INNOVATE WITH AFRL

DOOLITTLEINSTITUTE

speed·innovation·solutions

Welcome

Mike Edwards
Doolittle Institute Director

Rooms:

A: Shangri-La Auditorium

B: Outside Loop

C: Trophy Collaboration 1

D: Wagner Collaboration 2

E: Kollsman Collaboration 3

F: Octane Collaboration 4

G: Mitchell Classroom 1

H: USS Hornet Classroom 2

J: Raider Classroom 3

Restrooms:

Located by the front entrance.

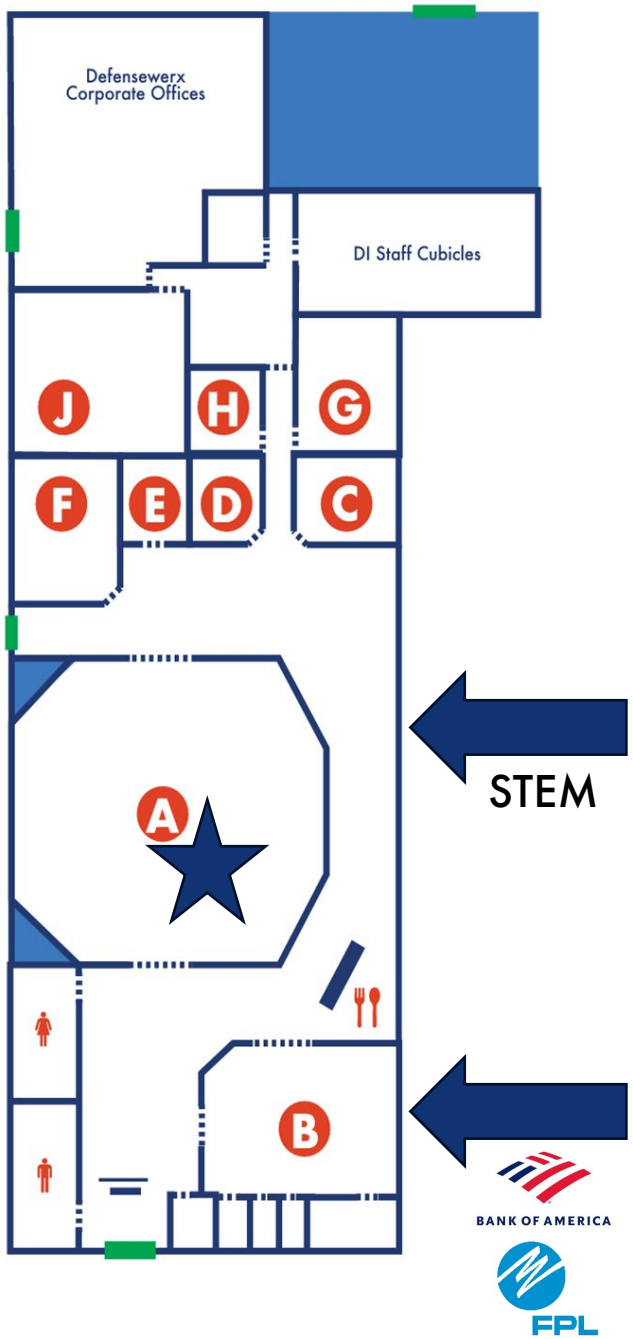
Snacks/Drinks:

$1 to $2 each

WiFi:

Network: Doolittle Guest

Password: Collabor8



DOOLITTLEINSTITUTE

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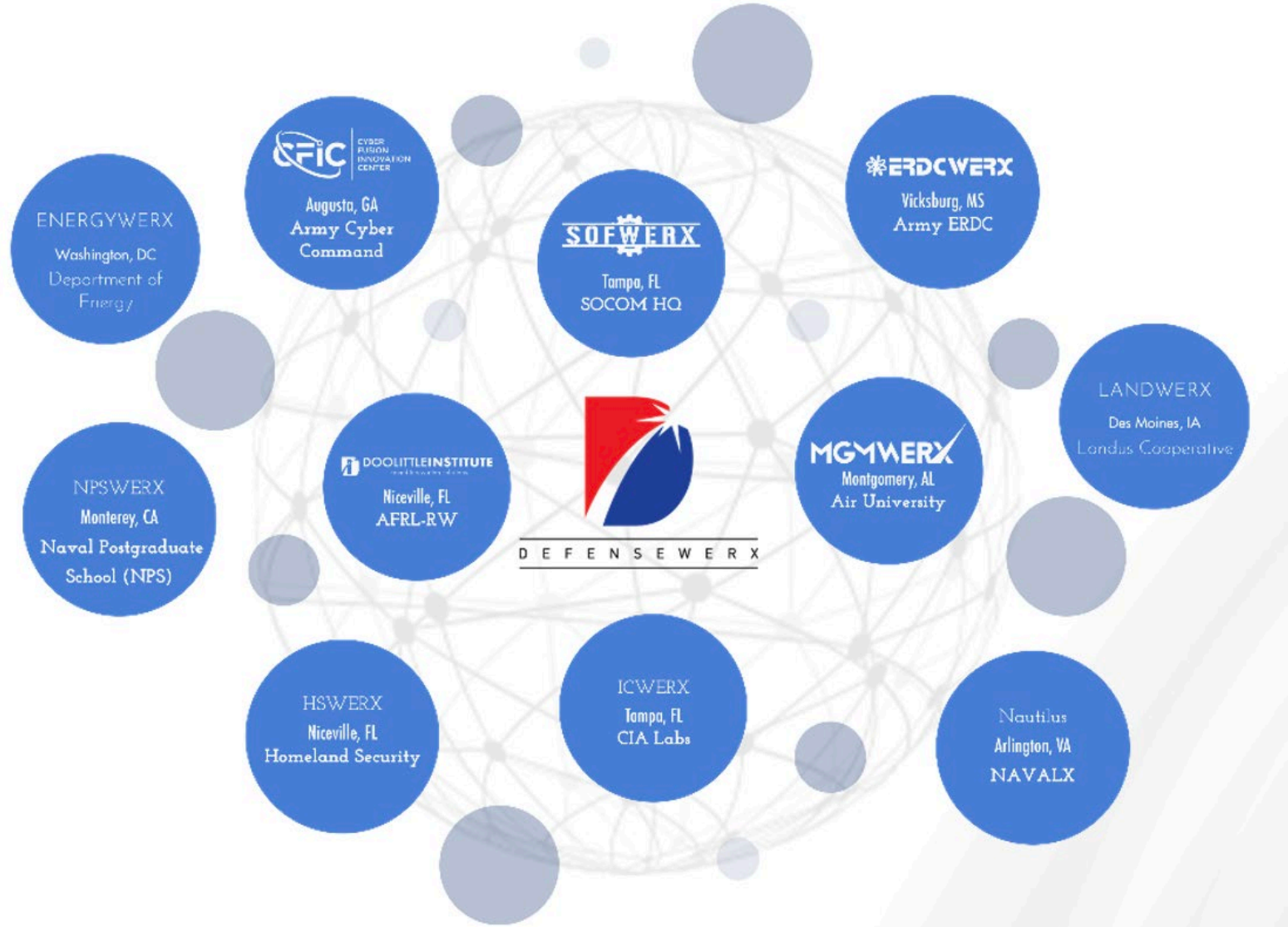
An Air Force Research Laboratory Innovation Institute

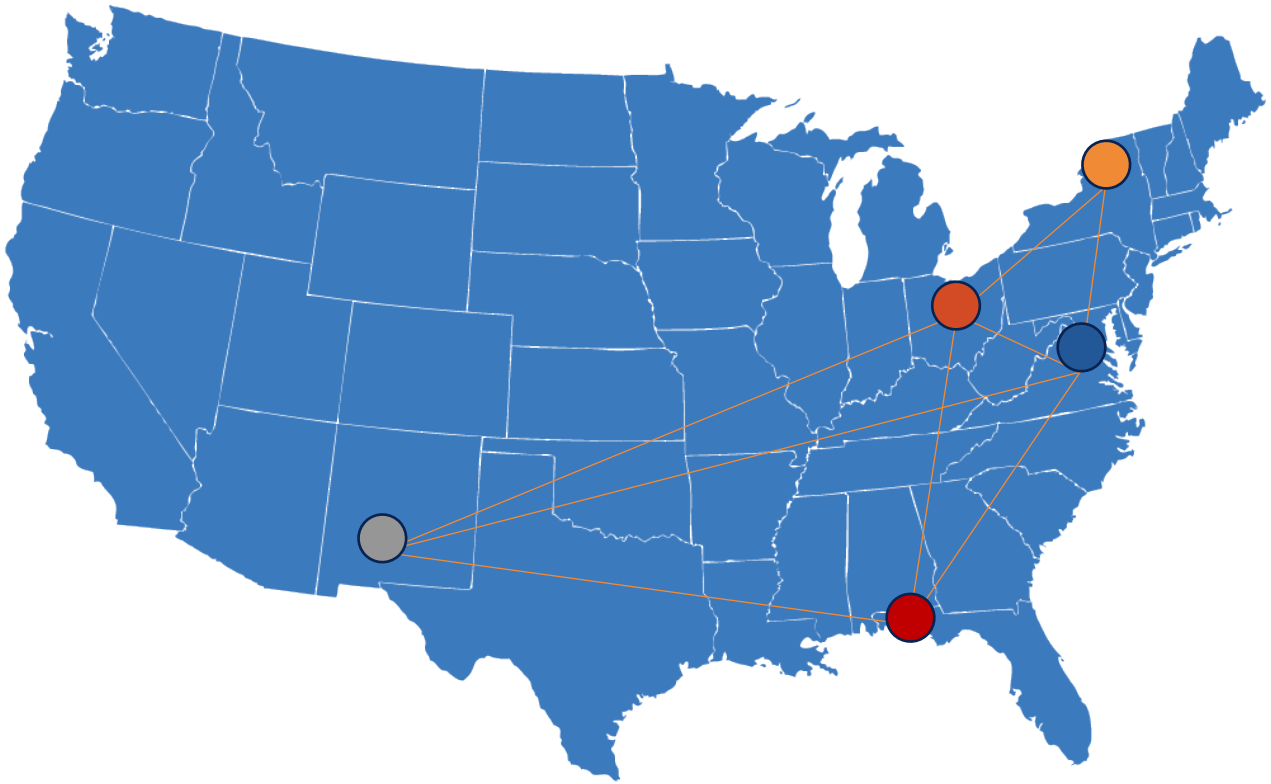
A DEFENSEWERX Innovation Hub

Ayesha Haider
Doolittle Institute Technology Transfer Program Manager

DEFENSEWERX Ecosystem



AFRL Innovation Institutes



New Mexico Tech
Directed Energy, Space Vehicles

Doolittle Institute
Munitions

Griffiss Institute
Information

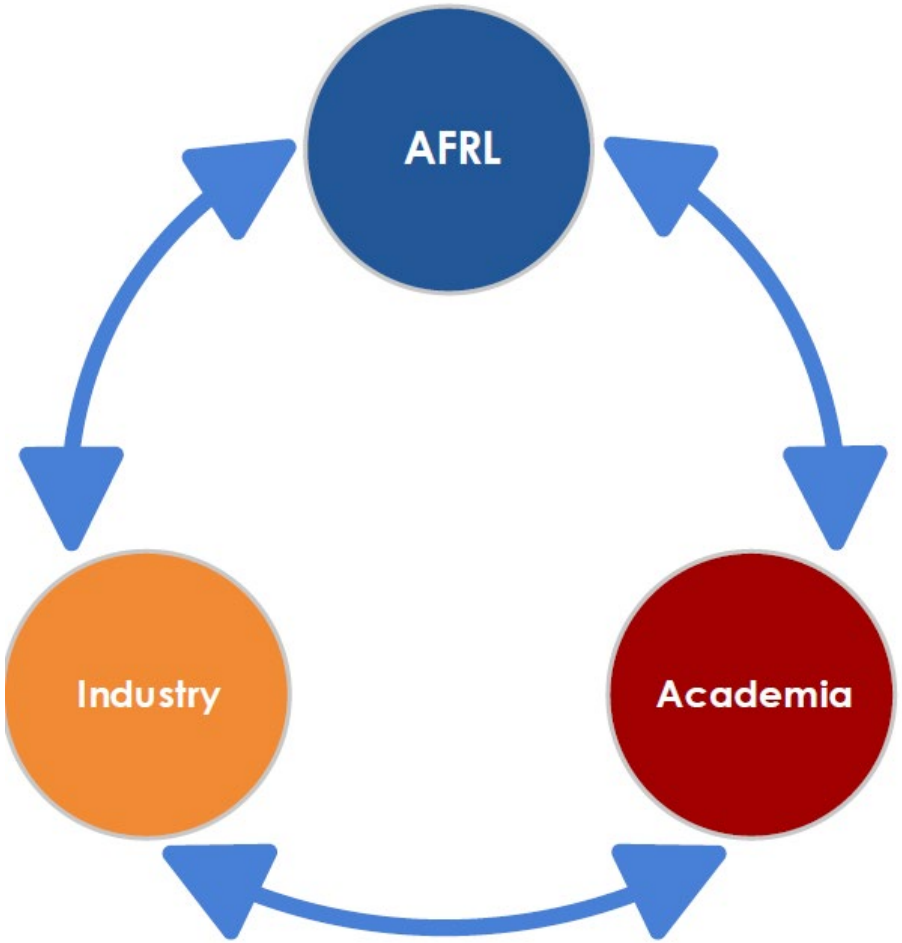
VT-ARC BRICC
AF Office of Scientific Research

Wright Brothers Institute
AFRL HQ
711th Human Performance Wing
Materials & Manufacturing, Aerospace Systems, Sensors

Technology Transfer (T2)

- Transfer of **knowledge** between government, businesses and academia

- T2 activities:
  - Identify and engage **industry partners** to further AFRL/RW R&D efforts
  - Identify companies or universities interested in **licensing** AFRL/RW patents
  - Execute **events** to foster collaboration and/or inform industry stakeholders about AFRL/RW research efforts and needs



Future Workforce Development - STEM

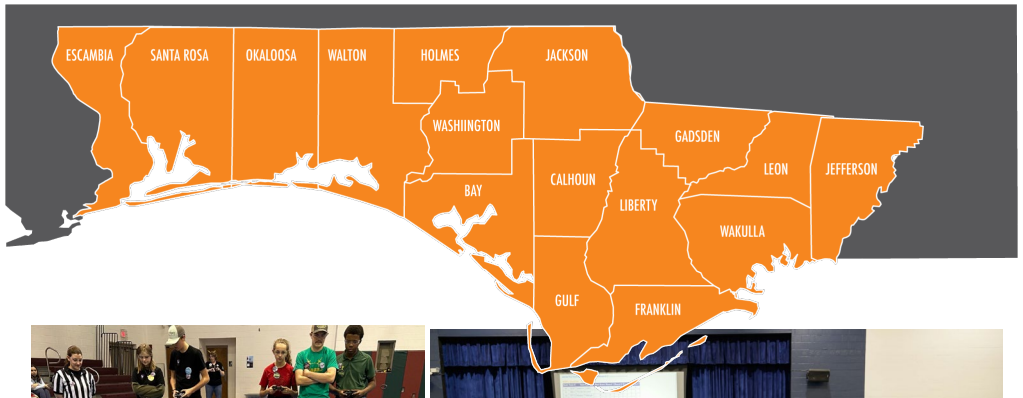
Program Overview:
The Doolittle Institute administers four *FIRST*® programs spanning 16 Panhandle counties. The *FIRST*® LEGO® League introduces science, technology, engineering, and math (STEM) to children ages 4-16.

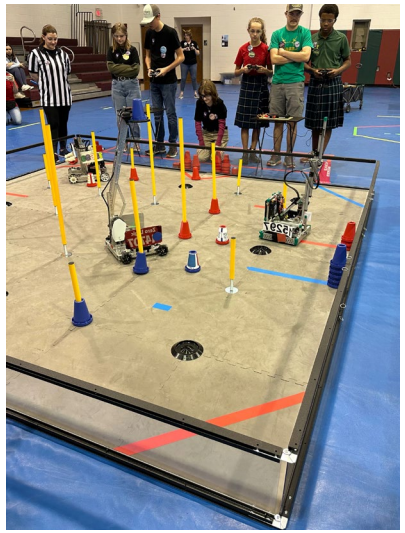
Upcoming Volunteer Opportunities with STEM:

- 01 August – FLL Challenge Season Kickoff – Virtual
- 08 August – Databots at The Doolittle Institute 330-430 pm
- 09 September – FTC Challenge Season Kickoff Sprint Theatre@ Mattie Kelly Arts (NWFSC)
- 11 September – Databots at The Doolittle Institute 330-430 pm

DataBots 2.0: The Doolittle Institute has purchased Databot 2.0s to have an afterschool STEM learning class. Databot 2.0 is an unstoppable STEM machine weighing in at just 1.2 oz and standing only ¾" high, Databot™ is a power-packed wireless, remote-ready scientific tool that instantly brings the world of data to life! The STEM team is looking for volunteers to help each curriculum module (STEAM, Physics, Earth Science, Life Science, Chemistry, Mathematics, Environment, AI, and Data Science.) Classes are the 2nd Tuesday of every month from 330-430 PM at the Doolittle Institute.

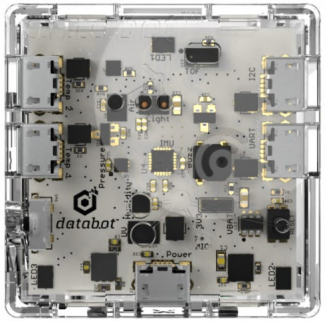
Want more information on volunteering? Email us at
STEM@doolittleinstitute.org



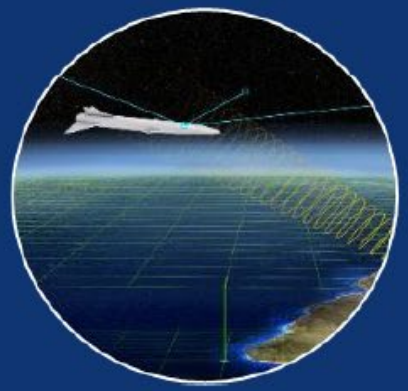


***FIRST*® Tech Challenge**

***FIRST*® Lego League Challenge**



AFRL/RW Capabilities & Areas of Interest



Alternative Navigation Methods

Advanced Energetics

Advanced Seeker Technologies

High Performance Weapon Materials

Smart/ Survivable Fuzing

Advanced Manufacturing

Artificial Intelligence/ Machine Learning

System Modularity & Software Defense Capabilities

Cyber Assurance

Modeling & Simulation

Snapshot of Air Delivered Effects BAA Research Areas

Bioprincipic Sensors, Information Processing and Control	Autonomous Target Recognition
EO/IR/LADAR/SAL System Research	Advanced Scene Generation
Munitions Energetic Materials	Weapon Autonomy and Control Technology
Navigation & Estimation Technology	Cybersurvivability for Precision-Guided Munitions

The full BAA can be downloaded from: https://doolittleinstitute.org/baa/

Snapshot of AFRL/RW Patents

USAF96 Steel	**Photonic crystal-enabled display stitching**
Hexagonal Efficient Coordinate System (HECS)	**Range enabled three-dimensional imaging system and associated methods**
Peel-and-adhere photonic crystal	**Touch-based tracking system and method**
Adaptive force vehicle airbag system	**Plasmonic-photonic biomimicking sensor for airborne agent detection**

Full list of patents: https://doolittleinstitute.org/afrl-rw-patents/

Technology Transfer Mechanisms

- Above agreements are not governed by FAR. AFRL/RW can partner with large, small and/or foreign companies.
- PLAs enable private sector to license AFRL/RW patents and scale up or "spin out" DoD tech. Royalties paid to researcher and lab.
- Collaborative R&D activities and different from federal procurement. In some cases, goods and money are not transferred.

Ways to Engage

- At the event
  - Learn, network, participate in discussion, ask questions
  - View our patent posters
  - Talk to our STEM team about volunteering (stem@doolittleinstitute.org)

- After the event
  - Read the Air Delivered Effects BAA and view the AFRL/RW patent portfolio
  - Schedule meeting with DI for further discussion and next steps (ahaider@doolittleinstitue.org)
  - Sign up to join our ecosystem
  - Participate in future events – Technical Showcase Sep 21
    - Topic announced Aug 8

AFRL Munitions Directorate S&T Priorities

DR. DAVID LAMBERT, ST - CHIEF SCIENTIST, MUNITIONS DIRECTORATE

25 July 2023

AFRL

A World-Wide Enterprise of Researchers

	Employees	Civilian	Military
Total	5,827	79%	21%
S&Es	3,455	80%	20%

S&E Education

A Legacy of Success AFRL Tech Inside

1st Laser Guided Bomb

GBU-28 “Bunker Buster”

AIM-120 “AMRAAM” Air-to-Air

GBU-39/B “Small Diameter Bomb”

CBU-97/CBU-105 “Sensor Fuzed Weapon” cluster mun.

Joint Direct Attack Munitions GBU-31/32/38

AGM-158 JASSM Low-Observable Cruise Missile

BLU-129/B “Precision Lethality Munition”

GBU-57A/B “Massive Ordnance Penetrator”

Massive Ordnance Air Blast (MOAB)

Strategic Drivers to S&T Execution

Demand Signals

Strategic:
Operational Imperatives, S&T 2030, National Defense Strategy, OSD Critical Technology Areas

Operational:
AFRL Commander's Intent, Diversity & Inclusion Commitment, Emergent DoD Focus Areas

Tactical:
Air Force Futures, AFLCMC/EB S&T Summit, USSF S&T Book of Needs, MAJCOM Interface

RW 2023 Technology Priorities

Digital Materiel Management

- Networked, Collaborative, Autonomous (NCA) Weapons
- Counter-Maritime
- Counter-Air
- Air Base Defense
- Foundational Weapon S&T
- S&T Enablers for NDO, SOF, and Space

Key Technical Areas of Munitions Directorate

Computational Engineering Sciences

Autonomy, Navigation & Control

Seekers

Energetic Materials

Ordnance

Air Force 2030 S&T Strategy

Three Objectives

1

Develop and Deliver Transformational Strategic Capabilities

- Global Persistent Awareness
- Resilient Information Sharing
- Rapid, Effective Decision Making
- Complexity, Unpredictability & Mass
- Speed and Reach of Disruption and Lethality

2

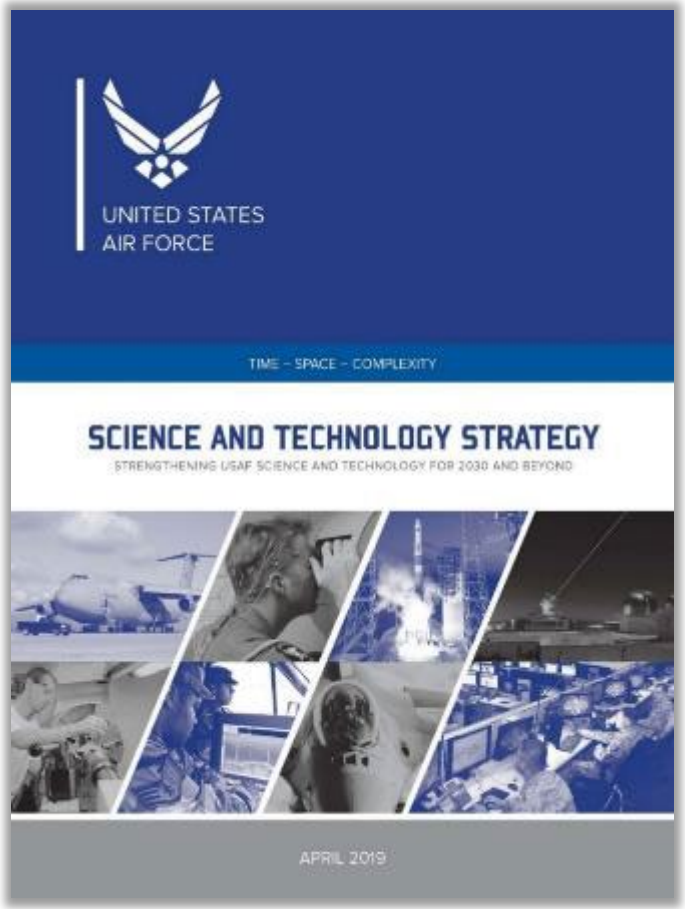
Reform the Way Science & Technology is Led and Managed

- Chief Technology Officer

3

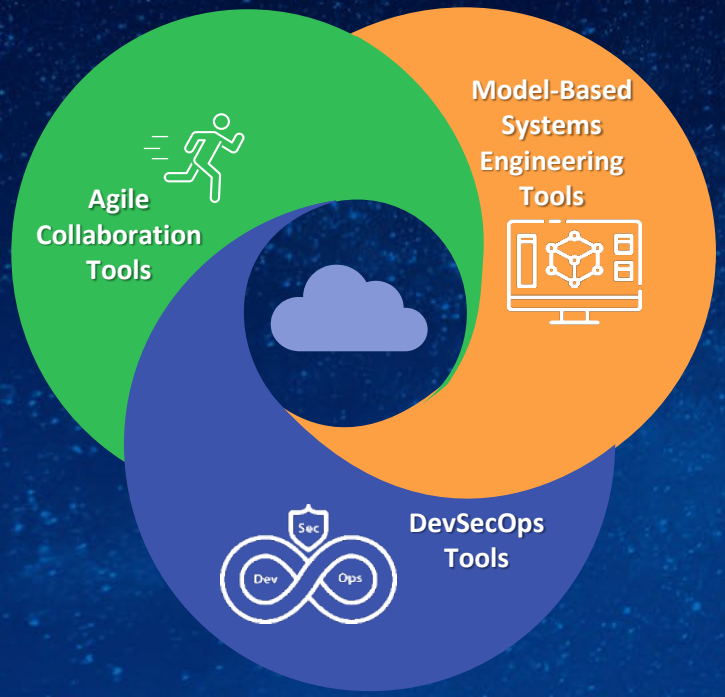
Deepen and Expand the Scientific and Technical Enterprise

- Engage and Support a Technical and Driven Workforce
- Drive Innovation Through Partnerships

