

America Makes Overview

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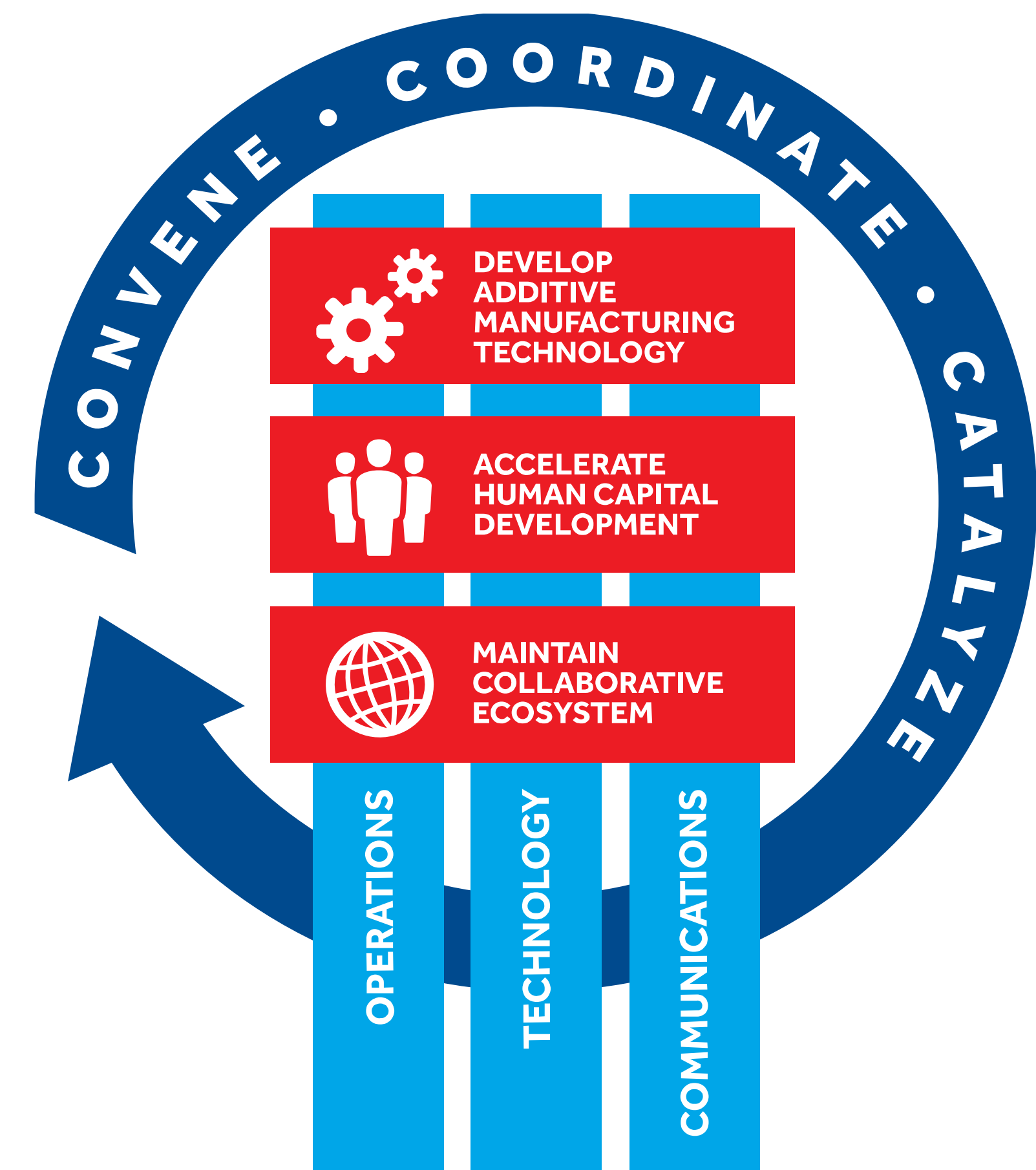
America Makes Overview

The three core activities of the Institute are:

- **Develop Additive Manufacturing Technology:**
Projects, Innovation, Technology Transfer, Implementation
- **Accelerate Human Capital Development:**
Workforce, Education, Training, Outreach
- **Maintain Collaborative Ecosystem:**
Government, Membership, Community

These focus areas are enabled by:

- **Operations:** Run by a not-for-profit organization with a lean and collaborative structure
- **Technology:** A dynamic advanced manufacturing technology including the core AM technologies as well as supporting technologies like the digital thread, standards, etc.
- **Communications:** Spreading the word to government, members, stakeholders, community



Who we are



Public / Private Partnership

America Makes has substantial federal investment, private industry and academic investment.

Multi-Agency Collaboration

Partnership between industry, government and universities, led by the Defense-wide Manufacturing S&T team.

Membership

Innovation facility in Youngstown, Ohio with more than 225 members. We continue to grow.

