Digital Manufacturing and Design Innovation Institute

Institute Overview
for
The Joint Technology Exchange Group (JTEG)
Model Based Enterprise (MBE) Forum

30 April 2014

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Agenda

- Strategic Overview on Institutes for Manufacturing Innovation (IMIs)

- DMDI Institute Description

Strategic Overview of IMIs

Creating an Innovation Ecosystem

Quote from a CEO: "(you) can't predict when or where innovation happens."

But – we do know key characteristics:

- Close proximity is key

- Design, make, learn cycle – must be quick

- Ecosystem needs all aspects of manufacturing to excel

The Administration's Continuing Focus on Advanced Manufacturing

January 2013

Jan 2014

Feb 2014

June 2011

REPORT TO THE PRESIDENT ON ENSURING AMERICAN LEADERSHIP IN ADVANCED MANUFACTURING

Executive Office of the President
President's Council of Advisors on Science and Technology

JUNE 2011

February 2012

A NATIONAL STRATEGIC PLAN FOR ADVANCED MANUFACTURING

Executive Office of the President
National Science and Technology Council

FEBRUARY 2012

July 2012

REPORT TO THE PRESIDENT ON CAPTURING DOMESTIC COMPETITIVE ADVANTAGE IN ADVANCED MANUFACTURING

Executive Office of the President
President's Council of Advisors on Science and Technology

JULY 2012

January 2013

NATIONAL NETWORK FOR MANUFACTURING INNOVATION: A PRELIMINARY DESIGN

Executive Office of the President
National Science and Technology Council
Advanced Manufacturing National Program Office

JANUARY 2013

Institutes for Manufacturing Innovation (IMIs)

- Leverage effectiveness of regional, public-private partnerships to spur innovation and competitiveness of U.S. manufacturing

- Institutes form the core of the National Network for Manufacturing Innovation (NNMI); key tenets:
  - Scale critical technologies in MRL 4-7 range
  - Self-sustainment objective for each institute

- Administration's NNMI Vision: up to 45 Institutes
  - Seeking Congressional authorization and funding to bring NNMI to full scale
  - Early institutes established via executive authorities, funding

IMIs as an Ecosystem

- Each institute will serve as a regional hub of manufacturing excellence, to:

  - Bring together industry, universities and community colleges, federal agencies, and states

  - Accelerate innovation

  - Invest in industrially relevant manufacturing technologies with broad applications

  - Bridge the gap between basic research and product development

  - Provide shared assets or knowledge to help companies – particularly small manufacturers – access cutting-edge capabilities and equipment

  - Create an unparalleled environment to educate and train students and workers in advanced manufacturing skills

  - Regional impact, national benefits

- Institute Tenets:

  - Led by a non-profit

  - Cost share

  - Shared infrastructure

  - Advanced research

  - Workforce development

  - Governance

  - Sustainability

DoE and DoD-led Institutes

- Established DoD-led and DoE-led Institutes

  - America Makes (Additive Manufacturing)—Established Aug 2012 DoD

  - Next Gen. Power Electronics Manuf. Innovation Institute—Est. Jan 2014 DoE

  - Digital Manufacturing & Design Innovation (DMDI) Institute—Est. Feb 2014 DoD

  - Lightweight & Modern Metals Manufacturing (LM3I) Institute—Est. Feb 2014 DoD

- FY15 Institutes
  - 1 Institute led by DoE
  - 2 Institutes led by DoD

IMI Comparison & Contrast

DMDI Institute

Criteria	NNMI Blueprint (Model)	Pilot Institute America Makes	Agency-Led
Total Federal Funding (Threshold)	$70-120 Million	$30 Million	$70- $75 Million
Self-Sustainability	Within 7 years	Within 3 - 5 years (exercised to 5 years)	Within 5 years (with option to extend to 7 yrs)
Technology Focus Areas	Self-Nominated by Industry	Agency Specified	Agency Specified
Lead Agency	DoC AMNPO requires authorization & appropriation	DoD with existing authorities & funding	DoD & DoE with existing authorities & funding

DMDI Institute Description

Vision of the Institute

- To establish a national institute as a resource to
  - focus on complex issues in manufacturing
  - develop solutions to offset the risk to the industrial base in adopting new technologies
  - improve competitiveness