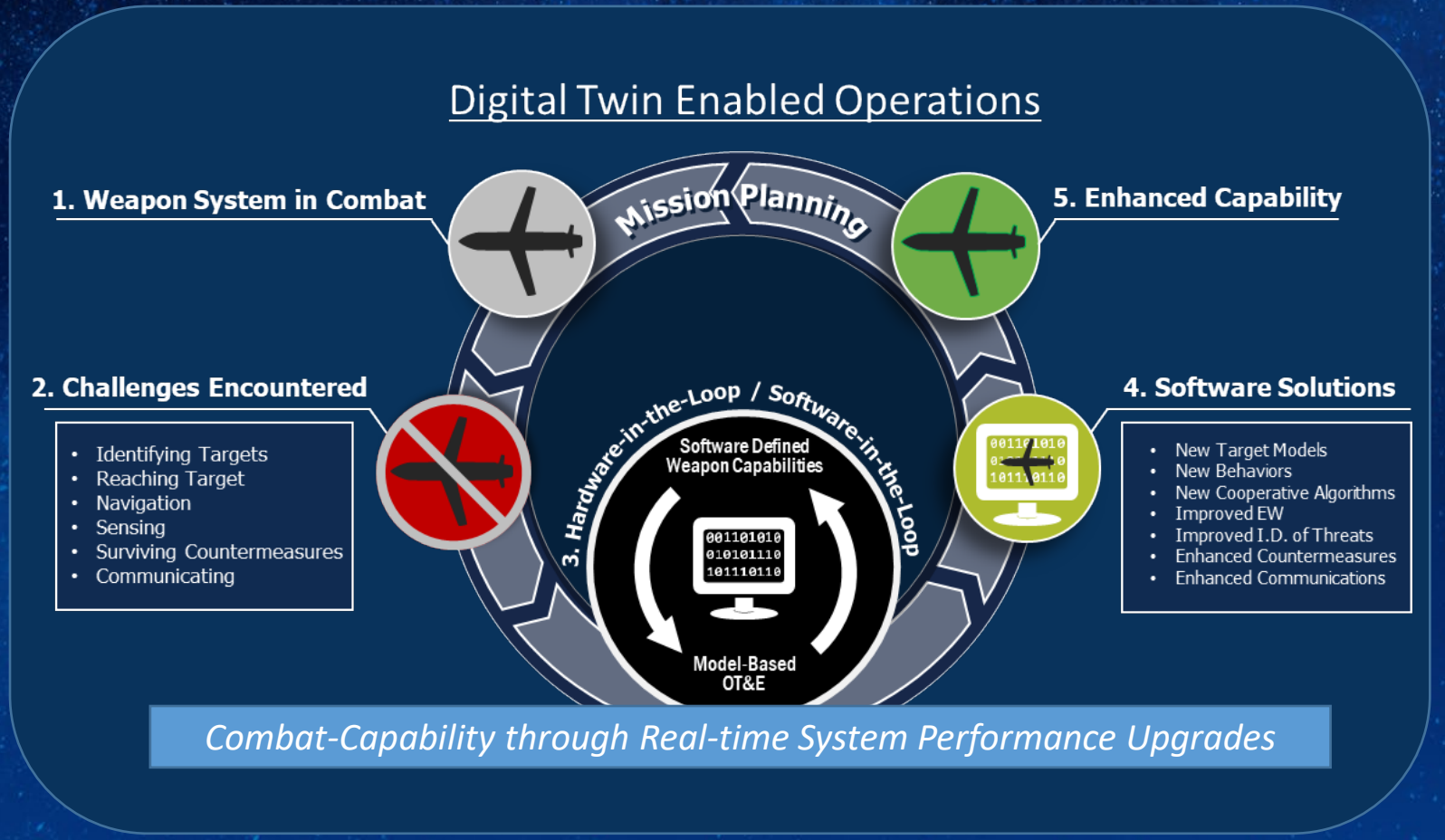


Fully Implement Digital Transformation– Rapid Tech Insertion

RogueOne – Integrated Digital Environment

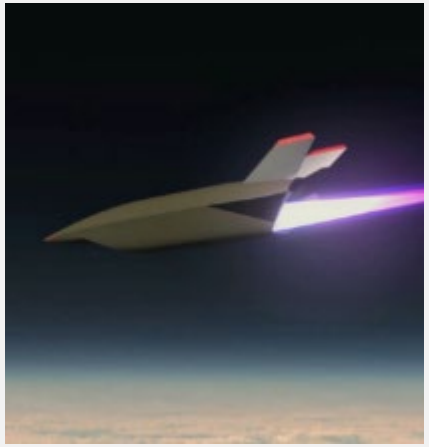


Digital Twin Enabled Operations



Enabling Rapid – Agile – Open solutions to Accelerate Life Cycle

High-Speed & Hypersonic Weapons



Speed and Reach of Disruption and Lethality

- Reduce Response time
- Difficult to Defend Against
- Survivable
- Reduce Platform Attrition
- Stand-Off Capable
- Sustain Technology Superiority
- Mission Flexibility
- Increased Lethality

Major Programs

- HSSW Tech Maturation → HSSW 2 (AFRL)
- NGHC Tech Mat (AFRL)
- Mayhem Multi-Mission Platform (AFRL)
- HITEM (AFRL)

Tech Enablers

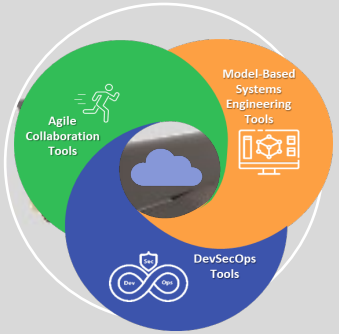
Tactical Boosters

Scramjets & Fuels

Ordnance Package & Lethality

Advanced Seekers

Airframe, Guidance, Navigation, & Control



Digital Models & Model Based Systems Engineering

HSSW – High-Speed Strike Weapon; **NGHC –** Next Gen Hypersonic Capabilities; **HITEM –** Hypersonic Integrated Technologies for Enhanced Missiles

Networked, Collaborative, Autonomous Weapons

Complexity, Unpredictability, and Mass

Rapid, Effective Decision-Making

Overwhelm & Confuse	Low-Cost / Cost-Imposing
Survivable	Responsive / Flexible Attack
Stand-Off Capable	Cooperative

Major Programs

Golden Horde - Colosseum

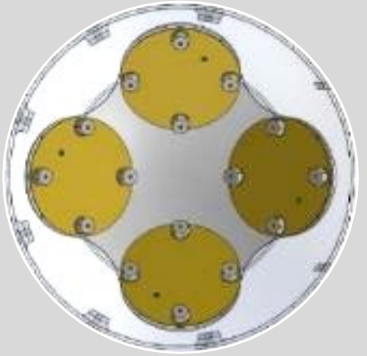
Tech Enablers

Low-Cost Engine Tech
Low-Cost Material Manufacturing

Weapons Open Systems Architectures

Secure Software-Defined Radios

Golden Horde Colosseum
NCA Assessments



Low-Cost, Direction-Finding Sensors, Nav, & Comms

Counter-Air & Air Base Defense

Speed and Reach of Disruption and Lethality

- Increase Load Out
- Platform Persistence in Highly Contested Environments
- Increase Weapon Range
- Lower Costs
- Enhance Platform Survivability
- Increase Weapon Lethality

Major Programs

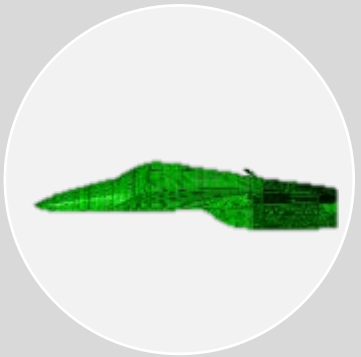
- CAST (AFRL)
- MSDM (AFRL/Navy)
- MUTANT (AFRL)

Tech Enablers

Highly Agile Airframes

Highly Efficient Solid Rocket Motors

Reduced Size, Highly-Lethal Warheads



Modeling & Simulation Tools to Evaluate Performance

Low-Cost Passive Seeker (MSDM)

CAST – Counter-Air Science and Technology; **MSDM** – Miniature Self-Defense Munition; **MUTANT -** Missile Utility Transformation via Articulated Nose Technology

Counter-Maritime

Speed and Reach of Disruption and Lethality

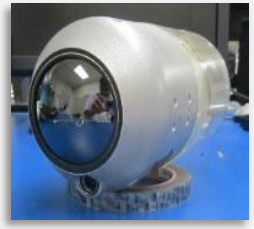
Complexity, Unpredictability, and Mass

- Reduce Collateral Damage
- Optimizes Effect on Target
- Control of Lethal Footprint
- Improves Sortie Flexibility
- Many Target Sets
- Increase Loadouts

Major Programs

- MWP (AFRL/Navy)
- Rotary Launcher (AFRL/SOCOM)

Tech Enablers



Low-Cost Seekers

Improved Energetic Effects

Compressed Carriage Rotary Launchers

Weapon Open Systems Architectures

MWP – Maritime Weapon Program

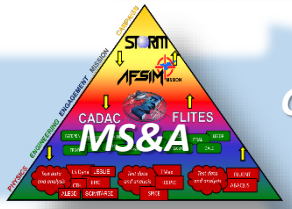
Accelerating Discovery, Development, and Transition of Munitions S&T

Knowledge Exchanges and Engagements

Symposiums
Working Groups

Communities of Interest

Digital Transformation



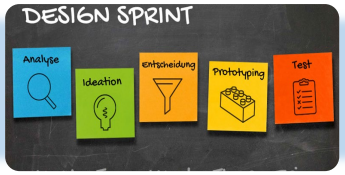
Golden Horde Colosseum

Infrastructure

Weapons Technology Integration Center

Processes & Org. Structure

Fusion Teams



Technology Transfer and Transitions

CRADAs

SBIR Pitch Days

Delivering Relevant, Responsive, and Transformational Capabilities to DAF

RW 2023 Technology Priorities

Digital Materiel Management

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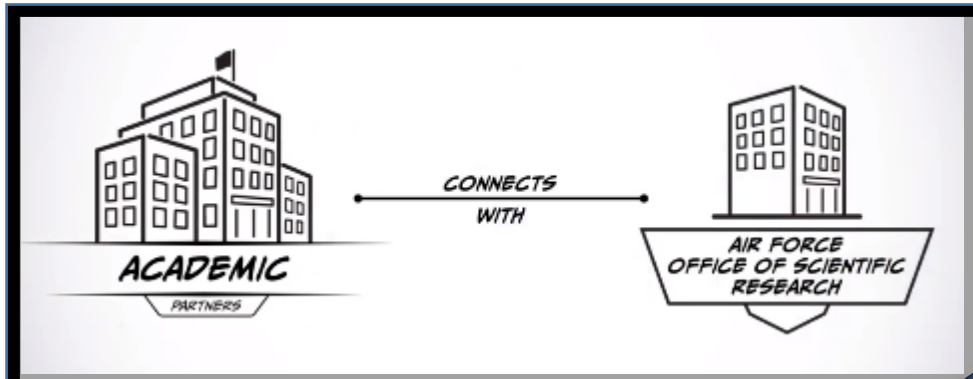
- Counter-Maritime
- Counter-Air
- Air Base Defense
- Foundational Weapon S&T
- S&T Enablers for NDO, SOF, and Space

Partnering with AFRL

Link Here

For more information, visit
AFRESEARCHLAB.COM

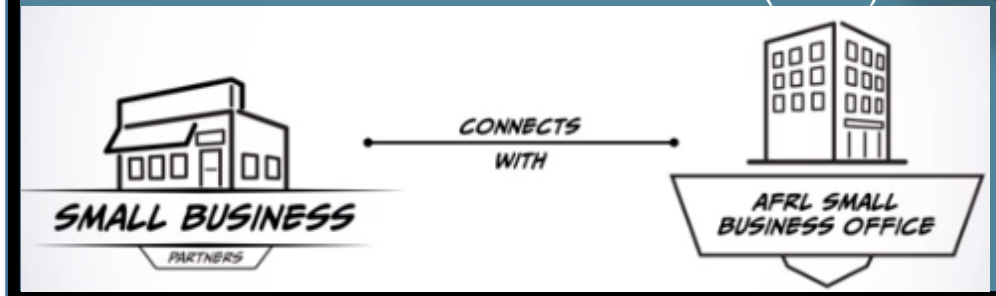


- Grants
- Partnerships

- Air Force Challenge
- AFWERX Spark Program
- AFRL Maker Hub
- AFRL CC's Challenge

WAYS TO PARTNER WITH AFRL

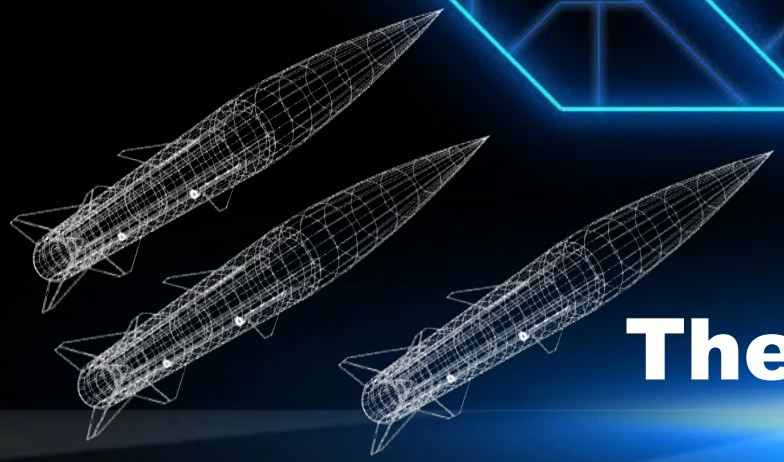
- Open Innovation Challenges
- Tech Accelerators
- AFRL's Innovation Institutions
- IP Licensing
- Small Business Innovation Research (SBIR)



- AFRL Institutes
- AFWERX
- Open Solicitations
- FedBizOpps.gov
- Defense Innovation Marketplace

AFRL

OneAFRL Digital Enterprise



The Digital Transformation

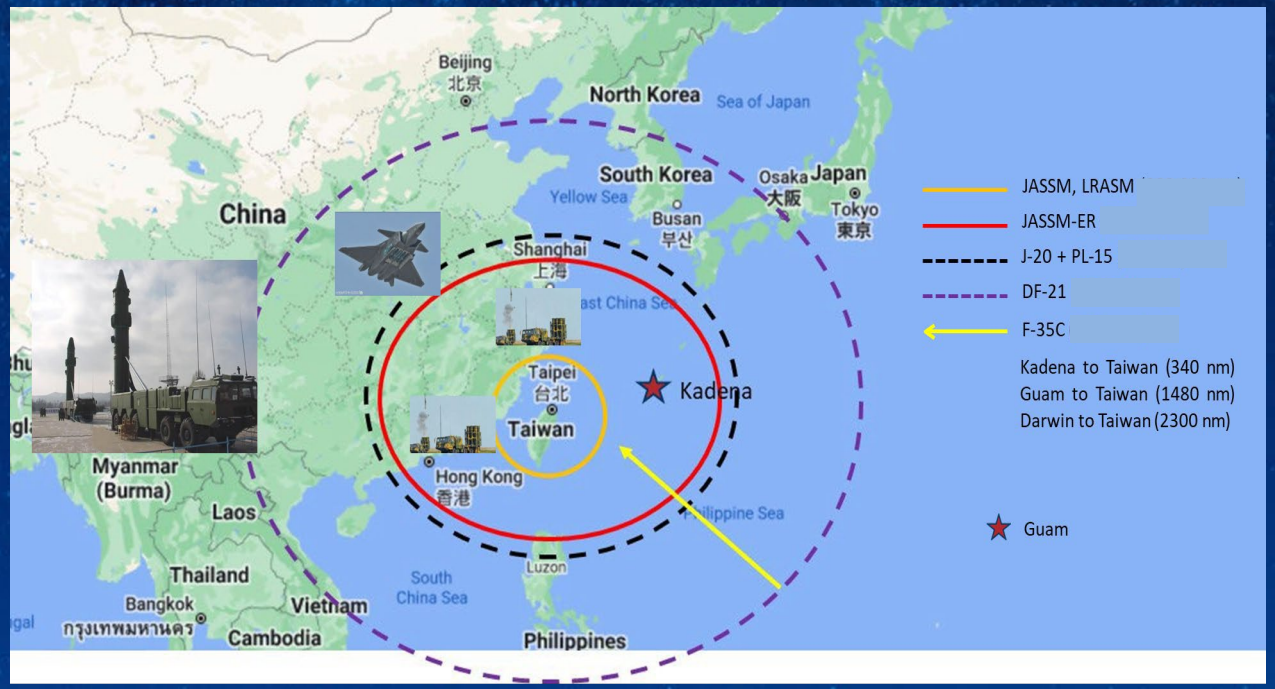
AFRL Munitions Directorate

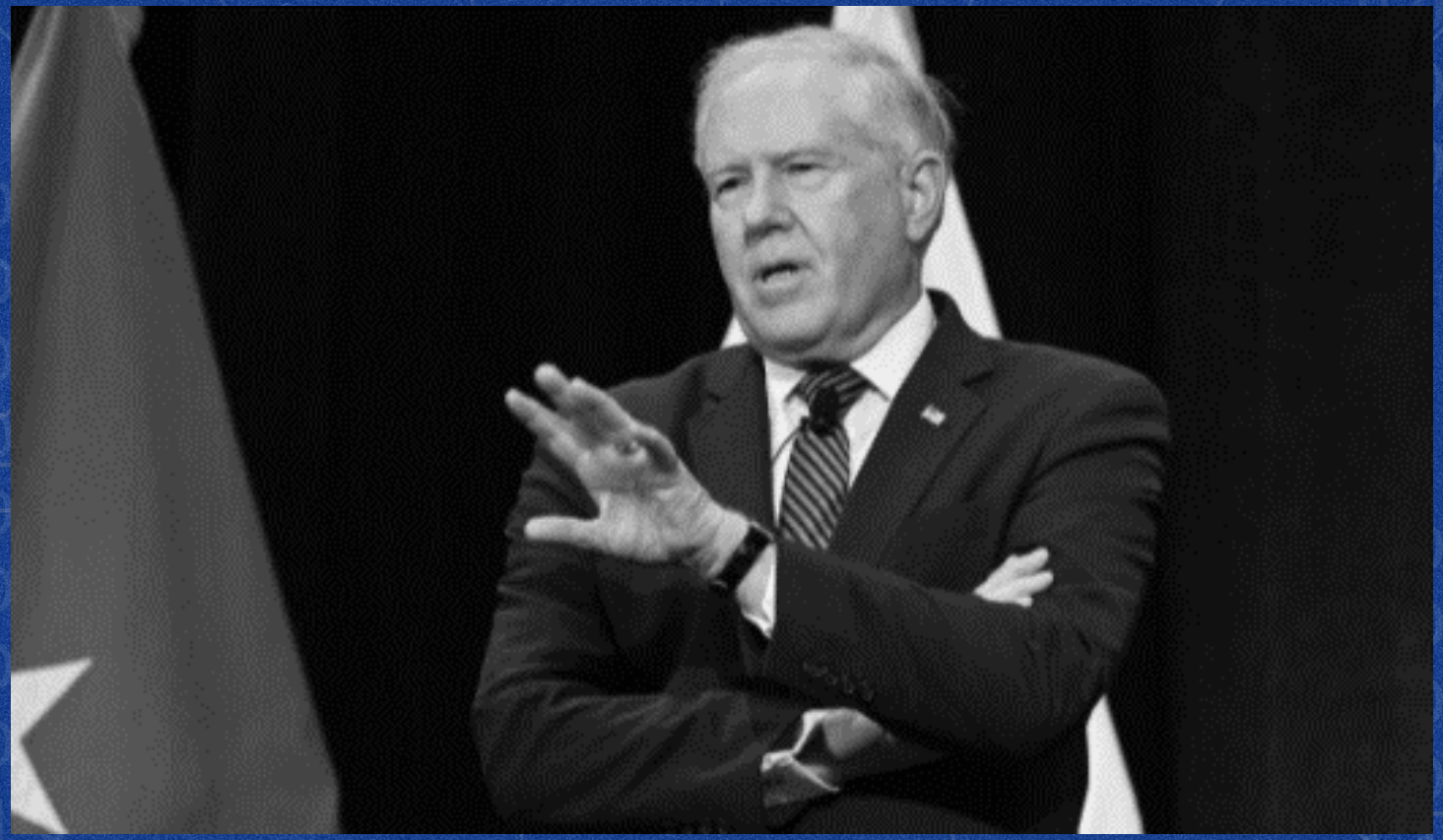
Scott Teel
AFRL/RW Chief Engineer

Why?

Six Fights

1. Fight to compete and deter
2. Fight to get into theater
3. Fight to get into the air
4. Fight to stay in the air
5. Fight to deny adversary's objectives
6. Fight to sustain the fight





"We are in a race for technological superiority!”

- Air Force Secretary Frank Kendall

AFRL/RW Portfolio Areas & Priorities

What?

Demand Signals

Strategic:
Operational Imperatives, S&T 2030, National Defense Strategy, OSD Critical Technology Areas

Operational:
AFRL Commander's Intent, Diversity & Inclusion Commitment, Emergent DoD Focus Areas

Tactical:
Air Force Futures, AFLCMC/EB S&T Summit, USSF S&T Book of Needs, MAJCOM Interface

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How?

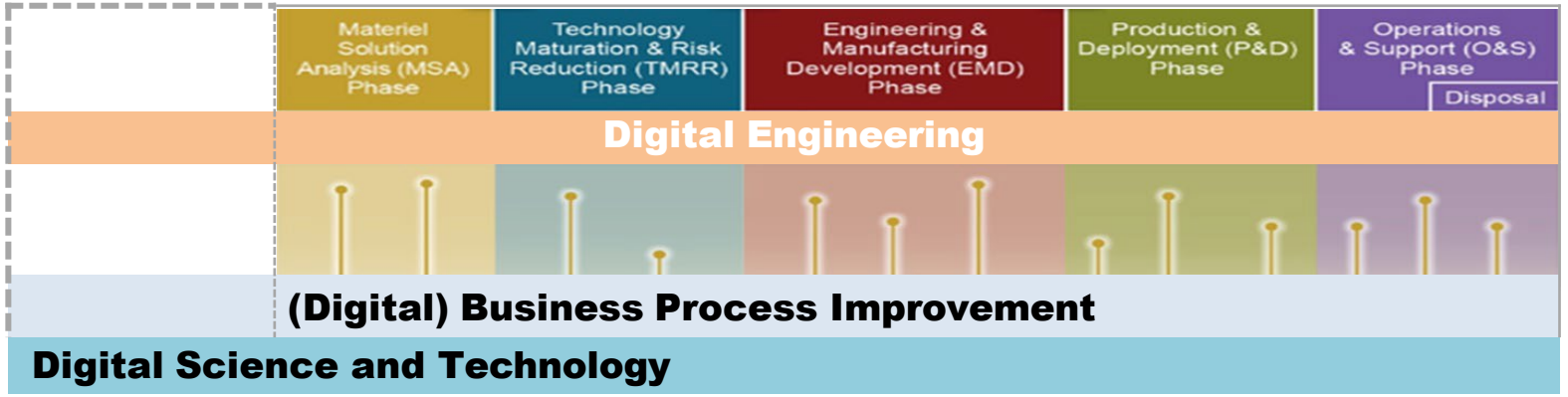
Background

Potential adversaries are moving fast to overcome our military dominance

Fielding new capabilities is our greatest hindrance to maintaining dominance in the future

To address the increasing time to field capabilities, AFRL must become digital, embracing digital tools, processes, and approaches to expedite time to market.

Hierarchy of Strategic Guidance Shaping AFRL Digital Transformation



"…We must contribute to the Joint Warfighting Concept, enabled by Joint All-Domain Command and Control, and place capability in warfighters' hands faster—through innovation, experimentation and rapid prototyping, and a collaborative approach with our service and industry teammates."

General Charles Q. Brown, Jr., USAF Chief of Staff

Accelerate Change or Lose

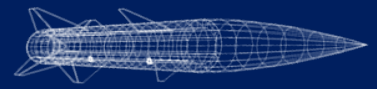
Deliver new capability to the warfighter at the speed of relevance

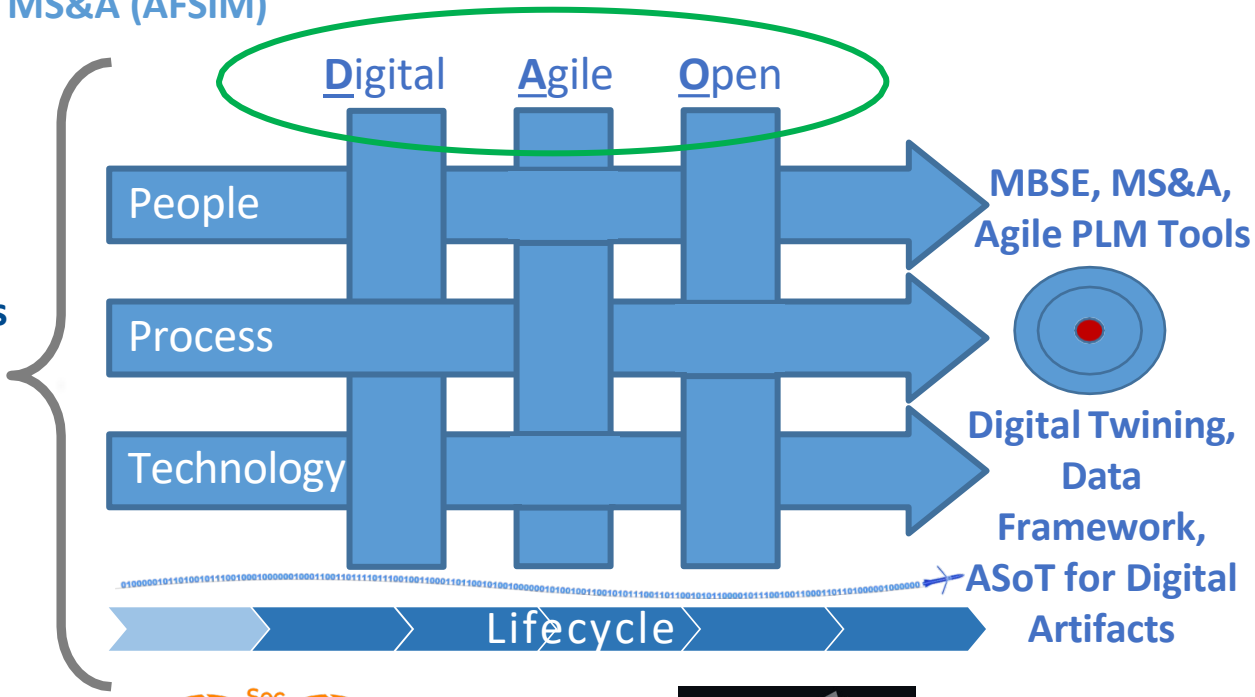
AFRL/RW Digital Transformation

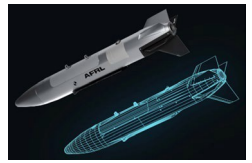
AFRL

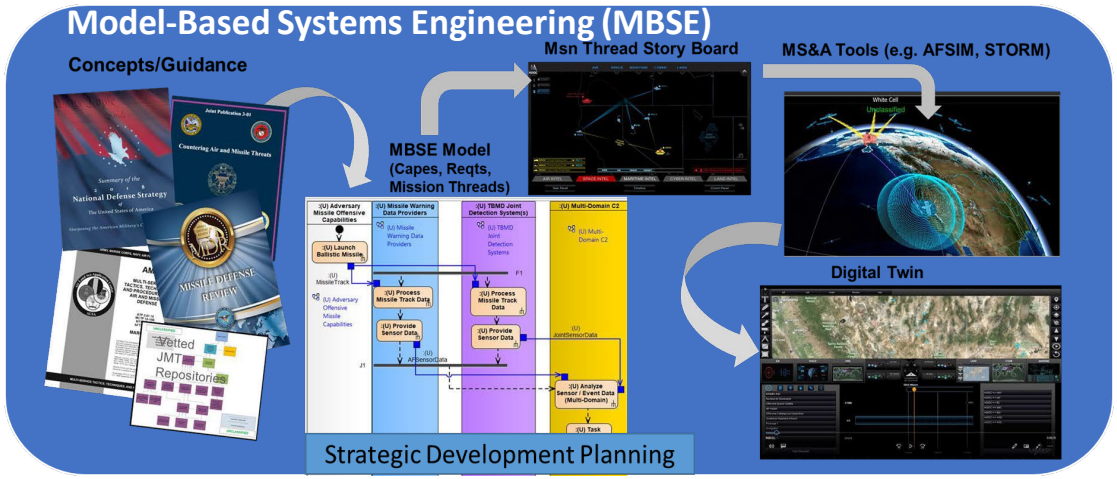
- **Why/ Goals**: Faster Research, Better Decisions, Streamlined Transitions, Low Friction Bus Ops
- **What**: Implement Holistic Digital Engineering Lab Environment
  - Research/Experimentation, Business Ops, Program Execution, Analytics
- **How**: Integrate Key On Going Initiatives to provide
  - Digital Infrastructure/Ecosystem – Cloud Based Services at Multi-Level Security
  - Model Based Approach for All We Do
    - R&D Development for Integrated MBSE (SysML- Cameo) & MS&A (AFSIM)
      - Weapon Government Referenced Architecture (GRA)
      - Evolve Digital Twinning, and Digital Thread ASoT
      - Digital Model-Based Reviews (HSSW2)
  - Weapon/Seeker Open System Architectures (WOSA/OSA)
  - Implement Agile Program Management and S/W Development
    - Program Execution, Automated Processes, and MBSE Tools and Apps- Atlassian Tech Stack (Jira, Confluence), SAFe

Digital Transformation Applied to Weapons System S&T Development across the Lifecycle









Model → Analyze → Decide → Execute

AFRL/RW Digital Transformation Strategy Summary

AFRL

Digital Transformation Vision

AFRL MADE to Accelerate:
Model, Analyze, Decide, Execute

Digital Transformation Mission

- Measurably accelerate the generation and transition of adoption-ready technology with demonstrable military benefit
- Apply digital transformation to perform R&D (ideate, research, design, prototype, test, analyze, transition)
- Apply digital transformation to execute business & operations (initiate, plan, resource, manage, deliver)

Digital Transformation Goals -->

	Sprint Champion	***FASTER RESEARCH:*** Accelerated Research, Experimentation, and Innovation — Dr. Vanden/Dr. Minier ✓	***BETTER DECISIONS:*** Analytically Rigorous Technical, Business, and Operations Decisions — John Williams ✓	***STREAMLINED TRANSITIONS:*** Seamless Entrance into Acquisition & Implementation — Col Sean Dorey ✓	***LOW-FRICTION BUSINESS & OPS:*** Flexible and Responsive Business & Ops to Facilitate our Research Mission — Jaime Pinto ✓
AFRL Digital Transformation Lines of Effort/Focus Areas					
Data	*John Williams* ✓	**Promote data transparency and accessibility to curated, trusted data via data management processes, policies, and tools**			
Modeling/ Analysis	*Kathy Flynn* ✓	**Expansive use of modeling and analysis to perform research, assess military utility, deliver products**			
Collaborative Tools for R&D	*Cody Carter* ✓	**Enable technical and business collaboration across multiple stakeholders, at multiple security levels**			
Integrated Infrastructure	*Don Bradley (coord with RW CIO)* ✓	**Infrastructure components including user devices, hardware, software, connectivity and services needed to support the AFRL mission while accelerating digital transformation**			
Cybersecurity	*Juanita Riley, Maggie Szczepanski* ✓	**Streamlined security controls, automated where possible, that enable AFRL's goals for digital data management and collaborative tools**			
Human Capital	*John Henry Williams* ✓	**Define the human capital approach, prepare the workforce, and manage cultural change for AFRL's digital transformation**			
Agile Program Mgmt	*Col Sean Dorey* ✓	**Develop and Implement SAFe Based Agile Progrma Management Approach and Tools**			

RW DIGITAL TRANSFORMATION

Guidance & Implementation Timeline

Office of the Chief Engineer, Mr. Scott Teel, AFRL/RW

Released: 28 March 2023

Guidance Summary/Background

WHY: AFRL and RW are developing the cutting-edge enabling technologies essential for building war-winning weapon systems that must be developed and delivered at the speed of relevance. We must also ensure the **right capabilities and technologies are available at the right time for the right customer** in the most effective and robust manner possible. Diverse and muti-domain solutions that enable our warfighter need to be rapidly explored from a spectrum of researchers, innovators and suppliers. As such, data needs to be available, accessible, searchable, understandable, shareable, and reusable on demand by researchers, collaborators and partners. Informed decisions need to be made based on supporting models and data analytics. To maximize the effectiveness and efficiency of conducting research, business operations must also have reduced friction.

