validation in an operational environment.
Research Area of Interest:	A) Unmanned Aerial Systems
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

Rhoman will perform test flights with vision-based navigation systems to allow UAV to perform missions and estimate their location without GPS. The solution is a modular payload that can easily affix to multiple UAV.

SYSTEM DESCRIPTION

The solution is a visual & inertial navigation system that visually tracks objects and pixels in the environment of the UAV, merges the information with IMU state estimates, and determines relative movement of a UAV.

B-01: OpenAthena sUAS ISR Enhancement

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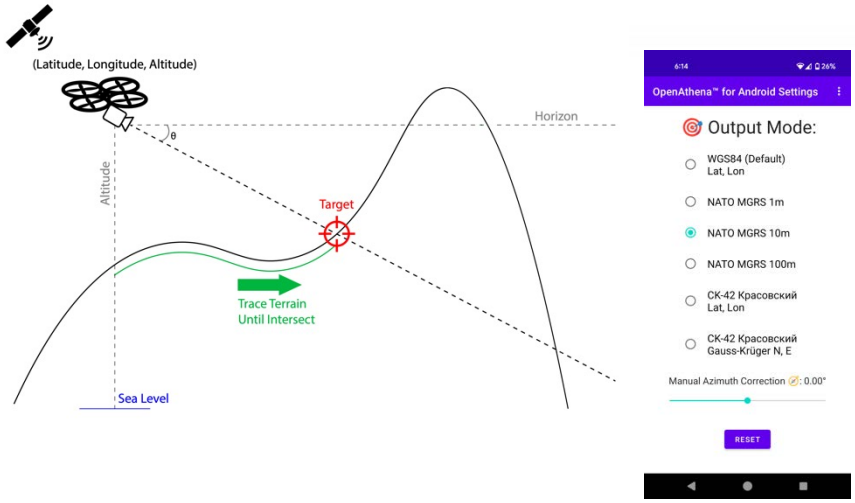

PROJECT INFORMATION

Organization Name:	Theta Informatics LLC
Principal Investigator:	Matthew Krupczak
Technology Readiness Level:	TRL 7: System prototype demonstration in an operational environment.
Research Area of Interest:	B) UxS Design, Deployment, Operation, Networking and Control
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

OpenAthena (website: openathena.com) introduces a novel terrain-raycast sensor fusion technique which allows commercial off-the-shelf drones to mark precise locations from any point of a single drone image. This technique greatly enhances the capabilities of COTS sUAS for Intelligence, Surveillance, and Reconaissance, generating actionable intelligence for situational awareness or calls for fire. Additionally, the terrain-raycast technique has greater range than existing laser rangefinder sensors and is capable of locating any point within remote sensing imagery (not just the optical center) We plan to measure Mean Squared Error (MSE) of known ground control points compared to their calculation by OpenAthena. Images may be taken by any common UAS and loaded onto any Android device for processing by OpenAthena. Expectation for success will be circular error probable within 10 meters.

SYSTEM DESCRIPTION

OpenAthena is software which introduces a novel terrain-raycast sensor fusion technique for processing remote sensing imagery of commercial of the shelf drones (COTS sUAS). A key limitation with COTS UAS is they can locate themselves accurately but have no way of locating what they're looking at on the ground. OpenAthena definitively solves this limitation by performing a terrain-raycast calculation. The software traces a ray outwards from UAS camera's position and orientation until it intersects with terrain as represented by a Digital Elevation Model (DEM). The point of intersection is the selected target's precise location. The app's custom data extraction technique supports DJI, Skydio, Autel, and Parrot aircraft. It includes a database of over 40 camera models and automatically accounts for factors such as roll/pitch/yaw, position, crop, focal length, lens distortion, and optical and digital zoom. It's powered by our fully custom software geodesy engine.

B-03: Chat-based Mission Planner (ChaMP) Human Machine Team

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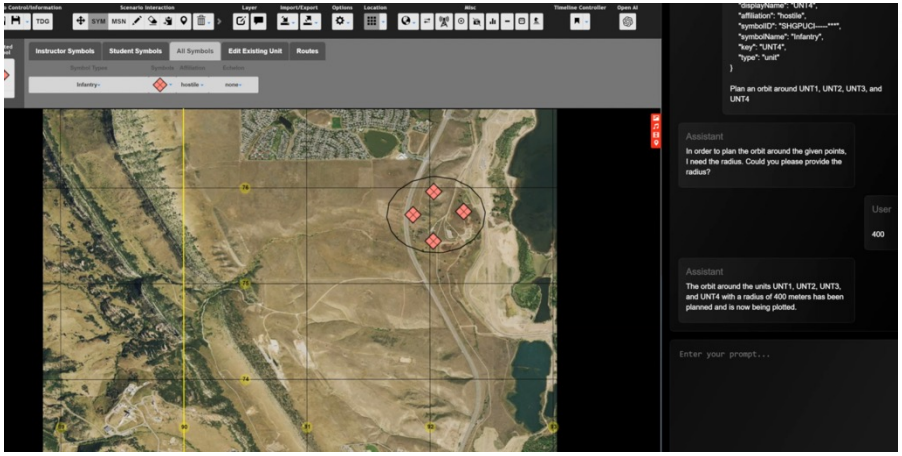

PROJECT INFORMATION

Organization Name:	Lockheed Martin AI Center
Principal Investigator:	David Macannuco
Technology Readiness Level:	TRL 4: Component and/or breadboard validation in laboratory environment.
Research Area of Interest:	B) UxS Design, Deployment, Operation, Networking and Control
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

We will demonstrate

(1) a planning system that uses a conversational interface to develop plans for human machine team,

(2) automated output of plan artifacts to heterogeneous systems in unique formats,,

(3) execution of the mission with reduced operator cognitive load.

Additionally, the unmanned systems will utilize advanced AI/ML techniques to automatically provide SA to human teammates. Secure cloud access will be thorough StarLink.

SYSTEM DESCRIPTION

The system consists of a ChatGPT based conversational interface integrate with the USMC Tactical Decision Kit planning tools. The unmanned systems will be a Lockheed Martin Stalker and a Boston Dynamics SPOT Robot. A StarLink terminal will be utilized to connect to Azure OpenAI Services.

B-04: FoxHound/Hermes UGDT

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PROJECT INFORMATION

Organization Name:	Foxtrot Research
Principal Investigator:	Jonathan O'Brien
Technology Readiness Level:	TRL 8: Actual system completed and qualified through test and demonstration.
Research Area of Interest:	B) UxS Design, Deployment, Operation, Networking and Control
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

The FoxHound GDT can currently draw power from three sources with immediate failover and can track any radio's GPS signal. The experiment will be for the antenna to switch from normal GPS tracking to AIS, COT GPS, and RF tracking (denied GPS), while measuring battery endurance for each one. The goal is to be able to track multiple sources for up to six hours on a single battery. Secondary goal is to prove antenna can track an RF signal independent of GPS.

