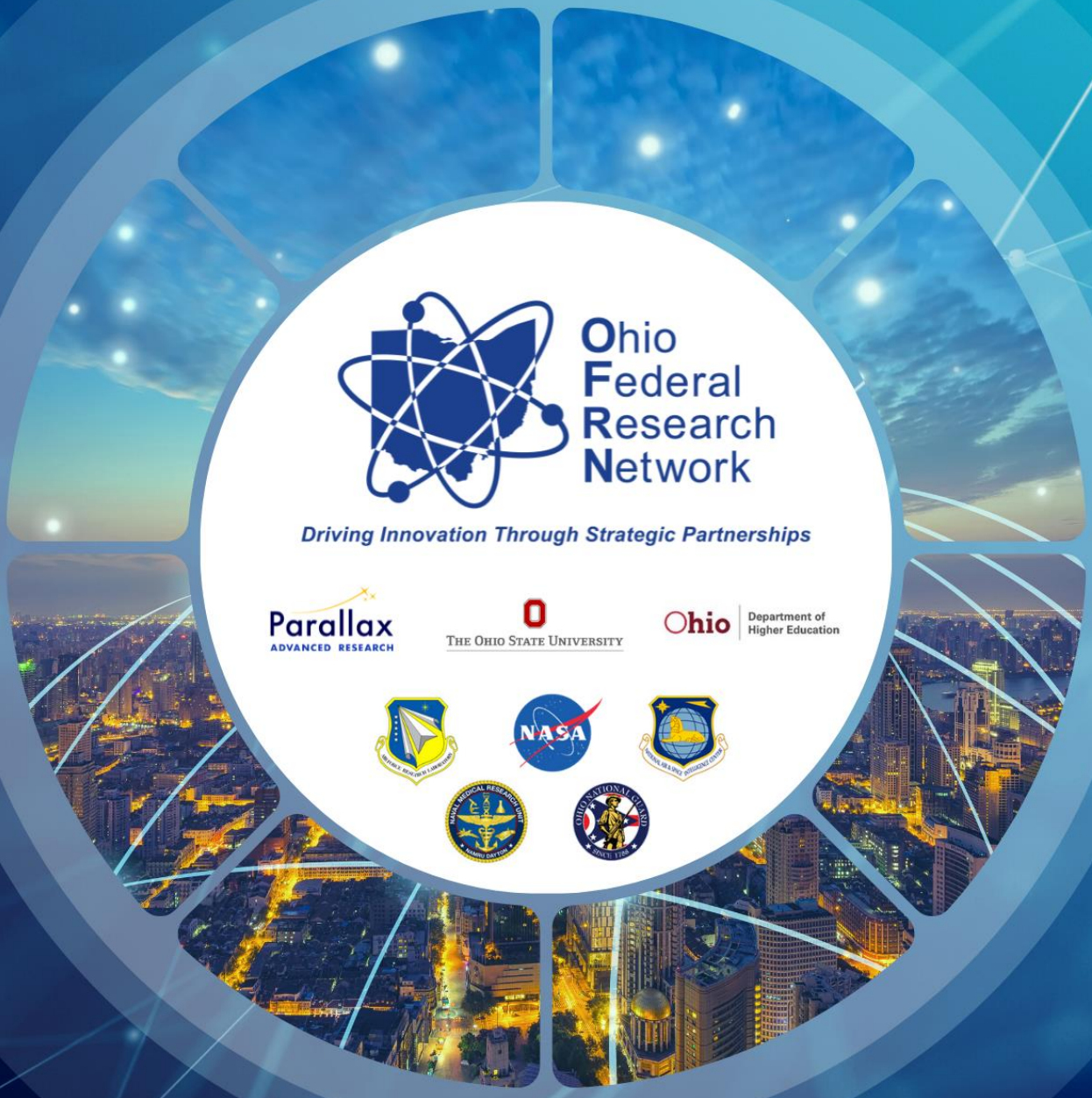
OHIO FEDERAL RESEARCH NETWORK

ANNUAL REPORT 2022



TO THE OHIO DEPARTMENT OF HIGHER EDUCATION

Executive Summary

Fiscal Year 2022 has been an exciting year for the Ohio Federal Research Network (OFRN). OFRN continues to focus on Advanced Research in the state of Ohio in collaboration with our Federal Partners. This year we had 16 projects in the portfolio from across the state: nine projects from Rounds 3 and 4 ended effectively closing out those Rounds. We took time to focus on where we wanted to be by 2025. **The OFRN strategic intent *is to be a vital integrator to leverage applied research to accelerate commercialization and gain additional funding in alignment with our federal partners.***

To accomplish our strategic intent by 2025, we focused on the following this year:

- Portfolio Engagement. We invested time every month meeting with the teams to get a pulse on progress and help them with connections as well as other things they needed.
- Enhancing Relationships. We focused on systems of systems networking to bring value to each program team within the portfolio as well as our federal partners.
- Increased SBIR/STTR Connectivity. The OFRN teams achieved over $4.5 million in SBIR/STTR awards. We also connected non-selected teams to SBIR/STTR opportunities that aligned with their original proposal.
- Increased BAA Awareness Connectivity, Teaming and Proposal Support. We provided training in Broad Area Announcements (BAAs) during our newly established quarterly Opportunity Days to increase awareness and understanding of the BAA opportunities with the federal government. We had over 240 attendees with an even split of industry and academia as well as ten percent from government. *For the first time the OFRN program staff led a submission to the Space Force research funding opportunity. We partnered with University of Akron and University of Cincinnati.*
- Improving Process. We implemented numerous internal improvements. The biggest externally improvement was Project Closeouts (final review presentation). These took place after the project demonstrations at one of our Federal Partners' sites. It allowed the team to take a deep dive into the technology with the federal partner Subject Matter Experts (SMEs). The feedback and additional opportunities have been outstanding.

Innovator

The OFRN is driving impressive innovation in the State of Ohio. What makes them unique is their ability to foster collaboration between industry, academia, and the Federal partners. As one of the Federal Partners within the program, I believe our Subject Matter Experts within AFRL are seeing significant benefits from this State sponsored program. The OFRN is an incredible example of teaming across the S&T ecosystem, and a true showcase of innovation in the State of Ohio

Brian McJilton, Director
Air Force Research Labs
Small Business

Fiscal Year 2022 Portfolio Results:

This year, OFRN had sixteen (16) projects in the portfolio that were on-going throughout the state of Ohio. Of those sixteen projects, nine of them closed out this year, three from Round 3 and six from Round 4, which effectively closes out those rounds. The OFRN portfolio accomplished the following:

$150,863,333 Follow-on Funding

59 Jobs

$7,596,412 Cost-share

3 Spinouts

Partnerships

The OFRN has been an important partner for NASA Glenn.

Their ability to connect Ohio's academic efficiently and effectively and industry based on our areas of interest has led to valuable innovation for us to leverage as well as providing tremendous benefit to the State of Ohio. The OFRN is truly making a difference in Ohio

Kurt Sacksteder, CTO of NASA Glenn

Project Closeouts

The OFRN portfolio had nine projects from solicitation Rounds 3 and Round 4 that closed out. The results from those projects thus far:

$17,972,000 Follow-on Funding

$18,904,407 Cost-share

119 Jobs

Overall Portfolio Results (Round 1-5)

Return on Investment

$51.4M State of Ohio Investment

$354M+ Follow-on Funding Awarded

$36M Cost-share

156.4% Improvement in State R&D Efficiency

13 Spinouts Created

35 R&D Projects Funded

328 Jobs Created

12 IPs Created

2 Pending IPs

Network, Collaborators and Partners

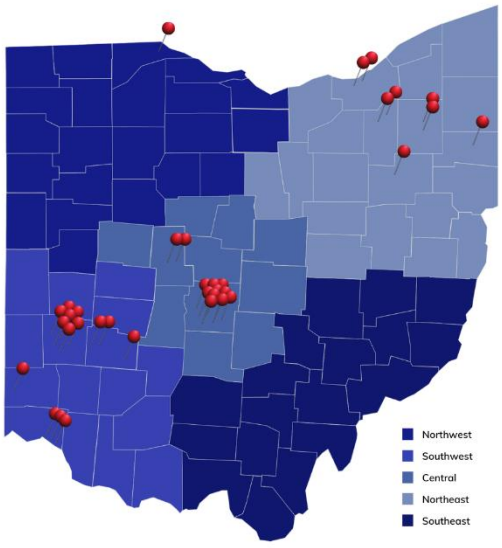
5 Government Agencies

97 Industry Companies

21 Academic Institutions

OFRN Portfolio

In collaboration with our federal partners, The OFRN continues to focus on Advanced Research from 6.2-6.3 in the state of Ohio.



FY22 Portfolio

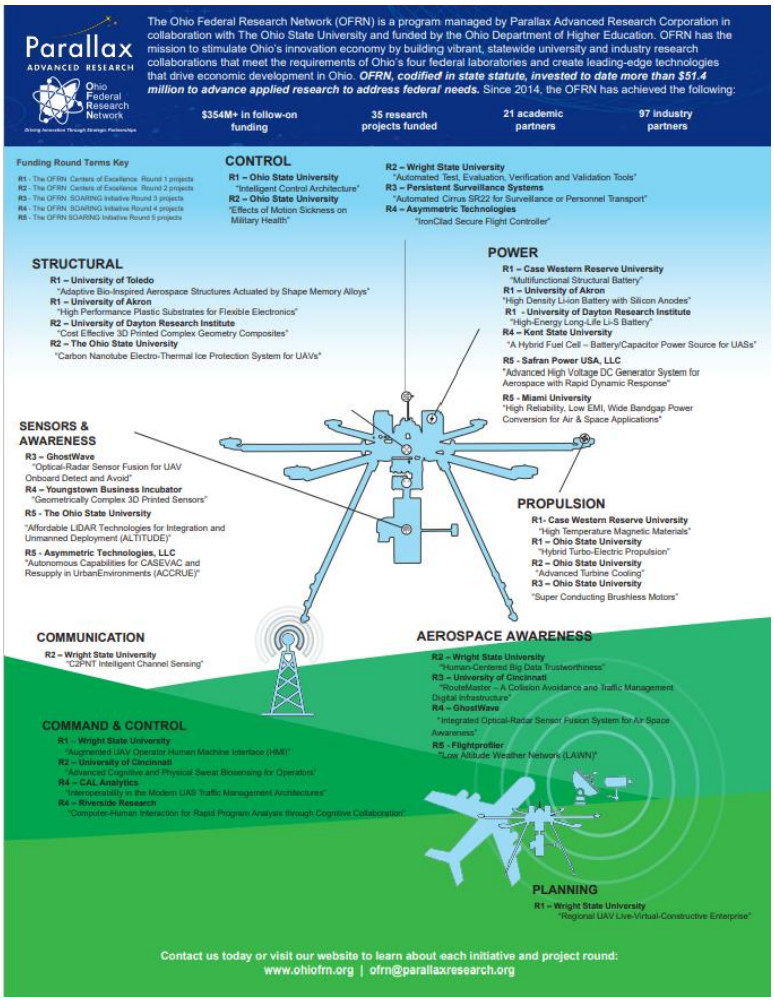
This year, OFRN had sixteen (16) projects in the portfolio that were on-going throughout the state of Ohio. Of those sixteen projects, nine of them closed out this year, three from Round 3 and six from Round 4, which effectively closes out those rounds.

