



OHIO FEDERAL RESEARCH NETWORK (OFRN)

Sustaining Ohio's Aeronautical Readiness and
Innovation in the Next Generation (SOARING)

Call for White Papers and Request for Proposals

Issued: January 19, 2018

White Papers Due: February 21, 2018, 2:00pm

Proposals Due: April 27, 2018, 2:00pm

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1 OVERVIEW INFORMATION

State Program:	Ohio Federal Research Network (OFRN)
Funding Opportunity Title:	Sustaining Ohio's Aeronautical Readiness and Innovation in the Next Generation (SOARING)
Announcement Type:	Initial Announcement
Funding Opportunity Number:	WSARC 18-002

1.1 Key Dates

RFP Release	January 19, 2018
Academia/Industry Day & White Paper Training	January 24, 2018
White Papers Due	February 21, 2018, by 2:00pm ET
White Paper Review/Down Select	Early March 2018
Proposal Training	March 22 – April 20 (approx.)
Proposal Questions Accepted Through	April 20, 2018
Proposals Due (Volume 1: Technical and Management Volume):	April 27, 2018, by 2:00pm ET
Proposals Due (Volume 2: Cost Proposal):	May 11, 2018, by 2:00pm ET
Proposal Review	Mid-May 2018
Awards Announced	Late-May 2018
Post-Award Conference & Review	Summer 2018

1.2 Concise description of the funding opportunity

The SOARING Request for Proposal (RFP) is focused on expanding Ohio's leadership in federal and industry aerospace research, development and sustainment for unmanned air systems (UASs), personal air vehicles (PAVs), and logistics delivery air vehicles (LDVs). Across the different classes, target applications, and technologies, several barriers persist, including FAA flight certification, safety concerns, and specific technical and market validation needs. OFRN's Federal and industry partners verified these concerns in their responses to OFRN's Request for Information (October 2017). The focus of the SOARING RFP is to leverage the unique Federal and Ohio assets to systematically address these challenges.

Total amount to be awarded: \$7-10 million

Anticipated individual awards: Multiple awards, up to \$2 million each

Cost share: At least 1:1 cost share is required
(Additional cost share will be considered favorably)

Project Period: 18 Months

Award Type: Contract

1.3 Program Contacts

Executive Program Director	Dennis Andersh	dennis.andersh@wright.edu
RFP Questions	Paul Jackson	paul.jackson@wright.edu
Administrative Questions	Becky Mescher	becky.mescher@wright.edu
Contracting Questions	Brian McCartan	brian.mccartan@wright.edu

2 OHIO FEDERAL RESEARCH NETWORK BACKGROUND

The Ohio Federal Research Network (OFRN) received funding from the Ohio General Assembly in the fiscal year 2016-2017 biennial operating budget as a strategic priority initiative identified by the Ohio Federal and Military Jobs Commission (OFMJC). In the FY 2018-2019 Ohio Biennium Budget, the State reaffirmed its commitment to OFRN with the inclusion of additional funding for this initiative as a standalone project managed by the Ohio Department of Higher Education.

The goal of OFRN is to enhance the Ohio Industrial base while also increasing research funding, talent, and capabilities development in Ohio to support future Federal, State, and Industry aerospace requirements. The OFRN established a novel approach to technology based economic development with a focus on aggregating, integrating, and leveraging federal, academic and private sector capabilities and resources in Ohio to develop proactive and innovative solutions to address emerging federal and state requirements and emerging market opportunities. OFRN research projects are intended to advance priority research thrust areas of the Air Force Research Lab (AFRL), National Air and Space Intelligence Center (NASIC), Naval Medical Research Unit – Dayton (NAMRU-D), and National Aeronautics and Space Administration Glenn Research Center (NASA-GRC), and The State of Ohio's Adjutant General (TAG). Also included in this document are thrust areas from the United States Marine Corps (USMC) around manufacturing and logistics automation.

Through its collaboration with the AFRL, NASIC, NAMRU-D, NASA-GRC, USMC, and TAG, OFRN has identified research priorities. OFRN organized universities and colleges in Ohio around Federal missions, technology roadmaps, and strategic priorities of AFRL, NASIC, NAMRU-D, NASA-GRC, and TAG. The aim of the OFRN is to provide value to its Federal customers, the State of Ohio, and the Ohio aerospace industry. Federal customers will benefit with translational research advances to improve operator performance and mission success and the State of Ohio will benefit with the transition of the research to Ohio defense and commercial enterprises that will create new products and fill new jobs.

The Wright State Applied Research Corporation (WSARC) has been designated by the OFMJC as the Program Administrator for the OFRN. To date OFRN has invested \$18 million in support of its Round 1 and Round 2 applied research activities. (See www.ohiofrn.org for details of current projects).

3 FUNDING OPPORTUNITY DESCRIPTION

3.1 Introduction

This Call for White Papers and Request for Proposals (RFP) is being issued for the third round of OFRN funding. This round focuses on Unmanned Aerial Systems (UAS), Personal Air Vehicles (PAV), and heavy-lift Logistic Delivery Vehicles (LDV). This round is intended to address technical and FAA certification challenges facing the Federal and State research entities and the Ohio aerospace industry.

OFRN has used input from Federal and State stakeholders as well as industry guidance secured through a nationwide request for information (RFI). These federal, state, and industry inputs identified shortfalls in the current state of the art, and provided the requirements required to support the federal partners and the Ohio aerospace Industry. SOARING seeks to expand Ohio's research base of talent, capabilities and investment to complement and support the research missions and priorities of its Federal stakeholders.

The OFRN Round 3 organizational structure is shown in Figure 1. The OFRN plans to use this team to prioritize, select, and review investments and monitor 2018-19 State funding for the SOARING Initiative.

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Figure 1: OFRN Round 3 Organizational Structure and Review Teams.

3.2 RFP Background

As an international hub for aviation, space, and manufacturing, Ohio has been at the forefront of advancing aerospace technologies for over a century. Ohio is the home of the Wright Brothers and to key aerospace firms and suppliers. For example, Ohio is the top supplier to Airbus and Boeing and houses the Air Force Research Laboratory (AFRL), NASA Glenn Research Center, Navy Aerospace Medical Research Unit (NAMRU-D), and the National Air and Space Intelligence Center (NASIC). OFRN is designed to support the next chapter of the Ohio aerospace industry.

The use of and interest in UASs, PAVs, and LDVs has grown rapidly in recent years, particularly the potential for Group III (≤ 598 kg) and larger systems to address issues in personnel transport, logistics delivery, and services. Interest has grown across many segments of the economy resulting in new technology-enabled business models using these revolutionary technologies. The DoD and NASA have both made significant investments and demonstrated their own aircraft with a variety of capabilities.

Investment in unmanned systems by the DoD in 2016 alone is estimated to have exceeded \$2.9 billion. Multiple groups are vying to debut personal air vehicles and the next generation of logistics delivery platforms. The development of and requirement for autonomous aerospace systems has grown dramatically with a variety of designs and targeted dates for deployment. These new classes of flight systems will disrupt existing transportation and logistics, and they are enabling new business models and improvements in quality of life. However, the development and certification of autonomous or semi-autonomous systems has significantly lagged the technology development.

The UAS, PAV, and LDV technology spaces represent the next leap for the Ohio aerospace industry to further its competitive advantage in the development, manufacturing, and sustainment of aerospace systems. Central to this transformation is the state's portfolio of research universities, small businesses, and nationally recognized manufacturing initiatives in energy storage, 3D printing, and lightweight materials. The State, through OFRN, has begun

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integrating these portfolios of research, technology, and manufacturing assets and is creating an incubator for new aerospace systems. The focus of the Round 3 ORFN RFP is to enable Ohio to lead aerospace innovation, to develop technical talent, and to remain the partner of choice in the next generation of flight technology, manufacturing, and business models.

3.3 Federal Customer Requirements

SOARING seeks to fund projects that align with needs identified by its Federal, State, and commercial stakeholders. Broadly, these relate to performance, safety, and FAA flight certification across diverse classes, target applications, and technology domains. High-level requirements of each Federal Customer are listed in Table 1:

Table 1: Federal Customer High-Level Requirements

Federal Customer	Requirements
AFRL	<ul style="list-style-type: none">• Mobile and ground-based Detect and Avoid• Safe access to mixed manned/unmanned airspace without op tempo disruption• Terminal air ops and AF UAS capabilities
Air National Guard	<ul style="list-style-type: none">• UAS Sense and Avoid systems• Persistent full-spectrum communication repeater• Mobile ad hoc networks• UAS deployable launch and recovery kit• Command and Control liaison kit• Joint Incident Site Communication Capability and Block III Incident site data service extension
NAMRU-D	<ul style="list-style-type: none">• Human-machine interface• Personnel performance characteristics• Advanced mobile sea platforms
NASA	<ul style="list-style-type: none">• Demonstration of T34 capability• Persistent and scalable Communication, Navigation and Surveillance (CNS)• Portable Unmanned Traffic Management (UTM), persistent UTM
NASIC	<ul style="list-style-type: none">• Secure and encrypted communications and UAS control• Persistent sensing and data analytics• Space applications
USMC	<ul style="list-style-type: none">• Mobile local manufacturing and digital in-field production• Logistics delivery systems and automation

More detailed requirements specific to AFRL STAT BAA and NASA GRC are included as attachments (See Attachments 8.6 and 8.7).

3.4 Areas of Interest (AOIs)

Applicants are encouraged to address specific AOIs. Teams may also propose any topic or combination of topics, listed or unlisted, that are directly relevant to federal and industrial needs (see 3.4.17). All topics will require a demonstration that will be based on an emergency response scenario (See Section 3.5).

Not all topic areas are expected to be funded. OFRN will seek to create a broad portfolio of projects to address multiple needs.

Areas of Interest (AOIs) are listed in no particular order.

3.4.1 AOI #1: Plug-and-Play Payloads

Being able to swap out the sensors, payload, control, comms and/or any non-flight related part of the UASs, PAVs, and LDVs is a critical need in an emergency and would also help to design future craft. Proposals should suggest different ideas and approaches to enable a complete plug-and-play retrofit and relaunch for the platform craft <30 minutes of landing as might be needed in an emergency scenario. Potential flight packages could include but are not limited to improved heat/motion detection, remote power substation querying, low-altitude loudspeaker, emergency cellular signaling, emergency comms repeaters, and/or flight deployable CBRNE sensor. Proposals should detail what sensors/capacities would be developed and how the plug-and-play retrofit could be achieved in <30 min. Miniaturization of advanced sensor systems would also be welcomed as long as the demonstration shows how UASs, PAVs, and LDVs capabilities could be significantly improved.

3.4.2 AOI #2: Universal Translator and Monitoring

There is a need to have one asset able to communicate and control multiple types of UASs, PAVs, and LDVs systems in an emergency. For this topic, the focus will be on communications input from UASs, PAVs, and LDVs as a priority and being able to communicate out basic commands as a secondary need. For the sake of the demonstration, the proposed system would need to translate signals from 8 different types of UAS OS to a Piccolo input acceptable by the Springfield GBSAA system. Proposals will need the minimum capability to support 8 simultaneous signals and some proof of scalability to address a swarm (Min # = 30 units) through any approach. Proposers that can support other output languages in addition to Piccolo will receive additional consideration. Proposers focused on this topic should directly contact OFRN (paul.jackson@wright.edu) to receive additional documentation on this topic. This specific topic has a 9-12-month performance period.