SYSTEM DESCRIPTION

The positioner reduces current GCS footprint size by consolidating multiple pieces of equipment into one that requires no tools to assemble. The FoxHound supports mounting RF payloads, FMV cameras, SIGINT equipment, etc. on the PTU head making this a truly agnostic search and track platform with well thought cable management to allow continuous 360-degree functionality. The platform has an integrated Inertial Navigation System that compensates for dynamic conditions imposed during mobile operations on land, or at sea. The system contains two hot-swappable DC power inputs and an internal battery with an 8-hour runtime, allowing for continuous operations regardless of the power source. Currently, the FoxHound antenna is an L and S band single antenna. The Hermes Module is a small form factor, weather resistant module that integrates two IP-based RF radios, along with a network implementation which allows separation of the network traffic to the intended parallel over-the-air path.

B-05: Tactical Edge Embodied AI

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3

PROJECT INFORMATION

Organization Name:	Gambit Defense Inc.
Principal Investigator:	Joshua Giegel
Technology Readiness Level:	TRL 4: Component and/or breadboard validation in laboratory environment
Research Area of Interest:	B) UxS Design, Deployment, Operation, Networking and Control
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

Establish a seek and find mission with three COTS UASs tasked to find targets of interest (TOI) with certain characteristics in an AOI. The COTS UASs are connected over a secure MANET networked with a GCS implementing ATAK through a point and click interface. Each COTS UAS moves to the location using onboard VIO techniques with the assumption that GNSS is always denied. Upon arrival at the AOI the COTS UASs search trajectories are implemented, the full EM spectrum is mapped in both time, spectral, and 3D space, the AOI is searched and all objects are identified using a variety of techniques while the system dynamically repositions to ensure connectivity, ISR measurement resolution, and data haul back of the relevant information (ML compression techniques will be used to reduce the need to haul back 720p/30 fps+ full motion video to minimize power, emissions, and network traffic) to the GCS station.

SYSTEM DESCRIPTION

Gambit's Tactical Edge Embodied AI Mesh (TEEAM) is an ultra-low size, weight, power, and cost (SWaP-C) add-on device that functions agnostic of platform or system, using inertial navigation, EM mapping, and video/images with increased edge computing capacity to support managed data haul back and edge object detection. This supports an on-demand mobile ad hoc network (MANET) with visible, assessable, understandable, linked, trusted, interoperable, and secure (VAULTIS) characteristics and an artificial intelligence and machine learning (AI/ML) layer to enable jamming resilient communication for mode routing and asset inclusion within a self-healing network for tactical decision support and target identification. The envisioned use is rapid and reliable movement of intelligent data at the tactical edge enabling multiple missions and support functions through collaborative management with minimum cognitive load to support the use of over one hundred autonomous systems.

B-06: Development & Assessment of Off-Road Autonomous-Driving Capabilities

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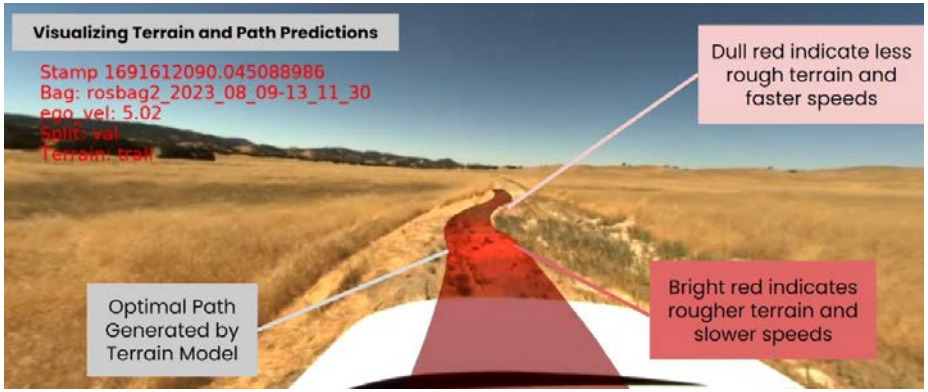

PROJECT INFORMATION

Organization Name:	BlueSpace.ai
Principal Investigator:	Jeremy Templeton
Technology Readiness Level:	TRL 5: Component and/or breadboard validation in relevant environment.
Research Area of Interest:	B) UxS Design, Deployment, Operation, Networking and Control
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

- Our first experiments will assess driver-assist technology for the warfighter:
  - Evaluate terrain models trained on data from previous JIFX events to quantify model transferability
  - Dynamically update models with new field data as needed
  - Assess first of their kind off-road driver-assist algorithms
  - Provide best trail path for driving towards objective
  - Provide trail departure warnings
  - Provide “turn-by-turn” navigation for the battlefield
- Our second experiments will pilot ground vehicle self-driving for leader/follower capabilities in off-road environments relevant for DOD missions:
  - Test and evaluate a new model to extract a trajectory for the following vehicle to use
  - A new motion planning algorithm to follow trajectories off road while maintaining safety bounds with the leader will be deployed and critically evaluated

SYSTEM DESCRIPTION

- BlueSpace provides off-road autonomy solutions without traditional dependencies on AI, training data, and HD maps
- Our software leverages 4D sensors with our proprietary algorithms based on math and physics to deliver autonomy in any domain
  - Industry-leading positioning accuracy (CTE<0.3%) using 4D Lidar/Inertial Odometry in any location on any terrain
  - Motion-first perception provides detects and tracks objects with industry-leading motion estimation, no AI necessary
  - Flexible off-road terrain understanding enables rapid learning for deployment in new areas

- Learn more at http://bit.ly/BlueSpaceDemos

B-09: A UxS That Collects Data Where No Other UxS Can

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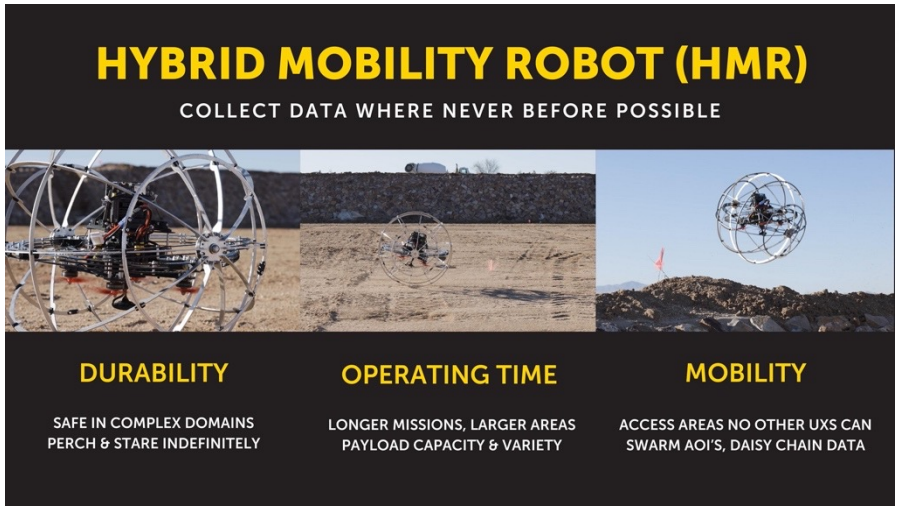

PROJECT INFORMATION

Organization Name:	Revolute Robotics
Principal Investigator:	Collin Taylor
Technology Readiness Level:	TRL 5: Component and/or breadboard validation in relevant environment.
Research Area of Interest:	B) UxS Design, Deployment, Operation, Networking and Control
Funding	

PROPOSED EXPERIMENT OVERVIEW

We propose two experiments:

1) Test our system's ability to operate and gather intel where no other UxS can. This requires real or simulated environments where neither a UAS nor UGS are able to navigate. For UAS, this includes indoors, in confined spaces, in collapsed buildings, underground, between dense flora, and in pipes and HVAC systems. For UGS, this includes extreme terrain (rocky, sloped, slippery), areas with obstacles (debris, ladders, ledges, water), and high-elevation areas.
2) Test our system's ability to save energy (thus extending operating time) when driving on the ground vs. when flying. A simple experiment includes operating the system until the battery runs out in a) driving mode, b) flying mode, and, optionally, c) loiter mode. Furtherance of this experiment can include testing the system in different environments with varying weather conditions, obstacles, and terrestrial surface characteristics.