Round 5

The OFRN Round 5 Areas of Interest

- *Unmanned Aerial Systems (UAS)*
- *Artificial Intelligence, Human Factors*
- *Data Analytics*
- *Space Commercialization*
- *Quantum Communications*
- *Advanced Power Systems*

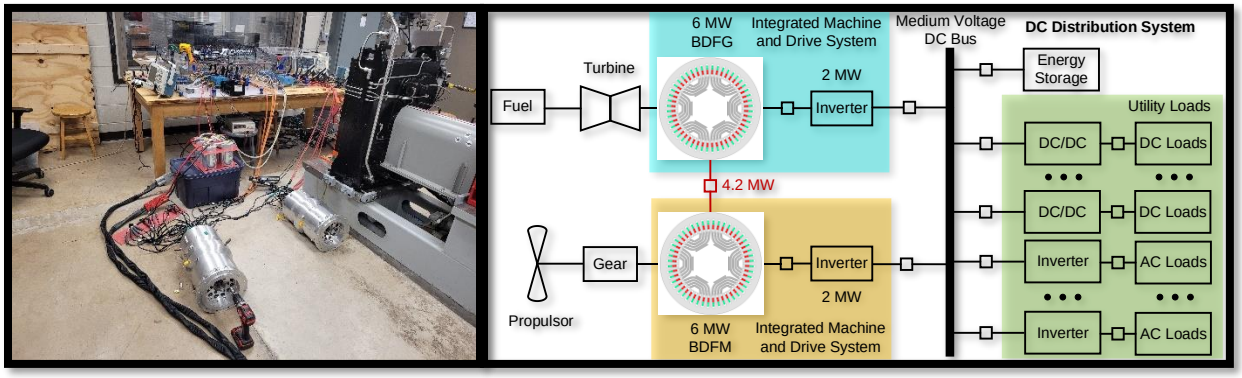
This announcement was the third round of the SOARING (Sustaining Ohio's Aeronautical Readiness and Innovation in the Next Generation) initiative has the vision to make Ohio the nexus for unmanned air systems (UASs), personal air vehicles (PAVs), logistics delivery air vehicles (LDAVs) testing, integration, and manufacturing. The OFRN has successfully run four solicitation rounds in the last six years.



Portfolio Overview

Brushless Doubly-Fed Machine and Drive Systems for Aviation Application	
OFRN Project Number: 303	**Status:** Completed
Project Start: 12/1/2018	**Project End:** 6/30/2022
Current TRL: 3	**Total Jobs Created:** 11
Total Follow-on Funding: $2,940,000	**Total Cost-Share:** $1,483,000
Lead: The Ohio State University	**Federal Partner:** AFRL & NASA Glenn
Team: University of Dayton Research Institute, Safran USA	

Project Description: The objective of this project was to design, develop and demonstrate a brushless doubly fed machine (BDFM) based hybrid electrical drive system with independent speed variable frequency operation capability. The machine proposed could be scalable to 100 kW for an unmanned aerial vehicle (UAV) application or 300 kW for a personal air vehicle (PAV) application. The proposed technology offers a safer system under fault conditions than permanent magnet synchronous machines, which was proved in testing of this project. The proposed technology may help NASA achieve several high priority goals in turbo electric propulsion technology. The system may be able to plug directly into existing UAVs/PAVs.



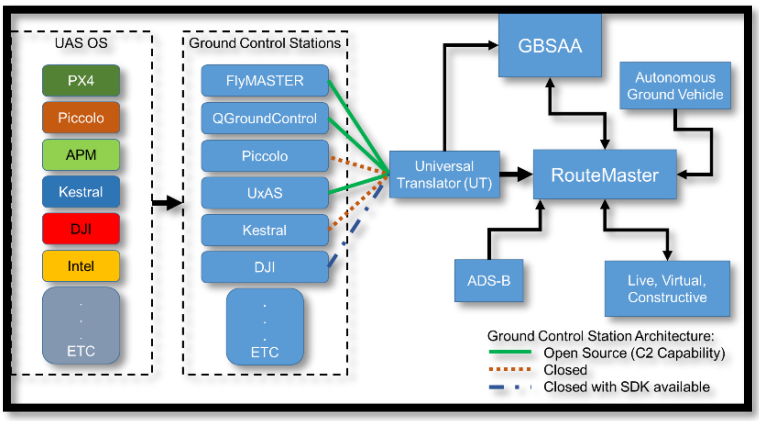
Project Results: The project created seven (7) new jobs at universities and six (6) new jobs at Safran. The follow-on funding includes $2.4 M from ARPA-E and $540 from Boeing. One OSU graduate student funded by this project received the DoD SMART Scholarship in 2022 and Boeing funded one student.

Although the BDFM-based system can achieve independent speed-variable frequency operation, its low power factor issue makes the total size of the BDFM and power converter system about the same as the traditional system that uses a constant speed drive (CSD) and a wound rotor synchronous generator (WRSG). The efficiency of the BDFM-based system is slightly better than the traditional CSD+WRSG system. OSU Technology Commercialization Office (TCO) filed an IP on this technology and posted on its website to allow companies to review the technology and determine interest.

Key takeaways: BDFMs have a low power factor that prevent size and weight reduction. Electric machines based on flux modulation mechanism often suffer from the low power factor issue. OFRN provided an excellent opportunity for industry companies and universities to collaborate. The project team received strong support from AFRL throughout this project.

Regional Unmanned Traffic Management System (RUTMS)	
OFRN Project Number: 314	**Status:** Completed
Project Start: 12/3/2018	**Project End:** 1/31/2022
Current TRL: 5	**Total Jobs Created:** 4
Total Follow-on Funding: $825,000	**Total Cost Match:** $1,062,407
Lead: University of Cincinnati	**Federal Partner:** AFRL
Team: Sinclair Community College, Demeter UAVs, SIMLAT	

Project Description: RUTMS is a collision avoidance and traffic management digital infrastructure that allows staffed and unstaffed systems to operate effectively in confined spaces such as an emergency response scenario or the modern urban environment, with heterogeneous communication and control protocols. It directly ties into the Springfield Ground Based Detect and Avoid (GBDAA - SkyVision) and Piccolo Autopilot.



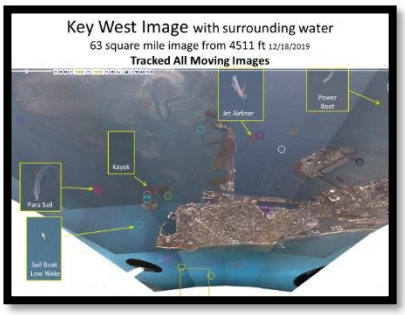
Project Results: The RUTMS system integrates with existing assets such as the GBDAA SkyVision at the National Advanced Air Mobility (AAM) Center of Excellence in Springfield, Ohio, to increase operational capabilities and capacities at both the Springfield Beckley airport and across the region. This project allowed for further development of Ohio's assets and made beyond visual line of sight (BVLOS) operations a possibility with small UAS.

The first potential product strategy is a Software as a Service (SaaS) approach for commercial applications. The second potential product strategy is an enterprise software solution that allows for the higher cybersecurity demands of military and other security and defense applications.

University of Cincinnati presented the finding as part of 2021 International Conference on Unmanned Aircraft Systems (ICUAS). Additionally, follow on funding for this project totals at $825K from two Phase I Small Business Technology Transfer (STTR) awards and a Phase II STTR for AAM.

Autonomous/Remote Cirrus SR22 Aerial Surveillance Platform and Personal Air Vehicle "Air Uber" System	
OFRN Project Number: 315	**Status:** Completed
Project Start: 8/1/2018	**Project End:** 1/31/2022
Current TRL: 5	**Total Jobs Created:** 56
Total Follow-on Funding: $6,759,000	**Total Cost Match:** $10,719,000
Lead: Persistent Surveillance Systems	**Federal Partner:** AFRL
Team: MacAir Aviation, Autonodyne, MacNauchtan Development, Aviation Fundamentals, Bosma Technical Services, Ohio University, Wright State University	

Project Description: The Autonomous SR22 effort was a broad reaching team effort to develop a new capability to enhance airborne surveillance operations and to provide a pathway to a remotely operated semi-autonomous Cirrus SR22 for personal transportation use similar to an Air Uber use in the future.



Project Results This effort successfully developed a wide range of technologies and systems that allows the aircraft and avionics to remotely control and operate the aircraft. This was done through modification to existing certified avionics systems. This was demonstrated in October 2019 to GE Aerospace and Honda Jet who had expressed strong interest in our systems. Persistent Surveillance Systems (PSS) also worked on capabilities such as the fuel leveling systems, the auto leaning and throttle/ mixture control and a range of other useful applications for the existing fleet of aircraft.

The team pivoted and integrated many of the systems onto other prior approved aircraft such as the PSS Cessna 207 and other commercial planes. The team conducted five demonstrations and operational evaluations of various systems to commercial companies, Joint Task Force South, Baltimore City Police, and supported the combined CUE 2021 exercise.

Partnerships

Working with OFRN and Parallax has helped us tremendously. The OFRN effort and support opened us up to new partnerships with other Ohio small businesses and universities that allowed us to expand our reach and the technologies and services we offer.

Our OFRN effort opened the doors to a wider range of customers and organizations and provided us the visibility to advance our technologies.