3.4.3 AOI #3: Field Swappable Aircraft Variants

In order to demonstrate flexible flight design, there is potential for one craft to have different flight packages. The long-term vision is a modular system flown from a single, mobile trailer that sits on base like any other National Guard asset that has custom flight variants available for each National Guard unit's expected response needs. This could easily be applied to future civilian fleet users that will have different needs of the same craft. For this program, proposers should be able to suggest at least two flight variants to demonstrate one craft with multiple capabilities: a low-altitude design for activity around buildings and crowds at ≤ 400 feet, a mixed endurance observation design for $\leq 2,000$ feet, and a high altitude/high endurance design $> 6,000$ feet. The swap-out must occur within an hour of landing as is expected of existing National Guard flight assets. Any system that can show both VTOL and fixed wing capabilities would be given preference but is not required. All proposals must have different payloads included in the swaps.

3.4.4 AOI #4: Automated Data-Feed Analytics

As the onboard capabilities of UASs, PAVs, and LDVs systems increase or are augmented for disaster response, data gathered must be able to be analyzed quickly in order to take action as needed. Balancing highly capable UASs, PAVs, and LDVs systems with the ability of human operators to review data quickly in an emergency will require substantial analytics support. Proposers should focus on how automated routines could support human analysts to reviewing flight video, audio, text, GIS and/or sensor data input in parallel and be able to draw attention to key sections of data for human analysts or flight operators. Proposals should include at least 2 other sensor data feeds beyond video, and will need to demonstrate the analytics systems onsite with their craft from a simulated trailer to maintain in-field constraints.

3.4.5 AOI #5: Human Operational Effectiveness Policy

All the innovation and push on technical envelopes will be limited without corresponding policy that enables the technologies and their business models to be realized safely. It is beyond the scope of the SOARING initiative to develop this corresponding policy. However, it is within scope to develop policy surrounding human operational effectiveness of UASs, PAVs, and LDVs. Applicants may propose policy studies or policy from technical study regarding the training of both operators and those impacted in the NAS by the adoption of UASs, PAVs, and LDVs (such as Air Traffic Controllers). These proposals have a minimum of \$250k.

3.4.6 AOI #6: Onboard Energy

The energy-to-weight ratio is as critical to flight capability and endurance as the lift-to-drag ratio. Energy limitations are especially acute in smaller craft. Solutions employed on larger systems may be adapted for smaller craft, and many yield different results across different platforms. Proposals focused on energy sources will need to lead to systems that can achieve at least 400 W-h/kg deployed for energy storage.

However, proposers are in no way limited to traditional approaches. Applicants should propose metrics that are competitive to state-of-the-art technologies, specific to their technology, and reflective of the weight, size, and on-board constraints expected in UASs, PAVs, and LDVs.

Proposers are encouraged to review the following reference materials regarding this area of interest:

- <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20160010280.pdf>
- <https://spectrum.ieee.org/aerospace/aviation/how-i-designed-a-practical-electric-plane-for-nasa>

3.4.7 AOI #7: Cryogenic Engines, Superconducting Magnetic Energy Storage (SMES), and Induction Motors

Cryogenic aircraft propulsion systems may employ low-AC-loss superconductors or hyper-conductive aluminum to improve performance. Such systems have shown significant potential for operation with low to near-zero energy loss and achieve superior weight reduction compared with non-cryogenic technologies. Coils wound with such conductors have also shown scaling potential for use in large aircraft in superconducting magnetic energy storage (SMES) systems. There has also been significant development of coupled induction motor systems that could offer reduced weight and higher efficiencies through multiple phase systems.

For cryogenic systems, applicants may propose any material that would be a capability enabler and is a part of a cryogenic system applied to UASs, PAVs, and LDVs. Examples include, but are not limited to, efficient onboard cooling systems, demonstration engines, novel materials, or a SMES with emergency discharge capability.

For induction motors, applicants could propose system flight demonstrations, power system controls and architecture, and/or hybrid electric propulsion related advancements with induction systems.

All selected cryogenic projects will demo their technology at NASA-GRC Superconducting Coil Test Rig. Cryogenic engines would need to achieve $\geq 1,000$ rpm for the demo and show a path to deployment.

Proposers are encouraged to review the following reference materials regarding this area of interest:

- <http://publish.illinois.edu/granger-ceme/files/2015/04/Electric-Aircraft-cleared-AFRL-2013.pdf>
- <http://www.sciencedirect.com/science/article/pii/S0011227516303794>
- <http://ieeexplore.ieee.org/iel1/20/3154/00101076.pdf>
- <https://arc.aiaa.org/doi/abs/10.2514/6.2017-4954>

3.4.8 AOI #8: Onboard Protocols for Non-Traditional Systems

Safety with new energy systems remains a key concern, as evidenced by Boeing's 787 issues with battery control. Increasing the fraction of non-fuel energy will require new approaches to maintain safety within the constraints of profitable flight. In automated or semi-automated Class 3 systems and above, safety for personnel and cargo must be assured. Onboard safety topics may include: power electronics, containment, emergency sources, and autonomous monitoring of safety. Applicants should address independent certification of new technologies.

3.4.9 AOI #9: Computational Efficiencies and Onboard Heat Management

Safety requirements are increasingly requiring UASs, PAVs, and LDVs to be computationally self-sufficient, rather than pushing computations to cloud-based or external computation assets. These requirements are increasing demand for onboard computation power and efficiency without a loss in system performance or capability. More onboard computation may also require more on-board heat management and removal.

Systems (hardware and/or software) should enable high levels of onboard computation, optimization, and computation during rapidly changing flight situations. Heat management solutions must fulfill weight, size, and onboard constraints.

3.4.10 AOI #10: Human Interpretation and Traffic Management in a Flexible Airspace

This AOI supports next-generation, data control software and hardware for interactive air traffic management. New craft traffic controllers must deal with a daunting amount of data, flight plans, deviations, craft types and local anomalies. These demands also require advanced systems to track, communicate, and control many craft safely. Swarms of craft introduce unprecedented management complexity.

Proposals may include, but are not limited to, complete systems that use front-end augmented reality (AR/VR), touch interfaces (screen or holographic), or any creative summarization/notification/control/visualization technique. Applicants may also combine with a backend analytics engine that can handle queries while summarizing data as needed or retrospectively.

3.4.11 AOI #11: Automation, Qualification, and Subcomponent Packaging

Automated systems require different, evolving sets of qualification requirements, such as testing how automated systems interact with different actors. Accelerating deployment of automated systems and subcomponents require rapid testing to ensure competitive advantages are not lost to qualification delay.

Proposals should define:

- Methods to certify and qualify control software and/or hardware related to aircraft;
- Methods for rapidly integrate routines or subcomponents in existing platform(s) quickly.

Proposed approaches should handle multiple aviation systems, software and/or hardware. Rapid software development and open collaborative modification is

encouraged as certification protocols should be known to both developers and end users.

For example, an applicant might propose a virtual “sandbox” approach that creates a black box representations of different control systems. The sandbox enables testing of interaction with other control systems and non-communicative actors. Similar approaches could be conceived for new hardware. Proposers should focus on approaches to qualify systems for stability and interaction, with a goal of allowing faster qualified modification.

3.4.12 AOI #12: Virtual Accelerator from Distributed Prototyping to Scaled Production of Flight-Worthy Parts

Rapid, cost-effective manufacturing remains a key bottleneck for new designs. New technology like additive manufacturing is not being fully exploited. Gaps remain for:

- testing new ideas cheaply
- creating flight-worthy tools, and
- transitioning from prototyping to higher volume manufacturing.

Manufacturing companies, startups, business models, and user facilities cannot properly be integrated into this new paradigm until there is also an established plan for scaling that gives competitive value to their external users.

Proposals should focus on human capital, linking expertise and assets, and building a roadmap for manufacturing new craft. Applicants should define a user experience and value rather than just integrating their physical assets and general expertise in manufacturing. Applicants should focus on modeling new aircraft manufacturing paradigms emphasizing traceability, safety, and budget. Experience in aircraft production is preferred but not mandatory. Ohio-based manufacturing partners are preferred. Applicants will need to produce and fly aircraft parts as part of their project and include production schema useful outside of their own team.

For example, a potential goal would be to show how multiple, physically separate experts and assets across the state could be integrated and moved through a workflow (backend). At the same time, the user sees the transition and timelines to move from prototype to scaled production with cost estimates (frontend).

3.4.13 AOI #13: Integrated Communications and Sensors

Smaller craft require smaller components, energy use, and aerodynamic profiles while maintaining safety and communication. From satellite communications to antenna, new designs can increase trust and safety without reducing capability or relying on legacy systems.

Applicants should propose unique approaches to communications equipment. Focus areas could include but are not limited to ultra-low weight, high-gain conformal antennae, ABS-D systems that could double as structural elements, optical comms, or SatCom alternatives at lower elevations and/or saturated bandwidth. Also of interest could be communications alternatives, or communications systems that would enable a large number of unique comms equipped craft to be seamlessly and safely integrated into a future, flexible national airspace. Invited full applications will also need to present a brief economic model of how/where this production could be coupled to domestic manufacturing at scale.

Proposers are encouraged to review the following reference material regarding this area of interest on conformal antennae:

- <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20140017756.pdf>

3.4.14 AOI #14: Detect and Avoid

UASs, PAVs, and LDVs must maintain a degree of onboard air-to-air detection and avoidance as well as air-to-ground detection (landing). Current detection systems may not meet weight and cost constraints. Scheduled flights have established ports and experienced human pilots. In contrast, future unmanned craft moving in populous areas must avoid in-air issues and confirming unmanned landing sites are clear.

Proposals should focus on onboard air-to-air and/or air-to-ground Detect and Avoid. Applicants should plan an end-of-project demonstration that shows control for random events outside of experimental conditions/potential training sets.

3.4.15 AOI #15: Security Assurance, Encryption, and Testing

Onboard assurance and encryption is essential for trusting next-generation craft. Needs include hacking resistance, assurance of control of multiple autonomous/semi-autonomous systems, and balancing privacy with required flight data logging. Trustworthiness may also play a part in how different autonomous systems interact and are able to make decisions based off shared information.

Proposals should focus on methods of assurance that are widely distributable and remotely securable. Any viable approach can be proposed; examples include physical hardening and software layering, physically unclonable functions, and onboard secure handshake. Given the large need space and potential solutions, proposers will need to justify why their approach would be superior within expected constraints, respecting computation decision speed needed in flight and across a large set of nodes/users with varying onboard computational power and energy available.

3.4.16 AOI #16: Alternative Airfield Technologies

Non-traditional airfields, in an emergency or in everyday use, must allow seamless integration of new aircraft into existing areas without disrupting existing infrastructure and expectations. The focus in this Area of Interest is technologies that allow operation in non-controlled environments in closer proximity to the public.

Proposers may focus on, but are not limited to, sound reduction technologies, emissions, verification, analytics redundancy, multifunctional materials or systems, all-weather operation technology, and turbulence mitigation. Additional areas of interest could include any automation or subcomponent that could improve the ability of future UASs, PAVs, or LDVs to operate in a variety of flight conditions safely in different flight locations. Proposers must provide context for why proposed technology will improve the state of the art.

3.4.17 AOI #17: Other Topics

Proposers may suggest any relevant topic(s) not listed but that have clear application and utility for SOARING focus areas. Proposers will be expected to provide the same level of state of the art context, metrics, description of an emergency demonstration, federal alignment, and long-term benefits.

3.4.18 Areas Specifically Not of Interest

The following types of projects are considered misaligned with the aims of the SOARING initiative and will not be competitive if submitted.

