Parallax
ADVANCED RESEARCH

Ohio Federal Research Network (OFRN) Background

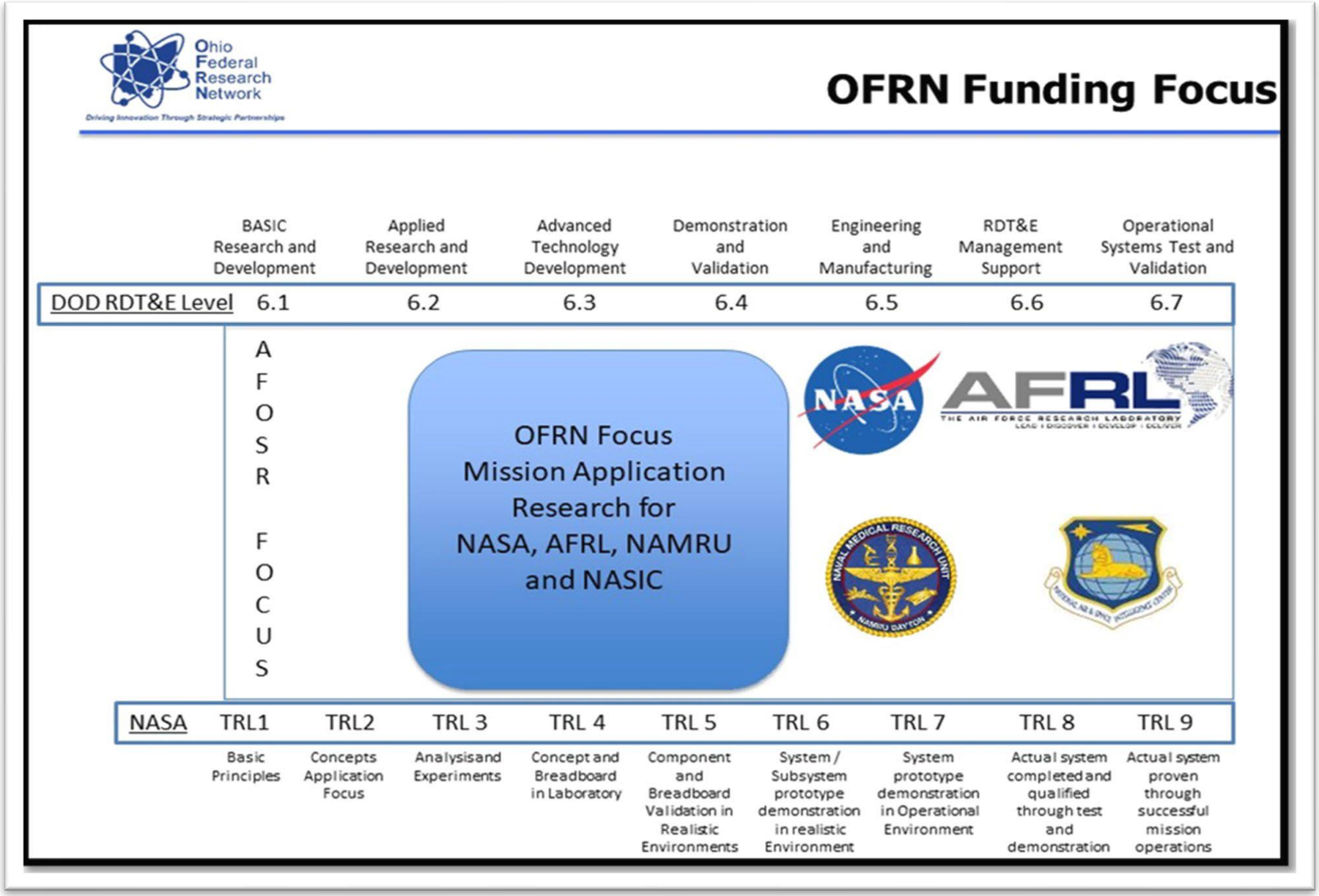
2015 to Present

Opportunity Days - April 2022

Mark Bartman, Maj Gen (Ret.)

Ohio Federal Research Network (OFRN)

Ohio Federal Research Network (OFRN)
$50M of State Funding Total for FY16-23



OFRN Program Impact

21
Universities & colleges engaged

4+1
Government Partners

97
Business partners engaged

1,167
Indirect jobs created

309
Direct jobs created

10
Spin out companies created

$34.7M
Industry-sponsored Research

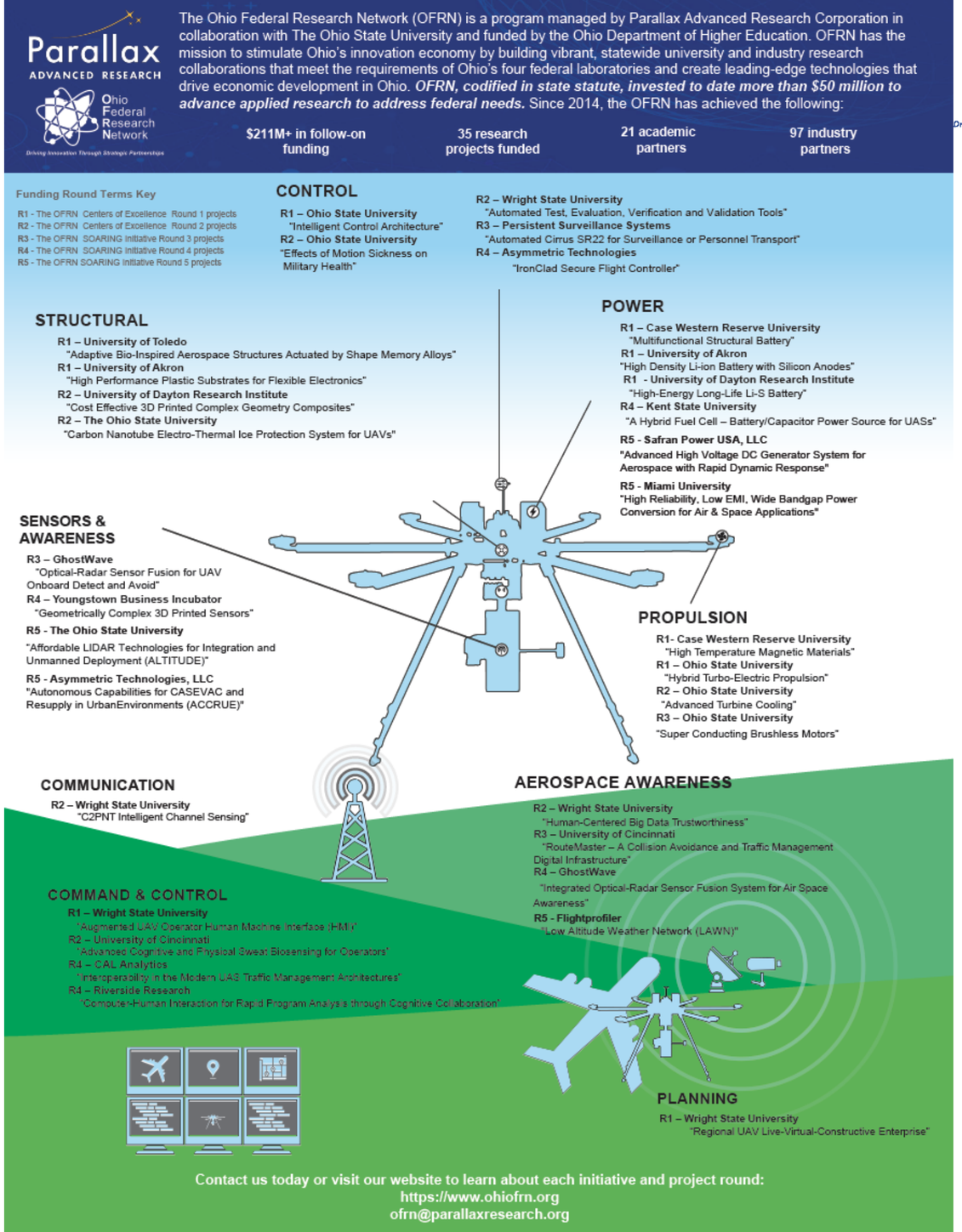
$211+M
Follow-on Funding Awarded

$35.2M
Cost Share

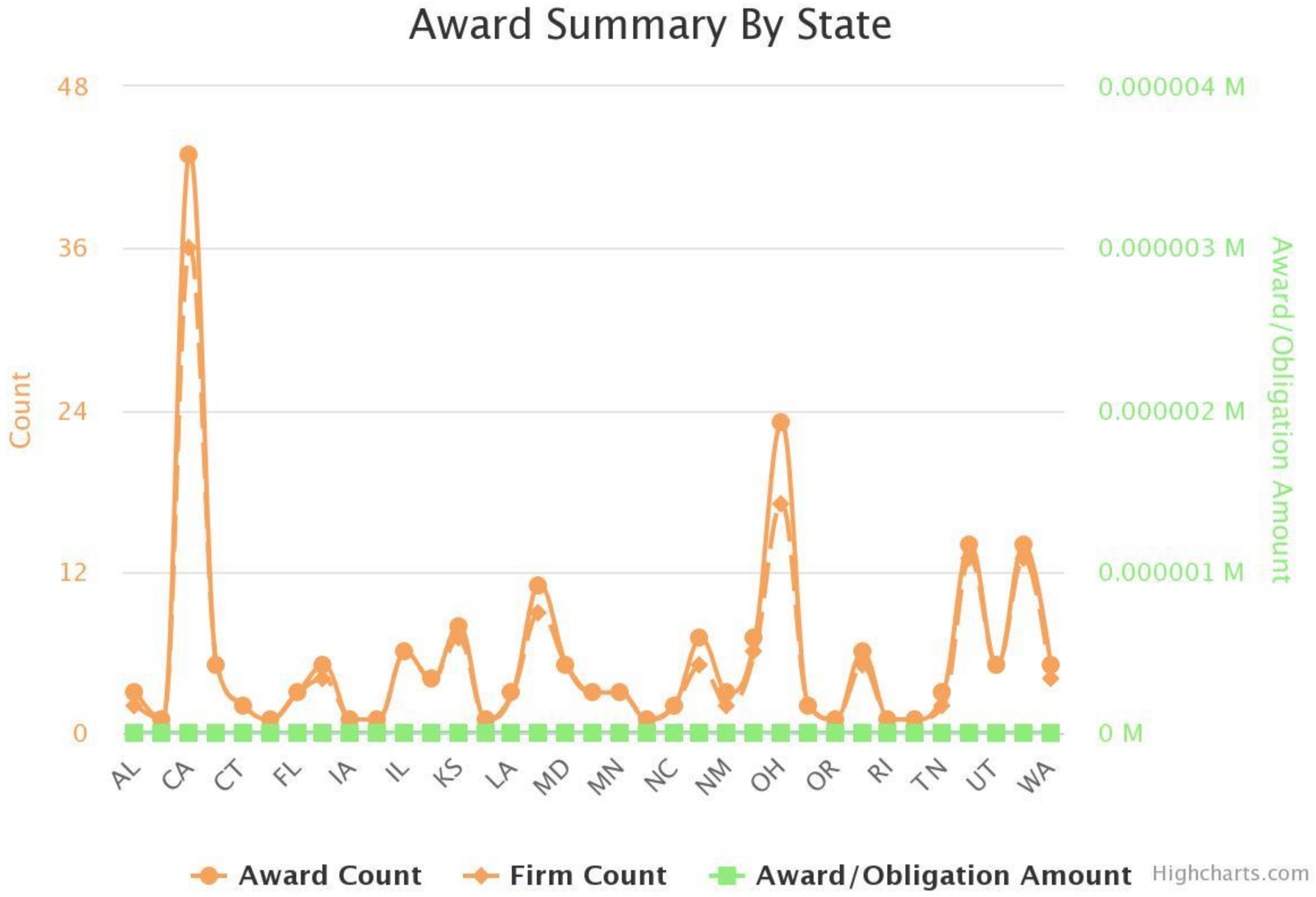
OFRN Rounds 1-5 Projects

***Interactive PDF available at:

https://ohiofrn.org/ohio-federal-research-network-rd-projects

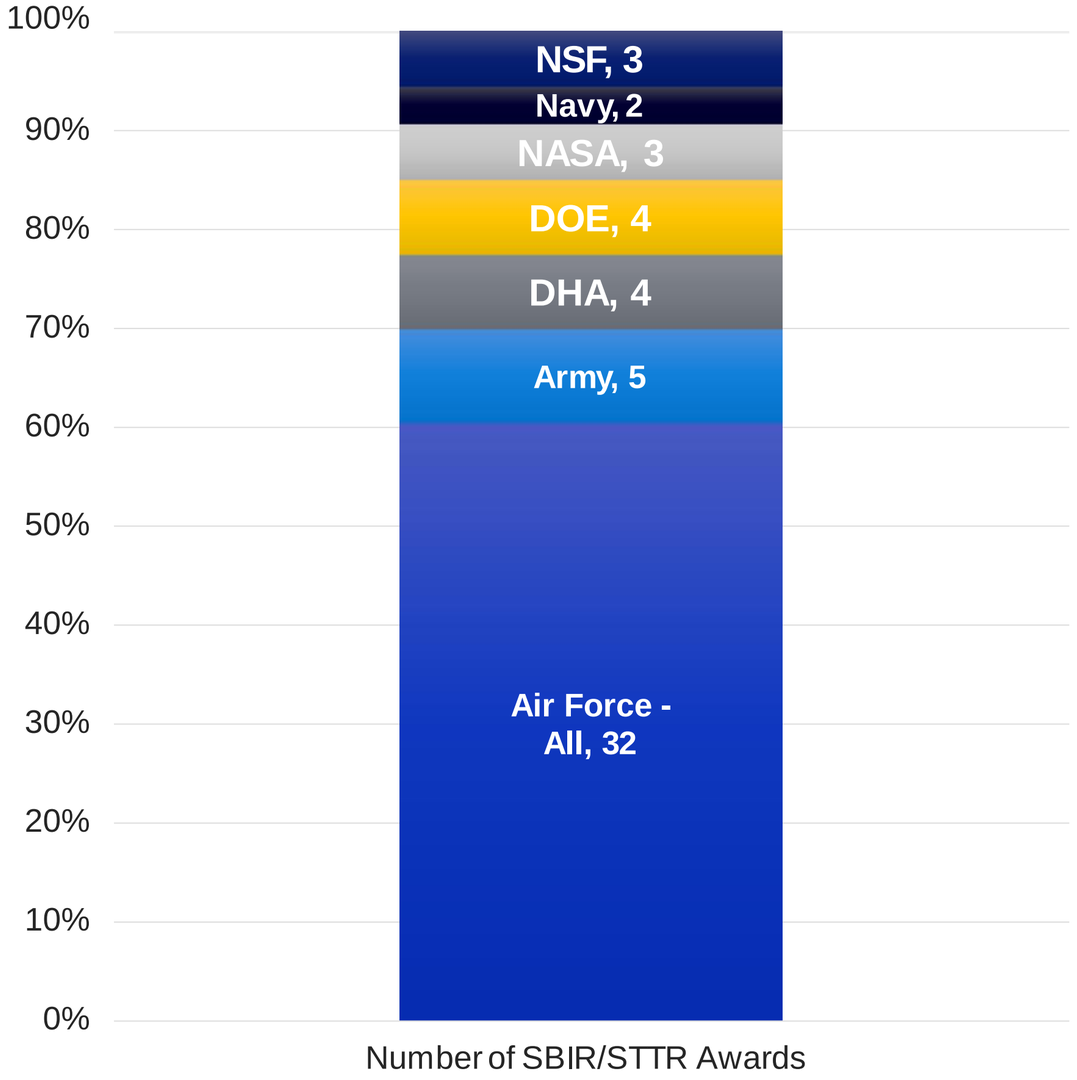


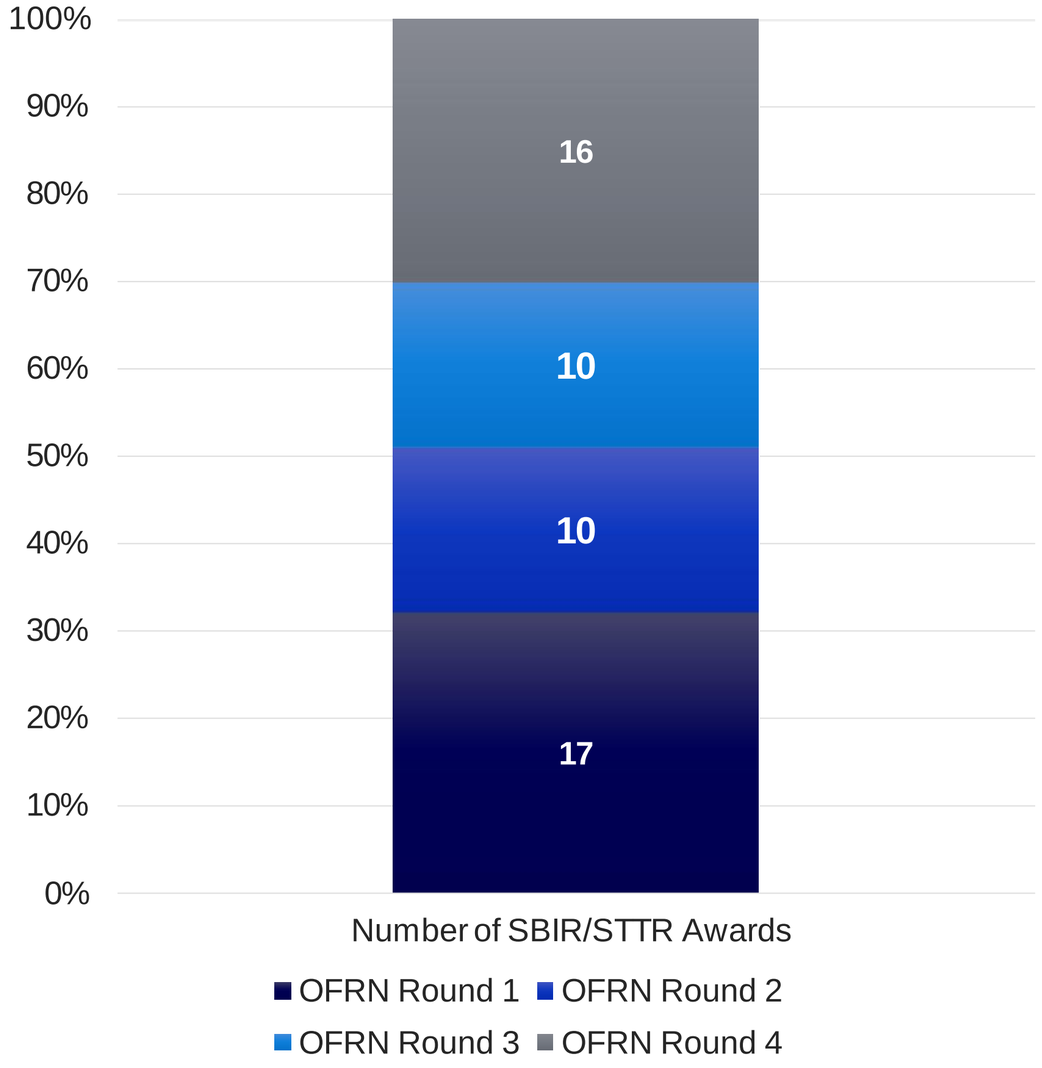
Agility Prime (Flying Orbs) STTR Awards



Ohio Federal Research Network (OFRN)