SYSTEM DESCRIPTION

Our UxS is a combination of UAS and UGS in one system. It can switch between driving on the ground and flying through the air to operate and collect intel where no other UxS can. Our system consists of a quad-copter UAS mounted to two gyroscopic, rotating gimbal rings enclosed by a spherical exoskeleton. This enables the UAS to "roll" on the ground to save energy and operate 500-1000% longer than when flying. The added operating time increases payload capacity so it can carry a mix of swappable cameras and sensors. If the system approaches an obstacle that would prevent a UGS from continuing the mission, it can simply fly around it. The exoskeleton also enables the system to safely fly in confined spaces and complex environments without the fear of a mission-ending collision, and similar to a UAS it can fast travel and collect data at height.

D-01: SkyWire HF

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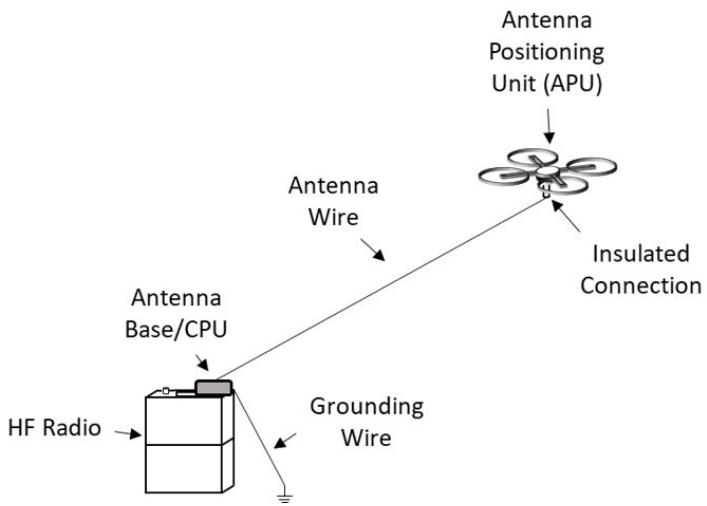

PROJECT INFORMATION

Organization Name:	CyvilCo LLC
Principal Investigator:	Will Scott
Technology Readiness Level:	TRL 5: Component and/or breadboard validation in relevant environment.
Research Area of Interest:	D) Communication and Networking
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

A prototype will be deployed. This will include the setup of an amateur HF radio, the connection of the base unit, antenna wire, and antenna positioning unit (APU) (Civilian SUAS). Ionospheric, weather, location, and other relevant data will be collected, and the optimal Tx/Rx frequency will be calculated to distant HF transmission beacons. The APU will adjust the antenna to match optimal frequencies, and beacon transmissions will be received and measured for signal strength. The first measure of effectiveness will be the time required to deploy the antenna system and receive beacon transmissions. The second MOE will be the time required to switch between frequencies/beacons and match the corresponding antenna length. The third MOE will be the precision of antenna length match to frequencies in use. These measurements will be compared to conventional tactical HF antennas currently in use to test for significant advantages over currently fielded HF antenna solutions.

SYSTEM DESCRIPTION

This technology is a dynamic and automated high frequency (HF) antenna system which includes an antenna base/control unit, a retractable and adjustable antenna wire, and an antenna positioning unit. The complete system uses relevant wave propagation data to compute optimal antenna orientation and automatically position the antenna for maximal transmission and reception. This will be done static or on the move at the push of a button, reducing operator demand. The optimal antenna configuration is maintained in real time and adjusts to changing electromagnetic conditions. These changes are maintained across a network of systems, ensuring the identification and utilization of best frequencies and matching antenna lengths.

D-02: REDCOM ATAK Communications Plugin

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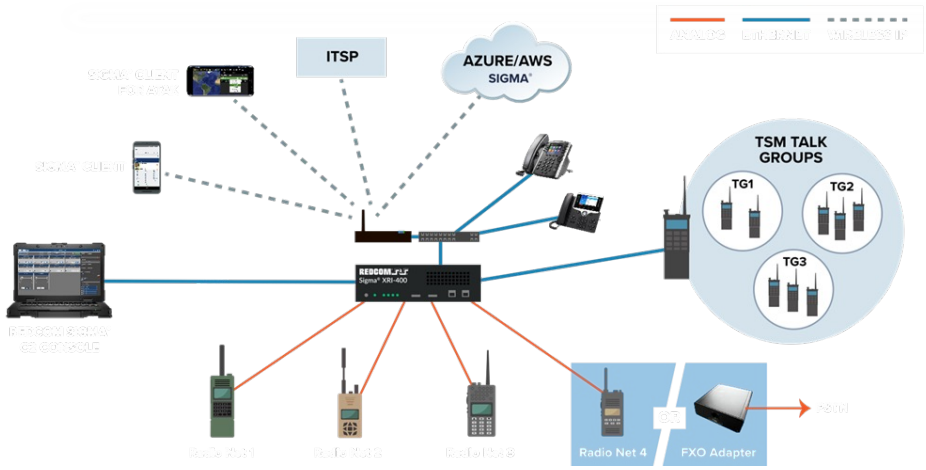


PROJECT INFORMATION

Organization Name:	REDCOM Laboratories
Principal Investigator:	Kristina Bush
Technology Readiness Level:	TRL 5: Component and/or breadboard validation in relevant environment.
Research Area of Interest:	D) Communication and Networking
Funding	IRAD