- Basic research work without a clear application or flight/flight-related demo
- User or Fee-for-Use Facilities
- Programs focused on proprietary air platforms, software, or technology
- Loosely associated teams or multiple, disparate projects submitted as a single submission

- Smaller UAV projects not directly applicable to larger flight systems
- Projects without a clear focus on a PAV and LDV need
- Landing pad, automation, or manufacturing proposals without clear innovation to UAS, PAV, LDV

3.5 Demonstration Projects

OFRN will support select demonstrations of new capabilities and technologies.

Technology will be demonstrated in simulated emergency scenarios in coordination with the Ohio National Guard. OFRN teams selected will be focused on creating technologies to support in-field disaster response and their associated support or base flight systems.

The demonstrations will serve to debut new capabilities in a simulated disasters response. Such demonstrations have near term-benefit for first responders and long-term benefits of improving the on-board autonomy of UASs, PAVs, and LDVs.

OFRN intends to make at least one award each for a UAS system, LDV system, and PAV system. Teams with an existing platform are invited to use that system as part of their cost share, provided it is relevant to the proposed focus on enabling the future vision of UAS, LDV and PAV aircraft. OFRN assumes this will be the first of many flight demonstrator projects it will initiate.

Proposed demonstrations must enable:

- An increase in the performance, capability, safety, and trust of UAS, PAV, and LDV systems
- A blueprint for rapid prototyping, scaling and qualification of systems
- An increase in deployment and service models
- Delivery of goods/personnel to remote and high value sites
- Changes to the nature of the last mile in logistics
- The advancement of automation technology to distributed aircraft models
- Flexible airspace and integration policy

3.5.1 Demonstration Grounds

Demonstrations should be based on using the Ohio/Indiana UAS Center (UASC, see <http://www.dot.state.oh.us/divisions/uas/Pages/default.aspx>) in Springfield, OH (Figure 2) and/or Calamityville (Figure 4). Proposers should select a topic relevant to cutting edge UASs, PAVs, and LDVs capabilities. Their demonstration should show value in an emergency response. Most importantly, it should demonstrate clear benefits to future deployment of UASs, PAVs, and LDVs beyond emergency scenarios. The UASC facility has the only ground-based Sense and Avoid test facility in Class E and Class G airspace currently available in the U.S.

Proposers should assume the entire area in and around the UASC demonstration area is “dark”, simulating a combined terrestrial (chem/bio) and space-based disruption (cyber). Going “dark” is not required for all projects and depends on the proposal focus area. Features could include:

- intermittent cellular, satellite, and data access,
- limited energy in field, and
- potentially crowded airspace.

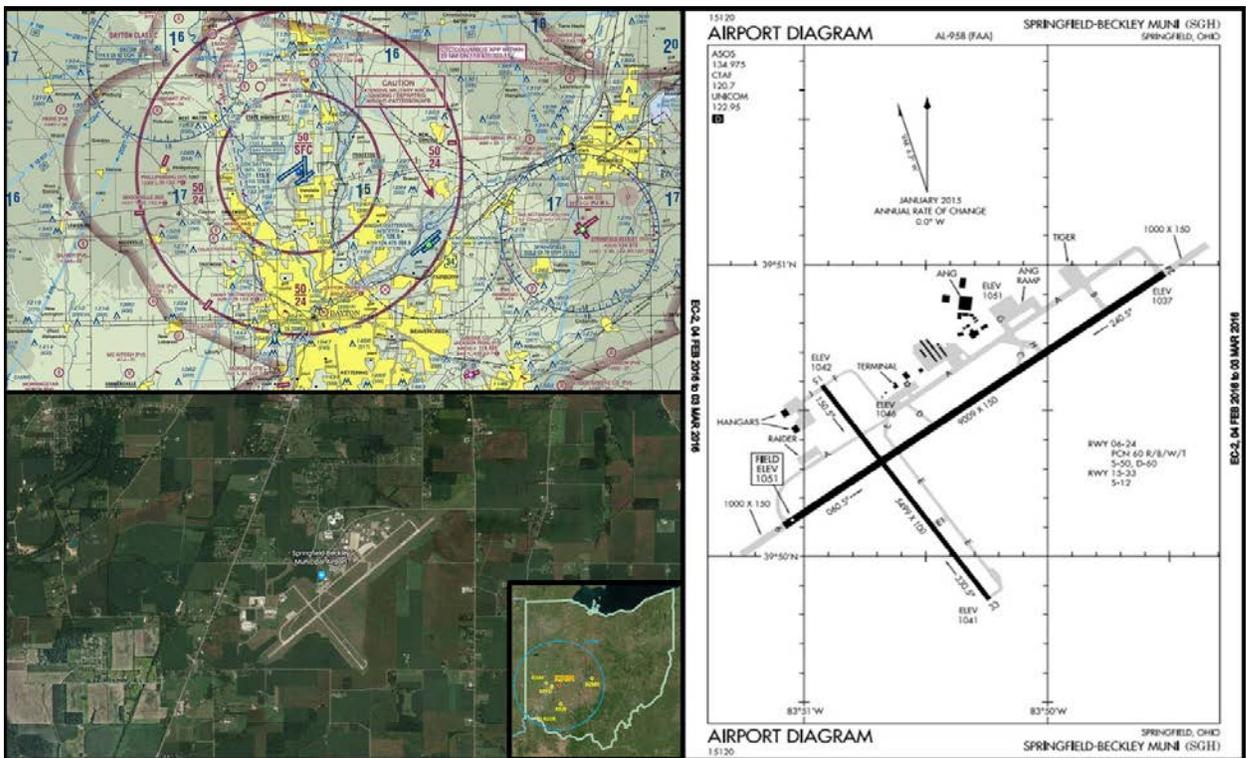


Figure 2: KSGH Springfield-Beckley Municipal Airport - Springfield, OH

Figure 2 shows the airspace available for the demonstration scenarios. There are two operational volume airspaces defined, one for Visual Line of Sight (VLOS) operations and another for Beyond Visual Line of Sight (BVLOS) operations. The VLOS airspace is surface to 3,500 feet AGL and an area of approximately 7 NM². The BVLOS airspace is 1,000 feet AGL to 8,000 feet MSL covering an area of over 200 NM². Additional details of the UASC flight requirements including air worthiness, pilot qualification, and additional facility and airspace details will be provided after white paper selection. Site questions that impact white paper submissions may be addressed through Q&A.



Figure 3: UASC VLOS and BVLOS Operational Volume

Figure 3 shows the Calamityville disaster response test area that is also intended to be available for the demonstration scenarios. These are two operational volume airspaces defined, 1 for Visual Line of Sight (VLOS) operations and another for Beyond Visual Line of Sight (BVLOS) operations. More information is available online about Calamityville (see: <https://wsri.wright.edu/programs-and-facilities/national-center-for-medical-readiness>)

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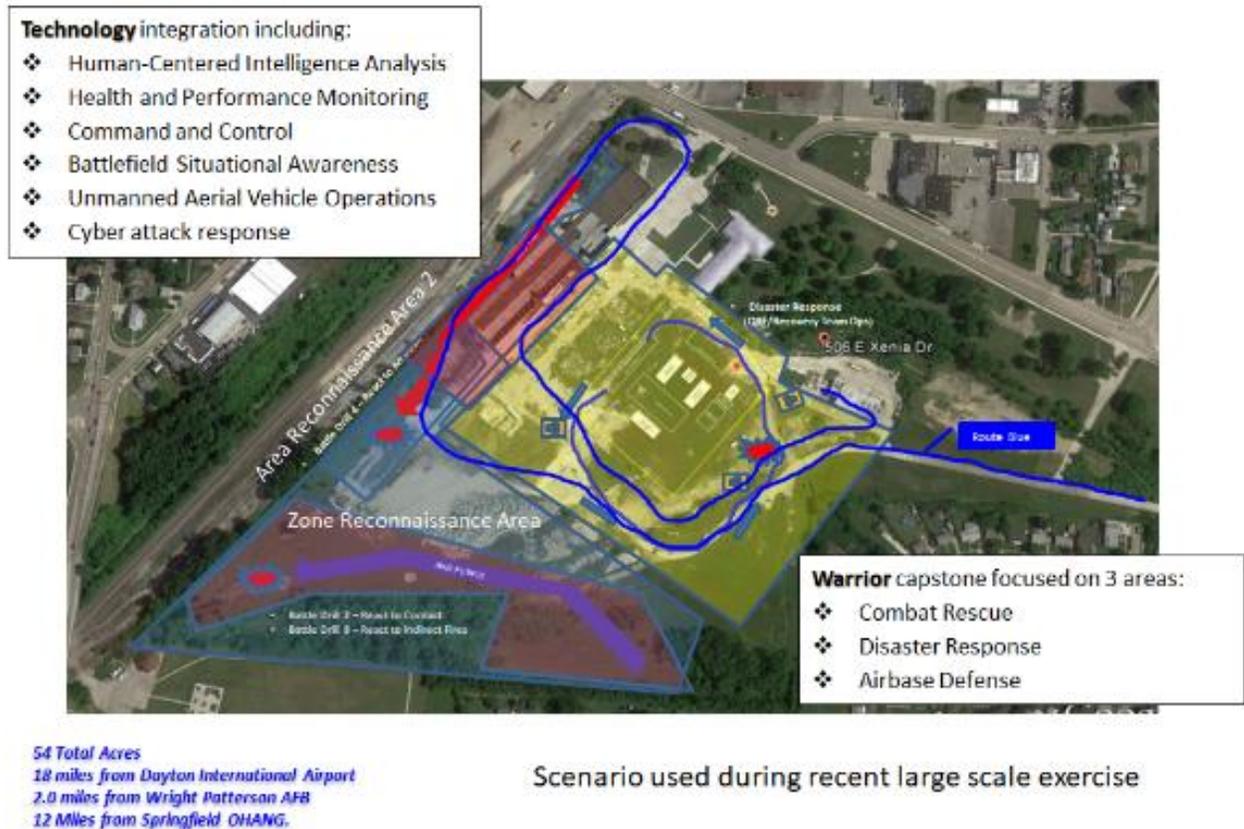


Figure 4: Calamityville Disaster Response Test Area

UASs, PAVs, and LDVs will be deployed to the edge of the simulated blackout from a trailer staging area. Vehicles must show how the proposed technology could improve the ability of the National Guard to respond in emergency scenarios. For example, fully independent and onboard Detect and Avoid systems would be useful in crowded, uncontrolled airspace after an event. They may also support non-disaster flight corridors, away from established flight paths, for LDV landing in residential areas. Other examples include but are not limited to:

- Communication system miniaturization for flight,
- Plug-and-play in-flight sensors systems enabling emergency water or regular package delivery
- Safely operation of a Class III autonomous personnel system in an area of constant cyberattacks or disrupted service,

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- More efficient energy systems,
- Propulsion that allow longer endurance flights, or
- Increased onboard computation.

Each responder's scenario must be unique to its topic area. All teams will bid to develop and then oversee the integration of their enabling technologies into existing platforms prior to testing at the UAS Test Center.

Applicants must pick a demonstration area and subtopic, and focus their project on systems integration and subcomponent/subsystem creation. The emergency scenario also will help the OFRN teams to develop their system engineering expertise in a system that will be tested outside of the laboratory. Respondents are invited to be creative with their demonstration, and focus on using the emergency response to showcase their technology's utility in civilian use.

3.6 Funding and Cost Share

OFRN anticipates awarding \$7-\$10 million in contracts through the SOARING initiative, with each contract in the range of \$500,000 to \$2 million.

