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OFRN Round 6 Info Session

7 March 2023

Administered by:

Parallax ADVANCED RESEARCH

The Ohio State University

Funded by:

Ohio Department of Higher Education

Agenda

- Welcome – Introductions
- OFRN Briefing
- Teaming Connections and Upcoming Proposal Training
- Federal Partner AOI Overview
- Q&A
- Next Steps

OFRN Partners

Ohio Federal Research Network
Driving Innovation Through Strategic Partnerships

- **Federal Partners**
  - AFRL
  - NASIC
  - Naval Medical Research Unit-Dayton (NAMRU-D)
  - NASA Glenn
  - Ohio National Guard
- 21 universities and community colleges
- 97 businesses

OFRN: Mission and Core Services

Ohio Federal Research Network
Driving Innovation Through Strategic Partnerships

Mission

To stimulate Ohio's innovation economy by building vibrant, statewide university / industry research collaborations that meet the requirements of Ohio's federal partners, resulting in the creation of leading-edge technologies that drive job growth in Ohio.

Services:

- **Commercialization & Workforce Development**
- **Federal Funding**
- **Networking & Collaboration**
- **Education & Training**

Goal: Move Ohio into the top 10 in federal research and development funding.

OFRN Program Impact

Ohio Federal Research Network
Driving Innovation Through Strategic Partnerships

21
Universities & colleges engaged

4+1
Government Partners

97
Business partners engaged

1,167
Indirect jobs created

349
Direct jobs created

13
Spin out companies created

$51.4M
State of Ohio Investment - ODHE

$355+M
Follow-on Funding Awarded

$36M
Cost Share

Round 6 Process Overview

Project Teams Must Include at least:

- **1 industry** member
  - Role can be as lead applicant or collaborator
- **2 Ohio colleges/universities**
  - Role can be as lead applicant or collaborator
  - AFIT is eligible
- **1 federal partner/sponsor**
  - AFRL, NASA-GRC, NAMRU-D, and/or NASIC
  - Financial commitment from federal partner is NOT necessary

Round 6 Process Overview

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Projects MUST meet the following Critera:

- **Projects Must be Applied Research:**
  - S&T Activities 6.2/6.3 as outlined by Government-Wide and DoD Definitions.
  - Technical Review Level (TRL) 3 or higher.
  - No Basic/Foundational Research will be accepted.

Round 6 Process Overview

Projects MUST meet the following Criteria:

- **Technology Control Plan (TCP)** – University/college-based Primary Applicants must develop a TCP within forty-five (45) days of notice of award.

- **Export Control** - Primary Applicants are responsible for export control compliance, including identifying the export control classification(s) of any projects and only utilizing employees that are U.S. persons or eligible to obtain the necessary export license to participate in the project.

Round 6 Process Overview

Proposals are due April 28, 2023, and consist of:

- Technical Proposal - 8 pages
- Technical Proposal Supplement – 2 pages
- Cost proposal (including budget worksheet)
- Student Experiential Engagement (SEE) attachment – 2 pages maximum
- Vendor Profile
- Quad Chart
- Technical Review Level (TRL) assessment results

Key Dates

Event	Key Date
Opportunity Announcement Formal Release	March 1, 2023
Webinar: Informational Session and Q&A with AOI SMEs	March 2, 2023 (12:00pm – 1:00pm ET)* March 7, 2023 (4:00pm-5:00pm ET)*
Bidders Conference and Proposal Training	March 14, 2023* (9:00am-11:00am) Mandatory
Webinar: Informational Session and Q&A with AOI SMEs	April 17, 2023 (3:00pm -4:00pm)*
Proposal Questions Accepted Through	April 18, 2023, by 4:00 pm ET
Round 6 Solicitation Due date	April 28, 2023, by 5:00pm ET
Notification of Finalists	May 23, 2023
Finalists Sessions with TRC	June 12-16, 2023
Awards Announced	August 2023
Projects Start	September/October 2023

**Register through Round 6 Solicitation page on OFRN website https://ohiofrn.org*

Round 6 Project Review Process

Round 6 Team Matchmaking

- **Round 6 Requires:**
  - 2 Universities
  - 1 Industry Partner
  - 1 Federal Partner Sponsor

- **IF YOU NEED A PARTNER**
  - To Satisfy Requirements
  - To Fill a Technical Gap

- **Matchmaking (https://ohiofrn.org)**
  - Link to “Team Matchmaking” Form
  - Advertise Your Need or What You Have to Offer
  - OFRN will make connections

Round 6 Proposal Training
(Mandatory)