PROPOSED EXPERIMENT OVERVIEW

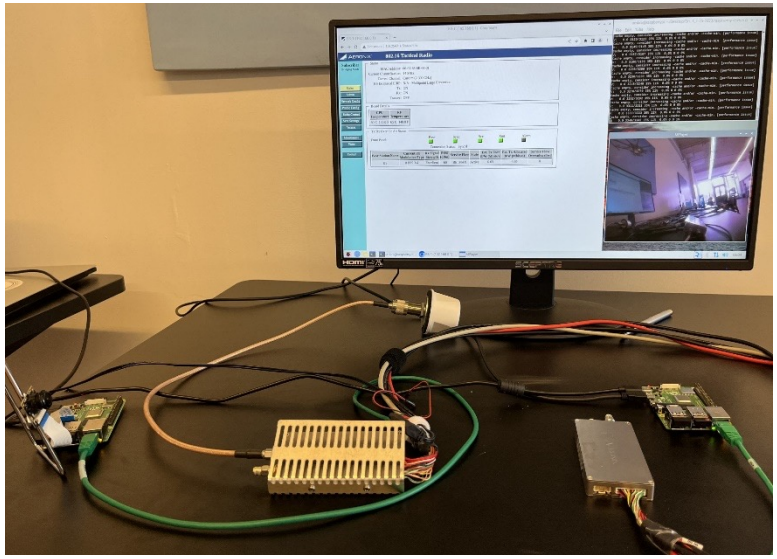
REDCOM will demonstrate enabling Command and Control at the tactical edge through adaptable communications that can be leveraged directly through ATAK via our prototype plug-in. Our experiment will include bridging multiple radios on various waveforms ‚Äì analog and MANET, SIP phones, mobile phones over ITSP, WW2 crank phones, and ATAK EUDs. In addition to bridging these disparate platforms all together in a single voice channel, we will demonstrate the ability to execute an automated comms PACE plan. REDCOM will also showcase our patented PTT/PTS signaling in an IP network technology. Conveying Push-To-Talk and Push-To-Signal (PTT/PTS) information over an IP network through signaling bits defined in and propagated with the Real-Time Protocol (RTP) stream allows the PTT/PTS information to remain synchronized with the voice packets of the stream. Following our execution of voice interoperability REDCOM will display our ability to bridge common but disparate chat protocols such as XMPP and IRC.

SYSTEM DESCRIPTION

REDCOM's Sigma software provides both server and client applications. Sigma is a JITC and FIPS 140-2 certified communications interoperability platform. Sigma is a Command and Control (C2) application that provides voice, video, chat, conferencing, transcoding, and a PTT console. Sigma is hosted natively on the Sigma XRI-400. Sigma XRI-400 hardware functions as the analog radio gateway and supports Radio over IP (RoIP), with the ability to bridge or crossband formerly incompatible devices into a single communications network. Sigma XRI-400 creates a unified radio interop network for up to four distinct radio nets. These radios can be different bands, waveforms, channels, or encryption formats. Sigma XRI-400 is a complete comms ecosystem in a single platform, enabling the convergence of IP and RF communications for scalable interoperability. The Sigma XRI-400 ecosystem can now be leveraged directly through ATAK, currently at TRL 5.

D-03: Ubiquitous Security Platform

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3



PROJECT INFORMATION

Organization Name:	Ombra
Principal Investigator:	Tommy Brown
Technology Readiness Level:	TRL 2: Technology concept and/or application formulated
Research Area of Interest:	D) Communication and Networking
Funding	Federally

PROPOSED EXPERIMENT OVERVIEW

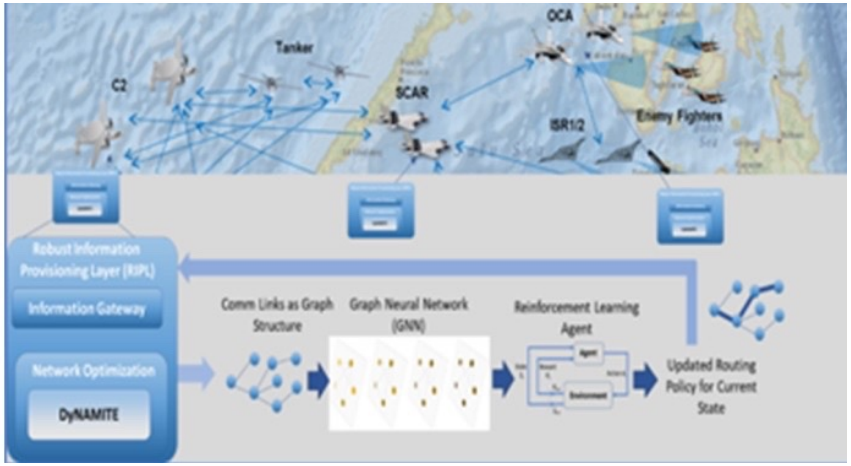
Ombra's Ubiquitous Security Platform (USP) currently can encrypt data over two data links using Ubiq's encryption SDK. Ombra will communicate using Aeronix EDL nano radio (2.4 GHz, 1 W) with jamming detection/mitigation using a localized jamming source (if approved). We will stream video using a Raspberry Pi from a range of ~100-500m between users and show the encryption/decryption capability as well as demonstrate simultaneous streaming as well as switching between WiFi and the radio network. We will measure packet loss and the ability to transmit the video near an active jamming device.

SYSTEM DESCRIPTION

Ombra's Ubiquitous Security Platform (USP) is a technology for secure terrestrial tactical radio and network communications between Team Awareness Kit devices using a third-party software development kit for encryption from Ubiq. The underlying technology consists of a lightweight, resource-efficient, software-only engine that leverages FIPS 140-2 compliant encryption algorithms to fragment, disassociate, encrypt, and disperse near real-time streaming or static data over mixed communication pathways (e.g., Ethernet, Wi-Fi, Bluetooth, LTE, Microwave, or SATCOM) to endpoints for decryption and use. USP currently offers a means of secure communication over single or multiple user selectable modes. The option for multichannel transport enhances security and effectively increases the total available bandwidth between endpoints. Objective capabilities for USP include automatic data retry and re-routing if channels become unstable or unavailable, making USP resilient to denied or contested communications environments.

D-04: DyNAMITE (Dynamic Network Assessment for Mission Information in Tactical Engagements)

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3



PROJECT INFORMATION

Organization Name:	Securboration
Principal Investigator:	Bruce McQueary
Technology Readiness Level:	TRL 5: Component and/or breadboard validation in relevant environment.
Research Area of Interest:	D) Communication and Networking
Funding	Federally (Navy SBIR)

PROPOSED EXPERIMENT OVERVIEW

The objectives of the experimentation and demonstration are to:

- Provide quantitative results that show the effectiveness of
  - Stressor classification algorithms
  - Decision tree processing
  - Mitigation strategies
- Show applicability of the DyNAMITE-enhanced RIPL system for battlespace-wide Situational Awareness (SA) data exchange while under varying degrees of disruption and various causes of disruption

SYSTEM DESCRIPTION

To address interoperability and battlespace-wide information flow, Raytheon BBN Technologies (BBN) has designed RIPL (Robust Information Provisioning Layer) as an information provisioning layer (IPL) for seamless, secure information sharing among existing and future systems to establish and maintain Air Supremacy via Information Dominance [1]. The design is based on and leverages our work on the Defense Advanced Research Projects Agency (DARPA) Dynamic Network Adaptation for Mission Optimization (DyNAMO) [2] Robust Information Gateway (RIG) architecture and code base [3]. RIPL is also informed by our clean-sheet capabilities study [4] conducted under the first part of the DISTRICT program.

