

Ohio
Federal
Research
Network

Driving Innovation Through Strategic Partnerships



Administered by:



Funded by:



2021 Annual Report to the Ohio Department of Higher Education

June 2021

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Letter to the Chancellor

June 30, 2021

Chancellor Randy Gardner
Ohio Department of Higher Education
25 South Front Street
Columbus, OH 43215

Chancellor Gardner,

It is with great pleasure that we submit the sixth annual report for the Ohio Federal Research Network (OFRN). Based on direction from our federal partners, the OFRN investments have accomplished the following:

- Grew federal research spending in Ohio.
- Advanced research initiatives aimed at emerging Department of Defense (DoD) and National Aeronautics and Space Administration (NASA) requirements.
- Enhanced Ohio-based university and industry collaborative innovation and projects.
- Created and retained jobs in Ohio.
- Made a broad and significant impact on Ohio's economy.

This remarkable initiative continues to represent our state's most innovative collaborations between Ohio's research universities, industry, and key federal partners. The relationships and connections that the OFRN continues to build within the state are very impactful for Ohio.

We look forward to receiving your feedback from this report and sharing what's next for the OFRN. You will see that the OFRN is truly driving innovation in Ohio through strategic partnerships!

Sincerely,



Dennis Andersh
Program Executive – OFRN
Parallax Advanced Research



Michael Gentil
Program Manager - OFRN
Ohio State University

Executive Summary

The key to OFRN's success is its remarkable collaboration with the Ohio Department of Higher Education (ODHE), The Ohio State University (Ohio State), Ohio Department of Transportation (ODoT), JobsOhio, the DoD and NASA partners, and the Ohio Governor's Office. These partnerships and their support of a requirements-based research model are what make the OFRN unique and able to grow industry, state, and federal R&D investments in Ohio.

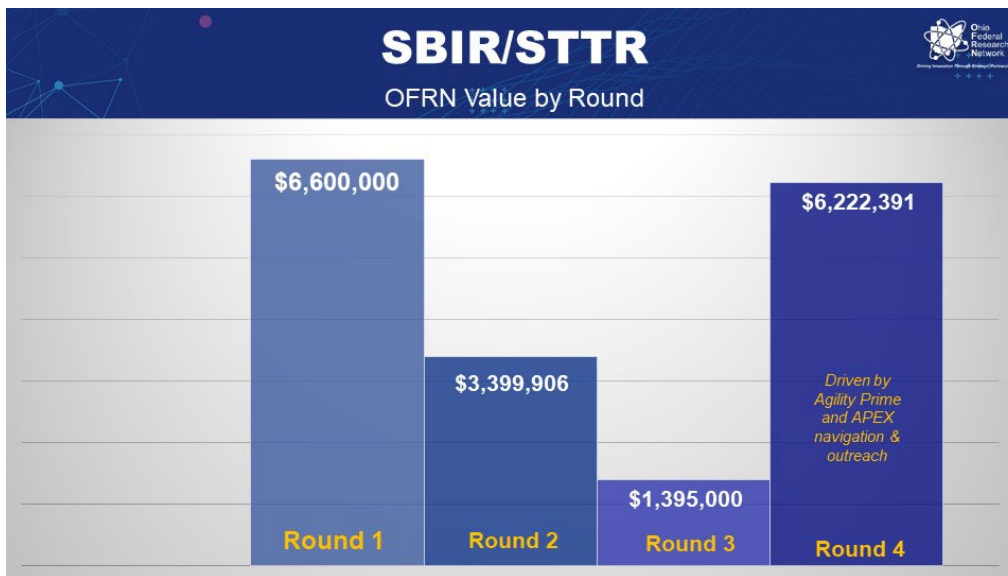
Over the past year, the OFRN's fourth round of funded projects was focused on the "Sustaining Ohio's Aeronautical Readiness and Innovation in the Next Generation" (SOARING) initiative. This initiative was designed to expand Ohio's leadership in defense and commercial aerospace research, development, and sustainment of unmanned air systems (UASs), personal air vehicles (PAVs), and logistics delivery air vehicles (LADVs).

SOARING projects leverage Ohio's unique aerospace assets to address critical research needs of OFRN's federal partners. These projects are advancing the state of the UAS industry, both in Ohio and nationally, and many are partners on the Ohio Department of Transportation's team that won a NASA Space Act Agreement to support the Advanced Air Mobility (AAM) National Campaign.

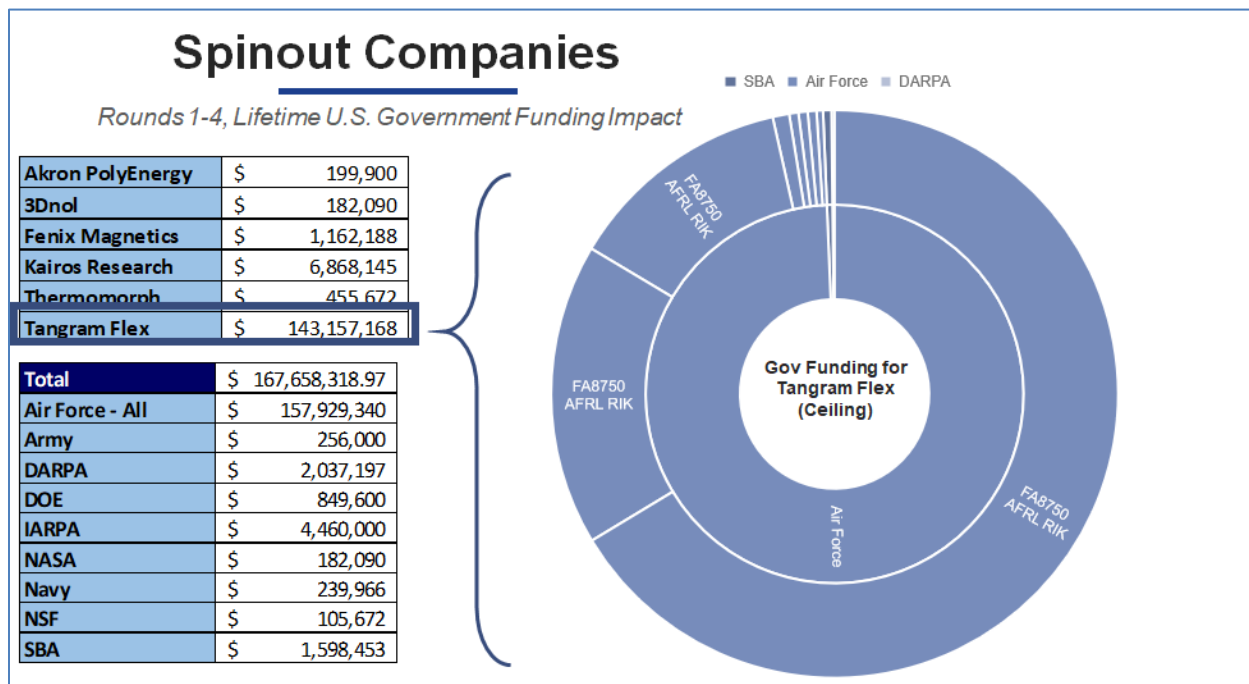
To date, OFRN has competitively allocated just over \$51.4 million across four rounds with 28 distinct research projects and teams located all over our great state as well as has produced effective workforce development and commercialization activities. The OFRN successes include:

- 156.4% improvement in state R&D efficiency
- Total cost share reported at the end of FY21 is \$28,443,564
 - Round 1/Round 2: \$15,385,647
 - Round 3: \$8,703,173
 - Round 4: \$4,354,744
- Pursuit of \$350+ million in follow-on funding of which \$204+ million was awarded and broken down by
 - Industry-sponsored research \$34.6 million
 - Federal funding \$164 million
 - Other (state, local, etc.) \$5.4 million
- \$10,456,075 follow-on funding in 2021. Total follow-on funding since OFRN's inception is \$204,073,902
- 10 spinout companies created
- 279 jobs created; 1,167 indirect jobs created.
- 12 intellectual property patents created, 2 pending.

In addition, there has been significant improvement in SBIR/STTR awards across Ohio. See the figure below for a breakdown of SBIR/STTR awards awarded to projects from each OFRN funding round.



Significant growth of spinouts companies created have also resulted from the OFRN effort. See the figure below for a breakdown of the spinouts created throughout the lifetime of the OFRN program.



The OFRN team assessed the follow-on funding amounts awarded to all OFRN Rounds 1-4 teams as well as tracked the teams' commercialization efforts involving Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grants. As a result of that assessment, the OFRN found that the Rounds 1-4 teams received a total of \$17.6 million. Below is a table that lists funding by round as well as by agency:

Total	17,617,297
By OFRN Round	
OFRN Round 1	\$6,600,000
OFRN Round 2	\$3,399,906
OFRN Round 3	\$1,395,000
OFRN Round 4	\$6,222,391
By Agency	
Air Force - AFWERX	\$4,379,906
Air Force - All	\$9,272,297
Army	\$1,345,000
DHA	\$2,950,000
DOE	\$760,000
NASA	\$1,775,000
Navy	\$210,000
NSF	\$1,225,000

Glossary

DHA – Defense Health Agency
DOE – Department of Energy
NSF – National Science Foundation

The OFRN team assessed the spinout companies and their lifetime SBIR and STTR funding impact. Six companies were awarded \$167.6 million in funding (listed below). The OFRN team also looked at how much money was awarded by agency:

Akron PolyEnergy	\$	199,900
3Dnol	\$	182,090
Fenix Magnetics	\$	1,162,188
Kairos Research	\$	6,868,145
Thermomorph	\$	455,672
Tangram Flex	\$	158,790,323

Total	\$	167,658,318.97
Air Force - All	\$	157,929,340
Army	\$	256,000
DARPA	\$	2,037,197
DOE	\$	849,600
IARPA	\$	4,460,000
NASA	\$	182,090
Navy	\$	239,966
NSF	\$	105,672
SBA	\$	1,598,453

OFRN Goals

The OFRN was established to:

- Expand Ohio's research base of talent capabilities and investment to complement and support the research missions and priorities of the Air Force Research Laboratory (AFRL), the Naval Medical Research Unit–Dayton (NAMRU-D), National Air and Space Intelligence Center (NASIC),

- and the NASA-Glenn Research Center (NASA-GRC).
- Align Ohio’s research universities and community colleges with the priority research initiatives of the AFRL, NAMRU-D, NASIC, and NASA-GRC to create external investment and business opportunities in and for Ohio.
- Focus on transitioning research advancements and technologies to operational domains and Ohio firms for both federal government and commercial sector customers where relevant.
- Enhance the competitive posture of Ohio research universities for federal R&D funding.
- Make Ohio a leader in development and manufacturing support in the areas of personal air vehicles (PAVs), unmanned aircraft systems (UASs), and heavy-lift logistics delivery air vehicles (LDAVs).

The OFRN-funded projects are intended to be applied research as opposed to fundamental research (see Figure 2).