WHAT: To meet these demands, a digital approach is being pursued to accelerate development and delivery of science and technology solutions, their maturation, and trade space over traditional timelines. The approach will also be more robust and provide better informed data driven and model-based investment decisions and technical solutions. Consequently, RW is ***transforming to a Digital, Agile, Open (DAO) based organization for all aspects of our business and research.*** The organization will utilize ***digital, and particularly model-based approaches, as the foundation*** for the way it conducts business and research. ***Agile management tools and approaches*** will be utilized to ensure more responsive feedback and collaboration while providing better customer solutions in a more timely manner. The capabilities, tools, environments and their adoption/application must have a **commonly understood and corporately established timeframe for transformation as provided in this document.**

HOW: RW stood up a 0.8 digital minimal viable digital capability (MVC) in FY22. Evolutions of the capability have occurred as a result of significant AFRL and RW digital enterprise initiatives. We must move toward the next adoption phase which requires embracing the transformation and one in which we begin operating and living into the digital environment and exploiting the tools, capability and agility they provide so we truly are operating at the speed of relevance. RW is specifically and intentionally moving to dove tail with the environment and capabilities being invested in by the AFRL digital enterprise with the intent to have RW operating as a digitally transformed organization by the end of FY24. RW will strategically leverage the digital transformation capabilities associated with the AFRL digital enterprise as well as develop tailored and unique capabilities we need for weapon technology research and transition. The strategy we are following mirrors the AFRL digital strategy and allows alignment between the AFRL enterprise transformational activities and RW's. The foundation of our comprehensive strategy involves people, processes and technology and covers 6 key lines of effort and 4 top level goals. Key contractors are shoring up the transformation team and are supporting both the Digital Capabilities Directorate (previously Digital War Room) for the AFRL digital transformation as well as RW's. They have direct involvement and connection with AFRL enterprise activity as well as the expertise for the transformation alignment and conduct. LinQuest/Perduco and Lean Scaled Architects (LSA) support AFRL digital transformation activities at the enterprise level. We have enlisted their support to ensure alignment between enterprise-level and RW activities. They will work alongside us, providing support, coaching, and training to accelerate our digital transformation. More specifically, they will facilitate effective setup of RW programs, processes, and research with digital tools (e.g., Jira, Confluence, Cameo), agile methods/approaches (e.g., Scaled Agile Framework "SAFe"), and cloud-based environments (e.g., Digital Laboratory Environment (DLE)). The team is developing and providing the architecture, representative models of the architecture, and business and IT elements as part of a holistic transformation and ecosystem for RW. With a theme of start small and build fast, initial pilot efforts are identified for digital adoption/born with phased scaling across RW during FY23-24.

Forward: This document provides an upfront executive summary of the digital transformation strategy for context of the implementation timelines that follow. The **implementation events and associated timelines** outlined in the following pages provide **expectations** and unity of our collective efforts to accelerate our digital transformation and execution of the strategy.

Consequently, RW is ***transforming to a Digital, Agile, Open (DAO) based organization for all aspects of our business and research.*** The organization will utilize ***digital, and particularly model-based approaches, as the foundation*** for the way it conducts business and research. ***Agile management tools and approaches*** will be utilized to ensure more responsive feedback and collaboration while providing better customer solutions in a more timely manner. The capabilities, tools, environments and their adoption/application must have a **commonly understood and corporately established timeframe for transformation as provided in this document.**

RW DIGITAL TRANSFORMATION IMPLEMENTATION TIMELINE

Implementation Timeline	Requirement
Current	☐ RW supports the **"Strategy on a Page (SOAP)"** which embodies the Model Analyze Decide and Execute (MADE) strategy and establishes RW goal champions and Line of Effort (LOE) leads. • Ensures robust alignment with AFRL digital enterprise activities and investments. • The Chief Engineer's office, supported by a Digital Materiel Management Chief, Chief Data Officer, Chief Information Officer, and contract transformation team will provide RW strategy, guidance, policy, and champion the transformation activity. ☐ A **working group** (finalized by Q3FY23) will ensure regular communication and status sharing resulting from active collaboration **between the AFRL and RW goal champions/LOE leads** as well as **RW's Digital Materiel Management Branch** (Agile Software Development, WeaponONE (W1), RogueONE (R1), and WOSA teams). ☐ *RW's transformation* is based on the **Digital Trinity: Digital, Agile, Open.** We will use digital tools, model-based approaches, cloud environments, agile management strategies, and open systems and standards. ☐ RW's holistic cloud-based environment will utilize/facilitate software, information, and platforms as a service. • Some on-premises networks will be integrated with cloud services where it makes sense but rarely and as an exception. As a result, we will minimize our on-prem networks in favor of cloud services. • The approach can support hybrid cloud, cloud to cloud, and cloud to on-premises integration.
Current	☐ RW programs already operating in **RogueONE (R1)** cloud service will continue un-interrupted until it migrates into the AFRL Digital Laboratory Environment (DLE) at the end of FY23. ☐ **All** programs not currently operating on R1 will stand-up in DLE, as they transition to operating digitally • DLE is an **Impact Level 5 (IL5)** cloud service. • Click here to view an AFRL "DLE Tutorial" video. ☐ RW will utilize DLE's **agile and collaboration stack** as a baseline ☐ The default/baseline tools RW will use are **JIRA, Confluence, Cameo, AFSIM (Advanced Framework for Simulation, Integration and Modeling)/Joint Simulation Environment (JSE),** and Gitlab. • Additional commercial design and analysis tools are also included, as well as custom designed tools and capabilities. These tools will evolve and be enhanced as needs dictate. ☐ RW will operate at all levels of the Modeling, Simulation and Analysis (MS&A) pyramid, as appropriate, from physics-based to mission level simulations. RW will support campaign level simulations and wargaming. ☐ RW will leverage the **Scaled Agile Framework (SAFe)** as the overarching agile approach, architecture, and integration method within RW. ☐ RW's transformation team will support the implementation of **MBSE, Jira, Confluence, SAFe, and AFSIM/JSE to include training and coaching,** working directly with program teams and leaders on S&T processes, business operations, and digital tools. • **Lean Scaled Architects (LSA)** will develop the RW enterprise architecture to address the specific integrated framework and pathway for RW to move from the current state to a transformed state.

All programs not currently operating on R1 will stand-up in **DLE.**

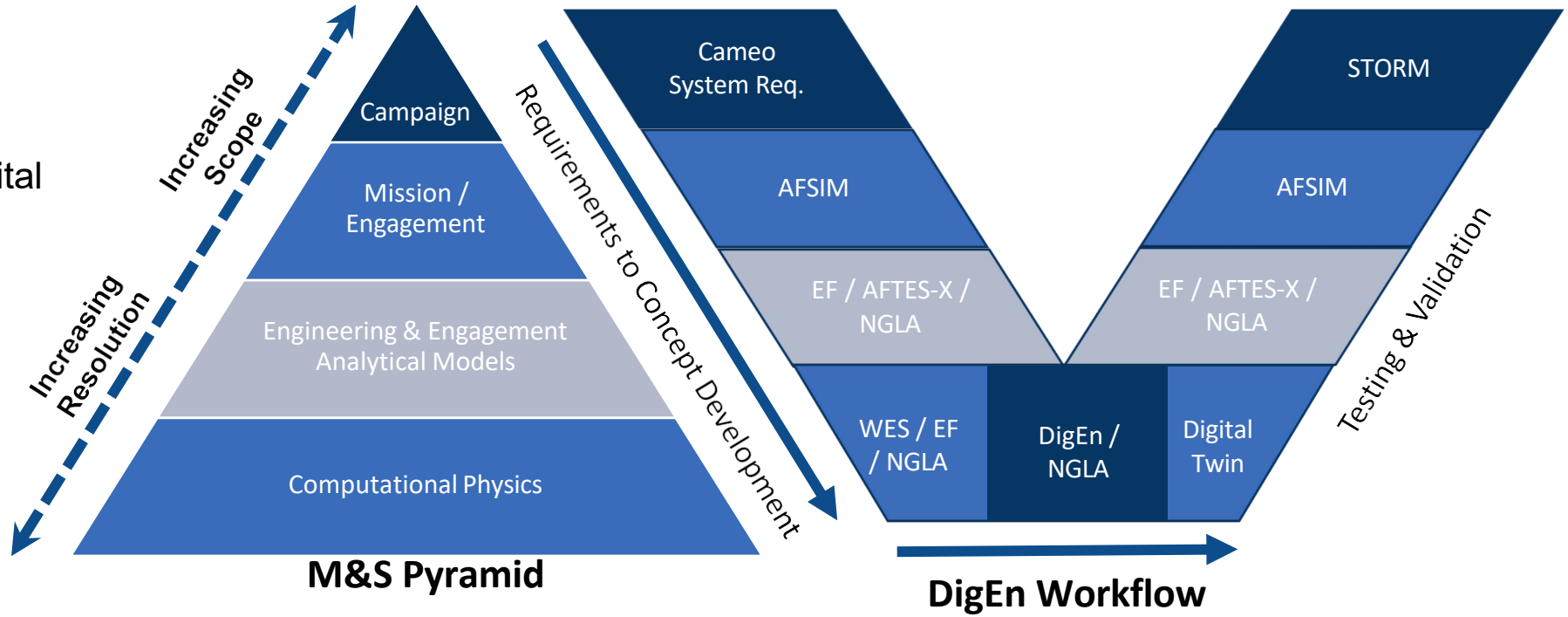
The default/baseline tools RW will use are **JIRA, Confluence, Cameo, AFSIM (Advanced Framework for Simulation, Integration and Modeling)/**

RW will leverage the **Scaled Agile Framework (SAFe)** as the overarching agile approach, architecture, and integration method within RW.

Accelerate - Digital Transformation

AFRIM = Advanced Framework for Simulation
AFTES-X = Air Force Targeting & Effects System
EF = Endgame Framework
NGLA = NextGeneration Lethality Architecture
WES = Weapons Effectiveness Studio

- Model-based
  - Systems Engineering
  - Investment Planning
- Common/shared tools
  - WeaponOne → AFRL's Digital Laboratory Environment
  - Weapon Open Standard Architecture (WOSA)



An integrated digital material management capability across the USAF Weapon Enterprise

Model | Analyze | Decide | Execute

Weapons Enterprise Approach- GRAs, WOSA, ASoT and Digital Twin / Thread

Government Reference Architecture (GRA)

Weapons GRA

Portfolio Architecture

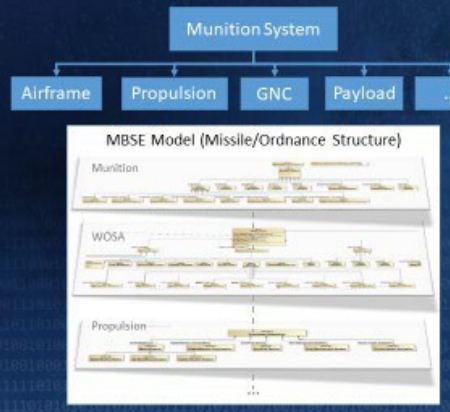
"E-Series" Weapon Standard
Useful across weapon life cycle

Promotes flexibility, reuse, collaboration -Speeds innovation

881WBS/DoDAF/UAF/WOSA/ASDP

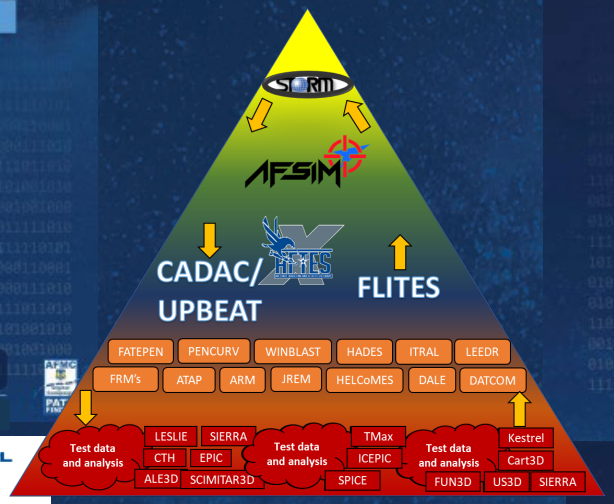
Protects Intellectual Property – Data Rights - Support Digital Acquisition / O&S

Technical & Collaborative Baseline



"A Reference Architecture is not defined by what it contains....but what it does." Col (Ret.) Brent Peavy

THE AIR FORCE RESEARCH LABORATORY



Model Based Approach

Authoritative Source of Truth (ASoT)

Weapons ASoT

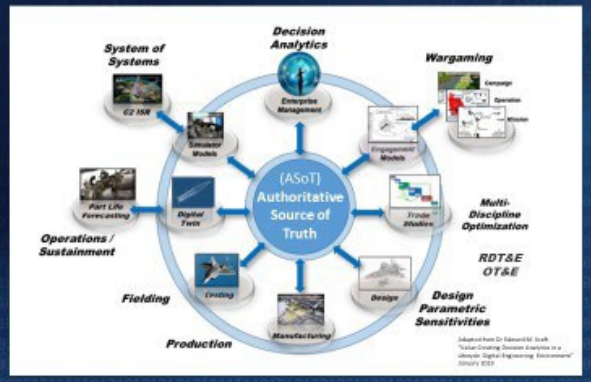
Trusted, Federated, Enduring Digital Thread

Cloud-based repositories

Git version control for MS&A data

AI/ML – Smart search and retrieval

Supports Data-driven Analysis & Decisions



Data-driven Analysis & Decision Pipeline

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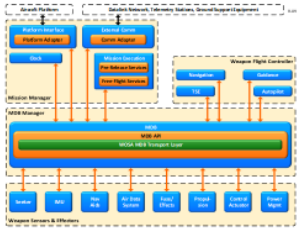
WOSA – Weapon Open Systems Architecture

Propulsion - **GNC** - Data Link - Ordnance - Seeker



What

- Government-owned, internal hardware/software interface standards developed in coordination with industry
- Compliance verification

Why

- Competition/affordability
- Best-of-breed subsystems
- Rapid upgrades to counter evolving threats

How

- Jonathan Shaver (Jonathan.Shaver.1@us.af.mil)
- Chris Neal (Christopher.Neal.8@us.af.mil)

AFRL/RW requiring WOSA compliance on all contracts

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Weapons Digital Twin Lifecycle

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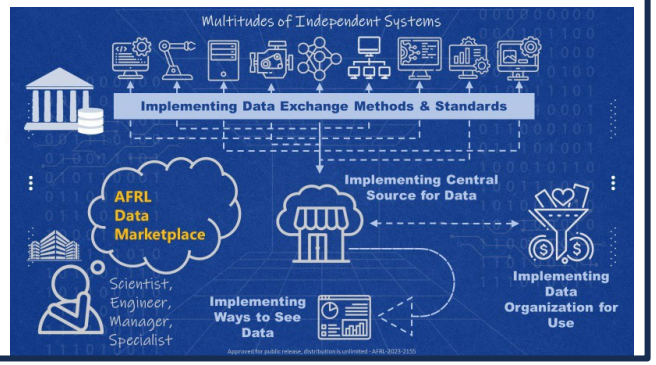
Digital Capabilities

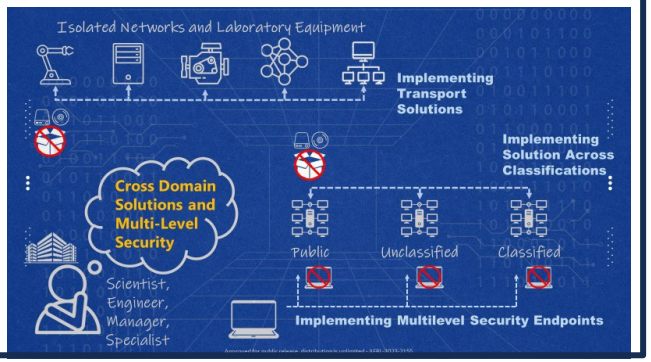
AFRL Data Marketplace

Enabling a Data-Informed Organization: Easily find, share, and use data across the AFRL



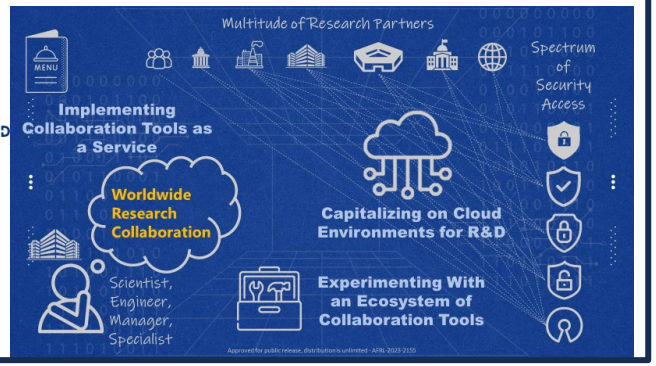
Cross Domain Solutions and Multi-Level Security

Conduct work at multiple levels of security and across security and network domain boundaries



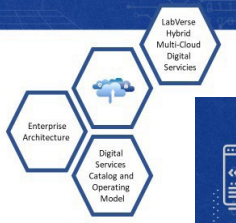
Worldwide Research Collaboration

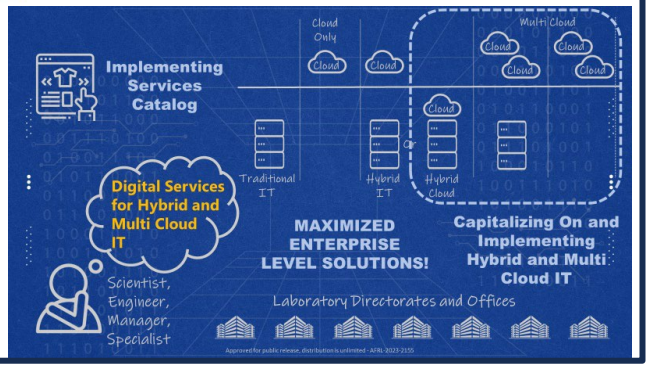
Digitally collaborate effectively and securely worldwide at the required security level



Digital Services for Hybrid Multi-Cloud IT

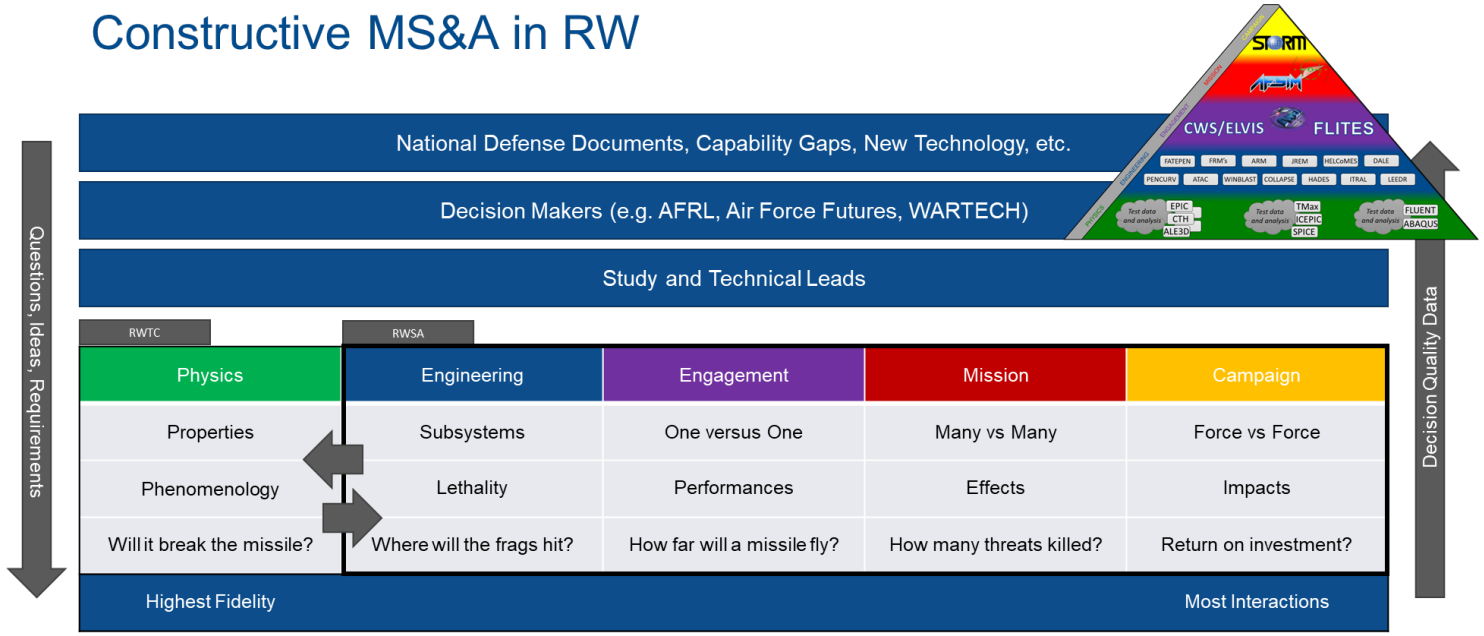
Provide modern digital services facilitated by a robust enterprise IT architecture



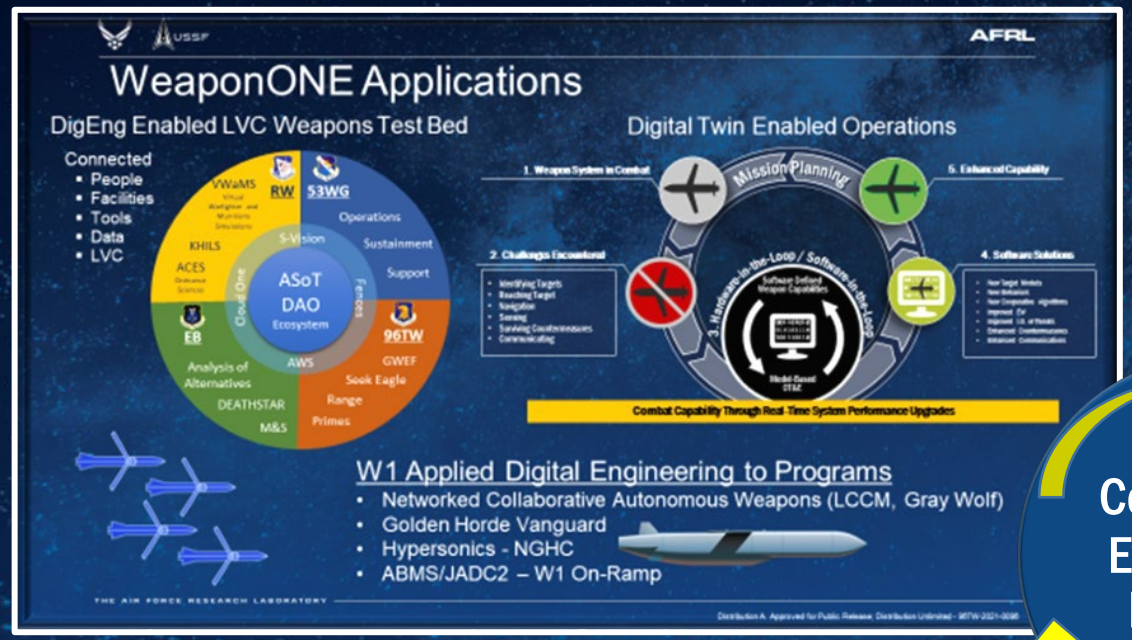


Digital Capabilities

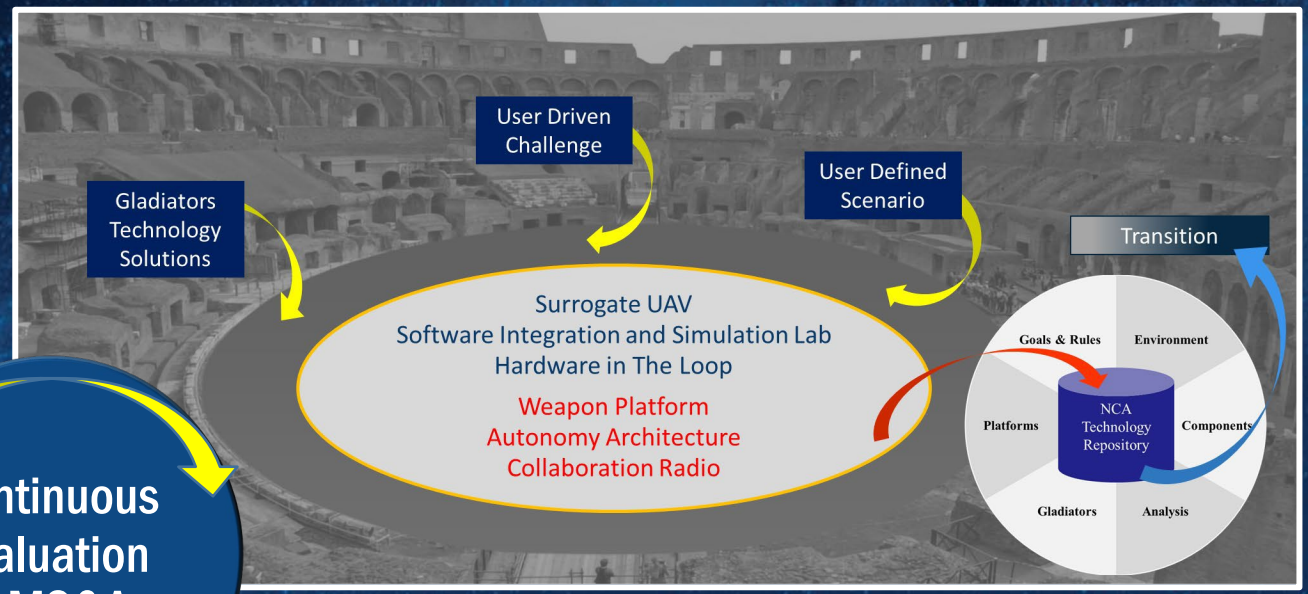
Constructive MS&A in RW



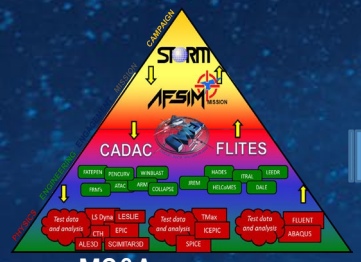
Accelerate the "Acquisiton Kill Chain"