F-03: ATAK Live Mapping

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3

PROJECT INFORMATION

Organization Name:	GreenSight
Principal Investigator:	Kyle Sayers
Technology Readiness Level:	TRL 6: System/subsystem model or prototype demonstration in a relevant environment.
Research Area of Interest:	F) Intelligence, Surveillance, and Reconnaissance (ISR)
Funding	Federally (US Air Force)

PROPOSED EXPERIMENT OVERVIEW

The ATAK Live Mapper is a software system which provides real-time aerial mapping of a geographic area which is streamed directly from an in-flight to UAV to fighters on the ground. At JIFX GreenSight hopes to test the system's streaming and mapping capabilities while the UAV at a distance as well as further develop the system's mapping quality in different aerodynamic and geographic conditions.

The tests will consist of only pre-planned routes as directed by a local ground control system. Imagery will be captured and stitched on the UAV, streamed to a lightweight PC on the ground, then forwarded to an ATAK tablet.

GreenSight will evaluate mission success using metrics including imagery throughput, map update latency, computational resource usage, and mapping quality. We will also invite other JIFX participants to evaluate the system and its effectiveness.

SYSTEM DESCRIPTION

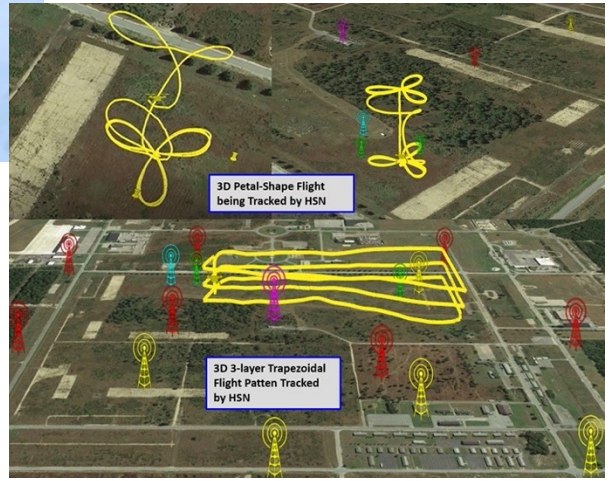
The ATAK Live Mapper builds upon technologies such as simultaneous localization and mapping (SLAM), spatially localized data chunking, and dynamic tiling for the purpose of aerial mapping. The system defines low-memory and algorithmically efficient data formats and standards which are designed to reduce mapping latency and increase the throughput of aerial intelligence.

The system first captures imagery using the in-flight imagery capture and tagging pipeline. That imagery is then passed to the live mapping algorithm which produces fresh chunks of mapped intelligence which is then tiled by the dynamic tiling service and served to the ATAK tablet with the installed plugin.

The outcomes of these tests will help inform the computational constraints that should be placed on the UAS as well as the communication and computation requirements for hardware on the ground.

F-04: Networked ALT_PNT - Self-Expanding Infinity Mesh Communications

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3



PROJECT INFORMATION

Organization Name:	PhasorLab Inc.
Principal Investigator:	Mark Sheehan
Technology Readiness Level:	TRL 6: System/subsystem model or prototype demonstration in a relevant environment.
Research Area of Interest:	F) Intelligence, Surveillance, and Reconnaissance (ISR)
Funding	Internally and Federally

PROPOSED EXPERIMENT OVERVIEW

Testing bidirectional inter-node data communications real-time network mapping and monitoring capabilities:

a. Create a wireless mobile ad hoc network consisting of mobile nodes such as ground rovers, UAVs or personnel walking with HSN radio.
b. Validate multi-hop inter-node and base station communications by establishing bidirectional telemetry link (MAVLink) between nodes or delivering text data from mobile node to base station.
c. Test real time 3D map visualization of entire network at the base station mobile nodes.

Performance metrics for real time 3D mapping:

a. Static and dynamic accuracy (RMSE and CDF plots)
b. Latency
c. Availability

Performance metrics for data communications:

a. Average end-to-end latency and throughput
b. Distance

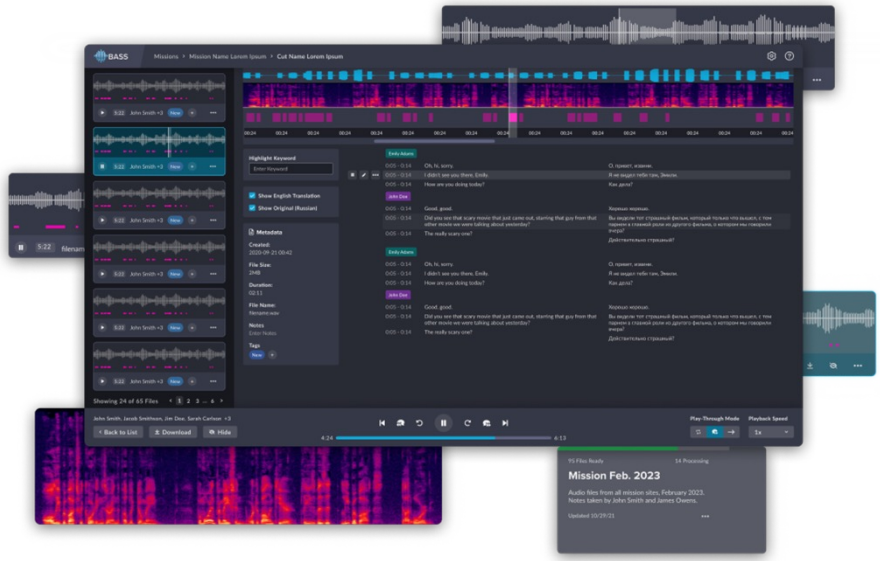
SYSTEM DESCRIPTION

PhasorLab's Hyper Sync Net (HSN) is a wireless RF mesh network whose nodes achieve and maintain sub-nanosecond time sync and frequency sync of better than 1 part-per-billion. The HSN mesh delivers precision Assured Position, Navigation and Timing (A-PNT) data, using organic timing rather than GNSS assets. Novel and patented algorithms discipline the frequency and phase of every node achieving virtual network-wide phase lock. Further algorithms maximize system bandwidth usage and improve range estimation. HSN nodes are on-demand, ad-hoc deployable as a mobile, static or hybrid A-PNT solution indoors, outdoors and in cluttered urban environments.

The HSN mesh is self-organizing, self-healing, self-expanding and secure with no-touch configuration. HSN frequency channel hopping mitigates jamming threats and super resolution algorithms counter multipath effects. The mesh synchronization protocol dynamically generates a 3D map of the entire network for shared 3D situational awareness, critical for

F-05: BASS BOOST - Better Operational Optimization through Speech Technology

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3



PROJECT INFORMATION

Organization Name:	Blue Ridge Dynamics, Inc.
Principal Investigator:	Kyle Miller
Technology Readiness Level:	TRL 4: Component and/or breadboard validation in laboratory environment.
Research Area of Interest:	F) Intelligence, Surveillance, and Reconnaissance (ISR)
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

To evaluate the efficacy of the BASS system in enhancing Full Motion Video (FMV) Processing, Exploitation, and Dissemination (PED) workflows, this experiment plan will compare standard manual data entry methods against BASS-enabled processes. The experiment consists of two phases:

Control Phase: Participants will analyze FMV scenarios using traditional data entry methods, manually typing observations into a predefined format. Key performance metrics include words per minute (WPM) typing speed, overall report production time, accuracy, and quality of the reports generated.