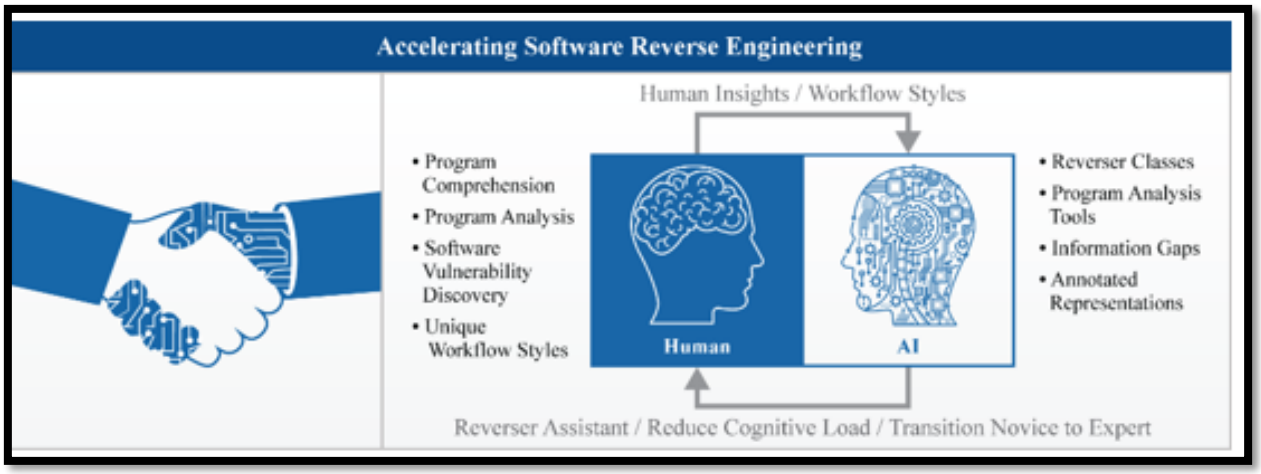
Our OFRN efforts directly allowed us to demonstrate our systems to defense, civil, and commercial customers beyond our previous reach.

Ross McNutt, PSS

Computer-Human Interaction for Rapid Program Analysis through Cognitive Collaboration (CHIRP2C)	
OFRN Project Number: 405	**Status:** Completed
Project Start: 12/23/2019	**Project End:** 5/31/2022
Current TRL: 5	**Total Jobs Created:** 0
Total Follow-on Funding: $0	**Total Cost Match:** $1,174,017
Lead: Riverside Research Institute (Beavercreek, OH)	**Federal Partner:** AFRL, NASIC, & NAMRU-D
Team: University of Cincinnati, University of Dayton, Unmanned Sciences, Inc.	

Project Description: 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.

Human beings are highly intuitive and adaptable, but they lack the processing power and speed of autonomous systems based on artificial intelligence and machine learning. Intelligent agents on the other hand lack intuition and capacity for rapid adaptation in real time. Bidirectional computer human interface is needed to allow on-the-fly reshaping of autonomous capabilities and autonomous agents that actively adjust themselves to the cognitive processes of humans engaged under high stress environments.



Project Results: The team submitted a white paper to AFWERX Flight Security and Control Challenge and are waiting for response.

The team also engaged with their NASIC Transition customer and set up a demonstration that occurred on September 9, 2021. Discussions are still underway with NASIC to determine follow-on interest.

Multi-purpose Mast/Aerial 360^{O} radar/optical fused sensors for Perimeter Monitoring and Aerial Detect and Avoid	
OFRN Project Number: 417	**Status:** **Completed**
Project Start: 12/16/2019	**Project End:** 4/30/2022
Current TRL: 3	**Total Jobs Created:** 7
Total Follow-on Funding: $430,000	**Total Cost Match:** $137,000
Lead: GhostWave (Columbus, OH)	**Federal Partner:** AFRL
Team: Sinclair College, The Ohio State University, Converge Technologies, Sivers Semiconductors, StreamDSP	

Project Description: 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.

Project Results: 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. It also allowed GhostWave to add a full-time engineer to their team. 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.

Commercialization

OFRN provided GhostWave with the resources we needed to take our company to the next level.

*As a **result of the OFRN contract, we gained credibility, which led us to multiple SBIR and STTR contracts along with Army xTechSearch awards**.*

The exposure from the OFRN contracts also introduced us to new Air Force contacts, new academic contacts, and DoD Prime connections. GhostWave cannot thank OFRN enough for its support.

Dean Zody, GhostWave

Geometrically Complex 3D Printed Antennas for UAVs	
OFRN Project Number: 421	**Status:** Completed
Project Start: 12/12/2019	**Project End:** 1/31/2022
Current TRL: 6	**Total Jobs Created:** 4
Total Follow-on Funding: $150,000	**Total Cost Match:** $385,000
Lead: Youngstown Business Incubator	**Federal Partner:** NASA Glenn
Team: Youngstown State University, Kent State University, Universal Technology Corporation, Event38 Unmanned Systems	

Project Description: 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.

Project Results: 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 or PCG for short. This new company is submitting a proposal for a Phase I STTR for X20.C. 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 OFRN-funded 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.

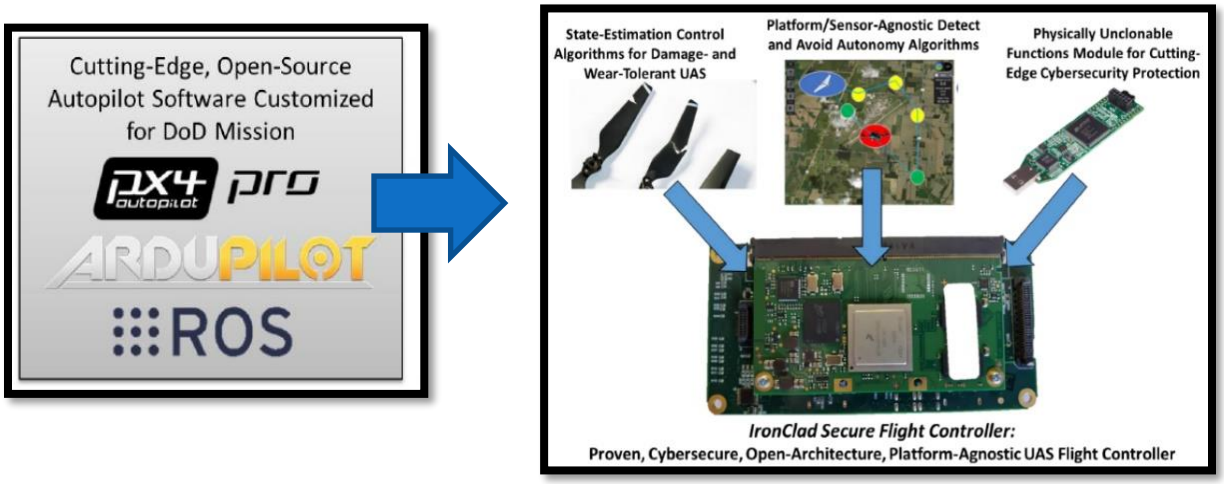
There are no known competitors that are 3D printing antennas as structural components of UAS.

Connector

OFRN has been a great help with forming critical connections, with providing funding, and with understanding the problems we've had. The OFRN's willingness to work with us on the delays we faced due to issues with access to testing facilities was very helpful.

Edward Burden, PPG

Resilient and Secure UAS Flight Control	
OFRN Project Number: 422	**Status:** Completed
Project Start: 12/19/2019	**Project End:** 6/1/2022
Current TRL: 7 – 8	**Total Jobs Created:** 7
Total Follow-on Funding: $3,380,000	**Total Cost Match:** $1,726,000
Lead: Asymmetric Technologies (Dublin, OH)	**Federal Partner:** AFRL
Team: The Ohio State University, Ohio University, Lockheed Martin	



Project Description: The American-made (Ohio), cybersecure IronClad Secure Flight Controller provides cutting-edge avionics sensors and computing capabilities with reliable, customized packages of open-source autopilot software. This project added three enhancements 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.

Project Results: Over the past year, Asymmetric Technologies started commercialization of the IronClad Secure Flight Controller, including the IronClad enhancements funded under the OFRN SOARING 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.

Commercialization

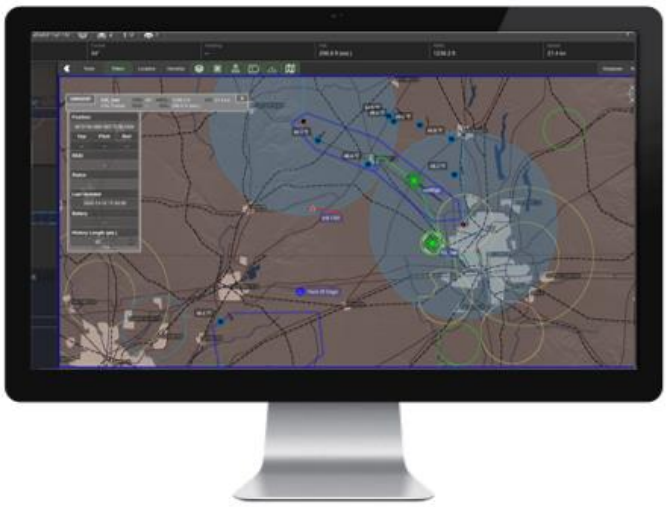
I'm excited to announce that Asymmetric Technologies, LLC is integrating their secure flight controller, IronClad, onto the E400.

This is the start of a partnership that will make the E400 a more capable and cyber hardened system. Thanks to Robert Hettler and Matt Bush for leading the way!

Jeff Taylor, Event38

Interoperability, Resiliency, and Contingency Management for Ohio UAS Operations	
OFRN Project Number: 424	**Status:** Completed
Project Start: 12/15/2019	**Project End:** 3/31/2022
Current TRL: 8	**Total Jobs Created:** 10
Total Follow-on Funding: $2,062,000	**Total Cost Match:** $1,314,983
Lead: CAL Analytics (Beavercreek, OH)	**Federal Partner:** AFRL & NASA Glenn
Team: The Ohio State University, Kent State University, Kongsberg Geospatial, TruWeather Solutions, ResilienX	

Contingency Management Platform Service Offerings
Airspace Situational Awareness Display
Airspace Management (UVR Issuance)
Airspace Alerting (DAA, Non-Conformance, etc.)
Service Monitoring / Operational Impact Assessments
Health & Integrity Monitoring
Weather Data, Forecasting, Weather Alerting
Cybersecurity Monitoring, Cyber Threat Mitigation
Flexible 3rd Party Application Integration

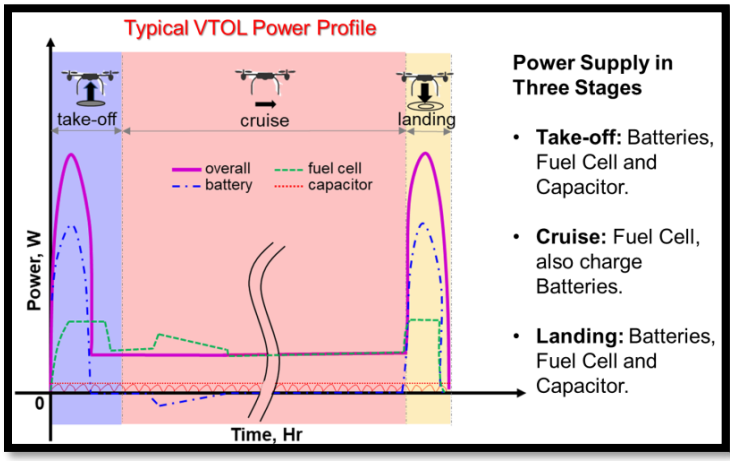


Project Description: The CAL Analytics' Contingency Management Platform (CMP) is an integrated capability that addresses a critical requirement for Beyond Visual Line of Sight (BVLOS) operations for Unmanned Aerial Systems (UAS) to support UAS Traffic Management (UTM) and Urban Air Mobility (UAM) operations.