Continuous Evaluation E-MS&A

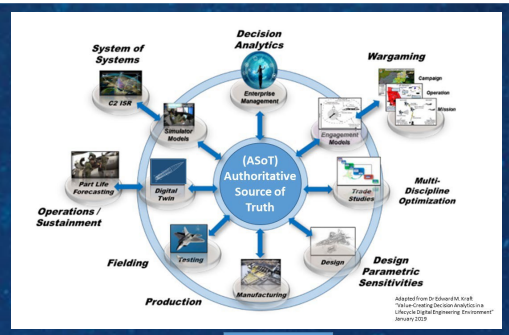


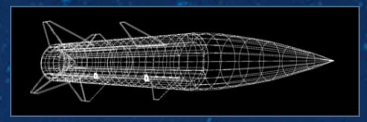
Colosseum HIL/SIL / Open Air Evaluation- Live Virtual Constructive



MS&A

ASOT





Digital Twin

Software Defined Systems

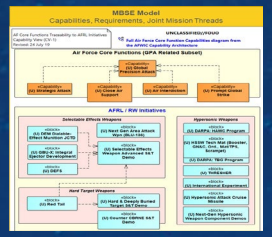
Non-Exquisite Adv Mfg

ABMS

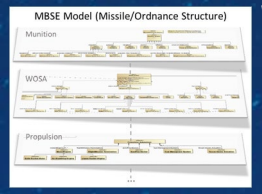
Dig Ecosystem

Live Virtual Constructive Testing/Experimentation

Exercises



Model Based Systems Engineering



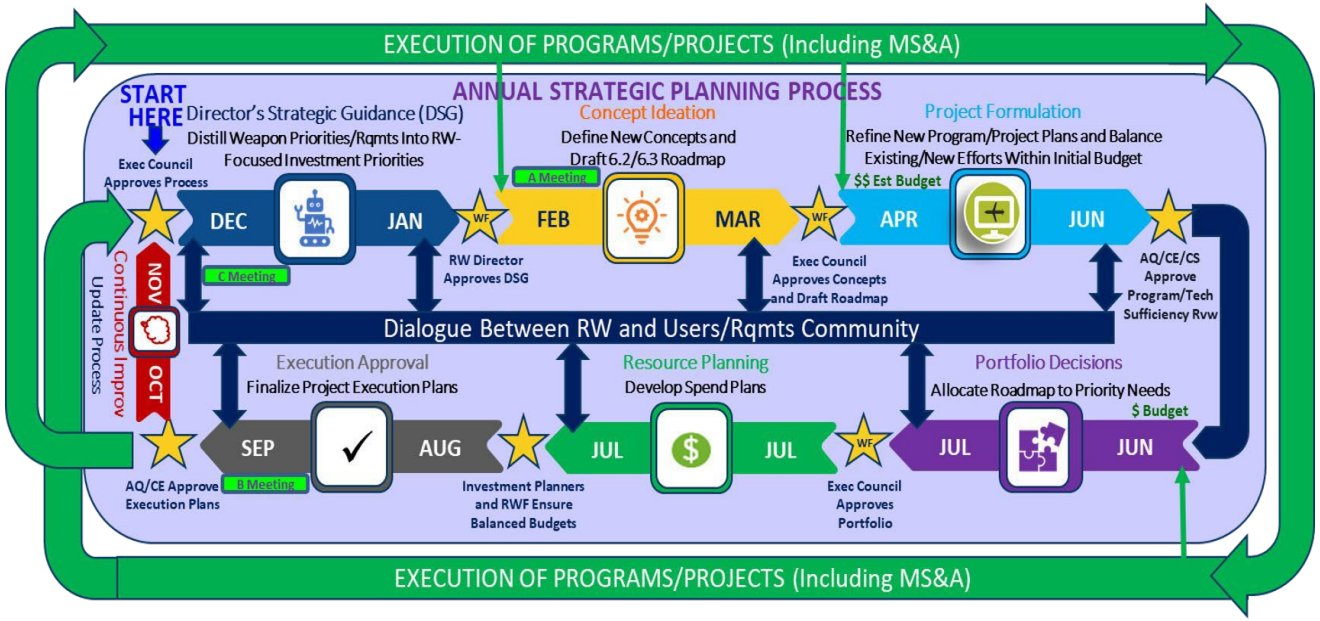
Weapon GRA

Weapon Open System Architecture

On-boarding New Ideas

When?

- Open Broad Agency Announcements (BAAs)
  1. Air Delivered Effects (BAA Number: FA8651-22-S-0001)
     - Open period: Through 21 March 2027
     - Ceiling: $750M
  2. Air Superiority Technologies (BAA Number: FA8651-20-S-0008)
     - Open period: Through 31 October 2024
     - Ceiling: $750M
- RW Strategic Development Planning Process
- RW Innovative Research Seedlings (Ignitor concepts)
- RW Proving Ground
- RW Strategic Development Program (SDP) Concepts
- USAFA Capstone Projects
- External opportunity Calls
  - AFRL Seedlings for Disruptive Capabilities Program (SDCP).
  - AFRL Innovation Incentives / SPRINT
  - AFOSR Lab Tasks
  - AFRL Minority Leaders – Research Collaboration Program (ML-RCP)
  - SAF/ST Edison Grants
  - OUSD(R&E) – Applied Research for Advancement of S&T Priorities (ARAP)
  - OUSD(R&S) - Rapid Defense Experimentation Reserve (RDER)



UNDERLYING ANALYTICAL AND DIGITAL ENGINEERING FOUNDATION

"In the midst of chaos, there is also opportunity", Sun-Tzu

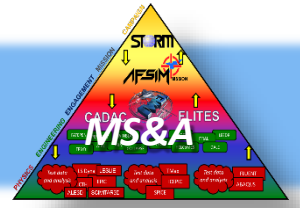
Why → What → How → When

Knowledge Exchanges and Engagements

Symposiums

Communities of Interest

Digital Transformation



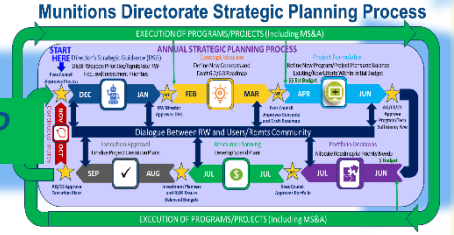
Infrastructure

Weapons Technology Integration Center

Processes & Org. Structure

RW2.0
Fusion Teams

SDP



Technology Transfer and Transitions

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CRADAs

AFLCMC/EB
SBIR Pitch Days

OPERATIONAL IMPERATIVES

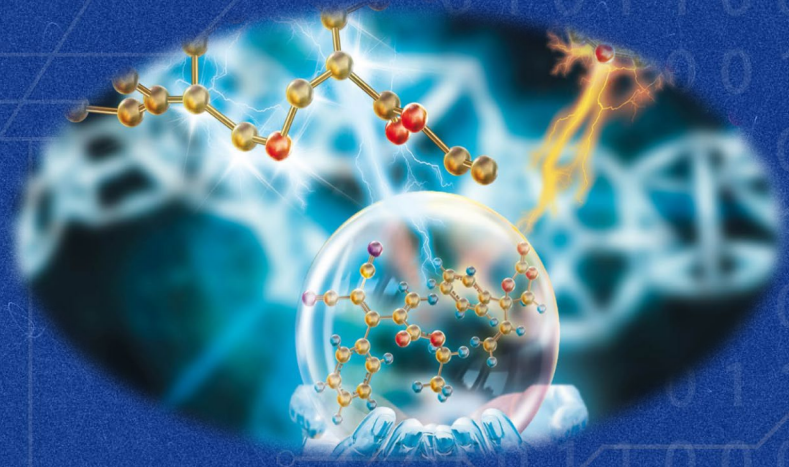
- **Space Order of Battle**
- **ABMS/JADC2**
- **Moving Target Engagement**
- **NGAD Family of Systems**
- **Resilient Forward Basing**
- **B-21 Family of Systems**
- **Readiness to Mobilize, Deploy, and Fight**

Opportunities… Who?

for Digital Service Providers

How can YOU help deliver the capabilities needed for this digital transformation?

for Research Providers

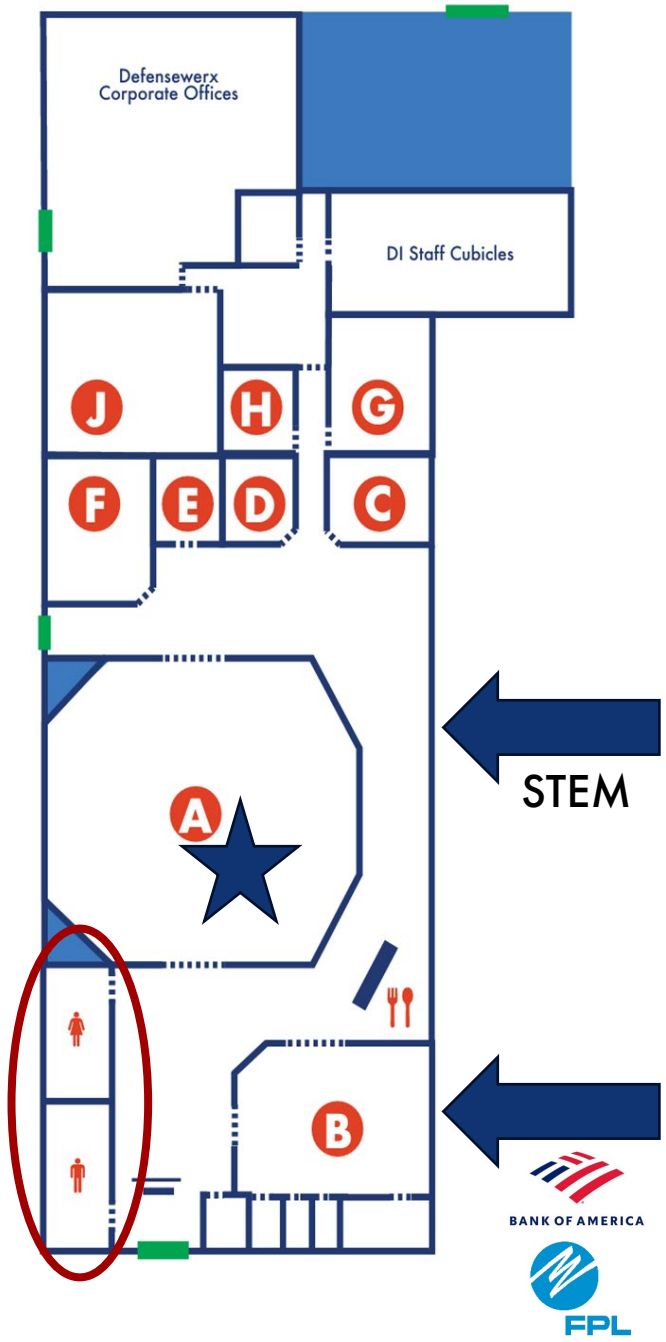


How can YOU leverage these new capabilities in your research activities and deliverables?

Questions?

Break

15-Minutes



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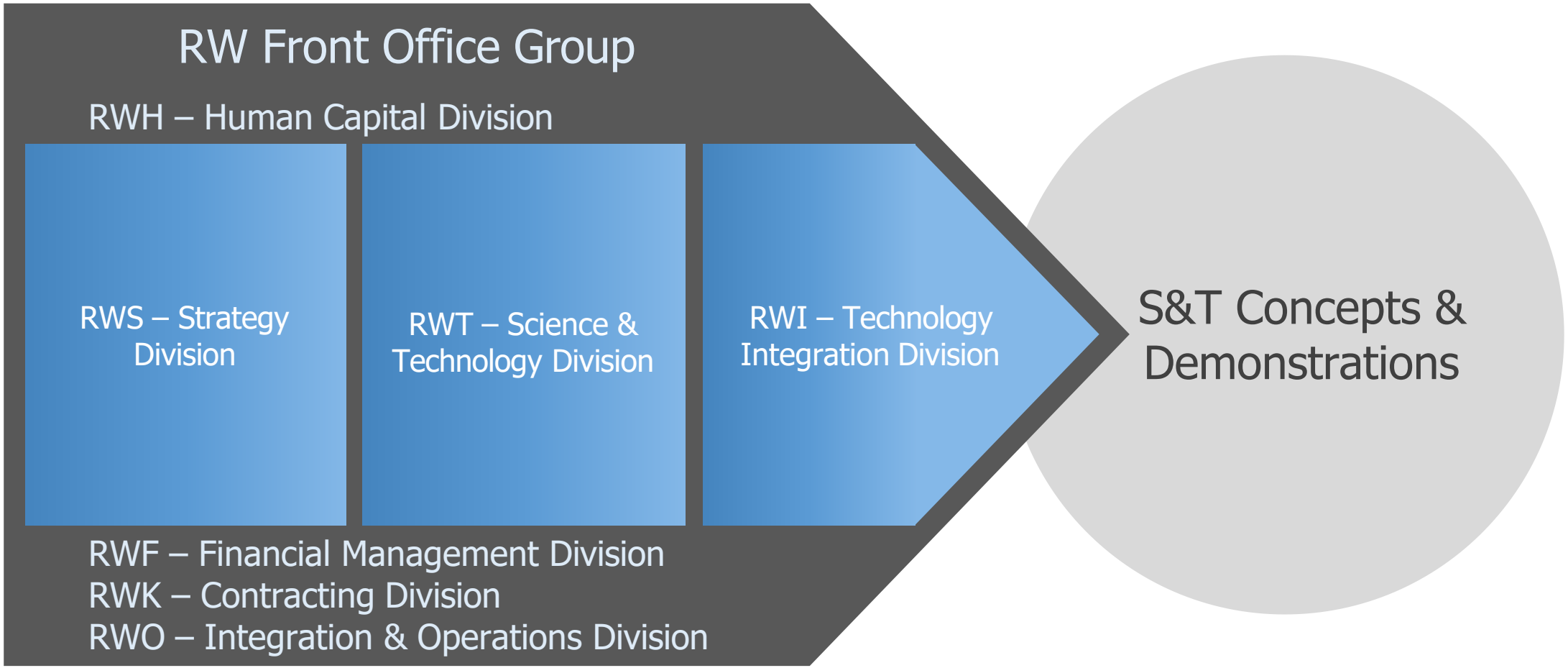
Air Force Research Laboratory RWI Overview

Dr. John Corley

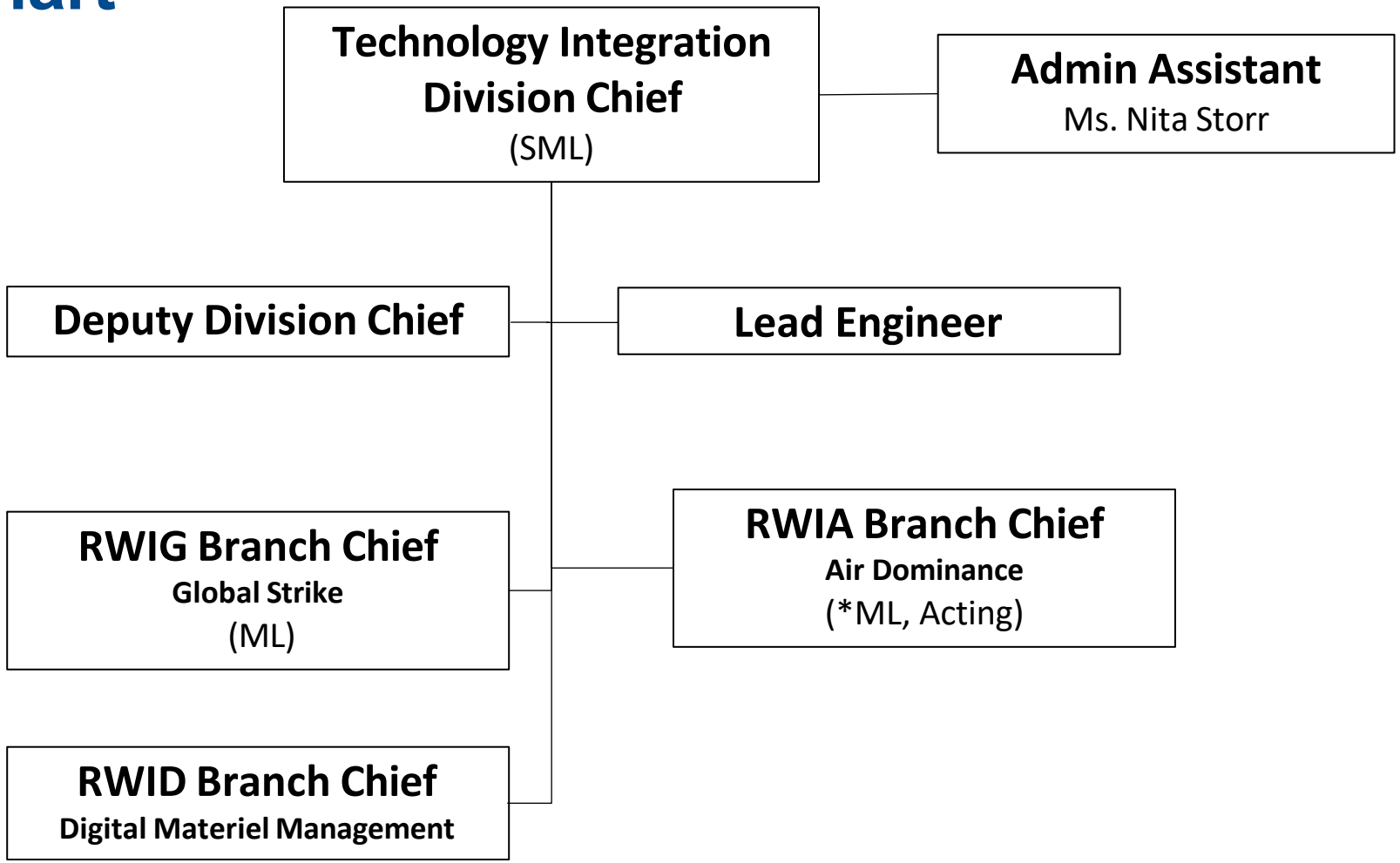
Technology Integration Division (RWI)

25 July 2023

RWI's Role: Integrate S&T Concepts and Demonstrations



RWI Org Chart



*ML position designation request at SAF/AQH for approval

AFRL/RWIG – Global Strike Branch

Mission: Develop, integrate, demonstrate, and transition global strike weapons technologies across the counter-land and counter-maritime domains.

International High-Speed Weapons

- Tactical High-Speed, Responsive and Highly-Efficient Round (THRESHER)
- International Flight Experiment (IFE)

High-Speed Weapons

- High Speed Strike Weapon 2 (HSSW 2)
- Hypersonic Integrated Technologies for Enhanced Missiles (HITEM)

Maritime Weapons

- Maritime Weapon Innovation Program (MWIP)*
- Counter-Maritime S&T (CMST)

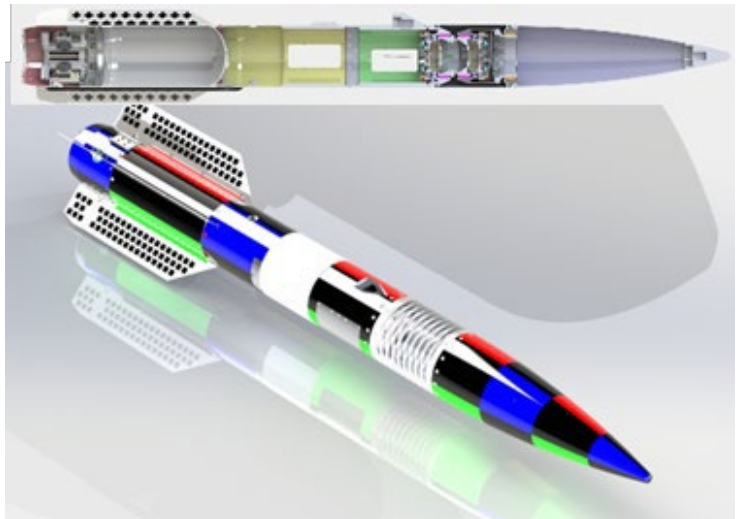
*Joint Capability Technology Demonstration (JCTD)

AFRL/RWIA – Air Dominance Branch

Mission: Develop, integrate, demonstrate, and transition air dominance weapons technologies across the counter-air, networked, collaborative, autonomous, and electromagnetic domains.

Air Superiority Weapons

- Counter-Air Science and Technology (CAST)
- Miniature Self Defense Munition (MSDM)
- Missile Utility Transformation via Articulated Nose Technology (MUTANT)

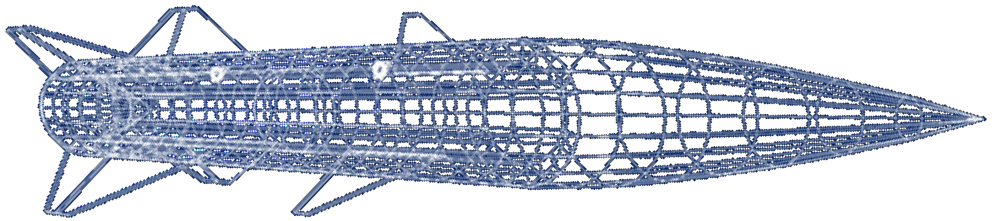


Emerging Technologies

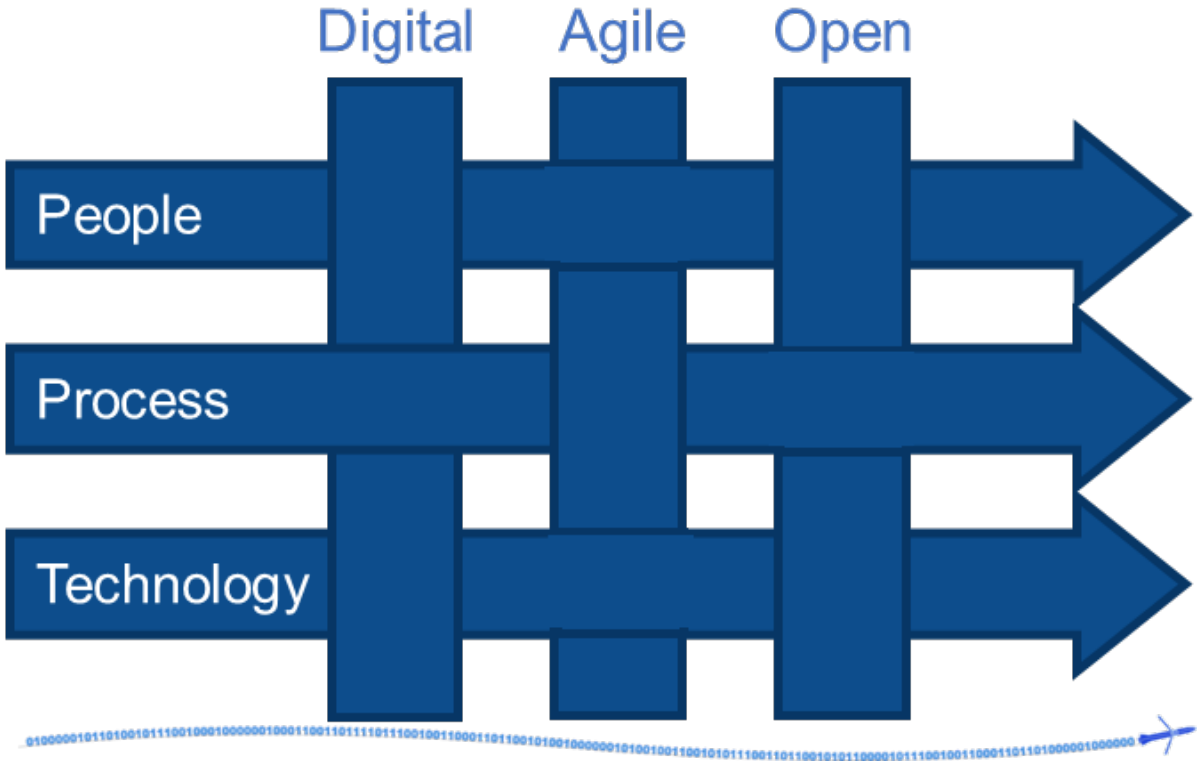
- Golden Horde Colosseum
- Swarming Collaborative Reconnaissance Electronic Effects Munition (SCREEM)
- Magnetic and Star Tracking for Extended Range Navigation (MASTER Nav)

AFRL/RWID – Digital Materiel Management Branch

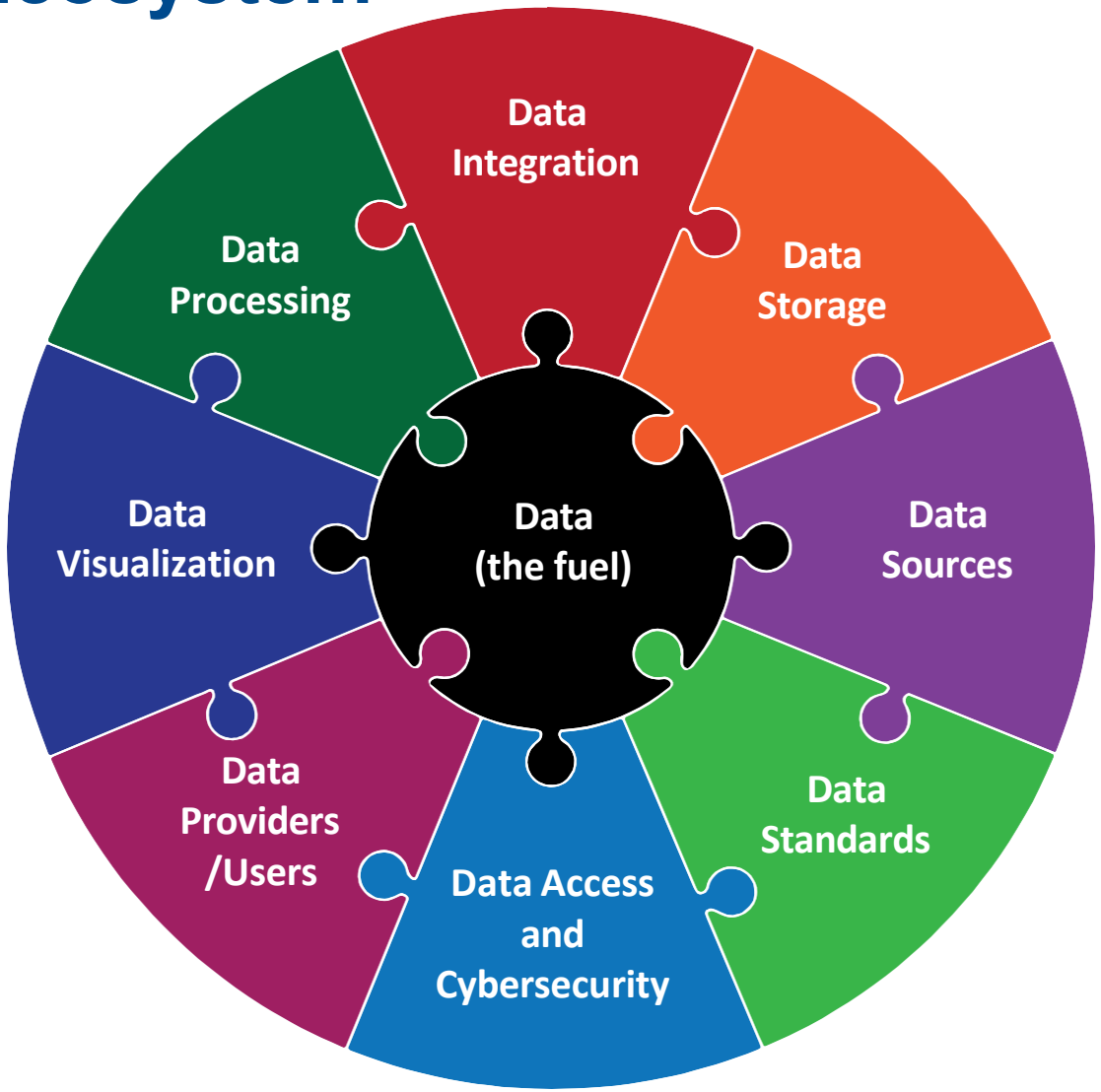
Mission: Develop, integrate, demonstrate, and transition software tools and advanced architectures to drive model-based systems engineering, automate agile business processes, and institutionalize open standards.



