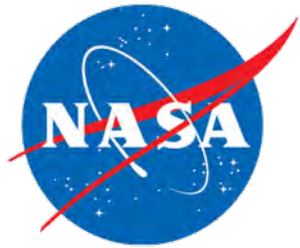# OHIO FEDERAL RESEARCH NETWORK

Defense/Aerospace Workforce Development Initiative

2016 Annual Report to the
Ohio Department of Higher Education

31-Oct-16

OHIO FEDERAL RESEARCH NETWORK

Defense/Aerospace Workforce Development Initiative

LETTER TO THE CHANCELLOR

Chancellor John Carey
Ohio Department of Higher Education

October 31, 2016

It is with great pleasure that we submit the first Annual Report for the Defense/Aerospace Workforce Development Initiative funded through Ohio HB 64 of the 131st General Assembly. Referred to as the *Ohio Federal Research Network (OFRN),* this remarkable initiative represents our state's most innovative collaboration between Ohio's research universities, industry and Ohio's key federal labs.

Driven by the requirements of the national labs, the OFRN investments are intended to grow federal research spending in Ohio; advance research initiatives aimed at emerging Department of Defense and NASA requirements; enhance university collaborations with Ohio-based small and medium size companies to engage them in innovation; create jobs in Ohio for government and industry-related activities; and most importantly have a broad and significant impact on Ohio's economy.

The OFRN proposal and project management processes and procedures are now in place and exciting collaborative research initiatives are well underway. The OFRN has *competitively awarded a total of $15.6 million* spread across *eighteen projects* at all six OFRN Centers of Excellence; and done so through a robust and highly competitive process. The research projects are all *aligned with the strategic research priority areas* of the Air Force Research Laboratory, Naval Medical Research Unit – Dayton, National Air and Space Intelligence Center, and the NASA Glenn Research Center and have included *11 universities, 52 industry partners* in addition to the national labs. Based on our current schedule, we plan to move forward with the Challenge Problem set with The Adjutant Generals Office in spring 2017. Our next step forward is to further leverage the OFRN investment with additional research opportunities, all designed to meet our stated goals. In addition to this first Annual Report, we remain committed to providing regular updates for you and your staff as well as other key groups including the Research Officers Council and the Ohio Aerospace and the Aviation Technology Committee.

In closing, the OFRN has been successful because of the incredible collaboration with ODHE, JobsOhio, the Ohio Third Frontier, and the Governor's Office. The Ohio Third Frontier Office also deserves special recognition and our thanks for their assistance in the establishment of the Proposal Review process through the OFRN Technical Review Council. And finally, we would like to recognize the leadership and research teams at the Federal Laboratories for their incredible support and day-to-day interaction with the researchers and leadership of this initiative. These partnerships are the key to our continued success for Ohio.

Sincerely,

Dennis Andersh
CEO
Wright State Applied Research Corporation

Martin P. Kress
Assistant Vice President for Research
The Ohio State University

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BACKGROUND

The Ohio Federal Military Jobs Commission (OFMJC) tasked Wright State University and The Ohio State University in November 2014 to frame a requirements-driven R&D initiative that would address emerging mission requirements for the US Air Force and NASA in which Wright Patterson Air Force Base (WPAFB) and NASA Glenn Research Center (NASA-GRC) play significant roles. The key goals were to (1) leverage the State of Ohio's investment, (2) capitalize on federal and university research assets, (3) integrate Ohio firms and industrial partners into the proposed projects aligned with operational user needs, (4) better prepare and train universities and firms in Ohio to compete for federal funding, (5) facilitate the transition of government funded technology to commercial markets, (6) create the jobs, processes and firms of tomorrow in Ohio, and (7) which may be the most important, to differentiate Ohio from other states relative to its commitment and support of our national defense and civil space missions.

Figure 1 DoD/NASA Priorities

The 2015 strategic planning effort resulted in the organization of Ohio's universities and community colleges around the future research priorities of WPAFB and NASA-GRC through the creation of the Ohio Federal Research Network (OFRN). The OFRN projects and activates were directly aligned with WPAFB and NASA-GRC strategic priorities, see Figure 1, and both of these organizations provided university researchers with insights into the requirements for each of the priority research areas. The OFRN investment is being utilized as seed funding and the catalyst for additional federal procurement and industry sponsored research. The OFRN also provides an impetus for the state's leading research universities to frame a new requirements-focused/application-oriented set of projects and activities that will stimulate economic development and job creation here in Ohio.

As a result of the above referenced strategic planning process in collaboration with the members of the OFMJC, the State supported the establishment of the OFRN to leverage federal, university, and commercial capabilities to support the future of WPAFB and NASA-GRC, while retaining and creating new jobs within Ohio through HB 64 of the 131st General Assembly. On 10 December 2015, the Ohio Department of Higher Education contracted out the management of the Defense/Aerospace Workforce Development Initiative to the Wright State Applied Research Corporation (WSARC).

There are currently 11 Ohio Research Universities and 52 Ohio Industry Partners (28 Small Businesses; 24 Large Businesses) engaged in the OFRN research activities. This number is likely to expand if this initiative is supported within the Governor's next budget submission. Universities included at present are: Case Western Reserve University, University of Cincinnati, University of Dayton/University of Dayton Research Institute, University of Akron, Ohio University, University of Toledo, Youngstown State University, the Air Force Institute of Technology, The Ohio State University, and Wright State University/Wight State Research Institute. OFRN also has a subcontract in place with Cleveland State University and Lorrain County Community College for support of its commercialization and workforce development activities.

For an in-depth background on the strategic planning of this initiative and the overall HB 64, 131st General Assembly guidance, please read the Ohio Federal Military Jobs Commission Annual Report to Governor John Kasich dated 31 December 2015. http://ong.ohio.gov/OFMJC.html

STRATEGIC INTENT OF THE OHIO FEDERAL RESEARCH NETWORK

The OFRN was established to:

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

Figure 2 DoD/NASA TRL Levels

- Align Ohio's research universities and community colleges around the priority research initiatives of AFRL, NAMRU-D, NASIC and NASA-GRC that create external investment and business opportunities for Ohio.
- Establish a major focus on transitioning research advancements and technologies to operational domains and Ohio firms for both the federal government customer and commercial sector where relevant.
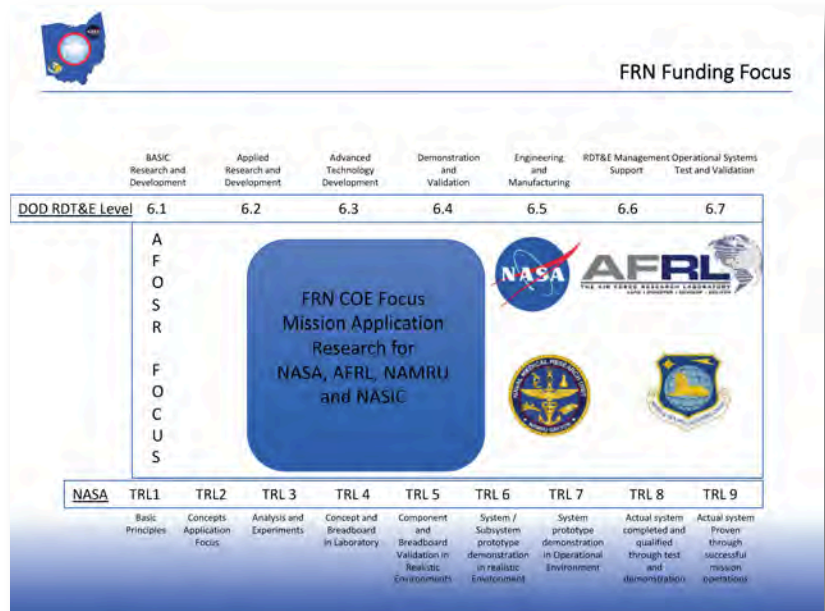- Enhance the competitive posture of Ohio research universities for federal R&D funding.

The focus for the Centers of Excellence in terms of Technology Readiness Level is displayed in Figure 2.

Organizational Management

The OFRN program is made up of six Centers of Excellence, a Technical Review Council, an Executive Review Board, and is managed by the Wrigh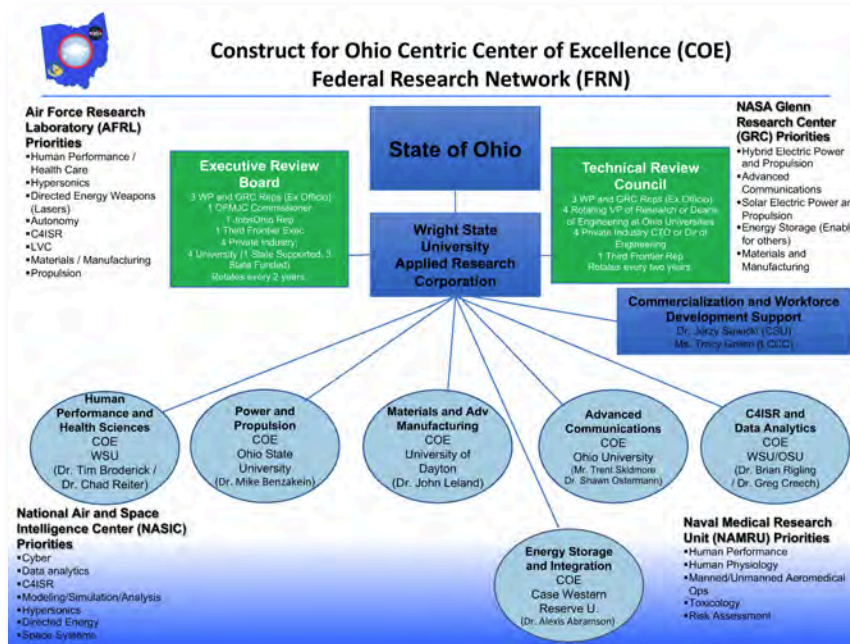t State Applied Research Corporation on behalf of the Ohio Department of Higher Education (ODHE), see Figure 3. OFRN currently reports to the ODHE and to the Chair of the Ohio Federal Military Jobs Commission (OFMJC).

Figure 3 OFRN Organizational Chart

The OFRN Leadership

Prior to the awarding of the ODHE funds, Dennis Andersh, Chief Executive Officer of the Wright State Applied Research Corporation, and Martin Kress, Vice President for Research for The Ohio State University were asked to take the day-to-day leadership role for framing the OFRN. This includes supporting the activities of the OFMJC, compiling the Research and Development section of the OFMJC Annual Report to the Governor, and the proposed organizational/ management model. In addition, the two leaders acted as the key interface to the federal labs and key state offices and they framed the charters and helped recruit the members, for the Executive Review Board (ERB) and Technical Review Council (TRC). The members of both the ERB and TRC are vetted and approved by the OFMJC, with recommendation and advice from the key state offices. They also led the establishment of the six university Centers of Excellence (COE). Lead universities were selected based on the recognized strengths and core competencies within the State's university system and their prior professional experiences with AFRL and NASA-GRC. Each COE is directed to integrate other Ohio research universities into its activities and programs; and no proposal will be considered for OFRN funding consideration if it does not have multiple university partners participating in a "meaningful way."

As Mr. Andersh and Mr. Kress continue to provide the day-to-day leadership for the OFRN, key to their success is the WSARC support staff and the support of key state offices – in particular: ODHE, JobsOhio and the Ohio Third Frontier. The two leaders also continue their commitment to regularly provide briefings to the key partners, state officials and other interested groups across the state on the OFRN, its goals and objectives, and progress to date. This open and transparent briefing process is part of their commitment to build a partnership coalition that allows Ohio's research and industry talent to be shown in an effort to boost the State of Ohio's overall economic impact by bringing in more federal research

dollars to the state. Next on the OFRN agenda is a set of industry days to further engage small and medium sized firms.

Wright State Applied Research Corporation (WSARC)

The WSARC acts as the contracting and program management agent for the OFRN. Specifically the WSARC leads and oversees all procurement, contracting and financial reporting activities; supports the ERB and the TRC; supports the documenting of the White Paper and Proposal Review process for OFMJC's review and approval; manages and mitigates ERB and TRC courses of instruction; is the funding agent for all COE's; keeps a repository of all deliverables of the OFRN; is the repository of federal lab requirements, and ensures that the OFRN remains fully compliant with state and federal policies, rules, regulations and accounting procedures.