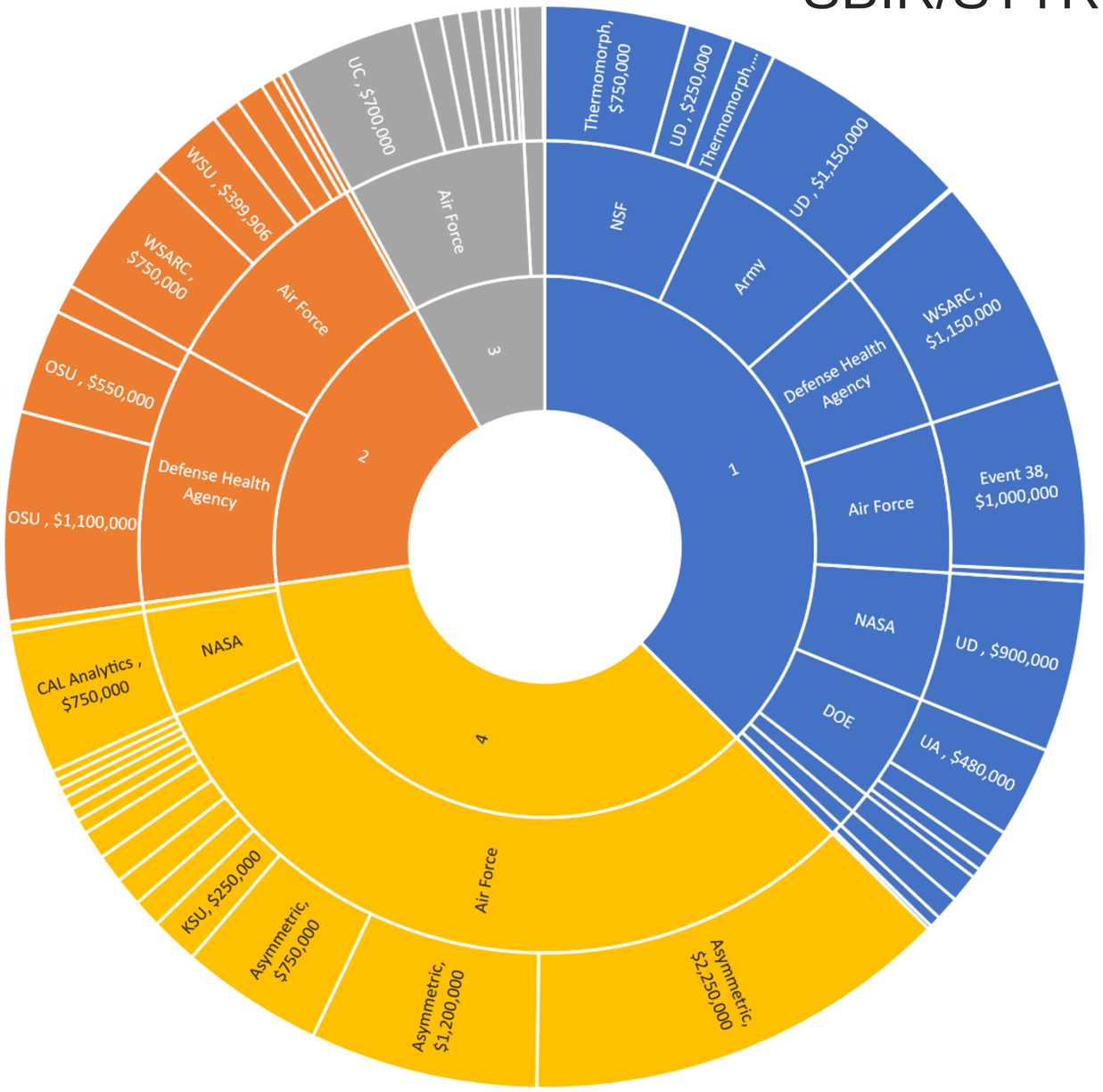
Total SBIR/STTR Awards - 53





OFRN U.S. Government Impact

- SBIR/STTR Awards



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

OFRN Spin Out Companies

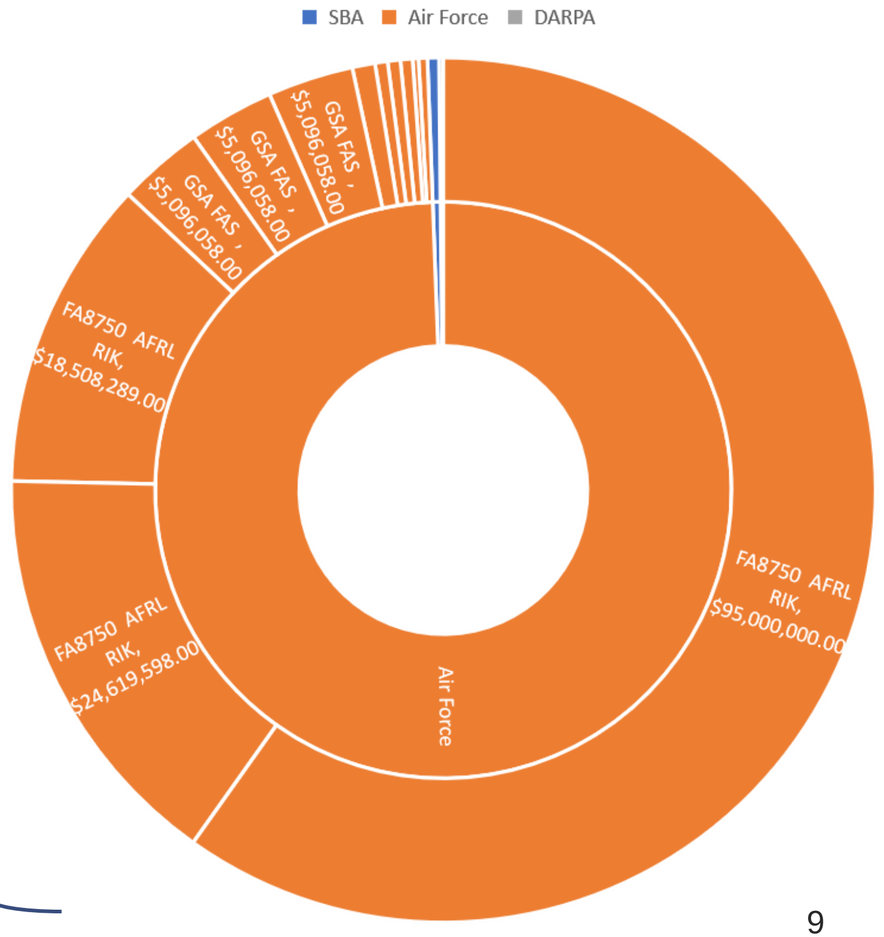
- Lifetime U.S. Government Funding Impact

Gov't Agency Funding for OFRN-related Spin-out (not including Tangram Flex)

Total	$ 161,742,418.97
Air Force - All	$ 157,929,340
DARPA	$ 1,037,197
DOE	$ 649,700
NASA	$ 182,090
Navy	$ 239,966
NSF	$ 105,672
SBA	$ 1,598,453

3Dnol	$ 182,090
Fenix Magnetics	$ 1,162,188
Kairos Research	$ 152,145
Thermomorph	$ 455,672
Tangram Flex	$ 158,790,323

Gov't Agency Funding for Tangram Flex



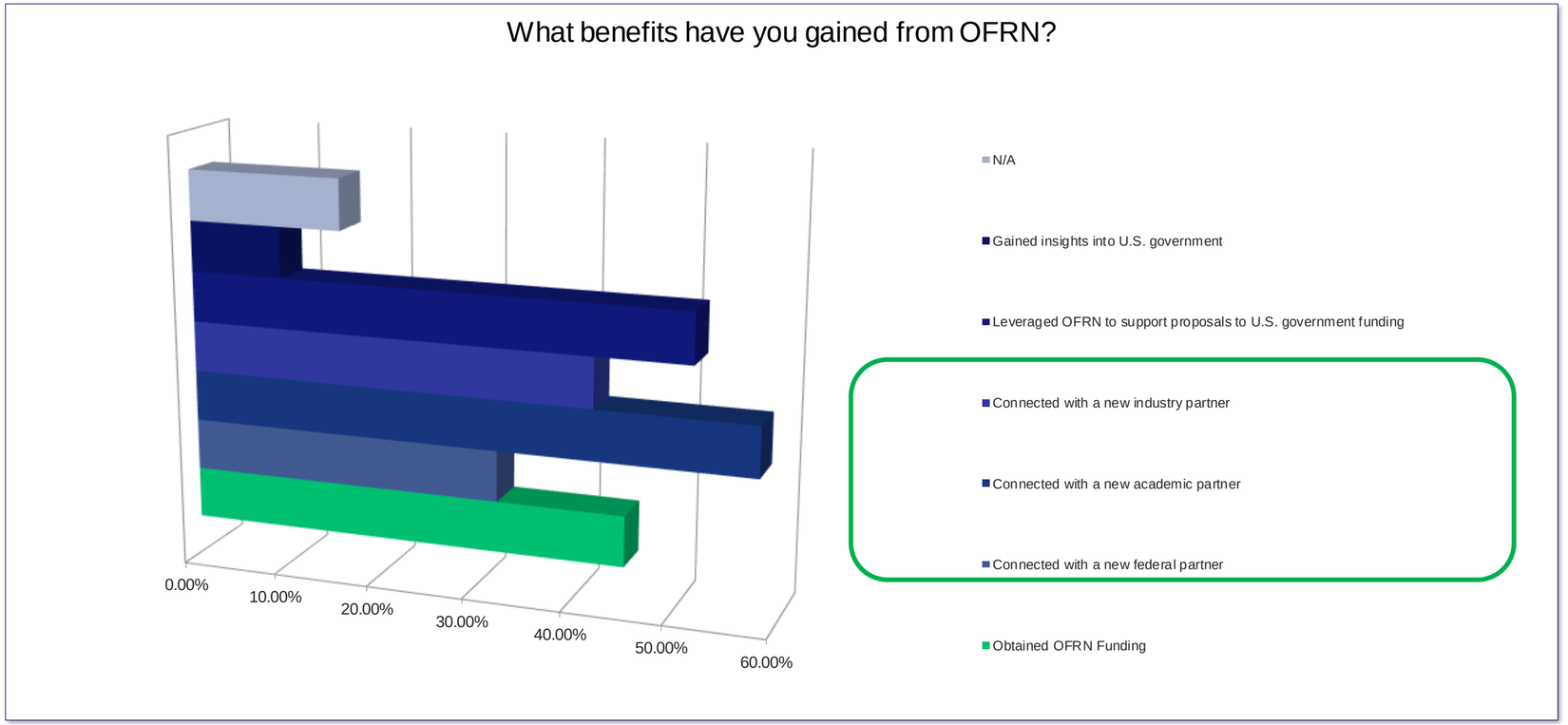
Prior Proposers Feedback

OFRN program continues to provide benefits to our network and build interest.

Where are you coming from?		
Answer Choices	Responses	
Academia	43.75%	14
Industry	56.25%	18
Government	0.00%	0
	Answered	**32**

Were you selected for OFRN funding?		
Answer Choices	Responses	
Yes	43.75%	14
No	50.00%	16
N/A	6.25%	2
	Answered	**32**

Would you submit for funding from an OFRN Round 6?		
Answer Choices	Responses	
Yes	87.10%	27
No	12.90%	4
	Answered	**31**



Thank you!

NAMRU-D/NAMRL Research Overview

Richard D. Arnold, Ph.D.

Director, Naval Aerospace Medical Research Laboratory

NAVAL MEDICAL RESEARCH UNIT DAYTON

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Navy Medicine Research & Development

CNO
Chief of Naval Operations - Washington, D.C.

BUMED
Bureau of Medicine and Surgery - Washington, D.C.

NMFP
Naval Medical Forces Pacific NAVMEDFORPAC - San Diego, CA

NMRC
Naval Medical Research Center - Silver Spring, MD

NAMRU-D
Naval Medical Research Unit - D
Dayton, OH

NHRC
Naval Health Research Center
San Diego, CA

NAMRU-2
Naval Medical Research Unit - 2
Cambodia

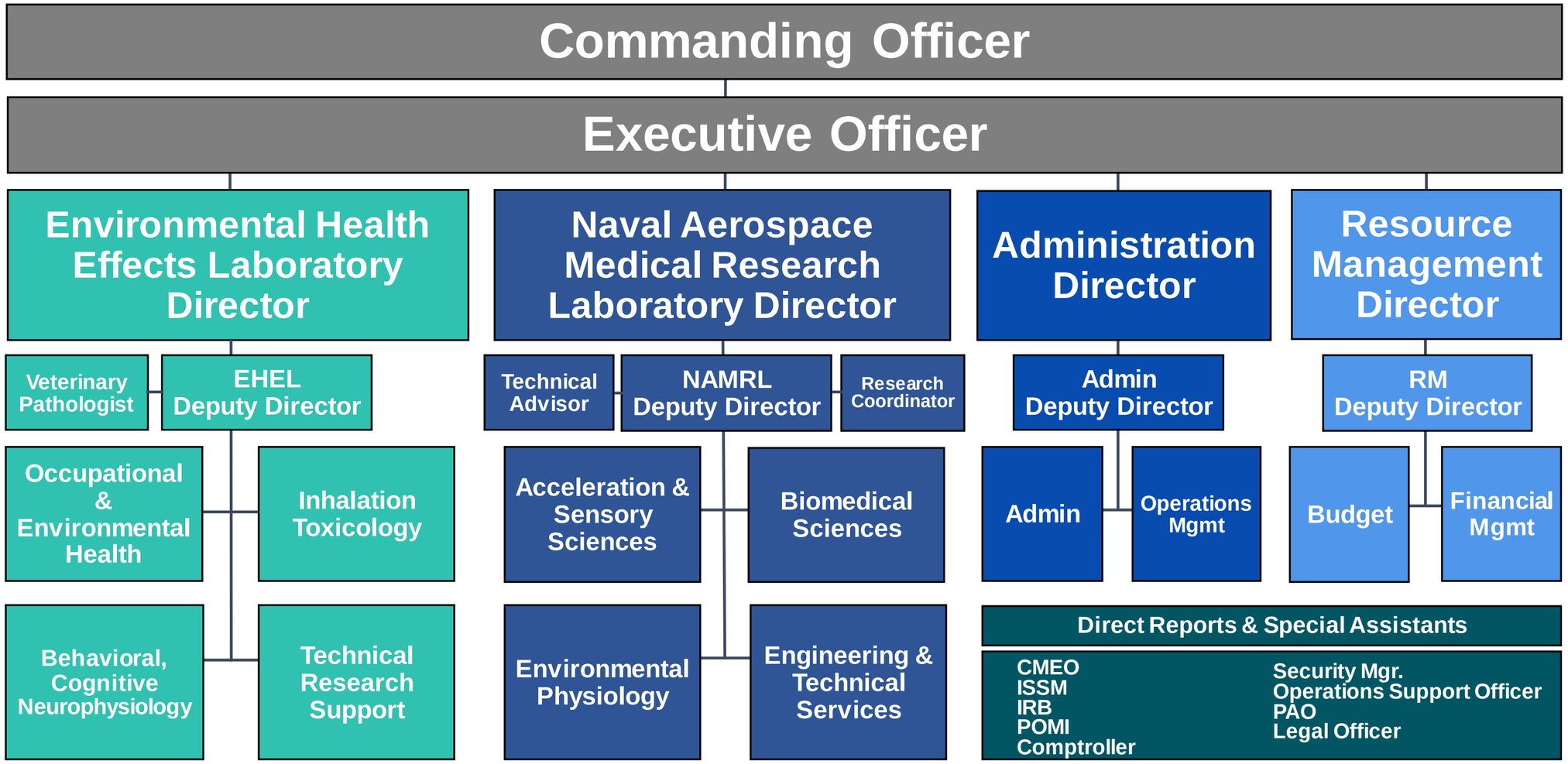
NAMRU-3
Naval Medical Research Unit - 3
Sigonella, Italy

NAMRU-6
Naval Medical Research Unit - 6
Lima, Peru

NAMRU-SA
Naval Medical Research Unit - SA
San Antonio, TX

NSMRL
Naval Submarine Medical Res. Lab
Groton, CT

Naval Medical Research Unit Dayton



NAMRU-Dayton

Federal Sponsors

External & Educational Collaborations

Community Relationships

29 Support Agreements - $51M

21 Cooperative Research & Development Agreements - $217K

3 Educational Partnership Agreements

NAMRU-Dayton

Overview

Mission

To protect and enhance the readiness, performance, and survivability of naval and joint warfighters by conducting operationally relevant environmental health effects, toxicology, and aerospace medical research.