- WeaponOne delivers integrated digital architectures and toolsets
- RogueOne delivers a digital ecosystem with ready-to-use software tools → migrating to AFRL Digital Engineering Environment (DLE)
- Weapon Open System Architecture (WOSA) delivers an industry-adopted open standard
- Model-Based Systems Engineering delivers automated agile business processes and enables data-driven decisions

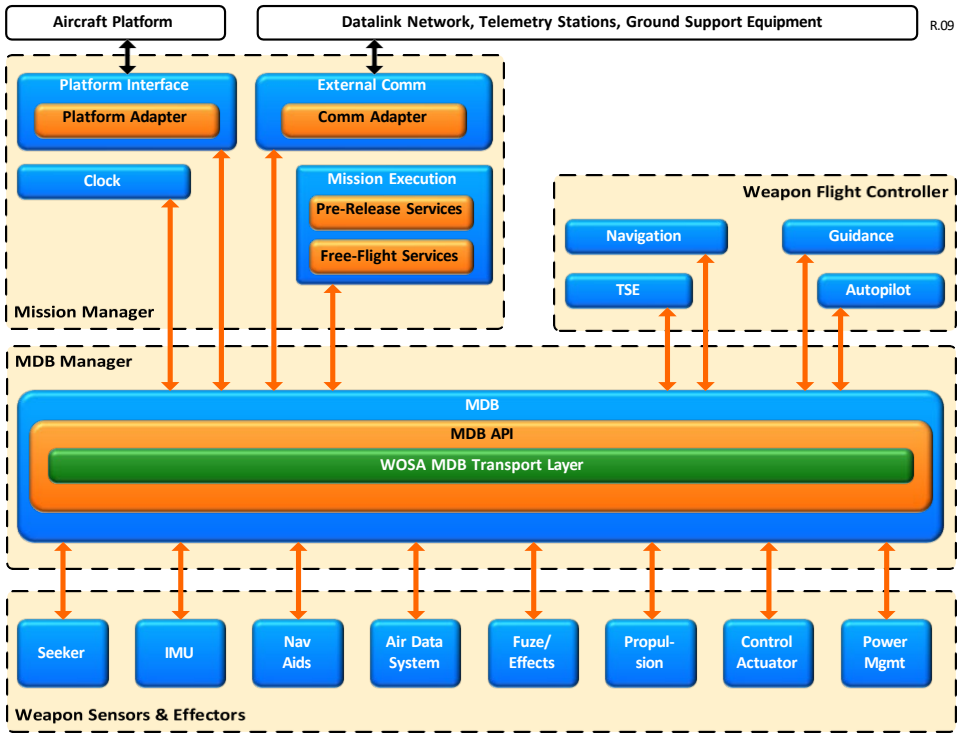


RW's Digital Ecosystem



Weapon Open System Architecture (WOSA)

Propulsion - GNC - Data Link - Ordnance - Seeker
WOSA Specification Version 3.3a Released Jan 2023



What

- Government-owned, internal hardware/software interface standards developed in coordination with industry
- Compliance Verification via Munitions Open Architecture Test and Evaluation Laboratory (MOATEL)

How

- Government/Industry collaboration on standards
- Government decisions based on analysis and data
- Weapon system interface documentation complete and correct thorough acquisition lifecycle

Who

- Mr. Jonathan Shaver (Jonathan.Shaver.1@us.af.mil)
- Mr. Chris Neal (Christopher.Neal.8@us.af.mil)

Why

- Sustainment/competition/affordability
- Best-of-breed subsystems
- Rapid upgrades to counter evolving threats

AFRL/RW requiring WOSA compliance on all contracts

Broad Agency Announcement (BAA) General Information

Two BAA types

- Open BAA: White papers may be submitted at any time during the open period
- Call BAA: White paper/proposal Call announcements may be issued by the Government in sam.gov and grants.gov under FA8651-22-S-0001 or FA8651-20-S-0008

Basic process

1. White paper; 5 pages or less including ROM cost → RW technical evaluation
2. Contracting division issues Request for Proposal (RFP)
3. Technical and cost proposal → RW technical evaluation
4. Contract may be awarded, subject to availability of funds

Key Points of Contact

- Program Manager: Mr. Didier Montaigne, AFRL/RW, didier.montaigne@us.af.mil
- Chief of Contracts: Melissa St. Vincent, AFRL/RWK or AFRL.RWK.AST_BAAWorkflow@us.af.mil

Specific Broad Agency Announcement (BAA) Overview

Title: Air Delivered Effects
BAA Number: FA8651-22-S-0001
Link: https://sam.gov/opp/7630cdd2c2b34b63aa8d9980f5b4a333/view
Open period: Through 21 March 2027
Ceiling: $750M

Title: Air Superiority Technologies
BAA Number: FA8651-20-S-0008
Link: https://sam.gov/opp/ee42da041ee949c2b5874cba00c1c63c/view
Open period: Through 31 October 2024
Ceiling: $750M

Purpose: To fulfill Basic Research (6.1), Applied Research (6.2), and Advanced Technology Development (6.3) for Munitions Directorate S&T development requirements by providing competitive selection of research proposals

Air Delivered Effects BAA Research Areas

RA	Title
1	WEAPON AIRFRAME SYSTEMS TECHNOLOGY RESEARCH (RWWN)
2	BIOPRINCIPIC SENSORS, INFORMATION PROCESSING, AND CONTROL (RWWI)
3	AUTONOMOUS TARGET RECOGNITION (RWWI)
4	HARDWARE-IN-THE-LOOP SIMULATION TECHNOLOGIES (RWWG)
5	ADVANCED SCENE GENERATION (RWWG)
6	EO/IR/LADAR COMPONENT RESEARCH (RWWI)
7	NAVIGATION AND ESTIMATION TECHNOLOGY (RWWN)
8	MODELING, SIMULATION, & ANALYSIS (MS&A) OF ADVANCED WEAPON CONCEPTS (RWWG)
9	LETHALITY, VULNERABILITY, AND SURVIVABILITY (RWMA)
10	WARHEAD RESEARCH (RWMRW)
11	FUZE RESEARCH (RWMRF)
12	MUNITIONS ENERGETIC MATERIALS (RWME)
13	FACILITIES AND EQUIPMENT ENABLING ORDNANCE TECHNOLOGIES AND ADVANCED ENERGETICS (RWM)
14	MULTI-FUNCTION, MULTI-MODE RADAR RESEARCH (RWWI)
15	MODULAR OPEN SYSTEMS RESEARCH (RWWG)
16	SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM) EDUCATION OUTREACH (RW)
17	WEAPONS AUTONOMY TECHNOLOGY RESEARCH (RWWN)
18	TECHNOLOGY TRANSFER INNOVATIVE COLLABORATION (RWPB)
19	CYBER RESILIENCY SECURITY RESEARCH FOR PRECISION GUIDED MUNITIONS (RWWI)
20	STRATEGIC PLANNING, PROTOTYPING AND EXPERIMENTATION (RWP)

Air Superiority Technologies BAA Research Areas

RA	Title
1	MODELING, SIMULATION, & ANALYSIS (MS&A)
2	INNOVATIVE AIRCRAFT INTEGRATION TECHNOLOGIES
3	FIND-FIX-TARGET-TRACK (F2T2) & DATALINK TECHNOLOGIES
4	ENGAGEMENT MANAGEMENT SYSTEM TECHNOLOGIES
5	HIGH VELOCITY FUZING
6	MISSILE ELECTRONICS
7	MISSILE GUIDANCE AND CONTROL TECHNOLOGIES
8	ADVANCED WARHEAD TECHNOLOGIES
9	ADVANCED MISSILE PROPULSION TECHNOLOGIES
10	CONTROL ACTUATION SYSTEMS
11	MISSILE CARRIAGE AND RELEASE TECHNOLOGIES
12	MISSILE TEST AND EVALUATION TECHNOLOGIES

QUESTIONS?

U.S. AIR FORCE

USSF

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AIR FORCE RESEARCH LABORATORY TECHNOLOGY TRANSFER

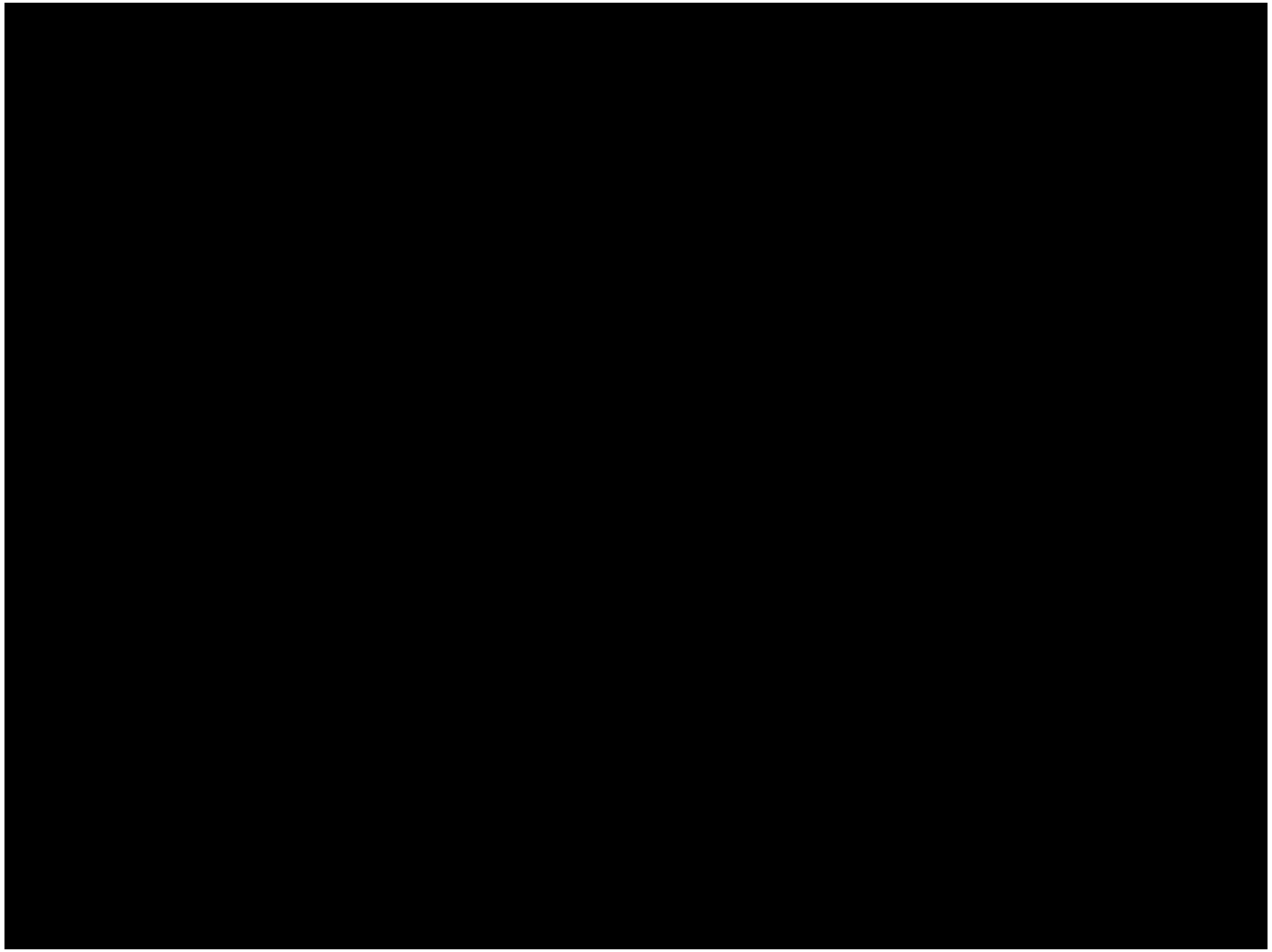
OFFICE OF RESEARCH & TECHNOLOGY APPLICATIONS (ORTA)

Bill Loux – william.loux.2@us.af.mil

Laura Rakas– laura.rakas.ctr@us.af.mil

MUNITIONS DIRECTORATE | JULY 2023

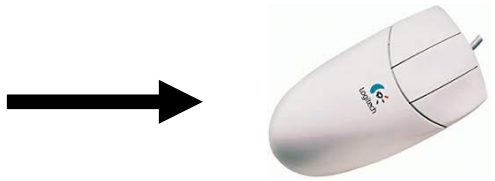
Air Force Technology Transfer



What is Technology Transfer?

- “Technology Transfer is the process by which existing knowledge, facilities, or capabilities developed under federal research and development (R&D) funding are utilized to fulfill public and private needs.”
- Prior to instituting Technology Transfer laws, much of the innovation and technology developed by federal government organizations sat idle on the shelf, unprotected, underutilized and in many cases unknown
- Congress enacted a series of laws to help facilitate and encourage the transfer of federally funded technologies into the private sector and to incentivize companies to turn these innovations into new commercial products that improve the world, increase economic development & jobs, and ensure the continued economic & technological superiority of the US by maximizing the value of government funded research & development
- The tools put in place allow the DoD to effectively share & transfer existing knowledge, know-how, personnel & capabilities with leading edge companies to ensure the technological dominance of our fighting forces.
- **EXAMPLES:**

The first computer mouse was developed by DARPA and later was licensed to Logitech for commercial production



GPS technology originally developed by the US military has been transferred into cars, phones & many other products

Why Technology Transfer is important

- Protect important Air Force intellectual property by putting in place the proper patent protection of technologies critical to future weapons programs
  - Prevents private defense contractors from claiming inventions developed by Air Force funding/personnel and then charging the Air Force to develop the technology for future weapons systems
  - Prevents vital Air Force technology from being patented by private industry, positioning them for sole-source production, reducing competition, and driving up acquisition costs
- Technology Transfer speeds up the development of Air Force technologies & facilitates a faster transition of these technologies into actual weapons systems to more rapidly benefit the warfighter
- The licensing of Air Force technologies into commercial partners increases the return on federal research and development funding
  - Larger commercial production of products increases the speed of technological development and reduces the cost to the Air Force for future production of weapons and equipment
  - Transfer of federally funded technology increases the economic development of the country & improves our technological and scientific workforce

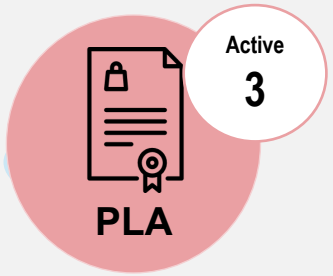
Between 2000-2017, DoD IP license agreements has resulted in over $58 billion of economic impact and created over 214,000 new jobs.

- **Leading to over $4.5 billion in sales of new products to the U.S. military, speeding impact to the warfighter**

How we accomplish Technology Transfer

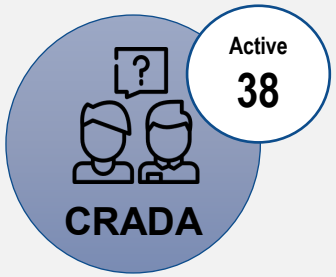
AFRL

Patent License Agreement



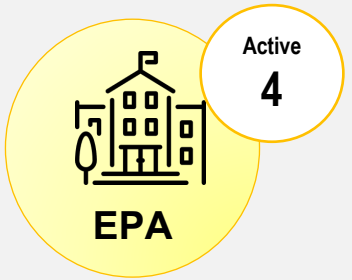
- Agreement to license RW patents into commercial companies
- Royalty bearing agreements generate revenue for lab and inventors
- Exclusive
  - Commercial value
  - New product development
  - Royalties $$
- Non-Exclusive
  - Multiple companies
- Fields of use can be limited by products, markets, geographic location, etc.
- Ability to also complete software license agreements

Cooperative Research & Development Agreement



- Agreement to facilitate joint R&D efforts and to share intellectual property
- Lab can accept, retain, & use funds, personnel, services & property from partner company or university
- Lab can provide personnel, services, & use of property & testing
- CRADA may not involve payment of funds out to partner
- Lab can loan GFE
- FAR and DFARS do not apply.
- Low cost - CRADAs allow shared resources between Government and private industry
- Ability to hand pick your partner
- NDA, MTA

Educational Partnership Agreement



- Agreement to partner with educational institutes for furthering STEM mission
- Provides lab personnel to teach or assist in developing courses
- Involve students and faculty in lab research
- Enables loaning equipment
- Donate surplus equipment

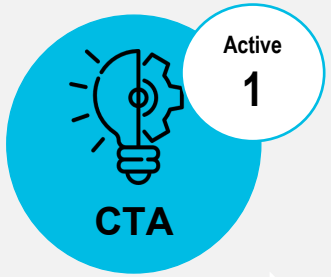
University EPAs

- Educational research
- Loan/donation
- Academic credit

K-12 EPAs

- STEM Outreach

Commercial Test Agreement



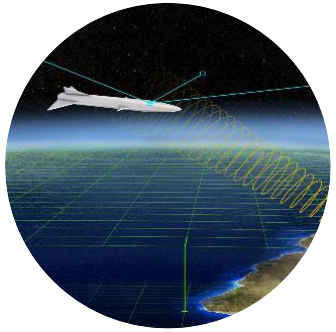
- Agreement to allow munitions directorate to perform testing for external parties
- May make available to any person or entity, at an appropriate fee, the services of any government lab, center, range, or other testing facility
- Perform tests that are confidential and may not be disclosed outside the Federal Government without the consent of the persons for whom the tests were performed

The ORTA Office can help you put place a wide range of useful technology transfer agreements

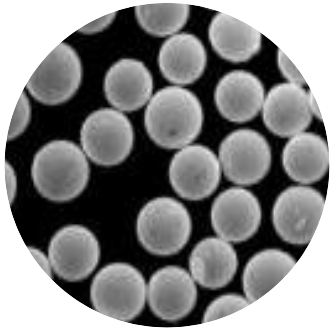
Munitions Directorate Patent Portfolio – Research Areas

- Optics/Photonics & LIDAR
- Navigation & Autonomy
- Advanced Energetics
- Mechanical
- Electronics/Sensors & Software
- Materials & Manufacturing

Optics/Photonics & LIDAR (27 Patents)



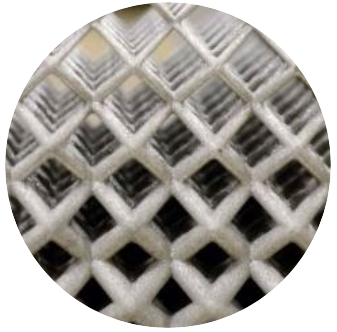
Navigation & Autonomy (10 Patents)



Advanced Energetics (11 Patents)

Advanced Mechanical (13 Patents)

Electronics/Sensors & Software (9 Patents)



Materials & Manufacturing (6 Patents)

USAF-9628 STEEL

Lowering Cost/Improving Performance

- Low Alloy High Performance Steel
- Invented by Dr. Rachel Abrahams (AFRL/RW) (Patented 2019)
- Originally designed for bunker-buster bombs
- 50% cost reduction; parts additively manufactured with the steel are about 20% stronger than conventional AM alloys

AFRL/RW Technology Transfer (T2) Partnerships

- 39 PARTNERS
- 38 CRADAs
- 4 EPAs
- 9 MOAs/MOUs/LOAs/IAAs
- 1 CTA
- 3 IP AGREEMENTS

CRADA = Cooperative R&D Agreement
EPA = Educational Partnership Agreement
MOA = Memorandum of Agreement
MOU = Memorandum of Understanding
LOA = Letter of Agreement
IAA = Inter-Agency Agreement
CTA = Commercial Test Agreement
JOAEL = Joint Ownership Agreement Exclusive License
IP ASSIGNMENT = Patent Rights Assignment
IP COMMERCIALIZATION = Patent Commercialization Agreement

DRAPER
Honeywell Aerospace
KAMAN Fuzing & Precision Products
Raytheon
SANDERS MANUFACTURING COMPANY
L3HARRIS™
SANKHYA SUTRA LABS
BAE SYSTEMS
GENERAL ATOMICS
U.S. Department of Defense

htmicro
DYTRAN INSTRUMENTS, INC.
AEROJET ROCKETDYNE
NORTHROP GRUMMAN
LOCKHEED MARTIN
PERSISTENT SYSTEMS

Australian National University
BYU BRIGHAM YOUNG UNIVERSITY
UNITED STATES AIR FORCE ACADEMY
UF UNIVERSITY of FLORIDA
APL JOHNS HOPKINS APPLIED PHYSICS LABORATORY
EMERALD COAST SCIENCE CENTER
HSU EDUCATIONAL FOUNDATION

MISSION TECHNOLOGIES
MOBILE TRACK SOLUTIONS TRACK FORWARD
ARMAMENT DIRECTORATE
DARPA

AMERICA'S NAVY
AFRL THE AIR FORCE RESEARCH LABORATORY
U.S. ARMY
DTRA DEFENSE THREAT REDUCTION AGENCY

QUESTIONS?

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Laura Rakas, Technology Transfer Specialist
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SBIR/STTR Overview

Supporting 23.3/C Solicitation

Shirley Schmieder
AFRL/RW SBIR-STTR Program Manager

SMALL BUSINESS INNOVATION RESEARCH (SBIR)

The SBIR program, established by Congress in 1982 as a three-phased process, solicits proposals and awards funding to small businesses for federal research and development, production, services, or any combination of these, to meet agency needs and missions.

The Four Goals of the SBIR Program:

- Stimulate technological innovation
- Use small business to meet Federal Research / Research & Development (R/R&D) needs
- Foster and encourage participation by the socially and economically disadvantaged small businesses and those that are 51 percent owned and controlled by women in technological innovation
- Increase 'private sector' commercialization of innovations derived from Federal R/R&D, thereby increasing competition, productivity, and economic growth

SMALL BUSINESS TECHNOLOGY TRANSFER (STTR)

The STTR program was established in 1992 with a similar statutory purpose SBIR.

The STTR program requires a research partner consisting of one of the following:

- Non-profit college or university
- Federally funded R&D center (FFRDC)
- Qualified non-profit research institution

The following five agencies utilize the STTR program:

- Department of Defense
- Department of Energy
- NASA
- National Institute of Health
- National Science Foundation

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SBIR vs. STTR

STTR is similar to SBIR:

- Three phase commercialization program codified in statute:
  Discover (Phase I) – Prototype (Phase II) – Transition (Phase III)
- Results in sole-source justification for use by *all US Federal Agencies*

BUT

STTR has unique qualities based on its research focus:

- Requires **one** qualifying research partner to perform **30% - 60%** of work (e.g. university, non-profit, or FFRDC)
- Principal Investigator may be primarily employed by research entity (e.g. professor) OR the small business
- Leverages close ties with both federal R&D AND operational communities

SMALL BUSINESS ELIGIBILITY

The non-negotiables – a company must:

- Have 500 or fewer employees
- Be for-profit. 501(c)(3) designation is not eligible, but may be considered subcontractor or consultant to applicant
- Primarily U.S. owned, at least 51% ownership by U.S. citizens and/or permanent resident aliens
- Additional considerations for venture-backed companies
- Principal Investigator (PI) must be “primarily employed” by the applicant small business during SBIR award period

BE SURE TO READ THE FULL ELIGIBILITY REQUIREMENTS ON SBA.GOV.

DOD PARTICIPATING ORGANIZATIONS

- Department of the Air Force
- Department of the Army
- Department of the Navy
- Joint Program Executive Office
- DARPA
- Defense Health Agency
- Defense Logistics Agency
- Defense Microelectronic Activity
- Defense Threat Reduction Agency
- Missile Defense Agency
- National Geospatial-Intelligence Agency
- United States Special Operations Command
- Chemical & Biological Defense (CBD)

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PARTICIPATING AGENCIES

- National Science Foundation (NSF)
- NASA
- Environmental Protection Agency (EPA)
- Department of Transportation
- Department of Homeland Security
- Department of Health and Human Services
- Department of Energy
- Department of Education
- Department of Defense
- Department of Commerce
- USDA
- Small Business Administration

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STRATEGY: CAPITAL AS A CAPABILITY

Restructure nested Open Topic, Specific Topic, and the STRATFI/TACFI programs all under the management of AFVentures. The three programs are:

OPEN TOPIC

- Technology-agnostic solicitation
- Encourages commercial industry to submit dual-use technology solutions without having a known end user
- Used to capture the best capabilities and emerging technologies that can impact our Airmen and Guardians

SPECIFIC TOPIC

- Seeks innovative solutions for a particular problem set defined by a DAF end user or customer
- Often not a dual-use capability and are specific to the DoD
- These topics have clearly-defined requirements and a known DAF customer built into the topic solicitation

STRATFI/TACFI

- STRATFI (Strategic Funding Increase) Program
- TACFI Program (Tactical Funding Increase)
- Awards help scale Phase II efforts to the level needed to achieve better technology transitions
- De-risks development through syndication with multiple transition-focused partners and leveraging outside investment

HOW THE PROGRAM WORKS

1 PHASE I

Feasibility Study

Open & Specific Topics

OPEN TOPIC
- Up to $75K per award
- 3 month period of performance
- ~700 awards per year
- "Open door for innovation"

SPECIFIC TOPIC
- Up to $150K per award
- 9 month period of performance
- ~300 awards per year
- Built in Air Force Customer
- Includes Pitch Day opportunities

2 PHASE II

Prototype

Open, Specific & Direct to Phase II (D2P2) Topics

OPEN TOPIC
- Up to $1.25M per initial award
- Up to 21 month period of performance
- ~300 awards per year
- Customer Memorandum required
- Matched funding encouraged
- D2P2 opportunity if customer is already known and Customer Memorandum is signed

SPECIFIC TOPIC
- Up to $1.25M per initial award ($1.7M for STTR)
- Up to 27 month period of performance
- ~200 awards per year
- Built in Air Force Customer
- Includes Pitch Day opportunities
- D2P2 opportunities

*Cost base max and period of performance are determined at the topic level and can be found within solicitation instructions.

3 STRATFI/TACFI

Strategic Funding Increase (STRATFI) and Tactical Funding Increase (TACFI) Program

- Notice of Opportunity
- TACFI - $375K - 1.8M SBIR/STTR funds
- STRATFI - $3M - $15M SBIR/STTR funds
- ~100 TACFI and ~15 STRATFI awards per year
- Defense only or dual use matching options
- Private Investor Opportunities

4 PHASE III

Transition

- Continuation, derivation, or extension of SBIR/STTR Phase I, II or STRATFI/TACFI work
- Contract with partnering US Government customer
- Utilizes non-SBIR funds

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Specific Topic

Defense-focused problem solving

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WHAT IS A SPECIFIC TOPIC?