Operations

We are operated by the National Center for Defense Manufacturing & Machining (NCDMM)

Air Force Research Laboratory
NASA
National Institute of Standards and Technology (NIST)
National Science Foundation (NSF)
U.S. Department of Commerce
U.S. Department of Defense
U.S. Department of Education
U.S. Department of Energy
3D Systems Corporation
AlphaStar Corporation
ANSYS, Inc.
Autodesk
Boeing Company
Carnegie Mellon University
Deloitte Consulting, LLC
EOS North America
General Electric
IBM
Johnson & Johnson
Lockheed Martin
Meggitt Aircraft Braking Systems
North Carolina State University
Northrop Grumman
Optonic Inc.
Raytheon
Siemens Corporation
Stratasys Inc.
Texas A&M Engineering Experiment Station
The Lanterman Group
United Technologies Corporation
University of Dayton Research Institute
University of Northern Iowa
University of Texas at El Paso
Wohlers Associates, Inc.
Youngstown State University
Gold
3DSIM, LLC
Advanced Machining LLC
Air Force Sustainment Center, United States Air

Force
American Foundry Society
Argonne National Laboratory
ASME
CalRAM
Case Western Reserve University
Concurrent Technologies Corporation
Consolidated Nuclear Security, LLC; Pantex Plant/Y-12 National Security Complex
Dassault Systems
SolidWorks Corporation
EWI
Federal Aviation Administration (FAA)
Ford Motor Company
General Motors
Hitachi Metals America, Ltd.
Hoegans Corporation
Honeywell International Inc.
HP, Inc.
Jet Propulsion Laboratory
Lawrence Livermore Lab
Lincoln Electric Company
Los Alamos National Laboratory
MAGNET
MIT Lincoln Lab
MITRE Corporation
MSC Software Corporation
National Energy Technology Laboratory (NETL)
NNSA's National Security Campus
North American Die Cast Association (NADCA)
Oak Ridge National Laboratory
Oberg Industries, Inc.
Oerlikon AM US
Pennsylvania State University (ARL)
Product Development & Analysis (PDA) LLC
Product Manager Soldier Clothing and Individual Equipment
Robert C. Byrd Institute (RCBI)

Rolls-Royce Corporation
rp+m – Rapid Prototype & Manufacturing
Sandia National Laboratories
Senvol
Sigma Labs
SME
Stratim
Tobyhans Depot
U.S. Food & Drug Administration (FDA)
University of Notre Dame
University of Pittsburgh
Youngstown Business Incubator
Silver
3Degrees, LLC
3Diligent
3M
3rd Dimension Industrial 3D Printing
AAK Consulting
Addaero Manufacturing
Advanced Graphics
Advanced Methods in Innovation
Aerospace Corporation
Aerotech, Inc.
Aleph Objects, Inc.
All Points Additive
Allegheny Technologies Incorporated
Amastan Technologies, Inc.
American Additive Manufacturing, LLC
AMT – The Association For Manufacturing Technology
APEX CNC Swiss, Inc.
Applied Optimization Inc.
Applied Systems and Technology Transfer, Inc. (AST2)
Arconic
Arizona State University
ASM International
ASTM International
Atlas 3D
Authentise, Inc.
Axsun Technologies, Inc.
BAE Systems
Baker Hughes Oilfield

Operations, Inc.
The Barnes Group Advisors
Binghamton University
Boardman Molded Products
Bush Consulting Group, LLC
Carpenter Technology Corporation
Carnegie Mellon University
Chromatic 3D Materials, Inc.
Cleveland State University
Commonwealth Center for Advanced Manufacturing (CCAM)
Connecticut Center for Advanced Technology, Inc.
Corning Incorporated
Cummins, Inc.
Cuyahoga Community College
Danko Arlington
DANTE Solutions, Inc.
Defense & Energy Systems, LLC
Dunwoody Manufacturing Company
DVIRC
Eaton Corporation
Elevate Systems
EPRI-Electric Power Research Institute
ExOne Company
Exova, Inc.
Extrude Hone, LLC
Fab Lab Hub, LLC
Fathom
Florida Turbine Technologies, Inc.
Formalloy
Formlabs, Inc.
Galorath Incorporated
Georgia Tech Research Corporation
Greenleaf Corporation
Grid Logic Incorporated
H.C. Starck Surface Technologies and Ceramic Powders
Harris Corporation
HoneyPoint3D
Humtown Products
Hybrid Manufacturing Technologies

IC3D Printers
Identify3D Inc.
Illinois Tool Works
Impossible Objects
Incodema 3D, LLC
Indiana University
International TechneGroup Incorporated (ITI)
Kennametal
Konica Minolta Laboratory USA, Inc.
LAI International, Inc.
Lorain County Community College
Louisiana State University
M-7 Technologies
Macy Consulting, Inc.
Made In Space, Inc.
Materials Sciences Corporation
MatterHackers, Inc.
Mississippi State University
Missouri University of Science and Technology
Moog, Inc.
MTS Systems Corporation
NanoCore Technologies
NCMS-National Center for Manufacturing Sciences
North Dakota State University
Northern Illinois University – College of Engineering & Engineering Technology
nTopology
Nucor Corporation
NuVasive, Inc.
Ohio Aerospace Institute
Ohio State University
Ohio University
Openarc, LLC
Oxford Performance Materials
Parker Hannifin Corporation
Phoenix Analysis and Design Technologies, Inc.
PieceMaker Technologies, Inc.
Product Evaluation Systems Inc.
Quaker City Casting
Rapid Applications Group LLC
Rapid Directions, Inc.