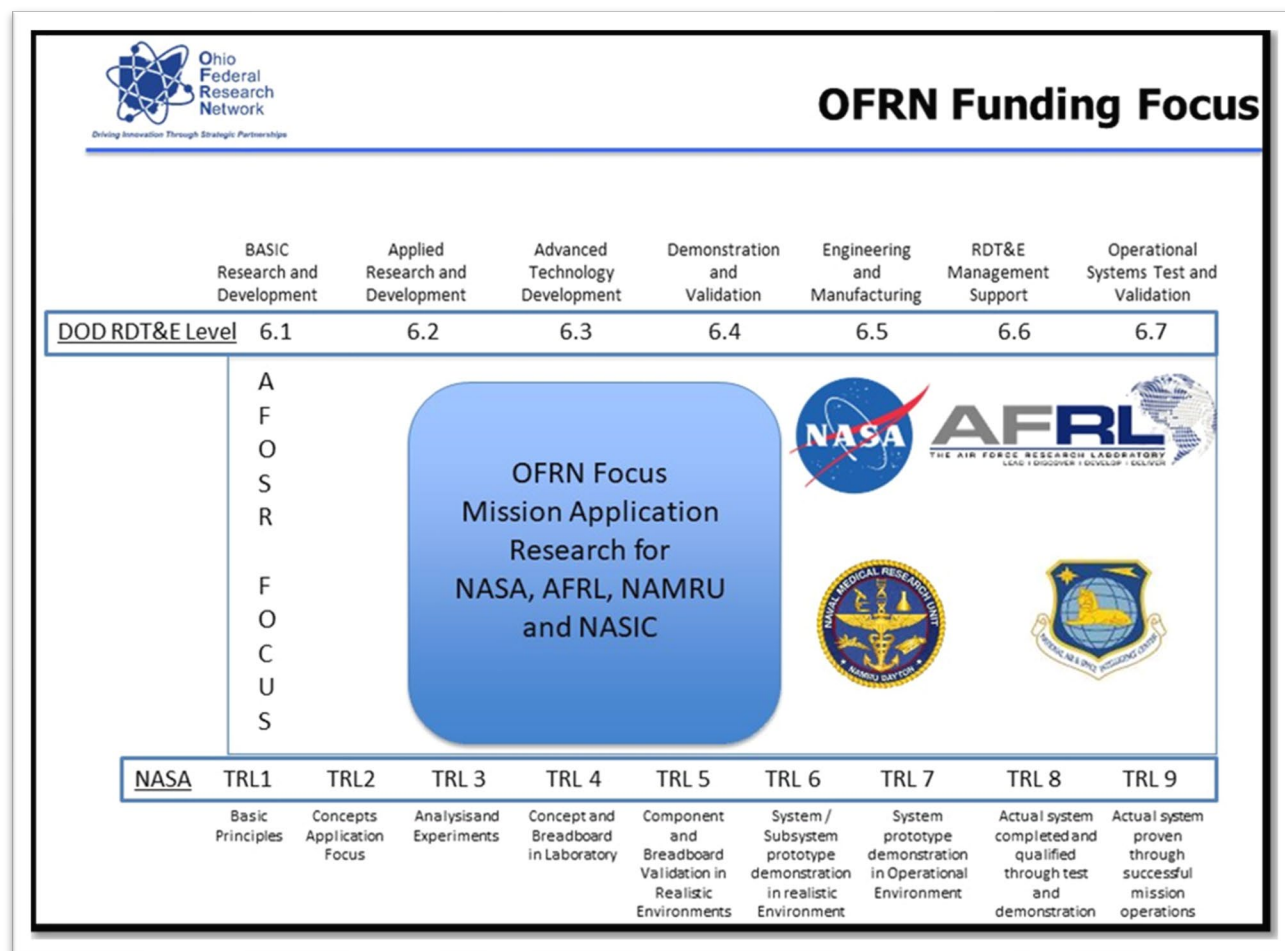


Figure 1 OFRN Funding Focus

Program Management



Figure 2: OFRN Network Construct

The OFRN is made up of a Technical Review Council (TRC), an Executive Review Board (ERB), and is managed by Parallax Advanced Research and Ohio State and is funded by the Ohio Department of Higher Education (ODHE) (see Figure 3). 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. This OFRN Network Construct, as it's relayed in Figure 3, are applicable for OFRN funding rounds 3 and onward.

OFRN Leadership

Dennis Andersh and Major General (retired) Mark Bartman are the OFRN program executives. Key to their success is Parallax Advanced Research, the Ohio State support staff, and the support and engagement of critical state offices, including ODHE, the Ohio Department of Development (ODoD), ODoT, and JobsOhio.

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.

In July 2021, as Parallax Advanced Research expanded to provide greater services to Ohio and the nation's R&D community, Robert Tanner became the executive director for aerospace partnerships at Parallax Advanced Research. Matt Bush assumed program management responsibilities of the OFRN.

Parallax Advanced Research

Parallax Advanced Research acts as the contracting, technical, and program management agent for the

OFRN. Specifically, Parallax leads and oversees all procurement, contracting, and financial reporting activities; supports the ERB and the TRC; supports the white paper and proposal review processes; facilitates quarterly project reviews; is the funding agent for all projects; frames the technical review and project evaluation processes of seed rounds; keeps a repository of all OFRN deliverables; is the repository of federal partner requirements; and maintains OFRN's full compliance with state and federal policies, rules, regulations, and accounting procedures.

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. This year, the OFRN included a representative from Central State University, a Historically Black College and University.

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.

Executive Review Board		Designee	Technical Review Council		Designee
Case Western Reserve University		Dr. Venkataramanan "Ragu" Balakrishnan	University of Cincinnati		Dr. Scott Petersen
Cleveland State University		Dr. Harlan M. Sands	Kent State University		Dr. Joycelyn Harrison
Ohio University		Dr. Joe Shields	Central State University		Dr. Subramania Sritharan
The Ohio State University		Dr. David Williams	University of Dayton VPR		Dr. John Leland
University of Toledo		Dr. Gregory Postel	Cleveland State University		Dr. Forrest Faison III
Youngstown State University		Jim Tressel	Ohio University VPR		Dr. Joseph Shields
Ohio Federal and Military Jobs Commission		Gary O'Connell	AFRL		Brian McJilton & Frank Albanese
NASA GRC		Dr. Marla Perez-Davis	NASA GRC		Mary Lobo
AFRL		Mr. Brian McJilton	NASIC		Steven Zech
NASIC		Mr. Duane Harrison	NAMRU-D		Dr. Richard Arnold
NAMRU-D		Dr. Richard Arnold	Ohio National Guard		Brig Gen James Camp
Ohio National Guard		Maj Gen John Harris	Industry 1		Dr. T.S. Sudarshan
Jobs Ohio		Glenn Richardson	Industry 2		William Mahoney
Ohio Department of Development		Karen Conrad	DriveOhio		Fred Judson
Industry 1		Maj Gen (Ret.) Mark Bartman	OAI Chair		Dr. John Sankovic
Industry 2 Chair		Ricky Peters	Ohio Department of Development		Scott Ryan
Industry 2		Salvatore Miraglia, Jr.	Business 1		Matthew Miller
Industry 3		Dr. Michael Triplett	Business 2		Jim Wheeler
Industry 4		Andy Jones	Business 3		Jeffrey Banker
			Former DHS		Craig Chambers

Figure 3 OFRN Executive Review Board (ERB) and Technical Review

Figure 4 shows the membership of the ERB and TRC, and each has representation from federal and state government, industry, and universities. Ricky Peters, chief executive officer of Tangram Flex, chairs the ERB. Dr. John Sankovic, president, and chief executive officer of the Ohio Aerospace Institute also chairs the TRC.

Ohio-based Federal Laboratory Partners

The Ohio federal laboratories are a vital connection for OFRN-funded projects and OFRN principal investigators (PIs). At the outset of the program, the project managers at the laboratories briefed hundreds of university researchers in special sessions held at NASA-GRC and Wright State University on their research priorities.

OFRN leadership and staff continually connect with the laboratories to ensure the research priorities remain up-to-date and reflect both national and local interests. Beyond this, the laboratories provide ongoing, direct access to the OFRN and are actively engaged in the activities of the TRC and ERB.

This engagement enables the TRC and ERB to fully understand how proposed projects align to the specific needs of the laboratories. This interaction does not stop at the TRC and ERB levels. For example, there are numerous instances of OFRN-funded PIs working with federal team members to tackle the OFRN projects. This collaboration has led to the formation of new follow-on collaborations and the laboratories investing their own capital and time into these efforts.

The OFRN government partners play an important role as developers of the areas of interest (AOIs) that are the foundation of OFRN R&D project solicitations. These AOIs are based on the government partners' national security plans and emphasize military and commercial value. The AOI development process is iterative and involves meeting with the OFRN leadership to provide feedback on the overall OFRN program and on each Research & Development (R&D) funding opportunity and its selection process.

To increase federal alignment, the OFRN's AFRL federal partner, Brian McJilton, led an iterative, collaborative process to define OFRN Round 5 federal partner areas of interest (AOI). Mr. McJilton's support was critical in integrating an increased number and level of government subject matter experts early on, who directly increased the OFRN Round 5 AOI alignment with government requirements and increased the probability for greater impact and follow-on funding opportunities. Furthermore, Mr. McJilton and the OFRN team held virtual public meetings, during which proposers engaged in Q&A sessions with government subject matter experts. All of this led to a significant increase in government partner engagement with proposal teams as they prepared for their OFRN Round 5 submissions.

State Stakeholders

Since the beginning, the OFMJC, ODHE, ODoD, ODoT, JobsOhio, Ohio Governor's Office, Ohio Lt. Governor's Office, legislators, and The Ohio Adjunct General's Office (TAG) have been instrumental in the start-up and continued progress of this program.

It has been a collaborative effort to ensure this program is centrally placed within Ohio's state government, federal laboratories, leading industry, and research universities' strategic initiatives, thereby ensuring the success of the state's overall goals and objectives for OFRN.

The Governor's Office and key state legislators have closely monitored the implementation of the OFRN and have helped identify ERB and TRC members. Regular briefings are provided to key leaders at the state level to keep them abreast of the program's progress and to gain their support for innovative initiatives. The Governor's Chief of Staff serves as the key point of contact for the Governor's Office.

The ODHE has been the key interface for the OFRN program leadership team at the state level. The funding for this statewide initiative is contained in the ODHE budget. Regular status reports are provided to the ODHE staff. ODHE also hosts meetings for the OFRN's ERB and arranges the briefings to the Chancellors' Research Officers Council.

The ODoD assists the OFRN by placing an executive on the ERB and a program manager on the TRC. They also assist in the formatting of the TRC review meetings and bring a wealth of knowledge on what has and has not worked for their program, thereby reducing the to run and improve the selection process.

JobsOhio provides an executive to the ERB and has been helpful in the framing and execution of the OFRN. A key OFRN performance indicator is job creation, and JobsOhio is the lead organization for assessing this metric. JobsOhio and the OFRN have enjoyed a close relationship, working with other Ohio agencies to promote Ohio's research network. Through the outreach efforts of JobsOhio and their promotion of the OFRN, Ohio's national profile within the UAS and the AAM industry has grown and is frequently cited by national companies as a reason for their interest in creating or growing their Ohio operations.

The ODoT, including its Drive Ohio and Fly Ohio programs, and the OFRN staff have worked closely on developing and networking UAS strategies and industry opportunities in Ohio. Whether engaging participants who are interested in using SkyVision, providing industry input to the Federal Aviation Administration (FAA), or leveraging new research for the advancement of Ohio's autonomous transportation systems, the OFRN and ODoT are moving Ohio forward as a leader in UAS.

The Ohio TAG Department has interfaced with the OFRN program since its inception. The OFRN team is working with TAG and other key federal organizations to execute OFRN's SOARING initiative. Former Ohio TAG, Major (retired) General Mark Bartman, continues to support direction and management of the OFRN. The Ohio TAG, Major General John Harris, is also a member of the ERB.

Key to this activity is a requirement that proposers identify additional procurement opportunities that they'll pursue if funded by the OFRN. In support of this requirement, the OFRN provides participating Ohio universities and businesses with training on government pre-proposal and proposal writing. To date, Ohio State's I-Corps@Ohio program has been instrumental in supporting the teams selected to present their technologies to the TRC.

The OFRN Portfolio of Projects: FY21 Updates

The OFRN research Centers of Excellence (COEs) and SOARING initiative were developed after thorough review of the strategic plans and priority planning documents of the Air Force, DoD, NASA-GRC, and State of Ohio as well as through an iterative review of and briefings on federal requirements provided by AFRL, NASIC, NAMRU-D, and NASA-GRC.

Centers of Excellence (COEs) – Rounds 1 & 2

COE-led projects were designed to build collaborative partnerships among leading Ohio-based public and nonprofit research organizations, forward thinking businesses and federal laboratories. COE projects include rounds 1 and 2.