- **Clearly defined need** & technology areas
- Only proposals solving a problem statement are awarded
- Specific Topics are solicited through **Broad Agency Announcement (BAA)** OSD criteria
- **Awarded by Managing Organizations**

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DOD BAA SOLICITATION SCHEDULE (SPECIFIC TOPIC)

- The Specific Topic Branch submits DAF topics into DoD's BAA
- DoD releases 3 recurring Joint DoD BAAs each year for both SBIR & STTR
- Both Air Force & Space Force organizations may submit Specific Topics into solicitations

Specific Topic Solicitations typically follow this DoD Schedule Standard cadence:

BAA Solicitation Number	Pre-Release	Open	Close
FY.1/A	December	January	February
FY.2/B	April	May	June
FY.3/C	August	September	October

DAF SBIR/STTR FUTURE SOLICITATIONS OVERVIEW

	Pre-Release	Open	Close	Selections Due	*Award Date
23.3/C	23 Aug 23	20 Sept 23	18 Oct 23	NLT 16 Jan 24	Jan – Apr 24
24.1/A	29 Nov 23	3 Jan 24	7 Feb 24	NLT 7 May 24	May – Aug 24
24.2/B	17 Apr 24	15 May 24	12 Jun 24	NLT 9 Sept 24	Sept – Dec 24
24.3/C	21 Aug 24	18 Sept 24	16 Sept 24	NLT 14 Jan 25	Jan – Apr 25

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*Topics subject to cancellation/funding decommitment if not awarded within this timeline

SBIR/STTR PHASE I SPECIFIC TOPIC INTENT

Objective: Conduct feasibility-related experimental or theoretical research/R&D related to agency's requirements to determine the scientific and technical merit and feasibility of the proposed effort and the quality of performance of the offeror. The Specific Topic seeks innovative solutions for a very particular problem set that is defined by an Air Force end user or customer.

The contracting details are **typically:**

- Period of Performance: **9 months**
- Cost Base Max: **$150,000**
- On contract to conduct: **Technical Feasibility**
- 2 deliverables: **Preliminary & Final Reports**
- Prepare for Phase II application
- **Conduct technical feasibility study but not required to find a new Customer & End User, baked in with requirements definition**
- Contracts & project management comes from the Managing Organization

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*Contracting details may vary per topic and solicitation. Please see the solicitation instructions for more information.

SBIR/STTR PHASE II OR D2P2 SPECIFIC TOPIC INTENT

Objective: Continue the research/R&D effort from the completed Phase I (PI) OR initiate a Direct-to-Phase II award where the proposal has sufficient scientific and technical feasibility and merit despite the lack of a Phase I award. Specific Topic Phase II awards frequently result in development of a prototype.

Typical

- Period of Performance: Up to **24-months**
- Cost Base Max **$1.25 Million for SBIR and $1.7M for STTR**
- Milestone Deliverables IAW Proposal Milestone Schedule
- Contracts & project management comes from the Managing Organization

Direct-to-Phase II (D2P2 Only SBIR)

- Period of Performance: Up to **24-months**
- Cost Base Max **$1.25 Million**
- Milestone Deliverables IAW Proposal Milestone Schedule
- Contracts & project management comes from the Managing Organization
- **Must demonstrate that the Small Business Concern (SBC) has met the feasibility requirements of a Phase 1**

Participating in a Specific Topic Solicitation

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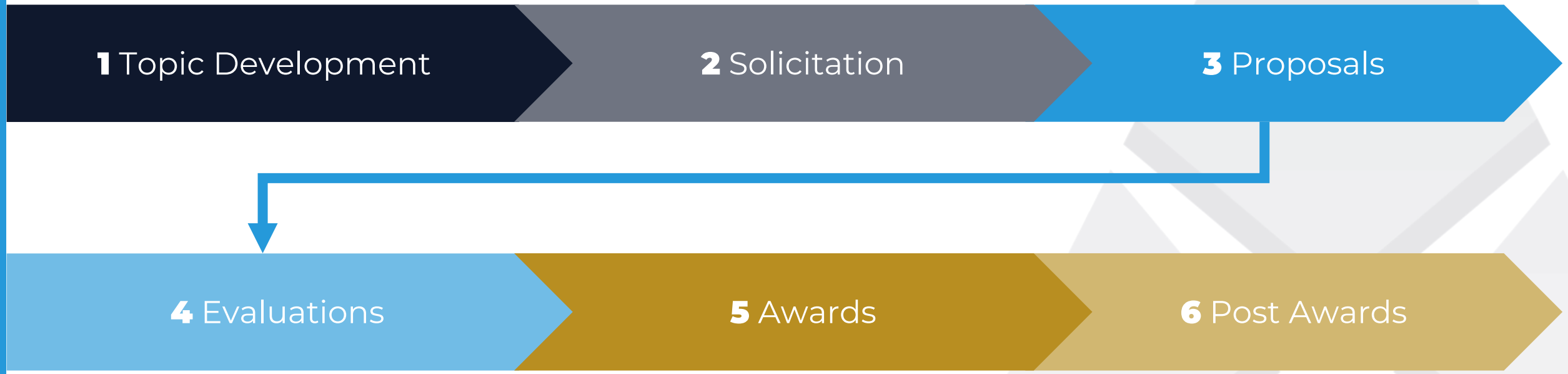
SPECIFIC TOPIC LIFECYCLE GATE OVERVIEW



RESOURCES

SBIR.gov Tutorials
https://www.sbir.gov/tutorials/

Defense SBIR/STTR Innovation Portal (DSIP) Tutorials
https://www.dodsbirsttr.mil/submissions/learning-support/training-materials

AFWERX Weekly Webinar Series and FAQs:
https://afwerx.com/afventures-weekly-webinar-series/

AFVentures Monthly Ecosystem Registration:
https://www.zoomgov.com/meeting/register/vJIsdeCgrTMpEqD1GcOzJJUyltD5jcmBxZY

AFWERX.com:
https://afwerx.com/

Munitions topics POCs:

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Shirley.schmieder@us.af.mil
Or
Lisa Little
Lisa.little.1.ctr@us.af.mil

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Questions?

af.sbir.sttr.workflow@us.af.mil

Lunch

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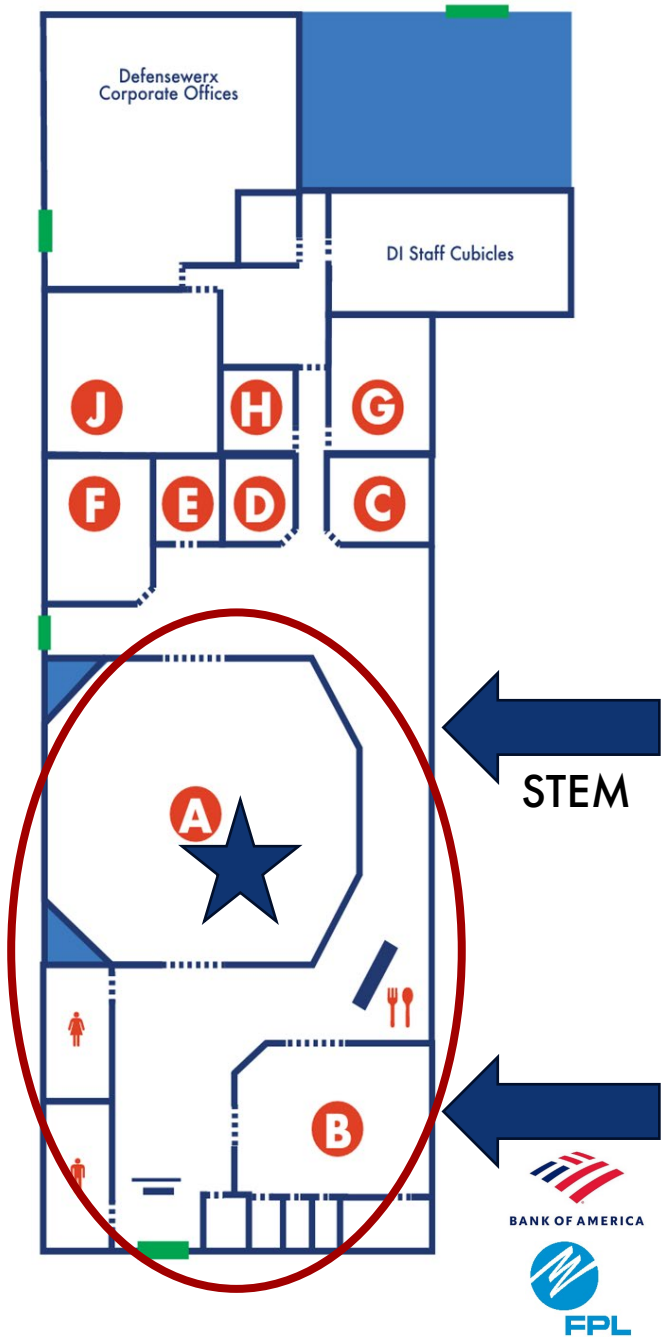


IRAD Process

John Campbell,
AFRL/RW Industry Research & Development
Program Manager

DEFENSE INNOVATION MARKETPLACE

https://defenseinnovationmarketplace.dtic.mil/

Government IR&D Searchers

Learn about and leverage industry's innovative technology projects.

Small Business Resources

- Small Business Innovation Research (SBIR) program
- Rapid Innovation Fund

Innovation Pathways Website

The Innovation Pathways website serves as a gateway for industry, small businesses, students, universities, and other organizations within the Department itself to discover opportunities with DoD organizations.

Industry IR&D Providers

The Defense Innovation Marketplace provides a centralized resource for the Department's Acquisition and Science and Technology professionals on information about industry's Independent research and development

New Business Opportunities

Have a solution to a DoD Technology need? Find links to:

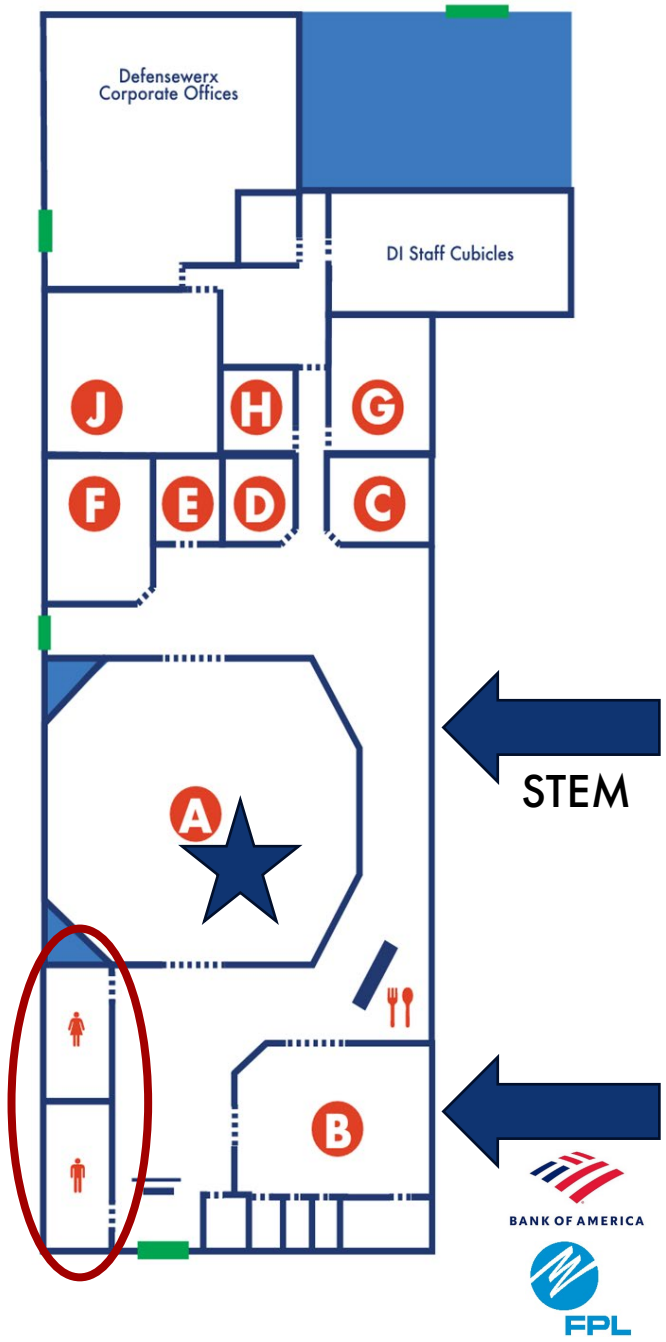
- Warfighting Lab Incentive Fund (WLIF)

Technology Interchange Meetings

Technology Interchange Meetings (TIMs) allow DoD and industry/academia to cooperate on Research and Engineering technology challenges.

Break

15-Minutes



DOOLITTLEINSTITUTE
speed·innovation·solutions

U.S. AIR FORCE

USSF

AFRL

AIR FORCE RESEARCH LABORATORY MUNITIONS DIRECTORATE (AFRL/RW)

2023 Innovate with AFRL

MISTI DESHIELDS, AFRL/RWK Branch Chief

25 July 2023

STRATEGIC GUIDANCE

Operational Imperatives (OIs)

1

Resilient and Effective Space Order of Battle and Architectures

2

Operationally Optimized ABMS + JADC2

3

Next Generation Air Dominance (NGAD) System-of-Systems

4

Moving Target Engagement at Scale in a Challenging Operational Environment

5

Optimized Resilient Basing, Sustainment, & Comms in a Contested Environment

6

B-21 Long Range Strike Family-of-Systems

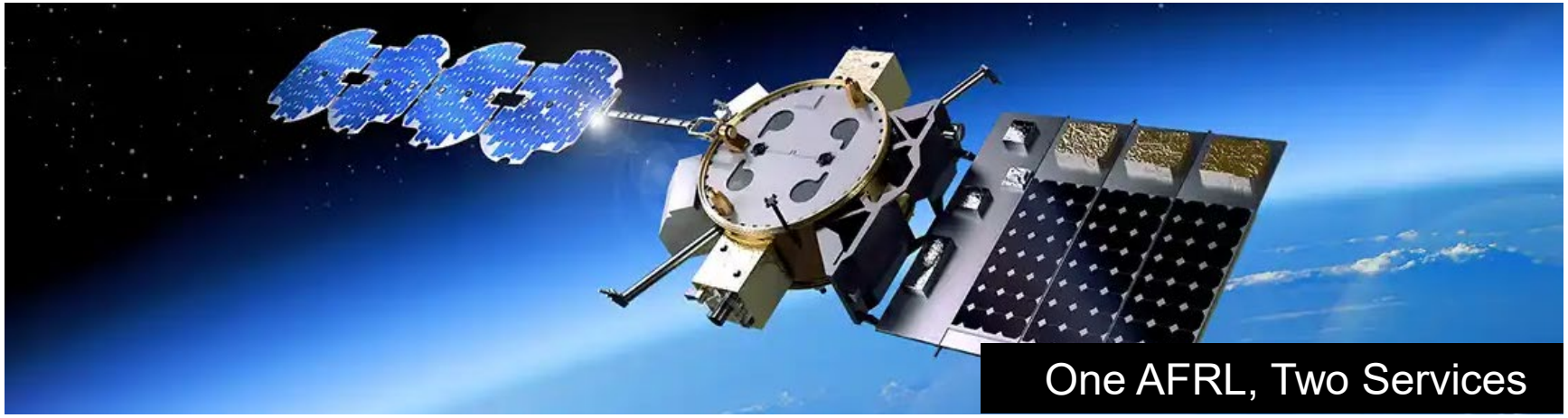
7

Readiness to Deploy and Fight

LEAD.
DISCOVER.
DEVELOP.
DELIVER.

AFRL

Accelerate S&T



One AFRL, Two Services

The Best Team

What do we need weapons to do?

- **Present credible options to national decision makers**
- **Six fights**
  1. Fight to compete and deter
  2. Fight to get into theater
  3. Fight to get into the air
  4. Fight to stay in the air
  5. Fight to deny adversary's objectives
  6. Fight to sustain the fight
- **Air Force Weapons**
  - Air Battle Management
  - Air Superiority
  - Counter-maritime
  - Counter-surface
  - Digital Transformation

As we work together to accelerate change, we want to tap into the intellectual capital and creativity industry brings to the table, and this **includes** our international partners.
SecAF, July 2022

To maintain that leading edge, we need to take an integrated approach in how we manage our people, policies and processes.
CSAF, July 2022

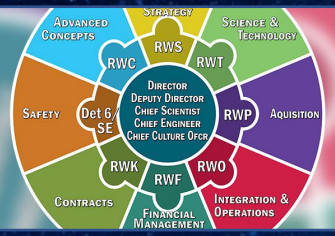
We recognize the character of war has changed, with growing kinetic and non-kinetic threats across multiple domains.
CSO, July 2022

Farther, cheaper, smaller, lighter, faster

MUNITIONS DIRECTORATE (RW)
2023 PRIORITIES

2023 Priority Areas for Munitions Directorate (RW)

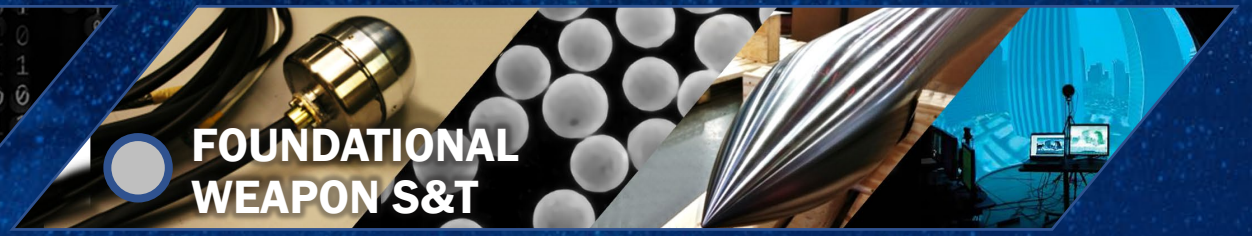
RW 2.0 IMPLEMENTATION



COUNTERAIR

DIGITAL MATERIEL MANAGEMENT

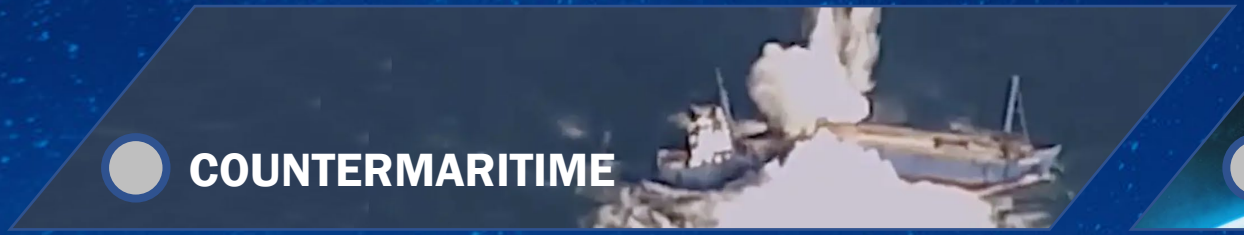
FOUNDATIONAL WEAPON S&T



NETWORKED, COLLABORATIVE, AUTONOMOUS (NCA) WEAPONS

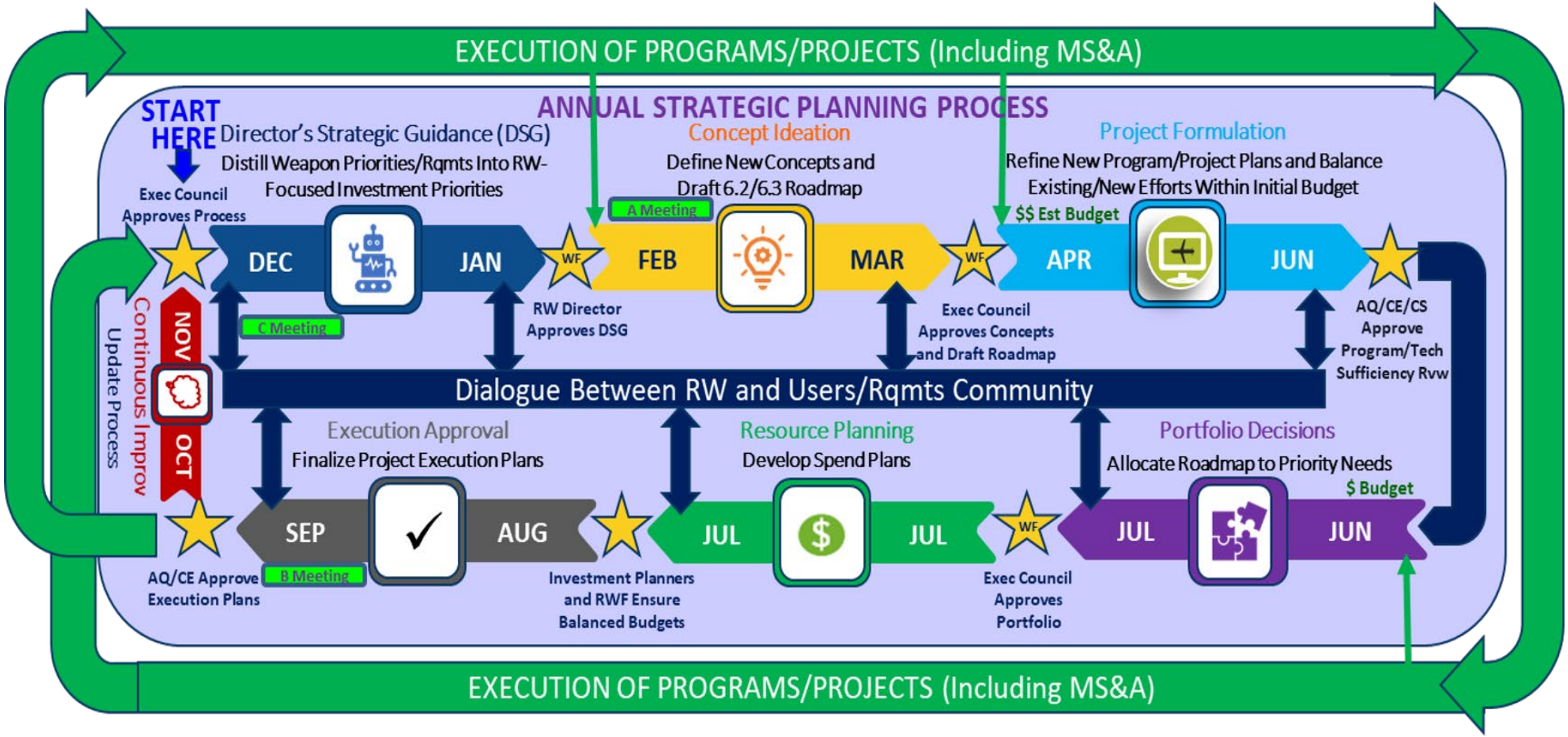
AIRBASE DEFENSE

COUNTERMARITIME



S&T ENABLERS FOR NDO, SOF, AND SPACE

Munitions Directorate (RW) Strategic Planning Process



MUNITIONS DIRECTORATE (RW) INDUSTRY OPPORTUNITIES

Broad Agency Announcement (BAA) Information

Two BAA types

- Open BAA: White papers may be submitted at any time during the open period.
- Call BAA: White paper/proposal Call announcements may be issued by the Government in sam.gov and grants.gov under FA8651-22-S-0001 or FA8651-20-S-0008.

Basic process

1. White paper; 5 pages or less for FA8651-22-S-0001 and 10 pages or less for FA8651-20-S-0008 including ROM cost >> RW technical review
2. Contracting division issues request for proposal (RFP) if white paper deemed selectable
3. Technical and cost proposal >> RW technical review
4. Contract awarded if proposal is recommended for awarded and sufficient funds are available

Key Points of Contact

- Chief of Contracts: Melissa A. St. Vincent, AFRL/RWK or AFRL.RWK.AST_BAAWorkflow@us.af.mil

Specific Broad Agency Announcement (BAA) Overview

Title: Air Delivered Effects (formerly “Armament Technologies”)

BAA Number: FA8651-22-S-0001 – sam.gov – grants.gov

Open period: Through 21 Mar 2027

Purpose: To fulfill basic research (6.1), applied research (6.2), and advanced technology development (6.3) for RW R&D requirements in *20 munitions-related research areas* of interest by providing competitive selection of research proposals within these areas

Program Manager: Dr. Philip Flater, AFRL/RW

Title: Air Superiority Technologies

BAA Number: FA8651-20-S-0008 – sam.gov – grants.gov

Open period: Through 31 Oct 2024

Program Manager: David Hartline, AFRL/RWPI

Purpose: To fulfill applied research (6.2), advanced technology development (6.3) and Advanced Component Development & Prototypes (6.4) for RW R&D requirements in 12 *munitions-related research areas* of interest by providing competitive selection of research proposals within these areas

Research Areas (RA) - Air Delivered Effects BAA

RA#	Title
1	Weapon Airframe Systems Technology Research (RWWN) [Daniel Reasor]
2	Bioprincipic Sensors, Information Processing, And Control (RWWI) [Nicholas Rummelt]
3	Autonomous Target Recognition (RWWI) [David Gray]
4	Hardware-in-the-loop Simulation Technologies (RWWG) [Rhoe (Tony) Thompson]
5	Advanced Scene Generation (RWWG) [Darryl Huddleston]
6	EO/IR/LADAR Component Research (RWWI) [James Savage]
7	Navigation And Estimation Technology (RWWN) [Kevin Brink]
8	Modeling, Simulation, & Analysis (MS&A) Of Advanced Weapon Concepts (RWWG) [Christopher Jarvis, Rusty Coleman]
9	Lethality, Vulnerability, And Survivability (RWMA) [Kirk Vanden]
10	Warhead Research (RWMRW) [Nydeia Bolden-Frazier]
11	Fuze Research (RWMRF) [George Jolly]
12	Munitions Energetic Materials (RWME) [Mike Lindsay]
13	Facilities And Equipment Enabling Ordnance Technologies And Advanced Energetics (RWM) [Tim Tobik]
14	Multi-function, Multi-mode RADAR Research (RWWI) [Tom Lewis]
15	Modular Open Systems Research (RWWG) [Jonathan Shaver, Christopher Neal]
16	Science, Technology, Engineering And Mathematics (STEM) Education Outreach (RW) [Brian Mitchell]
17	Weapons Autonomy Technology Research (RWWN) [Emily Doucette]
18	Technology Transfer Innovative Collaboration (RWPB) [Bill Loux]
19	Cyber Resiliency Security Research For Precision Guided Munitions (RWWI) [Calvin Roman, Juanita Riley]
20	Strategic Planning, Prototyping And Experimentation (RWP) [Avi Nusimow]

Research Areas (RA) - Air Superiority BAA

RA#	Title
1	Modeling, Simulation and Analysis (RWPI) [David Hartline]
2	Innovative Aircraft Integration Technologies (RWPI) [David Hartline]
3	Find-Fix-Target-Track (F2T2) & Datalink Technologies (RWPI) [David Hartline]
4	Engagement Management System Technologies (RWPI) [David Hartline]
5	High Velocity Fuzing (RWPI) [David Hartline]
6	Missile Electronics (RWPI) [David Hartline]
7	Missile Guidance and Control Technologies (RWPI) [David Hartline]
8	Advanced Warhead Technologies (RWPI) [David Hartline]
9	Advanced Missile Propulsion Technologies (RWPI) [David Hartline]
10	Control Actuation Systems (RWPI) [David Hartline]
11	Missile Carriage and Release Technologies (RWPI) [David Hartline]
12	Missile Test and Evaluation Technologies (RWPI) [David Hartline]

Cooperative Research and Development Agreement (CRADA) Opportunities

- Hypersonic Airframe Models of Fluid-Thermal-Structural Interaction
- GPS-Alternative Navigation
- Networked Collaborative Autonomy and Swarm vs. Swarm Algorithms
- Decentralized, Robust Battlespace Perception and Estimation
- Aerothermal and Aero-optical analysis
- Robust Autonomous Target Acquisitions/Tracking/Recognition
- Multi-function RF Seekers
- Low trust / No trust designs (Weapons Open System Architecture-compliant)
- Quantum Sensing
- Data management/Big Data (autonomy/autonomous behavior)
- Advanced MBSE-to-MS&A (AFSIM) integration (modeling, simulation, & analysis)

No funding -- payoff benefits both Gov't and Collaborator

Doolittle Institute

- Doolittle Institute supports AFRL's Munitions Directorate by working to:
  - License and commercialize AFRL/RW technologies in the private sector.
  - Enable rapid technology delivery to the warfighter.
  - Identify and foster new R&D partnerships.
- As a neutral, non-profit partnership intermediary, DI fosters **Technology Transfer** to and from the AFRL Munitions Directorate and facilitates the connection of DoD scientists and engineers, and industry subject matter experts with industry and academia.
- Doolittle Institute is currently interested in connecting with industry and small businesses about capabilities related to the following Air Delivered Effects Broad Agency Announcement topics:

Artificial Intelligence/Machine Learning	Energetics	Multi-Doman Sensing/Autonomy
Additive Manufacturing	Hypersonics	Navigation Systems
Advanced Materials	Integrated Sensing	Nuclear Modernization
Biological Systems	Microelectronics	Quantum Sciences
Cybersecurity/Advanced Computing	MS&A/MBSE/Digital Engineering	Space

- Join the Doolittle Institute Ecosystem by visiting our website at: https://doolittleinstitute.org/

QUESTIONS?