Executive Review Board (ERB)

The ERB is responsible to oversee the development, funding and performance of the OFRN. The ERB provides ongoing oversight of the OFRN to support the research priorities of the federal installations and build capabilities within Ohio to expand and focus research, workforce development, and technology commercialization. The ERB reviews and can concur in or reject the recommendations of the TRC as to funding of the OFRN programs and projects that have been reviewed pursuant to the OFRN's request for proposals. It also must approve the award of subcontracts by the OFRN. To ensure the alignment of the OFRN within the OFMJC goals and initiatives, the OFMJC has representatives on the ERB.

In the future, the OFRN hopes to further expand the role of the ERB to provide strategic guidance regarding new initiatives and activities, and to reassess some of the current criteria included within the OFRN proposal evaluation process.

Figure 4 ERB and TRC Composition

Reviewer (ERB and TRC) Composition			
Executive Review Board	**Designee**	**Technical Review Council**	**Designee**
Cleveland State President	Dr. Ron Berkman	UT VP of Research	Dr. Bill Messer
OSU Dean of Engineering	Dr. Dave Williams	UC Dept Head AEEM, OAATC	Dr. Paul Orkwis
WSU President	Dr. Dave Hopkins	OU Dean of Engineering	Dr. Dennis Irwin
LCCC President	Dr. Roy Church	CWRU VP of Research	Dr. Suzanne Rivera
OFMJC	Gary O'Connell	UDRI	Dr. John Leland
NASA Glenn Director	Dr. Janet Kavandi	OFMJC	Don Campbell
AFRL	Jack Blackhurst	NASA Glenn	Sandra Reehorst
NASIC	Curt Rowland	AFRL	Chris Ristich, Stephanie Miller
Jobs Ohio	Glenn Richardson	NASIC	Dale Benedetti, Mark Brown
Ohio National Guard	Maj Gen Mark Bartman	NAMRU-D	Richard Arnold
Ohio Third Frontier	Karen Conrad	Ohio National Guard	Brig Gen Gregory Schnulo
Industry 1 Chair	Ricky Peters, Perduco	Ohio Third Frontier	Paul Jackson
Industry 2	Salvatore Miraglia, Jr.	Industry 1	Carlos Grodsinsky
		Industry 2	Ed Morris
		Industry 3	Dr. T. S. Sudarshan
		Industry 4	Dr. Darren McKnight
		Industry 5	Dr. Suguna Rachakonda

All Federal and State government employees are *Ex Officio*   * Not Available for TRC

Technical Review Council (TRC)

The TRC is responsible to the OFMJC and the ERB for comprehensive oversight of the portfolio of technologies that are used and developed by the Centers of Excellence as part of the OFRN in the execution of their programs. The TRC reviews all White Papers and Proposals; then ranks them according to the key criteria established by the OFRN and approved by the ERC.

Figure 4 shows the membership of ERB and the TRC and each has representation from Federal and State government, industry, and universities. Ricky Peters chairs the ERB and Carlos Grodsinsky chairs the TRC. Both chairpersons were recruited from industry.

Centers of Excellence (COEs)

The COEs are the lead organizations for their designated focus area. They interact with all of the research universities and help them frame and submit proposals to the OFRN for funding. Only a COE can submit a proposal to the OFRN and that proposal must be consistent with the requirements of the Request for Proposals (RFPs) for White Papers and full proposals. COEs are also responsible for the program management of their projects subcontractors, ensuring their statements of work are completed and milestones are met. ODHE funding is provided to the COEs on an annual basis, and they conduct a Quarterly Program Brief to the OFRN Leadership Team and submits a quarterly report to the OFRN Program Manager. This ensures that deliverables are turned in and that any risks are capable of being mitigated in a timely manner.

> *Vision*
>
> *Establishing Ohio as a National Leader in Energy Storage and Integration for Defense and Space Exploration Priorities*

Partnership for Research in Energy Storage and Integration for Defense and Exploration of Space

PRESIDES – Case Western Reserve University

This COE aims to improve existing technologies and develop new technologies to better support NASA and AFRL's energy storage needs by leveraging existing expertise to strengthen Ohio's R&D collaborations and economic Growth. PRESIDES is led by Case Western Reserve University and is made up of seven academic institutions spread across three projects in Round 1.

Ohio Center for Power and Propulsion

OCPP – The Ohio State University

This COE focuses to support NASA and AFRL's aerospace power and propulsion needs and reinforce Ohio's position as the world class leader in power and propulsion by leveraging existing expertise and developing economic growth through strong cooperation with Ohio's industrial institutions. OCPP is led by The Ohio State University and is made up of

> *Vision*
>
> *To assure Ohio's Continued Leadership in Power and Propulsion global markets, which is estimated to be $50-$100B over the next 20-years.*

> *"...goal is to provide a solid return on investment with the creation or retention of 400 jobs in the State."*

three academic institutions spread across five projects in both Round 1 and Round 2. Its mission is to tackle propulsion and power challenges through a federation of the best intellectual and economic resources, whether from academia, federal labs or from private industry in the state and their goal is to provide a solid return on investment with the creation or retention of 400 jobs in the State.

> *Vision*
> *Develop 200 new jobs in high-value materials and manufacturing related disciples within the State of Ohio by 2019 for the State Federal Laboratories and related industries in three key material areas: flexible electronics, advanced magnetic materials, and shape memory alloys*

Materials and Advanced Manufacturing

M&M – University of Dayton/University of Dayton Research Institute

The projects conducted under this COE are targeted toward high priority government needs in materials and manufacturing which through a cooperative academic, industrial and government laboratory research approach; develop highly qualified college graduates, enabling Ohio industries and government laboratories to grow and excel through additional integrated R&D opportunities. M&M is led by the University of Dayton and is constructed of six academic institutions spread across four projects in both Round 1 and Round 2.

Human Performance and Health Sciences
HPHS – Wright State University/Wright State Research Institute

The research in this COE catalyzes government, academia, and industry collaboration to deliver high-impact solutions to the United States Air Force, United State Navy, National Air and Space Intelligence Center, Naval Medical Research Unit – Dayton, and National Aeronautics and Space Administration on human performance and health challenges while driving economic growth across Ohio. HPHS is led by Wright State University and is made up of six academic institutions spread across four projects in both Round 1 and Round 2.

> *Vision*
> *Establish Ohio as a global leader in human performance and health science research, technology development, and commercialization*

Advanced Communications, Cyber, Positioning, Navigation and Timing
C2PNT – Ohio University

> *Vision*
> *To create a true government, university and industry partnership focused on creating new and sustainable markets in the State of Ohio that can address the electronic communications, cyber, positioning, navigation, and timing needs of WPAFB and NASA-GRC.*

This COEs research is focused on addressing the electronic communications, cyber, positioning, navigation, and timing needs of the United States Air Force, United States Navy, National Air and Space Intelligence Center, and the National Aeronautics and Space Administration. C2PNT is led by Ohio University and is made up of four academic institutions spread across two projects in Round 2. Its mission is to actively engage business and industry partners to promote new business ventures in the C2PNT realm in an effort to create new jobs in Ohio that are directly traceable to the efforts and products of the C2PNT COE.

Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
C4ISR – The Ohio State University/Wright State University

This COE is focused on supporting the direct needs of the National Aeronautics and Space Administration and the Air Force Research Laboratory on command and control (C2) and information domain oversight. The COE looks to define and document the next generation C4ISR concepts and command center abstractions through innovative approaches to C4ISR infrastructure and systems that enhance decision making, sensor detection and classification, and communication efficiency and tolerance. C4ISR is co-led by The Ohio State University and Wright State University and is made up of

> *Vision*
> *To build a collaborative network of Ohio universities and industry partners that is nationally competitive in the research, development and commercialization of C4ISR technologies.*

four academic institutions spread across one project in Round 2. Its mission is to (1) build stronger collaborative research relationships among Ohio universities in the area of C4ISR, (2) Develop human capital within the state of Ohio in the area of C4ISR to improve regional competitiveness in the pursuit of federally funded work, and (3) transition research from Ohio universities into economic development opportunities for the state in the form of advanced research and development contracts, commercialization of C4ISR technologies into the private sector, and deployment of research enabling toolsets to federal government entities and supporting contractors.

Ohio Federal Laboratories

The Ohio Federal Laboratories: Air Force Research Laboratory (AFRL), Naval Medical Research Unit – Dayton (NAMRU-D), National Air and Space Intelligence Center (NASIC), and the National Aeronautics and Space Administration – Glenn Research Center (NASA-GRC); have been nothing short of amazing in assisting the efforts of the OFRN. They have been involved within the COE Projects, collaborating with the Research Principal Investigators. At the outset of the program, their key project managers briefed hundreds of university researchers in special sessions held at NASA-GRC and Wright State University on the priorities of the national labs. Following the briefings, they have provided their strategic research priorities to the OFRN and allowed WSARC to post their strategic opportunities on the OFRN website, www.ohiofrn.org. Not only have the Federal Laboratories allowed the OFRN access through day to day engagements within their labs, but they have provided the OFRN access to key staff and leaders allowing the TRC and ERB to receive alignment rankings and project comments straight from the customer. In year one, this day-to-day type engagement has led to a significant strengthening of the relationship between the Federal Labs and Ohio's Higher Education Institutions. Due to the program there are separate interactions, between the researchers and the labs, also taking place and the labs are investing their own capital and time into the OFRN projects.

State Offices and Programs

Since the beginning, the OFMJC, Ohio Third Frontier, JobsOhio, the Governor's Office, Legislators, the Adjunct General's Office, and the ODHE, have all been instrumental in the start-up and continued progress of this initiative. It has been a truly collaborative effort in ensuring this program is centrally placed within Ohio's State Government, Ohio's Federal Laboratories, Ohio's Leading Industry, and Ohio's Research Universities strategic initiatives; thereby ensuring the success of the State's overall goals and objectives for the OFRN.

The Governor's Office and key State Legislators have closely monitored the implementation of the OFRN and have helped with the identification of ERB and TRC members. Regular briefings are provided to key leaders at the State level to keep them abreast of the program's progress and to gain their support for innovative initiatives such as a proposed Challenge Grant.

The Ohio Department of Higher Education (ODHE) has been the key interface for the OFRN leadership team at the State level. The funding for this statewide initiative is also contained in the ODHE budget. Regular status reports are provided to the OFRN staff. ODHE has also hosted the review of the Round 1 and Round 2 proposals and they arranged the briefings to the Chancellors' Research Officers Council.

The Ohio Third Frontier assists the OFRN by having an executive sit on our Executive Review Board and a Program Manager on our Technical Review Council (TRC). They have also assisted in the format of the TRC review meetings and brings a wealth of knowledge on what has and has not worked in their program to this initiative, thereby reducing the amount of time it has taken to get up and running. They have also helped recruit key members of the ERB and TRC.

The JobsOhio program also provides a key executive to the ERB and the TRC and they have also been most helping in the framing and execution of the OFRN. A key outcome measure for the OFRN is jobs creation and JobsOhio has provided assistance in to how best to estimate job creation and what criteria should be used by the OFRN for its proposal evaluation so it can best reflect potential results. They have also helped recruit key members of the ERC and TRC.

The Ohio Federal Military Jobs Commission has supported OFRN through collaborative efforts with the other key focus areas of the Commission, in particular small business and workforce development. The Chair of the Commission, Mr. Gary O'Connell, former Chief Scientist of NASIC, also sits on the ERB, as well as, observes the TRC white paper and proposal reviews. He has provided significant input on how to better collaborate with the federal labs as well as with industry throughout Ohio, and continues to keep the TRC focus on the end goal of bringing a significant increase to Ohio's economy.

The Adjunct General (TAG), Major General Mark Bartman, has interfaced with the OFMJC and with the OFRN since their inception. The OFRN is currently working with the TAG and other key federal organizations to identify a candidate project for the OFRN's pending Challenge Grant Initiative. The challenge problem will likely center around command and control, cyber, unmanned aerial vehicles, or air traffic control. The OFRN hopes to announce the Challenge Grant topic in 2017 and utilize it to integrate the capabilities of multiple COEs.