Projects funded under the SOARING Initiative must have matching cost share. This cost share must achieve at least a 1:1 ratio with OFRN dollars requested. Cost share can be in the form of cash, in-kind, or research assets funded by industry investments or state/federal research dollars. Potential applicants should note that cost share will be a key selection criteria. It will be the responsibility of the Lead Applicant to ensure that the 1:1 cash cost share requirement is met or exceeded, and that all proposed cash cost share and reporting requirements are met. See Attachment 8.8 for more details on cost share.

3.7 Award Process and Requirements

3.7.1 Eligibility

A Lead Applicant is the entity that submits a proposal and will be legally and financially responsible for the administration of any resulting award of OFRN funds. Proposed projects can be led by either industry or an Ohio college or university. Regardless of the leading organization, project teams must include:

- at least one industry organization;
- at least two Ohio colleges or universities; and
- at least one partner from an Ohio-based federal lab

Lead applicants that become contract awardees must maintain eligibility while the contract is open. A contract awardee that loses eligibility forfeits its award and may be required to repay OFRN the full amount of the monies it has received, plus interest.

A Lead applicant can submit no more than 2 proposals under this RFP.

Note 1: While previous rounds of OFRN funding have required the lead applicant to be associated with an OFRN Center of Excellence, Round 3 does not. This broadening of the applicant pool is deliberate to ensure as many quality projects as possible can be submitted to the SOARING initiative, regardless of a Lead Applicant's direct involvement with a COE. This broadening of eligibility does not limit a COE from proposing projects, and prior performance on OFRN-funded projects and leveraging past OFRN investments will be considered in the evaluation of proposals.

Note 2: The option of Industry Lead Teams and/or Industry Lead Integration of the flight systems is new to Round 3. OFRN has presented this option to fully engage industry and to put added emphasis on Research for Development, R-for-D. R-for-D refers to technology transition, integration and validation into innovative systems solutions that will be adapted by the UAS, PAV, and LDV industry.

Note 3: In the interest of avoiding any real or perceived conflicts of interest, the Wright State Research Institute and its staff are not eligible to participate in this program, either as lead applicant or collaborator on any SOARING project.

3.7.1.1 Collaborators

OFRN defines a collaborator or team member as:

- an organization, institution, company or other legal entity that is not an affiliate of the lead applicant; or
- an individual not employed by or related to the lead applicant;
- and
- is anticipated to receive OFRN funds and/or has raised cost share, and
- is actively involved in the project on an ongoing basis.

Collaborating organizations for a project are not required to have a principal place of business in the State of Ohio. However, in-state involvement is preferred. Involvement of out-of-state entities must be well justified in the proposal.

3.7.1.2 Federal Partner

The proposal must demonstrate how applications or user-driven requirements are derived from and ***aligned with the emerging mission and research focus areas*** of AFRL, NASIC, NAMRU-D, NASA-GRC, USMC, and/or TAG.

The proposal must have an identifiable **Government Sponsor** at AFRL, NASIC, NAMRU-D, and/or NASA-GRC. The Government Sponsor(s) must be identified by name and organization with contact information as required in the Application Information Page (see 8.1). Proposers should not seek any further formal documentation (such as a letter) from the Government Sponsor. White Papers (see Section 4.5.1) and Proposals (see Section 6.3.5) must demonstrate endorsement from the federal partner for proposed technology.

Teams that need assistance in finding a potential Federal Partner for collaboration, after trying on their own, should contact OFRN for assistance by emailing Becky Mescher (becky.mescher@wright.edu).

3.7.1.3 Air Force Institute of Technology (AFIT) Participation

Proposals that include participation from the Air Force Institute of Technology (AFIT) are eligible for submission to this RFP. Proposers are expected to demonstrate how funding for AFIT research will directly support job creation across the State of Ohio. One example might be including non-government researchers ("outside the fence") in the AFIT graduate education system. Growing talent outside the Wright Patterson AFB and NASA-GRC is critical for Ohio to better compete going forward.

3.7.2 Program Process

The RFP process will consist of the following steps:

1. Release of RFP
 - Letter of Intent (Optional)
2. Industry Day and White Paper Training (Optional)
3. Submittal of White Papers
4. White Paper Down Select

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5. Proposal Training (Required)
6. Questions Regarding Proposals
7. Submittal of Proposals
8. Award Announcement
9. Kickoff Conference

An overview of the process is shown in Figure 5. This RFP governs both a Call for White Papers as well as the Request for Proposals. Unique to the aims of OFRN is the intent to improve the general competitiveness of Ohio-based researchers and institutions, thus training is provided to applicants for both the white paper and proposal steps of the process. Out of state proposers are also eligible to participate in OFRN-sponsored training programs.

Table 2: Content Locations

Content	Section
White Paper Requirements	4
Proposal Training	5
Full Proposal Requirements	6



Figure 5: Solicitation Process Overview

3.7.2.1 Letter of Intent

Potential applicants are encouraged to submit a 1-page letter of intent to OFRN prior to developing a white paper. This is an optional step, but engagement with OFRN staff may help ensure compliance and alignment with RFP requirements. Letters of intent may be submitted by email to Paul Jackson at paul.jackson@wright.edu.

3.7.2.2 Questions

OFRN will receive questions until April 20 (i.e., one week before the proposal submission due date). OFRN plans to publish an FAQ prior to the proposal due date that will incorporate all directly submitted questions. All questions must be submitted in writing via e-mail with a subject line of "OFRN Round 3: SOARING Q&A". Questions must be submitted to both Paul Jackson at paul.jackson@wright.edu and Becky Mescher at becky.mescher@wright.edu,

The FAQ will be posted to <https://data.ohiofrn.org/FAQ.aspx>

3.7.2.3 Kickoff Conference

A project Pre-Kickoff Conference will be held after the selection of projects, but before execution of Round 3 awards. All Round 3 Full Proposal awardees and

appropriate representatives from their teams will be required to attend. The conference will include a review of each project with the awardees as a group to review project metrics and other selected projects.

Project modifications and determination of final project metrics will occur following the Pre-Kickoff Conference. OFRN will ensure all team members, federal contacts, and OFRN are aware of and agree to their respective roles, responsibilities, and deliverables.

3.7.3 Project Requirements

All proposed projects must abide by the following requirements.

3.7.3.1 Export Compliance Guidance

All projects should adhere to export control laws to ensure they apply appropriate export controls on all information, software and hardware, as required under the International Traffic in Arms Regulations and/or Export Administration Regulations. The use of export controlled information (software, hardware, etc.) is expected due to the scope and applications identified in this RFP. Applicants are responsible for managing export compliance and should check with their own compliance offices to they are clear on export control issues and how this relates to any work they propose. See Attachment 8.5 for additional details.

3.7.3.2 Open Source Requirement

All full proposal invitees must submit an open-source plan. All software, including hardware control, will need to be in an open-source language with commented code that is demonstrated to be stable. Programs that are based in proprietary software must publish their relevant code created as part of the supported R&D. The final project code must be publicly posted and tested outside of the awarded organization. Awardees are responsible at their own expense to ensure code meets reuse requirements. Code that is confidential, export controlled or restricted access is not be allowed.

3.7.3.3 Flight Demonstration Requirement

Projects from this RFP and subsequent demonstrations may be integrated into a larger demonstration aircraft targeted for 2022. Projects under AOI #7: Cryogenic Engines, Superconducting Magnetic Energy Storage (SMES), and Induction Motors require a flight demonstration test rig.

See Section 3.5 for additional details.

3.7.3.4 Flight Demonstration Process

All flight demonstrations will take place at the Ohio/Indiana UAS Center (UASC) and/or Calamityville noted in Section 3.5.

Applicants should detail how they will demonstrate their unique technology during a flight demonstration during a multi-day, public event (see Sections 4.4.3 and 0). Each proposer should seek to best demonstrate their project within a reasonable emergency scenario. They should propose a scenario that is realistic and would be of obvious value to a potential user of the capability, such as the Ohio National Guard. Teams are free to propose any reasonable scenario and would have different requirements depending on their demonstration needs. The demonstration can be remotely piloted or autonomous. Maintaining line of sight for testing is allowed.

All awarded teams:

- Will be part of an AFRL-sponsored Certificate of Authorization (COA) that will be determined after award pending FAA approval
- Must attend a local area training session at the Springfield-Beckley Municipal Airport before using the UASC for flight testing or demonstration flights
- Must be able to support an air worthiness process from COA partner (AFRL) which may include providing engineering, flight operator qualification, modification and test support documentation submission to OFRN and partners
- Must meet State or AFRL standard qualifications that will be processed after award and may include UAS pilot certification, and presentation of FAA flight-worthy documents
- Should budget for use of the UASC demonstration facilities

Depending on their technology, teams will have different requirements for different flight demonstrations. Teams flying in line of site can fly as regulated by the UASC site and within existing regulations.

Teams flying out of line of site will need to:

1. Have a minimum dash speed of 30 knots and maintain a minimum turn rate (degrees/second) that will be determined after award

AND

2. Integrate an ATC compatible transponder with certified Mode 3 and Mode C

OR

3. Operate in a Piccolo compatible OS that can provide real-time location information

3.7.3.5 Demonstration Aircraft

Teams may purchase or use an already owned aircraft. Teams are not expected to create a new platform, but rather to modify an existing platform or create new systems to be integrated into an existing platform. Aircraft selection must be reviewed and approved by OFRN before project work can begin.

4 WHITE PAPER REQUIREMENTS AND PROCESS

4.1 White Paper Process

Applicants are required to submit a White Paper in order for OFRN to assess alignment of potential projects with SOARING's goals. White Papers will be reviewed by the OFRN's Technical Review Council. White Papers deemed sufficiently aligned with the SOARING's goals will be invited to submit full proposals.

All white papers must be submitted by 2:00pm ET, February 21, 2018. White papers are to be submitted via email to Paul Jackson paul.jackson@wright.edu with Cc to Becky Mescher becky.mescher@wright.edu. All White Papers must follow the format and content instructions below.

4.2 Public Information

Lead Applicants are reminded that all information submitted in response to this RFP is public information unless a statutory exception exists that exempts it from public release (See Ohio Public Records Act in Section 149.43 of the Ohio Revised Code).

Exempted information (i.e., trade secrets, etc.) shall bear the marking "Proprietary Information". To the extent possible, proposals shall contain this marking in the header and footer of each page where proprietary information is included.

Applicants are strongly discouraged from including any proprietary information in their White Papers. If it is included, the White Paper should contain an attachment that lists all instances of proprietary information.

4.3 White Paper Formatting

4.3.1 General Formatting Requirements

All White Papers must be written in English and adhere to the following format. Non-conforming White Papers may be rejected without review.

- White Papers are to be submitted on 8.5 x 11-inch page size.
- Margins must not be less than $\frac{3}{4}$ of an inch on all sides
- Font must be 11 point or larger with no more than 6 lines per inch.
- All pages must be numbered consecutively using the format "Page [#] of [total number of pages]" (e.g., Page 2 of 6).
- The White Paper title and Lead Applicant name must appear at the bottom of each page.
- The White Paper must have the area of interest in the header of each page
- White Papers should not include color figures that cannot be understood when photocopied in black and white.
- The first page of the White Paper must be the Application Information Page found in Appendix
- Do not include a cover or cover letter other than the Application Information Page.
- White Papers must be submitted in PDF format.