Mission-Focused Business Leaders driving modernization, readiness, lethality

Introduction to Eglin Small Business Office

Anita Jackson
AFLCMC/SB OL Eglin
25 July 2023

Small Business Policy

Mission-Focused Business Leaders driving modernization, readiness, lethality

Primes Subs

- It is the policy of the Government to provide maximum practicable opportunities in its acquisitions to small business, veteran-owned small business, service-disabled veteran-owned small business, HUBZone small business, small disadvantaged business, and women-owned small business concerns.

- Such concerns must also have the maximum practicable opportunity to participate as subcontractors in the contracts awarded by any executive agency, consistent with efficient contract performance.

FAR 19.201(a); DoD Instruction 4205.1(3)

What We Do For Acquisition

Mission-Focused Business Leaders driving modernization, readiness, lethality

- Support Air Force Research Laboratory (AFRL/RWK), Armament Directorate (AFLCMC), Base Operations (AFTC), Special Services (AFTC) and the Nuclear Weapons Center (NWC) in the following ways:

  - DD 2579 Packages
  - Sources Sought/RFI Reviews
  - Pre ASP/ASP/Delta ASP Attendance
  - Subcontracting Plan Reviews
  - Acquisition Plan Reviews
  - MIPR Reviews
  - Mentor Contracting Personnel (email, telephone)

What We Do For Acquisition

Mission-Focused Business Leaders driving modernization, readiness, lethality

- Maximize Small Business Participation
  - Review acquisitions, make set-aside recommendations, and provide sources
  - Assist acquisition teams with market research process
  - Participate in *early* planning meetings, program reviews, Acquisition Strategy Panels
- Member of all Acquisition Strategy Panels
  - Review Small Business Subcontracting Plans; oversee administration
  - Assist in the development and implementation of small business solicitation and contract language
  - Liaison with SBA, Congress, external organizations on SB issues
  - Maintain Education & Training Program
  - Eglin Acquisition Community
  - Advise and Assist the Field (and others) on all Small Business Matters

REF: AFI 90-1801; DFARS 219.201

What We Do For Small Businesses

Mission-Focused Business Leaders driving modernization, readiness, lethality

- Manage Outreach Program
  - Attend Federal Procurement Conferences (SB Matchmakers)
  - Conduct and attend Small Business Opportunity Conferences
  - Work with Local Civil Groups/Chamber of Commerce
- Counsel Contractors (both Small & Large)
  - Current and future contracts
  - Provide acquisition points of contact
  - Types of items/services procured at Eglin
  - Referral source between primes and subcontractors
- Assist with Contractual Issues
  - Understanding solicitation provisions
  - Payment and performance problems

REF: AFI 90-1801; DFARS 219.201

What We Do For Small Businesses

Mission-Focused Business Leaders driving modernization, readiness, lethality

Support Small Businesses

- Our Office Database containing over 2000+ SBs
- Email Listing – used to notify SBs in database of new opportunities, upcoming events, policy changes
- Phone Consults
- Email Consults
- One-on-One, Capability Briefings (Zoom, Teams, phone)
- Website presence – Useful Handouts, Presentations, & Web Links

What We Do For Small Businesses

Mission-Focused Business Leaders driving modernization, readiness, lethality

- Sampling of our participation in various Outreach Events

  - Facilitation of our own Small Business Outreach Workshops with Civil Engineering and Operational Contracting

  - Regularly requested to present/brief at events of other organizations and agencies in the community

  - Regular Attendees at events of our local partners

    - NDIA Air Armament Symposium
    - TeCMEN Industry Day
    - Technology Expo
    - NW FL APEX Accelerator Events
    - Contract Requirements Industry Days & Site Visits

Eglin SB Goal/Actuals

Mission-Focused Business Leaders driving modernization, readiness, lethality

- SB Goal Status as of 1 July 2023

Agency	SB Expected / Actual	SDB Expected / Actual	SDVOSB Expected / Actual	WOSB Expected / Actual	HUBZone Expected / Actual
AFLCMC (PEO Weapons)	1.01% / 2.55%	1.61% / 0.24%	1.16%/ 1.13%	1.21% / 1.10%	0.03% / 0.02%
AFTC Eglin T&E	56.61% / 61.03%	15.89% / 15.02%	0.44% / 0.0%	11.06% / 13.27%	0.22% / 0.43%
AFTC Eglin Base Support	75.36% / 82.17%	48.58% / 47.01%	3.58% / 18.62%	14.1% / 18.84%	1.98% / 10.58%
AFNWC PEO	1.8% / 3.14%	0.35% / 0.58%	.20% / 0.43%	0.0%. / 0.19%	0.00% / 0.00%
AFRL	50.14% / 45.22%	11.00% / 12.04%	2.53% / 2.54%	8.86% / 8.24%	0.56% / 0.50%

Eglin SB OL Staff

Mission-Focused Business Leaders driving modernization, readiness, lethality

Ms. Anita Jackson, Director

Ms. Tina Mercer, Deputy Director

Organization: AFLCMC/SB-OL Eglin

Office: 850-882-2843

Cell: 850-612-4686

Building 350, Room 438

aflcmc.sb.eglin@us.af.mil

http://www.eglin.af.mil/Units/Small-Business-Office/

Questions

U.S. AIR FORCE

USSF

AFRL

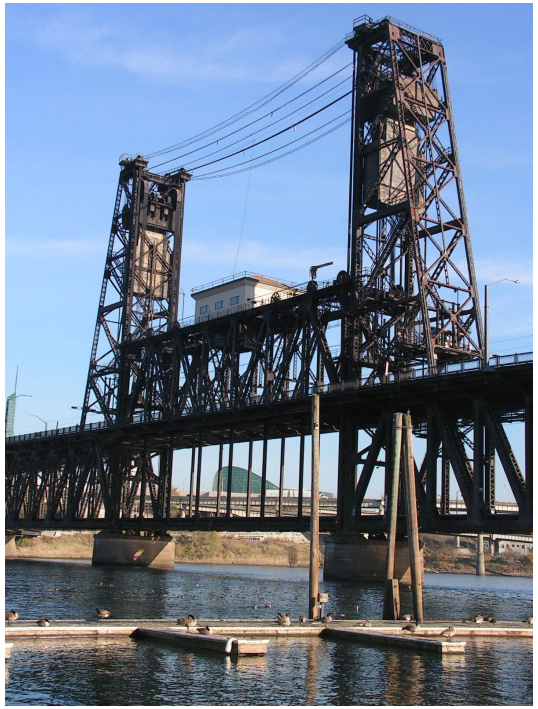
AF-9628 OVERVIEW

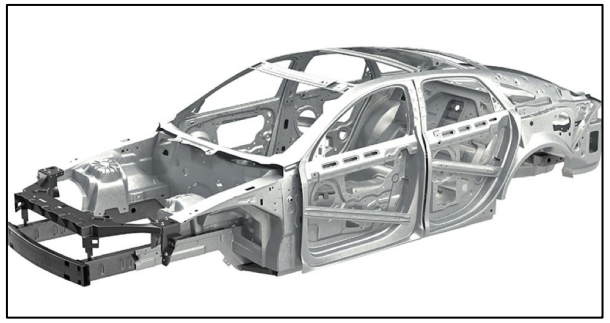
Sujeily Soto Medina

RWTOM 07/25/2023

Introduction

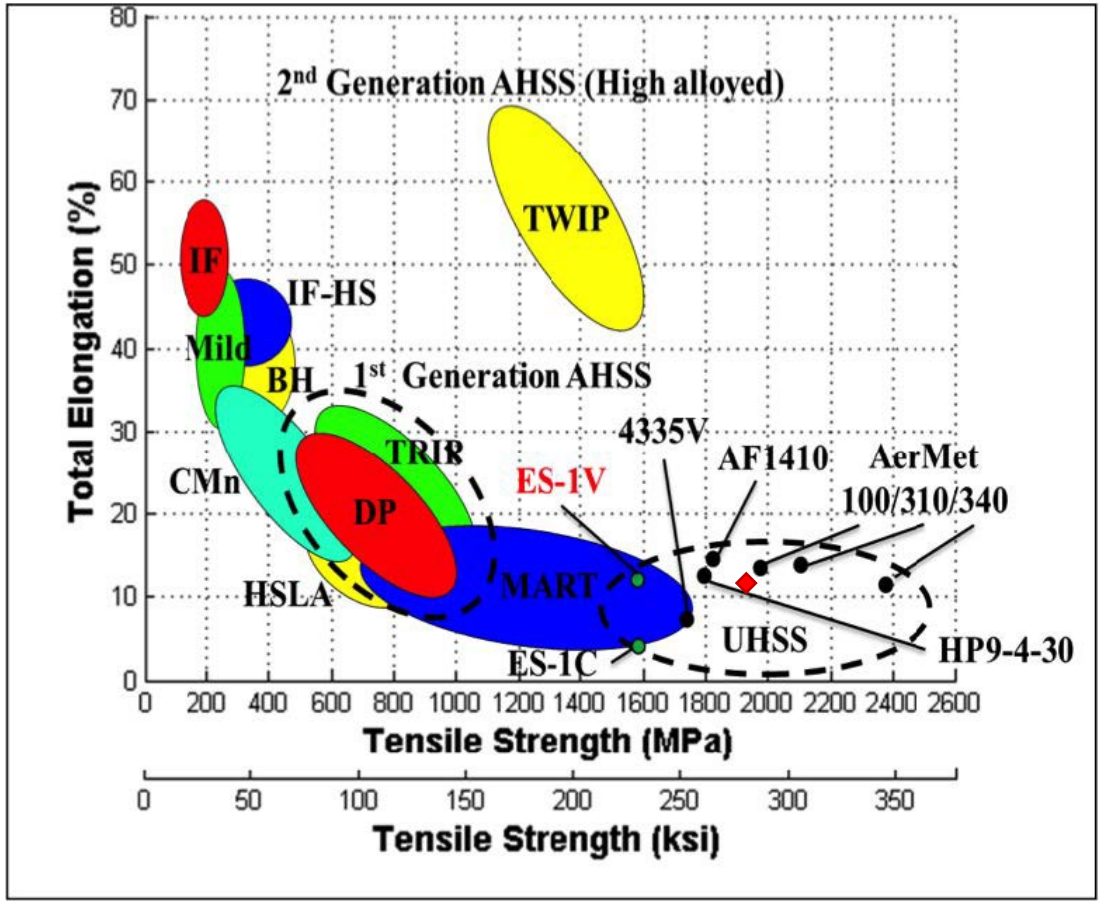
- Need for new low-cost, high strength, high toughness
- Wide range of applications
  - Automotive, aerospace, defense





Hunini, CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0>, via Wikimedia Commons - FoamFatale, CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons - Axcordion at English Wikipedia, CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons - https://www.airforce-technology.com/wp-content/uploads/sites/6/2021/10/AF2-5.jpg - https://media.defense.gov/2009/May/18/2000571988/-1/-1/0/090518-F-1234S-001.JPG

Next Generation Ultra High Strength Steels



- AF1410
  - High weight percentage of nickel (9.5 - 10.25)
- Eglin Steel (ES-1) ε - carbide low alloy UHSS
  - Similar strength levels to AerMet100, AF1410 and HP9-4-30
  - Reduced cost due to reduction of costly alloying additions like Ni and Co

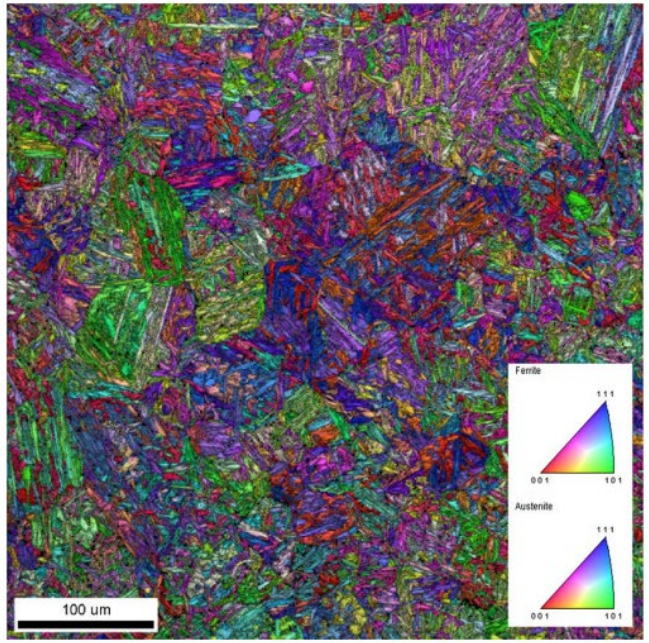
Gibbons (2016)

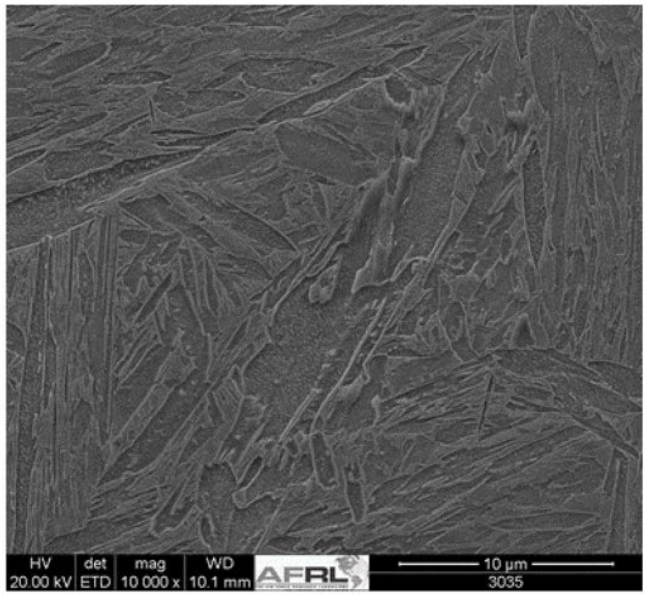
Composition of Relevant UHSS

Alloy	C	Mn	Si	Co	Cr	Ni	Mo	V	W
4340	0.37 - 0.43	0.60 - 0.80	0.15 - 0.30	-	0.70 - 0.90	1.65 - 2.00	0.20 - 0.30	-	-
4330	0.20 - 0.30	1 (max)	0.8 (max)	-	0.40 - 0.60	1.0 - 1.50	0.30 - 0.50	-	-
300M	0.4 -0.46	0.65 - 0.90	1.45 - 1.80	-	0.70 - 0.95	1.65 - 2.0	0.30 - 0.45	0.05	-
AerMet100	0.21 - 0.25	-	-	13.0 - 14.0	2.90 - 3.30	11.0 - 12.0	1.1 - 1.3	-	-
AF1410	0.13 - 0.17	0.1 (max)	0.10 (max)	13.5 - 14.5	1.8 - 2.2	9.5 - 10.5	0.90 - 1.1	-	-
HP9-4-30	0.29 - 0.34	0.10 - 0.35	0.20 (max)	4.25 - 4.75	0.9 - 1.1	7.0 - 8.0	0.90 - 1.10	0.06 - 0.12	-
ES-1	0.16 - 0.35	0.85 (max)	1.25 (max)	-	1.50 - 3.25	5.0 (max)	0.55 (max)	0.05 - 0.30	0.70 - 3.25

AF 9628

- Relative low cost
  - Limited amounts of costly alloying elements like Ni
  - W free
- Ultra high strength
  - Higher than 1.4 GPa
- High ductility
  - Elongations higher than 10 %
- Weldable



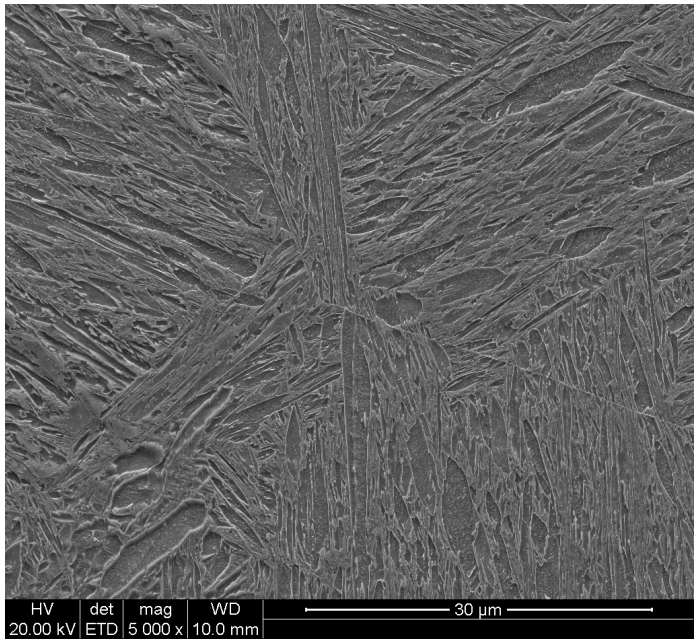


Neel, C., Gibbons, S., Abrahams, R., & House, J. (2020). *Journal of Dynamic Behavior of Materials*, *6*(1), 64-77.

Composition of Relevant UHSS

Alloy	C	Mn	Si	Co	Cr	Ni	Mo	V	W
4340	0.37 - 0.43	0.60 - 0.80	0.15 - 0.30	-	0.70 - 0.90	1.65 - 2.00	0.20 - 0.30	-	-
4330	0.20 - 0.30	1 (max)	0.8 (max)	-	0.40 - 0.60	1.0 - 1.50	0.30 - 0.50	-	-
300M	0.4 -0.46	0.65 - 0.90	1.45 - 1.80	-	0.70 - 0.95	1.65 - 2.0	0.30 - 0.45	0.05	-
AerMet100	0.21 - 0.25	-	-	13.0 - 14.0	2.90 - 3.30	11.0 - 12.0	1.1 - 1.3	-	-
AF1410	0.13 - 0.17	0.1 (max)	0.10 (max)	13.5 - 14.5	1.8 - 2.2	9.5 - 10.5	0.90 - 1.1	-	-
HP9-4-30	0.29 - 0.34	0.10 - 0.35	0.20 (max)	4.25 - 4.75	0.9 - 1.1	7.0 - 8.0	0.90 - 1.10	0.06 - 0.12	-
ES-1	0.16 - 0.35	0.85 (max)	1.25 (max)	-	1.50 - 3.25	5.0 (max)	0.55 (max)	0.05 - 0.30	0.70 - 3.25
AF9628	0.24 -0.32	1.0 (max)	1.5 (max)		2.0 - 3.0	3.0 (max)	0.5 - 1.5	0.05 - 0.35	-

Castability



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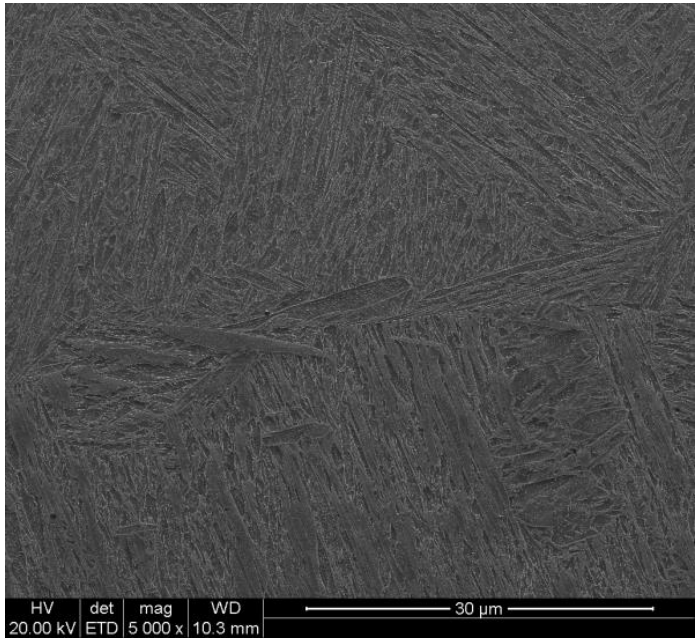
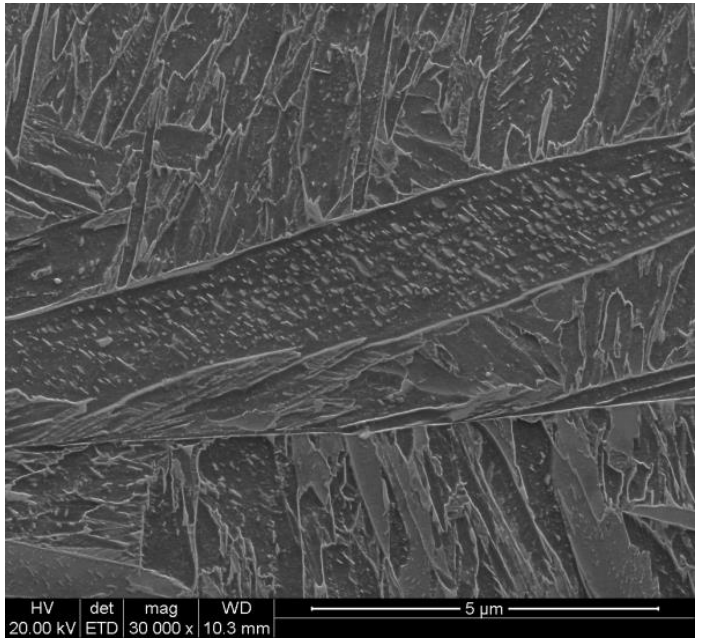


Casted

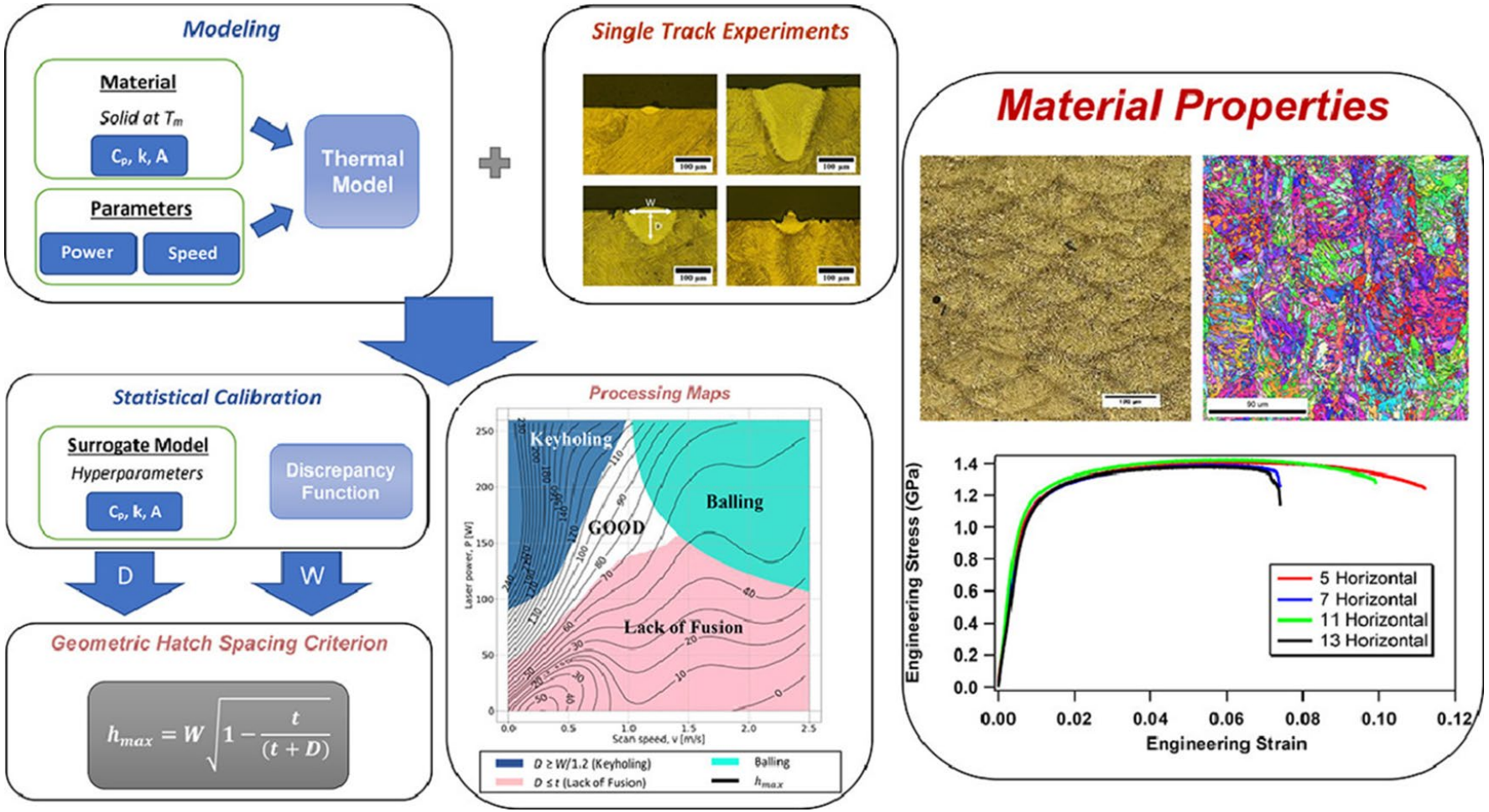


Casted (higher magnification)

- AF9628 has been successfully casted by Hybrid Investment Casting and Sand Casting
  - Excellent mechanical properties
  - Homogenized microstructure

Additive Manufacturing

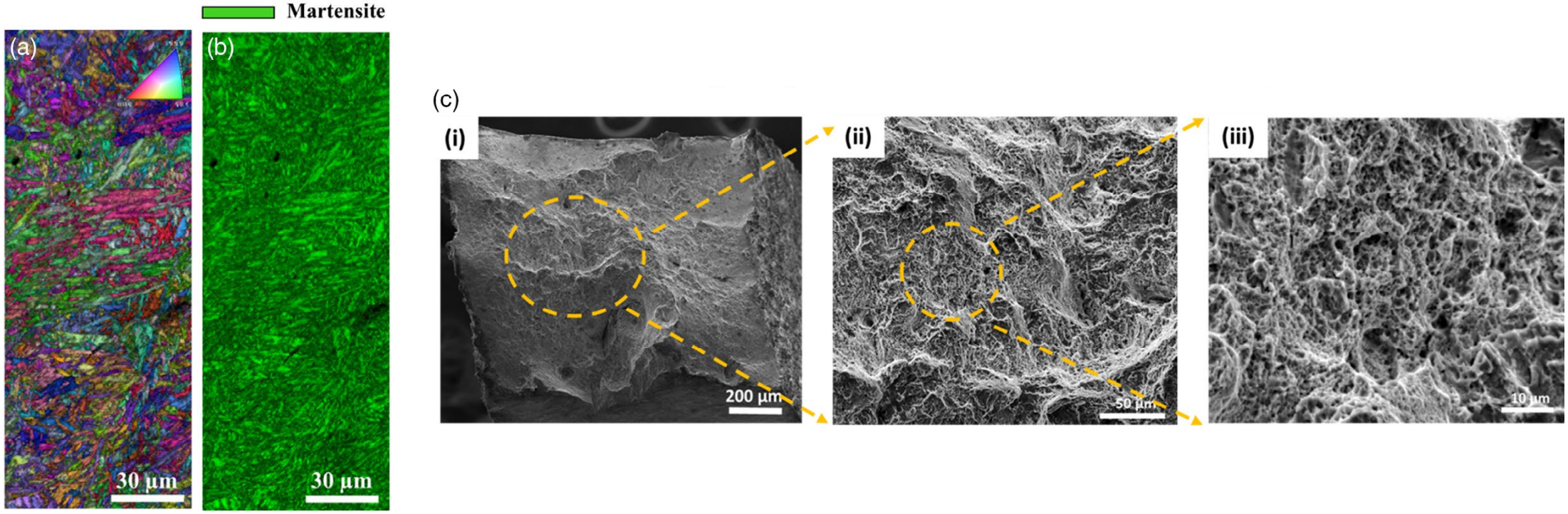
Laser Powder Bed Fusion **As-printed: UTS: 1.4 GPa, Elongation: 10%**



Seede, R., Zhang, B., Whitt, A., Picak, S., Gibbons, S., Flater, P., ... & Karaman, I. (2021). *Additive Manufacturing*, 47, 102255.