GETTING UP TO SPEED ON THE PROGRAM

Prior to the awarding of funds, WSARC and OSU spent considerable time during 2015 recruiting the participating universities, establishing the requirements process with the federal labs, formulating the OFRN model and identifying the six-key focus areas and the six Ohio-based universities that would serve as the COEs for the AFRL, NASIC, NAMRU-D, and NASA-GRC research priority focus areas. Key to the OFRN model is an effort to provide researchers with more insight into the proposal process for requirements based initiatives at leading R&D organizations.
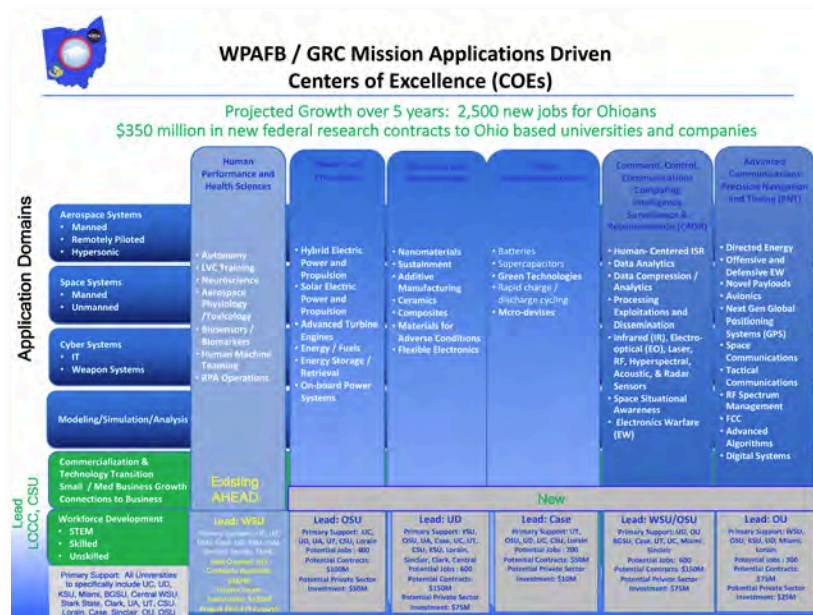

Figure 5 COE Priority Focus Areas

Based on the OFRN Model, the lead COE Universities are responsible to organize and operate the core OFRN research and technical commercialization programs through collaborations with the other Ohio research universities and small business/industry partners. In addition to conducting work in these focus areas, the collaborative COEs are required to aggressively pursue other business development opportunities beyond the core OFRN research programs. The OFRN COEs and the research priority focus areas of AFRL, NASIC, NAMRU-D, and NASA-GRC are depicted in Figure 5.

Round 1

Following the creation of the COEs on 31 August 2015, the OFRN issued a call for White Papers for Round 1 funding to all universities in Ohio. The response generated 31 white papers from the six COEs. The Round 1 White Papers were reviewed by the OFRN TRC and on 15 October 2015 a Request for Proposal was issued to the six COEs for 15 of the 31 white papers. On 28 October 2015, the OFRN Leadership Team then issued a Request for Proposal (RFP) to incorporate a Commercialization and Workforce Development COE.

On 30 November 2015, the six COEs submitted proposals for 15 research projects and on 20 December 2015 the Commercialization and Workforce Development (C&WD) COE submitted a proposal in response to the 28 October 2015 RFP.

The Technical Review Council (TRC) met and reviewed the Round 1 proposals. As part of that process, every member of the TRC was required to sign a Conflict of Interest document and anyone participating in any project did recuse themselves from voting and discussing that project.

The Cost-Proposals (Volume II) were handled by an independent consultant who reviewed the Cost Details. The consultant checked for errors and proper accounting for cost-share and rates. The COEs had a 20% cap on F&A rates.

The TRC convened on 10 December 2015 at the Electro-Science Laboratory at The Ohio State University and broke into project review groups. Each group had a minimum of three reviewers and proposals and the TRC created an evaluation matrix using agreed upon criteria. During the course of the review, the OFRN recognized that the reviewers were not able to locate the criterion

Round 1 Overall Ranking based on Technical Strength, Mission Alignment, and Jobs

Overall Ranking based on Tech Strength, Alignment & Jobs

RANK	COE	TITLE
1	HPHS	SAPHYRE
2	PRES	HI ENERGY DENSITY LI-ION BATTERY BASED ON ADVANCED SILICON ANODES
3	HPHS	IMPROVING HEALTHCARE TRAINING AND DECISION MAKING THROUGH LVC
4	PRES	HIGH ENERGY/POWER, LONG CYCLE LIFE, THERMALLY SAFE LI-S BATTERY
5	OCPP	HYBRID/TURBO-ELECTRIC PROPULSION
6	PRES	HI-PERFORMANCE MULTIFUNCTIONAL STRUCTURAL ENERGY STORAGE
7	M&M	ADAPTIVE BIO INSPIRED AEROSPACE STRUCTURES ACTUATED BY SHAPE
8	M&M	HIGH -TEMP MAGNETIC MATERIALS
9	OCPP	CONTROL ARCHITECTURE FOR INTELLIGENT AVIATION ELECTRIC POWER SYSTEMS
10	M&M	HIGH PERFORMANCE PLASTIC SUBSTRATES FOR FLEXIBLE ELECTRONICS
11	HPHS	COLLABORATIVE MICRO-ROBOT TEAMS IN CONSTRAINED WORLDS
12	C4ISR	FORWARD AND REVERSE ENGINEERING TOOLS AND WORKFORCE DEVELOPMENT FOR AFRL AND NASIC
13	C4ISR	DATA ANALYTICS AND DATA MINING FOR WORLD WIDE STRUCTURED AND UNSTRUCTURED DATA
14	C2PNT	CHCP- COGNITIVE ROUTING IN DTN NETWORKS FOR HYBRID RF/FSO COMMUNICATIONS (3 YEAR)
15	C2PNT	SMALL UNMANNED AIRCRAFT SYSTEMS IN LOW ALTITUDE CHALLENGED ENVIRONMENTS

Priority 1 Priority 2 Priority 3 Not Funded

Figure 6 Round 1 Overall Project Rankings

within the proposals. In response, the WSARC developed a Compliance Matrix for the COEs and asked each COE to complete it for their submitted proposals. Once the Compliance Matrixes were received from the COEs, the TRC reviewers were able to finish their evaluations. As a result of this progress, the OFRN adjusted the evaluation process for the Round 2 and potential Round 3 activities.

As shown in Figure 6, the projects were ranked based on alignment with the Federal sponsors, job growth, and technical strength and placed into three priority levels. As you can see C4ISR and C2PNT COE projects were not selected to be awarded during Round 1 but in both instances the key federal partner agreed to work with the university research teams to prepare them for Round 2. The intent of the OFRN is not to

award funding to every proposal that is submitted. Rather the intent of the program is to award funding to the best proposals.

The TRC also reviewed the C&WD COE proposal. Based on that review, it was proposed that rather than create a COE for C&WD, it would be more beneficial to develop a support service contract agreement with the two proposing schools. Under this approach, support could be provided to the OFRN and the respective project teams as needed in a "pay as you go" model. The OFRN leadership put in place a subcontract with Cleveland State University and Lorain County Community College for the C&WD functions. A former SES at NASA-GRC, Dr. Joe Shaw, coordinates the C&WD Team activity on behalf of the OFRN.

Based on the assessment of the 15 proposals, the TRC recommended that Priority 1 projects (with little to no modifications) and Priority 2 projects (with modifications) be funded and that Priority 3 projects not be funded.

Figure 7 shows the funding recommended for the ERB's consideration and approval for each COE to accomplish their project milestones.

The ERB convened on 12 January 2016 at the Ohio Board of Regents Building in Columbus, OH with Mr. Ricky Peters as the Chair. The ERB approved of the TRC recommendations in a roll-call style vote. The Chair of the OFMJC

Awardee	COE	Award Amount	Partners
Case Western Reserve University	The Partnership for Research in Energy Storage (PRESIDES) Center of Excellence	$1.6 million: ($800k in year 1; $800k in year 2)	**University Partners:** Ohio State University, University of Akron, University of Toledo, University of Dayton **Industry Partners:** Lubrizol Advanced Materials, Inc., pHMatter LLC, GrafTech International Holdings Inc., CRG Inc., UES Inc., CAR Technologies LL, Akron Polymer Systems Inc.
University of Dayton	The Materials and Manufacturing (M&M) Center of Excellence	$2 million: ($1MM in year 1; $1MM in year 2)	**University Partners:** University of Akron, Case Western Reserve University, Ohio State University, University of Cincinnati, University of Toledo, Ohio University, Youngstown State University **Industry Partners:** Lucintech Inc., Orbital Research Inc., Engineered Material Systems Inc., Hana Microdisplay Technologies Inc., Universal Technology Corporation, GE Aviation, Lincoln Electric, Norman Noble Inc., Lakeshore Cryotronics Inc., Eaton, ABB Inc., Electrodyne
Ohio State University	The Ohio Center for Power and Propulsion (OCPP) Center of Excellence	$2 million: ($750k in year 1; $750k in Year 2; $500k in year 3)	**University Partners:** University of Akron, University of Dayton **Industry Partners:** Orbital Research, Inc., Emerson Network Power, Lakeshore Cryotronics, IAP Research Inc., Vanner Group, Meggitt-USA Inc., Parker Hannifin Corporation, Aerospace Group, GE Aviation, GE EPISCENTER
Wright State University	The Human Performance and Health Science (HPHS) Center of Excellence	$1.5 million: ($745k in year 1; $755k in year 2)	**University Partners:** University of Cincinnati, University of Toledo, AFIT, Case Western Reserve University **Industry Partners:** University of Toledo Medical Center, Dayton Children's Hospital, The Perduco Group, University Hospitals Case Medical Center, University of Cincinnati Medical Center, Premier Health, Advanced TeleSensors, Red Bull

Figure 7 Round 1 Award Amounts

is a member of the ERB and provided OFMJC approval. With the final endorsement of ODHE, the final awards were made.

Round 2

Following the Round 1 proposal process, it was determined by the TRC and the OFRN Leadership that the proposals from the COE researchers needed to be elevated in order to be competitive at the national level with key federal R&D organizations. Based on the recommendation of the Ohio Third Frontier, the OFRN Leadership sought approval from ODHE to engage UVG Limited's Dr. Burr Zimmerman, to assist in training on how to write successful proposals for Federal RFPs for the researchers. Following ODHEs approval, the OFRN went forward and issued the Round 2 Request for White Papers on 28 January 2016. However, the OFRN delayed the White Paper due date until 30 March 2016, in order to provide ample time for the COE

teams to complete training with Dr. Zimmerman prior to the submission of their White Papers. This process was also intended to increase the level of collaboration among the participating universities in the final White Paper proposals.

