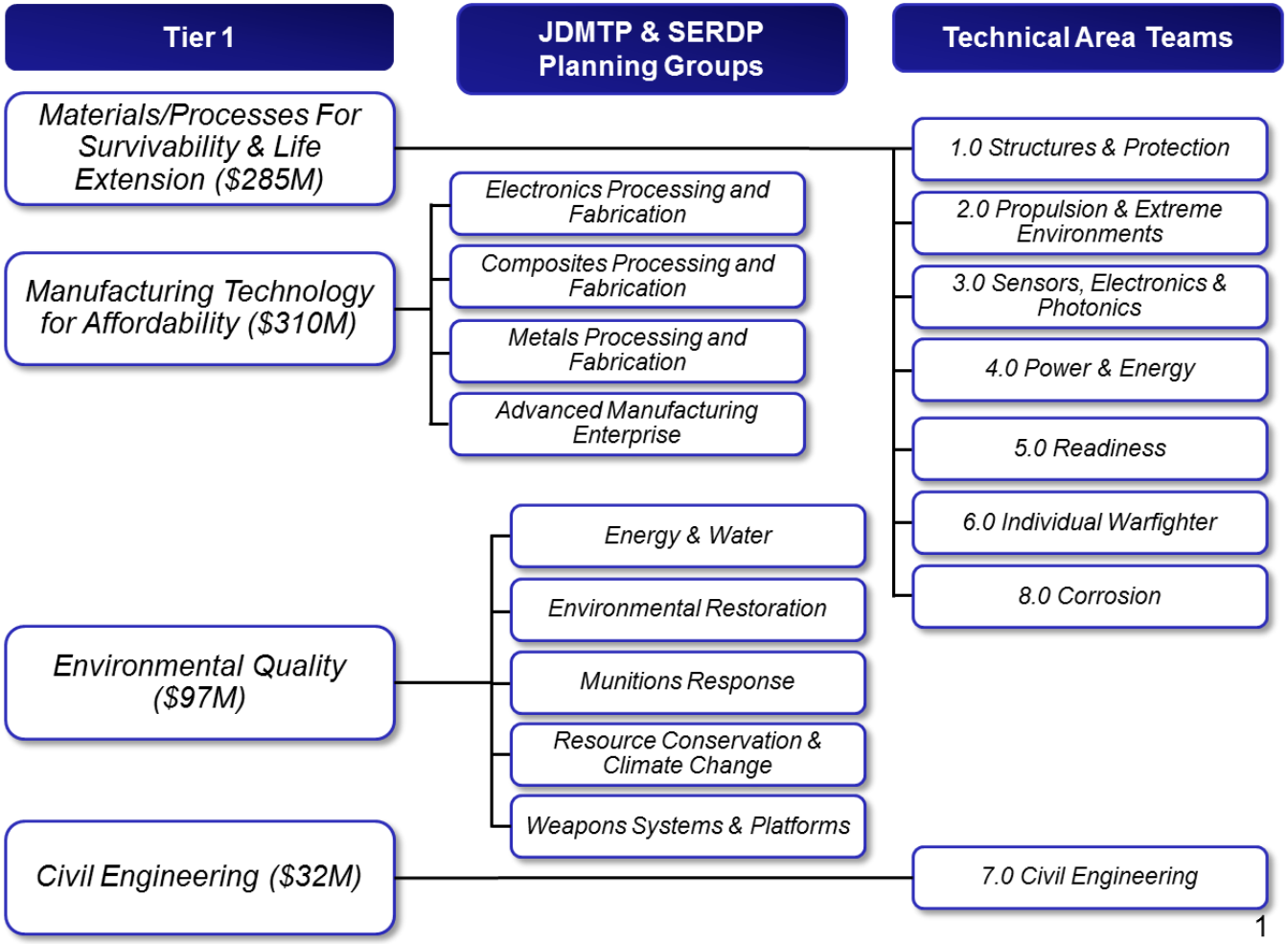
Materials and Manufacturing Processes COI

Timothy J. Bunning, Materials and Manufacturing Directorate (RX)