4.3.2 Page Limits

White Papers shall not exceed 7 pages in length (5 pages of content, 1 cover page, and a quad chart depicting the overall program. The cover page is detailed in Attachment 8.1 and the Quad Chart in Attachment 8.2). The page limit includes all graphics, figures, and/or tables. Any pages beyond this limit will be eliminated from the White Paper before it is sent for review and evaluation. Except as otherwise noted, appendices or other methods to augment the information presented in the White Paper are not allowed. References to web-based information to supplement the White Paper are not permitted, and such references will not be considered in the evaluation.

4.4 White Paper Content

Unless otherwise noted, the White Paper must address all of the elements listed in this section in the following order.

4.4.1 Application Information Page

The first page of the White Paper must be the completed Application Information Page found in Attachment 8.1.

4.4.2 Concept

Prepare a project concept/abstract that summarizes the Lead Applicant's project. This section must minimize the use of jargon and technical language and be written so that a technologically literate but non-expert reader can understand it. The concept should clearly explain how the project aligns with federal needs (see Section 3.3). Suggested length: 1 page.

4.4.3 Work Plan and Demonstration

Provide a proposed work plan to achieve the concept and how this will be shown in an appropriate, competitive demo. Include a high-level budget for the project, including the sources and types of cost share. Suggested length: 1 1/2 pages.

4.4.4 Technical Metrics

Applicants should describe the metrics for their proposal and provide justification for why those quantitative metrics are competitive with the state-of-the-art. Proposals will need to place their technology or outcome into context, even if done with the assumption that the scaled development will be in the future. Suggested length: 1/2 page.

4.4.5 Economic Impact Metrics

Applicants should describe the likely economic impacts that could result from success of their project. These numbers should be realistic in nature. Applicants should pointedly include information on any new jobs they expect as well as any likely sources of federal follow-on funding. Suggested length: 1/2 page.

4.4.6 Team

Applicants should describe each team member and their directly relevant experience and assets. Details should be provided regarding the team's relationship with the relevant federal sponsor. Suggested length: 1 page.

4.4.7 Quad Chart

White papers should include a quad chart (see Attachment 8.2) that summarizes key elements of their proposed project. A downloadable template of a Quad Chart is also available at ohiofrn.org

4.5 White Paper Evaluation Criteria

Only applicants submitting the most meritorious and well-aligned White Papers will be invited to submit full proposals. White Papers will be evaluated by the OFRN's Technical Review Council (TRC) based on responsiveness to all the requirements of this RFP. Implicit in those requirements and evaluation criteria is the quality of the statement of work.

4.5.1 Federal Alignment

The white paper must demonstrate how applications/user driven requirements are derived from and aligned with the emerging mission and research focus areas of AFRL, NASIC, NAMRU-D, NASA-GRC, USMC, and/or TAG.

The project has an identifiable Government Sponsor/Partner at AFRL, NASIC, NAMRU-D, and/or NASA- GRC.

4.5.2 Cost Share

The level of committed cost share is a vital factor in evaluating projects. Cost share directly demonstrates the level of commercial and academic support for a project.

Factors in assessing cost share include:

- Magnitude

- Compliance with the minimum 1:1 requirement
- Any conditions associated with the cost share
- Type of cost share

4.5.3 Additional Factors

The following elements will be specifically considered in the review of the white papers.

- Alignment of the White Paper with SOARING's purpose, goals, objectives, eligibility and funding requirements.
- Compliance with this RFP's administrative requirements.
- Quality of the responses to the requirements of this RFP as outlined in the White Paper narrative.
- Likelihood of a project's success
- Expected impact of the technical metrics on the state of art
- Magnitude and likelihood to achieve proposed economic impacts, particularly new job creation and attraction of federal follow-on funding
- Experience, qualifications, and commitment of the project team
- Prior performance on an OFRN-supported project
- Degree to which a white paper leverages prior OFRN investments into the centers of excellence.
- Degree to which a white paper leverages or links with Ohio's aerospace supply chain.

The evaluation criteria are designed to support the mission and goals of the Ohio Federal Research Network and its programs.

5 PROPOSAL TRAINING

5.1 Overview

In order to be eligible to submit a full proposal, invited applicant teams must attend a mandatory training program. The training program will be conducted over four weeks (approximately March 22-April 20).

The program will mirror a light version of the NSF I-Corps process, with focus on testing and validating the problem-solution fit of the proposed technology. Attendees will work toward articulating a clear and compelling value proposition for at least one qualified target customer segment (e.g., military). Some of the included topics of the training:

- Value Proposition Canvas
- Doing business with or research for federal labs
- Proposal writing

5.2 Offsetting Costs

Each team invited to submit a proposal and attend training will be awarded \$3,000 to help offset any costs associated with the training.

5.3 Level of Commitment

Proposal training will occur over a four-week window:

- An in-person, all-day kick-off meeting will be held in late March 2018 (tentatively scheduled for March 22).

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- Following this event, teams will virtually meet twice per week: once for instruction (approximately 3 hours, total: 12), and once for private consultation with executive coaches, instructors and mentors (approximately 1 hour; total: 4)

It is expected that during the training program, teams will work on their proposals. The training will directly aid in the creation of the proposals. It is expected that, at the conclusion of the training program, participating teams will have built a draft of their technical volume (see Section 6.3).

6 PROPOSAL REQUIREMENTS AND PROCESS

6.1 Public Information

Lead Applicants are reminded that all information submitted in response to this RFP is public information unless a statutory exception exists that exempts it from public release (See Ohio Public Records Act in Section 149.43 of the Ohio Revised Code).

Exempted information (i.e., trade secrets, etc.) shall bear the marking "Proprietary Information". To the extent possible, proposals shall contain this marking in the header and footer of each page where proprietary information is included.

If a proposal includes proprietary information, the proposal must also include an attachment that lists all instances of proprietary information.

6.2 Submission Guidelines

The Technical Volume of all proposals must be submitted by 2:00 PM EST on **April 27, 2018** via email to Paul Jackson paul.jackson@wright.edu with Cc to Becky Mescher becky.mescher@wright.edu. Proposers must submit their accompanying Cost Proposal by 2:00 PM EST on **May 11, 2018**.

Proposals received after the due date and time will be rejected. It is the responsibility of applicants to ensure submission of a complete proposal based on all requirements of this RFP. Applicants are encouraged to submit their proposals early.

6.2.1 General Formatting Requirements

All proposals must be written in English and adhere to the following format. Non-conforming proposals may be rejected without review.

- Proposals are to be submitted on 8.5 x 11-inch page size.
- Margins must not be less than $\frac{3}{4}$ of an inch on all sides, except the required Gantt Chart
- Font must be 11 point or larger with no more than 6 lines per inch.
- All pages must be numbered consecutively using the format "Page [#] of [total number of pages]" (e.g., Page 2 of 6).
- FOOTER: The proposal title and lead applicant name must appear at the bottom of each page.
- HEADER: The proposal must have the Area of Interest in the header of each page
- Proposals should not include color figures that cannot be understood when photocopied in black and white.
- The first page of the proposal must be the Application Information Page found in Appendix
- Do not include a cover or cover letter other than the Application Information Page.
- Proposals must be submitted in PDF format.

6.2.2 Page Limits

Any pages beyond the page limits listed below will be eliminated from the proposal before it is sent for review and evaluation. Except as otherwise noted, appendices or other methods to augment the information presented in the proposal are not allowed. References to web-based information to supplement the proposal are not permitted, and such references will not be considered in the evaluation.

Section	Page Limit
Application Information Page	1
Executive Summary	1
Quad Chart	1
Alignment with Federal Needs and Leveraging Ohio’s Capabilities	1
Technical Summary	12
Commercialization Plan	4
Economic Impact Metrics	1
Performance on Prior OFRN Projects	1
Project Team	4
Biographical Sketches	5
Schedule	1
High Level Budget and Cost Share	1
Statement of Work (SOW)	5
Letters of Commitment	1 per letter

6.3 Volume I: Technical Volume

Unless otherwise noted, the proposal must address all of the elements listed in this section in the order requested.

6.3.1 Application Information Page

The first page of the proposal must be the completed Application Information Page found in Appendix.

6.3.2 Executive Summary

Executive summaries are limited to 1 page that precisely describes the innovation, proposed project objectives, and commercial goals. Executive summaries may include figures. This section must minimize the use of jargon and technical language and be written so that a non-expert can understand the specific innovation and impact of proposed project around that innovation.

6.3.3 Table of Contents

Prepare a Table of Contents with detail for all levels of headings requested in this RFP. This section should also include a list of Charts, Figures, and Tables that appear in the proposal with a page number for each. The Table of Contents does not count towards any page limitations.

6.3.4 Quad Chart

Proposals shall include a quad chart (see Appendix) that summarizes key elements of their project. A downloadable template of a Quad Chart is also available at ohiofrn.org

6.3.5 Alignment with Federal Needs and Leveraging Ohio’s Capabilities

Thoroughly discuss how the project addresses and aligns with one or more federal needs (see Section 3.3). Applicants must demonstrate the quality of their relationship

with the Government Sponsor(s). Evidence may include details of meetings or previous relevant working engagements

Additionally, discuss any unique university capabilities and/or assets being utilized to accomplish the project. Include a discussion of whether Ohio's relevant supply chain resources are, or could be a positive factor in achieving success for the proposed project. It is recommended that applicants review the following documents for some helpful context regarding Ohio's supply chain (these are available on ohiofrn.org):

- OFRN Playbook/ OFRN COE Decision Support Resource
- Unmanned Systems Cluster Analysis Fact Book

6.3.6 Technical Summary

This section should include the following:

6.3.6.1 Vision and Scope

Detail the overall goal and vision of the funded work with minimal jargon. Include an explanation of how the technology fits within the state-of-the-art. Provide relevant background needed to understand the context, scope, and purpose of the project.

6.3.6.2 Impact

Describe the potential impact of the project on the established state-of-the-art. In addition to technical impact, applicants should address how the project will impact Federal customer(s), the aerospace industry, and how it will help achieve SOARING's goal of making an Ohio a leader in developing UAS, PAV, and LDV.

6.3.6.3 Metrics

Provide a tabular list of technical performance/capability metrics including quantitative targets. These metrics will be used to measure the progress and success of the project. Providing references and sources in Literature Cited in support of the proposed technical metrics is strongly suggested.

6.3.6.4 Technical Approach

Describe the activities that are proposed to meet the project's technical metrics and objectives. The approach should align with and detail the Tasks listed in the SOW. Each task should be accompanied by narrative approach(es), resource(s) milestone(s), measurable objective(s), and outcome(s). Provide enough detail to establish feasibility and likelihood of achieving the proposed impacts and successfully demonstrating the technology. Include descriptions of key methods, facilities, and equipment either for the entire project, or under each task.

This section should also include details associated with the flight demonstration of the technology. See sections 3.7.3.3 and 3.7.3.4.

6.3.6.5 Risks

Identify key risks or challenges and proposed strategies to mitigate them. It is expected that projects may face and overcome substantial risk and challenges. Demonstrate the knowledge and expertise of the applicant team in foreseeing and overcoming these risks.

6.3.7 Commercialization Plan

Research-for-Development projects have the potential to generate new, commercially relevant products and/or IP. Proposals must succinctly describe the team's plans to support commercialization with the following sections.

6.3.7.1 Products, Customers, and Value Proposition

Describe the most likely commercial applications if the project is successful. Identify the most likely product(s) and customer(s) (e.g., level of the industry value system) to be targeted.

Provide a specific value proposition for all identified applications/products and customers. This section should clearly establish the differentiating benefits associated with the technology. Provide evidence for the value customers place on the benefits offered.