- Focus on enterprise-wide utilization of the digital thread to
  - enable highly integrated manufacturing and design of complex products
  - reduced cost and time
  - accelerate market place penetration of new products

- Initiate a paradigm shift in the development, production and sustainment of complex systems by accelerating the design to production timeline at reduced costs

Vision of the Institute (2)

- The application of digitally networked and synchronized processes and tools will
  - result in an open and collaborative environment
  - sustain and enhance retention of supply chain knowledge
  - Improve the capability to affordably produce low volume, varying demand, complex systems

- The business of the institute will be
  - the development and execution of opportunities to mature technologies from lab environment or prototype to standard business practices
  - making a step-function improvement in the manufacturing capabilities in the U.S.

- This research activity generally falls within a manufacturing readiness level (MRL) range of 4 to 7.

Core Technical Area Interrelationships

- Digital manufacturing and design innovation includes a wide variety of concepts, theories, components and processes

- The Institute will facilitate the *maturation and integration* of three core technology areas:
  - Advanced Manufacturing Enterprise
  - Intelligent Machines
  - Advanced Analysis

- It is the integration of these technologies from which the dramatic improvements in manufacturing competitiveness will occur

DMDI Institute Overview

Lead: **uILABS**

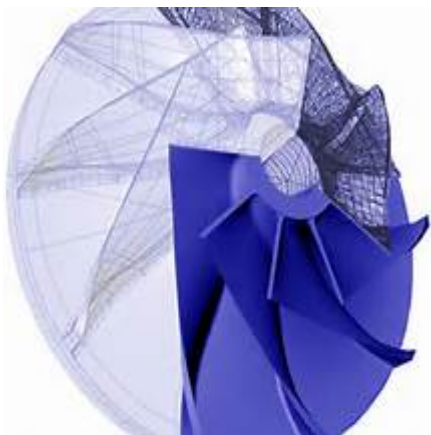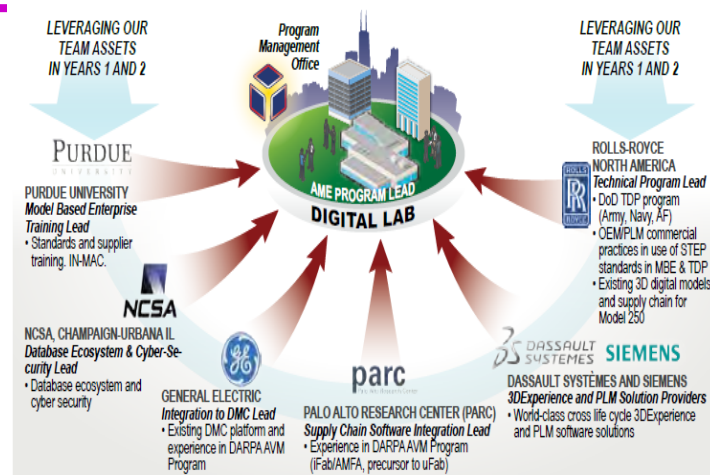**Hub location:**

Chicago, Illinois

42 Companies

23 University and Labs

9 Other Organizations

President Barack Obama announces the DMDI Institute, 25 February 2014.
(Official White House Photo by Pete Souza)

Mission: Establish a state-of-the-art proving ground for digital manufacturing and design that links IT tools, standards, models, sensors, controls, practices and skills, and transition these tools to the U.S. design & manufacturing industrial base for full-scale application

Over 3:1 Industry Cost Share

DMDI Institute Overview

- DMDI Institute
  - Lead: UI LABS (hub location: Chicago, IL)
  - 42 companies, 23 universities & labs, 9 other organizations
  - Multiple states represented including IL, MO, FL, NY, OH, MD, IA, IN, CO, TX, MI, OR, MA, WA, KT, NE, WI, among others

- Total cost share contribution: Cooperative Agreement = $105M
  - UI LABS announced a total of $250M
  - Total cash contributions - $56M
  - Total in-kind contributions - $194M

- Breakout by source
  - Industry - $80M
  - Academia - $120M
  - State/Local Government and Other - $50M

Digital Manufacturing and Design Innovation Institute

DMDII Membership Locations by State
(As of 4/1/14)

Academic   Government   Industry   Community

DMDII Next Steps

90 day major milestones:

- "The Framework"
- Personnel and Staffing
- Finalizing Key Documents/Plans
- Membership and Benefits
- Metrics
- Intellectual Property
- Technical Strategy Development
- Project Models
- Governance
- Kick-offs and Opening of Hubs/HQs
- Communication and Digital Estate / Website / Knowledgebase
- Sustainability
- Cost Share

First 90 days are critical

- Critical time to lay the foundation of the institute

- These are not in chronological order

- Some depend on or affect the others

Questions?