re:3D
Robert Morris University
Rockwell Collins
SABIC
Southern University and A&M College
Southwest Research Institute
Strangpresse, LLC
Team NEO
Techmer PM
TechSolve
The Technology House
Theken Companies, LLC
Thomas P. Miller and Associates
Toyota Motor Engineering & Manufacturing North America, Inc.
Trans Machine Additive
Triad Production Group
UES, Inc.
UL (Underwriters Laboratories)
University of Arkansas
University of Louisville
University of Michigan
University of North Texas
University of Tennessee, Knoxville
University of Texas at Austin
University of Utah
Manufacturing Extension Partnership Center
Utah Advanced Materials and Manufacturing Initiative
Virginia Polytechnic Institute and State University (Virginia Tech)
Western Illinois University-Quad City Manufacturing Lab
Westmoreland County Community College
Westmoreland Mechanical Testing & Research, Inc.
Wichita State University
Wolf Robotics, LLC – A Lincoln Electric Company
Wright State University
Xact Metal
Zodiac Aero Evacuation Systems (ZAES)

Our Partners

SMALL & MEDIUM INDUSTRY

LARGE INDUSTRY

NON-PROFITS

ACADEMIA

GOVERNMENT

Technology Overview

The DoD Modernization Priorities rely on advanced manufacturing – and specifically additive manufacturing – to be fully realized. While some priorities are more developed than others, all will benefit from the advantages and capabilities additive technology delivers.

However, there are a number of challenges which need to be addressed.

ADVANTAGES

Reducing weight while maintaining performance

Creating nearly unlimited design flexibility

Manufacturing direct from digital

Producing parts on-demand

Consolidating part count

Developing new parts and products rapidly

Manufacturing in a variety of materials

CHALLENGES

Intellectual Property / Privacy Issues

Regulatory Uncertainty

Exuberance vs. Natural Evolution and True Potential

Multiple “Voices”

Disconnected Supply Chain / Digital Thread

Qualification and Certification Standards

What We Have Heard – Stakeholder Needs

R&D Projects

Participation from broad, diverse teams and shared risk through cost share

Community Networking

Introduction to new and emerging partners in the supply chain

State of the AM Industry

Keeping pace with a fast moving and innovative technology

Member Resources

Access to knowledge; data; know-how

Business Opportunities

Engaging with new players; complicated “partners”

America Makes Quick Facts

DoD Partnering
Projects

113

DoD Partnering
Projects Complete

78

Total Dollar Value of
DoD Partnering Projects

\$180M

Total America Makes Cost Share
on DoD Partnering Projects

\$95M

IDENTIFY
CHALLENGES

creates

STRATEGIC
INVESTMENTS

drives

PROJECT
MODELS

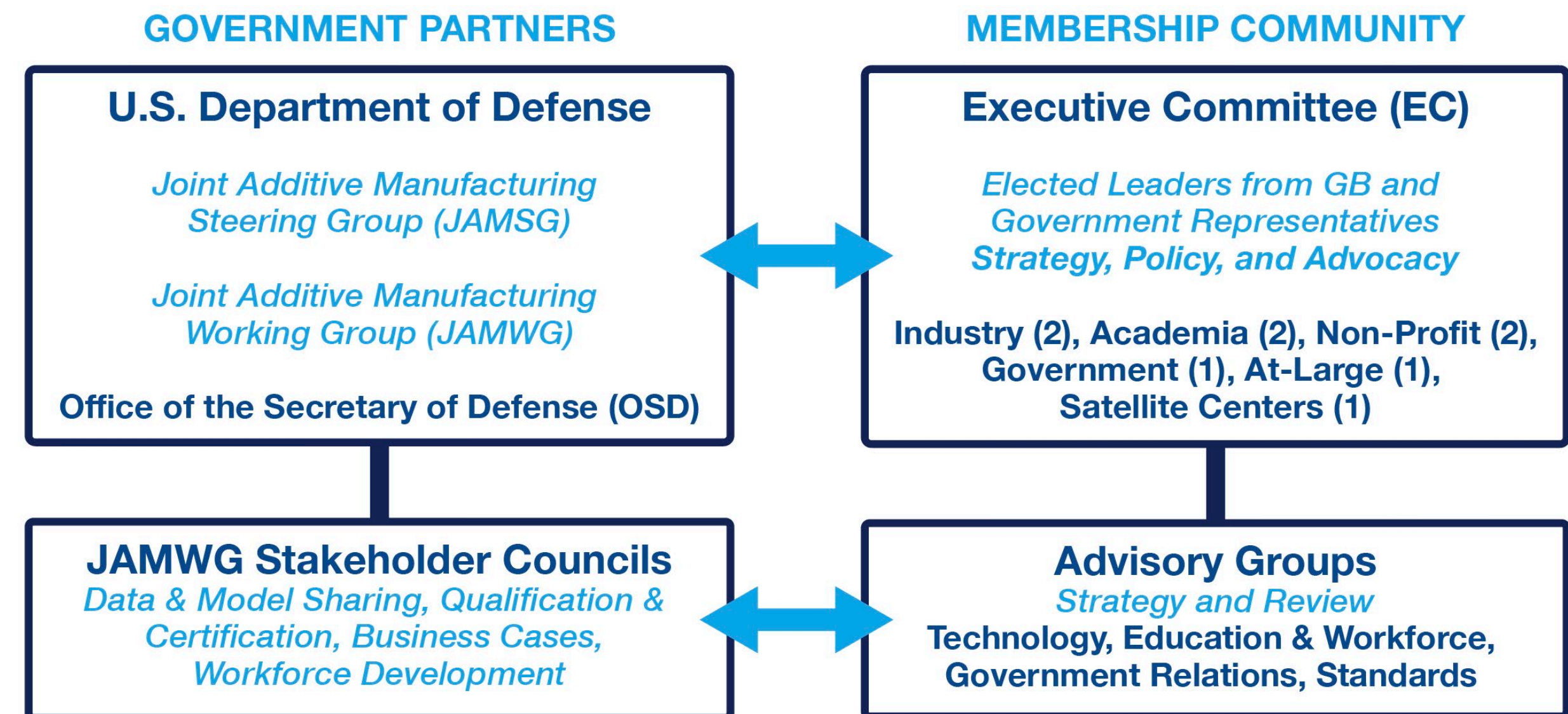
results in

SOLUTIONS

Value Proposition to DoD

America Makes serves as a collaborative environment between the industrial and R&D additive manufacturing community and the high-priority needs of the U.S. Department of Defense.