Human Centered Big Data Project (HCBBD).

The HCBBD project produced new methods for understanding, visualizing, and explaining the reasoning process of "black box" AI algorithms, resulting in more trustworthy and interpretable algorithms. Along the way, we developed novel approaches for several AI-assisted tasks including image interpretation, image search, context-aware text search. Results of the project included new algorithms for quickly searching through large image databases, methods for inferring how neural networks organize input data, and techniques for explaining that organization in human-understandable forms, and novel techniques for training neural networks to operate on human-interpretable text rules. HCBBD led to new collaboration with Tenet3.

Motion Sickness Interaction with Spine Disorders Project (MOSSD)

The effects of motion sickness (MOS) on military health, risk, performance, and operational effectiveness were explored during a unique two-year multi-disciplinary research investigation between three universities, two industry partners, and NAMRU-D. This study enrolled 28 volunteers from a military

population and assessed the effects of pre- and post-MS exposure. A wide variety of measures were utilized to quantify these effects including low back function, spinal loading, postural stability, gait function, genotypes, and gene expressions. Results found interesting changes to both biomechanical and genetic variables (low back function, postural stability, and gene expressions). In addition, the team found mild to moderate correlations between changes in biomechanics and gene expressions. These changes in gene expressions may be the underlying mechanism for observed changes in biomechanics.

The team was awarded an NSF Industry-University Cooperative Research Centers award as well as other DoD awards. Those efforts totaled nearly \$4 million. To date, the team has received over \$12 million in awards, including:

- Prediction of Multi-Level Spinal Loads from Biomechanical Measurement Data, DoD, NAMRU-D, \$240,000.
- The Spine Phenome Project: Enabling Technology for Personalized Medicine, National Institute of Health (NIH), NIAMS/UH2, \$902,000.
- The Spine Phenome Project: Enabling Technology for Personalized Medicine, NIH, NIAMS/UH3, \$3.10 million.
- Core Center for Patient-centric Mechanistic Phenotyping in Chronic Low Back Pain, NIH, NIAMS, \$552,000.
- Biomechanical Evaluation of Military Aviation-Related Occupational Tasks on the Spine, DoD, AFRL, \$243,000.
- Spine Kinematic Metrics as an Indicator of Safe Return to Work, Ohio Bureau of Workers' Compensation, \$250,000.
- Predicting and Preventing Low Back Pain in Marine Special Operations Command Raider Trainees, Marine Raiders and Marine Aviators at Camp Lejeune, DoD, \$327,000.
- Cervical Spine Health Improvement Products, DoD/DHA, STTR/Phase II, \$1.1 million.
- Cervical Spine Health Improvement Products, DoD/DHA, STTR/Phase II Booster, \$550,000.
- Spine Health Improvement Products, DoD/DHA, SBIR/Phase II, \$1.1 million.
- An Integrated System for Precision Warfighter Spine Health, DoD, Accelerating Innovation in Military Medicine, \$350,000.
- Wearable Spine Health System for Military Readiness Assessment, DoD, \$3.38 million.

Advanced Cognitive and Physical Sweat Bio Sensing

This technology is an adaptable experimental design in flight simulator. Researchers can create different scenarios in the application Pilot Trust in Autonomy with different routes, goals, and biometric sensors. They can customize or create new data fields. The technology provides adaptable experimental analyses. Data exploration and visualization analysis tool (visionary) allows analysts to focus on any experimental variable(s). Database architecture and filtering features of visionary greatly reduces data cleanup and provides quick look and deep dive analysis. The project also provides research into flight control input patterns, such as demonstrated predictive power of classification algorithms towards identifying the skill level of operators using only controller input. This research was published in the Institute of Electrical and Electronics Engineers International Conference on Machine Learning.

This project resulted in a spinout called Hydrolabs which developed an ultra-simple wearable local sweat volume monitoring patch based on swellable hydrogels and enables the optimization of an individual hydration strategy that leaves no performance on the table.

Adaptive bio-Inspired Aerospace Structures Actuated by Shape Memory Alloys

Adaptive structures actuated by shape memory alloys have generated significant interest at NASA-GRC (High Temperature & Smart Alloys Branch) and two Ohio-based AFRL directorates (Aerospace Systems and Materials & Manufacturing).

This project received a \$2.5 million contract from Oak Ridge National Laboratory to study additive

manufacturing of shape memory alloys. The project formed the new start-up company -3dnol- specializing in additive manufacturing of shape memory alloys for different industries

Advanced Turbine Cooling Project

The Advanced Turbine Cooling project investigated methods of improving the efficiency and performance of jet engines and gas turbine engines through improved cooling technologies.

Continuing their contract with Pratt & Whitney, the team added \$190,000 in additional contracts with Pratt this year. Some of the team's other funding sources, like Honeywell (who partnered on the team's OFRN project), are down right now due to COVID's impact on the commercial aerospace sector. The team is working on plans for next year and hopes to have new contracts in 2022.

High Energy Density Li-Ion Battery Based on Advanced Silicon Anodes Project

To mitigate the volumetric change of silicon anodes, especially at high mass loading conditions, the University of Akron team developed resilient binder materials. Such an elastic binder can provide an inexhaustible interfacial adhesion to electrode components, enhanced mechanical performance and electrolyte stability to enable high Si loading and thus high energy density electrodes. The team demonstrated an elastic binder-based silicon anode exhibiting over 1000 mAh/g specific capacity and less than 20% degradation after 200 cycles. A battery using this binder technology is anticipated to have over 30% increase in energy density, to > 300 Wh/kg. The team also formed the company Akron Polyenergy Inc. after their OFRN project and was working on a DOE SBIR project.

SOARING – Rounds 3 & 4

Soon after the start of fiscal year 2021, the OFRN completed the source selection process for the OFRN's fifth round of funding, which is the third round of the SOARING initiative. Leading up to this selection process, and as with previous OFRN funding solicitations, the OFRN team held multiple free virtual engagement sessions for potential proposers and offered matchmaking services to connect teams. SOARING projects leverage Ohio's unique aerospace assets to assist recipients in overcoming critical technical barriers and business challenges to enable more widespread adoption of unmanned aerial systems (UAS) into the national aerospace. SOARING AOIs include:

- COE and SOARING research topics include:
- Quantum Communications, Cyber, Position, Navigation, and Timing
- Command, Control, Communications, Computing, Intelligence Surveillance and Reconnaissance
- Power & Propulsion
- Energy Storage & Integration
- Human Performance, Human Factors & Health Sciences
- Materials & Manufacturing
- Personal Air Vehicles (PAVs), Unmanned Aerial Systems (UAS), Unmanned Aerial Vehicles (UAVs), Heavy-lift Logistics Delivery Vehicles (LDAVs), and Electric Vertical Takeoff and Landing Vehicles (eVTOLs)
- Artificial Intelligence & Data Analytics
- Space Commercialization
- Advanced Power Systems

The following are the Rounds 3 & 4 research projects:

Brushless Doubly-Fed Machine and Drive System for Aviation Application

Ohio State teamed up with Safran Electrical & Power in Ohio and the University Dayton Research Institute (UDRI) to develop high-speed brushless doubly fed machines for aviation propulsion application using a direct current distribution power system. Ohio State leads the electromagnetic design of the

electric machine, power converter design and drive system control algorithm design. Safran leads the mechanical design and thermal design of the machine and builds the machine prototypes. UDRI leads the aircraft power system analysis and control simulation.

The team gave updates to Boeing Company on the OFRN Round 3 project once a quarter in the regular Boeing-Ohio State project meetings from July 1, 2020, to June 30, 2021. Because of the OFRN Round 3 work, Boeing continues to purchase the membership of the Center for High Performance Power Electronics (CHPPE) for 2022. Also, Boeing continues to sponsor CHPPE research on independent speed variable frequency starter/generator technology from April 2021 to March 2022. Boeing buys the IP rights for this work. From July 1, 2021, to June 30, 2021, Boeing filed three invention disclosures on this work.

Regional Unmanned Traffic Management System (RUTMS)

In response to this technological sea change, the University of Cincinnati created RouteMaster—a collision avoidance and traffic management digital infrastructure that allows manned and unmanned systems to operate effectively in confined spaces such as an emergency response scenario or the modern urban environment. Just as the internet provided a digital infrastructure that de-conflicted and sped messages to their destinations from computers with vastly different operating systems, RouteMaster provides a digital infrastructure that allow mobile systems—manned and unmanned—to be de-conflicted and sped on their individual or collaborative missions even with heterogeneous communication and control protocols.

The UAV MASTERLabs, the University of Cincinnati branch of the RUTMS team, is in the development of a Cooperative Research and Development Agreement with the U.S. Army Corps of Engineers Engineering Research and Development Center to further technologies and cross pollinate the appropriate capabilities amongst first responders.

The team has also been awarded two separate STTR's from Agility Prime, with two new partners.

The UC team has also been awarded \$15,000 and was selected as a CDR finalist for the NIST/NSF First Responder Challenge.

Autonomous/Remote Piloted Cirrus SR22 Aerial Surveillance Platform and Personnel Air Vehicle "Air Uber" System

This technology is a low-risk approach to develop an economical, high-performance pilot optional autonomous airborne surveillance platform and remotely piloted or assisted Personal Air Vehicle (PAV) based on the widely used FAA certified Cirrus SR22 aircraft.

Persistent Surveillance Systems (PSS) and MacAir Aviation have expanded operations based on the support of the OFRN effort. These include operations in Baltimore totaling \$3.5 million, and operations in support of Wright-Patterson Air Force Base flight testing totaling more than \$350,000. The team led commercial aircraft integration and development efforts totaling \$220,000 across several companies. The team was asked to be a partner on a major surveillance support contract by a major defense prime and they are waiting to hear about an \$85 million per year contract. That prime has also asked the team to partner on another effort in support of another COCOM area comment for next year. If either of these efforts come through, it will fundamentally change the scope and scale of PSS. MacAir and PSS also continue to expand the Ohio Flight and System Test Consortium (OFAST), including additional companies and capabilities. The team is expanding the OFAST effort and are nearing completion of a new building to support the effort at the Greene County Airport. Through this OFRN follow-on effort, the team brought in additional work and funds. The team partnered with a major radar company to integrate its systems with the Synthetic Aperture Radar, providing a full day/night all weather capability some customers want.

CHIRP2C: Computer-Human Interaction for Rapid Program Analysis through Cognitive Collaboration

The innovative aspects of CHIRP2C include approaches that are unique and novel while at the same time employs proven scientific principles and methods, thereby reducing technical risks in the development of the CHIRP2C testbed.

The team engaged with commercial industry partner Citadel Defense to transition the technology developed under SOARING Round 4 to the Titan product line at Citadel Defense. Representatives from Citadel Defense were provided with a real-time demo of CHIRP2C, following which, the company provided a letter of interest in combining CHIRP2C and their patented radio frequency jamming technology for anti-drone technology. Current efforts are geared towards testing complex DJI phantom drones and demonstrating the efficacy of the CHIRP2C technology.

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 to happen on September 9, 2021.

Geometrically Complex 3D Printed Antennas for UAVs

This work concerns the 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 or 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 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.

Resilient and Secure UAS Flight Control

Asymmetric Technologies developed the IronClad Secure Flight Controller (SFC), which is a cyber-secure, robust open-architecture flight controller with advanced-computational capabilities available for additional high-level intelligent autonomy functions.

Over the past year, Asymmetric Technologies and its partners 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 modules, one of the key technologies developed under OFRN R4 funding. This spinout company is in discussions with several large defense contractors for potential licensing and purchasing of the Physically Unclonable Function (PUF) technology and devices.

Interoperability, Resiliency, and Contingency Management for Ohio UAS Operations

This effort is directly aligned with one of the NASA six focus areas: In-time System-wide Safety Assurance (ISSA). ISSA is discussed in detail in 'In-Time Aviation Safety Management: Challenges and

Research for an Evolving Aviation System (2018)' and would "...provide a continuum of information, analysis, and assessment that supports awareness and action to mitigate risks to safety..." This technology establishes what is essentially an ISSA system for Ohio UAS operations and directly supports NASA's research plans to develop an ISSA system for the National Airspace System.