6.3.7.2 Business Model and Customer Readiness

Describe how the proposed innovations will be adopted by commercial customers, such as by licensing, product manufacturing, or selling services. Provide insight into how ready the customers are to adopt the new innovation. Describe required testing, demonstration, volume, geographical scope, or other considerations that govern customer adoption. Provide a forecast of the time and capital requirements necessary for market entry.

6.3.7.3 Management of Intellectual Property

Describe how the proposed innovations will be adopted by commercial customers, such as by licensing, product manufacturing, or selling services. Provide insight into how ready the customers are to adopt the new innovation. Describe required testing, demonstration, volume, geographical scope, or other considerations that govern customer adoption. Project time and capital requirements for market entry.

6.3.8 Economic Impact Metrics

This section of the Proposal's narrative must address the projected economic impact metrics that are anticipated as a result of the project. The lead applicant should specifically address the following primary metrics:

- New job creation
- Federal Follow-on funding

Job creation should be realistic and supportable. Federal follow-on funding and any other identified opportunities must include pertinent details--agency, BAA, etc. (see New Opportunities table below). The Lead Applicant should document how these projections were developed and key assumptions used in the analysis. For example, if the projections are based on capturing a particular share of the market, the Proposal should indicate the magnitude of the addressable market and the basis for the estimated market share. The Lead Applicant should report only direct impacts, not secondary or tertiary impacts derived from economic models.

Proposals may also include a description of any relevant secondary metrics, including:

- possible Industry-sponsored research
- companies to be created or attracted to Ohio;
- talent recruitment;

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- enhanced national and/or international recognition which leads to further interest and potential sources of funding and collaboration.

The following tables must be completed and included in the Economic Impact Metrics section of the Proposal (add rows as needed to the New Opportunities table):

	At Project End	By 2022
New Jobs to be Created		
Total Federal Follow-on Funding		

New Opportunities/ Investments	Amount	Type (BAA, Sponsor, etc.)	Timing of Opportunity

6.3.9 Performance on Prior OFRN Projects

This section is required only if the proposal is related to prior Ohio Federal Research Network projects, either technologically or because the lead applicant or collaborator worked on the prior project. The proposal must address any relevant information related to the past performance, including:

- Achievement (or not) of technical goals of the prior project
- Any major complications (and solutions) that arose during the prior project
- The originally proposed timeline and metrics for economic impacts (jobs, follow-on funding, etc.) as well as the economic impacts actually achieved to date

This section should be written such that a reviewer who is not familiar with the prior project(s) may assess any pertinent issues or impediments and independently evaluate the impacts on the performance results.

6.3.10 Project Team

This section of the proposal must contain information that addresses the subject matter delineated below.

6.3.10.1 Organizational Capabilities

Provide a description of relevant organizational experience, capabilities, facilities and equipment, and general financial state of the lead applicant and collaborators. Specifically include the qualifications of the organization leading the project. If a project is to be led by a non-Ohio company, that arrangement should be appropriately justified through this section’s narrative.

Provide detail sufficient to evaluate whether the team has the direct experience needed to perform the work being proposed. References to past projects should be limited to activities that have occurred within the past five years. Detail any ways in which the project leverages past OFRN investment into centers of excellence (COE). While COE involvement is not a requirement of SOARING, such involvement will be viewed positively in the review of proposals.

6.3.10.2 Team Qualifications and Management Plan

Identify the Project Manager and up to four other key personnel involved with the project team, their roles and responsibilities, and the rationale for their selection for key positions. Address how the key personnel will monitor and maintain progress, control quality, resolve problems, and obtain advice on key decisions

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about the technical and commercial dimensions of the project. Also provide information about the management reporting structure among key personnel and the lead applicant.

Discuss plans for internal means of communication, coordination of data and information management, evaluation and assessment of progress, allocation of funds and personnel, and other specific issues relevant to the proposed activities. Proposals with sub-awards must provide a description of the lead applicant's oversight plan for those sub-awards, including:

- Ensuring financial accountability, including the monitoring of expenditures and reporting on outcomes, for all sub-awardees; and,
- Ensuring adherence to the scope of work.

6.3.10.3 Biographical Sketches

Biographical information is limited to no more than five individuals whom the Lead Applicant considers key to the success of the project (each individual should be identified in responding to the previous section). Biographical sketches shall be no more than 1 page each, and one sketch must be included for each Key Personnel up to the total of five individuals. The biographical information should present the relevant work history, technical experience, commercialization experience, project management experience, educational attainment, honors and recognitions, and selected recent publications that relate directly to the subject matter of the proposed work.

6.3.11 Schedule

Provide a schedule that graphically displays the duration of tasks, interactions between the tasks, and the timing of deliverables and other key milestones (i.e., a Gantt chart). The schedule should be based on weeks or months from authorization to proceed, rather than on any firm, fixed calendar dates.

6.3.12 High Level Budget and Cost Share

Using the tables below, provide a high-level budget for the project. Provide a brief narrative that explains how the funds will be deployed over the life of the project. Add additional columns or copies of the cost share table as needed. As stated previously (see Section 3.5), teams with an existing platform are invited to use that system as part of their cost share, provided it is relevant to the proposed focus on enabling the future vision of UAS, LDV and PAV aircraft.

	OFRN Awarded Funds	Cost Share Funds
Personnel/Fringe		
Supplies		
Purchased Services		
Travel		
Other Direct Costs		
Subcontracts		
Indirect		
Total		

	Cost Share Provider #1	Cost Share Provider #2	Cost Share Provider #3	Cost Share Provider #4
Personnel/Fringe				
Supplies				

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Purchased Services				
Travel				
Other Direct Costs				
Indirect				
Total				

6.3.13 Statement of Work

In plain English, clearly define the technical tasks/subtasks to be performed, their durations, and dependencies among them. The SOW shall be detailed to work breakdown structure (WBS) level 3 and map to the Schedule (see Section 6.3.11). For each task/subtask, provide:

- A general description of the objective (for each defined task/activity);
- A detailed description of the approach to be taken to accomplish each defined task/activity;
- Identification of the primary organization responsible for task execution (prime, sub, team member, by name, etc.);
- The completion criteria for each task/activity – a product, event or milestone that defines its completion;
- A definition of all deliverables (reports, data, software, hardware, demonstration system elements, etc.) to be provided to the OFRN in support of the proposed research tasks/activities. Include expected delivery date for each deliverable.

Additional guidance:

- Do not include any proprietary information within the SOW
- Provide full technical descriptions of each task and task deliverable
- Include the team(s) performing work, work location and the Technical metric specifically addressed by each task.
- Final Flight demonstrations should be considered a task and not the final deliverable
- Tables and Figures are allowed

See APPENDIX for a template SOW.

6.3.14 Letters of Commitment

A Commitment Letter must be provided for the Lead Applicant and each collaborator. Commitment letters may not be longer than one page and may not include appendices or attachments. It is OFRN's expectation that a letter from a project's Government Sponsor/partner will not be included in proposals. Commitment letters must meet each of the following requirements:

- Be submitted on the letterhead of the organization;
- Include the name of the Lead Applicant;
- Briefly state the nature and the duration of the relationship;
- State the specific amount and type of the cost share (cash, etc.);
- Define the source(s) and use(s) of funds committed;
- State the time period during which the committed cost share will be available to the project;
- If applicable, state any resources other than cost share that the organization is committing to the project;
- Be dated and signed by a representative of the organization with the authority to make the cost share commitment.

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General support letters are not allowed. Any such letters submitted will be removed from the proposal and not transmitted to the TRC.

6.4 Volume II: Cost Proposal

All forms referenced in this section may be downloaded from ohiofrn.org. Additional instructions for completing the Cost Proposal may be released during the course of the RFP process.

The Lead Applicant is responsible for developing a cost proposal that provides OFRN appropriate understanding of the proposed use of funding, cost share contributions, and indirect charges being applied (the latter of which may not exceed 20%). The cost proposal should have minimal narrative content.

6.4.1 Forms

Complete and include the Vendor Profile Form and Payment Compliance Form. If your organization has a government-approved accounting system, please prepare your proposal on a Cost Contract basis. If not, please propose on a Time and Material (T&M) basis.

- Include a statement as to whether your organization has an approved accounting system. Include a copy of the approval letter
- Include a statement as to whether your organization has an approved purchasing system. Include a copy of the approval letter.
- Include a statement as to whether or not your indirect rates are federally approved. Include a copy of the approval letter.

6.4.2 Schedules

A complete Cost Proposal will include the following schedules:

Schedule #	Content
1	Lead Applicant Cost Justification
2	Collaborator Cost Justification
3	Organization Cost Share
4	Cost Share Summary

Schedule 1 provides the necessary detail to justify the listed costs of the Lead Applicant. Each tab should be completed in full.

Schedule 2 provides the necessary detail to justify the listed costs of a project Collaborator/subcontractor over several tabs. A completed Schedule 2 must be provided **for each** collaborator/subcontractor associated with a project.

Schedule 3 provides cost share and summary budget information. A completed Schedule 3 should be provided for the lead applicant as well as each Collaborator/subcontractor.

Schedule 4 provides a project-level summary of costs, split between OFRN and Cost Share. A single Schedule 4 should be completed for the project. Note that Schedule 4 is in effect a summation of all Schedule 3's.

7 PROPOSAL EVALUATION CRITERIA

Only the most meritorious proposals are sought for funding. Proposals will be evaluated by the OFRN's Technical Review Council based on responsiveness to all the requirements of this RFP. Implicit in those requirements and evaluation criteria is the quality of the statement of work and budget.

7.1 Go/No Go Criteria

7.1.1 Alignment

The proposal demonstrates how applications/user driven requirements are derived from and aligned with the emerging mission and research focus areas of AFRL, NASIC, NAMRU-D, NASA-GRC, USMC, and/or TAG.

The project has an identifiable Government Sponsor at AFRL, NASIC, NAMRU-D, and/or NASA- GRC.

There is a demonstrated relationship with the Government and Industry Sponsor(s), either as the result of documented development meetings or previous relevant working engagements.

7.1.2 Cost Share

The level of committed cost share is a vital factor in evaluating projects. Cost share directly demonstrates the level of commercial and university support for a project. Factors in assessing cost share include:

- Magnitude of the cost share
- Compliance with the minimum 1:1 requirement
- Any conditions associated with the cost share
- Type of cost share

7.2 Additional Factors

The following elements will be specifically considered in the review of the proposals.

- Technical approach: proposals must provide a clear description of the project's technical objective, expected outcomes, and how those outcomes benefit Federal research centers and industry members. Specific factors that will be considered include, but are not limited to:
 - If the research objective advances knowledge and extends the state-of-the-art
 - Quality and reasonableness of the proposed technical approach with quantitative metrics connected
 - Deliverables, major milestones, and costs along with potential risks and mitigation strategy.
- Quality and reasonableness of the commercialization strategy
- Experience and qualifications of the project team
- Project's plan to capitalize on Ohio assets – personnel, small businesses, test capabilities, university assets
- Project's plan for federal follow on funding and/or industry sponsored research or commercial market opportunities
- Capitalization on OFRN-supported projects and teams
- Degree to which a proposal leverages or links with Ohio's aerospace supply chain
- Reasonableness of the proposed project schedule, budget, and SOW
- Presence of an IP Sharing Template

8 ATTACHMENTS

This RFP includes the following Attachments.