Joint Defense Manufacturing Technology Panel

Advanced Manufacturing Enterprise Sub Panel

Dr. Greg Harris, P.E.
AME Sub Panel Chair
U.S. Army RDECOM, AMRDEC
30 April 2014

https://www.dodmantech.com

AME Taxonomy

AME is a set of manufacturing strategies & integrated capabilities that enable productivity growth and a highly connected & collaborative enterprise

- **_Model-Based Enterprise_** – Build a *digital thread* of high value data and models; drive a continuous flow of integrated design, analysis, and manufacturing information throughout the product/system life cycle.

- **_Network Centric Manufacturing_** – Connect the enterprise to enable seamless interoperability of data and processes across company and organizational boundaries.

- **_Intelligent Manufacturing Planning & Execution_** – Create an agile factory floor with *adaptive* manufacturing capabilities that enable rapid response to the warfighter.

- **_Industrial Base & Infrastructure Readiness_** – Support initiatives and policies to ensure manufacturing infrastructure and workforce health and U.S. mfg superiority

AME Sub Panel Membership

Army Primary Representative - Chair
Navy Primary Representative
Air Force Primary Representative
DLA Primary Representative
MDA Primary Representative
Army Alternate Representative
Navy Alternate Representative
Air Force Alternate Representative
DLA Alternate Representative
AME SP Secretariat – Support Contractor
Government Ex-Officio
Industry Ex-Officio
Academic Ex-Officio

Ex-Officio Membership

- Reviewing current membership and roles

- Working to make participation in the Subpanel value-added for the time investment of the Subpanel and Subpanel members

- Evaluating and clarifying expectations for ex-officio members
  - Reporting AME activities with org they represent
  - Participation in Portfolio Review
  - Sub Panel Working Group Participation

Sub Panel Engagement

- Monthly call

- Portfolio Review
  - In the Fall
  - Type A Projects solicited
  - Outside speakers to talk about happenings in the TRL 1-3 realm to identify technologies of interest one or two years down the road

- Participation with Common Topic working Groups
  - Additive Manufacturing

MBE Related Events

Meeting Title	Subject Matter	Start Date	Duration	Location	DoD Sponsored	Priority (H, M, L)	Restricted Meeting or Invitational
LOTAR/CAx-IF Meeting		3-7 Mar 14	4	Gaithersburg, MD	N	M	Y
PDES WG and TAC Mtg	MBE/Standards	10-14 Mar 14	5	Gaithersburg, MD	N	H	N
NSF eDesign	MBE	1-3 Apr.14	3	Cleveland, OH	N	H	Y
MT Connect Conference	Interoperability and Networking	7-10 Apr.14	4	Orland, FL	N	H	N
ASME 14 series	Standards	28 Apr-02May 14	4	Tampa, FL	N	M	N
NCMS - Depot Maintenance Model-Based Enterprise Forum	MBE	29-30 Apr 14	2	Virtual	N	H	N
AIA Product Support	Standards	5-9 May 14	5	Clearwater, FL	N	H/M	N
CIC 2014	Interoperability for CAD and PLM	27-30 May 14	3	Colorado Springs, CO	N	H	N
PLM World	Siemen's User Training	16-19June14	3	Orlando, FL	N	M	N
PTC Live	PTC User Conference	15-18June14	3	Boston, MA	N	M	N
CMSC (Coordinate measurement)	Scanning and reverse engineering	21-25July14	4	Charleston, SC	N	H	N
LOTAR/CAx-IF Meeting	STEP Std WG meetings	15-19Sep 14	4	Charleston, SC	N	M	N
PDES, Inc. Offsite	TAC Mtgs	18-19Sep14	2	Charleston, SC	N	H	Y
GPDIS2014	MBE Interoperability	8-11Sep.14	3	Arizona	N	M	Y
DMC2014	MBE	1-4Dec14	4	San Antonio, TX	N	H	Y
Autodesk University	Autodesk User Training	2-5Dec. 14	4	Las Vegas, Nv	N	M	N
MBE/DMDII Summit	MBE	16-18 Dec.14	3	Gaithersburg, MD	N	H	N