March 14th 9-11am – MANDATORY Proposal Training

**one person from each proposing team required to attend*

Agenda

- OFRN Round 6 briefing
- Matchmaking
- Proposal Training
- Q&A

1. Hypersonics
2. Human Performance
3. High Power Energy Conversion
4. Digital Engineering Tools
5. Commercial Space in Low Earth Orbit
6. Quantum Sensing Technologies

Ohio Federal Research Network

Driving Innovation Through Strategic Partnerships

Federal Partner

Areas of Interests (AOIs)

AOI #1 Hypersonics

Federal Partners: AFRL & NASA Glenn

1. Gradient Printed Structures for High Thermal Gradient Applications

Future structures for high-speed aircraft will be subjected to severe temperatures and thermal gradients. It is anticipated that external skin temperatures may reach up to 2550F while supporting structures will be limited to 1300F. To minimize weight, the thermal protection system thickness needs to be thin (<2 inch) resulting in very high thermal gradients through the thickness. With the advent of advanced additive manufacturing techniques an area of interest to the government is the ability to print structures that can resist the external temperatures without oxidation and drop the temperature to levels acceptable to the support structure.

Innovations are sought in the following areas:

1. Design/optimization for high thermal gradient structures
2. Process parameters for making graded structures
3. Powder formulation to effectively grade the structure
4. Means for doing non-destructive evaluation to ensure final structure meets the specification
5. Ability to embed high temperature health monitoring sensors

AOI #1 Hypersonics

Federal Partners: AFRL & NASA Glenn

2. Novel Joining/Sealing Techniques for High-Speed Vehicle/Propulsion Systems

Future structures for high-speed aircraft will be subjected to severe thermal conditions, with external temperatures reaching up to 2550F. Future vehicles are anticipated to have joints between adjacent thermal protection panels and between thermal protection panels and leading edges. These joints must remain closed and leak-tight over the whole flight regime, without raising steps or gaps.

Innovations are sought in the following areas:

1. High temperature joining techniques to join “hot” structures (e.g., leading edges) to “warm” adjacent structures or “hot” structures to “cold” sub-structures
2. High temperature flexible seals with near zero leakage that can accommodate structural movement
3. Novel 3-D printing approaches that would eliminate joints or mitigate joining issues
4. Techniques for joining of thin metallic structures for cost-effective solutions for multiple mission cycles
5. Ability to embed high temperature health monitoring sensors.

AOI #2 Human Performance

Federal Partners: AFRL, NAMRU-D & NASA Glenn

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1. Physiological and environmental monitoring for ocular health and human performance

Non-invasively image optic nerve and retina of each eye to identify signs of Spaceflight Associated Neuro-Ocular syndrome (specifically: optic nerve swelling, choroidal folds, and cotton wool spots) and track changes over time.

Innovations are sought in these areas:

- Eye tracking and physiologic monitoring capable of evaluating signs of cognitive fatigue, workload, and impending loss of consciousness (LOC), including, but not limited to peak saccade velocity, saccade amplitude, pupil size, blink duration, fixation duration, and scan patterns mapped to objects of interest in the environment.
- A secondary, but integral parallel effort would support the development of ‘real-time analytics and algorithms’ that produce cautions or warnings when significant changes in physiology and associated human performance are detected. These algorithms could utilize single or integrated eye tracking metrics in combination with other commonly available physiological signals (e.g., heart rate, respiration).

AOI #2 Human Performance

Federal Partners: AFRL, NAMRU-D & NASA Glenn

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2. XR telemedicine / patient care in austere / isolated environments

The DoD and NASA are interested in exploiting technology advances for Extended Reality to enhance pre-hospital emergency care capabilities of individuals with minimal medical education and training. Enabling technologies may include Augment and Virtual Reality devices combined with in-house developed applications to provide guided instruction on emergency medical care.

Innovations are sought in these areas and the desired end-state would be a system that incorporates:

- Intelligent cueing of the situation, including patient ABCs (i.e., airway, breathing and circulation information)
- Injury/illness identification
- Refinement/tailoring of interventional strategy that generates a customized set of guided instructions for the user to follow

Technology approaches should address technologies including isolated network operation (i.e., no cellular, satellite or other wide area network connection), field-portability and ruggedness, and human factors design issues of operating in austere and isolated environments.