BASS Phase: Participants will repeat the FMV analysis using the BASS system, equipped with speech-to-text capabilities, post-processing automation for quality enhancement, and a custom User Interface designed for workflow optimization. Performance metrics identical to the control phase will be measured to ensure comparability.

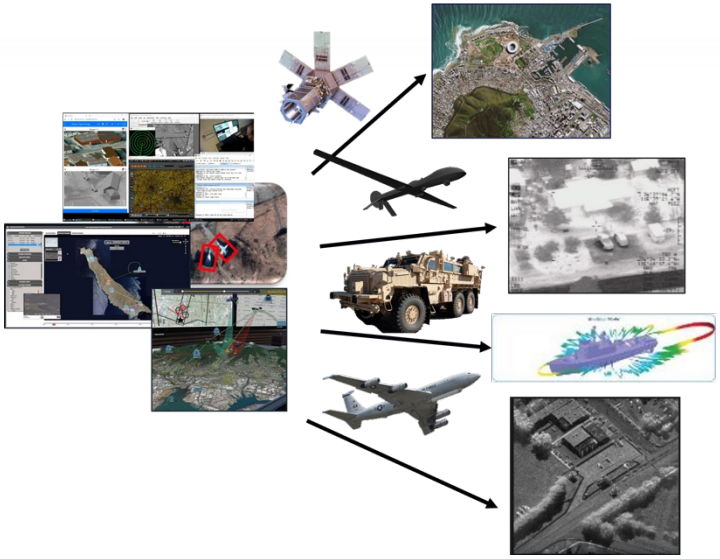
The comparative analysis will focus on quantifiable improvements in typing speed, report production time, accuracy, and quality, facilitating an

SYSTEM DESCRIPTION

The BASS system represents a revolutionary advancement in Full Motion Video (FMV) Processing, Exploitation, and Dissemination (PED) through its integration of cutting-edge Whisper.ai speech-to-text technology. At its heart, BASS leverages AI models for real-time transcription, enhanced by post-processing features that include formatting and auto-correction via predictive text. This core technology is encapsulated within a custom user interface, designed to align with specific workflow requirements while ensuring human analysts remain in the loop generating critical intelligence products. BASS operates disconnected from the cloud, ensuring uninterrupted service even in the most remote locales.

F-06: Synthetic ISR Data to Stimulate Targeting Processes

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3



PROJECT INFORMATION

Organization Name:	CAE USA
Principal Investigator:	Matthew Martin
Technology Readiness Level:	TRL 8: Actual system completed and qualified through test and demonstration.
Research Area of Interest:	F) Intelligence, Surveillance, and Reconnaissance (ISR)
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

The experiment will test the use of Modeling & Simulation (M&S)-produced synthetic ISR data, blended with live data, to stimulate the Tasking/Collection/Processing/Exploitation/Dissemination (TCPED) process for intelligence analysts, targeteers, and Intelligence / Surveillance / Reconnaissance (ISR) Collection Managers. It is typically not possible to train ISR processes to the level of complexity needed to prepare for all-domain, peer threats due to the limitations of range and live-fly training. The CAE Virtual ISR Training Application (VISTA) will augment a live training event by creating surface-to-space constructive ISR platforms with synthetic ISR data, streamed onto a operational TCPED network, to exercise and assess the full targeting cycle. Results will be measured in the speed and effectiveness of a Find, Fix, Target, Track, Engage, Assess (F2T2EA) process, and improvement of a TCPED team over multiple iterations.

SYSTEM DESCRIPTION

CAE VISTA is a scalable, cost-effective solution for C4ISR professionals to conduct targeted training, mission rehearsal, and assessment of proposed operational plans. The TCPED and ISR training audiences can create scenarios, train to their specific objectives, connect with other virtual training systems, and increase the flexibility, fidelity, and capacity of their On-the-Job (OJT) and exercise training.

CAE has leveraged investments in ISR sensor simulation as part of aircraft tactical flight and mission training to bring high-fidelity sensor models into mission simulation. This includes constructive all-domain ISR platforms and sensors with generation standard ISR datasets streamed onto operational networks and manipulated using standard ISR data processing tools.

CAE VISTA incorporates a faster-than-real-time M&S capability for theater-wide mission level M&S from surface to space in a Multiple Level Security environment. Users can rapidly configure peer warfare scenarios to explore complex operations and tactics across all domains including cyber and electronic warfare.

G-02: Airship AI Outpost

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3

PROJECT INFORMATION

Organization Name:	Airship AI
Principal Investigator:	Ryan Brophy
Technology Readiness Level:	TRL 9
Research Area of Interest:	G) Situational Awareness
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

Airship personnel will deploy at least one Outpost device connected to diverse COTS/GOTS cameras showcasing the transformative impact of enhanced encoding and artificial layered intelligence on full-motion video. Raw video streams serve as the baseline, while Outpost optimizes and dynamically adjusts encoding, offering advanced analytics like object recognition and motion detection. The difference between raw and enhanced video is striking, demonstrating the power of Outpost's intelligent processing. Airship Acropolis, serving as the backend video management system, ensures seamless storage and retrieval. This integrated approach, emphasizes the substantial enhancement Outpost brings to video streams, making them richer in insights and managed efficiently through Airship's comprehensive ecosystem.

SYSTEM DESCRIPTION

Airship AI's Outpost is designed for seamless integration of multiple video CODECs, prioritizing efficient remote transmission through bandwidth control. Its adaptive feature dynamically adjusts video transmission based on network capabilities or user presets, allowing users to enhance resolution in specific areas of interest while maintaining full-resolution recording at the edge. Outpost ensures secure data transmission with AES 256 encryption. The integration of Outpost AI brings advanced edge-based analytics, including license plate and aircraft tail number recognition, personnel and bag identification. The system's versatility extends to supporting additional OCR data sets, broadening its applicability in diverse scenarios. Overall, Outpost stands as a comprehensive solution, balancing efficient bandwidth usage with robust analytics for enhanced situational awareness.

G-03: Integrated Sensing and Communications Using 5G

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3

PROJECT INFORMATION

Organization Name:	Tiami Networks
Principal Investigator:	Amitav Mukherjee
Technology Readiness Level:	TRL 6: System/subsystem model or prototype demonstration
Research Area of Interest:	G) Situational Awareness
Funding	Internal

PROPOSED EXPERIMENT OVERVIEW

We will demonstrate a 5G-based integrated communications and sensing (ISAC) device that uses the 5G waveform for simultaneous data connectivity and radar sensing of the environment. Specific use cases for demonstration are camera-free classification of vehicles and uncrewed aerial systems using 5G ISAC in the S-band.

SYSTEM DESCRIPTION

Tiami's 5G radar module is equipped with edge machine learning– reflections of the 5G waveform are used for sensing objects, people, and gestures without using cameras. Both passive and active sensing modes are supported - passive sensing requires the availability of commercial 5G network signals.