During the period of July 1, 2020, through June 30, 2021, CAL Analytics had several commercialization research activities related to the development of its Contingency Management Platform (CMP). CAL Analytics completed the execution of its FAA sponsored program, including a flight test demonstration of the system. CAL Analytics performed a series of workshops with industry and government stakeholders, such as FAA, NASA, and ODoT, to evaluate the CMP platform and provide feedback on the various feature sets as part of the company's go to market preparation. CAL Analytics worked with its technology partners to secure all the necessary license and partnership agreements to make sales of the CMP. CAL Analytics is actively engaged with several industry and government customers to make initial deployments of the CMP for evaluation and commercial use. Additionally, 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 of the CMP to UAS platforms for more automated contingency response capabilities. Moving forward, CAL Analytics expects to deploy its CMP technology to several sites across the US 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

This technology is a lightweight high energy density (400 W-h/kg) on-board power source that enables vertical takeoff and landing (VTOL) type aircraft to have potentially extended flight time (12 hours) and increased payload.

Led by Dr. Yanhai Du, professor at Kent State University, the team pushed the technology towards commercialization by securing ten grant awards totaling over a million dollars, which was achieved by working with small businesses (SBIR and STTR). These awarded projects address fuels (aviation fuel sulfur removal and onboard hydrogen generation), fuel cell manufacturing, multi-UAV dispatch system, and intelligent air laser system, 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 advance power system, "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 Exhibition/Conference.

To date, this project has received ten follow-on awards/contracts totaling \$1,009,891 and is pursuing additional opportunities totaling \$7,400,000.

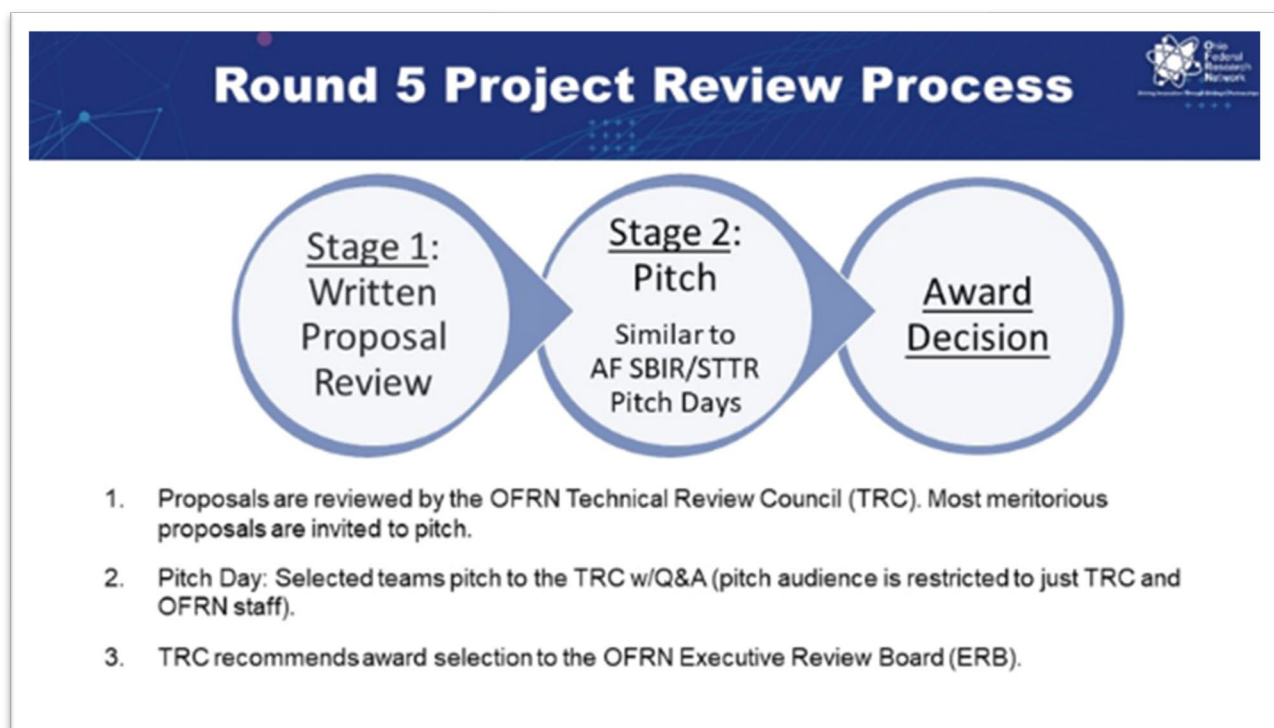
SOARING - Round 5

A total of 57 proposals were submitted in response to the Round 5 solicitation, requesting approximately \$81.7 million. The proposals were led by a mix of universities and businesses. At the first TRC meeting that discussed the OFRN Round 5, held virtually on March 4, 2021, the TRC evaluated and discussed each proposal.

From this set of proposals received, the TRC identified 25 projects to be offered an opportunity to pitch. Based on the requests for proposals' aims and listed criteria, the TRC evaluated each concept for alignment to federal research needs, project feasibility, potential economic impacts, budget, and team qualifications. The proposals that were not selected exhibited fundamental flaws or major misalignments with the Round 5 requirements. The TRC recommended select projects to the OFRN ERB for funding.

Considering one of the many aims of the OFRN is to lift the competitiveness of the state's research institutions for the AFRL and similar funding opportunities, the TRC utilized a categorization scheme like those used by the DoD while reviewing proposals, but with appropriate modification. These rating categories were:

- Category 1: Demonstrates technical merit and is consistent with the OFRN goals. The offeror presents relevant experience and access to adequate resources. Risk is acceptable. The cost/price is reasonable and realistic. Proposals in Category 1 are recommended for acceptance (subject to availability of funds) and normally should only be displaced by other Category 1 proposals.
- Category 2: Demonstrates technical merit and is consistent with OFRN goals. The offeror presents relevant experience and access to adequate resources. Risk of the project is generally viewed as acceptable. The cost/price is reasonable and realistic. Category 2 proposals are not recommended for funding at this time but are fundable concepts should OFRN secure additional funding.
- Category 3: Proposals in this category are not recommended for acceptance because they exhibit one or more of the following characteristics: the offeror does not demonstrate sufficient technical merit, does not meet the OFRN needs, does not present adequate experience or resources, the risk level is unacceptable, or the cost/price is not reasonable or realistic.



The following are the TRC-recommended projects for OFRN Round 5 SOARING funding:

1. Flightprofiler, The Ohio State University, and Ohio University's "Low Altitude Weather Network (LAWN)"
2. The Ohio State University, Sinclair Community College, University of Dayton, SK Infrared LLC, and L3Harris Space & Sensors' "Affordable LIDAR Technologies for Integration and Unmanned Deployment (ALTITUDE)"
3. Asymmetric, Lockheed Martin Procerus, The Ohio State University, and Ohio University's "Autonomous Capabilities for CASEVAC and Resupply in Urban Environments (ACCRUE)"
4. AlphaMicron, Bowling Green State University, Kent State University, and Miami University's "Electronically Dimmable Protective Eyewear"

5. The Ohio State University, University of Dayton, and Gooch & Housego Ohio's "Thin-film Crystals for High-speed Optical Modulation"
6. Safran, Youngstown Business Incubator, The Ohio State University, and Youngstown State University's "Advanced High Voltage Direct Current Generator System for Aerospace with Rapid Dynamic Response"
7. Miami University, The Ohio State University, GE Aviation Systems, PC Krause & Associates' "High Reliability, Low EMI, Wide Bandgap Power Conversion for Air & Space Applications"

The Round 5 project awardees will be announced in August 2021.

OFRN Outreach Activities

The OFRN also ramped up its marketing and communications efforts and capabilities in late 2019, to promote its programmatic efforts across the state, provide marketing and business development solutions for its awardees, and promote ecosystem partner achievements. The OFRN marketing and communications team uses an omnichannel approach that utilizes email marketing, content marketing, social media marketing (paid and organic), search engine optimization, event marketing, and media relations and communications. A popular feature of the OFRN marketing is its content marketing that relays stories on various past and present OFRN awardees, as well as news on industry. These stories have been featured in SUAS News, Dayton Business Journal, This Week News, EIN News, GCN.com, Channel 10 Dayton, Drone Tech UAV, Drone Nation, eVTOL Insights, Dayton Daily News, among others. Furthermore, these stories have been shared on social media, in ecosystem newsletters, by ecosystem thought leadership, and at industry events.

The OFRN also hosted an Ohio-focused Advanced Air Mobility (AAM) Research and Transition Collider, which communicated how the AAM industry is growing at an unprecedented rate thanks to the investment by the U.S. Air Force, DoT, and NASA in programs such as: Agility Prime, DriveOhio, FlyOhio, Ohio UAS Center, and NASA National Campaign.

The AAM Research and Transition Collider, hosted by the OFRN, DriveOhio, FlyOhio, Ohio UAS Center, and JobsOhio, provided attendees the unique opportunity to connect with supply chain vendors and original equipment manufacturers to innovative AAM-related research and development conducted by Ohio academia and small businesses. The event resulted in 320 industry, 130 academia, 43 government, and 42 individual connections made. To facilitate marketing and business development for prior funded teams, the OFRN marketing and communications team created the graphic below, which, on the affiliated PDF document, has direct links to detailed descriptions of each project and team. This [pdf](#) can be accessed from the OFRN website.



Driving Innovation Through Strategic Partnerships

The Ohio Federal Research Network (OFRN) has the mission to stimulate Ohio's innovation economy by building vibrant, statewide university and industry research collaborations that meet the requirements of Ohio's four federal laboratories and create leading-edge technologies that drive economic development in Ohio.

The OFRN partners include:

- 17 research universities
- 4 community colleges
- 96 businesses
- 10 spinout organizations
- \$41.4M invested + 1:1 Cost Share
- \$204M+ in follow-on funding
- 28 projects funded

If you are an academic or industry innovator with promising ideas or intellectual property you'd like to commercialize, are interested in collaborating with our network on research projects or need assistance and/or academic or industry partners in pursuit of federal funding opportunities, then we want to hear from you! Contact us today at ohiofrn.org!