Project Results: The team's work on the CMP led to two sponsored programs, from NASA and the U.S. Air Force respectively. The NASA program led to both a Phase I and II award (total of over $800,000 in funding) to enhance and expand the functionality of the CMP. CAL Analytics also was awarded a Phase I U.S. Air Force AFWERX Phase I contract to extend the concepts, and had several commercialization research activities related to the development of its CMP. CAL Analytics:

- Completed the execution of its FAA sponsored program;
- Performed a series of workshops with industry and government stakeholders (e.g., FAA, NASA, and ODoT);
- Worked with technology partners to secure all the necessary license and partnership agreements to enable direct sales of the CMP;
- 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.

A Hybrid Fuel Cell–Battery–Capacitor Power Source for UAS	
OFRN Project Number: 428	**Status:** Completed
Project Start: 1/2/2020	**Project End:** 5/31/2022
Current TRL: 6	**Total Jobs Created:** 20
Total Follow-on Funding: $1,426,000	**Total Cost Match:** $903,000
Lead: Kent State University	**Federal Partner:** AFRL & NASA Glenn
Team: University of Dayton, Wright State University, Case Western Reserve University, Event 38 Unmanned Systems.	



Project Description: Develop and flight test 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.

Project Results: By working with small businesses, the Kent State University team pushed the technology 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.

In addition to the awards, the team developed a proposal addressing the next generation of advanced power systems, "A High-Density Energy Power Source for Harsh Environments," plus five other proposals developed by members on the team. The company's industry member, Event 38, recently showcased their E450 flight system to commercial and government customers at the AUVSI XPonential Conference.

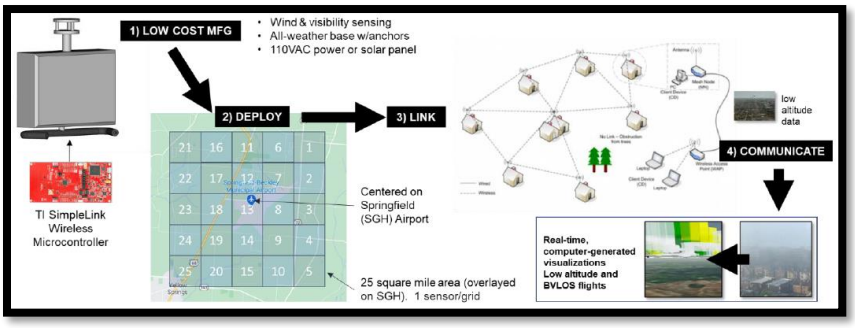
Connector

Without the OFRN's support, we wouldn't have gone this far. Apart from the critical monetary support, OFRN also helped us connect with federal agencies, like NASA Glenn Research Center, the Air Force Research Laboratory, and the Army Research Laboratory, and it confirmed that our effort aligned with the agencies' missions.

Dr. Yanhai Du, KSU

Low Altitude Weather Network (LAWN)

OFRN Project Number: 502	**Status:** On-going
Project Start: 10/29/2021	**Projected Project End:** 4/30/2023
Current TRL: 3	**Total Jobs Created:** 1.75
Total Follow-on Funding: $50,000	**Total Cost Match:** $109,000
Lead: Flightprofiler (Cincinnati, OH)	**Federal Partner:** AFRL NASA Glenn, & NAMRU-D
Team: The Ohio State University, Ohio University	

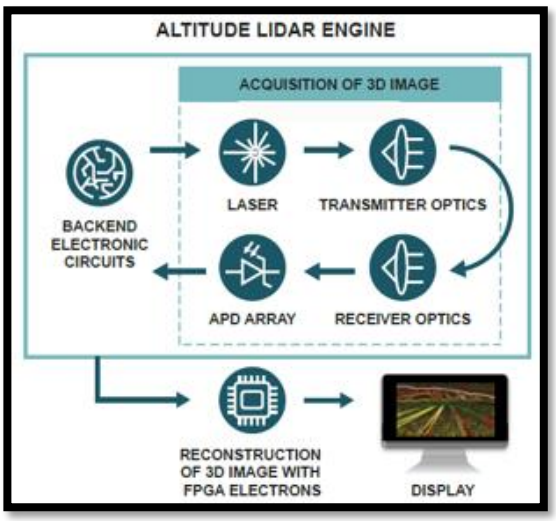


Project Description: The project will produce, install and network twenty-five (25) weather sensors to deliver a fully operational, mid-sized, low-altitude weather service for VTOL/UAS operations at Springfield UAS Test Center, providing a steppingstone to federal contracts and DOT growth. The weather sensors are ground-based, weather sensor network to provide vertical takeoff and landing (VTOL) vehicles with the real-time, low-altitude, high-fidelity, visibility, wind, and icing data to operate in Ohio. This capability will provide low cost, low altitude aviation weather data not delivered by other sources and does not require additional aircraft hardware.

Affordable LIDAR Technologies for Integration and Unmanned Deployment (ALTITUDE)

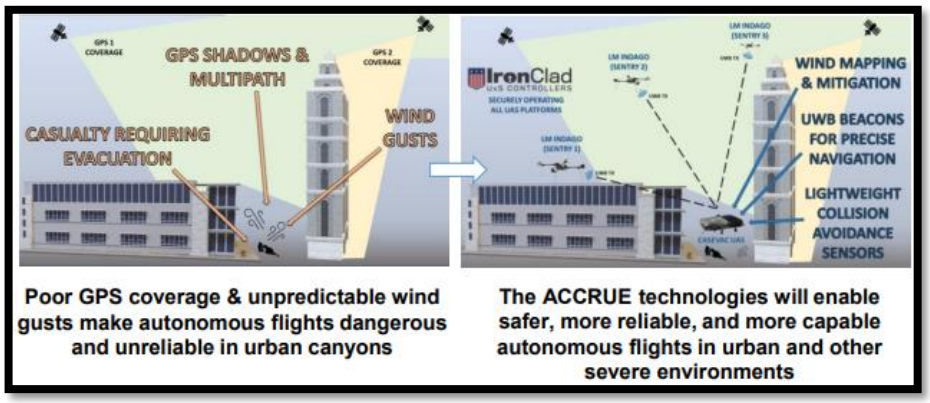
OFRN Project Number: 507	**Status:** On-going
Project Start: 10/29/2021	**Projected Project End:** 4/30/2023
Current TRL: 3	**Total Jobs Created:** 21
Total Follow-on Funding: $140,000	**Total Cost Match:** $67,000
Lead: The Ohio State University	**Federal Partner:** AFRL & NASA Glenn
Team: Sinclair Community College, University of Dayton, SK Infrared LLC, and L3Harris Space & Sensors	

Project Description: The project addresses sensor needs in the commercial aerospace and defense markets by developing low cost, manufacturable, and miniaturized Flash Light Detection and Ranging (LiDAR) technologies. They operate at 1.55- and 2-micron wavelengths, which are currently unavailable commercially, increase detector sensitivity, reduce Size-Weight-and-Power (SWaP), and enable high volume manufacturability. Specifically, the team will produce a Flash LIDAR operating at 1–2-micron wavelengths, Antimonide APDs that will enable high operating temperatures, and develop 16x16 avalanche photodiode (APD) arrays on Indium Phosphide (InP) substrates.



Autonomous Capabilities for Casualty Evacuation and Resupply in Urban Environments (ACCRUE)	
OFRN Project Number: 528	**Status:** On-going
Project Start: 11/1/2021	**Projected Project End:** 6/30/2023
Current TRL: 4	**Total Jobs Created:** 4
Total Follow-on Funding: 0	**Total Cost Match:** $342,000
Lead: Asymmetric Technologies (Dublin, OH)	**Federal Partner:** AFRL
Team: The Ohio State University, Ohio University, Lockheed Martin Procerus	

Project Description: ACCRUE will enable future autonomous urban resupply and Casualty Evacuation (CASEVAC) and Medical Evacuation (MEDEVAC) missions. It will do this by developing and building on several technologies to enable more capable, reliable, and safe autonomous flights in congested urban areas and other severe geographical environments, all hosted on Asymmetric's IronClad secure flight controller as the central, secure hub hosting.



The U.S. government is specifically interested in this project because most current DoD-used autopilots are proprietary, outdated, and/or lack at least one (or several) critical attributes of cybersecurity, open-source based flight control (FC) software, and/or deeply integrated edge computing. This same thing is true for GPS-denied navigation tools and collision avoidance sensors, or sensors too large to allow additional payloads. Finally, no existing technologies map and mitigate wind gusts.

Commercialization

We took the work we were doing under the OFRN and submitted it for a U.S. Air Force STTR Phase I, which we won and then submitted a Phase II STTR proposal and won that as well. The OFRN's goal is to facilitate federal funding and commercial opportunities for innovative technologies in the State of Ohio, and this project is the perfect example of the realization of that goal. We have seen interest in our technology from clients like United States Special Operations Command (USSOCOM) and the U.S. Army. Without the OFRN funding, that would not have been possible.