Dr. Zimmerman held two training sessions in the Electro-Science Laboratory at The Ohio State University on 5 February 2016 and 12 February 2016. There were over 80 participants registered: 65 of which were researchers from more than Higher Education Institutions throughout Ohio; and the group had representation from all six COEs. The remaining participants were in attendance to assist in answering questions or concerns in regards to commercialization and workforce development, federal research alignment, and the OFRN program.
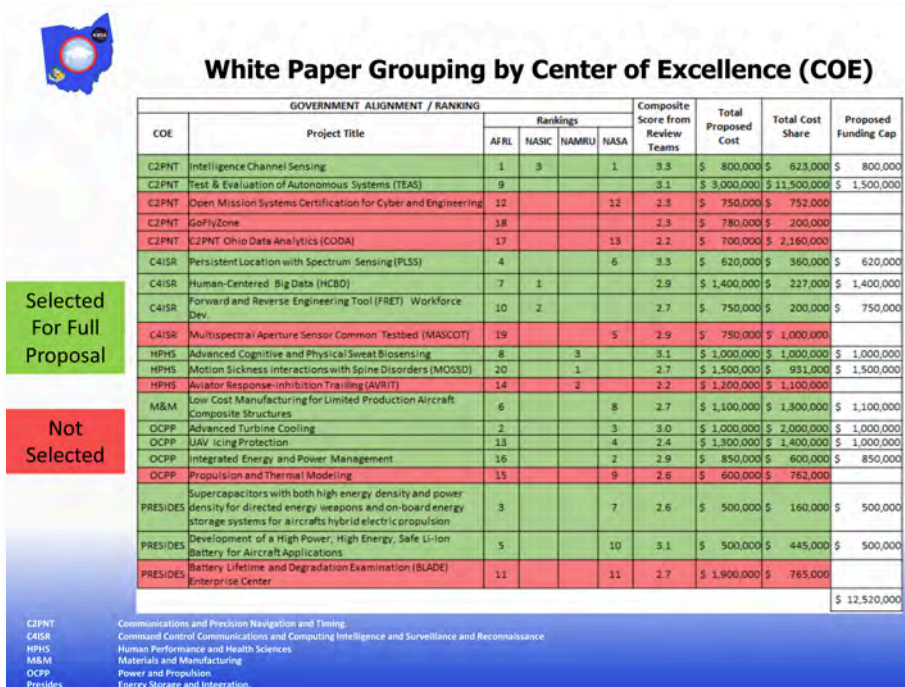
White Paper Grouping by Center of Excellence (COE)

Selected For Full Proposal (green) / **Not Selected** (red)

COE	Project Title	AFRL	NASIC	NAMRU	NASA	Composite Score from Review Teams	Total Proposed Cost	Total Cost Share	Proposed Funding Cap
C2PNT	Intelligence Channel Sensing	1	3		1	3.3	$800,000	$623,000	$800,000
C2PNT	Test & Evaluation of Autonomous Systems (TEAS)	9				3.1	$3,000,000	$11,500,000	$1,500,000
C2PNT	Open Mission Systems Certification for Cyber and Engineering	12			12	2.3	$750,000	$752,000	
C2PNT	GoFlyZone	18				2.3	$780,000	$200,000	
C2PNT	C2PNT Ohio Data Analytics (CODA)	17			13	2.2	$700,000	$2,160,000	
C4ISR	Persistent Location with Spectrum Sensing (PLSS)	4			6	3.3	$620,000	$360,000	$620,000
C4ISR	Human-Centered Big Data (HCBD)	7	1			2.9	$1,400,000	$227,000	$1,400,000
C4ISR	Forward and Reverse Engineering Tool (FRET) Workforce Dev.	10	2			2.7	$750,000	$200,000	$750,000
C4ISR	Multispectral Aperture Sensor Common Testbed (MASCOT)	19			5	2.9	$750,000	$1,000,000	
HPHS	Advanced Cognitive and Physical Sweat Biosensing	8		3		3.1	$1,000,000	$1,000,000	$1,000,000
HPHS	Motion Sickness Interactions with Spine Disorders (MOSSD)	20		1		2.7	$1,500,000	$931,000	$1,500,000
HPHS	Aviator Response-inhibition Trailling (AVRIT)	14		2		2.2	$1,200,000	$1,100,000	
M&M	Low Cost Manufacturing for Limited Production Aircraft Composite Structures	6			8	2.7	$1,100,000	$1,300,000	$1,100,000
OCPP	Advanced Turbine Cooling	2			3	3.0	$1,000,000	$2,000,000	$1,000,000
OCPP	UAV Icing Protection	13			4	2.4	$1,300,000	$1,400,000	$1,000,000
OCPP	Integrated Energy and Power Management	16			2	2.9	$850,000	$600,000	$850,000
OCPP	Propulsion and Thermal Modeling	15			9	2.6	$600,000	$762,000	
PRESIDES	Supercapacitors with both high energy density and power for directed energy weapons and on-board energy storage systems for aircrafts hybrid electric propulsion	3			7	2.6	$500,000	$160,000	$500,000
PRESIDES	Development of a High Power, High Energy, Safe Li-Ion Battery for Aircraft Applications	5			10	3.1	$500,000	$445,000	$500,000
PRESIDES	Battery Lifetime and Degradation Examination (BLADE) Enterprise Center	11			11	2.7	$1,900,000	$765,000	
									$12,520,000

C2PNT — Communications and Precision Navigation and Timing.
C4ISR — Command Control Communications and Computing Intelligence and Surveillance and Reconnaissance.
HPHS — Human Performance and Health Sciences.
M&M — Materials and Manufacturing.
OCPP — Power and Propulsion.
Presides — Energy Storage and Integration.

Figure 8 Round 2 White Paper Project Selection

Following the training, the six COEs submitted a total of 20 White Paper projects for the TRC review. The Round 2 White Papers were reviewed by the TRC on 7 April 2016 and TRC members were impressed with the quality and improvement in the White Papers; compared to the proposals from Round 1. The White Papers were so improved that it made it difficult for the TRC to reduce the number of White Papers to select for the Proposal Phase. After a great deal of deliberating, the TRC approved 13 of the 20 White Paper projects for the next step from the six COEs. The Federal Sponsor's ranking on alignment and the selected proposals is shown in Figure 8. On 29 April 2016, the Round 2 Request for Proposal was issued to the COEs for those White Paper projects approved by the TRC.

Based on the success of the White Paper Training Process, on 12 May 2016 the OFRN brought Dr. Burr Zimmerman back to conduct an additional proposal training session based on the actual Round 2 RFP. The OFRN team also met individually with each COE to describe Workforce Development and how to properly include it within the COEs proposal. This training saw 40 participants; 29 researchers representing seven Higher Education Institutions throughout Ohio and the six COEs. The remaining 11 participants attended to answer any questions or concerns in regards to the OFRN program, commercialization and workforce development efforts. This training session emphasized addressing the core requirements of the RFP,

providing reviewers with info as to what constitutes a solid summary chart, framing a quad chart consistent with DoD and DARPA program requirements, formulating a Statement of Work that lets reviewers know the team understands the project complexity and core requirements, and has an understanding of the concept of project risk mitigation.

On 30 June 2016, 13 projects from the six COEs were submitted to the TRC for review and consideration. The TRC then formulated questions for each of the COEs to verify key points within the proposals. The questions were to secure additional information required to make prudent decisions. The questions were provided to each COE Lead and the Project Principle Investigator in question and they were given two weeks to respond to the questions. Then on 24 August 2016 the TRC held a follow-up meeting to review the responses. Based on the Q/A responses the TRC approved eight of the 13 projects for funding as shown in Figure 9 and submitted written reviews for the historical file.

Round 2 Technical Awardees

Awardee	COE	Award Amount	Cost Share	Partners
Ohio State University and Wright State University	The Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) Center of Excellence	$1,200,000 (Yr1: $585,034 Yr2: $614,966)	$693,117 University Partners: $559,117 Small Business: $134,000 Large Business: $0	COE Partners: HPHS COE University Partners: Ohio University, Case Western Reserve University Industry Partners: Small Business: Tenet3, Perduco, DesignKnowledge, Illumination Works, DelphicDB, Columbus Collaboratory, Amperand, MatchTx Large Business: Hewlett Packard, Lexis Nexis, Ipsos, Nuance
Ohio University	The Advanced Communications, Positioning, Navigation and Timing (C2PNT) Center of Excellence	$2,100,002	$2,176,046 University Partners: $726,046 Small Business: $1,325,000 Contingent $4,200,000 Large Business: $0 Federal Partner Contingent: $1,250,000	COE Partners: HPHS COE University Partners: Wright State University, Air Force Institute of Technology Industry Partners: Small Business: Galois, Inc., Comsat Architects, Gird Large Business: None
University of Dayton	The Materials and Manufacturing (M&M) Center of Excellence	$1,097,197 (Yr1: $570,433 Yr2: $526,764)	$1,413,139 University Partners: $1,353,139 Small Business: $40,000 Large Business: $20,000	University Partners: Case Western Reserve University, Ohio University, University of Cincinnati, Wright State University, Youngstown State University Industry Partners: Small Business: NONA Composites, Cincinnati Inc. Large Business: Orbital ATK, GE Aerospace
Ohio State University	The Ohio Center for Power and Propulsion (OCPP) Center of Excellence	$1,999,838 (Yr1: $872,120 Yr2: $1,127,715)	$2,614,219 University Partners: $1,614,219 Small Business: $0 Large Business: $1,000,000	University Partners: University of Dayton, Case Western Reserve University, University of Cincinnati, The Ohio State University, Air Force Institute of Technology Industry Partners: Small Business: Innovative Scientific Solutions, Inc; Large Business: Honeywell, Battelle
Wright State University	The Human Performance and Health Science (HPHS) Center of Excellence	$2,115,001	$2,582,345 University Partners: $1,689,345 Small Business: $733,000 Large Business: $0 Federal Partner: $160,000	University Partners: University of Cincinnati, Ohio State University, University of Toledo Industry Partners: Small Business: Eccrine Systems, Bertec Corp, SpineDynX Large Business: None

Figure 9 Round 2 Award Amounts

The eight projects which the TRC approved requested funding in the amount of $9,023,800 and the OFRN budget for Round 2 had been budgeted at $8MM. To assist in ensuring the projects were possible, the OFRN proposed to the ERB that they approve the eight projects in the total amount of $8,505,261. This was possible because OFRN Leadership had moved $500,000 from the challenge problem funding to the Round 2 Projects. This has lowered the Challenge Problem funding from $3MM to $2.5MM.

The ERB met on 30 August 2016 in Columbus, OH and approved the eight recommend projects for award. The ERB also approved the transfer of $500,000 from the challenge problem to the Round 2 Project budget.

Round 2 approval award letters were sent out on 9 September 2016 with an authorization for the COEs to bill up to $100,000. This was to ensure that the COEs were able to get all sub-contracts ready to go and make the business development executions needed to support their projects. On 16 September 2016, Round 2 officially started and all sub-prime contracts are fully executed.

Issues/Risks/Mitigations

During the formation of the OFRN and the implementation of its processes and procedures, the OFRN Leadership team was required to deal with issues and to provide mitigation strategies. Below are four examples of such activities.

1. In Round 1, the start-up time of the projects was an issue. The universities RSP/Legal departments had never pushed projects to another university and were having difficulty releasing the projects from their charge. Although start-up on the projects was slow, there are currently no requests or changes to the executive timeline schedule.
2. Originally OFRN proposed seven COEs. However, as noted above, the OFRN Leadership team in consultation with the Chair of the OFMJC and TRC determined that the C&WD function would work better for the OFRN initiatives and the COEs under a service support contract.
3. As the TRC members were reviewing the Round 1 proposals, it came to their attention that the OFRN COE members needed training in writing federal proposals. As a result, the OFRN Leadership hired UVG Ltd to instruct researchers on how to write competitive Federal Proposals. The UVG Ltd training sessions on White Papers and Proposals have resulted in significant improvement in the white papers submitted in Round 2.
4. The export control of the projects for which the universities are working on became a risk as non-US Citizens began working on the projects. This risk was mitigated by (1) asking the compliance offices to ensure that all personnel working on the projects were US Citizens or Green Card holders. If non-US Citizens were working on the project, the government sponsor was asked to ensure that non-US Citizens were approved to work on the tasks assigned to them. This risk is being monitored continuously, however there has been no major setbacks by the government sponsors or the universities.

FINANCES - OFRN PROGRAM FUNDS ALLOCATION/EXPENDITURES

Total State Operation Funding for the OFRN program for defense, aerospace, workforce development is $25 million for FY 16 and 17. This consists of two line items in the State Budget: (1) $20MM is designated for WSARC and $5MM is designated for OSU. $20MM is allocated to the OFRN program for research projects executed by the COEs, for the commercialization and workforce development activities of Lorain County Community College and Cleveland State University, and for the pending Challenge Grant. A breakdown of the funding is displayed in Figure 10.
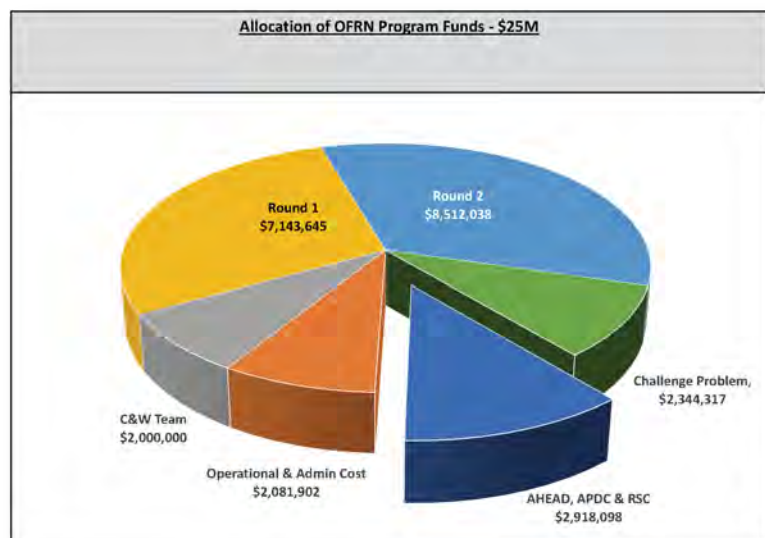
Figure 10 OFRN Allocation of Funds

It should be noted that $5M was revectored by WSARC to the OFRN from its own funding prior to the release of ODHE funds to assist in workforce development and small business growth through the Aerospace Professional Development Center, Regional STEM Collaborative, and the Operations/Administrative Costs of the OFRN.