Funding Round

- Rd.1 - The OFRN Centers of Excellence Round 1 projects
- Rd.2 - The OFRN Centers of Excellence Round 2 projects
- Rd.3 - The OFRN SOARING Initiative Round 3 projects
- Rd.4 - The OFRN SOARING Initiative Round 4 projects

CONTROL

- Rd.1 - Ohio State University
"Intelligent Control Architecture"
- Rd.2 - Ohio State University
"Effects of Motion Sickness on Military Health"
- Rd.2 - Wright State University
"Automated Test, Evaluation, Verification and Validation Tools"
- Rd.3 - Persistent Surveillance Systems
"Automated Cirrus SR22 for Surveillance or Personnel Transport"
- Rd.4 - Asymmetric Technologies
"IronClad Secure Flight Controller"

STRUCTURAL

- Rd.1 - University of Toledo
"Adaptive Bio-Inspired Aerospace Structures Actuated by Shape Memory Alloys"
- Rd.1 - University of Akron
"High Performance Plastic Substrates for Flexible Electronics"
- Rd.2 - University of Dayton Research Institute
"Cost Effective 3D Printed Complex Geometry Composites"
- Rd.2 - Ohio State University
"Carbon Nanotube Electro-Thermal Ice Protection System for UAVs"

POWER

- Rd.1 - Case Western Reserve University
"Multifunctional Structural Battery"
- Rd.1 - University of Akron
"High Density Li-Ion Battery with Silicon Anodes"
- Rd.1 - University of Dayton Research Institute
"High-Energy Long-Life Li-S Battery"
- Rd.4 - Kent State University
"A Hybrid Fuel Cell - Battery/Capacitor Power Source for UASs"

COMMUNICATION

- Rd.2 - Wright State University
"C2PNT Intelligent Channel Sensing"

SENSORS & AWARENESS

- Rd.3 - GhostWave
"Optical-Radar Sensor Fusion for UAV Onboard Detect and Avoid"
- Rd.4 - Youngstown Business Incubator
"Geometrically Complex 3D Printed Sensors"

PROPULSION

- Rd.1 - Case Western Reserve University
"High Temperature Magnetic Materials"
- Rd.1 - Ohio State University
"Hybrid Turbo-Electric Propulsion"
- Rd.2 - Ohio State University
"Advanced Turbine Cooling"
- Rd.3 - Ohio State University
"Super Conducting Brushless Motors"

COMMUNICATION

- Rd.2 - Wright State University
"C2PNT Intelligent Channel Sensing"

COMMAND & CONTROL

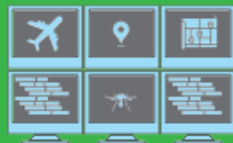
- Rd.1 - Wright State University
"Augmented UAV Operator Human Machine Interface (HMI)"
- Rd.2 - University of Cincinnati
"Advanced Cognitive and Physical Sweat Biosensing for Operators"
- Rd.4 - C&L Analytics
"Interoperability in the Modern UAC Traffic Management Architectures"
- Rd.4 - Riverside Research
"Computer-Human Interaction for Rapid Program Analysis through Cognitive Collaboration"

AEROSPACE AWARENESS

- Rd.2 - Wright State University
"Human-Centered Big Data Trustworthiness"
- Rd.3 - University of Cincinnati
"RouteMaster - A Collision Avoidance and Traffic Management Digital Infrastructure"
- Rd.4 - GhostWave
"Integrated Optical-Radar Sensor Fusion System for Air Space Awareness"

PLANNING

- Rd.1 - Wright State University
"Regional UAV Live-Virtual-Constructive Enterprise"



Visit our website to learn about each initiative and project round: <https://www.ohiofrn.org/>

The Ohio Federal Research Network is a program of Parallax Advanced Research.

4035 Colonel Glenn Hwy., Beavercreek, OH 45431

Finances

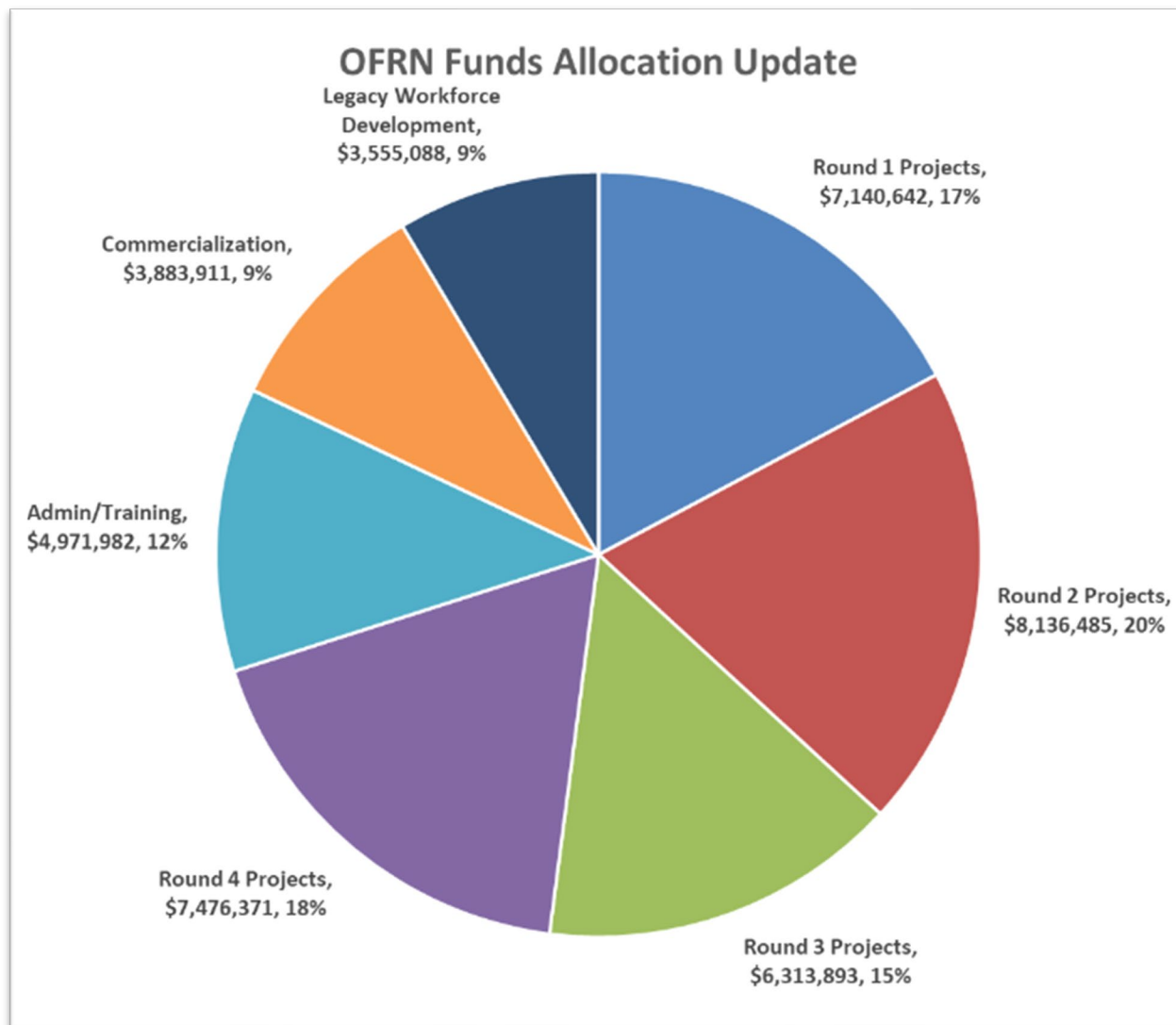


Figure 4 OFRN Allocated Funds

Total state operation funding for the OFRN programs for defense, aerospace, workforce development, and federal defense emerging mission is \$41.8 million for FY16 through FY21.

\$25 million was allocated to the OFRN program for research projects executed by the COE, for commercialization and workforce development activities by Lorain County Community College and Cleveland State University, legacy aerospace development projects, special projects, consultants, administration, and training.

\$6.9 million was designated for the Round 3 SOARING programs. \$9.9 million was designated for the Round 4 SOARING programs. A breakdown of the funding is displayed in Figure 5.

Figure 6 shows the funding allocation and expenses as of June 30, 2021, across all projects and funding rounds:

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	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
OCCP 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	\$2,757,517	\$487,082	\$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	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	\$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	Admin/Training	Commercialization	Legacy Workforce Development	Total Budget	Total Expensed	Balance
PERSISTENT SURVEILLANCE 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	-\$955,389	\$13,558
OFRN CONSULTANTS					\$57,595	\$156,264		\$213,866	-\$213,866	\$0
WSARC UNALLOCATED					\$0	\$13,049		\$13,049	-\$13,049	\$0
OSU PROJECTS & ADMIN			\$2,002,000		\$359,072			\$2,361,072	-\$1,639,072	\$722,000
Subtotal	\$0	\$0	\$6,313,893	\$0	\$416,667	\$169,313	\$0	\$6,899,873	-\$6,164,442	\$735,431
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	Admin/Training	Commercialization	Legacy Workforce Development	Total Budget	Total Expensed	Balance
ASYMMETRIC TECHNOLOGIES				\$1,450,071				\$1,450,071	-\$1,177,509	\$272,562
CAL ANALYTICS				\$1,399,882				\$1,399,882	-\$1,271,440	\$128,442
GHOST WAVE				\$1,262,622				\$1,262,622	-\$1,129,590	\$133,032
KENT STATE UNIVERSITY				\$1,214,202				\$1,214,202	-\$763,329	\$450,873
RIVERSIDE RESEARCH				\$1,176,717				\$1,176,717	-\$840,341	\$336,376
YOUNGSTOWN BUSINESS INCUBATOR				\$972,877				\$972,877	-\$587,608	\$385,269
OFRN ADMINISTRATION*					\$1,137,815	\$964,315		\$2,102,129	-\$1,885,125	\$217,004
Subtotal	\$0	\$0	\$0	\$7,476,371	\$1,137,815	\$964,315	\$0	\$9,578,500	-\$7,654,943	\$1,923,557
Grand Total	\$7,140,642	\$8,136,485	\$6,313,893	\$7,476,371	\$4,971,982	\$3,883,911	\$3,555,088	\$41,478,373	-\$38,819,385	\$2,658,988

Figure 6 Funding Allocation and Expenses Breakdown

Next Steps

Today, OFRN is recognized by a growing list of supporters and participants as a statewide resource and builder of strategic partnerships that delivers economic impact and workforce development for the State of Ohio. The OFRN will continue to provide its services as well as increase its focus on:

- Securing additional funds to enable funding of all TRC recommended Round 5 proposals.
- Expanding Ohio technology commercialization opportunities through increased collaboration with the entrepreneurial service providers, InnovateOhio, and other state assets.
- Improving the program's documentation, transparency, and engagement.

In 2022, the OFRN program leadership and staff will continue to engage with industry, academia, and all levels of government throughout the state. The team will promote current and prior OFRN proposal teams and continue building multi-disciplined teams that further Ohio's national leadership in research, development, testing, and manufacturing. The OFRN also plans to continue student participation and engagement through active learning opportunities created by future projects.

Appendix 1 - The Network: Industry and Academic Partners

The great State of Ohio is nationally recognized for its institutions of higher education that provide state-of-the-art science, technology, engineering, and mathematics (STEM) programs to students from all over the globe. The OFRN understands the technical prowess of Ohio's universities and colleges and academic talent as the state's greatest assets for developing the next generation of science and technology for federal and state missions and for advancing innovation in Ohio. Therefore, OFRN has partnered with 21 Ohio universities and colleges and connected them with the OFRN's small business network to collaborate on research and development projects supporting the AFRL, NASA-GRC, NASIC, and the NAMRU-D.

The OFRN works with industry, such as Ohio businesses and entrepreneurs, to develop research that fulfills the areas of interests and/or mission critical needs of our government partners. Additionally, the OFRN helps its industry partners transition and commercialize their OFRN-funded research projects into viable technologies used in laboratories across the State of Ohio as well as by other government and industry consumers.

The OFRN program leadership has taken considerable measures to design the program into an easily accessible and valuable resource for industry partners who contribute to innovation and economic growth in Ohio.