Rob Hettler, Asymmetric

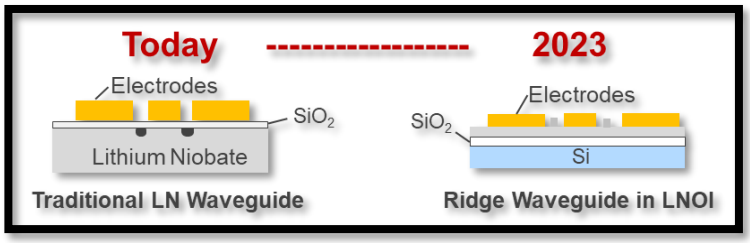
Electronically Dimmable Protective Eyewear

OFRN Project Number: 529	**Status:** On-going
Project Start: 10/28/2021	**Projected Project End:** 4/28/2023
Current TRL: 4	**Total Jobs Created:** 8
Total Follow-on Funding: $100,000	**Total Cost Match:** $370,000
Lead: AlphaMicron (Kent, OH)	**Federal Partner:** AFRL
Team: Bowling Green State University, Kent State University, and Miami University	

Project Description: Further development of electronically dimmable protective eyewear started under a 2020 Air Force Small Business Technology Transfer (STTR) grant from Air Force Research Laboratory to develop a production level product. The goal of the current STTR Phase II is to advance the relevant material and drive electronics of the current e-Tint system. Funding from OFRN will advance the program from a Technology Readiness Level (TRL) 6-7 to a TRL 8-9. Furthermore, OFRN funding is enabling the team to reduce the development of STTR Phase II to an eyewear format useful for both military and civilian applications. Two related applications will be considered under the OFRN funded project. The first is an advanced sun protection device for the Air Force crew. The second is a laser protection film for first responder/national guard. The work plan encompasses material development, product design, and conformity testing at external facilities to ensure compliance the industry regulations.

Thin-film Crystals for High-speed Optical Modulation

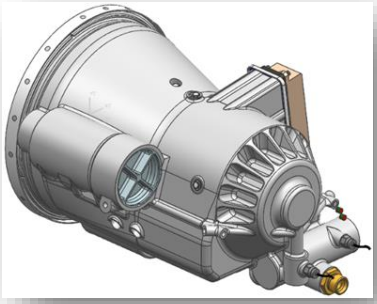
OFRN Project Number: 542	**Status:** On-going
Project Start: 10/29/2021	**Projected Project End:** 4/29/2023
Current TRL: 2	**Total Jobs Created:** 0
Total Follow-on Funding: 0	**Total Cost Match:** $18,000
Lead: The Ohio State University	**Federal Partner:** AFRL
Team: University of Dayton, and Gooch & Housego (G&H) Ohio	



Project Description: In support of on-shoring a capability from China to the US, the team is developing thin-film lithium niobate (LN) on insulator (LNOI) technology for 100 GHz optical modulation to impact future telecom and DoD applications. A successful project outcome will be for G&H to become the U.S. supplier of LNOI wafers and a producer of commercial grade 100 GHz modulators. This upgrade to commercial modulation technology will impact the telecommunications infrastructure and be an enabler for 5G/6G data capacity. This modulator will also serve the needs of our military. These outcomes translate to high-tech Ohio jobs as well as students educated in microwave photonics and optical materials.

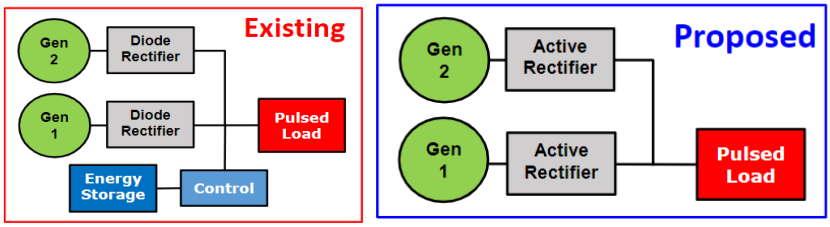
Advanced High Voltage Direct Current Generator System for Aerospace with Rapid Dynamic Response	
OFRN Project Number: 550	**Status:** On-going
Project Start: 10/30/2021	**Projected Project End:** 4/30/2023
Current TRL: 3	**Total Jobs Created:** 0
Total Follow-on Funding: 0	**Total Cost Match:** $205,800
Lead: Safran Electrical & Power (Twinsburg, OH)	**Federal Partner:** AFRL
Team: The Ohio State University, Youngstown State University, Youngstown Business Incubator	

Project Description: Develop a high voltage (270 – 800) direct current (DC) electrical power generation system providing high power density, dynamic response, and increased system reliability at the 40kW-level. This generator will provide capability at high speeds above 15,000 rpm, advanced controls, and optimized thermal management, while de-risking the manufacturing processes.



High Reliability, Low EMI, Wide Bandgap Power Conversion for Air & Space Applications	
OFRN Project Number: 552	**Status:** On-going
Project Start: 11/1/2021	**Projected Project End:** 5/1/2023
Current TRL: 3	**Total Jobs Created:** 2
Total Follow-on Funding: $295,000	**Total Cost Match:** $54,000
Lead: Miami University	**Federal Partner:** AFRL
Team: The Ohio State University, GE Aviation Systems, PC Krause & Associates	

Project Description: This program continues the development of soft switching power conversion technology using wide band gap power semiconductors. Soft switching reduces component and system-level electromagnetic interference (EMI) issues regardless of the application. The soft switching control approach enables parallel operation of disparate power generation sources. It offers high reliability, rock-solid system stability when powering unruly loads including constant power and pulsed loads. This project will demonstrate soft switching in a 100-kW active rectifier powering a pulsed, constant power weapons-grade load.



Portfolio Results

In Fiscal year 2022, The OFRN had solid results:

We also focused on driving improvements in several areas.

Portfolio Engagement
The OFRN established a monthly cadence with the current portfolio. The OFRN Program Manager meets with each Program learns about their progress, guides them on resource and opportunities to accelerate their progress towards the goal of commercialization. The Program Manager also visited every one of the leader organizations for the on-going projects over this fiscal year to review the organization's capability and increase engagement.

Relationships
The OFRN established a yearly cadence for the Portfolio to give exposure and share the teams' progress with our Federal Partners. This was accomplished through quarterly Executive Reviews with the Federal Partners and conducting deep dives twice a year that also included the Subject Matter Experts within the various federal agencies.

Increased SBIR/STTR Connectivity
In addition to the over $4.5M in SBIR/STTR awards for OFRN-funded teams, the OFRN connected non-selected teams to SBIR/STTR opportunities that aligned with their OFRN proposal. We did this through presentations during our newly established quarterly OFRN Opportunity Days where we emphasized the number of SBIR/STTR opportunities across the U.S. government and provided a training session on SBIR/STTR. During this training we also highlighted the extensive SBIR/STTR training available on Parallax's free virtual training portal, if participants wanted further information. Finally, matchmaking services were provided between multiple universities and small businesses to develop teams to submit for SBIR/STTR opportunities throughout this reporting period.

Increased BAA Awareness Connectivity, Teaming and Proposal Support
The OFRN provided training on Broad Area Announcements (BAAs) during our newly established quarterly OFRN Opportunity Days to increase awareness and understanding of the BAA opportunities available across the U.S. government. A specific outcome we were looking

to achieve was to build a team under the “OFRN” banner and submit a proposal where OFRN would be the Prime contractor facilitating expeditious proposal submission in support of our network partners. For the *first time, OFRN-program staff led a submission to a Space Force research funding opportunity with University of Akron and University of Cincinnati.* Although the U.S. government determined the proposal was selectable, it was not funded. We hope to build on this in coming years.

Opportunity Days:
To accomplish our goals to increase SBIR/STTR Connectivity and BAA Awareness Connectivity, the OFRN initiated Opportunity Days, which are quarterly events that further connect and enlarge our network of government, academic, and industry partners, based on posted opportunities and customer discussions. These events featured Federal Partner Thought Leader presentations, networking, program status updates from OFRN leadership, and Q&A sessions. A few examples:

Dr. Michael Gregg leads AFRL’s Digital Engineering Transformation initiative. Dr. Gregg gave attendees insights into an exponentially growing requirement to increase the innovation cycle in the Air Force and Space Force through knitting the labs with the acquisition communities more closely.

Professor John M. Horack is the Senior Associate Dean in the College of Engineering at The Ohio State University and the inaugural Neil Armstrong Chair in Aerospace Policy. Professor Horack shared the opportunity for the State of Ohio to lead in space-based research through partnering with NanoRacks in development of the Starlab-George Washington Carver Science Park, which is one of the three commercial free-flying space stations in low-Earth orbit to be fielded.

During this fiscal year, we had over 240 attendees with an even split of industry and academia, roughly 10% of the attendees came from government. These events led to over thirty (30) follow-on meetings with current and new OFRN partners. One of the discussions led to OFRN’s first OFRN program-led submission to a federal funding opportunity, which we did with University of Akron and University of Cincinnati. Although the Air Force determined the proposal was selectable, it was not funded. Additionally, one of the new network partners that OFRN gained from hosting Opportunity Days, Engineered Products Inc, learned the value of registering their business as a Woman-Owned Small Business and now has a line on a potential sole-source funding opportunity with the U.S. Federal Government.

Navigator

Wow that was great information - I'm interested in working with OFRN to help us navigate and bring our technology to other DoD entities.

Justine Blank, Engineering Products Inc.

Improved Processes
Through state-wide engagement with our stakeholders, we identified a need for multiple improved processes. The first was a need for increased transparency and engagement. We instituted quarterly OFRN Opportunity Days, in part, to provide consistent public-facing engagement. An

additional need was to increase awareness in the U.S. government of OFRN project technical results. To address this need, we implemented a final review presentation that will take place after project demonstrations and be given at one of our Federal Partner sites. The chance to take a deeper dive on the technology has led to several opportunities for our Program Teams.

Thus far, we have facilitated two final reviews, one at AFRL the other at NASA Glenn.

- The first was The Ohio State University-led, “Brushless Doubly-fed Machine and Drive System for Aviation Application” project. This project highlighted the limitations of Doubly fed Machine and Drive Systems for certain applications and facilitated two students receiving extremely prestigious scholarships, AFRL-funded one that will directly lead to a U.S. government civilian position after graduation and Boeing funded the other.

- The second was the Kent State University-led, “A Hybrid Fuel Cell–Battery–Capacitor Power Source for UAS” project. This project led to a hydrogen fuel cell manufacturer contacting the team to set up future collaborative research and was as a U.S. government UAS-related office noted, “making waves.” Further, this project also supported two students who will be working at Tesla after graduation.

We’ve also reviewed past solicitation rounds and made enhancements to improve the experience for our bidders, Technical Review Council and Executive Review Board.

Ohio Stakeholders

Federal Partners
The OFRN partners are critical to the success of this program. They provide valuable insight and guidance to the program as well as helping to drive engagement from Subject Matter Experts within their organization.