Vision

To be the premier laboratory delivering world class medical research in support of naval and joint warfighter superiority.

Values

We anticipate and respond to operational requirements by delivering research products that enhance the readiness, performance, and survivability of the naval and joint warfighter.

Naval Aerospace Medical Research Laboratory

Mitigate and prevent leading factors associated with aviation mishaps. Protect and enhance the health, readiness, and performance of aircrew.

Acceleration & Sensory

U.S. Navy photo by Mass Communication Specialist 3rd Class Wyatt L. Anthony/Released

Biomedical Sciences


Navy photo by Mass Communication Specialist 3rd Chris Cavagnaro/Released

Environmental Physiology

Engineering & Technical Services


U.S. Navy photo by Mass Communication Specialist 2nd Class Z.A. Landers/Released

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Naval Aerospace Medical Research Laboratory

Core Research Programs

- Acceleration & Multisensory Effects
  - Vestibular Physiology
  - Spatial Disorientation
  - Motion Sickness
- Aircrew Neck/Back Pain & Injury
- Altitude Effects
  - Respiratory Physiology
  - In-cockpit Physiologic Monitoring
- Fatigue Assessment & Mitigation
- Vision Standards & Performance
- Aviation Personnel Selection Testing
- En Route Care

Department of the Navy Photo

Courtesy photo by NAMRU-Dayton

NAMRU-Dayton

Naval Aerospace Medical Research Laboratory

Research Facilities

- Human-rated Motion Platforms
  - DRD/Kraken
  - Moog
  - Rotating Chair Devices
  - Vertical Linear Accelerator
  - Visual Vestibular Sphere Device
- Spatial Disorientation Simulators
- Altitude Effects
  - Environmental Chamber
  - Reduced Oxygen Breathing Environment
  - Sensors Lab
  - Respiratory Physiology Labs
  - Unmanned Breathing Systems Lab


Department of the Navy photo


Department of the Navy photo

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Naval Aerospace Medical Research Laboratory

Research Facilities

- Operational Biomechanics & Ergonomics (OBiE) Lab
- Sleep & Fatigue Lab
- Vision Research Lab
- Mixed Reality Simulation
- Naval Extended Reality User Support (NEXUS) Lab
- Cognitive Neuroscience Lab
- MV-22 Osprey
- Fabrication Shop
- Wet Lab


Department of the Navy photo


Department of the Navy photo

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Research Program: Acceleration & Multisensory Effects

Human Rated Motion Platforms

Disorientation Research Device (DRD): Kraken™

- One of a kind national research asset
- Motion in full six degrees of freedom; fully capable of human in the loop control, flight simulation driven motion or basic research capabilities
- Motion base is a 35.5 ft. diameter platform turning 245,000 lbs. of rotating mass & two 50 ft. arms
- Capable of sustained planetary acceleration field up to 3.0 G
- Up to 680 lbs. of customer payload and 32 cubic ft. configurable payload space with single seat installed
- Time max G ≤ 5 seconds
- All 6 axes are bi-directional & all can operate simultaneously
- Breathing system installed
- EEG and HMD capable

Courtesy photos by NAMRU-Dayton

Courtesy photos by NAMRU-Dayton

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Environmental Health Effects Laboratory

Health effects of environmental hazards/stressors

Chemical Stressors

National Guard photo by Tech. Sgt. Jorge Intriag

Physical Stressors

U.S. Navy photo by MC3 Macadam Weissman/Released

Combinations/Co-stressors

U.S. Navy photo by Oliver Cole/Released

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Environmental Health Effects Laboratory

Core Capabilities

- *In vivo* exposures; unique expertise in inhalation toxicology
- *In vitro* exposures
- Determinations of health effects of exposure
  - General/gross tissue changes
  - Hematology & clinical chemistry
  - Ex vivo tissue analyses
  - Hearing testing
  - Microbiological/microbiome alterations
  - Chemical & analytical testing
  - Pulmonary assessments
  - Cognitive & behavioral testing
  - Neurophysiology evaluation
  - Reproductive & developmental effects
- Risk Assessment

U.S. Navy photo by PO3 Joseph C Boggio

U.S. Navy photo by Petty Officer 2nd Class Felicito Rustique/Released

U.S. Navy photo by Mass Communication Specialist 3rd Class Roland John/Released

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Partnering with NAMRU-D

Partnerships and research collaborations are of high interest to NAMRU-D.

- OFRN alignment to NAMRU-D mission priorities
- DoD and non-DoD research solicitations
  - Intramural and extramural solicitations
- SBIR/STTR
  - STTR allows for active participation by a gov't lab
- Cooperative Research and Development Agreement (CRADA)
- Contracting mechanisms
- Educational Partnership Agreement (EPA)

Leadership Team

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NAMRU-Dayton

QUESTIONS?

Thermal Management for Electrified Aircraft

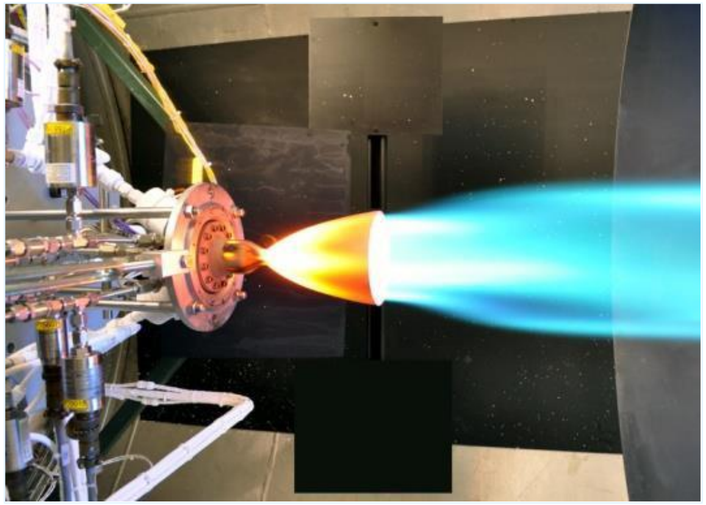
April 12, 2022

Ezra McNichols, NASA GRC
Email: ezra.o.mcnichols@nasa.gov

Prepared for: The Ohio Federal Research Network

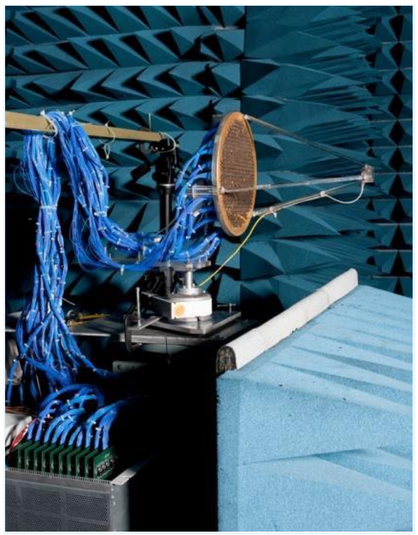
NASA Glenn Research Center Core Competencies

Air-Breathing Propulsion



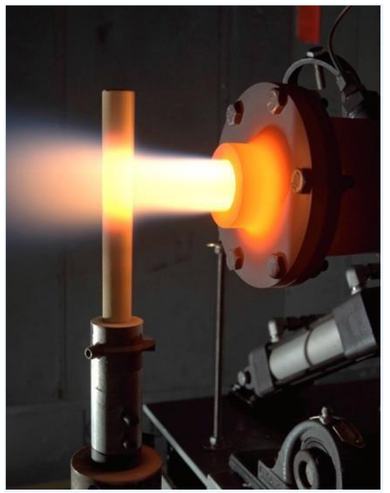
In-Space Propulsion and Cryogenic Fluids Management

Physical Sciences and Biomedical Technologies in Space



Communications Technology and Development

Power, Energy Storage and Conversion



Materials and Structures for Extreme Environments

NASA Aeronautics Strategic Thrusts

Safe, Efficient Growth in Global Operations
- Achieve safe, scalable, routine, high-tempo airspace access for all users

Innovation in Commercial Supersonic Aircraft
- Achieve practical, affordable commercial supersonic air transport

Ultra-Efficient Subsonic Transports
- Realize revolutionary improvements in economics and environmental performance for subsonic transports with opportunities to transition to alternative propulsion and energy

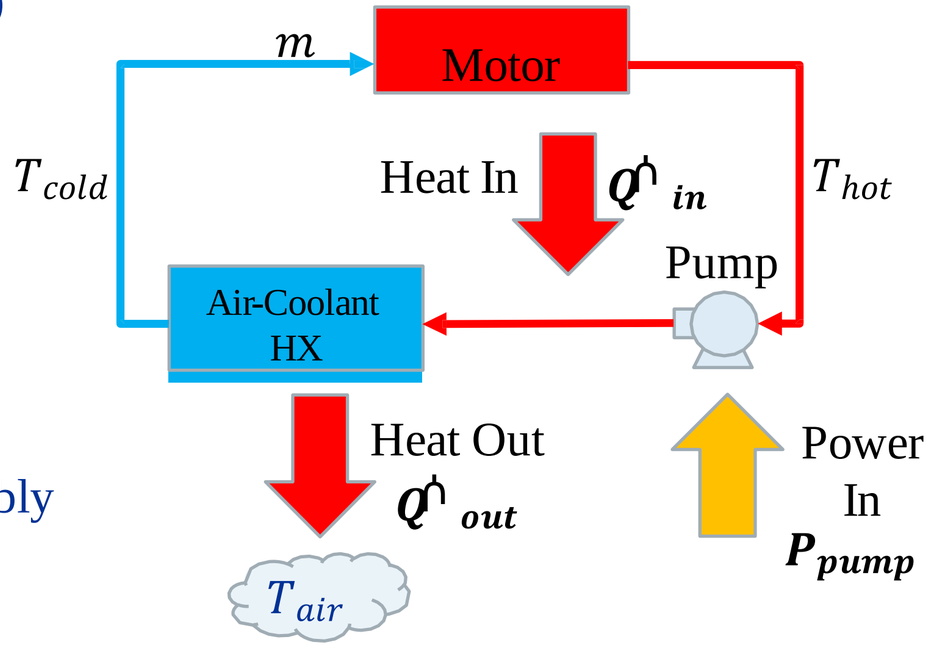
Safe, Quiet, and Affordable Vertical Lift Air Vehicles
- Realize extensive use of vertical lift vehicles for transportation and services including new missions and markets

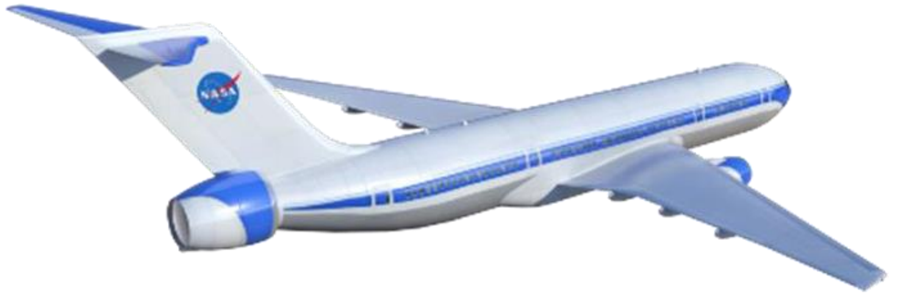
In-Time System-Wide Safety Assurance
- Predict, detect and mitigate emerging safety risks throughout aviation systems and operations

Assured Autonomy for Aviation Transformation
- Safely implement autonomy in aviation applications

Electric Aircraft Thermal Management System (TMS) Challenges

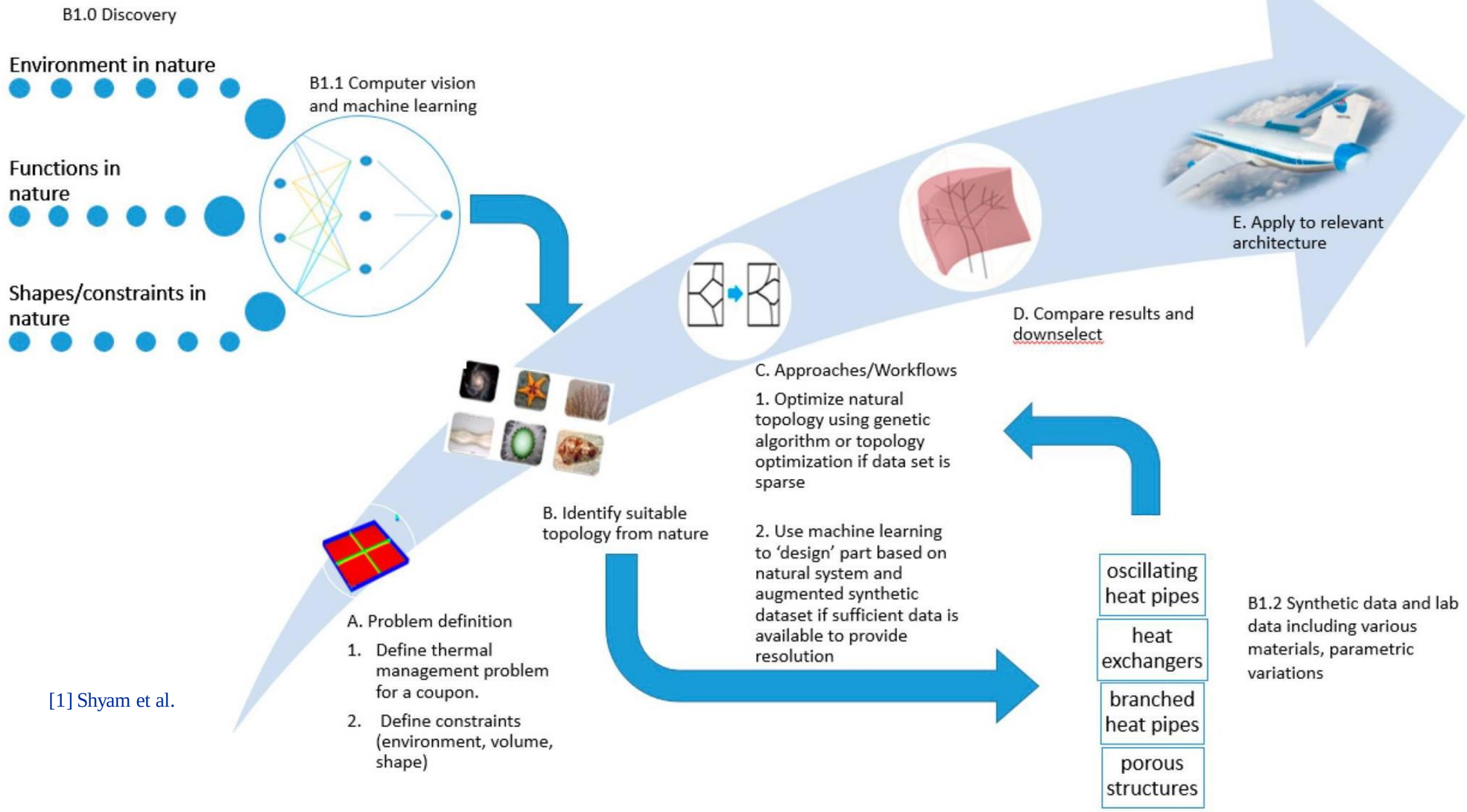
- **Higher-rated motors require more aggressive cooling approaches**($\uparrow \dot{Q}_{in}$)
  - Require more novel and invasive techniques($\uparrow complexity$)
- **Large amounts of low-quality heat are generated**
  - Low efficiency components (< ~98%), electronics ($\uparrow \dot{Q}_i$)
  - Low temperature limits: $60℃ \leq T_{component} \leq 200℃$ ($\downarrow \Delta T_{component}$)
  - 10 MW system with 2 % inefficiency = 200 kW heat to be managed
- **Component reliability is considerably affected by temperature**
  - Every 10℃ decrease in component temperature can extend life considerably
  - But this causes the TMS to be more massive and power consuming
- **Different vehicle configurations present different and variable challenges**
  - Varying & intense load profile over mission
  - Different flight profiles will determine limits in rejection
  - Physical vehicle constraints may limit components to small spaces, which may lead to greater potential for overheating and higher TMS complexity