America Makes convenes industry in a pre-competitive collaborative innovation environment bringing together technical expertise from different organizations to build teams with broader capability beyond that of any single organization to address the specific needs of the DoD. By fostering this collaborative mindset, America Makes accelerates the development and deployment of additive manufacturing solutions to enhance military readiness, strengthen alliances, improving business performance, and overall manufacturing affordability.

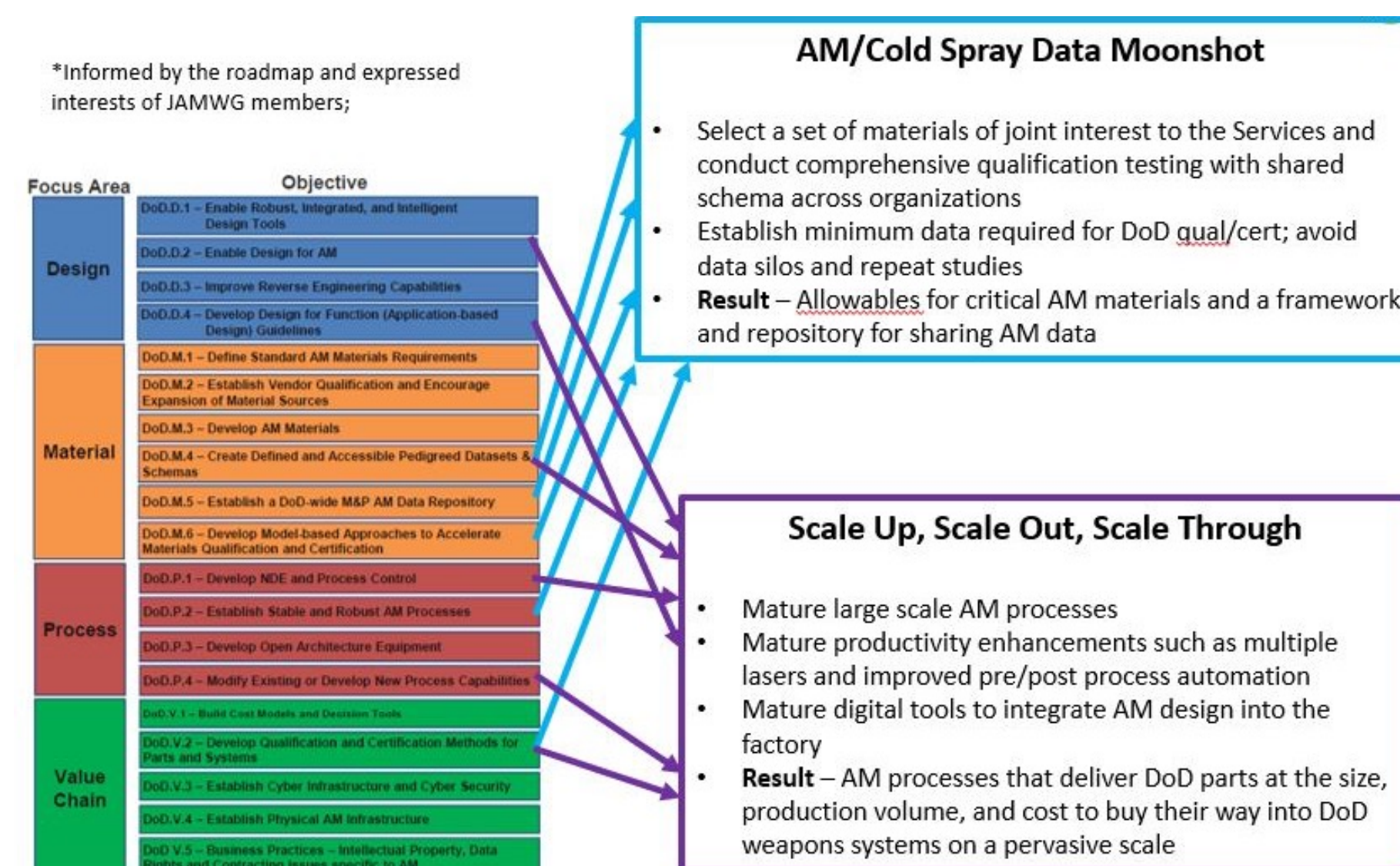


America Makes has been invited to be the strategic industry partner bringing the voice of industry to the OSD-led Joint Additive Manufacturing Working Group (JAMWG) and Joint Additive Manufacturing Steering Group (JAMSG). America Makes also participates in the various stakeholder councils within the JAMWG structure.