AOI #3 High Power Energy Conversion

Federal Partners: AFRL & NASA Glenn

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1. Affordable DC Emulation and Digital Engineering

Electric system failures have accounted for a majority of Remotely Piloted Aircraft (RPA) Class A Mishaps. Meanwhile, vehicle integrators are adding electrically enabled features such as: autonomy, advanced electrically powered payloads, and hybrid, electric propulsion systems all while reducing costs. In order to assess these systems in an efficient, cost-effective manner for performance (MIL-STD-704) and safety, the federal government leverages Digital Engineering (DE) approaches to investigate and address design shortfalls and reduce risks early in the development cycle. Experimental hardware-in-the-loop is a DE approach that leverages digital models and physical hardware. For electrical systems a Direct Current Emulator (DCE) is an advanced bi-directional DC power supply/sink that can be used to fill-in for unavailable components while presenting their relevant boundary conditions.

Innovations are sought in these areas:

- Developing a modular, affordable Direct Current Emulator (DCE) to encourage budget-constrained industry and academia to use and develop novel Digital Engineering (DE) techniques, conduct smart integrated testing, and bring non-traditional vendors to market.

At the end of 18 months an ideal state or result would be a low TRL demonstration of an affordable DCE coupled in real-time with relevant, digitally engineered, electrical source or sink representations with a path towards commercialization.

AOI #3 High Power Energy Conversion

Federal Partners: AFRL & NASA Glenn

2. Beta-Gallium Oxide (β-Ga2O3) Substrate Development

A bottleneck in the transition of *Beta-Gallium Oxide (*β-Ga_2O_3) for power electronic applications from the lab to industry is the lack of substrate availability. There are very few sources of these substrates domestically and an expansion in domestic capabilities is needed to stay competitive in the field. Current domestic supplies of substrates need additional work to demonstrate their readiness for device applications.

Innovations are sought in the development and demonstration of testing protocols for qualifying existing substrates through:

- Extensive characterization such as X-ray diffraction (XRD)
- Atomic force microscopy (AFM)
- Growth of device ready epitaxial films
- Additional investigation in the area of polishing and subsurface damage is also required in the early stages of development

At the end of 18 months an ideal state would be the demonstration substrate of testing protocols for substrate qualification which include high quality epitaxial films grown on domestic substrates to show readiness for state-of-the-art power electronics.

AOI #4 Digital Engineering Tools

Federal Partners: AFRL, NASA Glenn & NASIC

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1. Techniques to convert between model fidelity levels or the development of surrogate models using machine learning and artificial intelligence tools for applications in complex engineering systems and digital twins.

Digital technology has been revolutionizing the world of engineering design and complex product development. Modeling of engineering systems based on multi-physics models has played a major role in understanding system behavior, degradation of systems, and prediction of future performance. Such models are also playing a key role in the development of digital twins. As engineering systems become more complex, multi-physics models become computationally expensive and requires high performance computing resources. An alternate approach is the development of surrogate models based on artificial intelligence (AI) tools such as deep learning. Such models can run simulations orders of magnitude faster than the conventional multi-physics models. This topic is focusing on application of AI or development of complex engineering systems and digital twins of such systems.

Innovations are sought in these areas:

- Development of trustworthy and explainable AI models to facilitate development of surrogate models for complex engineering systems
- Development of engineering workflow deploying the surrogate AI-based models
- Demonstration of the application of AI-based surrogate models for design and development of systems in the areas solicited by OFRN for this cycle (e.g., high power energy, hypersonic gradient printed structures, and dc emulators)

AOI #4 Digital Engineering Tools

Federal Partners: AFRL, NASA Glenn & NASIC

2. Methods (low cost) model validation and assessment of digital maturity metrics

Digital transformation has become a high priority for almost all organizations. Transformation of engineering and its integration with business practices is a key priority for aerospace businesses and aerospace technology development organizations. Despite significance progress made in digital transformation, there is no common accepted practice for assessing the maturity of digital transformation in various organizations. Most of the digital maturity assessments have been qualitative. This topic will focus on the development of quantitative tools to assess the digital maturity of organizations.

Innovations are sought in these areas:

- Development of easy-to-use software that can measure digital maturity of different kinds of organizations, such as manufacturing, design engineering, and technology development.
- The application of the quantitative tools and associated software should be demonstrated for two or three different types of organizations.

AOI #5 Commercial Space in Low Orbit

Federal Partners: AFRL & NASA Glenn

1. Materials Joining Automation in Lower Earth Orbit

In-Space, Servicing, Assembly, and Manufacturing (ISAM) is a fast-growing sector supporting commercialization, exploration, and defense purposes. The White House has published guidance for both an ISAM national strategy and an ISAM implementation plan. The White House has also included ISAM and robotics as two key factors supporting the Space S&T strategy. As the concept of on-orbit (in-space) assembly and manufacturing begins to take shape, there exists a need for robust and validated methods for joining a variety of materials. This is a necessary for enabling the industrialization of the space environment.