The ODHE funding covers FY 16 and FY 17. Consistent with the legislative intent, The Ohio State University and WSARC has a contract arrangement in place to receive the $5MM from ODHE to support COE activities and the proposed Challenge Grant. Figure 11 shows the current amounts funded to each COE as well as the amounts expended as of 31 October 2016. The OFRN will place emphasis on the universities expensing funds in the next set of quarterly reviews.

FUNDING						
Contract / PO#	Prime	POP		Allocation	Funded to Date	Expensed to Date
5JC0/HB 64 Defense/Aerospace Workforce Development Initiative	ODHE	1 Jul 15 – 30 Jun 17		$17,081,902	$17,081,902	($1,568,462.08)
5JC0/HB 64 AHEAD/RSC/APDC	ODHE	1 Jul 15 – 30 Jun 17		$2,918,098	$2,918,098	($1,853,938)
235616/HB 64 Ohio State University Federal Research Center Initiative	ODHE	1 Jul 17 – 30 Jun 18		$5,000,000	$5,000,000	$0
		TOTAL		$25,000,000	$25,000,000	($3,422,400.08)
Contract / PO#	COE	POP	Round 1 Allocation	Round 2 Allocation	Funded to Date	Expensed to Date
1077-100/FY-16-045-Case Western Reserve	PRESIDES	1 Feb 16 – 25 Aug 18	$1,649,726	$0	$955,000	$0
1077-200/FY-16-042-Ohio State University	OCPP	1 Feb 16 – 25 Aug 18	$2,000,000	$1,999,838	$1,872,120	($118,064)
1077-300-Ohio University	C2PNT	26 Aug 16 – 25 Aug 18	$0	$2,100,002	$100,000	$0
1077-400/FY-16-046-University of Dayton/UDRI	M&M	1 Feb 16 – 25 Aug 18	$1,999,997	$1,097,197	$1,570,433	($43,727)
1077-600-OSU/WSU	C4ISR	26 Aug 16 – 25 Aug 18	$0	$1,200,000	$600,000	$0
1077-700/FY-16-049-Wright State University	HPHS	1 Feb 16 – 25 Aug 18	$1,493,922	$2,115,001	$883,109	($260,990.50)
1077-500/FY-16-047-Cleveland State University	C&W	1 Feb 16 – 25 Aug 18	$1,000,000	N/A	$625,000	($213,233.25)
1077-510/FY-16-048-Lorain County Community College	C&W	1 Feb 16 – 25 Aug 18	$1,000,000	N/A	$625,000	($274,830)
		COE SUB TOTAL	$9,143,645	$8,512,038	$7,230,662	(910,844.75)

Figure 11 OFRN COE Funding / Expenditure of Funds

Figure 12 provides an overview of the OFRN Administration and Management costs. It depicts the OFRN subcontracts, with amounts funded and expensed as of 31 October 2016. All subcontracts have been approved through ODHE and assist the management team in training, program management of the C&WD Team, Job Growth estimation for use in COE proposal writing, as well as the creation of a search capability of Ohio Small Businesses and Firms that provide systems or subsystems for each of the COEs research priority areas. These tools may be reached online at the OFRN webpage, www.ohiofrn.org, and they will be posted by the Ohio Third Frontier and JobsOhio.

STAFFING				
Consultants	Role	Allocation	Funded	Expensed
FRN Administration	FRN Mgmt	$1,388,902	$1,388,902	($336,211)
UVG, Ltd.	Trng Consultant	$50,000	$31,000	($13,138)
Global Glu	COE Handbook	$250,000	$248,500	($248,501)
LMRS Info Systems	C&WD Mgmt	$200,000	$100,000	($59,767.33)
CUPA	CSU Growth	$108,000	$108,000	$0
OSU Support	Associate PM	$85,000	$85,000	$0
	SUB TOTAL	$2,081,902	$1,961,402	($657,617.33)

Figure 12 OFRN Administration Funds Allocation

Federal Opportunities

A key driver for the creation of the OFRN was to incentivize Ohio's Universities and industry partners to collaborate with a focus on Federal Opportunities. To date, the OFRN has already had success in this domain.

Currently the OFRN is working to establish an $11M+ funding mechanism from AFRL to augment the Joint COE Project, Test and Evaluation of Autonomous Systems (TEAS). The TEAS project has also recruited a company from Portland, OR to establish a new office in Dayton, OH.

In addition, the OFRN has led the development of a statewide response to DARPA Opportunities. The focus is on providing DARPA specific proposal training to universities across the state.

Also, Congressman Ryan has spearheaded $4M in funding for a Joint Flexible Electronics and Trust Proposal. This proposal is a collaboration between University of Akron and Wright State University for the Air Force Research Laboratory's Sensor Directorate.

Another great response to the OFRN's collaboration capabilities is shown through the Joint Additive Manufacturing Effort with the Air Force Research Laboratory from Youngstown State University, Kent State University, and Youngstown Air Reserve Unit to help reduce the challenge of part obsolescence. This effort leveraged ODHE's Rapids Program.

Finally, multiple universities across the state are now pursuing joint efforts, totaling over $193M through the Air Force Office of Scientific Research, the Defense Advanced Research Projects Agency, and the Office of Naval Research. To the right is a listing of the efforts that are currently in the pipeline along with the government sponsor.

C2PNT	AFRL	$750,000
C2PNT	OSD	$3,500,000
C2PNT	AFRL	$400,000
C2PNT	AFRL	$160,000
C2PNT	AFRL	$4,500,000
C2PNT	AFRL	$3,750,000
C2PNT	DARPA	$750,000
C2PNT	DARPA	$250,000
C2PNT	ARMY	$12,000,000
C2PNT	DARPA	$3,900,000
C2PNT	AFRL	$12,500,000
C2PNT	AFRL	$2,000,000
C2PNT	AFRL	$1,000,000
C2PNT	AFRL	$20,000
C2PNT	DARPA	$1,500,000
C2PNT	AFRL	$500,000
C4ISR	DARPA	$5,400,000
C4ISR	ONR	$2,000,000
C4ISR	ONR	$1,200,000
C4ISR	AFRL	$175,000
C4ISR	AFRL	$3,960,000
C4ISR/HPHS	AFRL	$224,000
C4ISR/HPHS	OSD	$3,000,000
C4ISR/HPHS	IARPA	$1,800,000
HPHS	ONR	$7,500,000
HPHS	DARPA	$8,600,000
HPHS	ARO	$110,000
HPHS	AFRL/RH	$6,700,000
HPHS	AFRL/RH	$3,500,000
HPHS	AFRL/RH	$345,000
HPHS	AFRL/RY	$1,000,000
HPHS	AFRL/RV	$220,000
HPHS	DARPA DSO	$5,900,000
HPHS	NSF	TBD
HPHS	DAGSI	$50,000
HPHS	DAGSI	$50,000
HPHS	AFRL	$2,400,000
HPHS	AFRL	$75,000
HPHS	AFRL/RY	$10,000,000
M&M	NSF – DMREF	$1,600,000
M&M	DARPA Seedling	$300,000
M&M	ONR LIFT	$530,000
M&M	AFRL/RXM	$510,000
PRESIDES	NASA	$1,800,000
PRESIDES	NASA	TBD
PRESIDES	DOE	TBD
OCPP	NASA	$50,000,000
OCPP	AFRL	$48,000/yr
OCPP	AFRL	$400,000/yr
OCPP	AFRL	$15,000,000

Key	
C2PNT	Communications and Precision Navigation and Timing.
C4ISR	Command Control Communications and Computing Intelligence and Surveillance and Reconnaissance
HPHS	Human Performance and Health Sciences
M&M	Materials and Manufacturing
OCPP	Power and Propulsion
Presides	Energy Storage and Integration.

Funds Expended Report – As of 31 October 2016

OHIO DEPARTMENT OF EDUCATION
WORKFORCE MOU
FUNDS EXPENDED REPORT

OFRN ROUND 1 FUNDS EXPEDED REPORT

Please Type all Information | Subaward No.: | 1077

Recipient:	Wright State Applied Research Corporation
Project:	Defense/Aerospace Workforce Development Initiative
Reporting Period:	July 1, 2015 - October 31, 2016

Budget Categories (Subawards)	(A) Budgeted Amount	(B) Total Costs Through Last Report	(C) Costs Incurred This Period Only	(D) Balance A-(B+C)=D		Cumulative Expenditures B+C
PRESIDES COE - Case Western Reserve	$1,649,948	$0	$0	$1,649,948		$0
OCPP COE - The Ohio State University	$3,999,838	$0	$118,064	$3,881,774		$118,064
M&M COE - University of Dayton	$3,097,194	$0	$43,727	$3,053,467		$43,727
HPHS COE - Wright State University	$3,608,923	$0	$260,991	$3,347,933		$260,991
C4ISR COE - Wright State University / The Ohio State University	$1,200,000	$0	$0	$1,200,000		$0
C2PNT - Ohio University	$2,286,250	$0	$0	$2,286,250		$0
C&WD Team - Cleveland State University	$1,000,000	$0	$213,233	$786,767		$213,233
C&WD Team - Lorain County Community College	$1,000,000	$0	$274,830	$725,170		$274,830
OFRN Administration	$2,081,902	$0	$657,617	$1,424,285		$657,617
TOTAL	$19,924,055	$0	$1,568,463	$18,355,592		$1,568,463

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

Authorized Signature: _____ Date: _____

Typed Name _____

STATE USE ONLY BELOW THIS LINE

CAP: _____

Project Administrator: _____ Date: _____

Form B2

Cost Share Contribution Report – As of 31 October 2016

OHIO DEPARTMENT OF EDUCATION
WORKFORCE MOU
COST SHARE CONTRIBUTION REPORT

OFRN ROUND 1 COST SHARE CONTRIBUTION REPORT

Please Type all Information			Subaward No.:	1077

Recipient:	Wright State Applied Research Corporation
Project Name:	Defense/Aerospace Workforce Development Initiative
Reporting Period:	July 1, 2015 - June 30, 2016

Budget Categories (Projects)	(A) FRN Budgeted Amount	(B) Total Costs Through Last Report	(C) Costs Incurred This Period Only	(D) Balance A-(B+C)=D	Cumulative Expenditures B+C
PRESIDES COE - Case Western Reserve	$750,000	$0	$1,844	$748,156	$1,844
OCPP COE - The Ohio State University	$1,633,514	$0	$143,551	$1,489,963	$143,551
M&M COE - University of Dayton	$1,635,423	$0	$0	$1,635,423	$0
HPHS COE - Wright State University	$854,536	$0	$0	$854,536	$0
C4ISR COE - Wright State University / The Ohio State University	$583,361	$0	$0	$583,361	$0
C2PNT - Ohio University	$2,697,037	$0	$0		$0
C&WD Team - Cleveland State University	$341,072	$0	$0	$341,072	$0
C&WD Team - Lorain County Community College	$0	$0	$0	$0	$0
OFRN Administration	$0	$0	$0	$0	$0
TOTAL	$8,494,943	$0	$145,395	$5,652,511	$145,395

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

Authorized Signature: _____ Date: _____

Typed Name: _____

STATE USE ONLY BELOW THIS LINE

CAP: _____

Project Administrator: _____ Date: _____

Form B2-A

Next Steps

The OFRN will continue to build strong linkages and collaboration across Ohio's research universities, industry and Federal Laboratories but requires continued support and focus. The plan of the OFRN is to enhance business development statewide with an initial focus on DARPA Opportunities, expand to STTR and SBIR Opportunities with Small Businesses, expand to other Federal Agencies (i.e. IARPA, DARPA, ARPA-E, HS-ARPA, ONR, ARO, etc), and increase industry sponsored research.