Value Proposition to AM Community

America Makes brings the additive community together by convening their events. The America Makes TRX (Technical Review and Exchange) events are two-day events and are held two to three times each year at facilities across the nation to bring the additive technical community together to review project progress and exchange insights and best practices. An annual MMX (Members Meeting and Exchange) event is held bringing together the entire membership of America Makes to stay informed of institute initiatives and projects. America Makes is also a trusted partner in numerous national additive manufacturing industry events.

America Makes catalyzes the AM community with direct funded projects by coordinating agency AM needs and deconflicting opportunities to ensure funding is strategically invested to support national defense. Examples of this coordination include DoD roadmapping alignment efforts and Congressional Interest Items such as MAMLS – Maturation of Advanced Manufacturing for Low-cost Sustainment and ATRQ – Advanced Tools for Rapid Qualification.

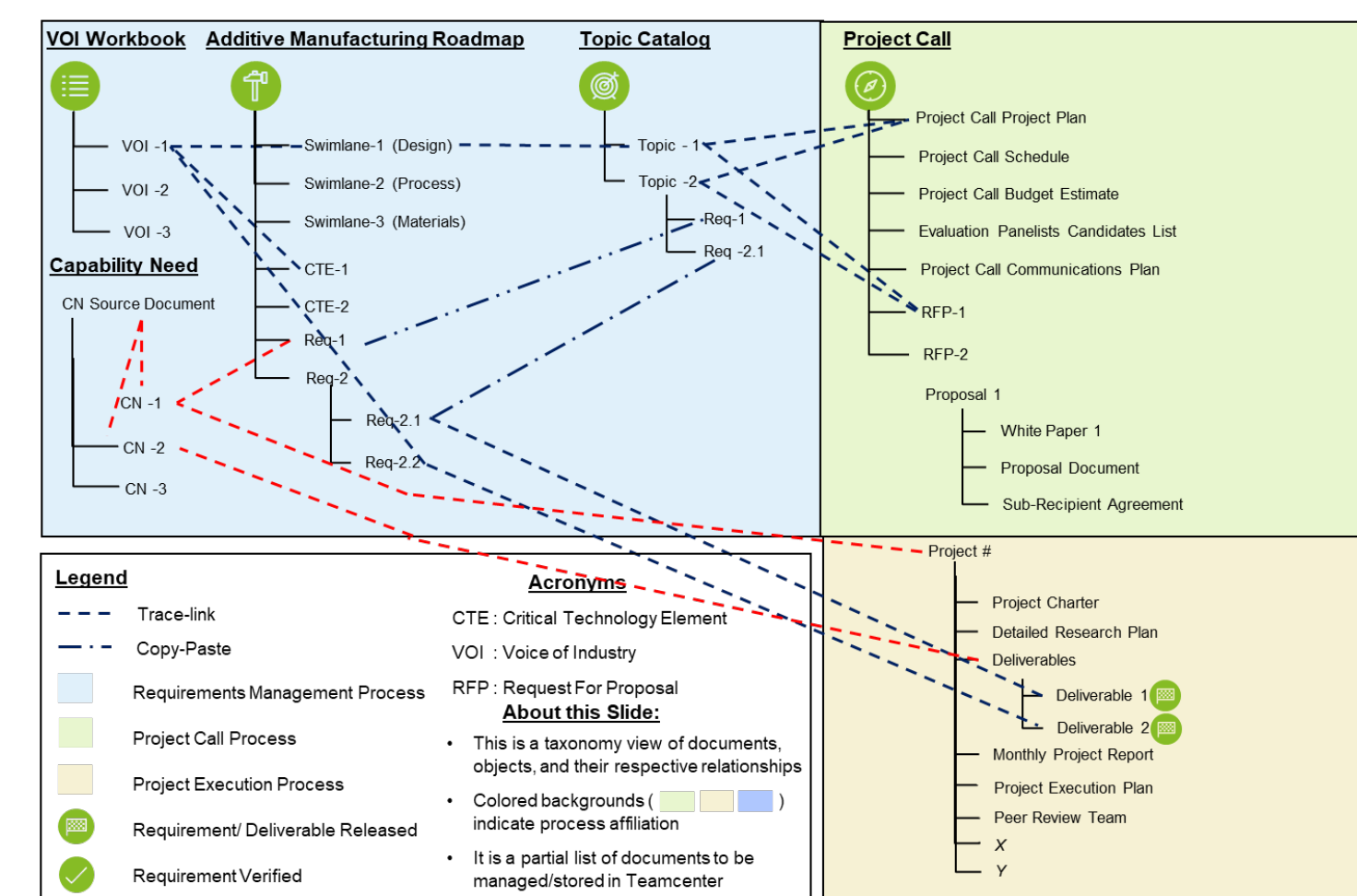


Value Proposition to Industrial Base

America Makes coordinates an environment where competitors and partners across the supply chain work together to collaborate for the advancement of the industry's overall competitiveness. America Makes will support technology development, technology transition and ecosystem development through:

Standards – America Makes and the American National Standards Institute (ANSI) launched the Additive Manufacturing Standards Collaborative (AMSC) in 2016 with the support of OSD. The AMSC was established to coordinate and accelerate the development of industry-wide additive manufacturing standards and specifications. Standards and conformity assessments are key to creating trust in innovative technologies and fostering their widespread acceptance.