Subpanel Working Groups

- **Suggested Working Groups**
  - Co-Chairs (1 Gov't & 1 Industry or Academia)
  - Working Groups (Not Final)
    - Institutes
    - Strategic Planning Review/Road Mapping
    - Gaps & Trends in AME
    - AME Website Content
    - DMC & MBE Summit (with DMDII) Planning
    - AME Projects/Portfolio Review Planning

Road Mapping & Planning

- Engage with other entities to identify gaps, trends and significant topics to further define the AME space
  - AMP 2.0
  - NDIA
  - Engineered Resilient Systems
  - OSD Systems Engineering
  - DLA MBE Road Map
  - DMDI Institute Technology Road Map
  - 6-1, 6-2 research to identify early technologies of interest
- Use this information to
  - Inform Joint Technology Pursuit Areas
  - Develop Type A projects
  - Encourage collaboration

DMC & MBE Summit Planning

- Reviewed last year's conference
- Session overlap and coordination
- AME topics are very popular and appear in other sessions
  - Conflicts in timing and topic areas diluted attendance
- Promotion of sessions

- Working group to lead this for the sub-panel
  - Attempting to coordinate co-chairs with the groups where we had duplication in topics
  - De-conflict sessions
- Work with DMDII and NIST in the organization and operation of the 2014 MBE Summit

Emerging Trends & Forces

- DMDI Institute, America Makes, LM3I Institute
  - Subpanel engagement (multiple touch points)
  - Stepping forward to engage

- Digital Thread/Tapestry
  - Links with other entities working in this domain
  - Engagement with industry (OEMs, institutes, standards orgs, etc.)

- Supply Networks
  - Risk management – a requirement WIDELY cited
  - Desire for visibility versus expanding reach of networks
  - Huge potential for "enterprise social networks"

- Intelligent Manufacturing – adaptive machining
  - Actionable intelligence – 'live' process data influencing downstream operations
  - Digital work instructions – multiple formats, multiple environments, digital thread basis
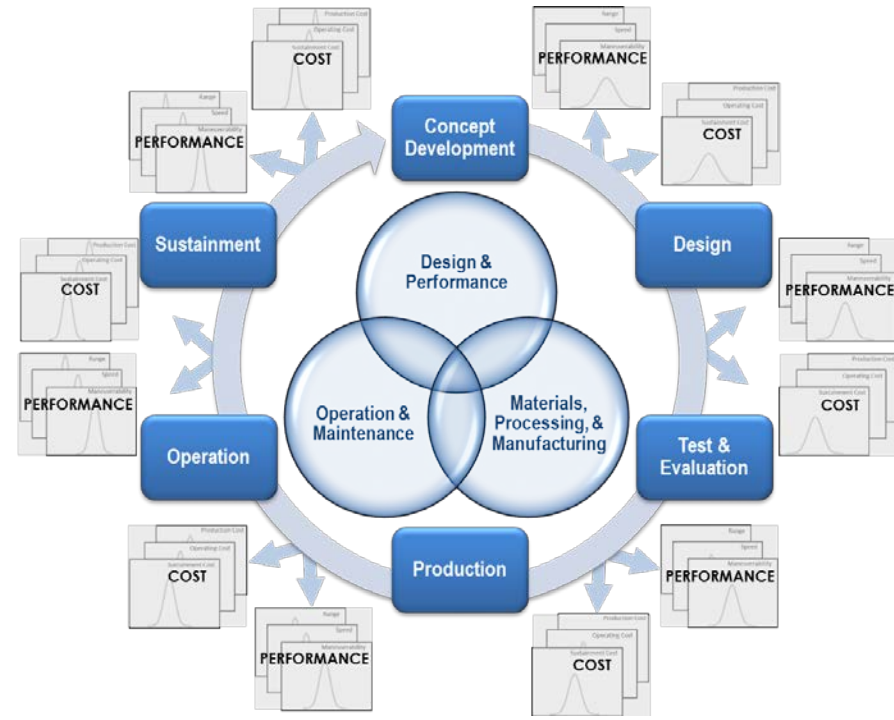
Challenging Topics
(1) Tech Data
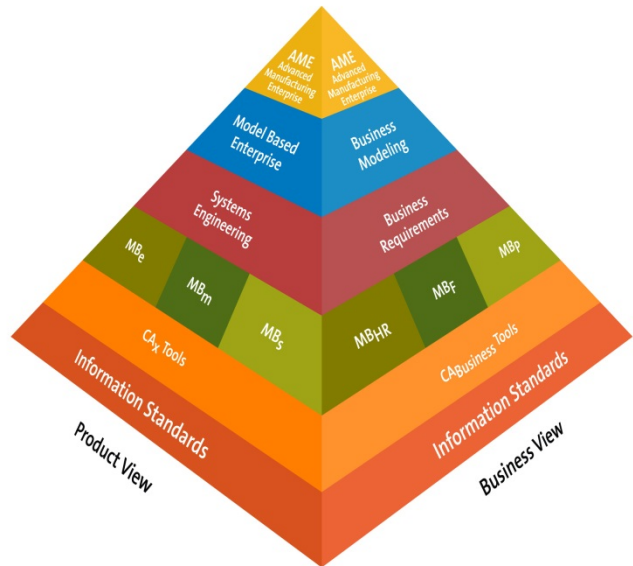
– Govt readiness for 3D data
- Contracting for it (and validation)
- Receiving/analyzing/storing