Air Force Research Laboratory

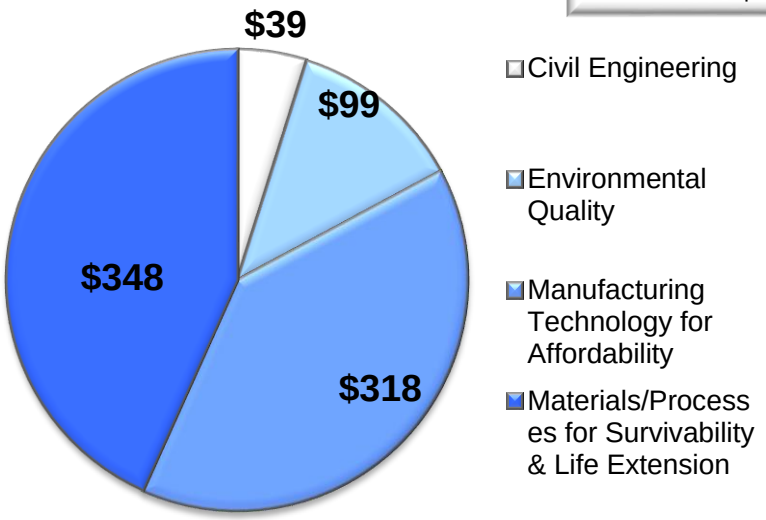
M&MP COI Taxonomy



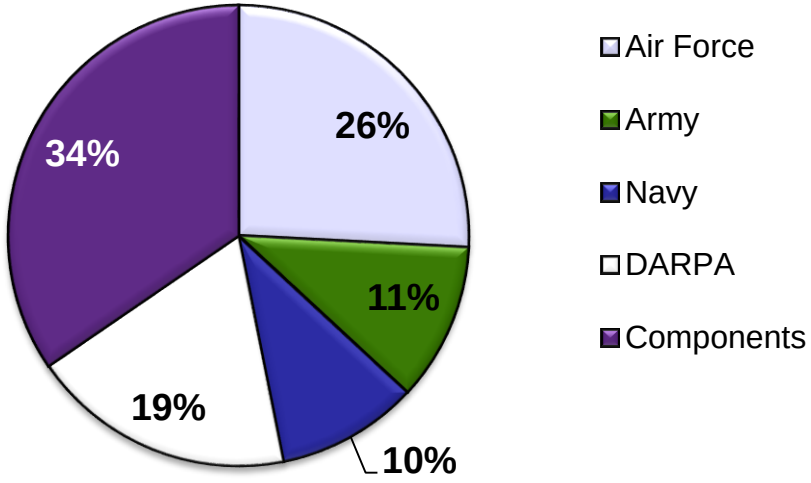
M&MP COI

COI Sub-Areas ($M)