The OFRN partners:

Government

- | | |
|---|----------------------------------|
| 1. Air Force Research Laboratory | 11. Ohio University |
| 2. NASA Glenn | 12. Sinclair Community College |
| 3. NASIC | 13. The Ohio State University |
| 4. Naval Medical Research Unit-Dayton | 14. The University of Akron |
| 5. Ohio Department of Transportation (ODOT) | 15. The University of Cincinnati |
| 6. Ohio National Guard | 16. The University of Dayton |

Academic

- | | |
|--------------------------------------|---------------------------------|
| 1. Air Force Institute of Technology | 17. The University of Findlay |
| 2. Bowling Green State University | 18. The University of Toledo |
| 3. Case Western Reserve University | 19. Wilberforce University |
| 4. Central State University | 20. Wright State University |
| 5. Clarke State Community College | 21. Youngstown State University |

Industry

- | | |
|------------------------------------|--------------------------|
| 6. Cleveland State University | 1. AAB |
| 7. Heidelberg University | 2. Advanced TeleSensors |
| 8. Kent State University | 3. AEP |
| 9. Lorain County Community College | 4. Akron Polymer Systems |
| 10. North Central State College | 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. MacNaughtan 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 2 – OFRN History



Joint WPAFB/NASA Glenn Priorities

Reviewed and Refined OFMJC Research Priorities

<p>AFRL Priorities</p> <ul style="list-style-type: none"> ▪ Human Performance/Health Sciences ▪ Hypersonics ▪ Directed Energy Weapons (Lasers) ▪ Autonomy ▪ C4ISR ▪ LVC ▪ Materials/ Manufacturing ▪ Propulsion <p>NASIC Priorities</p> <ul style="list-style-type: none"> ▪ Cyber ▪ Data analytics ▪ C4ISR ▪ Modeling/Simulation/Analysis ▪ Hypersonics ▪ Directed Energy ▪ Space Systems 	<p>NASA Glenn Priorities</p> <ul style="list-style-type: none"> ▪ Hybrid Electric Propulsion ▪ Air-breathing Propulsion ▪ Advanced Communications ▪ Solar Electric Propulsion ▪ Power and Energy Storage ▪ Materials and Manufacturing <p>Naval Medical Research Unit (NAMRU) Priorities</p> <ul style="list-style-type: none"> ▪ Human performance ▪ Human physiology ▪ Manned / unmanned aeromedical ops ▪ Toxicology ▪ Risk assessment
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The OFMJC tasked Wright State University and Ohio State in November 2014 to frame a requirements-driven research and development initiative that would address emerging mission requirements for the U.S. Air Force and NASA in which Wright-Patterson Air Force Base and NASA-GRC play significant roles. The key goals were to:

- Leverage the State of Ohio's R&D investment.
- Capitalize on federal and university research assets.
- Integrate Ohio firms and industrial partners into the proposed projects aligned with operational user needs.
- Better prepare and train universities and firms in Ohio to compete for federal funding.
- Facilitate the transition of government funded technology to commercial markets.
- Create the jobs, processes, and firms of tomorrow in Ohio.
- Differentiate Ohio from other states relative to its commitment and support of our national defense and civil space missions.

The 2015 strategic planning effort resulted in the organization of Ohio's universities and community colleges around the future research priorities of Wright-Patterson Air Force Base and NASA-GRC through the creation of the OFRN. OFRN projects and activities were directly aligned with our federal partner's strategic priorities. Our federal partners also provided university researchers with insights into the requirements for each of the priority research areas.

As a result of the above referenced strategic planning process in collaboration with the members of the OFMJC, the state supported the establishment of the OFRN program to leverage federal, university, and commercial capabilities to support the future of federal installations in Ohio, while retaining and creating new jobs within Ohio.

On December 10, 2015, the ODHE contracted out the management of the OFRN to the Wright State Applied Research Corporation, now Parallax Advanced Research.

For in-depth background on the original strategic planning of the OFRN, see the OFMJC Report to Governor John Kasich, dated December 13, 2015, at https://ohiofrn.org/sites/ofrn/files/2021-03/OFMJC_Final_Report.pdf

Appendix 3 – OFRN Funds Expenditure and Cost Share Reports

Funds Expended Report – As of 30 June 2021

OHIO DEPARTMENT OF HIGHER EDUCATION WORKFORCE DEVELOPMENT AND EMERGING MISSIONS MOU's OFRN FUNDS EXPENDED REPORT					
Please Type all Information			Subaward No.: PO BOR01-00000004706/MOU DATED 12/1/15		
Recipient:	Parallax Advanced Research				
Project:	Ohio Federal Research Network - Centers of Excellence				
Reporting Period:	July 1, 2020 - June 30, 2021				
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
OCPD 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	\$3,238,559	\$6,040	\$0	\$3,244,599
TOTAL	\$20,000,000	\$19,993,960	\$6,040	\$0	\$20,000,000
<p>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 limited to, receipts or other evidence of payment, is on file and available as provided for in the Award Agreement.</p> <p>Authorized Signature: _____ Date: _____</p> <p>Typed Name: Dennis Andersh _____</p> <p style="text-align: center;">STATE USE ONLY BELOW THIS LINE</p> <p>CAP: _____</p> <p>Project Administrator: _____ Date: _____</p>					

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 G.A.					
Recipient:	Parallax Advanced Research				
Project:	Ohio Federal Research Network - Centers of Excellence				
Reporting Period:	July 1, 2020 - June 30, 2021				
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
<p>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 limited to, receipts or other evidence of payment, is on file and available as provided for in the Award Agreement.</p> <p>Authorized Signature: _____ Date: _____</p> <p>Typed Name <u>Dennis Andersh</u></p> <p style="text-align: center;">STATE USE ONLY BELOW THIS LINE</p> <hr/> <p>CAP: _____</p> <p>Project Administrator: _____ Date: _____</p>					

Form B2

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:	<u>Parallax Advanced Research</u>				
Project:	<u>Ohio Federal Research Network - Centers of Excellence</u>				
Reporting Period:	<u>July 1, 2020 - June 30, 2021</u>				
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 SURVEILLANCE SYSTEMS	\$1,998,349	\$1,946,454	\$51,894	\$0	\$1,998,349
GHOST WAVE	\$1,344,597	\$1,314,368	\$30,230	\$0	\$1,344,597
UNIVERSITY OF CINCINNATI	\$968,947	\$799,620	\$155,770	\$13,558	\$955,389
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	\$1,050,000	\$589,072	\$722,000	\$1,639,072
TOTAL	\$6,900,000.00	\$5,337,477	\$826,965	\$735,558	\$6,164,442
<p>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 limited to, receipts or other evidence of payment, is on file and available as provided for in the Award Agreement.</p> <p>Authorized Signature: _____ Date: _____</p> <p>Typed Name <u>Dennis Andersh</u></p> <p style="text-align: center;">STATE USE ONLY BELOW THIS LINE</p> <p>CAP: _____</p> <p>Project Administrator: _____ Date: _____</p>					

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, 2020 - June 30, 2021				
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	\$272,841	\$904,667	\$272,562	\$1,177,509
CAL ANALYTICS	\$1,399,882	\$307,756	\$963,684	\$128,442	\$1,271,440
GHOST WAVE	\$1,262,622	\$212,358	\$917,232	\$133,032	\$1,129,590
KENT STATE UNIVERSITY	\$1,214,202	\$14,445	\$748,884	\$450,873	\$763,329
RIVERSIDE RESEARCH	\$1,176,717	\$146,742	\$693,599	\$336,376	\$840,341
YOUNGSTOWN BUSINESS INCUBATOR	\$972,877	\$117,880	\$469,728	\$385,269	\$587,608
OFRN ADMINISTRATION	\$2,102,129	\$699,485	\$1,185,640	\$217,004	\$1,885,125
TOTAL	\$9,578,500	\$1,771,508	\$5,883,435	\$1,923,557	\$7,654,943
<p>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 limited to, receipts or other evidence of payment, is on file and available as provided for in the Award Agreement.</p> <p>Authorized Signature: _____ Date: _____</p> <p>Typed Name <u>Dennis Andersh</u></p> <p style="text-align: center;">STATE USE ONLY BELOW THIS LINE</p> <p>CAP: _____</p> <p>Project Administrator: _____ Date: _____</p>					

Form B2

Cost Share Contribution Report – As of 30 June 2021

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, 2020 - June 30, 2021				
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
OCPD 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
<p>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 limited to, receipts or other evidence of payment, is on file and available as provided for in the Award Agreement.</p> <p>Authorized Signature: _____ Date: _____</p> <p>Typed Name: <u>Dennis Andersh</u></p> <p style="text-align: center;">STATE USE ONLY BELOW THIS LINE</p> <hr/> <p>CAP: _____</p> <p>Project Administrator: _____ Date: _____</p>					

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.: 60065626/Sec.369.473, Ohio H.B. 64 of 131st G.A.			
Recipient:	Parallax Advanced Research				
Project:	Ohio Federal Research Network - Cost Share Contribution				
Reporting Period:	July 1, 2020 - June 30, 2021				
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
C2PNT COE - Ohio University	\$0	\$0	\$0	\$0	\$0
HPHS COE - Wright State University	\$0	\$0	\$0	\$0	\$0
TOTAL	\$0	\$0	\$0	\$0	\$0
<small>* Duplicate of \$20M report.</small> 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 limited 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

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

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:	<u>Parallax Advanced Research</u>				
Project:	<u>Ohio Federal Research Network - Cost Share Contribution</u>				
Reporting Period:	July 1, 2020 - June 30, 2021				
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 SURVVEILLANCE	\$5,482,826	\$4,150,065	\$839,214	\$493,547	\$4,989,279
GHOST WAVE	\$1,247,722	\$1,263,873	\$13,983	-\$30,134	\$1,277,856
UNIVERSITY OF CINCINNATI	\$1,009,024	\$867,157	\$180,881	-\$39,014	\$1,048,038
OSU	\$2,230,000	\$986,000	\$402,000	\$842,000	\$1,388,000
TOTAL	\$9,969,572	\$7,267,095	\$1,436,078	\$1,266,398	\$8,703,173
<p>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 limited to, receipts or other evidence of payment, is on file and available as provided for in the Award Agreement.</p> <p>Authorized Signature: _____ Date: _____</p> <p>Typed Name <u>Dennis Andersh</u></p> <p style="text-align: center;">STATE USE ONLY BELOW THIS LINE</p> <hr/> <p>CAP: _____</p> <p>Project Administrator: _____ Date: _____</p>					

Form B2

OHIO DEPARTMENT OF HIGHER EDUCATION WORKFORCE DEVELOPMENT AND EMERGING MISSIONS MOU's OFRN COST SHARE CONTRIBUTION REPORT					
Please Type all Information			Subaward No.: 60073805/Sec.381.440, Ohio H.B. 166 of 136th G.A.		
Recipient:	<u>Parallax Advanced Research</u>				
Project:	<u>Ohio Federal Research Network - Cost Share Contribution</u>				
Reporting Period:	<u>July 1, 2020 - June 30, 2021</u>				
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	\$839,283	\$816,500	-\$303,505	\$1,655,783
CAL ANALYTICS	\$1,177,798	\$314,252	\$881,729	-\$18,183	\$1,195,981
GHOST WAVE	\$1,396,614	\$21,506	\$104,691	\$1,270,418	\$126,197
KENT STATE UNIVERSITY	\$1,011,776	\$0	\$328,855	\$682,921	\$328,855
RIVERSIDE RESEARCH	\$748,260	\$119,439	\$693,944	-\$65,123	\$813,383
YOUNGSTOWN BUSINESS INCUBATOR	\$434,229	\$25,234	\$209,311	\$199,684	\$234,545
TOTAL	\$6,120,955	\$1,319,714	\$3,035,030	\$1,766,211	\$4,354,744
<p>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 limited to, receipts or other evidence of payment, is on file and available as provided for in the Award Agreement.</p> <p>Authorized Signature: _____ Date: _____</p> <p>Typed Name <u>Dennis Andersh</u></p> <p style="text-align: center;">STATE USE ONLY BELOW THIS LINE</p> <p>CAP: _____</p> <p>Project Administrator: _____ Date: _____</p>					