Credit: Susan Johnson and Hashmatullah Hasseeb (NASA GRC)

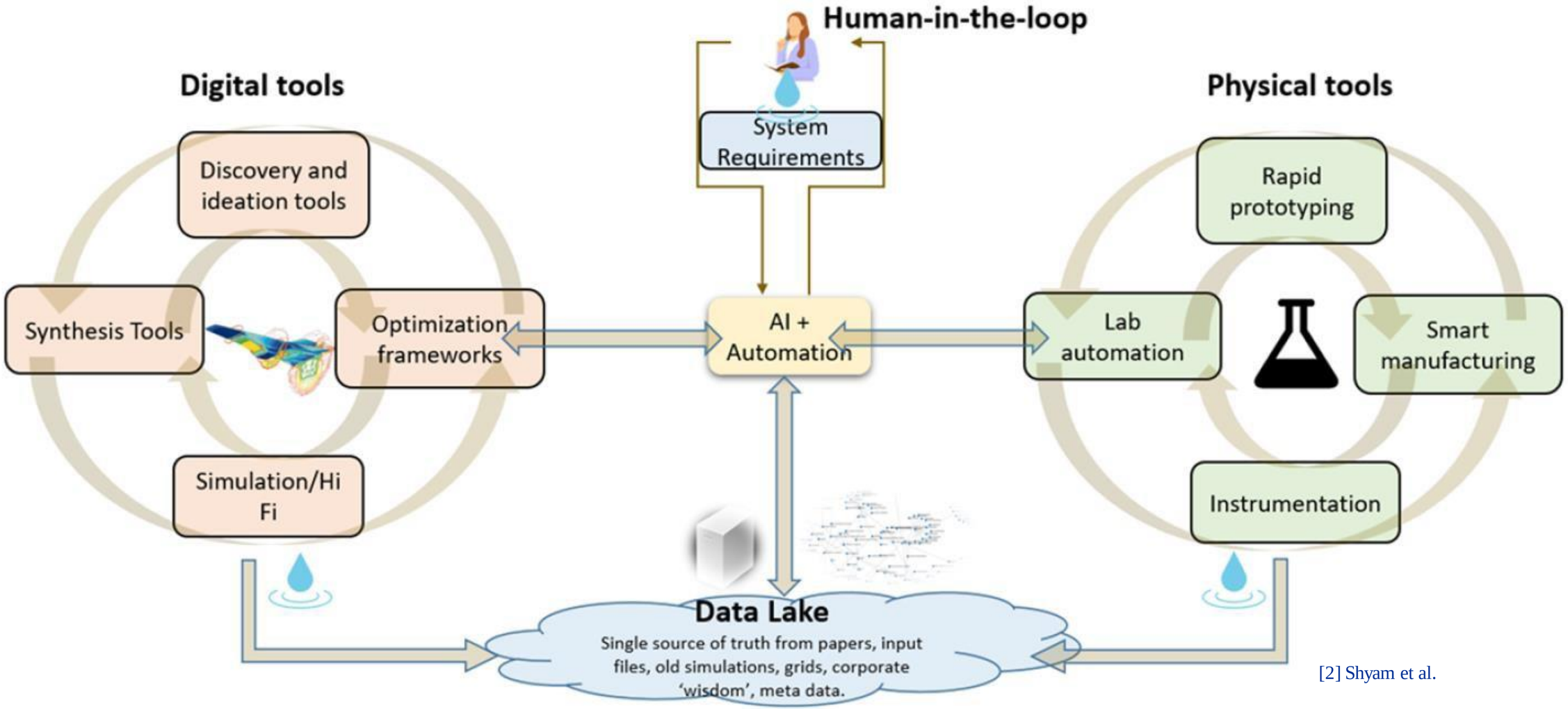
Workflow for Thermal Design with AI/Machine Learning



[1] Shyam et al.

[1] Shyam, Vikram, Lauren Friend, Brian Whiteaker, Nicholas Bense, Jonathan Dowdall, Bishoy Boktor, Manju Johny, Isaias Reyes, Angeera Naser, Nikhitha Sakhamuri, Victoria Kravets, Alexandra Calvin, Kaylee Gabus, Delonte Goodman, Herbert Schilling, Calvin Robinson, Robert O. Reid II, and Colleen Unsworth. 2019. "PeTaL (Periodic Table of Life) and Physiomimetics" Designs 3, no. 3: 43. https://doi.org/10.3390/designs3030043

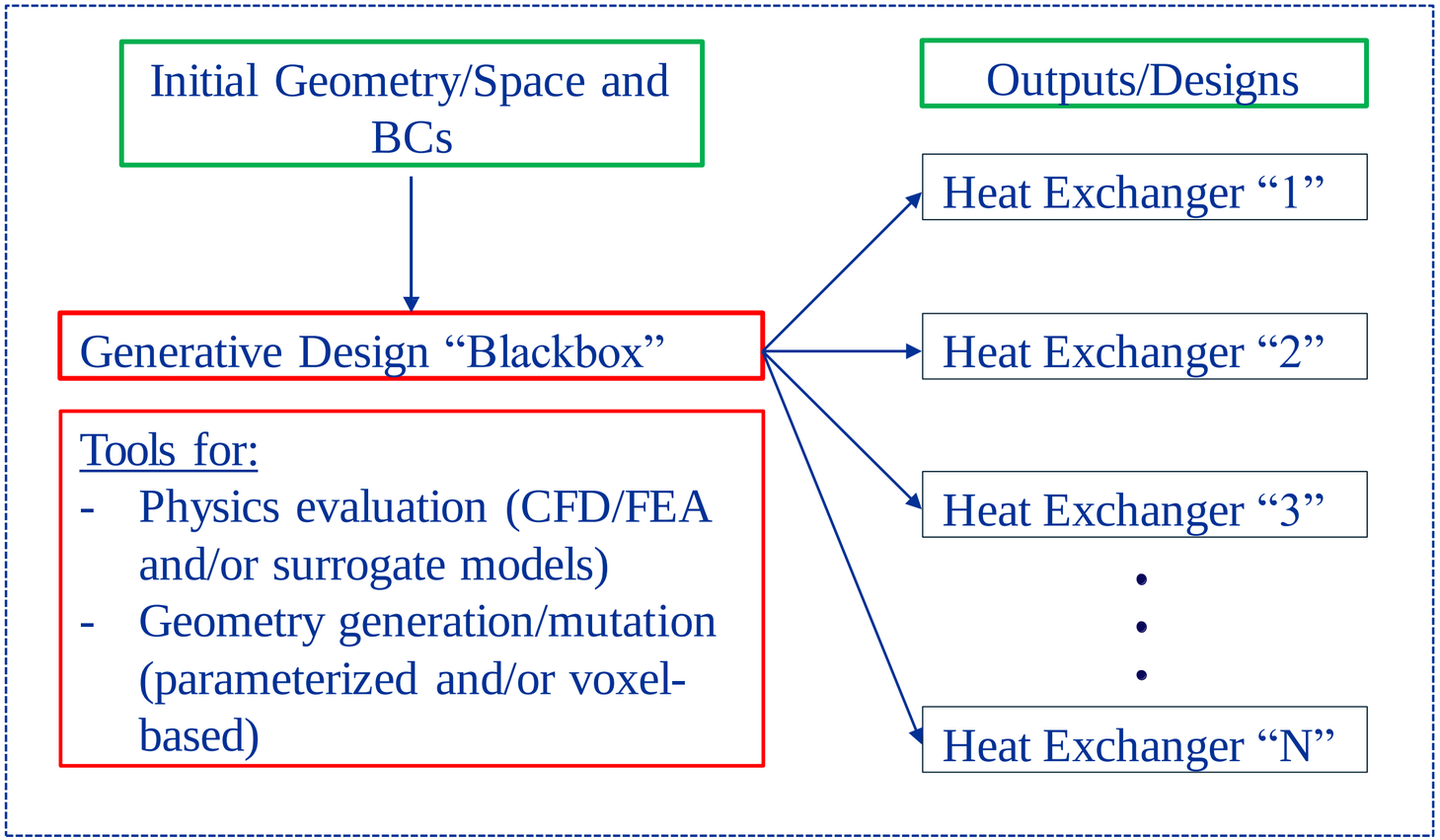
IDEAS – Intelligent Design and Engineering of Aerospace Systems

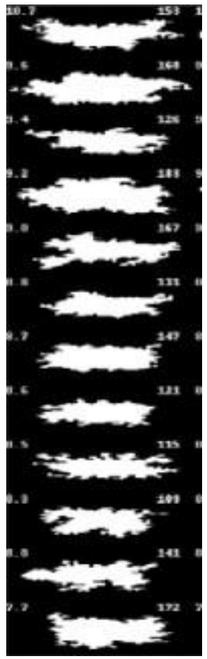


[2] Shyam et al.

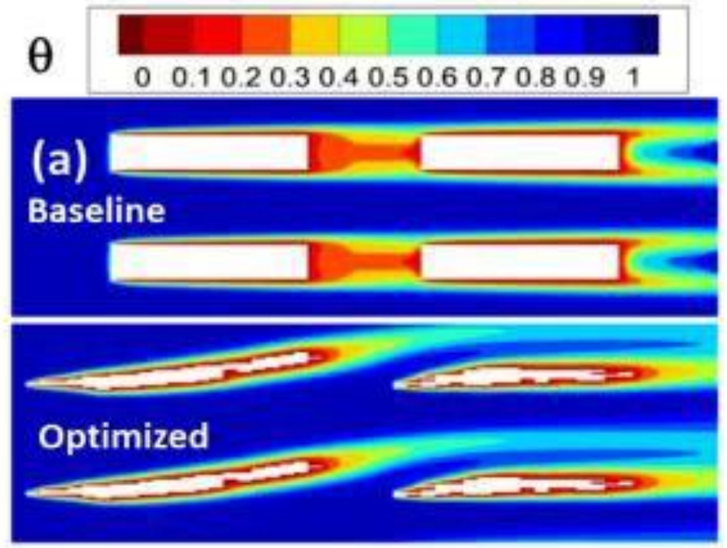
[2] Vikram Shyam, Paht Juangphanich, Ezra O. McNichols, Brooke Weborg, Herbert Schilling, Calvin Robinson, Kenji Miki, Manan A. Vyas, Arman Mirhashemi, Joshua Stuckner, Laura Evans, Samaun Nili and Ajay Misra. "IDEAS (Intelligent Design and Engineering of Aerospace Systems)," AIAA 2022-1043. AIAA SCITECH 2022 Forum. January 2022.

Leveraging Generative Design for Heat Exchangers





[3] Mekki et al.



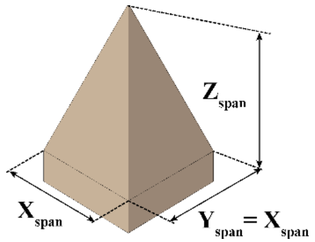
[3] Mekki et al.

[3] Bashir S. Mekki, Joshua Langer, Stephen Lynch, "Genetic algorithm based topology optimization of heat exchanger fins used in aerospace applications", International Journal of Heat and Mass Transfer, Volume 170, 2021, 121002, ISSN 0017-9310, https://doi.org/10.1016/j.ijheatmasstransfer.2021.121002.

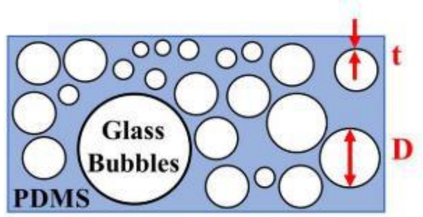
Tunable Radiation with Surface Microstructures

Goal: Use machine learning to analyze and design surface microstructures to change the wavelength of reflection and emission from a surface