Total = $804M



Component Investment

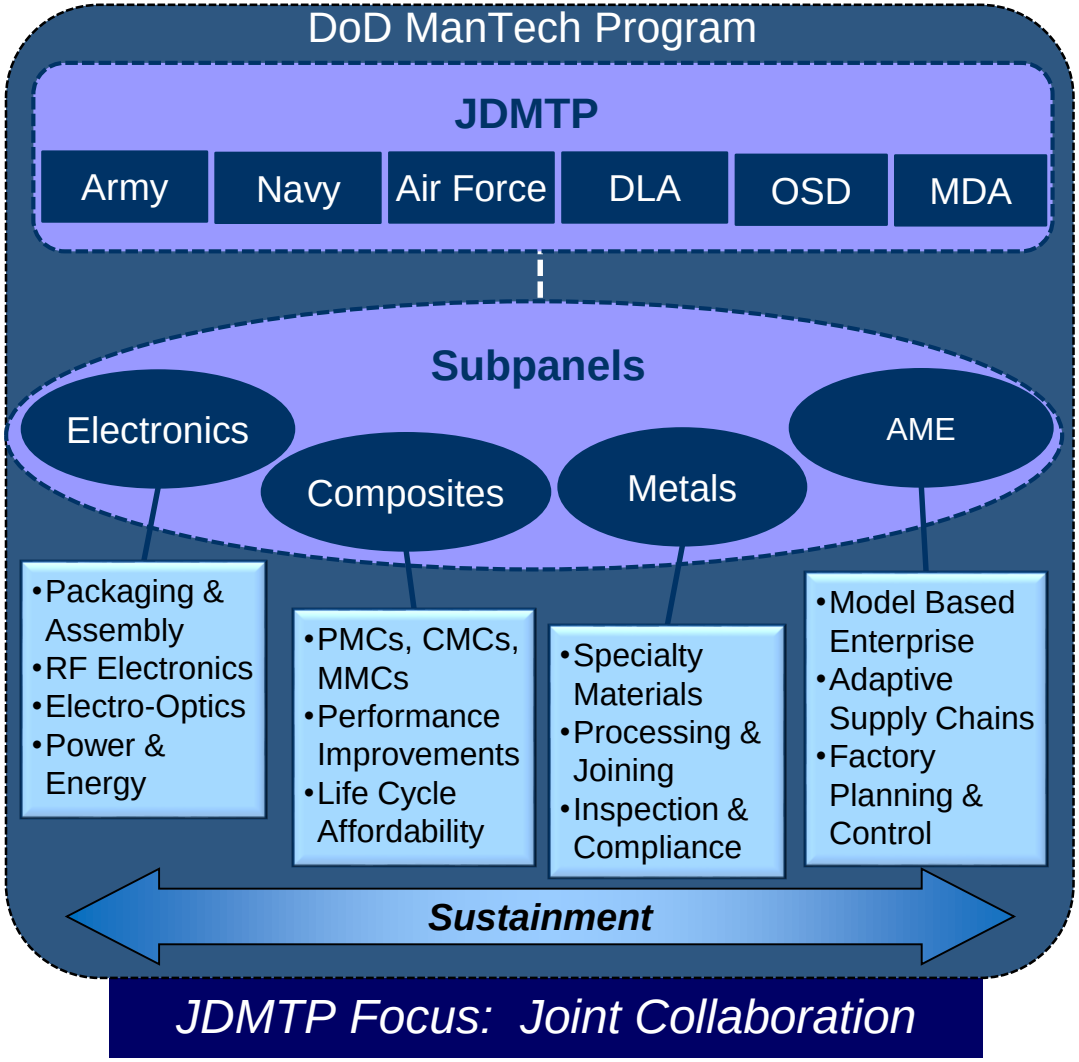


Steering Committee

Dr. Tim Bunning, Air Force, Lead
Dr. Julie Christodoulou, Navy
Dr. Jeffrey Zabinski, Army
Dr. John Beatty, OSD (Dr. Lew Sloter)
Dr. Steven Wax, DTRA
Mr. Ellison Urban, DARPA

TAT 1: AF (Wilks)
TAT 2: Navy (Wuchina)
TAT 3: Army (Karna)
TAT 4: Army (Mantz)
TAT 5: AF (Mazdiyasni)
TAT 6: Army (Steeves)
TAT 7: Army (Kinnebrew)
TAT 8: Navy (Perez)
JDMTP: AF (Russel)
SERDEP…

Organization



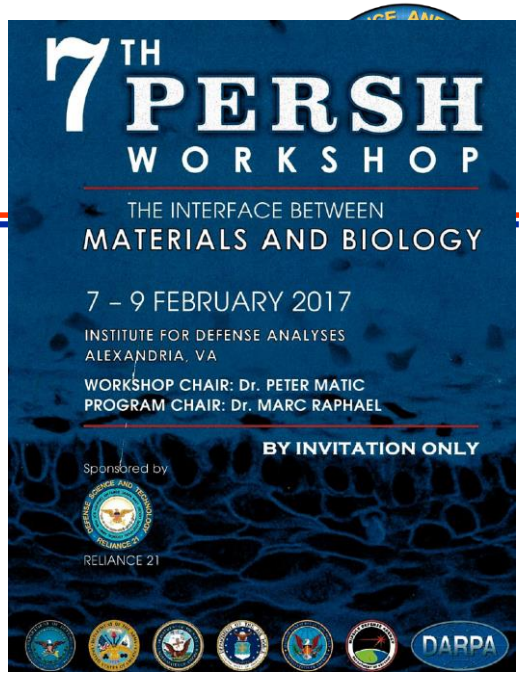
- Roles of the Panel
  - Conduct reviews and assessments of the program and related manufacturing issues
  - Strategic planning to identify joint opportunities
  - Information exchange with government, industry, academia, professional associations