Form B2

Appendix 4 – Round 1, Round 2, Round 3, and Round 4 Follow on Funding

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
1	HPHS	WSARC / Reiter / RLVC		SBIR PH I PMAA Aptima	20,000
1	HPHS	WSARC / Reiter / RLVC	AFSOC	AFSOC ACTOR	1,800,000
1	HPHS	WSARC / Reiter / RLVC		Norell/WSARC - CRAMMIT	110,000
1	HPHS	WSARC / Reiter / RLVC	AFRL/RV	Norell/WSARC - TENET 3 Phase II	220,000
1	HPHS	WSARC / Reiter / RLVC	N/A	SBIR-TCCC	10,000
1	HPHS	WSARC / Reiter / RLVC	N/A	SBIR-CLEAR	60,000
1	HPHS	WSARC / Reiter / RLVC	AFRL	Tech Warrior	2,600,000
1	HPHS	WSARC / Reiter / RLVC	N/A	SBIR-ECCCHO	225,000
1	HPHS	WSARC / Reiter / SAPHYRE	AFRL	Recently awarded SAVANT	75,000
1	HPHS	WSARC / Reiter / SAPHYRE	AFRL	Deployable Technologies	350,000
1	HPHS	WSARC / Reiter / SAPHYRE	AFRL	Mission-Directed Learning Environment	3,500,000
1	HPHS	WSARC / Reiter / SAPHYRE	AFRL/RH	Norell/WSARC - HMT TO4	6,700,000
1	HPHS	WSARC / Reiter / SAPHYRE	DARPA	Goal-driven Agile Teams and Environments (GATE)	1,000,000
1	HPHS	WSARC / Reiter / SAPHYRE	SOCOM	Teamwork analysis in Diads of Analyst-Machine	45,000
1	HPHS	WSARC / Reiter / SAPHYRE	DARPA	Norell/WSARC - LEAP	8,600,000
1	OCPD	OSU / Zhang / Hybrid/Turboelectric Propulsion	DoE	STTR	80,000
1	OCPD	OSU / Zhang / Hybrid/Turboelectric Propulsion	NASA	ULI	10,000,000
1	OCPD	OSU / Zhang / Hybrid/Turboelectric Propulsion	SAFRAN	contract	105,000
1	OCPD	OSU / Zhang / Hybrid/Turboelectric Propulsion	GE/State of Ohio	Education of Engineers and Students	2,500,000

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
1	OCP	OSU / Zhang / Hybrid/Turboelectric Propulsion	DOE/Power America	Develop SiC Inverter Driver for Switched Reluctance Motor	240,000
1	OCP	OSU / Zhang / Hybrid/Turboelectric Propulsion	DOE	STTR Phase I Variable flux machine and drive for hybrid electric vehicles	150,000
1	OCP	OSU / Zhang / Hybrid/Turboelectric Propulsion	Navy	n/a	2,300,000
1	OCP	OSU / Wang / Control Architecture	NSF	Cybersecurity proposal related to control of power systems	500,000
1	OCP	OSU / Wang / Control Architecture	AFRL	Power, Thermal and Control Technologies and Experimental Research	7,300,000
1	OCP	OSU / Wang / Control Architecture	Future Motors	Inverter Drive and Power Architecture system for Electric Bike	69,000
1	OCP	OSU / Wang / Control Architecture	GE EPIScenter	Real-time modeling and simulation for commercial aircraft	175,000
1	OCP	OSU / Wang / Control Architecture	AEP	Cybersecurity testbed of power systems	250,000
1	OCP	OSU / Wang / Control Architecture	Exacter Inc	Advanced Grid Infrastructure	120,000
1	OCP		DOE	STTR	150,000
1	MM	UA / Vogt / Flex Electronics	DOE/Sandia	DuraMAT / Composite adhesives for PV- Prime - UA	180,000
1	MM	UA / Vogt / Flex Electronics	FlexTech Alliance	FlexTech Alliance / Power pack for electronic print devices- Prime – ITN Energy Systems (\$170K to Lucintech)	500,000
1	MM	UA / Vogt / Flex Electronics	AFRL	AFRL funding on PV development (UT lead)	1,870,000
1	MM	UA / Vogt / Flex Electronics	AFRL	University Cooperative Agreement - UT lead	2,600,000
1	MM	UA / Vogt / Flex Electronics	ODOT	Energy Harvesting Flexible Piezoelectric Elements	40,000
1	MM	UA / Vogt / Flex Electronics	UTC, Dayton	Flexible Hybrid electronics Technology Review	40,000
1	MM	UA / Vogt / Flex Electronics	Ohio U	Innovative flexible electronics for intelligent monitoring	50,000
1	MM	UA / Vogt / Flex Electronics	AFRL	TRUST in Flexible Electronics	4,000,000

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
1	MM	UA / Vogt / Flex Electronics	Air Force Research Laboratory	Lightweight Flexible Solar Cells	4,669,907
1	MM	UA / Vogt / Flex Electronics	Ohio University, Innovation Strategy Planning Grant	Non-invasive Continuous Wearable Glucose Sensor	20,000
1	MM	UA / Vogt / Flex Electronics	NSF	NSF / low cost manufacture of tandem PV- Prime - UT	300,000
1	MM	UA / Vogt / Flex Electronics	ONR	solar cell degradation	450,000
1	MM	UT / Elahinia / Shape Memory Alloys	UT Rocket Fuel	Organ repositioner: Enhancing the Safety of Radiation Therapy in Treating Pelvic Tumors	50,000
1	MM	UT / Elahinia / Shape Memory Alloys	UT Rocket Fuel	Aerospace additive manufactured actuators	50,000
1	MM	UT / Elahinia / Shape Memory Alloys	NSF	SBIR Phase I Quick Flow Blood Clot Removal Device	225,000
1	MM	UT / Elahinia / Shape Memory Alloys	NSF	SBIR Phase II Quick Flow Blood Clot Removal Device	750,000
1	MM	UT / Elahinia / Shape Memory Alloys	NASA	Pilot study in preparation for a large grant submission to NASA	35,000
1	MM	UT / Elahinia / Shape Memory Alloys	TVSF	TVSF	150,000
1	MM	UT / Elahinia / Shape Memory Alloys	Oak Ridge National Laboratory	study additive manufacturing of shape memory alloys	2,500,000
1	MM	CWRU / Willard / Hi Temp Mag Mat	NSF	DMREF	1,600,000
1	MM	CWRU / Willard / Hi Temp Mag Mat	DARPA	Ultra High Performance Fe16N2	300,000
1	MM	CWRU / Willard / Hi Temp Mag Mat	OH/DAGSI	AFRL (Spintronics work)	155,000
1	MM	CWRU / Willard / Hi Temp Mag Mat	DOE SBIR/STTR	Nano-Laminate Soft Magnetics for Powder Conversion	50,000
1	MM	CWRU / Willard / Hi Temp Mag Mat	EERE	Advanced Manufacturing	800,000
1	MM	CWRU / Willard / Hi Temp Mag Mat	NSF	CMMI	350,000
1	PRESIDES	UA / Zhu / Li-ion Battery	PNNL/DOE		420,000
1	PRESIDES	UA / Zhu / Li-ion Battery	DOD - NAVY	SBIR Phase I	150,000

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
1	PRESIDES	UA / Zhu / Li-ion Battery	Rev	Funding for pouch cell fabrication equipment	100,000
1	PRESIDES	UA / Zhu / Li-ion Battery	DOE	SBIR	480,000
1	PRESIDES	UA / Zhu / Li-ion Battery	NSF	CBET	300,000
1	PRESIDES	UA / Zhu / Li-ion Battery	NASA	HOT Program	75,000
1	PRESIDES	UA / Zhu / Li-ion Battery	Spark	Spark	100,000
1	PRESIDES	UA / Zhu / Li-ion Battery	DOE	DOE EERE SBIR Phase II High Energy Density Lithium	1,000,000
1	PRESIDES	UA / Zhu / Li-ion Battery	NASA	“High Energy, Long Cycle Life, and Extreme Temperature Lithium-Sulfur Battery for Venus mission” (UDRI and UA team)	600,000
1	PRESIDES	UD / Kumar / Li-S Battery	NASA	Integrated high temperature battery and micro-controller with active cooling for Venus and Mars applications	600,000
1	PRESIDES	UD / Kumar / Li-S Battery	US Army	SBIR Ph 1 & II 2018-0124	1,150,000
1	PRESIDES	UD / Kumar / Li-S Battery	NASA	HOTTech 80NSSC17K0762	633,363
1	PRESIDES	UD / Kumar / Li-S Battery	FAA	DTFAC-16-C-00045	600,000
1	PRESIDES	UD / Kumar / Li-S Battery	Army	Developing Li-S battery, including new carbon materials for S-cathode	1,000,000
1	PRESIDES	UD / Kumar / Li-S Battery	NSF	SBIR Ph I NSF17-545	250,000
1	PRESIDES	UD / Kumar / Li-S Battery	NASA	SBIR Ph I & II NNX17CC08C	900,000
1	PRESIDES	CWRU / Prakash / Multifunction Structural energy Storage	DAGSI	DAGSI Fellowship	65,000
1	PRESIDES	CWRU / Prakash / Multifunction Structural energy Storage	AFRL	AFRL–RQ -- CWRU Educational Partnership Agreement (EPA) on Structural Batteries (2017-2021) -Facilitate educational and research collaboration in structural batteries between AFRL & CWRU	600,000

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
1	PRESIDES	CWRU / Prakash / Multifunction Structural energy Storage	NASA	OSGC VTOL aircraft (student competition)	3,000
1	PRESIDES	CWRU / Prakash / Multifunction Structural energy Storage	AFRL	AFRL 2017 SFFP (Summer faculty fellowship) Led to new collaborations (co-advising graduate students) on the development of structural battery (CWRU+AFRL-RQ)	35,000
1	PRESIDES	CWRU / Prakash / Multifunction Structural energy Storage	AFRL	AFRL 2018 SFFP (Summer faculty fellowship) Led to new collaborations (co-advising graduate students) on the development of structural battery (CWRU+AFRL-RQ)	33,000
1	PRESIDES	CWRU / Prakash / Multifunction Structural energy Storage	AFRL	AFRL 2019 SFFP	32,000
1	PRESIDES	CWRU / Prakash / Multifunction Structural energy Storage	DAGSI	DAGSI Fellowship	65,000
1	PRESIDES	CWRU / Prakash / Multifunction Structural energy Storage	NASA	NASA ULI	530,000
2	HPHS	UC / Heikenfeld	DOD	SBIR	150,000
2	HPHS	UC / Heikenfeld	AFRL (DOD - USAF - AFMC)	Physiological Marker Sensing Materials and Devices	38,000
2	HPHS	UC / Heikenfeld	AFRL (DOD - USAF - AFMC)	Objective Pilot State Assessment through Sweat Biomarkers	423,000
2	HPHS	UC / Heikenfeld / ACSB	CincyTEch/ODS A and UC 2019 Funds	LFA Concentrator Phase 2	175,000
2	HPHS	UC / Heikenfeld / ACSB	Eccrine Systems	ISF Sensing Discover Project	39,000
2	HPHS	UC / Heikenfeld / ACSB	CincyTEch/ODS A and UC 2019 Funds	LFA Concentrator Phase (UC Accelerator Phase I)	40,000
2	HPHS	UC / Heikenfeld / ACSB	Y Combinator	Amplify Investment	150,000
2	HPHS	UC / Heikenfeld /	DOD	SBIR Phase II - Eccrine	150,000

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
		ACSB			
2	HPHS	OSU / Marras / MOSSD	DoD	NAMRU-D	240,000
2	HPHS	OSU / Marras / MOSSD	NIH	NIAMS/UH2	902,000
2	HPHS	OSU / Marras / MOSSD	NIH	NIAMS	552,000
2	HPHS	OSU / Marras / MOSSD	DoD	AFRL	243,000
2	HPHS	OSU / Marras / MOSSD	OH	BWC	250,000
2	HPHS	OSU / Marras / MOSSD	DoD	JPC-5	327,000
2	HPHS	OSU / Marras / MOSSD	DoD/DHA	STTR/Phase II	1,100,000
2	HPHS	OSU / Marras / MOSSD	DoD/DHA	SBIR/Phase II	1,100,000
2	HPHS	OSU / Marras / MOSSD	DoD	AIMM	350,000
2	HPHS	OSU / Marras / MOSSD	DoD	JWMRP	3,380,000
2	HPHS	OSU / Marras / MOSSD	DoD/DHA	SBIR/Phase II	550,000
2	HPHS	OSU / Marras / MOSSD	DHA	STTR, Phase 1	150,000
2	HPHS	OSU / Marras / MOSSD	Ohio Occupational Safety and Health Research Program		250,000
2	HPHS	OSU / Marras / MOSSD	NSF	NSF 17-516	310,000
2	HPHS	OSU / Marras / MOSSD	Misc	STTR, SBIR, and 2 NIH awards	4,000,000
2	OCP	OSU / Mathison / ATC	Honeywell	HPTIC-II	261,000
2	OCP	OSU / Mathison / ATC	Pratt and Whitney	Blade Tip Rub Center of Excellence	8,581,000
2	OCP	OSU / Mathison / ATC	Honeywell	Continuation of experiment	110,000
2	OCP	OSU / Mathison / ATC	Honeywell	support ongoing research related to OFRN experiment (post project end)	250,000
2	OCP	OSU / Mathison /	Pratt and	Blade Tip Rub Center of	1,000,000