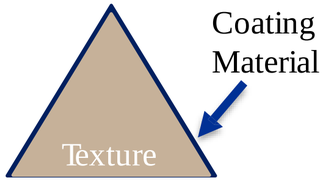
Microstructures



Micropyramids



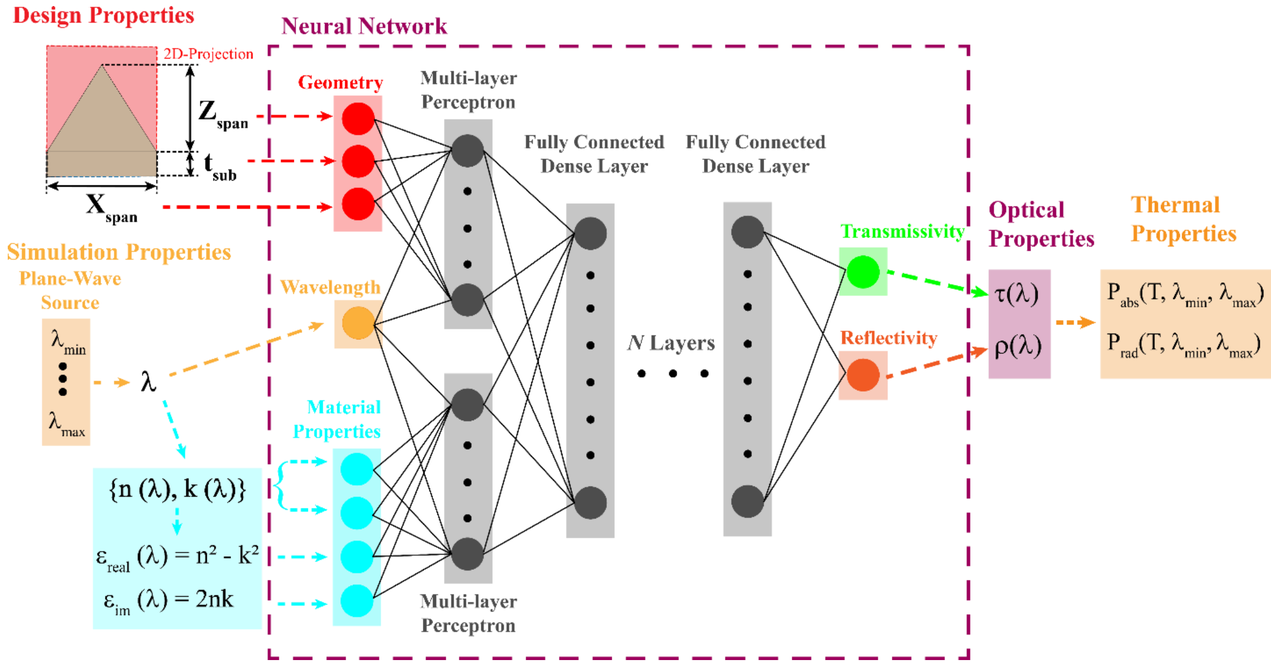
Microspheres



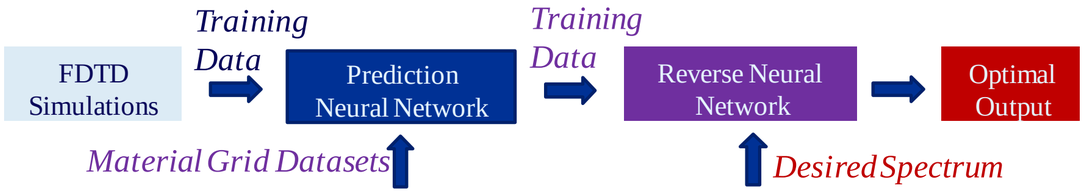
Multilayer/Coated

Hierarchically Textured

Neural Network for Analysis

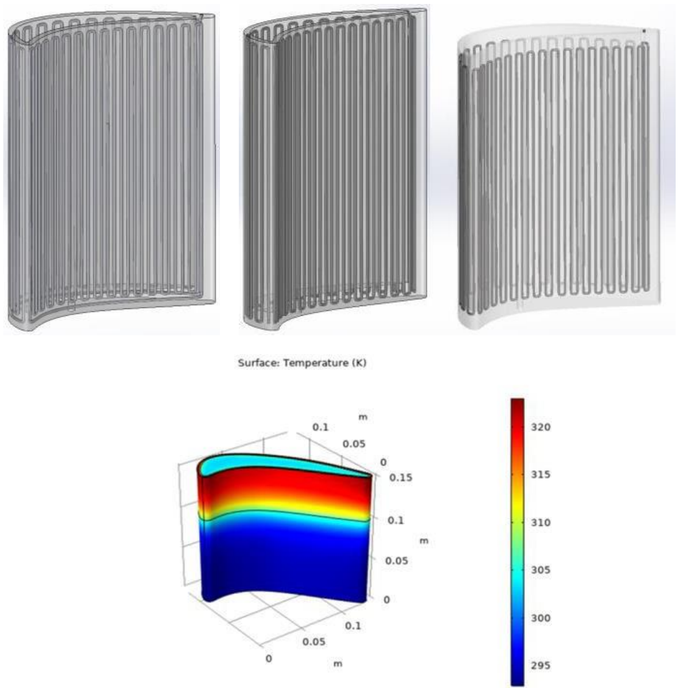


Design Process



Multifunctional Heat Pipe Airfoils

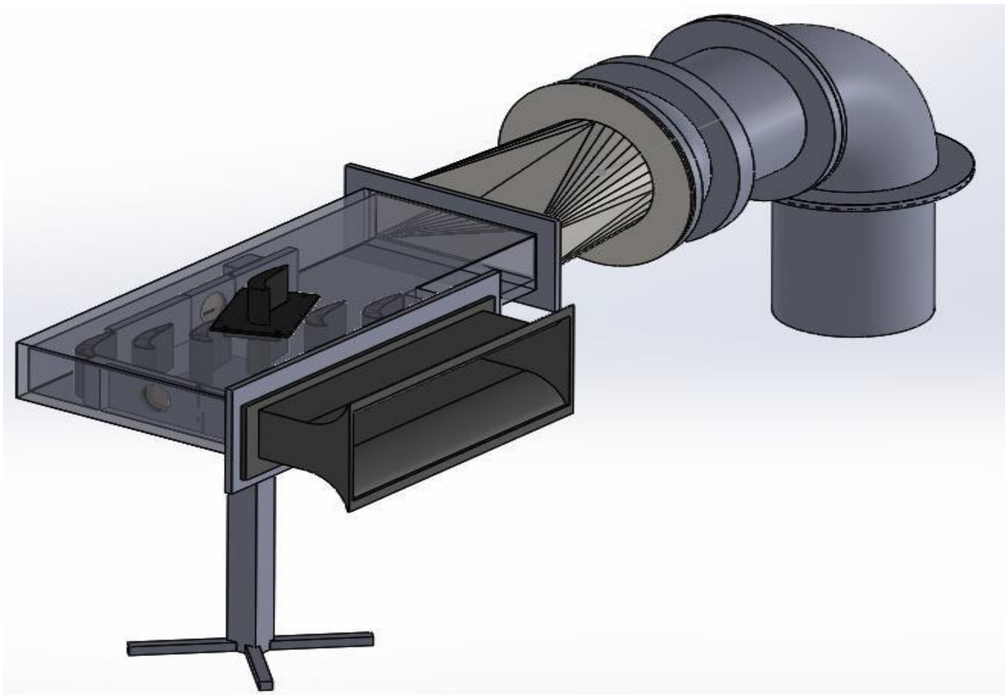
Design and Analysis Tool Development



Tools consist of:

- 0-D for Initial Sizing (thermal resistance network)
- 3-D Multiphysics (ignoring external aero)
- 3-D Multiphysics (coupling with external aero)

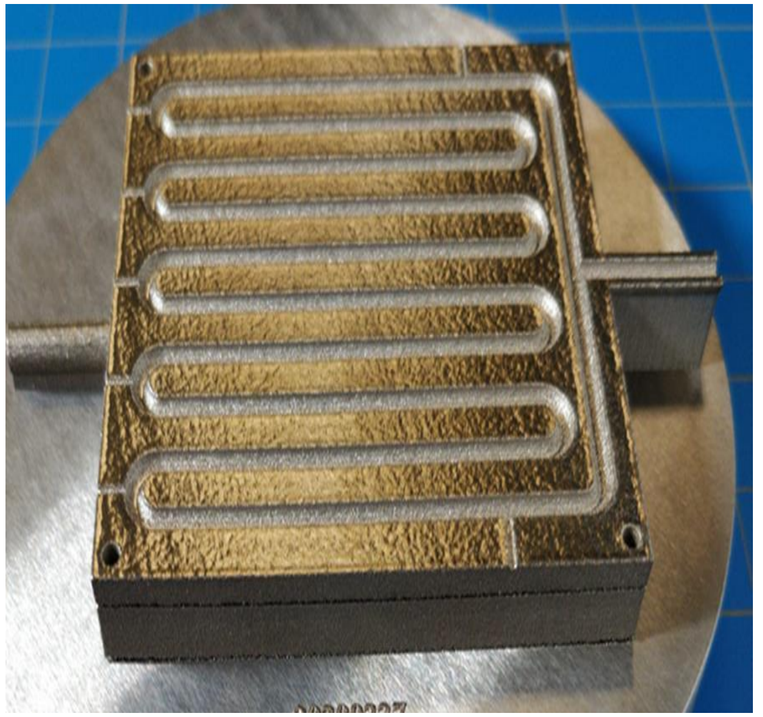
Low Temperature Aero/Thermal Testing



Main Points:

- Goal of tests are to assess performance/stability, and to compare to 3-D Multiphysics models (both levels of fidelity)
- For OHP designs, more emphasis on stability rather than comparison to tools

High Temperature Coupon Testing

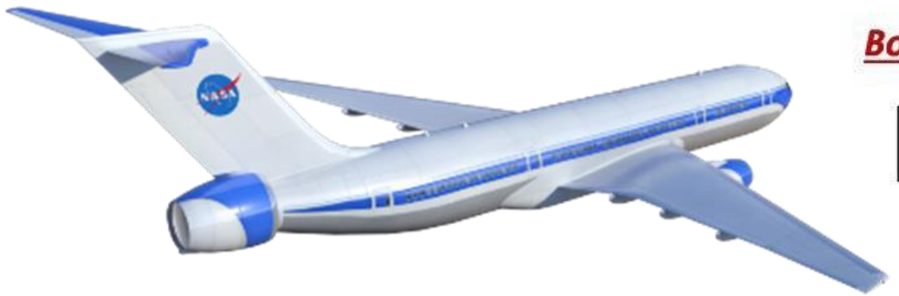


Main Points:

- Data for high temperature OHPs is scarce. Only 1 published paper with this data (in 2020)

Thermal Management System with Solid-State Thermal Switching

Goal: Use heat pipes to passively (without electronic controls) redirect heat between multiple sources/sinks on the aircraft.



[4] Diebold et al.

[4] Jeff Diebold, Calin Tarau, Kuan-Lin Lee, William Anderson and Rodger W. Dyson. "Electric Aircraft Thermal Management Using a Two-Phase Heat Transport System with Solid-State Thermal Switching Capability," AIAA 2021-3334. AIAA Propulsion and Energy 2021 Forum. August 2021.

What is needed?

- Design and Analysis Tools
  - Leveraging AI/Machine Learning to expedite the design/analysis process
  - Leveraging AI/ML to expand the design space
- Advanced Heat Exchanger Concepts
  - High thermal performance
  - Minimal weight
- Additively Manufactured Heat Pipes
  - Innovative wick designs, implemented through additive, may lead to an increase in performance and limitations
  - Multifunctional design
- Oscillating Heat Pipes
  - Predictive modeling of this is extremely difficult and time consuming. This is the largest barrier for this technology to be implemented on a wider scale.
- Phase Change Materials

Previous NASA Funding Opportunities for Electrified Aircraft TMS

- **SBIR/STTR Program**
  - Numerous awards (~5 or 6) each year for Electrified Aircraft
  - Thermal is crosscutting
- **NASA Fellowship Program**
  - 3 Fully-funded PhD Students
    - "Radiative Thermal Control by Novel Selective Emitter Materials" – Jonathan Sullivan (University of California Irvine)
    - " Topology Optimization of Multifunctional Thermal Management Systems for Aerospace Applications" – Bashir Mekki (Penn State University)
    - "Development of Ultra-Lightweight Acoustic Absorption Material/Structural System for Acoustic Management" – Bharath Kenchappa (North Carolina A&T State University)
- **NASA GRC Independent Research and Development (IRAD) and Center Innovation Fund (CIF) Programs**
  - PI must be a NASA Civil Servant
  - Teaming with Industry/Academia is encouraged
  - Generally smaller funds than SBIR/STTR program

Links for NASA Calls for Proposal

- NASA Solicitation and Proposal Integrated Review and Evaluation System (NSPIRES)
  - https://nspires.nasaprs.com
- Small Business Innovation Research (SBIR) & Small Business Technology Transfer (STTR) Program
  - https://sbir.nasa.gov/

THE OHIO STATE UNIVERSITY

State of Ohio and *Starlab*-GWCSP

Key leadership in the future of US Commercial Spaceflight

OFRN Opportunity Days

John M. Horack, Ph.D.

horack.1@osu.edu

The Ohio State University

April 2022

International Space Station

Starlab-George Washington Carver Science Park (*Starlab*-GWCSP)

- One of the three selectees, led by Nanoracks. Awarded $160 million by NASA to get started.
- **Significant Ohio-based leadership in *Starlab*-GWCSP**
- **Ohio State is responsible for** 1.) developing and managing an academic research consortium that will drive *Starlab* research and technology development activities; 2.) develop a ground-based ag-bio laboratory for control experiments in 1-G (Earth gravity), and 3.) STEM education and outreach activities in partnership with DreamUp.
- **Zin Technologies (Cleveland, Ohio)**, will develop the customer research and lab hardware for *Starlab*; the
- **Universities Space Research Association (team based at NASA/Glenn Research Center in Ohio)** will manage the operation of the GWC Science Park on orbit;
- Additional partners include the **International Association of Science Parks and Areas of Innovation** (Madrid, Spain), who will coordinate global outreach efforts to their member community; and **Lockheed-Martin** (Littleton, CO), who is responsible for engineering design work for the *Starlab*.

GWC Science Park Founding Partners

Voyager Space
Strategy Lead

Advisory Board

Nanoracks
Owner and Operator

Management Team

Lockheed Martin
Spacecraft Integration Lead

DreamUp
STEM Education Advisor

- Coordinate youth and college STEM education efforts

Ohio State University
University Consortium

- Coordinate university research
- Manage terrestrial research analog facilities
- Provide inputs into lab development efforts.

Universities Space Research Association
Director, GWC Park

- Manage the GWC Science Park
- Oversee the scientific operations of the lab

International Association of Science Parks
Global Engagement

- Foster a global network of academic and commercial researchers
- Build research pipeline to grow GWCSP utilization

ZIN Technologies
Component Development

- Overall lab design, component upgrades, and overall architecture
- Develops key lab subcomponents

Industry expertise spanning decades of NASA projects, commercial development, and worldwide academic research

George Washington Carver Science Park Overview

First Science Park in Space

- Starlab Core
- First in-space member organization of the International Association of Science Parks (IASP)

Our Labs

- Feature dedicated laboratories for biology, plant habitation, physical sciences, and materials research
- Open workbench area and room for commercial projects.

Our Process

- Reconfigurable – allows for scientific components to be upgraded, replaced, or expanded
- Leverage Nanoracks processes for gathering and reacting to academic, industry, and government input.

Our Past

- Honors the scientific legacy of a great American scientist
- Starlab continues tradition of research, especially in the fields of agriculture and sustainability

Our Future

- Host and manage dedicated student programming by DreamUp and OSU
- Terrestrial analogs allows students to see and feel what conducting science in space is like

Starlab-GWCSP Research Areas and Figures

- Agriculture
- Astrophysics
- Atmospheric Physics, Weather, and Climate
- Biotechnology
- Combustion
- Communications
- Earth Remote Sensing
- Engineering, Hardware, and Sensor development
- Fluid Physics
- Human Health and Performance
- Materials Science
- Space Environmental Effects
- Space Plasma Physics
- Space Situational Awareness

- 8 m diameter inflatable + metallic section
- Total ~25 m in length
- Four-person, permanent crew
- ~335 cubic meters of volume
- 60 kW solar power
- Single-launch Initial Operational Capability

GWC Lab Components Summary

GWC Park Components							
Category	**Element**	**Volume (m^3)**	**Mass (NTE, kg)**	**Power (W)**	**Owner/Responsible Partner**	**Ownership/IP Status**	**Development Method**
Core Capabilities	ISPR Racks	--	--	--	HUNCH (Nanoracks)	NASA-licensed IP	Manufactured in-house
	EXPRESS Racks	--	--	--	ZIN	NASA-licensed IP	Manufactured in-house
	Cold Stowage	1.571	800	900	ZIN	Licensed/Purchased component	Developed in-house with subcontractors
	Combustion Facility	1.571	800	1000	ZIN	Owned	Developed in-house with subcontractors
	Glovebox Facility	1.571	800				ubcontractors
	Microscope Facility	0.39	200				ubcontractors
	Furnace Facility	0.79	400				ubcontractors
	Additional NASA Heritage Payloads	4.71	312				
GWC Park Capabilities	GPL Bench Systems	--	--				ubcontractors
	Space Acceleration Measurement System	0.39	200				ubcontractors
Biological Research Lab	Bioreactor	0.20	87.5				ubcontractors
	Cell Culture System	0.20	87.5	50	ZIN	Licensed/Purchased component	Developed in-house with subcontractors
	Microplate Reader	0.20	87.5	2.4	ZIN	Licensed/Purchased component	Purchased COTS
	Real-Time PCR System	0.20	87.5	50	ZIN	Licensed/Purchased component	Purchased COTS
	DNA/RNA Sequencer	0.20	87.5	50	ZIN	Licensed/Purchased component	Purchased COTS
	Cell Counter / Cytometer	0.20	87.5	50	ZIN	Licensed/Purchased component	Purchased COTS
	Centrifuge	0.79	175	200	ZIN	Licensed/Purchased component	Developed in-house with subcontractors
	Transit Spectrometer	0.20	87.5	50	ZIN	Licensed/Purchased component	Purchased COTS
	Microplate Hotel	0.20	87.5	50	ZIN	Licensed/Purchased component	Developed in-house with subcontractors
Plant Habitation Lab	Plant Growth Facility	1.571	700	560	ZIN	Licensed/Purchased component	Developed in-house with subcontractors
	Crop Mutation Facility	0.20	87.5	25	ZIN	Licensed/Purchased component	Developed in-house with subcontractors
Physical Science and Materials Research Lab	Fluid Handling Facility	1.571	800	1000	ZIN	Owned	Developed in-house with subcontractors
	Flash Freezer	0.20	87.5	50	ZIN	Licensed/Purchased component	Developed in-house with subcontractors
	Workbench Area	1.571	700	250	ZIN	Owned	Developed in-house
Customer Volume	Various Customer Payloads	--			Customers (managed by Nanoracks)	Customer-owned	Varies by customer

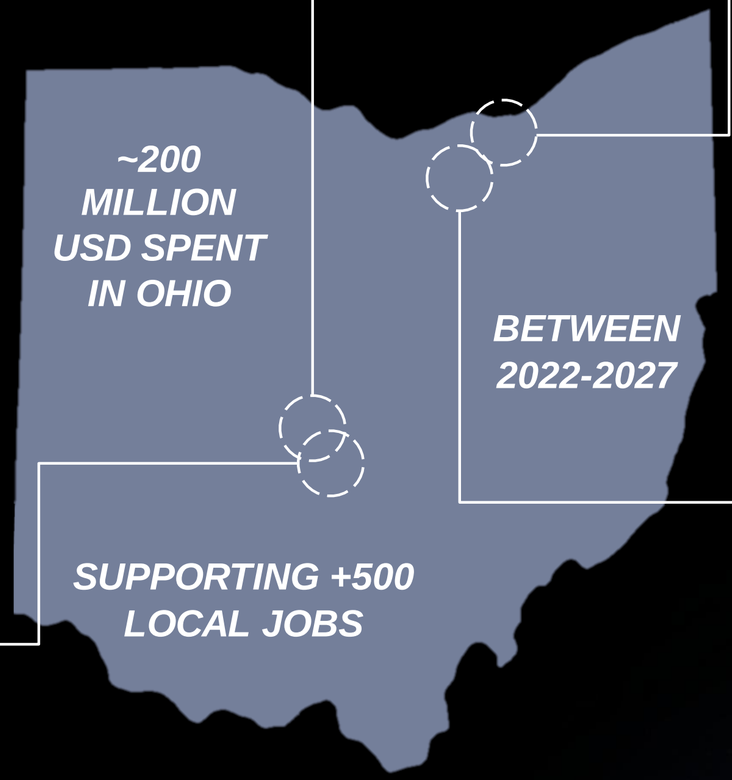
George Washington Carver Science Park

The namesake clearly points to a strong *plant*, *bio*, and *agriculture* focus.

