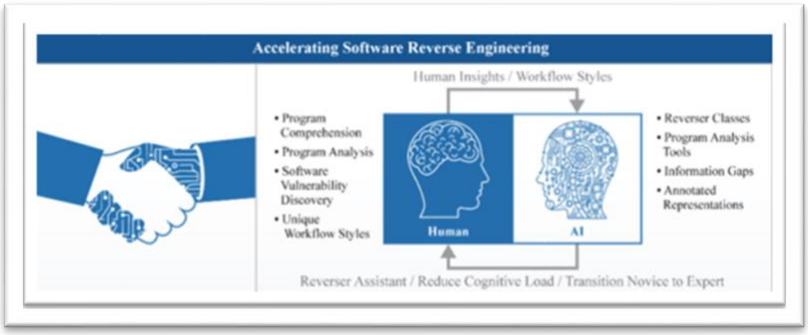
Round 4 Projects Overview

405 Computer-Human Interaction for Rapid Program Analysis through Cognitive Collaboration (CHIRP2C)

Project Team: Riverside Research (Lead); University of Dayton; University of Cincinnati; Unmanned Science, Inc.

https://www.ohiofrn.org/projects/computer-human-interaction-rapid-program-analysis-through-cognitive-collaboration



The project sought to provide a demonstrated capability for a bidirectional Computer Human Interface for Rapid Program Analysis through Cognitive Collaboration (CHIRP2C). The initial application of this technology is accelerating reverse engineering of digital systems to aid in foreign materiel exploitation and aiding novices in utilizing complex and advanced digital reverse engineering tools such as Ghidra. The innovation expands the bandwidth of Human Autonomy Teaming allowing for greater empowerment of human partners and more rapid adaptation of intelligent agents

417 Multi-purpose Mast/Aerial 360^{O} radar/optical fused sensors for Perimeter Monitoring and Aerial Detect and Avoid

Project Team: Ghostwave (Lead), Sinclair College, The Ohio State University, Converge Technologies, Sivers Semiconductors, StreamDSP

https://www.ohiofrn.org/projects/integrated-optical-radar-sensor-fusion-system-air-space-awareness

This project sought to combine GhostWave's RF Noise radar technology with long range cameras for perimeter monitoring. The product will be a system looking for a typical Group 1 UAS out 3KM, 360^{O} in azimuth using stealthy radars from The Ohio State University patents, exclusively licensed to GhostWave. The radars are stealthy with low probability of jamming or intercept. This project determined that the existing radar was not going to have the range desired for the application. As a result, the team made a change of course to correct this problem and team added "beam steering" to the solution which added range, but also consumed budget. Although the project did not progress to a final demonstration because of the pivot in radar design, the optical detection and tracking was a success. GhostWave is getting interest from Joint Counter-UAC Office (JCO) on their solution for low altitude perimeter monitoring.

421 Geometrically Complex 3D Printed Antennas for UAVs

Project Team: Youngstown Business Incubator (Lead), Youngstown State University, Kent State University, Universal Technology Corporation, Event 38 Unmanned Systems

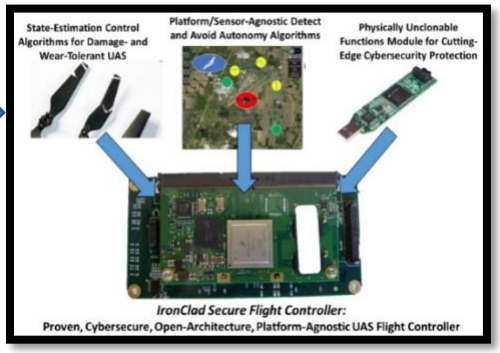
https://www.ohiofrn.org/projects/geometrically-complex-3d-printed-sensors

This project focused on design, simulation, fabrication, evaluation, and demonstration of novel 3-D printed antennas for use in the air collision avoidance and information system known as Automatic Dependent Surveillance-Broadcast (ADS-B). These antennas double as structural components such as an antenna embedded in a rotor support strut, fuselage components such as an antenna embedded in the nose cone, or lift-generating surfaces such as an antenna embedded in the skin of the leading edge of the wing of a hybrid quadcopter-plane UAV. The team designed and printed a series of 1.09 GHz antennas for use in the ADS-B environment. The antennas were tested to verify that their radiation characteristics agreed with simulations. The antennas were then mounted to a UAV and their performance was demonstrated. The antennas were shown to receive the ADS-B signal at acceptable levels. The professors have created a new start-up called Pathologically Complex Geometries (PCG). The 3D printed antenna is also an option for buyers of the Event 38's new E400 eVTOL UAS that was made commercially available during this Fiscal Year. This project demonstrated the team's capability to produce multi-functional 3D printed components. For example, the nose cone itself is an antenna (see above picture). Geometric complexity and a wide array of materials allow the team to pursue innovative designs for electromagnetic materials, multi-functional radiating structures, and specialized components for the communications and remote sensing industries.