JDMTP

- **Work closely with stakeholders to identify top manufacturing requirements**
  - JDMTP facilitates collaboration for joint opportunities supporting those requirements
- **Collaborate and Leverage Cooperative Activities**
  - DARPA (Open Manufacturing, TFF), DoE, DoC/NIST, NASA
  - DPA/DPAC, acquisition programs, organic industrial base, Diminishing Manufacturing Sources and Material Shortages (DMSMS)
  - Small Business Innovation Research (SBIR)
- **Subject matter expertise supporting DoD-led Manufacturing Institutes**
  - Institute technical focus area development/refinement
  - Solicitation support - RFI/BAA development, proposal evaluations
  - Participation in Institute technical advisory boards, panels
- **Collaborate with Industry through Industry Associations, Conferences and Workshops**

- Focus Service: Air Force
- 2016 Attendance: Over 900
- JDMTP Standing Roles:
  - Identify and coordinate relevant themes and technology focus areas
  - Provide assistance in identifying and obtaining speakers for plenary sessions
  - Present the Defense Manufacturing Technology Achievement Award
  - Major touch-point for industry interactions

COI Activity In-Year



- **Annual Planning Meeting (Flagg-Keynote), 7th Persh Workshop**

  (Feb. 7-9, 17)

- **Synthetic Biology for Military Environments (SBME) ARAP**
  - Building service syn biology knowledge to meet unique defense needs

- **OSD COI Seedling - Joint-Service Universal Materials Data Fusion and Visualization Structures**
  - Digitize, catalog and integrate scientific and engineering data across the service labs and warfare centers to further accelerate ICME processes.

- **Numerous technology transitions, demonstrations, …**
  - Vertical Cavity Surface Emitting Lasers, transparent ceramic windows, CMCs to T-700 engine, infrared focal plane array technology processes, LCAAT, Manufacturing (hypersonics) base aeroshells, …..

- **JDMTP**
  - Army RDECOM -Administrative Agent duties for the DMS&T Core program
  - DoD Integrated Technology Additive Manufacturing Roadmap
  - DLA R&D, NAVAIR and DLA Aviation on Development of AM qualification and testing processes
  - New Manufacturing Institutes in Robotics and Tissue Biofabrication awarded.
  - Lots of leverage from Existing Institutes (key leadership positions)

Timeline to Create Manufacturing USA

A Century of Scientific Excellence

WH Advanced Manufacturing Partnership (AMP) Recommendation: "Create Public-Private Partnerships on Advanced Manufacturing"

Announcement of National Network for Manufacturing Innovation (NNMI) Concept and a "Pilot" Institute