#	Attachment Title
8.1	Application Information Page

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8.2	Quad Chart Template
8.3	Quad Chart Example
8.4	OFRN Document Repository Access
8.5	Security and Export Control Considerations
8.6	SOARING Alignment with AFRL STAT BAA
8.7	NASA GRC
8.8	Cost Share Guidelines
8.9	Cost Share Schedules
8.10	SOW Template

8.1 Application Information Page

COE NAME: (enter N/A if not affiliated with a COE)

PROJECT NAME:

1. Summary description of project being proposed	
2. Description of Federal research requirement (s)	
3. Government POC (Include Phone & Email)	
4. List of University Team members and leads at each U	
5. List of industry team members and leads at each	
6. Cost share listed by source (Industry, University, Other)	
7. Additional potential new funding by organization and timing	
8. Amount of funding requested for the project by year	
9. Number of new jobs to be created by 2022	
10. Background IP contributed – Y/N (State what it is and who owns it)	
11. Anticipated Project IP created - Y/N (State who will own it)	

8.2 Quad Chart Template



OFIRN Confidential

COE Name— Project Title

Technical Concept & Approach

- Place overview graphics here
(this quadrant should be ~85% graphics, 15% text)
- Illustrate what you are trying to do.
 - What is the problem you seek to address?
 - Why is this challenging?

Project Requirement, Federal Alignment, Sponsoring Organization (s)

- Identify the Government Sponsor(s) and their formal requirement.
- Elaborate on the potential impact on Government Sponsor(s) mission.
 - What is, and what are the limitations of, current practice?
 - What is new in your approach?
 - Summary of benefits for the Government Sponsor(s).

Team & Economic Impact For State of Ohio

- Identify Team members
- Elaborate on potential economic development impact for the state of Ohio.
 - Including jobs, additional research (federal grants, sponsored research, etc.)
- Identify commercial impact industry/sector/business partners.

Budget, Schedules, Deliverables, & Risks

- Requested Budget Total: [\$] (per member and project totals)
- Year 1: [\$], Year 2:[\$] (project yearly total only).
- Period of Performance: [months].
- Milestones: [up to 4].
 - Add highlights of your research plan.
- List Deliverables.
- Identify key technical risks.

8.3 Quad Chart Example

An example Quad Chart will be made available at <http://ohiofrn.org>

8.4 OFRN Document Repository Access

To access this portion of the site, navigate to: www.ohiofrn.org

Step 1: Click "Login" (Located at top right)

Step 2: Login (If you do not have a login, you may create one by selecting the link below the Blue Log In button titled "If you do not have a login, please register first").

*Note: Some files will have restricted access. Contact Ms. Becky Mescher at becky.mescher@wright.edu if you need assistance.

8.5 Security and Export Control Considerations

Security and Export Control

Under US export laws a "U.S. Person" is defined as any US citizen or any person who is a lawful Permanent Resident and a "Foreign Person" is any individual who is not a lawful Permanent Resident or U.S. Citizen. As a general rule, all funded participants in the OFRN Program must be U.S. Persons unless the partner organizations – AFRL, NASIC, NAMRU-D or NASA-GRC – permit Foreign Persons to participate pursuant to their Export Control policies and procedures. Participants must submit documentation from the partner organization authorizing deviations to the requirements below with their proposal in order to be considered for award. It is the obligation of the COE to ensure the compliance of each project with the applicable partner organization's Export Control policies and regulations. Specifically, the guidelines we will use for the White Papers are:

1. For projects proposed against NASIC or AFRL requirements, Foreign Persons cannot be involved in any capacity – regardless of their position as a professor or student. Temporary work or student visas do not permit categorization as a "U.S. Person."
2. For projects proposed against NASA-GRC requirements, NASA-GRC personnel cannot work directly with any Foreign Person of 'designated' countries, but may communicate appropriate information through a designated university person who acknowledges he/she is understanding of ITAR/EC requirements and will not pass any export-controlled information to the requesting person from the university. For Air Force, Navy and NASIC projects the projects must follow the following guidance:

For Air Force, Navy and NASIC projects the projects must follow the following guidance:

Air Force, Navy and NASIC Export Control Requirements will apply:

1. Export Control: Information involved in this research effort will be subject to Export Control (International Traffic in Arms Regulation (ITAR) 22 CFR 120-131, or Export Administration Regulations (EAR) 15 CFR 710-774). It is anticipated that export control will be applicable to all task orders; therefore, Export Control applies to all task orders to be awarded under this IDIQ. A Certified DD Form 2345, Militarily Critical Technical Data Agreement, is required to be submitted with proposal.
2. Export-Controlled Items: As prescribed by DFARS 225-7901-4, DFARS 252.225-7048, "Export- Controlled Item (JUN 2013)" is contained in this solicitation (as shown below). This clause shall be contained in ALL solicitations and resulting contracts.

EXPORT CONTROLLED ITEMS (JUNE 2013)

- a. Definition. "Export-controlled items," as used in this clause, means items subject to the Export Administration Regulations (EAR) (15 CFR Parts 730-774) or the International Traffic in Arms Regulations (ITAR) (22 CFR Parts 120-130). The term includes:
 - i. "Defense items," defined in the Arms Export Control Act, 22 U.S.C. 2778(j)(4)(A), as defense articles, defense services, and related technical data, and further defined in the ITAR, 22 CFR Part 120.
 - ii. "Items," defined in the EAR as "commodities", "software", and "technology," terms that are also defined in the EAR, 15 CFR 772.1.
- b. The Contractor shall comply with all applicable laws and regulations regarding export-controlled items, including, but not to, the requirement for contractors to register with the Department of State in accordance with the ITAR. The Contractor shall consult with the Department of State regarding any questions relating to compliance with the ITAR and shall consult with the Department of Commerce regarding any questions relating to compliance with the EAR.

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- c. The Contractor's responsibility to comply with all applicable laws and regulations regarding export-controlled items exists independent of, and is not established or limited by, the information provided by this clause.
- d. Nothing in the terms of this contract adds, changes, supersedes, or waives any of the requirements of applicable Federal laws, Executive orders, and regulations, including but not limited to—
 1. The Export Administration Act of 1979, as amended (50 U.S.C. App. 2401, et seq.);
 2. The Arms Export Control Act (22 U.S.C. 2715, et seq)
 3. The International Emergency Economic Powers Act (50 U.S.C. 1701, et seq.);
 4. The Export Administration Regulations (15 CFR Parts 730-774);
 5. The International Traffic in Arms Regulations (22 CFR Parts 120- 130); and
 6. Executive Order 13222, as extended.
- e. The Contractor shall include the substance of this clause, including this paragraph (e), in all subcontracts.

(End of clause)

For NASA-GRC sponsored research, funded participants must comply with the NASA-GRC export control and foreign national collaboration summarized below.

NASA-GRC Rules on Transferring Export Controlled information

1. The sharing of technical data under the International Traffic in Arms Regulations (ITAR) or the sharing of technology under the Export Administration Regulations (EAR) with foreign entities is an export
2. NASA-GRC will transfer export-controlled information to a foreign entity provided NASA-GRC has a legal obligation to do so (Ex: international agreement, contract, MOU, etc.)
3. Approval by the cognizant NASA-GRC Center Export Administrator (CEA) is required prior to exporting technical data or technology to a foreign entity
4. If there is a Space Act Agreement, a corresponding export license, or license exemption or exception in-place allowing for the sharing of export-controlled technical data/technology, the CEA will verify that the export request meets the exact parameters in those documents.
5. Upon the CEA's approval, the technical data or technology can be exported per the terms and duration of the authorization

NASA-GRC General Rules on Transferring Publicly Available Information

- NASA-GRC can work with a foreign national employed by the external partner on a contract, grant, or space act agreement without restriction provided that the technical data/information that is exchanged is deemed to be publicly available or fundamental research and provided that the foreign national is not from a designated country
- NASA-GRC refrains from working with foreign nationals from designated countries even if the technical data or technology is publicly available or deemed to be fundamental research
- A foreign national who is a Lawful Permanent Resident is deemed to be a U.S. Person and NASA-GRC can work with that individual relative to technical data and technologies that are export controlled. The LPR can have access to export controlled technical data and technologies on a need to know basis.

8.6 SOARING Alignment with AFRL STAT BAA

Federal customers communicate their requirements in multiple ways, one of which is in broad agency announcements (BAA). AFRL's Science and Technology for Autonomous Teammates (STAT) program (AFRL BAA FA8650-17-S-6001) is one example. SOARING requirements are based on the technologies and requirements of AFRL STAT.

Purpose of AFRL STAT. AFRL STAT funds demonstrations of modular, transferable, open system architectures, and delivery of autonomy technologies applicable to a wide spectrum of multi-domain applications. Development efforts will mature a set of technologies that enable airmen to plan, command, control, and execute missions with manageable workloads.

The AFRL STAT in particular effort features 8 important research areas of interest, listed below, which include needs for both technology maturation and integration. The research Areas for STAT are:

1. **Mission Planning and Debrief.** STAT research is required to enable platforms to receive information generated during the mission planning process. Platforms must provide relevant information during the debrief process, without causing extension of the mission cycle timelines or requiring increased manpower. This area develops the capability for STAT-enabled systems to take in information about the mission plan (including mission contracts, contingencies, targets, frequencies, etc.) that will be necessary to react appropriately and autonomously to events and commands during mission execution. This area is critical for MDC2, ISR PED, as well as manned-unmanned teaming.
2. **Flight Operations.** Autonomous platforms must be able to safely aviate and navigate in military airspace with other aircraft, manned and unmanned. They must monitor their own state of health and performing the appropriate actions to ensure safe flight. The platforms must perform basic flight operations to include automated flight modes, flight safety, survivability, and energy resource management.

Autonomous vehicle functions enable the execution of mission taskings that span overall mission phases and kill chain elements. These elements are intended to execute the desired vehicle response commanded from other subsystems such as dynamic mission planning. Air and ground collision avoidance capabilities are required, adaptable to varying aircraft capabilities in maneuverability, sensors, and datalinks.

Flight Operations is responsible for ensuring continued, safe operation in the presence of flight-critical failures and degradations. It is also responsible for ensuring continued, safe execution of mission tasking in the presence of mission-critical guidance, navigation, and control system failures and degradations.

3. **Communication and Datalinks.** Communication and data links are responsible for processing, passing, and coordinating messages both onboard and between external communication nodes. Technologies are required for dynamic networking capabilities within the full spectrum of communications control and intelligent management of the dissemination of information (the how, when, and how much to communicate in a given environment agnostic of any singular communications medium). This area supports MDC2, ISR PED, and manned-unmanned teaming.
4. **Human Interfaces.** Human interfaces and decision aids enable humans to team with autonomous systems, leveraging the advantages of both human intelligence and machine intelligence. Human interfaces with autonomy platforms must be intuitive and simple to use. Direct supervision of all decisions cannot be required. Interfaces provide human awareness and understanding of autonomous system decisions with minimal display clutter, through tailorable human-machine interfaces. Interfaces should effectively alert the operator when human action is required. This area is critical for MDC2, ISR PED as well as manned/unmanned teaming.

5. **Multi-Domain Mission Operations.** Multi-Domain Mission Operations is focused on mission execution and operation of mission systems. Major components include:
- Situation understanding through robust sensor exploitation, data analysis, and information sharing
 - Dynamic mission planning for contingencies
 - Multi-domain command and control

Robust sensor exploitation is essential for autonomous, closed-loop decision making in a complex mission environment. Effective sensor integration is critical in autonomous vehicles, command and control, and the processing, exploitation, dissemination (PED) process. Situational understanding must provide detection, geo-location, identification, and tracking of target and threats. Situational awareness must integrate sensing sources, traditional single and multi-INT fusion, and distributed and cooperative techniques. It must operate over a large breadth of operating conditions.