For the upcoming Challenge Problem, the OFRN has decided to utilize The Ohio Adjutant Generals Office and have been issued a list of potential challenge problem topic sets which include: (1) Cyber Needs for Workforce Development and Forensics Support Statewide; (2) the need to fly and train staff on UAV systems; (3) UAV Test Center Experimentation; or (4) The challenges of aging aircraft and the need for flight certified additive manufacturing processes.

OFRN plans to create a planning team made up of retired corporate leaders, Federal Lab Leaders, industry leaders working Third Offset Strategy challenges, and Federal Research Department Leaders.

The OFRN Leadership Team is working with the Governor's Office and ODHE to identify the future OFRN Budget Line Item within the FY18-19 Ohio Budget.

OFRN CY16 and CY16 Event Timeline

Date	Description
Feb 2, 2016	Round 1 Awards
May 24, 2016	NASA Technology Day
July 19-21, 2016	AFRL Wright Dialogue with Industry (Dayton Defense)
July 26, 2016	Round 1 COE Quarterly project review (Columbus)
July 26, 2016	All COE Leads discussion (Columbus)
August 9, 2016	DARPA DSO Director Dr. Stefanie Tompkins DARPA 101 (Athens)
August 10, 2016	DARPA DSO Director Dr. Stefanie Tompkins DARPA 101 (Columbus)
August 11, 2016	DARPA DSO Director Dr. Stefanie Tompkins DARPA 101 (Dayton)
August 31, 2016	Delivery of Ohio Industry Data Base to Enhance COE Biz Connections
September 2, 2016	Round 2 Approval Award Letters Released to COE Leads
September 9, 2016	Updated SOWs / Budgets Due
September 16, 2016	Contracts / Contract Modifications Released to COE Leads
September 26, 2016	Round 2 Program Start Date / COE Lead Contracts Fully Executed
October 26, 2016	COE Round 1 Quarterly Review / Round 2 Kick Off
February TBD, 2017	COE Industry Days for Three Centers
February TBD, 2017	COE Round 1 / Round 2 Quarterly Review
March TBD, 2017	Industry Days for all COEs
March TBD, 2017	Challenge Problem RFP
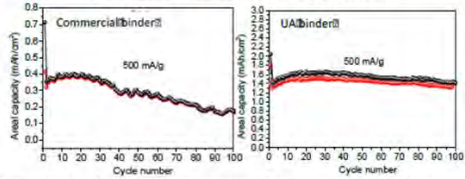
APPENDIX 1 – PRESIDES COE PROJECT DETAIL

Round 1
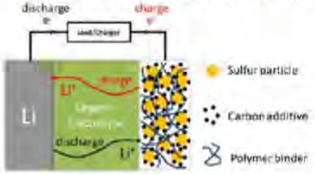
High Energy Density Li-Ion Battery Based on Advanced Silicon Anodes

Technical Concept & Approach

LIBs do not have sufficient specific energy and cycling durability to meet targets of > 300 Wh/kg
→ Silicon-based anode, polymer binders mitigate volumetric expansion problems

Project Requirement, Federal Alignment, Sponsoring Organization (s)

NASA + AFRL: Rechargeable batteries; high energy density; > 300 Wh/kg; lightweight; > 100 cycles (AFRL), > 200 cycles (NASA)
NASA: Power source for EVA suits, load-leveling and electrical power on solar-powered missions, orbital missions, landers/rovers
AFRL: Power worn systems, UAVs, surveillance

Team & Economic Impact For State of Ohio

PI: Yu Zhu, UA
NASA: James Wu
AFRL: Michael Rottamayer, Joseph Fellner
University partners: S. Chuang (UA), M. Canova (OSU), M. Heben (UT)
Industry partners: P. Matter (ph Matter), C. Chen (GrafTech), X. Shi (Lubrizol), K. Dudek (CAR Technologies), M. Graham (Akron Polymer Systems)
Potential economic impact (in 2 years):
- Jobs: 4+
- Follow-on funding: $300K+ via fed agencies

Budget, Schedules, Deliverables, & Risks

Budget total: $599,740
Period of performance: 24 months
Key deliverable: Li-ion Si anode full cell with 1000 mAh/g
Key risk: Inability to meet technical targets during period of performance

High Energy/Power, Long Cycle Life, Thermally Safe, Li-S Battery

Technical Concept & Approach

Fig 1. Schematic of Li-S cell.

IBs do not have sufficient specific energy and have thermal safety issues; Li-S batteries have poor cyclability
→ Li-S battery w/hybrid electrolyte and novel S-graphene cathode

Project Requirement, Federal Alignment, Sponsoring Organization (s)

NASA + AFRL: Rechargeable batteries; high energy density; > 300 Wh/kg; lightweight; > 100 cycles (AFRL), > 200 cycles (NASA)
NASA: Power source for EVA suits, load-leveling and electrical power on solar-powered missions, orbital missions, landers/rovers
AFRL: Power worn systems, UAVs, surveillance

Team & Economic Impact For State of Ohio

PI: Jitendra Kumar (UD)
NASA: D. M. Hernandez-Lugo
AFRL:S. Rodrigues
University partners: R. Alkolkar (CWRU), Liming Dai (CWRU), Zhenhua Jiang (UD), G. Subramanyam (UD)
Industry partners: B. Henslee (CRG), A. Rai (UES)
Potential economic impact (in 2 years):
- Jobs: 3+
- Follow-on funding: $200K+ via fed agencies

Budget, Schedules, Deliverables, & Risks

Budget total: $449,991
Period of performance: 24 months
Key deliverable: high energy density, durable and safe Li-S battery prototype
Key risk: Inability to meet technical targets during period of performance

Hi Performance Multifunctional Structural Energy Storage

Technical Concept & Approach

Structures are not multi-functional – high performance compromises mechanical integrity
→ Solid-state thin film Li batteries integrated with structural elements

Project Requirement, Federal Alignment, Sponsoring Organization (s)

NASA + AFRL: Multi-functional high energy density; > 300 Wh/kg; lightweight; > 100 cycles (AFRL), > 200 cycles (NASA) with high mechanical integrity for space/aircraft/rover structures

Team & Economic Impact For State of Ohio

PI: Vikas Prakash (CWRU)
NASA: P. Loyselle
AFRL: J. Baur, M. Durstock
University partners: R. Alkolkar (CWRU), J. Kumar (UD)
Industry partners: B. Henslee (CRG), C. Chen (GrafTech), A. Sane (Americarb)
Potential economic impact (in 2 years):
- Jobs: 3+
- Follow-on funding: $250K+ via fed agencies

Budget, Schedules, Deliverables, & Risks

Budget total: $449,995
Period of performance: 24 months
Key deliverable: prototype structural battery module that meets current battery performance with high mechanical integrity
Key risk: Inability to meet technical targets during period of performance

APPENDIX 2 – OCPP COE PROJECT DETAIL
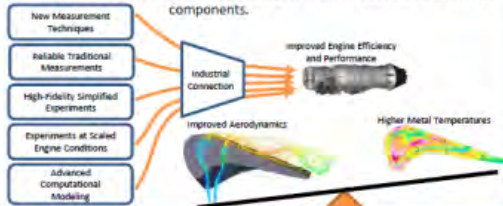
Round 1

Round 2

Power & Propulsion COE
Advanced Turbine Cooling

Technical Concept & Approach

Jet engines of the future will require better understanding of film cooling and losses caused by air leaking over the tips of turbine blades. New designs must balance efficiency improvements against higher thermal loads that can damage components.

Project Requirement, Federal Alignment, Sponsoring Organization (s)

- Key federal stakeholders: Dr. John Clark in the Turbine Engine Division of the Air Force Research Laboratory, Dr. Ken Suder in the NASA Turbomachinery and Turboelectric Branch
- Benefits to federal customers:
  - High-fidelity data sets for exploring turbine blade tip leakage flows and heat transfer
  - Advanced development tools including well validated computational models and novel experimental techniques
  - New understanding feeding into industrial design cycle to produce more efficient engines

Team & Economic Impact For State of Ohio

- Team members include: The Ohio State University, University of Cincinnati, Air Force Institute of Technology, Honeywell Aerospace, Innovative Scientific Solutions Incorporated
- Results could impact other industry members including GE Aviation, Teledyne Turbines (Toledo), Siemens Energy (Mt. Vernon), and suppliers around the state
- Methods and results developed will improve competitiveness for future funding opportunities including follow on to NASA's Small Core Engine initiative, Air Force development programs, and further industry investment

Budget, Schedules, Deliverables, & Risks

Two year funding request totals : $636,000 for OSU, $267,000 for UC, and $96,000 for AFIT ($1M total request matched by $1.27M)
- Year 1: $499,898 requested from state + $865,745 cost match
- Year 2: $499,939 requested from state + $402,975 cost match

Month	Method Development	Computational Modeling	Stationary Experiment	Rotating Experiment
1-6	Test PSP	Develop model using existing data	Update Hardware	Hardware Modifications
7-12	Determine optimal technique	Comparison to stationary expt.	Surface and Flow field data	Experiment Assembly
13-18	Impact of wakes on film cooling	Detailed validation, create rotating model	Investigate revised geometries	Experiment Execution
19-24	Comparison to rotating experiment			Data Analysis

Power and Propulsion COE – UAV Icing Protection

Technical Concept & Approach

Design, implementation and testing of MQ-9 engine inlet Ice Protection System

WBS	Task Description
1.0	Project Management
2.0	Requirements
3.0	Inlet Test Article Development
4.0	HeatCoat Analysis & Design
5.0	System Integration
6.0	IRT Testing
7.0	Reporting

Project Requirement, Federal Alignment, Sponsoring Organization (s)

The Air Force Life Cycle Management Center (AFLCMC) requires a retrofittable anti-icing technology and certification approach for medium altitude unmanned aircraft systems (UAS). Battelle's HeatCoat™ Ice Protection System (IPS) is an innovative electro-thermal anti-icing and de-icing system based on carbon nanotube (CNT) heaters. It will enable UASs to operate in icing conditions without adding excessive weight and without requiring the expense of structural redesign of aircraft components. Tests to date on a large UAS wing and inlet sections have demonstrated that HeatCoat™ provides excellent ice protection for UASs when operated in icing conditions per Federal Air Regulation (FAR) 25, Appendix C, for flight into known icing conditions (FIKI).

Team & Economic Impact For State of Ohio

Team: OSU: Jim Gregory; Battelle: Brett Burton; UDRI: Brian Rice; CW: Vikas Prakash; NASA Glenn: Icing Research Tunnel (IRT)

OSU: Principal Investigator and ice accretion analysis
Battelle: Requirements, tailor the HeatCoat design, fabricate the HeatCoat kit, support development of the test article, integration
CW: Thermal analysis of HeatCoat to aid in system performance tailoring
UDRI: Lead development and fabrication of the test stand for use in the NASA IRT, test latest AFRL coating stackup with HeatCoat
NASA Glenn: Testing performed at Icing Research Tunnel (IRT)

New job creation is estimated to begin in FY 18 and ranges from 23 total jobs for 50 ship sets to 80 jobs for 200 ship sets. Total production for MQ-9 UAS is estimated to be 300 sets.

Commercialization Partners: Battelle Memorial Institute

Budget, Schedules, Deliverables, & Risks

- OFRN Project Total: $1.0M
  - OSU: $260k, Battelle: $260k, CW: $125k, UDRI: $87k, NASA Glenn: $268k
- Cost Share: $1.35M
  - OSU: $204k, Battelle: $1M, CW: $125k, UDRI: $16k
- Period of Performance: 24 months
- Deliverables: Report showing results of icing wind tunnel testing on MQ-9 surrogate engine inlet structure
- Risks: Cost for development of engine inlet test stand is the biggest risk. Currently do not have CAD models or specifics regarding the icing wind tunnel interface.