Brian McJilton
U.S. Air Force Research Labs

Dr. Kurt Sacksteder
NASA Glenn Research Center

Steven Zech
U.S. Air Force

Dr. Richard Arnold
Navy Medical Research Unit –Dayton (NAMRU-D)

Col Frank Dominguez
Ohio National Guard

Executive Review Board / Technical Review Council

To ensure we have unbiased perspective and focus, the OFRN created an Executive Review Board (ERB), and a Technical Review Council (TRC) that are administered by Parallax

Advanced Research and The Ohio State University and funded by the Ohio Department of Higher Education (ODHE). The ERB and TRC provide strategic and technical guidance and oversight of the OFRN. OFRN also has contracts with several consultants to assist with commercialization, proposal navigation, and workforce development. The members of the commercialization team evolve based on project and stakeholder needs.

Executive Review Board (ERB)

The ERB oversees the development, funding, and performance of the OFRN. The ERB provides ongoing oversight of OFRN to support the research priorities of the federal installations and build Ohio's capabilities in applied research, workforce development, and technology commercialization. The ERB reviews concur with or reject the recommendations of the TRC as to which projects will be funded under the OFRN. To ensure the continued alignment of the OFRN within the original Ohio Federal Military Jobs Commission (OFMJC) goals and initiatives, the former OFMJC chair has a seat on the ERB. Additionally, OFRN leadership leverages the ERB for strategic guidance on new initiatives and activities.

Technical Review Council (TRC)

The TRC oversees the portfolio of technologies that are used and developed by OFRN-funded projects. The TRC reviews all white papers and proposals, ranks them according to key criteria (established in requests for proposals), and then submits funding recommendations to the ERB.

OFRN Leadership Team

Dennis Andersh
Program Executive
OFRN

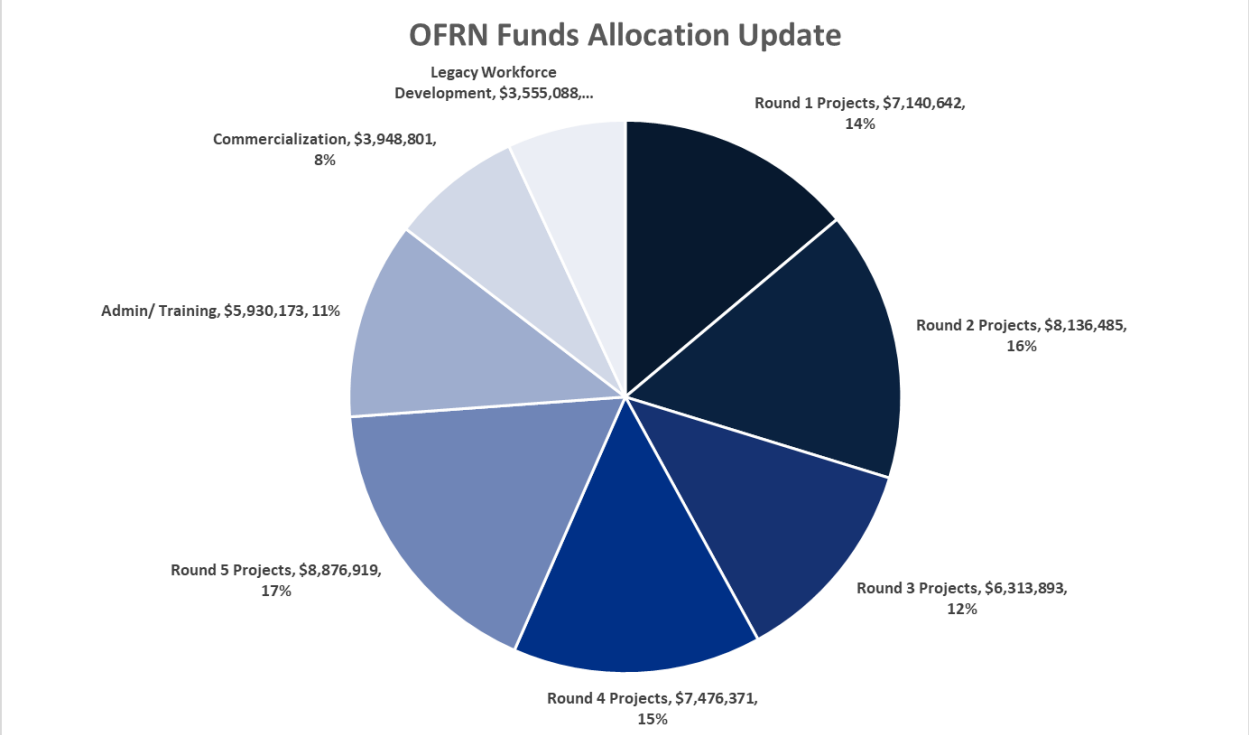
Maj Gen (Ret) Mark Bartman
Program Executive
OFRN

Matt Bush
Program Manager
OFRN

Dennis Andersh and Major General (retired) Mark Bartman are the OFRN program executives. Key to their success is Parallax Advanced Research, The Ohio State University support staff, as well as the support and engagement of critical state offices, including ODHE, the Ohio Department of Development (ODOD), the Ohio Department of Transportation (ODOT), and JobsOhio. Matt Bush is the Program Manager of OFRN.

These leaders regularly provide OFRN briefings to key partners, state officials, and other interested groups across the state of Ohio. This open and transparent briefing process is part of their commitment to build a partnership coalition that allows Ohio's research and industry talent to be exemplified, with the goal of boosting the State of Ohio's overall economic impact to bring more federal research dollars to the state.

Finances



Total state operation funding for the OFRN programs for defense, aerospace, workforce development, and federal defense emerging mission is $51.4 million for FY16 through FY22.

ODHE-WSARC (OFRN) MOU Section 369.455 of Amended House Bill 64 of the 131st General Assembly, Defense/Aerospace Workforce Development Initiative											
Budget Categories	**Round 1 Projects**	**Round 2 Projects**	**Round 3 Projects**	**Round 4 Projects**	**Round 5 Projects**	**Admin/ Training**	**Commercialization**	**Legacy Workforce Development**	**Total Budget**	**Total Expensed**	**Balance**
PRESIDES COE - Case Western Reserve	$1,633,806								$1,633,806	-$1,633,806	$0
OCPP COE - The Ohio State University	$2,005,537	$1,739,609							$3,745,145	-$3,745,145	$0
M&M COE - University of Dayton	$2,007,377	$1,017,061							$3,024,438	-$3,024,438	$0
HPHS COE - Wright State University	$1,493,922								$1,493,922	-$1,493,922	$0
C4ISR COE - Wright State University		$1,200,000							$1,200,000	-$1,200,000	$0
C2PNT COE - Ohio University		$20,118							$20,118	-$20,118	$0
C&WD Team - Cleveland State University							$1,108,000		$1,108,000	-$1,108,000	$0
C&WD Team - Lorain County Community College							$974,884		$974,884	-$974,884	$0
OFRN Legacy Workforce Development Programs								$3,555,088	$3,555,088	-$3,555,088	$0
OFRN Administration						$2,757,517	$487,082		$3,244,599	-$3,244,599	$0
Subtotal	**$7,140,642**	**$3,976,787**	**$0**	**$0**	**$0**	**$2,757,517**	**$2,569,966**	**$3,555,088**	**$20,000,000**	**-$20,000,000**	**$0**

ODHE-OSU (OFRN) MOU Section 369.473 of Amended House Bill 64 of the 131st General Assembly, Emerging Missions and Job Growth Opportunities											
Budget Categories	**Round 1 Projects**	**Round 2 Projects**	**Round 3 Projects**	**Round 4 Projects**	**Round 5 Projects**	**Admin/ Training**	**Commercialization**	**Legacy Workforce Development**	**Total Budget**	**Total Expensed**	**Balance**
C2PNT COE - Ohio University		$2,087,478							$2,087,478	-$2,087,478	$0
HPHS COE - Wright State University		$2,072,220							$2,072,220	-$2,072,220	$0
OFRN CONSULTANTS						$43,019	$180,317		$223,337	-$223,337	$0
OFRN ADMIN G&A						$40,255			$40,255	-$40,255	$0
OSU PROJECTS & ADMIN						$576,710			$576,710	-$576,710	$0
Subtotal	**$0**	**$4,159,698**	**$0**	**$0**	**$0**	**$659,984**	**$180,317**	**$0**	**$5,000,000**	**-$5,000,000**	**$0**

ODHE-OSU (OFRN) MOU Section 381.440 of Amended Substitute House Bill 49 of the 132nd General Assembly, Emerging Missions and Job Growth Opportunities											
Budget Categories	**Round 1 Projects**	**Round 2 Projects**	**Round 3 Projects**	**Round 4 Projects**	**Round 5 Projects**	**Admin/ Training**	**Commercialization**	**Legacy Workforce Development**	**Total Budget**	**Total Expensed**	**Balance**
PERSISTENT SURVVEILLLANCE SYSTEMS			$1,998,349						$1,998,349	-$1,998,349	$0
GHOST WAVE			$1,344,597						$1,344,597	-$1,344,597	$0
UNIVERSITY OF CINCINNATI			$968,947						$968,947	-$968,938	$9
OFRN CONSULTANTS						$57,595	$156,264		$213,986	-$213,986	$0
WSARC UNALLOCATED						$0	$13,049		$13,049	-$13,049	$0
OSU PROJECTS & ADMIN			$2,002,000			$359,072			$2,361,072	-$1,810,072	$551,000
TOTAL	**$0**	**$0**	**$6,313,893**	**$0**	**$0**	**$416,667**	**$169,313**	**$0**	**$6,899,873**	**-$6,348,991**	**$550,882**

ODHE-OSU (OFRN) MOU Section 381.440 of Amended Substitute House Bill 166 of 136th G.A.											
Budget Categories	**Round 1 Projects**	**Round 2 Projects**	**Round 3 Projects**	**Round 4 Projects**	**Round 5 Projects**	**Admin/ Training**	**Commercialization**	**Legacy Workforce Development**	**Total Budget**	**Total Expensed**	**Balance**
ASYMMETRIC TECHNOLOGIES				$1,450,071					$1,450,071	-$1,426,617	$23,454
CAL ANALYTICS				$1,399,882					$1,399,882	-$1,399,882	$0
GHOST WAVE				$1,262,622					$1,262,622	-$1,262,622	$0
KENT STATE UNIVERSITY				$1,214,202					$1,214,202	-$1,163,692	$50,510
RIVERSIDE RESEARCH				$1,176,717					$1,176,717	-$1,176,717	$0
YOUNGSTOWN BUSINESS INCUBATOR				$972,877					$972,877	-$972,877	$0
OFRN ADMINISTRATION						$1,137,815	$964,315		$2,102,129	-$2,102,129	$0
Subtotal	**$0**	**$0**	**$0**	**$7,476,371**	**$0**	**$1,137,815**	**$964,315**	**$0**	**$9,578,500**	**-$9,504,536**	**$73,964**