Roadmapping – America Makes has spent considerable effort over the past seven years developing and maturing a roadmap development process. The roadmapping process is based on America Makes membership and stakeholder interaction for development, curation, and decomposition activities. America Makes has developed member-driven roadmaps for technology, education and workforce development, and standards. These roadmaps were created to identify measurable and meaningful challenges that, when met, promote inquiry, knowledge-sharing, and advancements across the industry.



Value Proposition to the U.S. Workforce

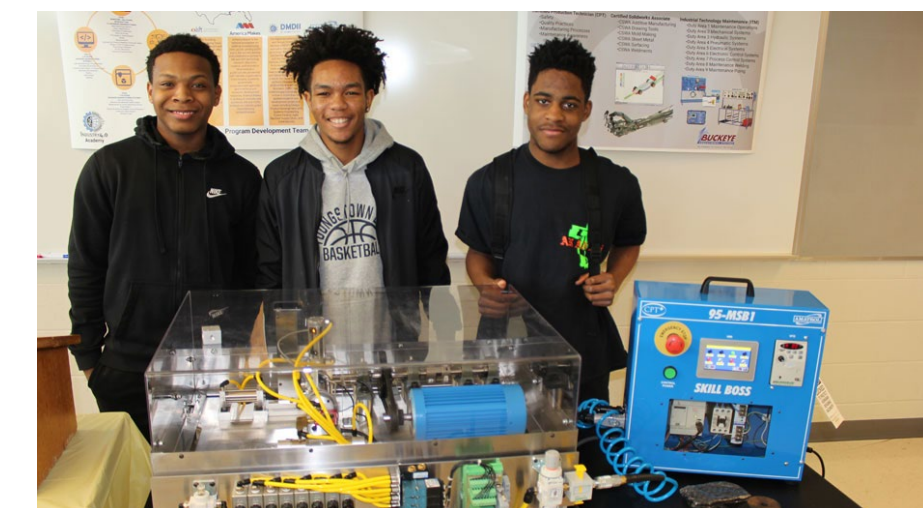
The extensive America Makes portfolio includes education and workforce development programs that cover a broad the spectrum and includes a wide range of activities from outreach in communities to K-12 engagement to post-secondary courses to warfighter training. It also includes an additive training program specifically created for separating veterans, as well as an apprenticeship framework and industry recognized credentials.

As a dynamic partner, America Makes executes projects, builds scale and scope, sets strategy, identifies and creates programs to meet new requirements, and establishes best practices through an advisory committee.



Ongoing efforts in Education and Workforce Development

- Focus in AM, advanced manufacturing and enabling technologies
- Updated Bodies of Knowledge, Competency Models & Assessments for the Manufacturing Technologist & Manufacturing Engineer certification programs (SME/Tooling U-SME)
- Development of elearning classes & instructor-led training classes (SME/Tooling U-SME)
- ACADEMI Expansion – Advanced Curriculum in Additive Design, Engineering and Manufacturing Innovation
- Apprenticeships/Pathways
- Digital Badges
- Training course content development and release
 - Universities
 - Local schools
 - DoD workforce

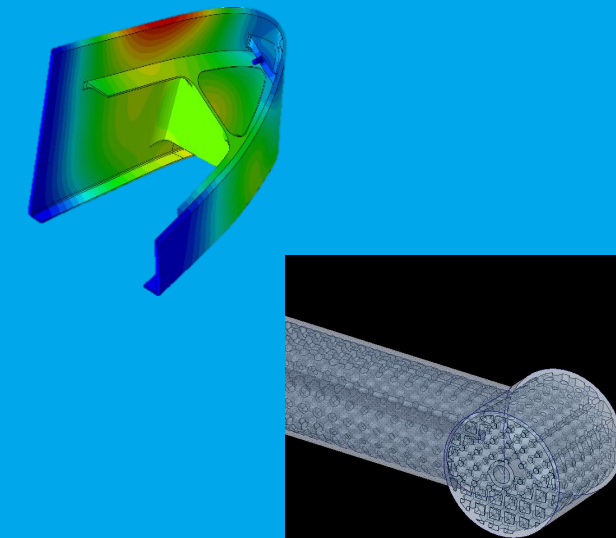


Considerations for Production/Acquisition of AM Products



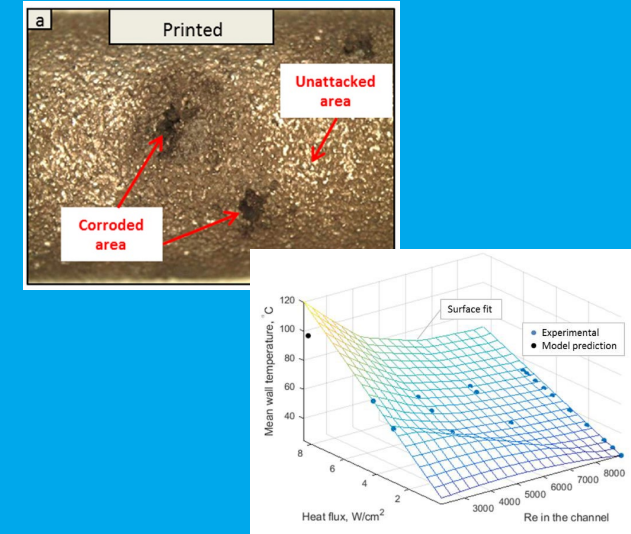
Supply Chain & Sourcing

- Capacity
- Capability
- Technical Resources
- Standards and Specifications
- Quality Control