APPENDIX 3 – M&M COE PROJECT DETAIL

Round 1

FRN Confidential

High Performance Plastic Substrates for Flexible Electronics

Technical Concept & Approach

OBJECTIVE: Develop high performance polymer substrates/films tailored for flexible Electronics

Project Requirement, Federal Alignment, Sponsoring Organization (s)

- AFRL Functional Materials: Flex Hybrid Electronics
- Flexible electronics are proposed as an enabling disruptive technology for both the AF and NASA.
- Flexible electronics enable survivable electronics for munitions or impact at terrestrial surfaces.

Team & Economic Impact For State of Ohio

- University of Akron (Lead), Akron Polymers, Orbital research, Hana Microdisplay Systems, Lucintech, EMS Inc.

Budget, Schedules, Deliverables, & Risks

- Requested Budget Total: $606K
- Year 1: [$303], Year 2:[$303].
- Period of Performance: [24 months]

Milestones
- Selection and fabrication of high temperature polyimide substrates
- Characterization of the thermomechanical properties and deliver substrates

Deliverables
- Transparent plastic substrate with $T_g > 375°C$
- 10%, 1 cm², efficiency device on one or more flex substrates

Risks:
- Film compatibility with microelectronics
- Uniform thermal expansion coefficients

FRN Confidential

Adaptive Bio-Inspired Aerospace Structures Actuated by Shape Memory Alloys

Technical Concept & Approach

OBJECTIVE: Develop High Temperature Shape Memory Alloys

Project Requirement, Federal Alignment, Sponsoring Organization (s)

- NASA Glenn Research Center (High Temperature & Smart Alloys Branch)
- 2015 NASA Technology Roadmaps TA 12: Materials, Structures, Mechanical Systems, and Manufacturing.
- Shape-morphing materials for a variety of applications, i.e., control surfaces, deployable reentry vehicles, expandable habitats, and deformable mirrors

Team & Economic Impact For State of Ohio

- Univ of Toldeo, OSU, CWRU

- Estimate 20 jobs; ~$20M potential from creation of the Global Center for Shape Memory Materials & Structures

- Various fundamental and applied funding opportunities at NASA, AFRL, US DOE, NSF, and DARPA

- Industry Partners: GE Aviation, Lincoln Electric, and Norman Noble

Budget, Schedules, Deliverables, & Risks

- Requested Budget Total: $606K
- Year 1: [$303], Year 2:[$303].
- Period of Performance: [24 months]

Milestones
- Identification of NASA desired composition for HTSMAs
- Characterization of the structure of the HTSMAs using high-resolution TEM

Deliverables
- Alloy development for High Temperature SMAs by adding different amounts of ternary elements
- Create functional shape memory and superelastic NiTiHf

Risks:
- Thermodynamic stability of ternary additions to Ni-Ti
- Embrittling

High Temperature Magnetic Materials

Technical Concept & Approach

OBJECTIVE: develop soft magnetic alloys with exceptionally small losses at high temperatures and frequencies up to 20 kHz

Ultra-Efficient Commercial Vehicles
(*NASA GRC Strategic Thrust*)

Project Requirement, Federal Alignment, Sponsoring Organization (s)

- NASA Aeronautics Strategy, aircraft propulsion must move necessarily more toward hybrid-electric or all electric concepts to provide sustainability, energy efficiency, and low-carbon emissions by 2025
- Mission critical magnetic components must be small, light-weight, and energy efficient.

Team & Economic Impact For State of Ohio

- CWRU (Lead),Univ of Cincinnati, Univ. of Toledo, YSU

- The proposed project will supply trained professionals with the necessary skills to fill existing needs at WPAFB and GRC. Our project addresses the burgeoning field of 3D printed functional materials.

- Development of this novel expertise in Ohio will encourage job growth in the growing hybrid electric propulsion industry

- Industry Partners: GE Aviation, Eaton and Electrodyne

Budget, Schedules, Deliverables, & Risks

- Requested Budget Total: $606K
- Year 1: [$303], Year 2:[$303].
- Period of Performance: [24 months]

Milestones
- Fabrication of the alloy into melt spun ribbons with nanocrystalline structure
- Production of particulate samples from melt spun ribbons
- Consolidation of powders into sputtering targets

Deliverables
- Thick film fabrication of nanocomposite magnets (Q6)
- Additively manufactured parts from particulate samples of nanocomposite ribbons (Q7)

Risks:
- Metallurgical stability during laser processing (additive)
- Thick film fabrication of nanocomposite magnets

Round 2

Materials & Manufacturing CoE – Low Cost Manufacturing for Limited Production Aircraft Composite Structures

Technical Concept & Approach

OBJECTIVE: Reduce the fabrication time and cost of composite structures by 25% to meet AF Low Cost Attritable Aircraft Technology goals.

Additively Manufactured Tools

Advanced Composite Manufacturing

Design Tools

Project Requirement, Federal Alignment, Sponsoring Organization (s)

- AFRL: affordable composite mfg, processing science, additive manufacturing and multifunctional structures. NASA: composite materials systems and advanced manufacturing techniques to tailor component properties for hybrid electric power systems
- Cost/Risk Model for Composites: impact design with initial manufacturing risk modelling/assessment
- Low Cost Composite Tools: time to market; tools produced < 2 weeks at 75% the cost of machined metal tools
- Low Cost Composite Preforms: reduced fabrication time and associated costs; increased toughness

Team & Economic Impact For State of Ohio

- UDRI: lead, Case Western Reserve, Univ of Cincinnati, Ohio University, Wright State University, Youngstown State University
- Manufacturing has the greatest impact upon the State's economy with a GDP of nearly $100B (JobsOhio). New lightweight composite materials and 3D printing/additive manufacturing are two of the game changers where Ohio is leading the way (JobsOhio)
- Industrial Partners:
  - NONA Composites
  - General Electric Aerospace
  - Orbital-ATK

Budget, Schedules, Deliverables, & Risks

- Requested Budget Total: $1.1M TOTAL / $1.4M Cost Share
- UDRI ($750K/$1000K), CWRU ($50K/$50K), UC ($50K/$50K), Ohio ($100K/95K), WSU ($50K/$50K), YSU ($100K/$10K)
- Year 1: $600K, Year 2: $500K (project yearly total only).
- Period of Performance: 24 months
- Milestones:
  - Cost/Risk model verification and validation
  - Demo small scale tools using low CTE designs/matls
  - Mechanical characterization of woven composites
- Deliverables: 1. Cost/Risk Model 2. LCAAT tool demo 3. Woven composite component demo
- Access to proprietary cost items for composites, durability of additively manufactured composites tools

APPENDIX 4 – HPHS COE PROJECT DETAIL

Round 1

FRN Confidential

Regional LVC Enterprise

Technical Concept & Approach

Project Requirement, Federal Alignment, Sponsoring Organization (s)

- Research Requirement: Defragmenting healthcare delivery for aeromedical missions
- Research Requirement: Performance Augmentation
- Research Requirement: Persistent, affordable, integrated LVC Training
- Sponsor - 711 HPW/RHAS POC: Wink Bennett, Ph.D.
- Creates a realistic immersive environment infrastructure to support education, training, technology development, and technology testing capabilities

Team & Economic Impact For State of Ohio

- U of Toledo, Case Western, Wright State University, and U of Cincinnati
- Elaborate on potential economic development impact for the state of Ohio.
    - Expansion of UT research with Microsoft
    - Expansion of research and commercial development with CAE
    - Private industry investment into research and commercial capability development
    - Projected 73 new jobs
        - Logistics, healthcare, and defense will be primary areas of growth

Budget, Schedules, Deliverables, & Risks

- Requested Budget Total: $655k (UT - $138k; CWRU - $50k; UC - $67k; WSU - $376)
- Year 1: $340K, Year 2:$315k
- Period of Performance: 24 months
- Milestones:
    - LVC Environment – Month 19
    - HMT Architecture – Month 19
    - Concept Abstraction – Month 17
    - Exercise – Month 24
- Software, HMT User Requirements Document, LVC Environment Requirements
- Aligning work development plan to coincide with exercises to demonstrate technical development (limitation of exercise participants)

FRN Confidential

Sliding-Scale Autonomy Through Physiological Rhythm Evaluations (SAPHYRE)

Technical Concept & Approach
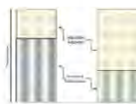
Problem: Individual variability, experience, trust in the system, and proficiency present a challenge in design of autonomous systems.
Challenge: These variables change throughout a mission based on mission requirements.

Project Requirement, Federal Alignment, Sponsoring Organization (s)

Federal Needs:
- Augmentation of human performance
    - Heart Rate Variability methodology (AFRL/RH).
- Performance Augmentation of Human Machine Teaming
    - Individualized performance assessment in HMT environments (AFRL/RH), cognition and performance simulations (AFRL/RH)

Approach:
- Current industry methods for augmenting human machine teaming are focused on reducing workload independent of the operator state.
- Our approach incorporates the individual unique qualities, platform, and environmental states into the sliding scale autonomous workload.

Team & Economic Impact For State of Ohio

- Ali K. Reiter, PhD Wright State University
- Bruce Howard Wright State University
- Vijay Devabhaktuni, PhD University of Toledo
- Jeff Weir, PhD AFIT
- Ron Storm, PhD, The Perduco Group

- This research will generate an estimated 55 jobs including jobs with team members and aviation and automotive industry partners within the state of Ohio.
- Impact on multiple commercial areas including the automotive sector for in-vehicle dynamic adjustments (Advanced Telo Sensors, Inc.), aviation industries as well as sports and gaming.

Budget, Schedules, Deliverables, & Risks

- Requested Budget Total: $832,967, ($228,644 WSU, $85,000 UT, $219,986 AFIT, and $299,337 Perduco)
- Year 1:$416,235, Year 2:$416,733
- Period of Performance: 24mos
- Milestones: Needs Assessment (May 2016), Software and Hardware Install (July 2016), Initial Data Collection and Analysis (Oct 2016), Test and Evaluation of Augmentation Using Sliding Scale Autonomy (July 2017).
- Deliverables:
    - Description of Industry needs and potential performance indicators of systems and individuals.
    - Data architecture / Software including user interfaces for the collection, storage, analysis, and reporting/visualization of data.
    - Sliding scale autonomy methods and performance indicators.
- Risk: IRB approval delay (mitigation-early submission & ample time between initial data collect and augmentation task.)

Round 2

HPHS– Advanced Cognitive and Physical Sweat Biosensing

Technical Concept & Approach

Wearable bio sensing will soon hit a glass ceiling without access to and sensing of actual chemical analytes. The most compelling biofluid for non-invasive continuous monitoring is sweat. Sweat biosensing is in its infancy (commercialization is limited right now to only sweat electrolytes).
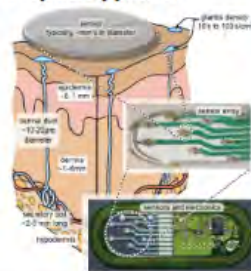
Project Requirement, Federal Alignment, Sponsoring Organization (s)

- AFRL - Josh Hagen, Scott Galster / NAMRU-D - Richard Arnold – *Provide continuous access to chemical biomarker information coming from the body.*
- There are no existing approaches or similar alternatives.
- Compared to other 'sweat sensing' patches in development, our approach and IP directly addresses challenges we have identified, challenges which are not yet known by the public.
- This technology will allow the DOD to monitor warfighter cognitive and physical performance, recovery, and also for the 1st time quantify in real-time internal toxin exposure.

Team & Economic Impact For State of Ohio

- Jason Heikenfeld (UC) – global leader in sweat biosensing
- Brent Cameron (Toledo) – electrochemical biosensor expert.
- William Kraemer (Ohio State) – global leader, physical perf.
- Ali Rezai (Ohio State) – global leader, cognitive perf.

- Economic impact is >50-100 jobs in 5 years and >$16M in follow on funding which is dominantly private investment in commercialization.

- Target markets include: elite athletics, military personnel, mental illness, workforce safety, health and wellness. Total aggregate market for sweat biosense easily could be >$1B/yr.