ODHE-OSU (OFRN) MOU Section 381.373, Ohio H.B. 110 of 134th G.A.											
Budget Categories	**Round 1 Projects**	**Round 2 Projects**	**Round 3 Projects**	**Round 4 Projects**	**Round 5 Projects**	**Admin/ Training**	**Commercialization**	**Legacy Workforce Development**	**Total Budget**	**Total Expensed**	**Balance**
FLIGHTPROFILER					$902,498				$902,498	$0	$902,498
THE OHIO STATE UNIVERSITY (PROJECT 507)					$1,744,650				$1,744,650	-$264,380	$1,480,271
ASYMMETRIC TECHNOLOGIES					$1,575,120				$1,575,120	-$290,650	$1,284,470
ALPHAMICRON					$849,999				$849,999	-$141,666	$708,333
THE OHIO STATE UNIVERSITY (PROJECT 542)					$1,076,040				$1,076,040	$0	$1,076,040
SAFRAN					$1,710,000				$1,710,000	-$248,022	$1,461,978
MIAMI UNIVERSITY					$1,018,611				$1,018,611	$0	$1,018,611
OFRN ADMINISTRATION						$958,191	$64,890		$1,023,081	-$808,061	$215,020
Subtotal	**$0**	**$0**	**$0**	**$0**	**$8,876,919**	**$958,191**	**$64,890**	**$0**	**$9,900,000**	**-$1,752,778**	**$8,147,221**

Grand Total	**$7,140,642**	**$8,136,485**	**$6,313,893**	**$7,476,371**	**$8,876,919**	**$5,930,173**	**$3,948,801**	**$3,555,088**	**$51,378,372**	**-$42,606,305**	**$8,772,067**

Appendix - Partners

Government

1. Air Force Research Laboratory
2. NASA Glenn
3. National Air and Space Intelligence Center
4. Naval Medical Research Unit-Dayton
5. Ohio Department of Transportation
6. Ohio National Guard

Academic

1. Air Force Institute of Technology
2. Bowling Green State University
3. Case Western Reserve University
4. Central State University
5. Clark State Community College
6. Cleveland State University
7. Heidelberg University
8. Kent State University
9. Lorain County Community College
10. North Central State College
11. Ohio University
12. Sinclair Community College
13. The Ohio State University
14. The University of Akron
15. The University of Cincinnati
16. The University of Dayton
17. The University of Findlay
18. The University of Toledo
19. Wilberforce University
20. Wright State University
21. Youngstown State University

Industry

1. AAB
2. Advanced TeleSensors
3. AEP
4. Akron Polymer Systems
5. Akron Polymers
6. AlphaMicron
7. Americarb
8. Amperand
9. Asymmetric Technologies
10. Autonodyne/Avidyne
11. Battelle Memorial Institute
12. Berriehill Corp
13. Bertec Corporation
14. Bosma Technology
15. Broadline Capital
16. CAL Analytics
17. CAR Technologies
18. Caterpillar
19. Cincinnati Inc.
20. Columbus Collaboratory
21. Comsat Architects
22. Converge Technologies
23. CRG
24. Crown Equipment
25. CSA America
26. DataScience.com
27. Dayton Childrens
28. DelphicDB
29. Demeter UAVs
30. DesignKnowledge
31. Eaton
32. Electrodyne
33. EMS Adhesives
34. Event 38 Unmanned Systems
35. Fenix Magnetics
36. Flightprofiler
37. Ford
38. Galois
39. GE Aerospace
40. GE Aviation
41. GE EPIS Center
42. General Dynamics
43. GhostWave Inc.
44. GIRD Systems Inc.
45. Gooch & Housego Ohio
46. GrafTech
47. Hana Microdisplay Systems
48. Hewlett Packard
49. Honeywell
50. Illumination Works
51. Innovative Scientific Solutions, Inc.
52. Inorganic Specialist Materials
53. Ipsos
54. IS4S
55. KeyW Corp
56. Kongsberg Geospatial
57. Lexis Nexis
58. L3Harris Space & Sensors
59. Lincoln Electric
60. Lockheed Martin
61. Lockheed Martin Procerus
62. Lockheed Martin Rotary and Mission Systems
63. Lubrizol
64. Lucintech
65. MacAir Aviation
66. MacNauchtan Development
67. MatchTx
68. Meggitt
69. NONA Composites
70. Norman Noble
71. Nuance
72. Orbital Research
73. Orbital-ATK
74. Parker Hannifin
75. PC Krause & Associates
76. Perduco
77. Persistent Surveillance Systems
78. ph Matter
79. Powdermet
80. Premier Health
81. Resilient and Secure UAS Flight Control
82. ResilienX
83. Riverside Research
84. Rubix
85. SAFRAN
86. Simlat, Ltd
87. SK Infrared LLC
88. SpineDynX
89. Tenet3
90. TruWeatherSolutions
91. UES
92. United Technology Corporation from Dayton
93. Unmanned Science, Inc (USI)
94. UTRC
95. Xerion
96. Youngstown Business Incubator (YBI)

Appendix – Program Expenditures & Costs

Funds Expended Report – As of 30 June 2022

OHIO DEPARTMENT OF HIGHER EDUCATION
WORKFORCE DEVELOPMENT AND EMERGING MISSIONS MOU's
OFRN FUNDS EXPENDED REPORT

Please Type all Information

Subaward No.: PO BOR01-000000004706/MOU DATED 12/1/15

Recipient:	Parallax Advanced Research
Project:	Ohio Federal Research Network - Centers of Excellence
Reporting Period:	July 1, 2021 - June 30, 2022

Budget Categories (Subawards)	(A) Budgeted Amount	(B) Total Costs Through Last Report	(C) Costs Incurred This Period Only	(D) Balance A-(B+C)=D	Cumulative Expenditures B+C
PRESIDES COE - Case Western Reserve	**$1,633,806**	**$1,633,806**	**$0**	**$0**	**$1,633,806**
OCPP COE - The Ohio State University	**$3,745,145**	**$3,745,145**	**$0**	**$0**	**$3,745,145**
M&M COE - University of Dayton	**$3,024,438**	**$3,024,438**	**$0**	**$0**	**$3,024,438**
HPHS COE - Wright State University	**$1,493,922**	**$1,493,922**	**$0**	**$0**	**$1,493,922**
C4ISR COE - Wright State University	**$1,200,000**	**$1,200,000**	**$0**	**$0**	**$1,200,000**
C2PNT COE - Ohio University	**$20,118**	**$20,118**	**$0**	**$0**	**$20,118**
C&WD Team - Cleveland State University	**$1,108,000**	**$1,108,000**	**$0**	**$0**	**$1,108,000**
C&WD Team - Lorain County Community College	**$974,884**	**$974,884**	**$0**	**$0**	**$974,884**
OFRN Legacy Workforce Development Programs	**$3,555,088**	**$3,555,088**	**$0**	**$0**	**$3,555,088**
OFRN Administration	**$3,244,599**	**$3,244,599**	**$0**	**$0**	**$3,244,599**
TOTAL	**$20,000,000**	**$20,000,000**	**$0**	**$0**	**$20,000,000**

CERTIFICATION: I hereby certify that the above amounts are true and accurate to the best of my knowledge; that all costs incurred are solely for the purpose set forth in ODHE MOU.
Appropriate documentation, including, but not lmited to, receipts or other evidence of payment, is on file and available as provided for in the Award Agreement.

Authorized Signature: _____ Date: _____

Typed Name: Dennis Andersh

STATE USE ONLY BELOW THIS LINE

CAP: _____

Project Administrator: _____ Date: _____

Form B2

OHIO DEPARTMENT OF HIGHER EDUCATION
WORKFORCE DEVELOPMENT AND EMERGING MISSIONS MOU's
OFRN FUNDS EXPENDED REPORT

Please Type all Information

Subaward No.: 60065626/Sec.369.473, Ohio H.B. 64 of 131st GA

Recipient:	Parallax Advanced Research
Project:	Ohio Federal Research Network - Centers of Excellence
Reporting Period:	July 1, 2021 - June 30, 2022

Budget Categories (Subawards)	(A) Budgeted Amount	(B) Total Costs Through Last Report	(C) Costs Incurred This Period Only	(D) Balance A-(B+C)=D	Cumulative Expenditures B+C
C2PNT COE - Ohio University	**$2,087,478**	**$2,087,478**	**$0**	**$0**	**$2,087,478**
HPHS COE - Wright State University	**$2,072,220**	**$2,072,220**	**$0**	**$0**	**$2,072,220**
OFRN CONSULTANTS	**$223,337**	**$223,337**	**$0**	**$0**	**$223,337**
OFRN ADMIN G&A	**$40,255**	**$40,255**	**$0**	**$0**	**$40,255**
OSU PROJECTS & ADMIN	**$576,710**	**$576,710**	**$0**	**$0**	**$576,710**
TOTAL	**$5,000,000**	**$5,000,000**	**$0**	**$0**	**$5,000,000**

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Project Administrator: _____ Date: _____

OHIO DEPARTMENT OF HIGHER EDUCATION
WORKFORCE DEVELOPMENT AND EMERGING MISSIONS MOU's
OFRN FUNDS EXPENDED REPORT

Please Type all Information

Subaward No.: 60064366/Sec.381.440, Ohio H.B. 49 of 132nd G.A.