NNMI: A Preliminary Design Report Issued by Dept. of Commerce

Revitalizing American Manufacturing Initiative (RAMI) Act Signed into Law

2013 and 2014 "State of the Union" Calls for NNMI

NNMI Rebranded to ***Manufacturing USA***

2011 | **2012** | **2013** | **2014** | **2015** | **2016** | **2017**

DoD Institutes

America Makes
Additive Manufacturing
Youngstown, OH

DMDII
Digital Manufacturing and Design
Chicago, IL

Lift
Lightweight Metals
Detroit, MI

NEXTFLEX
Flexible Hybrid Electronics
San Jose, CA

AIM photonics
Integrated Photonics
Albany and Rochester, NY

Advanced Functional Fabrics of America
Fibers and Textiles
Cambridge, MA

Advanced Tissue Biofabrication Alliance
Tissue Biofabrication
Manchester, NH

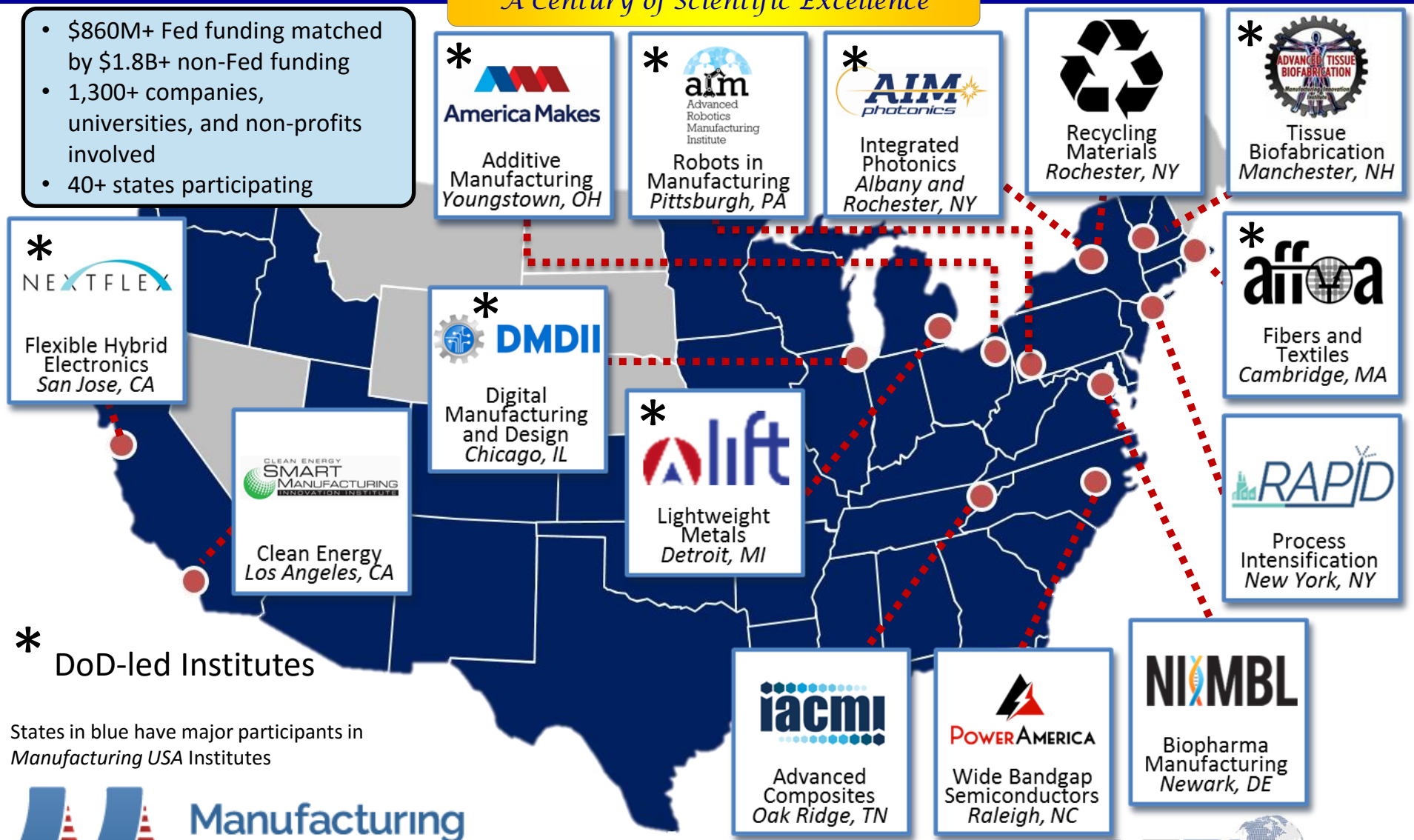
aim
Advanced Robotics Manufacturing Institute
Robots in Manufacturing
Pittsburgh, PA

Significant AFRL Leadership

Manufacturing USA

A Century of Scientific Excellence

- $860M+ Fed funding matched by $1.8B+ non-Fed funding
- 1,300+ companies, universities, and non-profits involved
- 40+ states participating