G-04: Narrative Intelligence in the Information Environment

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3

PROJECT INFORMATION

Organization Name:	Clara Copilot
Principal Investigator:	Alex Moffitt
Technology Readiness Level:	TRL 3: Analytical and experimental critical function and/or characteristic proof of concept.
Research Area of Interest:	G) Situational Awareness
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

Clara Copilot proposes using its web-based application to demonstrate its ability through the C5ISR framework to monitor narrative intelligence in the information environment, identify biases and vulnerabilities, and provide actionable recommendations from Open-source Intelligence and Personal Activity Intelligence analysts to decision-makers for modern military operations.

We will engage with the DoD/SOF Stakeholders and Technology evaluators for end user feedback to show them how they can operate through the integration of advanced technologies and information systems to enhance situational awareness, decision-making, and operational effectiveness. Clara provides real-time situational awareness into the narratives, stories, and messages within the information environment so that military leaders can effectively implement strategies for geopolitical events using Artificial Intelligence signal processing.

SYSTEM DESCRIPTION

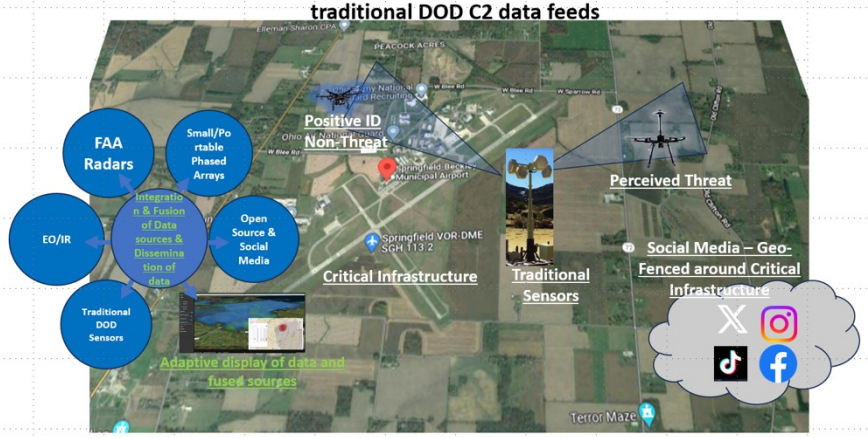
Clara provides real-time situational awareness into the narratives, stories, and messages within the information environment so that military leaders can effectively implement strategies for geopolitical events using Artificial Intelligence signal processing.

Clara transforms open-source data in real-time into prioritized, actionable, predictive insights, ensuring rapid, informed decision-making, and a proactive adaptive strategy. Clara's commercialization potential showcases a commitment to building a future where AI is a fundamental pillar of organizations, enhancing human capabilities, and ensuring a more prosperous, safer, and more stable world.

G-05: Joint and Multi-National Integration in Real-Time

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3

Fusion and adaptive display of open-source/social media, Other Government Agency and traditional DOD C2 data feeds



Green Text is focus or experiment – Determine best way to ingest, fuse, disseminate and display data from disparate sources to reduce cognitive load and decrease decision timelines

PROJECT INFORMATION

Organization Name:	United States Space and Missile Defense Command
Principal Investigator:	David Estacio
Technology Readiness Level:	TRL 5: Component and/or breadboard validation in relevant environment.
Research Area of Interest:	G) Situational Awareness
Funding	Internally and Federally

PROPOSED EXPERIMENT OVERVIEW

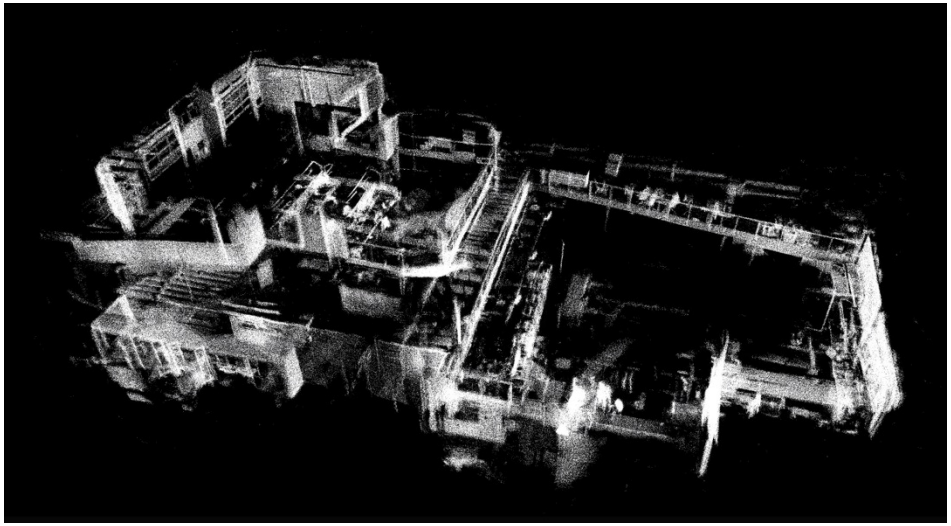
Experiment with real-time integration/fusion of live and recorded social media feeds and traditional military C2 data types simulated using constructive sims targeted at detecting and informing the user of activities associated with small UxS operations within CONUS. Activities of interest would be around critical infrastructure and politically sensitive or other important events that could represent a target for terrorism or, in the case of critical infrastructure a soft target as a precursor to hostilities. This would support homeland defense operations as well as DSCA activities. We will integrate these disparate data sources with an adaptive SA system, we will provide, and will experiment with innovative display/UX approaches to investigate ways to best display this data and reduce user cognitive load. We will welcome the opportunity to integrate with other participants, their displays and/or data sources to provide more complete information to personnel performing Title 32 or DSCA related activities.

SYSTEM DESCRIPTION

Three technologies will be utilized to perform the above experiment. The first is a user configurable, low-latency integration engine designed to facilitate seamless data interoperability between disparate systems. This capability will be capable of being configured locally, without software development, to meet data content, structure and transport requirements of integrated SA/C2 systems and available sensors. The second is an adaptive prototype SA tool that is extensible to depict data in different ways to experiment with mechanisms to more rapidly develop understanding from data and to reduce cognitive load. The final system is an SMDC built prototype of a constructive simulation designed to be easily and rapidly reconfigured. This will not be a direct part of the experiment but will be used to provide data for the experiment and will be available, as will all of these tools, for others to utilize if additional data is needed by other experiments.