Additive Manufacturing

Laser Powder Bed Fusion **As-printed: UTS: 1.5 GPa, Elongation: 10%**



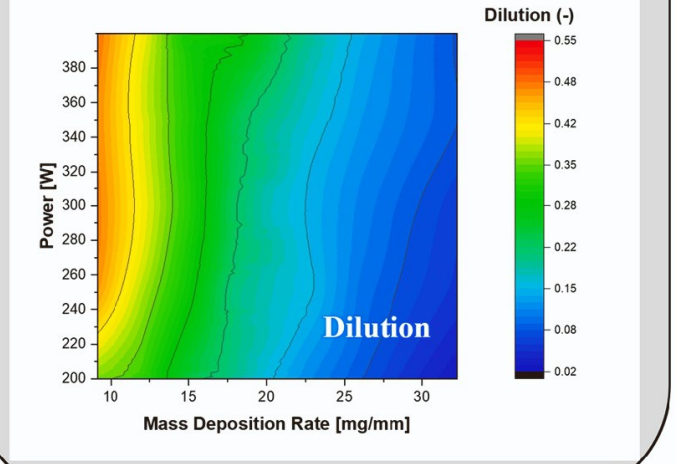
Only 0.004 pore vol%, average pore size of 7.71 ± 5.72 µm

Priyanshi Agrawal, Shivakant Shukla, Saket Thapliyal, Priyanka Agrawal, Saurabh S. Nene, Rajiv S. Mishra,Brandon A. McWilliams, and Kyu C. Cho (2020), *Advance Engineering Materials,* 23, 2000845

Additive Manufacturing

Direct Energy Deposition **As Printed: 1.2 GPa, Elongation: 13%**

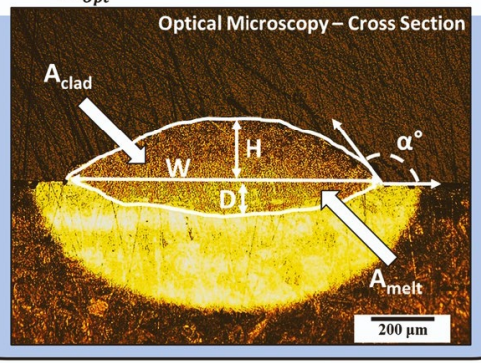
1. Single-Track Printing Experiments:
Parametric P-V-$\dot{m}$ sampling to construct printability maps with optimal track dilution ranging from 20-50%



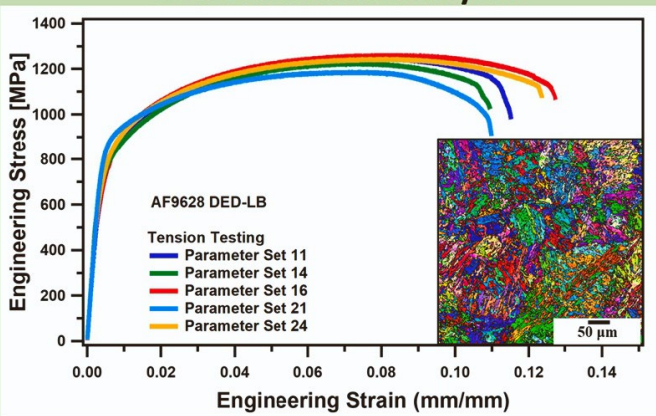
2. Fully-Dense Part Printing Experiments:
Guided by 3 criteria - (a) printability maps (dilution: 20-50%), (b) optimal hatch spacing, & (c) optimal layer thickness

(a) $Dilution = \frac{A_{Melt}}{(A_{Melt}+A_{Clad})}$, (b) $HS_{Opt} = W\sqrt{1-\frac{H}{(H+D)}}$,

(c) $LT_{Opt} = \frac{A_{Clad}}{HS_{Opt}}$



3. Post-Printing Validation Experiments:
Mechanical property characterization and microstructural analyses



Microstructure: % density, grain/lathe size, texture, composition, and so forth.

M.W. Vaughan, M. Elverud, J. Ye, R. Seede, S. Gibbons, P. Flater, B. Gaskey, R. Arroyave, A. Elwany, I. Karaman, (2023), *Additive Manufacturing*, 67, 103489.

QUESTIONS?

U.S. AIR FORCE

USSF

AFRL

Peel & Adhere Photonic Crystals

Advanced Optical Properties in a “Sticker”

Dr. Joshua Lentz, Physicist/Innovator

Munitions Directorate, Weapon Simulation & Analysis Branch

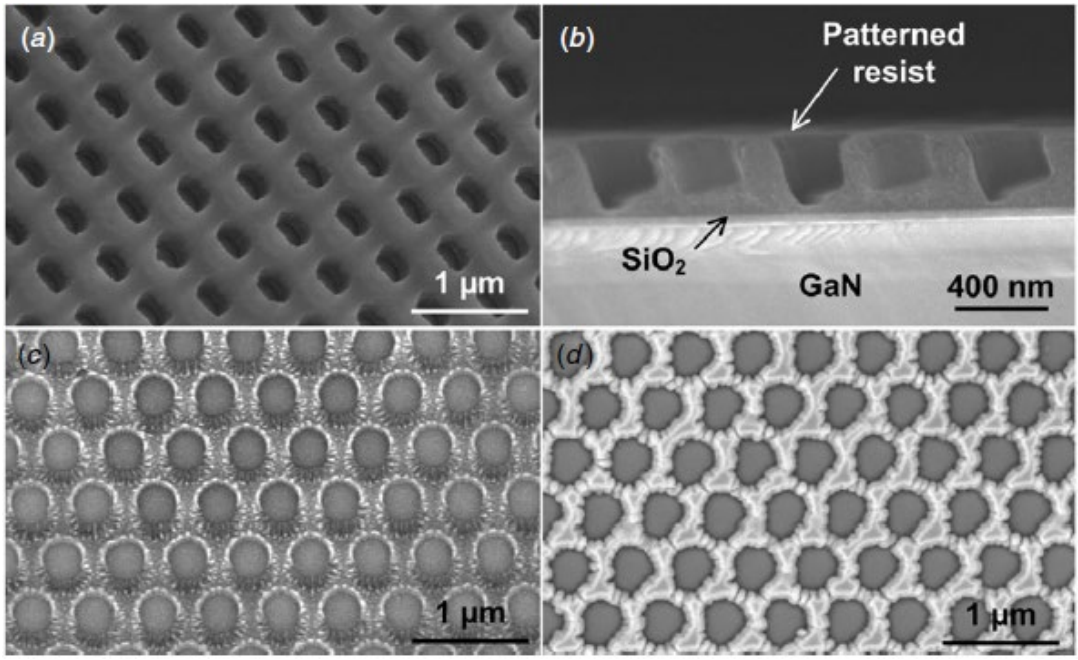
25 July 2023

Opportunity Statement

- Custom optics are generally expensive and have long lead times
- Rapid prototyping requires extensive selection of optical elements to avoid the cost/lead problems
- 3D printing of optics is still limited in quality; coatings not possible with standard printers
- Peel and adhere optical coatings can convert bulk materials to quality elements

Photonic Crystals -- Fundamentals

- Photonic crystals are structures with periodic or quasi-periodic lattices that occur naturally or are man-made
- Lattice constant is sub-wavelength
- 1-D, 2-D, 3-D crystal structures
- Most commonly composed of dielectrics (glass, plastic, polymers, etc.)
- Fabrication limited
- Subject of extensive research



Tangyou Sun, Zhimou Xu, Haifeng Xu, Wenning Zhao, Xinghui Wu, Sisi Liu, Zhichao Ma, Jian He, Shiyuan Liu and Jing Peng; "Photonic crystal structures on nonflat surfaces fabricated by dry lift-off soft UV nanoimprint lithography," Journal of Micromechanics and Microengineering, Volume 23, Number 12, 2013

Photonic Crystals -- Fabrication

- Theoretical photonic crystal designs are published frequently
- Few are fabricated in useful sizes
  - Longer wavelengths use 3-D printing (larger features)
  - Additive or subtractive manufacturing techniques
  - Multi-photon lithography
  - Deposition processes
- Generally small samples are fabricated for research purposes
- Fabrication technology is lagging
  - Reel-to-reel fabrication for Polarization gratings

Photonic Crystals – Beam Bending

- Photonic crystal (PC) beam bending has been demonstrated
- Spatially Variant Photonic Crystal lattice structure
  - Guides wave through crystal – emerges at a different angle than it entered
- Demonstrated narrow band
  - Possible to design for broad spectrum

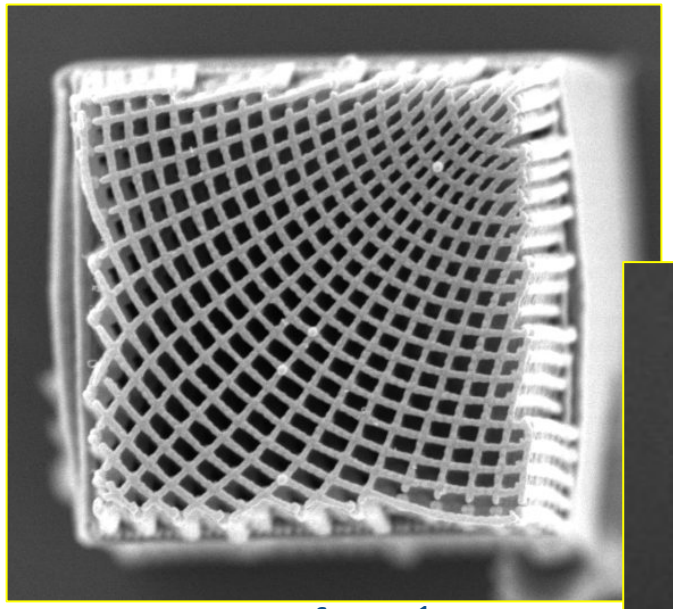


Image from [1]

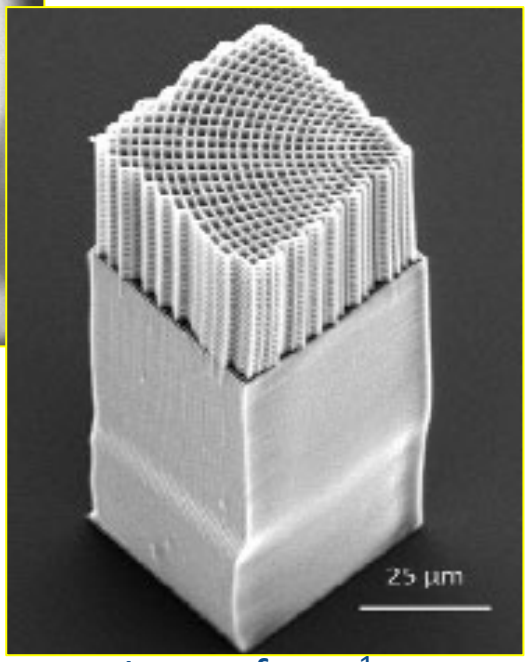
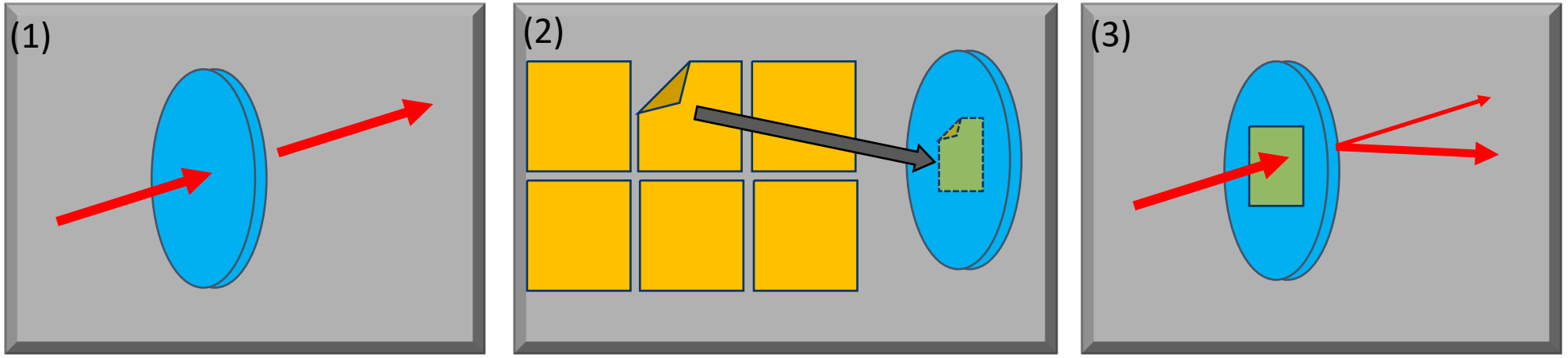


Image from [1]

[1]Jennefir L. Digaum, Rashi Sharma, Daniel Batista, Javier J. Pazos, Raymond C. Rumpf, Stephen M. Kuebler, "Beam-bending in spatially variant photonic crystals at telecommunications wavelengths", Proc. SPIE 9759, Advanced Fabrication Technologies for Micro/Nano Optics and Photonics IX, 975911 (14 March 2016)

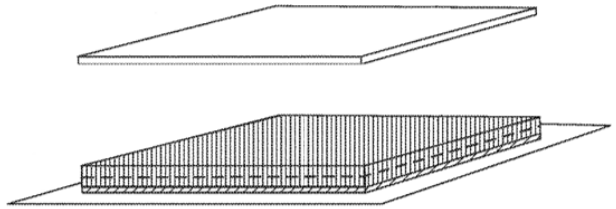
How It Looks

- Mass produced photonic crystals with varieties of optical properties (AR coatings, reflective coatings, band pass, band stop, light redirection, polarization conversion, attenuation, focusing, scattering, splitting, etc.)
- Provide the photonic crystals as peel-and-adhere products (adhesive backed, static cling, etc.)



- Advantages
  - Reconfigurable
  - Low cost prototyping
  - Fast prototyping
  - Non-provisional Patent
    - USNO 11372134
    - Issued 6/28/2022

2023 PATENT TECHNOLOGY SUCCESS STORY



An isometric view of an example flexible photonic film sans backing of the flexible photonic film assembly after application to the flat transparent surface.

PATENT NUMBER:
US 11,372,134 B2

TECHNOLOGY NAME:
Peel-and-Adhere Photonic Crystal

INVENTORS:
Joshua Lentz

TECHNICAL PROJECT OFFICE:
AFRL Munitions Directorate

PATENT DATE:
June 2022

SOURCE:
US Patent and Trademark Office
www.uspto.gov

CONTACT INFORMATION:
Joshua Lentz
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A SIMPLE QUESTION LEADS TO

SEVENTH PATENT FOR AFRL PHYSICIST

Sometimes a simple question can lead to a great idea that grows into improved technology. Joshua Lentz, Ph.D., of the Air Force Research Lab Munitions Directorate (AFRL/RW) at Eglin Air Force Base in Florida, just happened to be the person to ask such a question, which led to a patent involving photonic crystals.

"A photonic crystal is a generic term for an engineered optical material that has a repetitive structure just like a crystal," Lentz said. "There is no limit to the number or types of materials used, the number of layers, the size and shape of the repeating features, and there are some very interesting optical responses that can be created by carefully designing such a crystal."

The full story can be found at https://www.aft3.af.mil/Success-Stories/

USSF

DEPARTMENT OF THE AIR FORCE TECHNOLOGY TRANSFER AND TRANSITION

DISTRIBUTION A. Approved for public release: distribution unlimited.

AFRL-2023-0710

Commercial Applications

- Advertising/Marketing – complex ads using a variety of optical effects (stores, etc.)
- R&D – Laboratories and Product Development Organizations/Teams (bench stock)
- Consumer electronics – (screen treatments for magnification, blue light reduction, reduced glare, etc.)
- Lighting – quick changes to lighting to support a variety of applications
- Automotive – low cost changes to condition mirrors for reduced glare, etc.
- Agriculture – vertical farming research
- Entertainment – a variety of optical effects can be introduced at low cost to enhance: stage lighting, UAV or laser light shows, projected imagery (immersive and/or interactive art experiences), fashion shows (optical effects/illusions in apparel)

QUESTIONS?

LinkedIn

Gov't

AFRL
THE AIR FORCE RESEARCH LABORATORY
LEAD DISCOVER DEVELOP DELIVER

Joshua Lentz, PhD
Physicist / Innovator | Munitions Directorate (RW)
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DEFENSEWERX

Challenges are opportunities

About DEFENSEWERX

Innovate with AFRL | July 25, 2023

Teresa Barber, COO
DEFENSEWERX

Under a Title 15 Partnership Intermediary Agreement (PIA):

DEFENSEWERX + UNITED STATES SPECIAL OPERATIONS COMMAND = SPEED INNOVATION SOLUTIONS SOFWERX

"Big Tent" philosophy which includes:

- Partner Organization
- Inter Agency Partners
- Industry Partners/Fellows
- FFRDC's/Labs
- Academics/Interns
- Hackers/Makers

What is a Partnership Intermediary?

- Non-FAR based agreement between Federal Partner and certain Non Profits
- Eharmony.gov
- Focuses on non-traditional/small business enterprises
- Emulates private sector business operations
- Reduces or eliminates govt barriers
- Considered ”Partner” vs “Contractor”

What is a Partnership Intermediary?

- Can act quickly and proactively
- Is a neutral facilitator focused on results
- Enables the *BEST* solutions, not just the *KNOWN* solutions
- **Business to Business relationships and contracts allow for agility and speed in support of Govt**
- ~86% of submissions come from the DWX non-traditional ecosystem. ~14% come from Sam.Gov

DWX PIA Key Attributes

- Flexible, non-FAR business methodologies and processes to support DoD / Govt needs
- **Neutral** facilitation and ideation - creating ecosystems and processes that enable *purposeful collisions* for the benefit of the Govt and DoD (and the ecosystem collaborators). DWX does not commercialize, hold IP of performer/product solutions
- Easy to access & reduced barriers – allows for access and leveraging across services / ecosystem for DoD / Govt gaps / capability ”desirements”
- Baseline of PIA costs can be covered by O&M or RDT&E. Funds are obligated and expended as soon as they are put on PIA
- Business to Business relationships and contracts allow for agility and speed in support of Govt / DoD priorities. DWX facilitates the “leveraging” of resources to have collaborative development opportunities

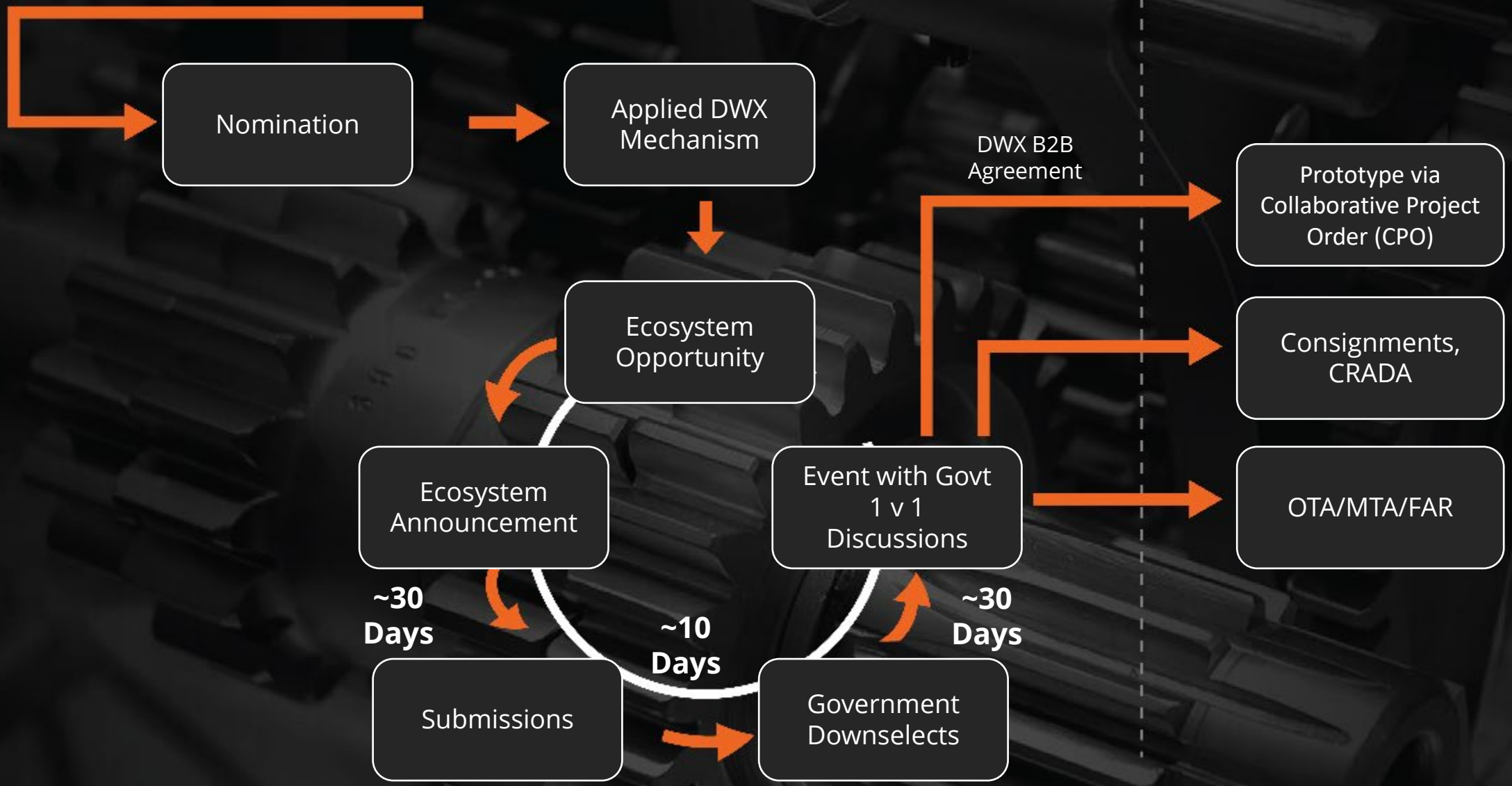
Mission under current agreements (PIA focused):

1. Technology transition (agile spin in - getting technology to the warfighter)
2. Technology transfer (agile spin out - getting technology to the commercial marketplace)
3. Innovation & Collaboration (cultivate the ecosystem)
4. Workforce development (current & future, STEM)
5. Concept prototyping

For Small Business, Industry, Innovators:

We are free, neutral, and hold no performer IP

How it WERX

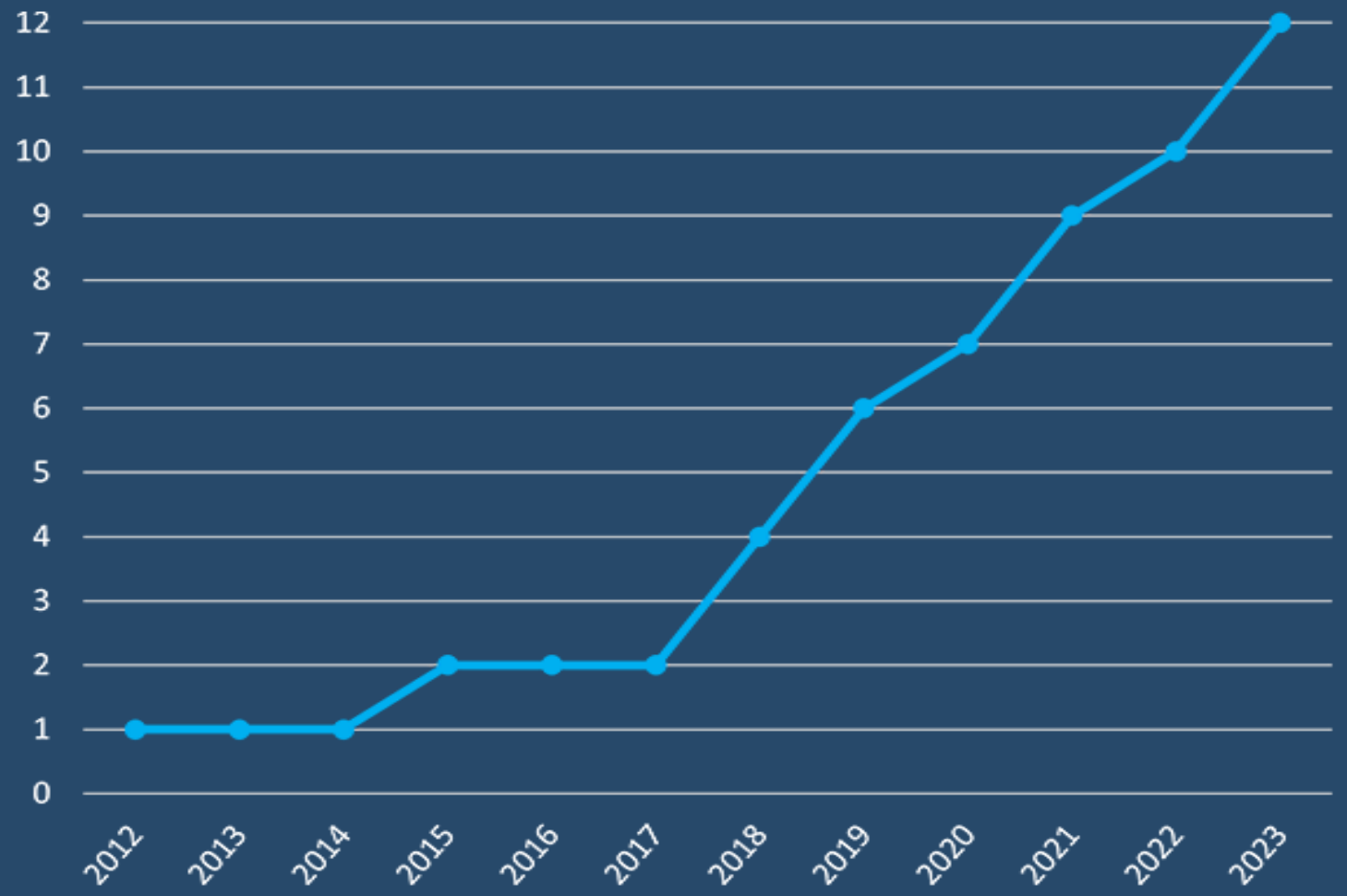

Nomination
Applied DWX Mechanism
Ecosystem Opportunity
Ecosystem Announcement
~30 Days
Submissions
~10 Days
Government Downselects
Event with Govt 1 v 1 Discussions
~30 Days
DWX B2B Agreement
Prototype via Collaborative Project Order (CPO)
Consignments, CRADA
OTA/MTA/FAR

HUB HISTORY

DEFENSEWERX

Hub Established Dates

2012: Doolittle Institute
2015: SOFWERX
2018: AFWERX
2018: MGMWERX
2019: CFIC
2019: ERDCWERX
2020: HSWERX
2020: ICWERX
2020: NPSWERX
2022: Nautilus
2023: ENERGYWERX
2023: LANDWERX



Join the mission:

www.defensewerx.org

tbarber@defensewerx.org

DEFENSEWERX

Thank you!

Refreshments outside, courtesy FPL & Bank of America

Closing

Mike Edwards
Doolittle Institute Director

DOOLITTLEINSTITUTE
speed·innovation·solutions

Networking Reception

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