* DoD-led Institutes

States in blue have major participants in *Manufacturing USA* Institutes

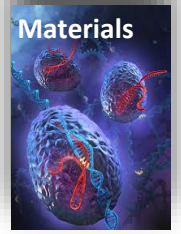
Manufacturing USA℠

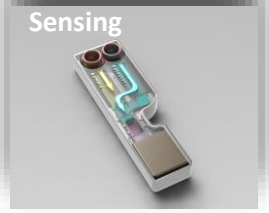
New Cross-Service Efforts

SBME ARAP

Purpose:

Apply basic advances in synthetic biology and knowledge to meet unique defense needs and the specific challenges presented within military environments.





Payoff:

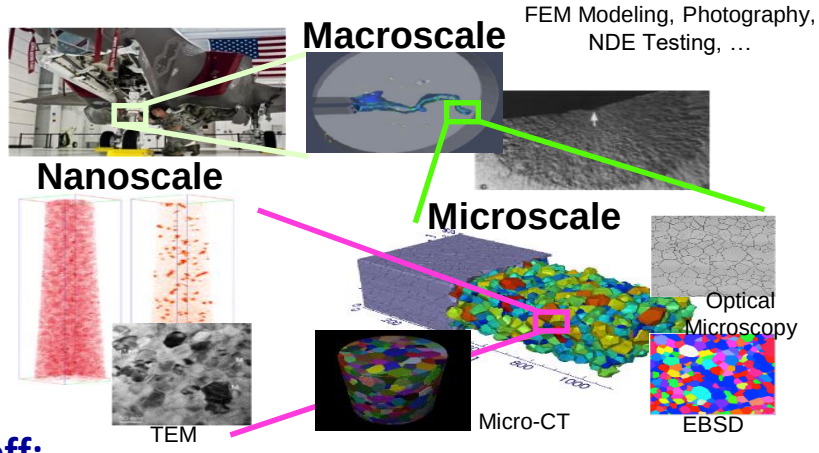
- DoD smarts in the area
  - Established knowledge domain experts and ecosystem
- Provide DoD leadership with cadre of SMEs to provide assessment of Syn Bio advances
- Joint future DoD capabilities using syn bio

OSD COI Seedling

Joint-Service Universal Materials Data Fusion & Visualization Structures

Purpose:

- A single data-structure for merging, analyzing, and visualizing large amounts of spatial and temporal materials data.

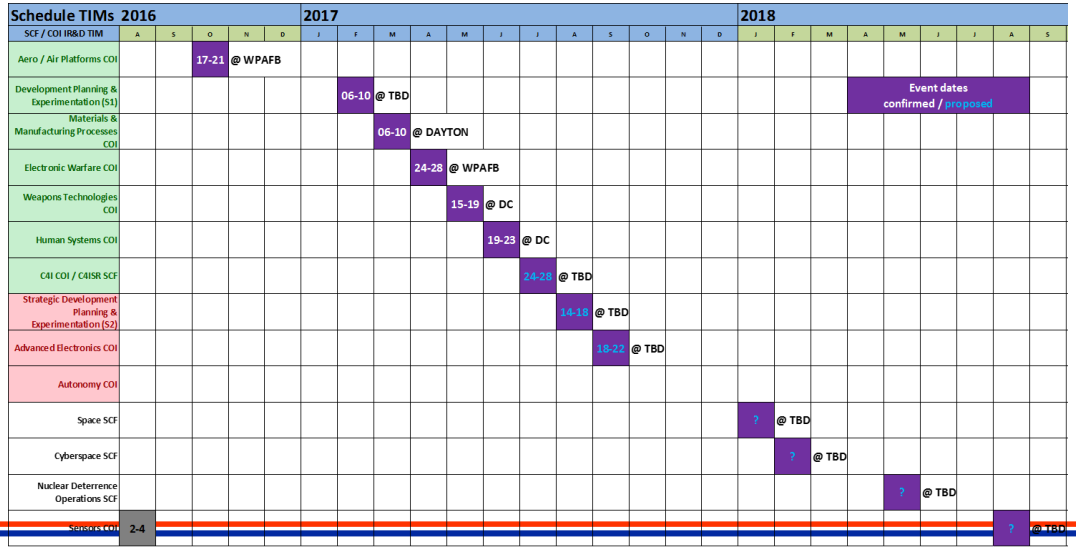


Payoff:

- Framework(s) to combine data sets from multiple instruments and modeling tools, across many length scales, providing unprecedented insight to the controlling mechanisms of materials evolution and performance.