G-06: sUAS operations in GPS Denied Environments for HADR Applications

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3



PROJECT INFORMATION

Organization Name:	BRINC Drones, Inc.
Principal Investigator:	Andrew Cote
Technology Readiness Level:	TRL 9: Actual system proven through successful mission operations.
Research Area of Interest:	G) Situational Awareness
Funding	Internally

PROPOSED EXPERIMENT OVERVIEW

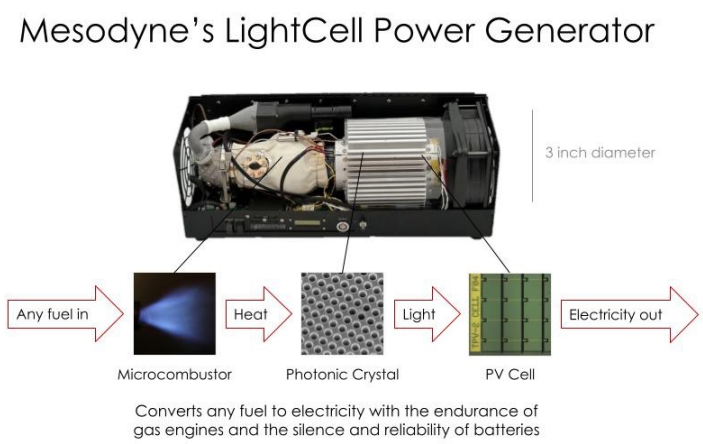
Our collaborative experiment with the Navy focuses on conducting simulated Humanitarian Assistance and Disaster Relief (HADR) reconnaissance missions using the BRINC Lemur 2 drone. This innovative initiative entails navigating complex Military Operations in Urban Terrain (MOUT), specifically in subterranean tunnel environments. The primary objective is to enhance situational awareness for rescue officials operating in challenging disaster-stricken areas. Leveraging the drone's unique ability to operate in GPS-denied and subterranean environments, we aim to provide real-time, critical data for effective decision-making during HADR missions. Our prior successful simulations in diverse locations such as the US, Ukraine, Israel, Turkey, and others attest to the drone's adaptability and reliability in varying scenarios. This experiment underscores our commitment to advancing disaster response capabilities and fostering international collaboration for enhanced emergency preparedness and swift, effective crisis management.

SYSTEM DESCRIPTION

The BRINC Lemur 2 drone represents a pioneering aerial system tailored for a diverse range of applications, with a particular emphasis on Humanitarian Assistance and Disaster Relief (HADR) missions. Notably, its standout feature lies in its exceptional capability to operate seamlessly in GPS-denied and subterranean environments. Armed with advanced sensors, including cutting-edge terrain mapping and obstacle avoidance technologies, the Lemur 2 excels in navigating challenging landscapes where traditional GPS signals may be compromised. This attribute makes it an invaluable asset for HADR scenarios, where rapid and precise data collection is essential in subterranean or GPS-deprived locations. The drone's modular design accommodates various mission-specific payloads, enhancing its adaptability for critical tasks such as search and rescue operations, making the BRINC Lemur 2 an indispensable tool for efficient and effective disaster response efforts.

K-02: LightCell: Portable, Silent, Long-Endurance Power Generation for Tactical C5ISR

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3



PROJECT INFORMATION

Organization Name:	Mesodyne Inc
Principal Investigator:	Mathew Ellis
Technology Readiness Level:	TRL 6: System/subsystem model or prototype demonstration in a relevant environment.
Research Area of Interest:	K) Infrastructure and Power
Funding	Federally and Internally (SBIR)

PROPOSED EXPERIMENT OVERVIEW

We intend on demonstrating and testing our LightCell power generator as a solution for tactical C5ISR equipment power in the field. We will be charging our own equipment, mainly laptops and phones, as well as military batteries to demonstrate the power generation capability. We will encourage end users and any other relevant stakeholders to interact with the demonstration however they see fit as a means of evaluating the technology's impact in the field. The feedback from this experiment will be directly used in further development of our LightCell technology in order to maximize the effectiveness of a final product.

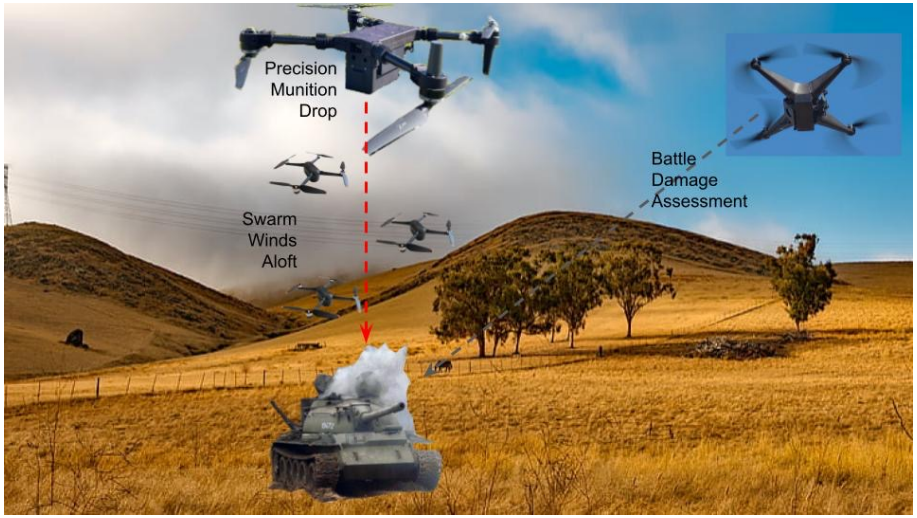
SYSTEM DESCRIPTION

Mesodyne's patented LightCell is a new class of power generator that converts fuel into electricity via light. Simply put, the LightCell enables portable, efficient, quiet, reliable, long-endurance power anywhere, anytime, and from any fuel. With more than 10x the energy density of batteries, the LightCell enables people, sensors, autonomous vehicles - virtually any system that requires portable power - to perform their mission beyond what is possible today and extend range, endurance, and lethality across a multitude of platforms.

The LightCell prototype unit to be demonstrated and tested in this experiment will be approx. 16 x 6 x 6 inches and weigh approx. 13 pounds. The unit will generate DC power from propane and butane fuel.

M-01: Combined WxUAS Enhanced Targeting and Battle Damage Assessment with SUAS

Naval Postgraduate School Joint Interagency Field Experimentation (JIFX) 24-3



PROJECT INFORMATION

Organization Name:	GreenSight
Principal Investigator:	James Peverill
Technology Readiness Level:	TRL 6: System/subsystem model or prototype demonstration in a relevant environment.
Research Area of Interest:	M) Precision strike, Non-Lethal Weapons, Information Operations
Funding	Federally (US Air Force)

PROPOSED EXPERIMENT OVERVIEW

We intend to leverage a heterogeneous team of SUAS to optimize the accuracy of high altitude dropped munitions as well as provide autonomous battle damage assessment.

These three SUAS systems will be used in a combined experiment, simulating a precision airdrop munition CONOPs. Winds aloft measured by WeatherHive will be used to correct targeting of an ARL designed Trillium inert munition dropped by the Mustang SUAS. OWL will provide live ISR and battle damage assessment. Noise measurements will be taken to assess probability of detection of the combined system.

Experiment will be repeated at a number of different altitudes. Correlations will be made between the precision of the drop and assessed precision through OWL. Results will be analyzed to assess whether wind corrections from WeatherHive WISP improved accuracy and whether fully autonomous collaboration among the platforms is feasible.

SYSTEM DESCRIPTION

The WeatherHive is a swarm of WISP nano-SUAS that provides live winds aloft above the target. These nano-SUAS are extremely small (under 250g) and clandestine.

Mustang is a modular, folding tactical VTOL SUAS that can carry and drop munitions up to 4kg.

OWL is an attrittable, 2kg SUAS with ISR capabilities built to meet the requirements of the Army PMUAS Low Cost SUAS operational need.