GWC Science Park Regional Economic Development in Ohio

Starlab Terrestrial Analog Facility

- **Location**: KOSU Airport (potential)
- **Role**: Provide planning site for researchers, commercial partners, and Starlab operators; serve as a terrestrial control group for experiments; host student outreach and STEM engagement activities, events, and international visitors
- **Types of Activities**: Operations, Engineering, Research, STEM Engagement
- **Projected Cumulative Research Pipeline** (by 2035): **+600 M USD**



ZIN Technologies

- **Location:** Middleburg Heights
- **Role**: Design and develop the scientific components of the GWC Science Park and other Starlab space habitat equipment
- **Types of Activities:** Engineering, Manufacturing
- **Current Employees: 205**
- **Projected Subcontract Value** (2022-2027)**: 152 M USD**

Universities Space Research Association

- **Location:** NASA Glenn Research Center, Cleveland
- **Role:** Managing the scientific pipeline, day-to-day operations of the GWC Park, and post-flight activities like publishing and commercialization
- **Types of Activities:** Management, Research, Business Operations, In-Space Operations, Publication
- **Current Employees: 420**
- **Projected Subcontract Value** (2022-2027)**: 16 M USD**

The Ohio State University

- **Location**: Columbus
- **Role**: Build and operate the Terrestrial Analog Facility; Manage the GWC University Consortium; Generate a research pipeline from academic and government users
- **Types of Activities**: Management, Operations, Construction, Outreach
- **Projected Subcontract Value** (2022-2027): **14 M USD**

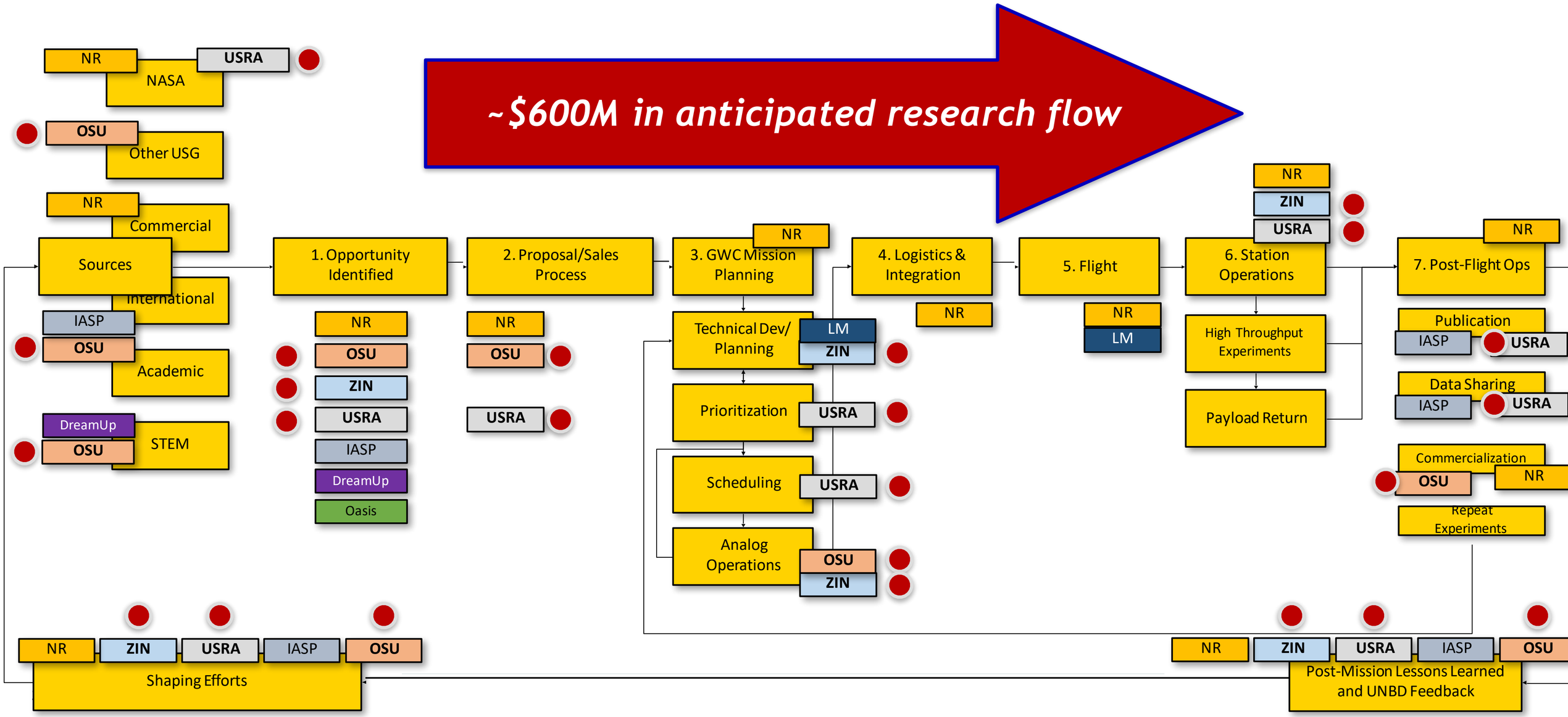
International Engagement through Global GWC Science Park Locations

- **Outlined on following slide**

GWC Science Park Order Flow

Ohio-based leadership role

- Order Acquisition (Generation) - Order Management (Prioritization) - Order Fulfillment (Execution)



Ohio and *Starlab*-GWCSP - opportunities

- Exploit synergies across university, private sector, and federal government to further develop Ohio-focused research thrusts for *Starlab*-GWCSP.
- Start “now” so that flight programs are ready for flight in the 2027 time-frame.
- Leverage *Starlab*-GWCSP for growth of STEM, education, and a pipeline for Ohio workforce development.
- Leverage *Starlab*-GWCSP for NSF, NASA, NOAA, EPA, USDA, DoD, and other research funding opportunities.
- Use *Starlab*-GWCSP as a hub for entrepreneurship, technology, new companies, and innovation.
- Create new innovation intersections in space, to benefit all on the ground
  - *“Agri-Bio Spaceflight Research”*
  - *“Microbiome of Space Habitats”*

OFRN - helping build Ohio as a global center for commercial spaceflight and low-Earth orbit research.

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Thank You.

Opportunities Deep Dive

1. U.S. Government Arrangements

2. Funding Opportunities
    1. NASA – Watts on the Moon
    2. NASA – LuSTR
    3. NASA – ULI
    4. AFRL – ManTech
    5. DHS – LRBAA
    6. ODNI – S&T Landscape

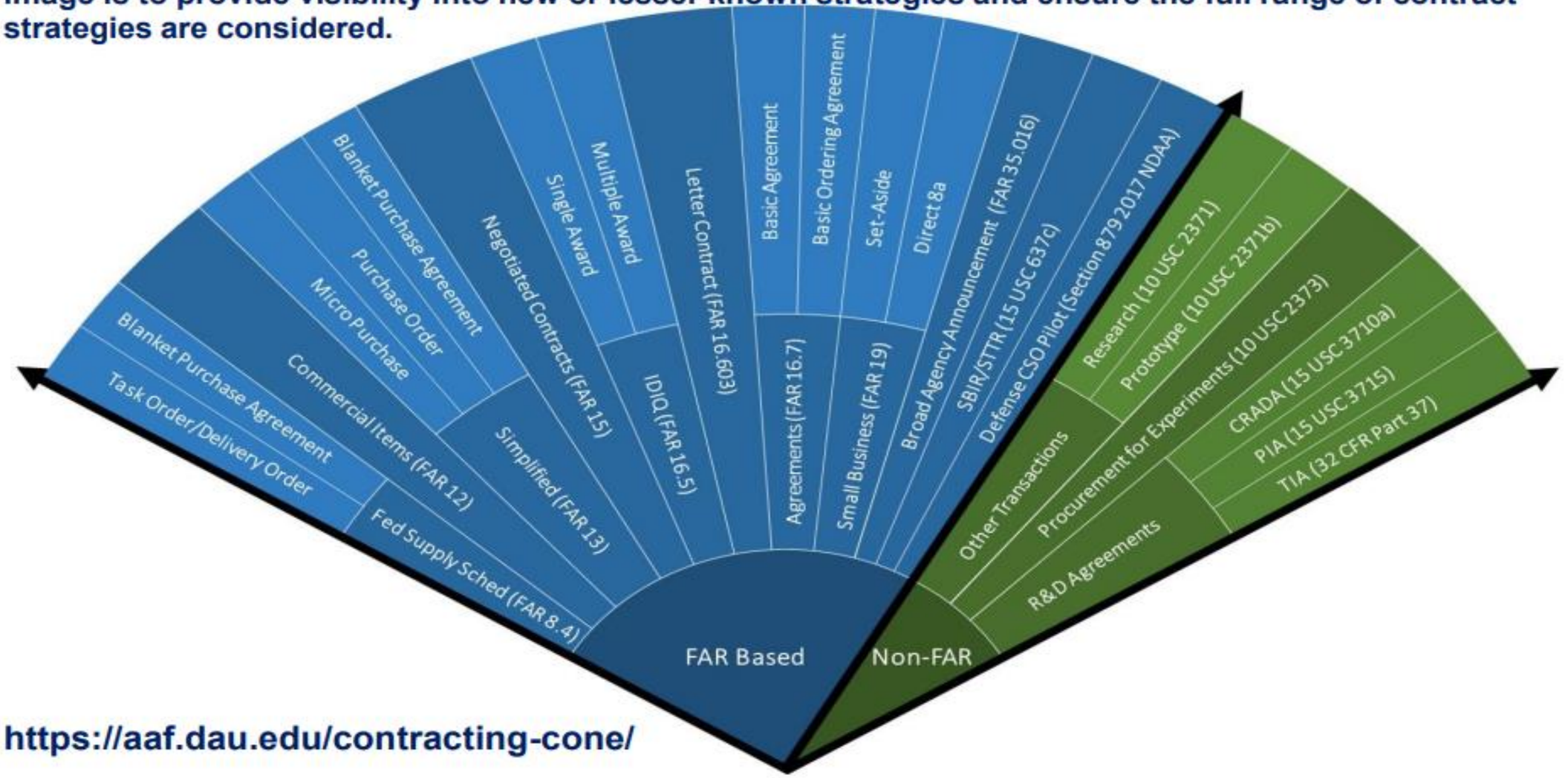
3. Who Can Help

4. Process Navigation Way Ahead

Please feel free to ask questions throughout!

U.S. Gov't Business Arrangements

The Contracting Cone outlines the full spectrum of available FAR and Non-FAR contract strategies. The supporting materials provide details about each contracting strategy, to enable collaborative discussions to select the right strategy based on environment, constraints, and desired outcomes. The goal of this image is to provide visibility into new or lesser known strategies and ensure the full range of contract strategies are considered.



https://aaf.dau.edu/contracting-cone/

U.S. Gov't Business Arrangements

		FFP	FPEPA	FPIF	FFP-LOE	Cost	CPIF	CPAF	CPFF	T&M
FAR Based	Federal Supply Schedules - FAR 8.4	•								•
	Commercial Items - FAR 12	•	•							•
	Simplified Acquisitions - FAR 13	•	•	•	•	•	•	•	•	•
	Contracting by Negotiation - FAR 15	•	•	•	•	•	•	•	•	•
	IDIQ Contracts - FAR 16.5	•	•	•	•	•	•	•	•	•
	Letter Contract - FAR 16.603	N/A								
	Agreements - FAR 16.7	Agreements, not contracts								
	Small Business - FAR 19	•	•	•	•	•	•	•	•	•
	BAA - FAR 35.106	•	•	•	•	•	•	•	•	•
	SBIR/STTR	•		•	•	•	•	•	•	•
	Defense CSO Pilot	•		•						
Non-FAR	Other Transaction Authority	Agreements, not contracts								
	Procurements for Experimental Purposes	Agreements or contracts (usually FFP)								
	CRADA (15 USC 3710a)	Agreements, not contracts								
	PIA (15 USC 3715)	Contract, agreement, or memorandum of understanding								
	TIA (32 CFR Part 37)	Agreements, not contracts								

Prize Competitions / Challenges …. ?

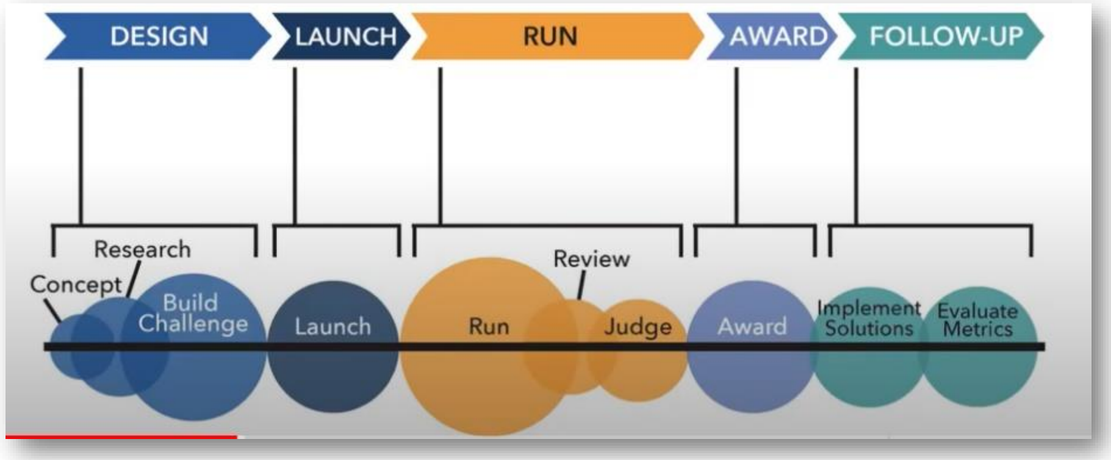
Additional Agreement and Assistance Types

- Education Partnering Agreement (EPA)
- Patent License Agreements (PLA)
- Testing Services Agreements (TSA)

Link - https://aaf.dau.edu/aaf/contracting-cone/contract-type-matrix/

U.S. Government Prize Competitions AKA "Challenges"

- **Who**:
  - All U.S. government department and agency are authorized to issue
  - Participants:
    - Individuals who are over the age of 18 and are U.S. citizens or lawful permanent residents at the time of submission
    - Organizations: U.S. entities that are incorporated in and whose primary place of business is in the United States.
- **What**:
  - A form of crowdsourcing, where funding comes at the end
- **When**: Since 2010, the U.S. has run over 1,200 competitions
- **Where**: Challenge.gov
- **Why**:
  - Funding:
    - < $100K to ~$50M;
    - Typically, below $5M
  - Intent: Stimulate innovation that has the potential to advance the mission of the respective agency
  - IP: Law prohibits the U.S. government from gaining interest in IP developed by participating in a competition, without written consent of the participant; but the U.S. government may negotiate a license.



Watts on the Moon

- **Mission Capability Objective**: Complement NASA investments in Lunar Surface Power Systems with innovative prototypes that integrate two power system elements *operating in vacuum and extreme cold*:
  - *Power Management and Distribution* from a remote power source
  - *Energy Management and Storage* to survive and operate when the energy source is not available

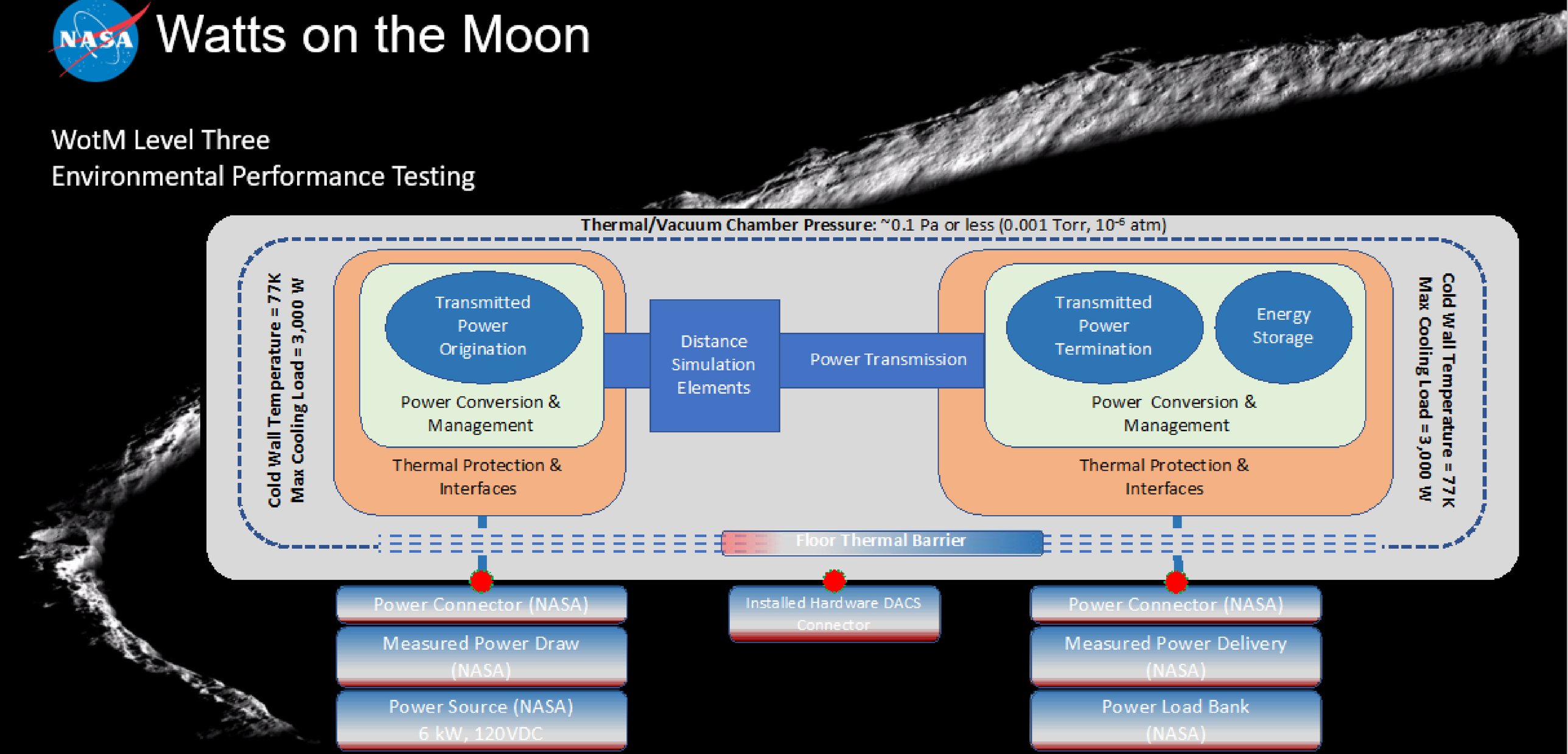
- **Three "levels" of challenge provide interim cash awards and help meet final performance requirements**
  - ***Level One*:** Preliminary Design Review (due: June 15, 2022)
    - Analytical system design, expected performance, and plans for testing and risk reduction
    - Outcome: Seven (7) teams receive a cash prize ($200K) and progress to Level Two
  - ***Level Two*:** Critical Design Reviews (due: February 2023)
    - Hardware component/system testing data and final plans for testing and risk reduction
    - Ambient performance demonstration: 3 km power transmission and energy storage charge/discharge cycling
    - Outcome: Four (4) teams receive a cash prize ($400K) and progress to Level Three
  - ***Level Three*:** Prototype performance demonstration in a NASA lunar environmental testing facility (April 2024)
    - Prototype systems demonstrate integrated power transmission and energy storage over a 50-hour timeline
    - Winning entry has the lowest *Total Effective System Mass:* measured weight plus an inefficiency mass penalty
    - One Grand Prize Winner ($1 million), One Runner Up ($500K)

https://www.nasa.gov/directorates/spacetech/centennial_challenges/watts-on-the-moon/index.html