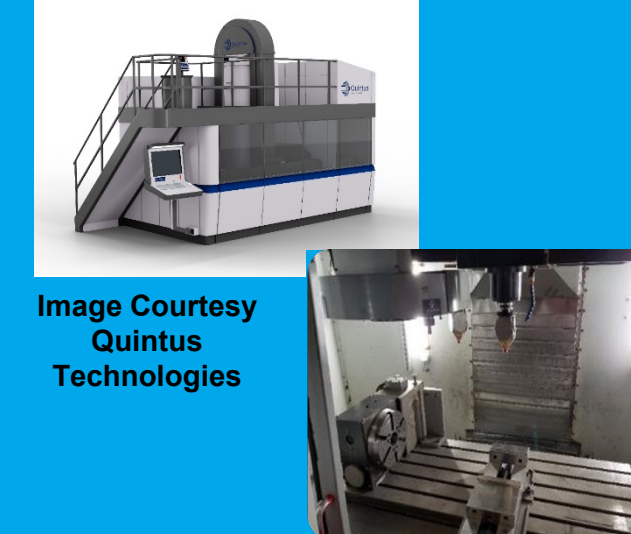
Design

- Design data
- Manufacturability
- DfAM
- Data Management
- Standards and Specifications
- Materials Selection
- Tools/Methods



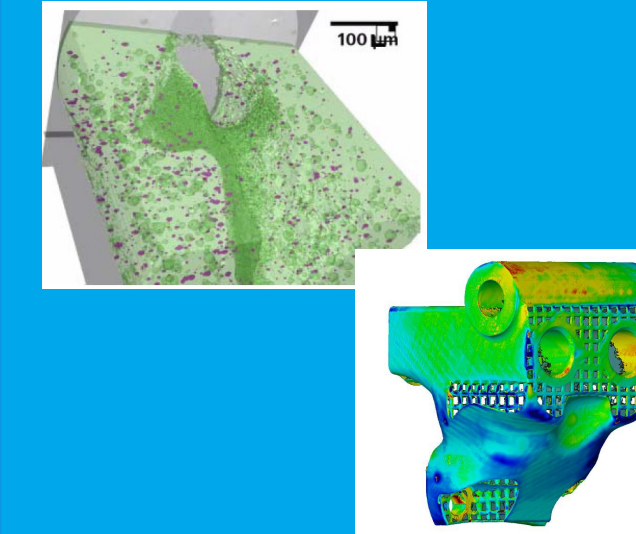
Performance & Durability

- Mechanical properties
- Component/Subsystem behavior
- Environmental Factors
- Standards and Specifications
- Maintenance/Repair



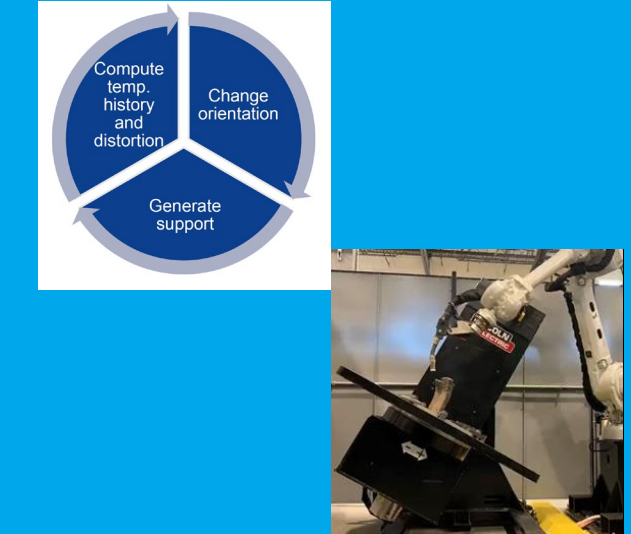
Post-Processing & Finishing

- Heat treatment
- Coating
- Machining
- Polishing
- Joining/Brazing
- Standards and Specifications



Inspection/NDE

- Reasonable criteria
- Inspectability
- Tools/methods
- Standards and Specifications



Cost & Rate

- Complexity
- Cost drivers
- Yield
- Productivity drivers

Establishing an Additive Manufacturing (AM) Infrastructure for the US Army future AM supply chain

- Army Needs Assessment
 - Materials, Designs, Applications
- Initiate digital connectivity
 - Bid and source selection
 - Issue PO
- Technical Requirements and Definition maturation
- Supply chain assessment
- AM manufacturing risk mitigation
- Identify pain points
- Assessment product quality/yield



IMPACT TO THE INDUSTRIAL BASE

America Makes project 3003

Development of a complete materials property database for ULTEM™ 9085 that can be used across industry and within the DoD

- *Improve material understanding and reliability*
- *Reduce variance in applications*
- *Increase uses of this high-performance thermoplastic used in aerospace, automotive and other industries*



ACCOMPLISHMENTS

- Developed parameters and process specifications
- Confirmed reproducible material properties across recognized methods for aerospace grade manufacturing
- Followed NIAR/NCAMP guidelines to generate baseline data

(Above) Brackets 3D printed on the Fortus 900mc Production 3D Printer.
(Photo: Stratasys)

[LINK](#)

(Left) Final, flight-approved, 3D printed ducting for air conditioners. 3D printed in ULTEM™ 9085 resin on the Fortus 450mc
(Photo: Business Wire)

[LINK](#)

IMPACT TO THE DoD

America Makes – Education and Workforce Development

Investment Casting Course for Tinker AFB Personnel

A two-day advanced manufacturing class for Air Force personnel, including civilian and military technicians and engineers on July 30-31, 2019.