422 Resilient and Secure UAS Flight Control

Project Team: Asymmetric Technologies (Lead), The Ohio State University, Ohio University, Lockheed Martin

https://www.ohiofrn.org/projects/ironclad-secure-flight-controller



The American-made, cybersecure IronClad Secure Flight Controller provides cutting-edge avionics sensors and computing capabilities with reliable, customized packages of open-source autopilot software. Three enhancements were added to IronClad that are of keen interest to the U.S. government: fault-tolerant flight controls, onboard collision avoidance algorithms, and advanced, on-demand encryption key generation. This project gives the ability to securely operate any drone with a single pilot interface with a Platform-Agnostic, Open-Architecture, Cybersecure UAS Flight Controller. Asymmetric Technologies has started commercialization of the IronClad Secure Flight Controller, including the IronClad enhancements funded under the OFRN Round 4 program. In addition to the $3.4 million in follow-on federal research funding that Asymmetric and its university partners secured, in the first two months of availability, Asymmetric received orders for over $20,000 in IronClad hardware from commercial partners, with several hundred thousand dollars of orders in the sales pipeline. Additionally, Ohio State is completing the spinoff of a start-up company focused on Physically Unclonable Function (PUF) modules, one of the key technologies developed under OFRN Round 4 funding. The spinout company is in discussions with several large defense contractors for potential licensing and purchasing of the PUF technology and devices.

424 Interoperability, Resiliency, and Contingency Management for Ohio UAS Operations

Project Team: CAL Analytics (Lead), The Ohio State University, Kent State University, Kongsberg Geospatial, TruWeather Solutions, ResilienX

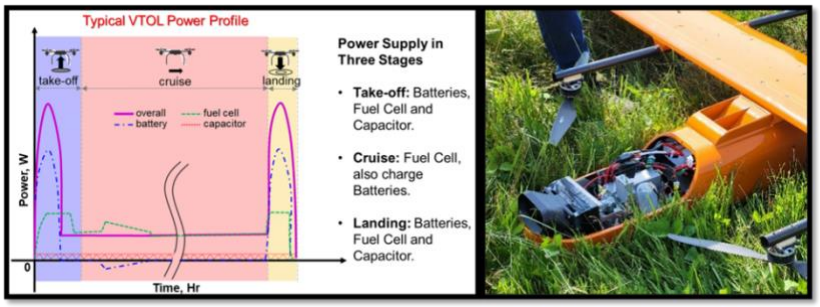
https://www.ohiofrn.org/projects/interoperability-modern-uas-traffic-management-architectures

The CAL Analytics' Contingency Management Platform (CMP) is an integrated capability that addresses a critical requirement for Beyond Visual Line of Sight (BVLOS) operations for Unmanned Aerial Systems (UAS) to support UAS Traffic Management (UTM) and Urban Air Mobility (UAM) operations. The CMP enables BVLOS Operations through Operations Solutions, Health & Integrity Monitoring Services, Integrated Detect & Avoid Service, and Integrated Weather Services. CAL Analytics has an active dialogue with several industry and government customers to make initial deployments of the CMP for evaluation and commercial use; and expects to deploy the CMP technology across the U.S. and globally, with the goal of ramping up the company's Software as a Service (SaaS) revenue stream.

428 A Hybrid Fuel Cell Battery Capacitor Power Source for UAS

Project Team: Kent State University (Lead), University of Dayton, Wright State University, Case Western Reserve University, Event 38 Unmanned Systems.

https://www.ohiofrn.org/projects/hybrid-fuel-cell-batterycapacitor-power-source-uass



This project developed and flight tested the hybridized advanced fuel cell power system with modern batteries and high-power density capacitors that maximize the on-board power density and extend the flight time of the UAS. The team's hybrid power system utilizes fuel cell technology to provide a constant average power for cruising, while peak power is supplied by a battery and a capacitor bank in addition to the fuel cell. The technology was pushed towards commercialization by securing ten grant awards totaling over a million dollars (SBIR and STTR). These awarded projects address fuels (aviation fuel sulfur removal and onboard hydrogen generation), fuel cell manufacturing, a multi-UAV dispatch system, and an intelligent air laser system, a motor drive system with predictive maintenance, and ground fault detection.