IR&D TIM

- **Dates: Week of March 27 at UES, Inc., Dayton, OH**
- **Companies selected: GATech, Materials & Electrochemical Research, Northrop, Raytheon, Boeing**
- **Targeted solicitation**
  - TAT 1.0 - M&MP for Structures & Protection
  - TAT 4.0 - M&MP for Power & Energy
  - TAT 5.0 - M&MP for Readiness
  - TAT 6.0 - M&MP for the Individual Warfighter



FedBizOpps Announcement – 2017 M&MP COI IR&D TIM
https://www.fbo.gov/spg/USAF/AFMC/AFRLWRS/AFRL-XPPD-16-0009/listing.html

Cross COI and Community Activities
(Materials and Manufacturing – Pervasive)

- **COI Interchanges**
  - DOD/DOE Workshop on Additive Manufacturing for Munitions (Feb 2017)
  - Ground & Sea Platforms w/ Cyber, and M&MP
  - SBME ARAP (Human Systems, ASBREM)
  - Advanced Electronics – 09/2016 at AFRL/RY
- **FIMaR –Federal Interagency Materials Representatives**
  - DoD, DoE, NSF, NIST, NASA
- **Extensive interaction w/ NNI and MGI**
- **National Academies**
  - National Materials and Manufacturing Board - Defense Materials, Manufacturing, and Infrastructure (DMMI) – facilitate workshop
- **International footprint thru TTCP, NATO, ……**
- **Intelligence Community- Structures and Materials Intelligence Seminar (SMIS) 2017 – April 2017**

Example Success Stories

Airfield Recovery After Attack

Rapid Airfield Damage Repair (RADR) Technical Challenges
AFCEC, AFRL, USACE ERDC, NAVAIR

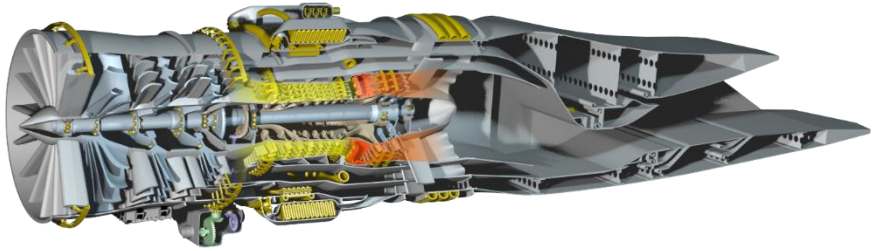
- **Technologies**
  - New airfield repair materials
    - Flowable fill backfill – Hours to Minutes
    - Rapid setting concrete – Days to Hours
  - Specialized and multi-use repair vehicles
  - Scalable matting solution for cargo/fighter
  - Command & Control Training Simulator
  - Sustainment Pavement Repair (SuPR) Kit
  - Optimized Tactics, Techniques, & Procedures
  - Developed Geospatial Solutions for Damage Management
- **Transition**
  - CRATR JCTD to AFCENT/PACAF/Silver Flag
  - SuPR Kit in WRM


19 products ranging from vehicle/materiel/equipment to guidance

High Temperature Composite Materials for Advanced Turbine Engines

Air Force, Navy

- **Purpose**
  - Air Force and Navy working jointly to mature high temperature composites to enable efficiency, range, and loiter goals for future advanced turbine engines
- **Technologies:**
  - 2700°F ceramic matrix composites (CMCs)
    - HPT Vane
  - 625°F polymer matrix composites (PMCs)
    - Fan Duct



ADAPT
Air Dominance Adaptive Propulsion Technology

VCAT
Variable Cycle Advanced Technology