Budget, Schedules, Deliverables, & Risks

- Requested Budget Total: [$1,090,000] ($490k UC, $200k Toledo, $400k Ohio State).
- Year 1: [$490,000], Year 2:[$600,000]
- Period of Performance: 2 years.
- Milestones:
  - (1) Clinically downselect biomarkers (vasopressin, adrenal, creatine kinase, neuropeptides, cortisol, etc.)
  - (2) Robust electrochemcial sensors for biomarkers.
  - (3) Sweat sensing patch integration and pilot manufacturing.
  - (4) Clinical validation of sweat sensing patches.
- Major technical risks include blood-sweat correlations and limit-of-detection for electrochemical sensing modalities.

HPHS COE – MOtion Sickness interactions with Spine Disorders (MOSSD)

Technical Concept & Approach

Challenge: Understand motion sickness (MS) causal mechanisms and its influence on susceptibility to low back disorders (LBDs)

Human Systems Causal Pathways for MS-LBD
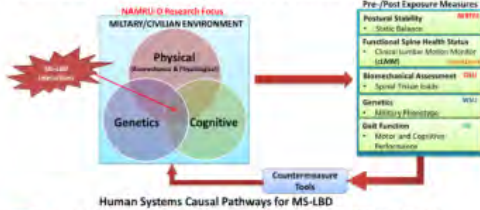
Project Requirement, Federal Alignment, Sponsoring Organization (s)

- NAMRU-D: CDR Rich Folga, richard.folga@us.af.mil
- Requirements: Understand MS-LBD causal mechanisms and develop quantitative tools to evaluate Countermeasure efficacy against MS and LBDs.
- NAMRU-D Mission Impacts
  - Current MS desensitization training is marginally effective and requires refresher training.
  - Our approach integrates genetics, postural stability, spine loading and kinematics (*cLMM*) before and after MS exposure to combat MS and LBDs.
  - Supporting Human Systems Integration including personnel health, protection, performance, and training.

Team & Economic Impact For State of Ohio

MOSSD Team
- The Ohio State University: William Marras, Ph.D. (PI)
- University of Cincinnati: Amit Bhattacharya, Ph.D.
- Wright State University: Chad Reiter, Ph.D.
- Economic Impact
  - **Leverage the cLMM as a spine health service and expand to broader markets**
  - Jobs: 55 - 68
  - Additional Research: BAA
    - PA-AFRL-AFOSR-2016-0001: ~$47,000,000
    - BAA-AFRL-RQKHC-2016-0009: ~$40,000,000
    - BAA-AFRL-AFOSR-2016-0004: $25,000,000
  - IP: Yes
- HealthCare, Military (NAMRU-D, AFRL)
- Industry Partners: SpineDynX LLC (Columbus, OH), Bertec Corporation (Columbus, OH)

Budget, Schedules, Deliverables, & Risks

- Requested Budget Total: **Up to $1.375M over two years**
- Year 1: [$625K], Year 2:[$750K] (project yearly total only).
- Period of Performance: 24 [months]
- Milestones:
  - NOTC and KRAKEN data acquisition with human testing
  - Data Integration and Human-in-loop tests in the KRAKEN
- List Deliverables
  - **MS-LBD susceptibility report**
  - **Countermeasure test protocol**
  - **Spine Health testing service**
- Identify key technical risks: **DRD availability, test subject recruitment**

APPENDIX 5 – C2PNT COE PROJECT DETAIL

Round 2

C2PNT– Intelligent Channel Sensing Based Secure Cross Layer Cognitive Networking for Resilient Space Communication

Technical Concept & Approach
- "Cyber secure" high capacity resilient UAV & space communication network
- "Cognitive communication" for adapting rapidly to changing environments
- "Cognitive radio" hardware and software integrated in a unique framework
- "System level" technological solution to airborne & space communication

Project Requirement, Federal Alignment, Sponsoring Organization (s)
- AFRL: Technologies for mission assurance in contested and denied environments against threats to EM spectrum, & network-enabled spectrum warfare
  - POC: Michael Nowak (michael.nowak@wpafb.af.mil) Tech Advisor, Spectrum Warfare, Sensors Directorate, WPAFB
- NASA: Space-based spectrum sharing, assured access to spectrum, cognitive technologies
  - POC: Elias Naffah (elias.t.naffah@nasa.gov) Chief, Space Communications & Spectrum Management, NASA
- NASIC: Detection/mitigation of malicious-code/malware in satellite hardware and software; trusted satellite-cockpit communication.
  - POC: Chad Arnold (chad.arnold.4@us.af.mil), Cyber Analysis, NASIC/ACYM, and David Fay (david.fay@us.af.mil) Satellite Systems, NASIC/SMSM

Team & Economic Impact For State of Ohio
- **University Partners**
  - Wright State University: Dr. Zhiqiang Wu
  - University of Toledo: Dr. Ahmad Javaid and Dr. Vijay Devabhaktuni
  - Ohio University: Dr. Harsha Chenji and Dr. James Stewart
  - Air Force Institute of Technology: Dr. Robert Mills, Dr. Scott Graham
- **Industry**
  - Comsat Architects: Dr. Kul Bhasin
  - GIRD Systems Inc.: David Maldonado
- **Job Creation Plan**
  - Ohio jobs through Comsat & GIRD federal dollars on CR&SDR (40 in 5 years)
  - Training specialized workforce across OH (produce 65 graduates in 2 years)
  - Trained workforce hiring by AFRL/NASA/NASIC & Contractors (80 in 5 years)
- **Commercialization and IP**
  - Team holds a wide range of existing IP including publications, SBIR data rights, proprietary technologies, and trade secrets.
  - Team is at the frontier of the proposed technological areas, confirmed by publications, GIRD's multiple SBIRs, and Comsat's NASA contract.

Budget, Schedules, Deliverables, & Risks
- Total Project Budget Requested: $800,265 (including $70,264 of AFIT Budget)
  - Y1: $424,853 (WSU:$137,853, OU:$97,064, UT:$100,000, Comsat:$30,000, GIRD: $0, C2PNT:$25,000, AFIT:$34,936)
  - Y2: $375,412 (WSU:$77,147, OU:$97,936, UT:$100,000, Comsat:$40,000, GIRD:$0, C2PNT:$25,000, AFIT:$35,328)
- Total Committed Cost Share: $850,809 (including AFIT cost share)
- Period of Performance: 24 months
- **Significant Milestones**
  - Cognitive networking algorithms designed to enable spectrum sensing, interference mitigation, and high data-rate communications
  - Machine learning enabled cross-layer cybersecurity algorithms/models designed and implemented for optimal information security
  - "FPGA based secure hardware" for multi-level secure code compilation
  - Proposed algorithms and technologies implemented & validated using nationally strategic federal testbeds, i.e. AFRL's DYSE and NASA's SCaN
  - Integration into the Interplanetary Overlay Network software codebase
  - New Collaborations, New IP, New Jobs, New Talents, New Technologies.

HPHS & C2PNT COEs: Test & Evaluation of Autonomous Systems (TEAS)

Technical Concept & Approach
- TEAS – Autonomy test, evaluation, verification, and validation process and tool improvements creating technical capability to support Air Force autonomy requirements
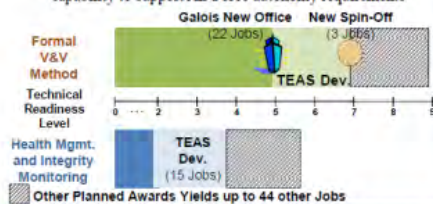
Project Requirement, Federal Alignment, Sponsoring Organization (s)
- AFRL/DoD Req: Develop and Execute TEV&V capability for Autonomy Security and Safety; System-of-Systems resiliency inclusive of human-machine teaming
- Project is aligned to OSD T&E of Autonomous Systems
  - Test Infrastructure and Personnel
  - Safety/Cyber Security for Autonomous Systems
  - Testing of Human System Teaming
  - Health Monitoring and Integrity Management
- Achieves capability development of sequential testing and supports security/safety analysis for autonomous systems
- Sponsors: AFRL/RQ – Matt Clark, AFRL/RH – Jason Clark

Team & Economic Impact For State of Ohio
- Team Members: Wright State University, Ohio University, AFIT, Galois, Ohio FRN HPHS & C2PNT COEs
- Potential Economic Development Impact
  - $51M+ in identified Research opportunities from AFRL, DARPA, Army and industry
  - Galois – Open Dayton Office
    - $1.325M Cash Committed Cost Share
    - $4.2M Contingent Investment to grow business based on commercial demand
  - Spin-out business from IP maturation planned within three years
  - 84 New Jobs (Galois (25), OU (8), WSU (7), AFRL/Industry (44))

Budget, Schedules, Deliverables, & Risks
- Requested Budget Total: $1.5M
- WSU ($378k); OU ($362K); Galois ($675K); AFIT ($85k)
- Year 1: $707K; Year 2: $699K
- Period of Performance: 24 months
- Milestones: 1) Analysis of UxAS Software 2) GPS Denied Scenarios; 3) Refactored Code Decision; 4) Health Monitoring and Integrity Mgmt interface for autonomy; 5) Testing of Human-System Teaming/Resilience Research Report
- Deliverables: Analysis Document; Software V&V Report; Software, Flight Test Reports, Final Report including Operator Trust Verification Analysis
- Cost Share: $2.53M (WSU, OU, Galois)
- Key Risk: Limited ability to use M&S; Complexity of autonomy TEV&V
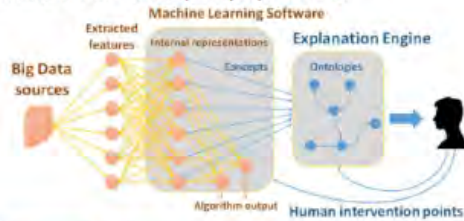
APPENDIX 6 – C4ISR COE PROJECT DETAIL

Round 2

HPHS & C4ISR COEs: Human-Centered Big Data (HCBD)

Technical Concept & Approach

(1) Improve discovery and hypothesis generation from Big Data. (2) Increase *transparency and trustworthiness* of analytic algorithms to maximize human-in-the-loop analytic performance

Project Requirement, Federal Alignment, Sponsoring Organization (s)

- **NASIC/AF requirement:** Advanced techniques & technologies for Big Data analysis.
- **Current limitations:** Discovering *relevant* information in Big Data is challenging. Analytic algorithms (e.g., *deep neural networks*) are helpful but are often "black boxes" lacking transparency.
- **Our solution:** Leverage semantic ontologies to generate *human-understandable explanations* of an algorithm's internal representations & outputs. Develop methodology for optimally combining human & machine judgments.
- **Impact:** Optimal integration of human & machine intelligence will greatly improve accuracy & reliability of analytic products.
- **Sponsors:** NASIC/GXKA (J. Homer, M. Brown), AFRL/RYW (M. Nowak).

Team & Economic Impact For State of Ohio

- **Team members:** WSRI/WSU, Ohio State, Case Western. Industry partners: Perduco Group, Ipsos, Hewlett Packard, DesignKnowledge, LexisNexis, Nuance, Illumination Works, Tenet3, DelphicDB, Columbus Collaboratory, Amperand, MatchTx
- **$12M in potential new R&D funding:** IARPA HFC program, IARPA Stories program, IARPA-wide BAA, DARPA Explainable AI, DARPA Information Innovation Office, NSF (multiple programs)
- **Est. 40 new jobs** (established industries & start-ups)
- **Broad potential impact extends to non-DoD industries.** Near-term focus on commercializing health care analytics applications (matching patients to drugs / clinical trials). Additional market opportunities in business analytics (marketing, finance, demand forecasting), infrastructure management (energy grid), and geopolitical analysis (election forecasting, risk assessment)

Budget, Schedules, Deliverables, & Risks

- Requested Budget Total: $1,343,600
- Year 1: $675,530 Year 2: $668,070.
- Period of Performance: 24 months
- Milestones: 1) Concept assignment for cluster analysis; 2) Concept assignment for deep learning; 3) Initial methodology for hybridizing human-machine judgments; 4) Validation of hybridized judgments
- List Deliverables
  - Algorithms for enabling knowledge discovery from high-dimensional cross-modal data
  - "Readable" machine learning systems
- Key technical risks:
  - Diffuse or uninterpretable results
  - Insufficient ontology richness for generating explanations