Oblique view of the rim of Shackleton Crater near the Lunar South Pole
Image Credit: LROC NAC M1224655261LR [NASA/GSFC/Arizona State University]

Watts on the Moon

WotM Level Three
Environmental Performance Testing

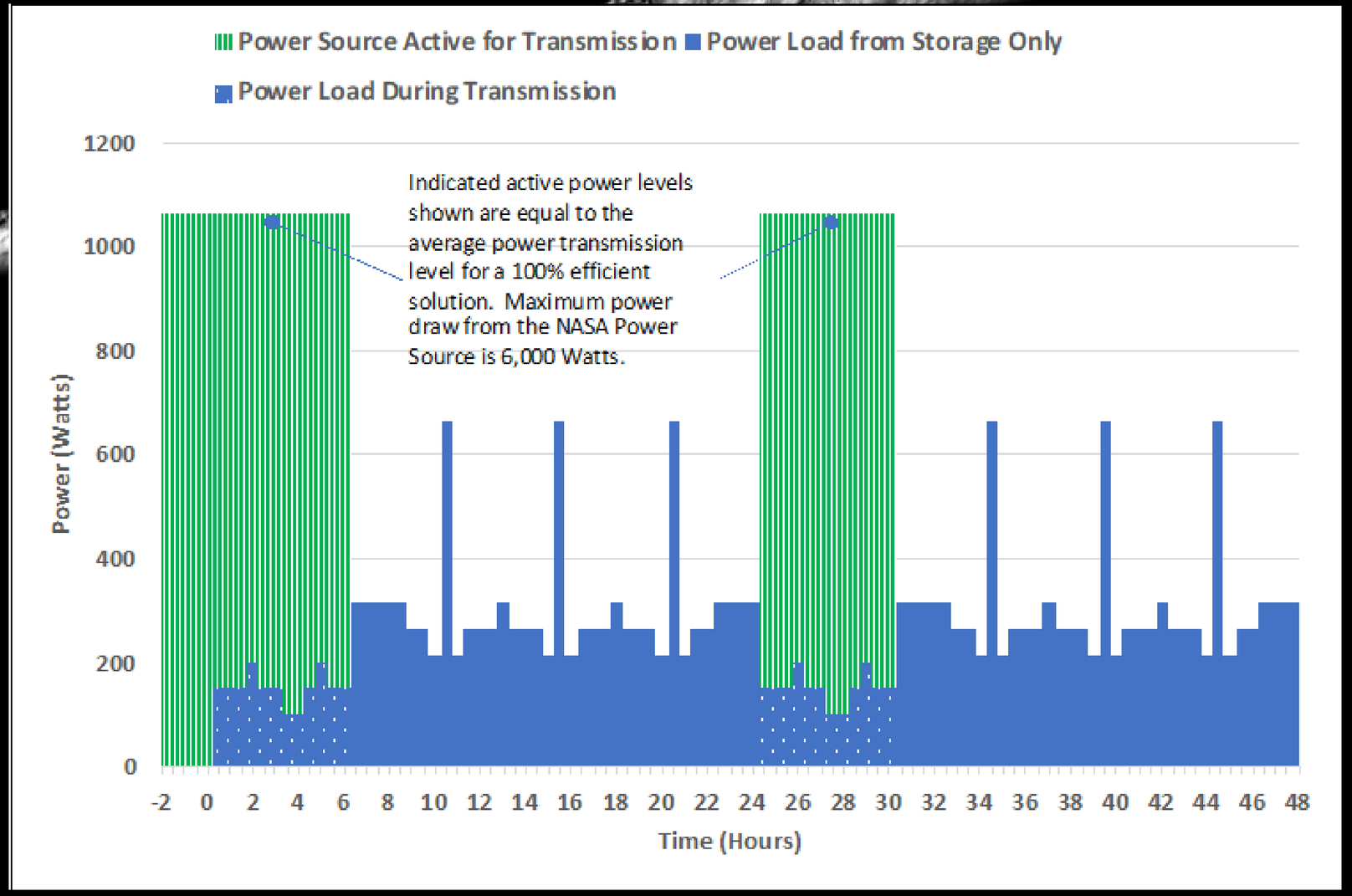


https://www.nasa.gov/directorates/spacetech/centennial_challenges/watts-on-the-moon/index.html

Oblique view of the rim of Shackleton Crater near the Lunar South Pole
Image Credit: LROC NAC M1224655261LR [NASA/GSFC/Arizona State University]

Watts on the Moon

WotM Level Three
Environmental Performance
Testing



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Oblique view of the rim of Shackleton Crater near the Lunar South Pole
Image Credit: LROC NAC M1224655261LR [NASA/GSFC/Arizona State University]

Watts on the Moon

- **Watts on the Moon is intended to attract innovation from the external community to support anticipated NASA Lunar Missions**:
  - Supply operating power for mission critical devices immersed continuously inside a permanently shadowed crater near the Moon's south pole
  - Stimulate solutions to power transmission and energy storage in terrestrial environments.
- **Challenge management:** NASA has engaged a challenge management firm to administer the WotM challenge:
  - **HeroX:** https://www.herox.com/WattsOnTheMoon?from=home
  - The HeroX site provides all challenge rules, registration, and submission details and documents, etc.
  - The site also supports a FAQ and Q&A blog to ensure inquiry responses are available to everyone.
  - Eligibility is limited to US-based entities but may include non-citizen employees or students.

The Ohio Aerospace Institute (OAI) has stepped up to encourage participation from Ohio.

https://www.nasa.gov/directorates/spacetech/centennial_challenges/watts-on-the-moon/index.html

Oblique view of the rim of Shackleton Crater near the Lunar South Pole
Image Credit: LROC NAC M1224655261LR [NASA/GSFC/Arizona State University]

Lunar Surface Technology Research

Solicitation Number: TBD

- **Who:**
  - *Gov't*: NASA, Space Technology Mission Directorate
  - *Program*: Space Technology Research Grant (STRG)
  - *Eligibility*:
    - ✓ PI/Prime: Accredited U.S. universities
    - ✓ Teaming: Industry and/or non-profit partners are encouraged, at least 60% of the proposed budget must go to accredited U.S. universities
    - ✓ NASA centers and JPL are not permitted to participate on proposals
    - ✓ Participation in more than two submissions may result in all being deemed non-compliant

- **What:** Grant, Appendix to the SpaceTech-REDDI NASA Research Announcement

- **When:**
  - *Release*: ~July
  - *Notice of Intent Due*: ~August
  - *Proposals Due*: ~September
  - *Selection Notification*: ~February
  - *Award*: ~May

- **Where:**
  - https://www.nasa.gov/directorates/spacetech/strg/lustr
  - https://nspires.nasaprs.com/external/

- **Why:**
  - *Funding*:
    - $1M - $2M per award over 2 years
    - Cost sharing is not required and is not considered
  - ****Focus Areas/Thrusts/Areas of Interest****
    - Discussed on next slide

Lunar Surface Technology Research

Lunar Surface Innovation Initiative (LSII) - Focus Areas

- In Situ Resource Utilization: Advance technologies for the collection, processing, storing, and use of material found or manufactured on other astronomical objects.
- Surface Power: Develop technologies to supply continuous power throughout day and night for lunar surface missions.
- Dust Mitigation: Develop dust mitigation technologies that protect lunar systems in use on the lunar surface from the threat of contamination and damage from local dust.
- Extreme Environments: Progress technologies enabling the survival and operation of systems through the full range of lunar surface and subsurface conditions.
- Extreme Access: Expand technology enabling humans and robotic systems to efficiently access, navigate, and explore previously inaccessible lunar surface and subsurface areas.
- Excavation/Construction: Evaluate technologies that enable affordable, robust, autonomous manufacturing and construction on the lunar surface to establish a sustained human presence.

Lunar Surface Technology Research

Lunar Surface Innovation Initiative (LSII) - Focus Areas

- In Situ Resource Utilization: Advance technologies for the collection, processing, storing, and use of material found or manufactured on other astronomical objects.
  - O2 and Metals
  - Water-Ice prospecting and mining
  - Value Networking
  - Modularity & Interoperability

- Surface Power: Develop technologies to supply continuous power throughout day and night for lunar surface missions.

- Dust Mitigation: Develop dust mitigation technologies that protect lunar systems in use on the lunar surface from the threat of contamination and damage from local dust.
  - Materials & Surface Coatings
  - Seals, Soft Goods & Fabrics
  - Mechanisms
  - Monitoring & Filtration
  - Modeling
  - Lunar Surface Modification
- Extreme Environments:
- Extreme Access:
- Excavation/Construction:

Lunar Surface Technology Research

Lunar Surface Innovation Initiative (LSII) - Focus Areas

- In Situ Resource Utilization:
- Surface Power:
- Dust Mitigation:
- Extreme Environments: Progress technologies enabling the survival and operation of systems through the full range of lunar surface and subsurface conditions.
  - Radiation Environment
  - Regolith/Surface Interfaces
  - Surface Weather/Plasma Environment
  - Thermal & Illumination Environment
  - Vacuum/Exosphere Environment

- Extreme Access: Expand technology enabling humans and robotic systems to efficiently access, navigate, and explore previously inaccessible lunar surface and subsurface areas.
  - Communications
  - Mobility
  - Position, Navigation, and Timing
  - Terrain Relative Navigation
  - NASA Briefing - https://lsic.jhuapl.edu/uploadedDocs/focus-files/1066-EA%20Monthly%20Meeting%20-%202021%2012%20December_Presentation%20-%20NASA.pdf

- Excavation/Construction: Evaluate technologies that enable affordable, robust, autonomous manufacturing and construction on the lunar surface to establish a sustained human presence.
  - Autonomy, Maintenance, Site Planning & Prep
  - Additive Manufacturing, Raw Materials
  - Horizontal & Vertical Construction
  - Outfitting

Lunar Surface Technology Research

Lunar Surface Innovation Consortium

- **Who:**
  - *Sponsor*: Johns Hopkins Applied Physics Lab
  - *Eligibility*: Anyone is eligible to register

- **What:** Lunar Surface Innovation Consortium (LSIC), 2022 Spring Meeting

- **When:** May 4-5, 2022…
  - LuSTR announcement is typically June

- **Where:** In-person and Online
  - Online Registration open until April 25
  - Website: https://lsic.jhuapl.edu/Events/

- **Why:**
  - The LSIC 2022 Spring Meeting will concentrate on understanding NASA's plans and technology investments relevant to building a sustained presence on the lunar surface.

NASA LuSTR Page - https://www.nasa.gov/directorates/spacetech/strg/lustr

University Leadership Initiative

Solicitation Number: TBD

- **Who:**
  - *Gov't*: NASA, Aeronautics Research Mission Directorate,
  - *Program*: Transformative Aeronautics Concepts (TACP)
  - *Eligibility*:
    - ✓ PI/Prime: Accredited, degree-granting U.S. universities
    - ✓ Partners (i.e. funded): Industry and/or non-profit partners are permitted, focus must be on university leadership; NASA centers and JPL are not permitted to be partners
    - ✓ Collaborators (i.e. non-funded): Industry, U.S. government agencies or other organizations

- **What:** Collaborative Agreement, Appendix to the Research Opportunities in Aeronautics

- **When:**
  - *Release*: ~April
  - *Applicant Workshop*: ~April
  - *Step-A Proposal Due*: ~June
  - *Step-B Proposal Due*: 60 days after Step-B notification
  - *Selection Notification*: ~February

- **Where:**
  - https://nari.arc.nasa.gov/uli
  - https://nspires.nasaprs.com/external/

- **Why:**
  - *Funding*:
    - $3M-$6M per award over 3 years
    - Cost sharing is not required, buy may be considered
  - ****Focus Areas/Thrusts/Areas of Interest****
    - Discussed on next slide

University Leadership Initiative

NASA's Description

What: Introduce NASA-complementary, system-level, multi-disciplinary ideas from the university community and transition the research to aviation stakeholders

Why (Goals):

1. Achieve outcomes in the ARMD Strategic Implementation Plan
2. Transition research for continuation or implementation
3. Provide opportunities for undergraduate and graduate students in aeronautics research
4. Promote diversity in aeronautics with inclusion of MSIs and underrepresented faculties

How:

- University teams propose technical challenges and innovative ARMD complementary ideas
- Define multi-disciplinary solutions, apply innovative teaming strategies and form peer review mechanisms to strengthen the research impact
- Teams actively explore transition opportunities and workforce development

University Leadership Initiative

NASA ARMD – Strategic Thrusts

1. Safe, Efficient Growth in Global Operations: Achieve safe, scalable, routine high tempo airspace access for all users.

2. Innovation in Commercial Supersonic Aircraft: Achieve practical, affordable commercial supersonic air transport.

3. Ultra-Efficient Subsonic Transports: Realize revolutionary improvements in economics and environmental performance for subsonic transports with opportunities to transition to alternative propulsion and energy.

4. Safe, Quiet, and Affordable Vertical Lift Air Vehicles: Realize extensive use of vertical lift vehicles for transportation and services including new missions and markets.

5. In-Time System-Wide Safety Assurance: Predict, detect and mitigate emerging safety risks throughout aviation systems and operations.