Recipient:	Parallax Advanced Research
Project:	Ohio Federal Research Network - Centers of Excellence
Reporting Period:	July 1, 2021 - June 30, 2022

Budget Categories (Subawards)	(A) Budgeted Amount	(B) Total Costs Through Last Report	(C) Costs Incurred This Period Only	(D) Balance A-(B+C)=D	Cumulative Expenditures B+C
PERSISTENT SURVVEILLLANCE SYSTEMS	**$1,998,349**	**$1,998,349**	**$0**	**$0**	**$1,998,349**
GHOST WAVE	**$1,344,597**	**$1,344,597**	**$0**	**$0**	**$1,344,597**
UNIVERSITY OF CINCINNATI	**$968,947**	**$955,389**	**$13,549**	**$9**	**$968,938**
OFRN CONSULTANTS	**$213,986**	**$213,986**	**$0**	**$0**	**$213,986**
WSARC UNALLOCATED	**$13,049**	**$13,049**	**$0**	**$0**	**$13,049**
OSU PROJECTS & ADMIN	**$2,361,072**	**$1,639,072**	**$171,000**	**$551,000**	**$1,810,072**
TOTAL	**$6,900,000.00**	**$6,164,442**	**$184,549**	**$551,009**	**$6,348,991**

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Project Administrator: _____ Date: _____

Form B2

OHIO DEPARTMENT OF HIGHER EDUCATION
WORKFORCE DEVELOPMENT AND EMERGING MISSIONS MOU's
OFRN FUNDS EXPENDED REPORT

Please Type all Information

Subaward No.: 60073805/Sec.381.440, Ohio H.B. 166 of 136th G.A.

Recipient:	Parallax Advanced Research
Project:	Ohio Federal Research Network - Centers of Excellence
Reporting Period:	July 1, 2021 - June 30, 2022

Budget Categories (Subawards)	(A) Budgeted Amount	(B) Total Costs Through Last Report	(C) Costs Incurred This Period Only	(D) Balance A-(B+C)=D	Cumulative Expenditures B+C
ASYMMETRIC TECHNOLOGIES	$1,450,071	$1,177,509	$249,108	$23,454	$1,426,617
CAL ANALYTICS	$1,399,882	$1,271,440	$128,442	$0	$1,399,882
GHOST WAVE	$1,262,622	$1,129,590	$133,032	$0	$1,262,622
KENT STATE UNIVERSITY	$1,214,202	$763,329	$400,363	$50,510	$1,163,692
RIVERSIDE RESEARCH	$1,176,717	$840,341	$336,376	$0	$1,176,717
YOUNGSTOWN BUSINESS INCUBATOR	$972,877	$587,608	$385,269	$0	$972,877
OFRN ADMINISTRATION	$2,102,129	$1,885,125	$217,004	$0	$2,102,129
TOTAL	$9,578,500	$7,654,943	$1,849,593	$73,964	$9,504,536

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Project Administrator: _____ Date: _____

Form B2

OHIO DEPARTMENT OF HIGHER EDUCATION
WORKFORCE DEVELOPMENT AND EMERGING MISSIONS MOU's
OFRN FUNDS EXPENDED REPORT

Please Type all Information

Subaward No.: GR125178/Sec.381.373, Ohio H.B. 110 of 134th G.A.

Recipient:	Parallax Advanced Research
Project:	Ohio Federal Research Network - Centers of Excellence
Reporting Period:	July 1, 2021 - June 30, 2022

Budget Categories (Subawards)	(A) Budgeted Amount	(B) Total Costs Through Last Report	(C) Costs Incurred This Period Only	(D) Balance A-(B+C)=D	Cumulative Expenditures B+C
FLIGHTPROFILER	**$902,498**	**$0**	**$0**	**$902,498**	**$0**
THE OHIO STATE UNIVERSITY (PROJECT 507)	**$1,744,650**	**$0**	**$264,380**	**$1,480,271**	**$264,380**
ASYMMETRIC TECHNOLOGIES	**$1,575,120**	**$0**	**$290,650**	**$1,284,470**	**$290,650**
ALPHAMICRON	**$849,999**	**$0**	**$141,666**	**$708,333**	**$141,666**
THE OHIO STATE UNIVERSITY (PROJECT 542)	**$1,076,040**	**$0**	**$0**	**$1,076,040**	**$0**
SAFRAN	**$1,710,000**	**$0**	**$248,022**	**$1,461,978**	**$248,022**
MIAMI UNIVERSITY	**$1,018,611**	**$0**	**$0**	**$1,018,611**	**$0**
OFRN ADMINISTRATION	**$1,023,081**	**$0**	**$808,061**	**$215,020**	**$808,061**
TOTAL	**$9,900,000**	**$0**	**$1,752,778**	**$8,147,222**	**$1,752,778**

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Project Administrator: _____ Date: _____

Form B2

Cost Share Contribution Report – As of 30 June 2022

OHIO DEPARTMENT OF HIGHER EDUCATION
WORKFORCE DEVELOPMENT AND EMERGING MISSIONS MOUs
OFRN COST SHARE CONTRIBUTION REPORT

Please Type all Information

Subaward No.: PO BOR01-000000004706/MOU DATED 12/1/15

Recipient:	Parallax Advanced Research
Project:	Ohio Federal Research Network - Cost Share Contribution
Reporting Period:	July 1, 2021 - June 30, 2022

Budget Categories (Subawards)	(A) Budgeted Amount	(B) Total Cost Share Through Last Report	(C) Costs Share This Period Only	(D) Balance A-(B+C)=D	Cumulative Cost Share B+C
PRESIDES COE - Case Western Reserve	**$708,758**	**$820,258**	**$0**	**-$111,500**	**$820,258**
OCPP COE - The Ohio State University	**$4,247,733**	**$4,862,032**	**$0**	**-$614,299**	**$4,862,032**
M&M COE - University of Dayton	**$2,983,670**	**$2,676,861**	**$0**	**$306,809**	**$2,676,861**
HPHS COE - Wright State University	**$3,339,576**	**$2,871,275**	**$0**	**$468,301**	**$2,871,275**
C4ISR COE - Wright State University	**$589,117**	**$532,072**	**$0**	**$57,045**	**$532,072**
C2PNT COE - Ohio University	**$2,769,203**	**$3,145,983**	**$0**	**-$376,780**	**$3,145,983**
C&WD Team - Cleveland State University	**$326,552**	**$477,166**	**$0**	**-$150,614**	**$477,166**
TOTAL	**$14,964,609**	**$15,385,647**	**$0**	**-$421,038**	**$15,385,647**

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Project Administrator: _____ Date: _____

Form B2

Note: A negative number in column D represents cost share provided in excess of budget.

OHIO DEPARTMENT OF HIGHER EDUCATION
WORKFORCE DEVELOPMENT AND EMERGING MISSIONS MOUs
OFRN COST SHARE CONTRIBUTION REPORT

Please Type all Information

Subaward No.: 60064366/Sec.381.440, Ohio H.B. 49 of 132nd G.A.

Recipient:	Parallax Advanced Research
Project:	Ohio Federal Research Network - Cost Share Contribution
Reporting Period:	July 1, 2021 - June 30, 2022

Budget Categories (Subawards)	(A) Budgeted Amount	(B) Total Cost Share Through Last Report	(C) Cost Share Incurred This Period Only	(D) Balance A-(B+C)=D	Cumulative Cost Share B+C
PERSISTENT SURVVEILLLANCE	**$5,482,826**	**$4,989,279**	**$5,730,000**	**-$5,236,453**	**$10,719,279**
GHOST WAVE	**$1,247,722**	**$1,277,856**	**$0**	**-$30,134**	**$1,277,856**
UNIVERSITY OF CINCINNATI	**$1,009,024**	**$1,048,038**	**$14,369**	**-$53,383**	**$1,062,407**
OSU	**$2,230,000**	**$1,388,000**	**$124,000**	**$718,000**	**$1,512,000**
TOTAL	**$9,969,572**	**$8,703,173**	**$5,868,369**	**-$4,601,971**	**$14,571,542**

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Project Administrator: _____ Date: _____

Form B2

Note: The Cost Share was reported with the $20M where it was a requirement.

Note: A negative number in column D represents cost share provided in excess of budget.

OHIO DEPARTMENT OF HIGHER EDUCATION
WORKFORCE DEVELOPMENT AND EMERGING MISSIONS MOUs
OFRN COST SHARE CONTRIBUTION REPORT

Please Type all Information

Subaward No.: 60073805/Sec.381.440, Ohio H.B. 166 of 136th G.A.

Recipient:	Parallax Advanced Research
Project:	Ohio Federal Research Network - Cost Share Contribution
Reporting Period:	July 1, 2021 - June 30, 2022

Budget Categories (Subawards)	(A) Budgeted Amount	(B) Total Cost Share Through Last Report	(C) Cost Share Incurred This Period Only	(D) Balance A-(B+C)=D	Cumulative Cost Share B+C
ASYMMETRIC TECHNOLOGIES	$1,352,278	$1,655,783	$72,132	-$375,638	$1,727,916
CAL ANALYTICS	$1,177,798	$1,195,981	$119,003	-$137,185	$1,314,983
GHOST WAVE	$1,396,614	$126,197	$19,631	$1,250,787	$145,828
KENT STATE UNIVERSITY	$1,011,776	$328,855	$460,538	$222,383	$789,393
RIVERSIDE RESEARCH	$748,260	$813,383	$23,633	-$88,757	$837,016
YOUNGSTOWN BUSINESS INCUBATOR	$434,229	$234,545	$178,987	$20,697	$413,532
TOTAL	$6,120,955	$4,354,744	$873,924	$892,287	$5,228,668

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Form B2

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OHIO DEPARTMENT OF HIGHER EDUCATION
WORKFORCE DEVELOPMENT AND EMERGING MISSIONS MOUs
OFRN COST SHARE CONTRIBUTION REPORT

Please Type all Information

Subaward No.: GR125178/Sec.381.373, Ohio H.B. 110 of 134th G.A.

Recipient:	Parallax Advanced Research
Project:	Ohio Federal Research Network - Cost Share Contribution
Reporting Period:	July 1, 2021 - June 30, 2022

Budget Categories (Subawards)	(A) Budgeted Amount	(B) Total Cost Share Through Last Report	(C) Cost Share Incurred This Period Only	(D) Balance A-(B+C)=D	Cumulative Cost Share B+C
FLIGHTPROFILER	**$219,294**	**$0**	**$0**	**$219,294**	**$0**
THE OHIO STATE UNIVERSITY (PROJECT 507)	**$417,292**	**$0**	**$63,259**	**$354,033**	**$63,259**
ASYMMETRIC TECHNOLOGIES	**$1,083,526**	**$0**	**$356,344**	**$727,182**	**$356,344**
ALPHAMICRON	**$349,688**	**$0**	**$228,750**	**$120,938**	**$228,750**
THE OHIO STATE UNIVERSITY (PROJECT 542)	**$287,559**	**$0**	**$0**	**$287,559**	**$0**
SAFRAN	**$1,010,331**	**$0**	**$205,766**	**$804,565**	**$205,766**
MIAMI UNIVERSITY	**$821,376**	**$0**	**$0**	**$821,376**	**$0**
TOTAL	**$4,189,065**	**$0**	**$854,119**	**$3,334,946**	**$854,119**

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