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
		ATC	Whitney	Excellence	
2	OCPP	OSU / Mathison / ATC	Pratt and Whitney	additional contracts	190,000
2	MM	UDRI / Szaruga / LCM	DoE - IACMI	Injection Overmolding of Continuous Carbon Fiber Preforms	500,000
2	MM	UDRI / Szaruga / LCM	DoE	Hybrid Additively Manufactured Tooling for Large Composite Aero Structures	520,000
2	MM	UDRI / Szaruga / LCM	AFRL	Air Force SBIR - NextGen (AM tooling)	40,000
2	MM	UDRI / Szaruga / LCM	AFRL	Reusable Hypersonic Vehicle Study	35,000
2	MM	UDRI / Szaruga / LCM	AFRL	LCAAT WiSDM (TFP and AM tooling)	1,150,000
2	MM	UDRI / Szaruga / LCM		Automotive Sub-tier (TFP)	49,941
2	MM	UDRI / Szaruga / LCM	Automotive OEM	Automotive OEM (TFP)	125,000
2	MM	UDRI / Szaruga / LCM	AFRL		300,000
2	MM	UDRI / Szaruga / LCM	DoE - IACMI	Scale-Up of Next Gen Nano-Enhanced Composite Materials	620,000
2	MM	UDRI / Szaruga / LCM	IACMI/Lockheed	Aligned Fiber for High Performance, Rapid Cycle Time Processing (Part of larger IACMI program w/Lockheed. Objective: Low cost fiber preforms for military aircraft components)	710,000
2	MM	UDRI / Szaruga / LCM	IACMI	developing Laystitch Tailored Fiber Placement (TFP) technology for reinforcing advanced composites.	
2	MM	UDRI / Szaruga / LCM	AFRL	LCAAT WiSDM (TFP and AM tooling)	440,000
2	MM	UDRI / Szaruga / LCM	AFRL	LCAAT Design/Mfg Composite Structures)	1,260,000
2	MM	UDRI / Szaruga / LCM	AFRL	Tailored Fiber Placement of Ceramic Composites	500,000
2	MM	UDRI / Szaruga / LCM	AFRL	Materials Maturation for Hypersonics	1,125,000

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
2	MM	UDRI / Szaruga / LCM	NASA	Internal Investigation (TFP Isogrid with CNT yarn)	50,000
2	MM	UDRI / Szaruga / LCM	AFRL	SBIR w/Spintech (TFP Optimization)	\$70,000
2	C4ISR	WSU / Raymer / HCBD	IARPA	Hybrid Forecasting Competition Program	2,100,000
2	C4ISR	WSU / Raymer / HCBD	DARPA	Ground Truth Program	3,700,000
2	C4ISR	WSU / Raymer / HCBD	DoD	Enginility - Reactionary Assistance Support for Container	30,000
2	C4ISR	WSU / Raymer / HCBD	DARPA	Agile Teams Program	950,000
2	C4ISR	WSU / Raymer / HCBD	AFOSR	Towards Undifferentiated Cognitive Agents	450,000
2	C4ISR	WSU / Raymer / HCBD	Raytheon-BBN/IARPA	Forecasting Counterfactuals in Uncontrolled Settings	1,920,000
2	C4ISR	WSU / Raymer / HCBD	Army	SBIR Phase I	40,000
2	C4ISR	WSU / Raymer / HCBD	Air Force	AF19B-T001 EMERALD Phase 1&2 STTR	399,906
2	C4ISR	WSU / Raymer / HCBD	DARPA	TAILOR (Teaching AI to Leverage Overlooked Residuals)	453,278
2	C2PNT	WSU / Wu / ICS	NSF	CRII	175,000
2	C2PNT	WSU / Wu / ICS	NSF	CRII	175,000
2	C2PNT	WSU / Wu / ICS	NIST	FirstNet	1,800,000
2	C2PNT	WSU / Wu / ICS	AFRL	IDATE	25,000
2	C2PNT	WSU / Wu / ICS	NSF	EAGER	125,000
2	C2PNT	WSU / Wu / ICS	USAF	SBIR	150,000
2	C2PNT	WSU / Wu / ICS	NSF	DRL	1,955,190
2	C2PNT	WSU / Wu / ICS	AFRL		33,000
2	C2PNT	WSU / Wu / ICS	AFRL		62,500
2	C2PNT	WSU / Gross / TEAS	DARPA	Case TA4	2,400,000
2	C2PNT	WSU / Gross / TEAS	DARPA	Case TA3	4,700,000
2	C2PNT	WSU / Gross / TEAS	DARPA	CASE TA5	4,900,000
2	C2PNT	WSU / Gross / TEAS	AFRL	RQQA V&V	148,000
2	C2PNT	WSU / Gross / TEAS	AFRL	RQQA V&V	230,000
2	C2PNT	WSU / Gross / TEAS	AFRL/RHCI	HIVE	3,000,000
2	C2PNT	WSU / Gross / TEAS	Air Force	SBIR	750,000
2	C2PNT	WSU / Gross / TEAS	DARPA	(Galois)	2,700,000
2	C2PNT	WSU / Gross / TEAS	AFRL	RQQA V&V	420,000
2	C2PNT	WSU / Gross / TEAS		Tangram Flex	

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
3		OSU / Zhang / Brushless Doubly-fed Machine	Boeing	Independent speed variable frequency generator for 787	240,000
3		OSU / Zhang / Brushless Doubly-fed Machine	Boeing	Independent speed variable frequency generator for 787 phase II	300,000
3		GhostWave / Zody / UAS Detect Avoid	Army xTech Search	SBIR Competition	130,000
3		GhostWave / Zody / UAS Detect Avoid	AFWERX	SBIR Competition - 1st round	50,000
3		GhostWave / Zody / UAS Detect Avoid	AFWERX	STTR Competition - 2nd round	25,000
3		GhostWave / Zody / UAS Detect Avoid	AFWERX	STTR	150,000
3		GhostWave / Zody / UAS Detect Avoid	Army xTech Search	SBIR Competition	10,000
3		UC / Cohen / RUTMS	Sinclair LVC exercises		10,000
3		UC / Cohen / RUTMS	NIST/NSF	CDR finalist for the NIST/NSF First Responder Challenge	15,000
3		UC / Cohen / RUTMS	AFRL	STTR Phase 1	100,000
3		UC / Cohen / RUTMS	AFRL	STTR Phase 1	100,000
3		UC / Cohen / RUTMS	ODOT	Economic Impact for AAM	500,000
3		UC / Cohen / RUTMS	USAF	STTR Phase 1 for AAM	50,000
3		UC / Cohen / RUTMS	USAF	STTR Phase 1 for AAM	75,000
3		UC / Cohen / RUTMS	USAF	STTR Phase 2 for AAM Assured Autonomy	700,000
3		PSS / McNutt / Autonomous Cirrus SR22	AFRL / Leidos	Flight Test Support	45,000
3		PSS / McNutt / Autonomous Cirrus SR22	THEIA Group	Aircraft Integration Services	200,000
3		PSS / McNutt / Autonomous Cirrus SR22	AFRL Leidos	RTD2 contract Team Member	25,000,000
3		PSS / McNutt / Autonomous Cirrus SR22	Baltimore Police Department Law Enforcement Support	Community Support Program support of People of Baltimore	4,000,000
3		PSS / McNutt / Autonomous Cirrus	MSTI	Extended Tether Operations Demonstration	100,000

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
		SR22			
3		PSS / McNutt / Autonomous Cirrus SR22	AFRL Leidos	Air Force Marathon Support	125,000
3		PSS / McNutt / Autonomous Cirrus SR22	MTSI REAS	Flight Dev and Test	19,000
3		PSS / McNutt / Autonomous Cirrus SR22	US SOUTHCOM	WAAS Demo Successfully demonstrated System	43,000
3		PSS / McNutt / Autonomous Cirrus SR22	Ball MOSIAC	Flight Test Support	279,000
4		GhostWave / Zody / Perimeter Monitoring and Aerial Detect and Avoid	Army	xTech Search	130,000
4		GhostWave / Zody / Perimeter Monitoring and Aerial Detect and Avoid	Air Force	AFWERX	150,000
4		GhostWave / Zody / Perimeter Monitoring and Aerial Detect and Avoid	Air Force	Swarm Detection	50,000
4		YBI / Gaffney / Geometrically-Complex 3D Printed Antennas for UAVs	AFWERX	STTR-Plasecki and UTEP / PCG	150,000
4		Asymmetric / McCandlish / UAS Flight Control	USAF/USSOCOM	SBIR phase 2	2,250,000
4		Asymmetric / McCandlish / UAS Flight Control	USAF/USSOCOM	Payload Integration Work	200,000
4		Asymmetric / McCandlish / UAS Flight Control	DARPA	IronClad integration on future platform	30,000
4		Asymmetric / McCandlish / UAS Flight Control	USAF/AFWERX	Agility Prime IronClad	150,000

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
4		Asymmetric / McCandlish / UAS Flight Control	MILTECH (University of Montana DoD UARC)	IronClad Integration, GCS, consulting	
4		Asymmetric / McCandlish / UAS Flight Control	USAF/AFWERX	Agility Prime IronClad Phase II STTR, AFRL/RQ sponsored	750,000
4		CAL Analytics / Calhoun / Interoperability, Resiliency, and Contingency Management for Ohio UAS Operations	FAA	FAA BAA contract related to the CMP	1,162,000
4		CAL Analytics / Calhoun / Interoperability, Resiliency, and Contingency Management for Ohio UAS Operations	NASA	SBIR Phase II	750,000
4		CAL Analytics / Calhoun / Interoperability, Resiliency, and Contingency Management for Ohio UAS Operations	Agility Prime	CMP	150,000
4		Kent State Univ / Du / Hybrid Fuel Cell Battery	AFRL Leidos	Jet-fuel desulfurization	25,000
4		Kent State Univ / Du / Hybrid Fuel Cell Battery	AFRL	Jet-fuel desulfurization	250,000
4		Kent State Univ / Du / Hybrid Fuel Cell Battery	DOE	additive Manufacturing fuel cell	82,500
4		Kent State Univ / Du / Hybrid Fuel Cell Battery	AF	AI-Powered Autonomous Multi-UAV dispatch System	100,000
4		Kent State Univ / Du / Hybrid Fuel Cell Battery	AF	STTR UAM Electric Motor Drive System with Predictive Maintenance	69,891

Round	COE	Lead Organization / PI / Project	Funding Agency	BAA/Program	Value
4		Kent State Univ / Du / Hybrid Fuel Cell Battery	AF	STTR Intelligent Air Laser system for Mission Support w/Multi-UAVs Equipped with Laser Beams	50,000
4		Kent State Univ / Du / Hybrid Fuel Cell Battery	Navy	Ground Fault Detection	60,000
4		Kent State Univ / Du / Hybrid Fuel Cell Battery	NSF	Supplemental Funding	55,000
4		Kent State Univ / Du / Hybrid Fuel Cell Battery	AF	SBIR Onboard Hydrogen Generation for Long Range UAV Fuel Cell Power	67,500
		Event38		Phase II	867,926
		KEYW		ACT3 Autonomy Research Center	3,000,000
		Mile2		ACT3 Autonomy Research Center	3,500,000
		STR		ACT3 Autonomy Research Center	2,500,000
		UDRI		ACT3 Autonomy Research Center	3,500,000
		WSRI		ACT3 Autonomy Research Center	500,000
		WSRI		ACT3 Autonomy Research Center	4,000,000