Dynamic mission planning determines how to achieve commanded mission effects. It includes:

- Task assignment and scheduling across mission contingencies
 - Multiple manned and unmanned systems,
 - Route planning, and
 - Re-planning.
 - Dynamic mission planning and re-planning;
 - At vehicle, team, and battlespace levels.
 - Achieving coordinated effects
 - With heterogeneous assets in air, space, and cyber domains.
6. **Executive Functions.** Executive Functions provide high-level reasoning capabilities and a goal-prioritization service based on Commander's Intent. Executive Function research should support an agent-based model for an Observe, Orient, Decide, and Act Loop (OODA-loop).

Information about the operational environment will need a common state representation that allows for rational decision-making based on mission plans and current mission status.

Decisions made by the machine will include:

- Determining what information must be shared with human operators,
- When new self-tasking should occur based on opportunity or necessity,
- Planning new possible Courses of Action that achieve Commander's Intent, and
- Responding to a dynamic battlespace that requires adaptive behavior, such as real-time schedule changes and route planning.

This area is critical for MDC2, ISR PED as well as manned-unmanned teaming.

7. **System Integration.** Technology components and capabilities developed must be integrated with and demonstrated in USAF mission applications. Components should be as platform-agnostic as possible, adaptable to different capabilities, sensors, datalinks, etc. with minimal modification. Systems engineering activities are needed to determine functional, physical, and interface architectures, including allocation of tasks between humans and system autonomy.

This activity includes Open System Architecture and Open Technology Development to ensure common interfaces and standards where appropriate. The architectures shall determine how the autonomy functions will be allocated and instantiated, how components will interact, the processing power required, and the information storage/access issues that arise from having distributed autonomous decision-making across multiple platforms and agents.

8. **Test and Evaluation, Verification, and Validation Techniques.** Autonomous behaviors developed require verification, validation, and test and evaluation. Test events will stress the response of complex autonomous systems to both planned and unplanned events. Such testing requires cutting edge non-traditional verification and validation techniques. Formal methods specification, simulation-based research and development, and analysis are included in these techniques. Modeling & Simulation (M&S) activities will demonstrate technology readiness, air worthiness certification, and/or cyber-security authorization in coordination with existing in-house government M&S activities and support multiple, iterative field or flight test evaluation efforts. This area is critical for all autonomy research in MDC2, ISR PED and manned-unmanned teaming.

8.7 NASA GRC Assets and Technical Guidance

NASA-GRC supports programs and projects directly relevant to SOARING's goals. All proposers are encouraged to explore NASA programs and published documentation. A specific, longer term goal of OFRN is for flight demonstrations to eventually include NASA-GRC's T34 program. The T34 program is based on an aircraft that NASA has used to demonstrate different communications schema and will be available for broader unmanned testing by late 2019. Many technologies selected in this proposal will likely be part of future demonstrations that include the T34 directly as part of a larger demonstration. Additionally, NASA-GRC has conducted a significant amount of research into key areas of need in future unmanned systems and their integration into the national airspace that proposers should consider. This research includes work on electric systems/motors, communications, and onboard energy:

- **Electrical Systems:** In addition to the fundamental work at NASA-GRC, the NASA-GRC's Cryogenic High Power Density Motors (see <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20060003628.pdf>) and NEAT Electric center provide some of the expected directions for next generation systems. Specifically, from the NEAT Test Bed description:
"As large airline companies compete to reduce emissions, fuel burn, noise, and maintenance costs, NASA expects that more of their aircraft systems will shift from using turbofan propulsion, pneumatic bleed power, and hydraulic actuation—to using electrical motor propulsion, generator power, and electrical actuation. This requires new flight-weight and flight-efficient powertrain components, fault tolerant power management, and electromagnetic interference mitigation technologies. Moreover, initial studies indicate that some combination of ambient and cryogenic thermal management and bus voltages that are high in comparison to the state of practice will be required to achieve a net system benefit."
See: <https://www.nasa.gov/feature/it-s-electric-nasa-glenn-engineers-test-next-revolution-aircraft>
- **Communication:** Future unmanned systems require integration of systems into the existing National Airspace (NAS). However, it is expected to have complexity associated with its integration. Specifically from a NASA-GRC study on unmanned communications:
"The safe, routine, and efficient integration of UAS into the NAS requires new radio frequency (RF) spectrum allocations and a new data communications system which is both secure and scalable with increasing UAS traffic without adversely impacting the Air Traffic Control (ATC) communication system. These data communications, referred to as Control and Non-Payload Communications (CNPC), whose purpose is to exchange information between the unmanned aircraft and the ground control station to ensure safe, reliable, and effective unmanned aircraft flight operation."
See: <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20140010365.pdf>
- **Onboard Energy:** As UAS, PAV, and LDV systems continue to evolve, novel approaches to energy management, energy storage, and energy generation will be critical. Specialized and novel technologies of real interest in aircraft energy will need to be balanced against profitable flight realities. Specific to future aircraft, NASA-GRC in a presentation has summarized some of the key needs:
"For large hybrid electric or all-electric commercial airplane, 4-5x increase in power density of solid oxide fuel cell and specific energy or batteries is required, along with long-term durability. Faster charging time for batteries and heating time for solid oxide fuel cell is required. Multi-functionality can reduce weight of overall structural system containing power conversion and energy storage. Integration with aircraft is a challenge and must be addressed early on with demonstration on smaller airplane"
See <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20160010280.pdf>

8.8 Cost Share Guidelines

Cost Share is an evaluation criterion for OFRN projects for two reasons. First, it shows that the Lead Applicant and its partners are fully committed to the success of the proposed projects. Second, it increases the level of resources that are available to support the execution of a project. For example, if the Lead Applicant is granted \$1M in funding by the OFRN and the Lead Applicant has been able to arrange for \$1.5M in committed cost share, then the total effective budget to perform the work is \$2.5M. Accordingly, each proposal must clearly describe how the identified cost share will be used to support execution of the project.

If awarded a contract, Lead Applicant will adhere to the following Cost Share requirements governing its identification and use for project expenditures. Ideally OFRN leadership would expect Industry cost share to pay for its expenses related to the project research.

8.8.1 Types of Cost Share

Cash Cost Share is defined as monetary expenses for allowable costs:

- 1) incurred by the contractor as an integral part of the activities described in the proposal, as amended, during the term of the project(s);
- 2) charged to accounts of the contractor other than accounts funded from State of Ohio General Revenue Funds (GRF); and
- 3) Documented within the financial books of the Contractor. This would include monetary resources contributed directly to the Contractor or to a parent organization by a third party for support of the Contractor and used in furtherance of the project(s).

In-Kind Cost Share is defined as the value of contributions, goods, or services: (1) donated to the project during the term of the project; (2) received by the Contractor in the period to which the cost share applies and used in furtherance of the project(s); and (3) cannot be traced through the financial books of the Contractor. The following are types of services and donations that count as In-Kind Cost Share:

- 1) Volunteer services are unpaid contributions provided to a Contractor by individuals or entities and will be valued at rates consistent with those ordinarily paid for similar services in the Contractor's organization. If the Contractor does not have employees performing similar work, the rates will be consistent with those ordinarily paid by other employers for similar work in the same labor market. A reasonable amount for fringe benefits may be included in the valuation.
- 2) Donated services occur when an employer other than the Contractor furnishes the services of an employee in the employee's normal line of work free of charge for Project activities. The services will be valued at the employee's regular rate of pay including fringe benefits up to 30 percent of salaries.
- 3) Donated supplies or materials are supplies or materials donated to the Project by a third party. The contribution will be valued at the market value of the supplies or materials at the time of donation.
- 4) Donated use of equipment or space occurs when a third party donates the use of equipment or space in furtherance of the Project. The contribution will be valued at the fair rental rate of the equipment or space.
- 5) Donated equipment, buildings, and/or land are real and personal property donated by a third party in furtherance of the Project, where title passes to the Contractor. The contribution will be valued using the fair market value of the property at the time of donation.

Committed Cost Share must clearly explain how its use supports the execution of the project and must be documented in a letter from an authorized representative of the provider stipulating the nature and valuation of the cost share.

Contingent Cost Share can be either Cash or In-Kind Cost Share that is dependent upon another event, such as the receipt of a contract, to be realized. While these circumstances are outside of a proposer's control, Contingent Cost Share may be included in a proposal, but it must be shown separately from the Committed Cost Share. The documentation of this type of cost share must still show how it supports to the execution of the project; must have a supporting letter of commitment; and must also explain what effect the loss of the Contingent Cost Share will have on the project's timeline and deliverables in the event that it is not realized.

If there are other types of support that a Contractor deems to be Cost Share, then this must be reviewed and approved by the OFRN-WSARC in writing to be able to be included in the Project(s) as Cost Share.

8.8.2 Counting Contracts as Cost Share

The focus of the OFRN is to grow new collaborative research efforts across Ohio, so only those contracts or newly funded programs directly resulting from the OFRN investments may be counted as Committed Cost Share. Neither Cash nor In-Kind Cost Share may count towards satisfying this requirement if the Cost Share has been, or will be counted towards satisfying a Cost Share or Matching Funds requirement of another State award.

The valuation of Cost Share proposed by the Lead Applicant is based on what is committed and documented from known sources and available at the time of awarding, with no contingencies or conditions.

8.8.2.1 Documenting Cost Share

The documentation for both Cash and In-Kind Cost Share must include the company or institution name and address, the nature and value of the Cost Share, and the method of valuation. For example, documentation for Cost Share based on the value of a membership must also include the term of membership. The Contractor is to retain letters of commitment or a membership form or agreement signed by an authorized official of the contributing member and by the Contractor. Further, the Contractor must also maintain documentation sufficient to verify all reported Cost Share, including the nature and value of the contributions and how these were calculated.

8.8.2.2 Reporting Cost Share

- 1) The method and frequency of reporting Cash and/or In-Kind Cost Share will be specified in the Agreement.
- 2) An itemized listing of eligible Cost Share attributed to the Project(s) during the Project's Period is to be included in the Cost Proposal

8.8.3 Recovering Foregone Indirect Costs as Cost Share

To receive funding under this program, a participating university must:

- 1) Accept a cap on Indirect Charges (IDC) or (F&A) of 20% on Direct Labor and Other Direct Costs (ODCs), excluding Travel and Material expenditures.
- 2) If F&A greater than 20% is claimed, then additional Committed Cost Share must be documented that is equal on a dollar-for-dollar basis to the funding

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amount in excess of 20%.

- 3) Ensure that no portion of the OFRN funding is used to provide bonuses, incentive compensation or rewards.

The following illustrate the application of these provisions:

- 1) If the normal F&A rate for the proposing university is greater than 20%, then the difference can be counted as committed cost share.
For example, if the normal F&A rate is 50% then on funding of \$100,000, the university can recover \$20,000 in F&A and attribute \$30,000 as Cost Share.
- 2) If a university chooses to apply an F&A rate greater than 20%, then it must provide additional Cost Share that is a dollar-for-dollar match for the amount that will be funded in excess of the 20% limit.
From the example above, the university can apply their normal 50%, but must identify and contribute an additional \$30,000 in Cost Share.

8.9 Cost Share Schedules

All Cost Share Schedules are available for download at <http://ohiofrn.org>

8.10 SOW Template

A SOW Template will be available for download at <http://ohiofrn.org>