Fifty-two personnel attended the training held at a community college near Tinker AFB. Industry professionals affiliated with the Investment Casting Institute (ICI) presented the material.

ACCOMPLISHMENTS

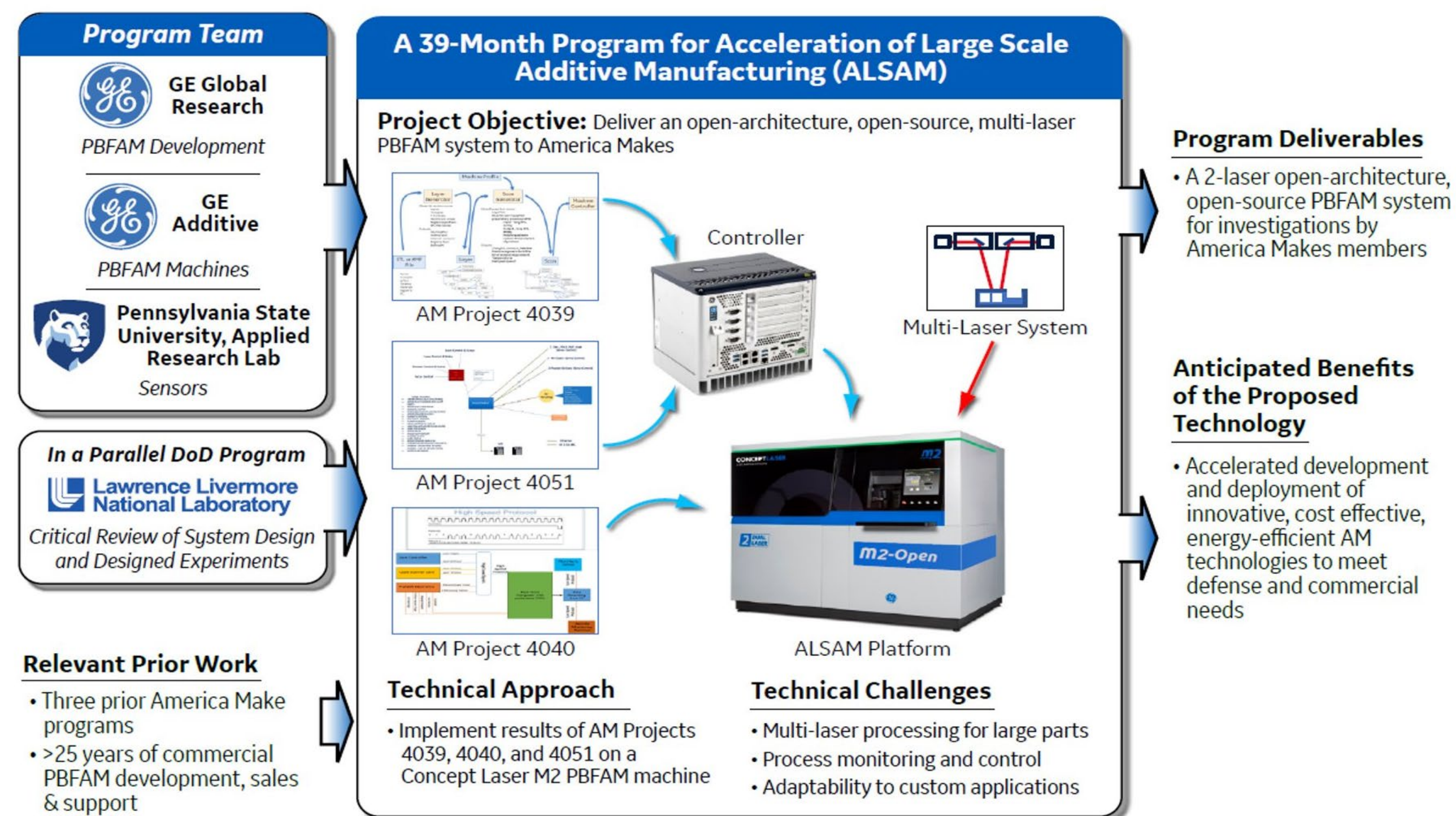
- Improved organic additive manufacturing capability
- knowledge of the advanced domestic supply chain
- On-line access to presentations and best practices
- Government attendees eligible for 16 hours of continuous learning credits.



(Photos: Tinker AFB)

Scaling of AM Capability to Meet Defense Supply Chain Needs

- Multi-contract effort in partnership with USAF
- Addressing challenges supply chain faces today
 - Product quality
 - Certification
 - Repeatability
 - Scalability
- Vision - enable large scale part production
 - Efficient
 - Increased productivity
 - Repeatable
 - Reliable
 - Broad applicability
- Successful demonstration of institute model



Upcoming Events

Virtual Game Day Series Event: The Economics, Opportunities, and Challenges of Designing for AM

July 23 11:30 – 2:30

- <https://www.americamakes.us/events/virtual-game-day-series-event-the-economics-opportunities-and-challenges-of-designing-for-am/>

America Makes Technical Review & Exchange (TRX)

August 4-5 12:00 – 5:00

- <https://www.americamakes.us/trx-osu/>

When America Makes America Works

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