Innovations are sought in these areas:

- Construct solutions for joining metals, polymers, and composites in hazardous, on-orbit (in-space), and non-terrestrial extreme environments with microgravity, vacuum, radiation, atomic oxygen, and thermal variations.
- These solutions may require humans out-of-the-loop and autonomous solutions are highly desired.

AOI #5 Commercial Space in Low Orbit

Federal Partners: AFRL & NASA Glenn

2. On-Orbit Biomanufacturing and Repurposing of Space-based Materials

DoD is seeking innovative technological solutions to address industrialization of space and advance materials science research and development for manufacturing using biological organisms in unique space environments. Future commercial space platforms could offer tremendous potential for supporting the on-orbit manufacturing enterprise through the use of biological organisms (bacteria, fungi, plants, etc.) that enable manufacturing processes, such as reclamation, synthesis, and others, in outer space and controlled space environments.

Proposal teams are encouraged to address techno-economic advantages of on-orbit bio-based processes vs. chemistry-based (non-biological) solutions and terrestrial manufacturing alternatives in terms of process efficiency, technology lifecycle cost, and energy budget.

Innovations are sought in these areas, but are not limited to the following topics:

- Technologies for reclamation and repurposing of materials and waste in space and utilizing space materials as feedstock for biological processes, with emphasis on low Earth orbit.
- Industrial biotechnology solutions for advancing the state-of-the-art of biological processes that facilitate in-space energy harvesting and storage.
- Technologies enabling fermentation in reduced gravity environment.
- Natural materials that enhance radiation shielding.
- Technology solutions focused primarily on biomedical or human factor applications are outside the scope of this topic.

AOI #6 Quantum Sensing Technologies

Federal Partners: AFRL & NASA Glenn

Quantum Information Science (QIS) is a growing area of interest nationally and includes quantum sensing, computing, and communication. The focus of this topic is to stimulate the development and integration of quantum sensing technologies into quantum systems to realize broader quantum systems of enhanced capability.

Sensors developed with a quantum communication or processing capability can lead to enhanced multimode quantum sensor networks that would have high levels of sensitivity (i.e., long baseline sensor array). In this call, it is desired that quantum sensors technology be developed and that there be a physical development of a sensor. The sensing technology should be developed with an understanding that it must be integrated into a quantum system.

This topic is focusing on quantum sensor development that incorporates an aspect of either quantum processing or computation.

Innovations are sought in these areas:

- Sensors that provide high precision measurement of physical quantities (e.g., magnetic and electrical fields, temperature, rotation) that is not possible today with conventional sensors.
- The quantum sensors should be physically developed but the study of the integration of the sensors into a quantum system can either be done through the development of a physical capability or the modeling of the sensor in the context of a broader quantum sensing system. For instance, the offeror could develop a small quantum processor, of perhaps a gate or two, or they could model how the sensor connected to a quantum processor could obtain an improved measurement.
- Likewise, a communication capability that would transmit a quantum state from the sensor to a remote location could be developed or a model of how the quantum state could be transmitted and utilized at a remote location could also be developed. Another possibility would be sensors connected through quantum communication to quantum computers as part of future Quantum Internet of Things.

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Area of Interest Q&A

1. **Hypersonics**
    1. *Gradient Printed Structures for High Thermal Gradient Applications*
    2. *Novel Joining/Sealing Techniques for High-Speed Vehicle/Propulsion Systems*
2. **Human Performance**
    1. *Physiological and environmental monitoring for ocular health and human performance*
    2. *XR telemedicine / patient care in austere / isolated environments*
3. **High Power Energy Conversion**
    1. *Affordable DC Emulation and Digital Engineering:*
    2. *Beta-Gallium Oxide (β-Ga2O3) Substrate Development*
4. **Digital Engineering Tools**
    1. *Techniques to convert between model fidelity levels or the development of surrogate models using machine learning and artificial intelligence tools for applications in complex engineering systems and digital twins.*
    2. *Methods (low cost) model validation and assessment of digital maturity metrics*
5. **Commercial Space in Low Earth Orbit**
    1. *Materials Joining Automation in Lower Earth Orbit*
    2. *On-Orbit Biomanufacturing and Repurposing of Space-based Materials*
6. **Quantum Sensing Technologies**

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Federal Partner

Areas of Interests (AOIs)

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General Q&A

Ohio Federal Research Network
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Next Steps

Key Dates

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Information

Submit Questions to

OFRN-Question@parallaxresearch.org

https://ohiofrn.org

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