6. Assured Autonomy for Aviation Transformation: Safely implement autonomy in aviation applications.

University Leadership Initiative

NASA ARMD – Strategic Thrusts

1. Safe, Efficient Growth in Global Operations: Achieve safe, scalable, routine high tempo airspace access for all users.
   - Advanced Operational Concepts, Technologies, and Automation
   - Safety Management for Emergent Risks
   - Integrated Modeling, Simulation, and Testing
   - Airspace Operations Performance Enablers

2. Innovation in Commercial Supersonic Aircraft: Achieve practical, affordable commercial supersonic air transport.
   - Elimination of Environmental Barriers to Commercial Supersonic Aircraft
   - Integrated Design and Efficiency
   - Modeling, Simulation, and Test Capability
   - Efficient Supersonic Flight Operations

3. Ultra-Efficient Subsonic Transports:
4. Safe, Quiet, and Affordable Vertical Lift Air Vehicles:
5. In-Time System-Wide Safety Assurance:
6. Assured Autonomy for Aviation Transformation:

University Leadership Initiative

NASA ARMD – Strategic Thrusts

1. Safe, Efficient Growth in Global Operations:
2. Innovation in Commercial Supersonic Aircraft:

3. Ultra-Efficient Subsonic Transports: Realize revolutionary improvements in economics and environmental performance for subsonic transports with opportunities to transition to alternative propulsion and energy.
   - Ultra-efficient Airframes
   - Ultra-efficient Propulsion
   - Ultra-efficient Vehicle System Integration
   - Modeling, Simulation, and Test Capability

4. Safe, Quiet, and Affordable Vertical Lift Air Vehicles: Realize extensive use of vertical lift vehicles for transportation and services including new missions and markets.
   - Clean and Efficient Propulsion
   - Efficient and Quiet Vehicles
   - Safety, Comfort, and Accessibility
   - Modeling, Simulation, and Test Capability

5. In-Time System-Wide Safety Assurance:
6. Assured Autonomy for Aviation Transformation:

University Leadership Initiative

NASA ARMD – Strategic Thrusts

1. Safe, Efficient Growth in Global Operations:
2. Innovation in Commercial Supersonic Aircraft:
3. Ultra-Efficient Subsonic Transports:
4. Safe, Quiet, and Affordable Vertical Lift Air Vehicles:

5. In-Time System-Wide Safety Assurance: Predict, detect and mitigate emerging safety risks throughout aviation systems and operations.
   - Continuous System-wide Safety Awareness (Monitor)
   - Safety Risk Identification and Evaluation (Assess)
   - Coordinated Prevention, Mitigation, and Recovery (Mitigate)
   - Experimentation, Demonstration, and Assessment

6. Assured Autonomy for Aviation Transformation: Safely implement autonomy in aviation applications.
   - Technologies and Methods for Design of Complex Autonomous Systems
   - Assurance, Verification, and Validation of Autonomous Systems
   - Human-Autonomy Teaming in Complex Aviation Systems
   - Implementation and Integration of Autonomous Airspace and Vehicle Systems
   - Testing and Evaluation of Autonomous Systems

NASA ULI Page: https://nari.arc.nasa.gov/uli

Air Force Manufacturing Technology

Solicitation Number: FA8650-21-S-5001

- **Who:**
  - *Gov't*: DoD, Air Force, AFRL, RXM
  - *Eligibility*: Unrestricted solicitation.
    - Small businesses, nonprofit, and not-for-profit organizations are encouraged to propose.
- **What:** Multiple types of Agreements; 2-step, BAA
- **When:**
  - *Release:* Mar 24, 2021
  - *Contact Technical SME:* Prior to submitting white paper
  - *White Paper:* Any time
  - *Close:* Mar 24, 2026
- **Where:**
  - https://www.dodmantech.mil/DoD-ManTech/Air-Force-ManTech
  - https://sam.gov/opp/85aa94ef17eb4820904ea5c85fa7ed88/view
- **Why:**
  - *Funding*:
    - $250K to >$10M;
    - Cost Sharing is not required or considered
  - ****Focus Areas/Thrusts/Areas of Interest****
    - Discussed on next slide

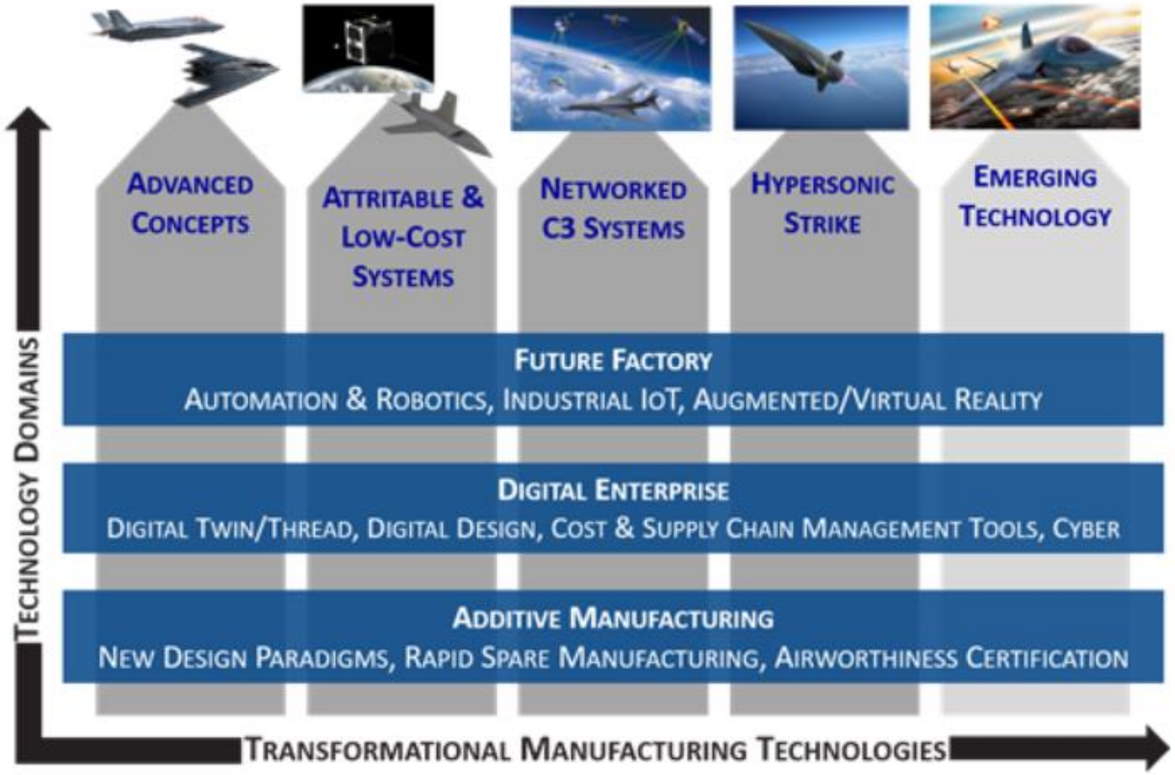
Manufacturing Readiness Level (MRL)

- ManTech proposal focuses on maturation plan of MRL
- Use DoDMRL.com
- Defense Acquisition University provides a course on MRL and Manufacturing Readiness Assessments

Air Force Manufacturing Technology

Solicitation Number: FA8650-21-S-5001

1. Challenges
    1. Reducing acquisition & supportability costs
    2. Reducing manufacturing & repair cycle times
    3. Adapting Industry 4.0 technology (Digital Manufacturing)
2. Specific Areas of Interest
    1. Mostly funding projects that are hardware intensive
    2. Support to Tier 2 and 3 Supply Chain Vendors
        1. Low Cost Composites –
            1. Automation of manufacturing
            2. Attritables are fighter-sized attritable airframes
        2. Low Cost Sensors – Manufacturing of sub-component to sensor systems



- DoD ManTech - https://www.dodmantech.mil/DoD-ManTech/Air-Force-ManTech
- BAA - https://sam.gov/opp/85aa94ef17eb4820904ea5c85fa7ed88/view

Department of Homeland Security, Long Range Broad Area Announcement

Solicitation Number: DHSST_LRBAA_18_01

- **Who:**
  - *Gov't*: DHS Headquarters, Science & Technology Directorate
  - *Eligibility*: Unrestricted solicitation.

- **What:** Multiple types of Agreements; 2-step, BAA

- **When:** Open BAA with multiple steps
  - *Industry Engagement Assessment:* Response and Follow-up by DHS within 10 days
  - *Part I – Virtual Pitch Presentation Materials:* Must be submitted on DHS Portal within 14 days of written notification
  - *Part I-Virtual Pitch and Evaluation*: Scheduled within 21 Days of the presentation material's due date
  - *Part II – Written Proposal*: Must be submitted to the DHS S&T OIP portal within 45 days of written notification
  - *Part II-Written Proposal Evaluation*: Completed by DHS within 21 days of the written proposals due date

- **Where:**
  - https://oip.dhs.gov/baa/public/funding-page?status=open
  - https://sam.gov/opp/fb3e9652ee5d2995705a8cda9a0c6ac3/view

- **Why:**
  - *Funding*: US Fiscal Year 22 Appropriations
    - C-UAS = $35M/yr
    - Maritime Defense: $23M/yr
    - Air, Land, and Port of Entry Security: $40M/yr
    - First Responder/Disaster Resilience: $64M/yr

  - ****Focus Areas/Thrusts/Areas of Interest****
    - Discussed on next slide

Department of Homeland Security, Long Range Broad Area Announcement

Countering – Unmanned Aerial Systems (C-UAS) Topic

- Research Area: Securing Boarders, SEC BORD 03-06

- R&D Need: *Integrated and Improved Sensors, Systems, and Data*; Develop enhanced technologies and methods that allow for the detection, tracking, identification, and mitigation of unmanned aircraft systems under varied terrains and environmental conditions

- Capability: *TRL 4 at start and TRL 7 at end*; with objective to transfer the advancement of C-UAS technologies to enhance the mission capability of the DHS Operational Components and the extended Homeland Security Enterprise.

- Topic Description: New technologies and enhanced methods should be able to detect, track, identify and mitigate an array of unmanned aircraft threats and flight modalities.
  1. Remote manual flight control using radio frequency-based transmissions
  2. Remote flight control using commercial networks (i.e. cellular, satellite), particularly 5G
  3. Global navigation satellite system (GNSS) supported pre-programmed flights
  4. Autonomously pre-programmed flights that are unsupported by GNSS
  5. UAS not emitting or receiving RF signals (operating autonomously via alternative navigation)
  6. Detect, Track and ID of multiple, simultaneous UAS with selective mitigation and low or no collateral effect

Department of Homeland Security, Long Range Broad Area Announcement

Air Based Technologies (ABT) Topic

- Research Area: Securing Boarders, SEC BORD 03-05

- R&D Need: *Integrated and Improved Sensors, Systems, and Data*; advances manned and unmanned aircraft technology to improve the mission capability of the DHS operational components as well as the extended Homeland Security Enterprise.

- Capability: *TRL 1-7 at start and TRL 8 at end*; with objective to transfer the advancement of aircraft technology (manned and/or unmanned) technologies to enhance the mission capability of the DHS Operational Components and the extended Homeland Security Enterprise.

- Topic Description: Focus Areas.
  1. ISR Sensors
  2. Small UAS (Suas) Technology; and
  3. Command, Control, Communications, and Computers (C4) Operations

Office of the Director of National Intelligence Science & Technology Landscape

Solicitation Number: ICSPE-RFI-22-01

- **Who:**
  - *Gov't*: Office of the Director of National Intelligence, Science & Technology Group (STG)
  - *Eligibility*: Any U.S. entity
- **What:** Request for Information (RFI), submitting Excel to S&Tinvestments@dni.gov
- **When:**
  - *Release:* February 28, 2022
  - *Due:* May 28, 2022
- **Where:**
  - https://www.nationalacademies.org/event/02-28-2022/science-and-technology-needs-for-the-intelligence-community
  - https://sam.gov/opp/15d5927d5c5345939830e882856d2fca/view
- **Why:**
  - *Funding*:
    - None
    - Responses will be used to identify potential participants for future funding; revives the Intelligence Science & Technology Partnership (In-STeP)
  - *Focus Areas/Thrusts/Areas of Interest:*
    - Discussed on next slide

Office of the Director of National Intelligence Science & Technology Landscape

Response Excel Data Fields

- Need number(s) (Column A)
- Company/Organization Name
- Company/Organization Headquarters Location
- Affiliations(use codes from Table I)
- Respondent's point(s) of contact (POC(s))
- Technology/Project Name
- Non-proprietary description of the technology/project (up to 500 words)
- Optional proprietary description of the technology/project (up to 500 words)
- Non-proprietary description of how the technology/project relates to the applicable Need number(s) (up to 100 words)
- Capability Estimate (see Table II) (Column N)
- Current sponsor(s) (internal, IRAD or external)
- Technology Domain(s)(see Table III) (Column P)

Response Excel
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Identify Need
- Table I, S&T Landscape PDF
- Column A, RFI Excel

Identify Tech Domain
- Table III, RFI Tables docx
- Column P, RFI Excel

Identify Capability Estimate
- Table II, RFI Tables docx
- Column N, RFI Excel

Office of the Director of National Intelligence Science & Technology Landscape

Table 3.3 — **Multi-INT, IC-wide S&T Needs Best Addressed by Several IC Program Managers (*Category Two Needs*)**

NEED #	NEED DESCRIPTION	RELEVANT TECHNOLOGY DOMAINS													
		ARTIFICIAL INTELLIGENCE	BEHAVIORAL SCIENCES	BIOLOGICAL SCIENCES	CHEMICAL SCIENCES	COMMUNICATIONS	COMPUTING	CYBER	DATA	ELECTRONICS	ENERGY AND POWER	FORENSICS	IDENTITY	MATERIALS AND MANUFACTURING	NUCLEAR SCIENCE
2N002	Develop/enhance capabilities to collect information on global science and technology activities.						x	x				x			
2N006	Develop/enhance capabilities to advance space situational awareness.					x									
2N011	Develop/enhance near-real-time cyber forensics.	x					x	x	x			x			

ODNT S&T Landscape PDF
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Identify Need

- Table I, S&T Landscape PDF
- Column A, RFI Excel

Identify Tech Domain

- Table III, RFI Tables docx
- Column P, RFI Excel

Identify Capability Estimate

- Table II, RFI Tables docx
- Column N, RFI Excel

Office of the Director of National Intelligence Science & Technology Landscape

Table III. IC R&D-related Technology Domains

Code	Tier 1 Technology Domains	Tier 2 Technology Domains	Description
1	**Artificial Intelligence**	Adversary Models Autonomous Systems Deep Learning Human Language Technology Human–Machine Teaming Information Assurance Machine Learning Pattern Recognition Recommender Systems Summarization Engines	Sometimes called machine intelligence, artificial intelligence (AI) is the branch of computer science focused on programming machines to perform tasks that replicate or augment aspects of human cognition, such as learning, seeing (computer vision), understanding, and problem solving.

Table II. IC R&D-related Capability Codes

CAPABILITY DESCRIPTION	CODE	CAPABILITY DEFINITION
Basic Research	111	Includes all effort of scientific study and experimentation in the fields of the physical, engineering, environmental, and life sciences pertaining to long-term national security needs. Basic research results in increased knowledge or understanding.
Applied Research	112	Efforts that translate promising basic research into solutions for broadly defined intelligence needs, short of major development projects. This type of effort may vary from fairly fundamental applied research to sophisticated breadboard hardware, study, and program.

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Identify Need
- Table I, S&T Landscape PDF
- Column A, RFI Excel

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- Column P, RFI Excel

Identify Capability Estimate
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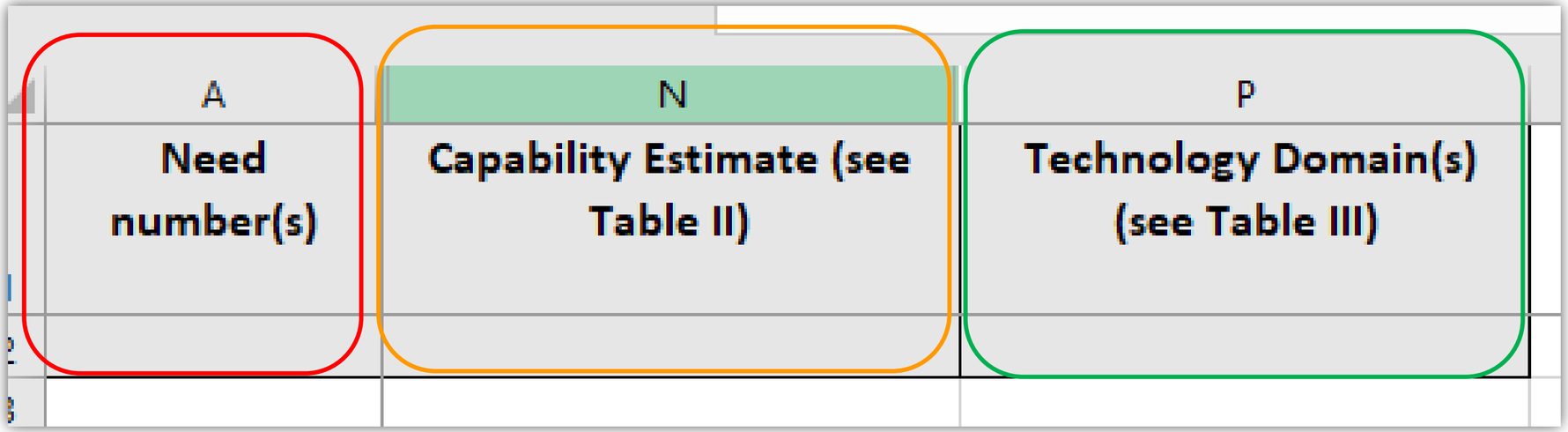
- Column N, RFI Excel

Office of the Director of National Intelligence Science & Technology Landscape



Response Excel
https://sam.gov/api/prod/opps/v3/opportunities/resources/files/eebf12ccd618449a83e56de3a7c08ce8/download?&token=

Submit completed Excel to - S&Tinvestments@dni.gov

Webinar - https://www.nationalacademies.org/event/02-28-2022/science-and-technology-needs-for-the-intelligence-community

Identify Need
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- Column A, RFI Excel

Identify Tech Domain
- Table III, RFI Tables docx
- Column P, RFI Excel

Identify Capability Estimate
- Table II, RFI Tables docx
- Column N, RFI Excel

Process Navigation – 1 to 2 Weeks from Today

*****Please respond to the poll that is populating now*****

- From the poll responses OFRN will set up a follow-on Zoom event for opportunity(ies) that have high interest for teaming
- In the future event, OFRN will have a dedicated advisor to support teaming discussion
- OFRN will track the teaming as a “cohort” and support the proposal development and submission process

Special thanks to our volunteers who will help us monitor discussions to help build events and teams, as well as help you all win more awards!

Upcoming events

Follow-up OFRN Opps Day Process Navigation Meeting

Late April or Early May 2022 TBD – Be on the lookout for our email!

Ohio Space Forum by Dayton Development Coalition

May 17 – 18, 2022 @ NASA Glenn Research Center in Cleveland, Ohio

CORONA Event by Dayton Development Coalition

June 13 – 14, 2022 @ Location TBD

Ohio Advanced Air Mobility by Dayton Development Coalition

August 22, 2022 @ Springfield Airport

OFRN Opps Day – In-Person Event

Fall 2022 TBD – Be on the lookout for our email!

Ohio Defense & Aerospace Forum by Dayton Development Coalition

October 3-4, 2022 @ Location TBD

Contact Us

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Beavercreek, OH 45431

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Website:

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