- Govt readiness for Digital Thread
  - Architecture
  - Contracting for new types of data
    – and paying for it
  - Storage / utilization

Challenging Topics
(2) Business case

- Good initial data from Customer-Supplier Interoperability project
- Much to build around inefficiencies in info management
- Opportunity with future DoD Programs to build comprehensive case

Magnitude of Costs That Could be Avoided by AME Practices: A Comparison of Industry Studies			
Industry	Reported Potential Cost Avoidance for This Industry	Cost Avoidance as Applied to Each $100B of Defense Acquisition	Cost Avoidance if AME Were in Place at Inception of Current 98 Major Weapon System Programs
U.S. Automotive (Inadequate Interoperability)	$1.05B costs on $288.7 revenues = 0.364 % of revenues	$364 million	$4.4 billion
U.S Automotive (Inadequate Infrastructure for Supply Chain Integration)	1.25% of shipments	$1.25 billion	$15.2 billion
U.S. Electronics (Inadequate Infrastructure for Supply Chain Integration)	1.22% of shipments	$1.22 billion	$14.9 billion
U.S. Industrial Facilities Construction	$15.8B costs on $374B revenues = 4.2% of revenues	$4.20 billion	$51 billion
Process Manufacturing (Petroleum, Chemical Pharmaceutical)	Improve overall operating efficiency by at least 10%	$7.30 billion	$89 billion

Challenging Topics
(3) Sourcing; (4) Cyber security

- ## Parts support for the warfighter
  - Connecting American Mfg – showed us how far we still have to go
  - Reverse Engineering technologies and practices
  - ManTech role in this space

- ## Cyber Physical Security assessment…What is the role for ManTech??
  - Digital thread "value" proportional to cyber risk
  - Supply *network* management – international; on-line
  - Increased human-machine complexity

Joint Technology Pursuit Areas

1. Development and Implementation of Improved 3D Technical data Packages (I-3DTDP)

2. Enhance Interoperability

3. Develop Tools to Enable Better Designs

4. Tools & Methods for Intelligent Manufacturing

5. Supply Network Integration and Management

MBE Team

- The informal group of MBE SMEs associated with the AME Subpanel, and others in the home organizations of the members are being recognized by those in weapon system development as desirable resources

- We are consider some type of formal recognition with a structure for the MBE team

Engaging the Institutes

- Are the institutes and ManTech the same thing or different?
  - They are not "the same" or "different" and they do not have to be.
  - The two organizations should not be funding the same work on the same issue at the same time, but the organizations are both focusing on the broad issues of the efficient and effective design and management of the system realization strategies and operations that produce systems of interest.
  - The two efforts should be complimentary.

- ManTech focuses on the issues in the Defense Industrial Base (DIB) to develop solutions demonstrated in the DoD environment.
  - These solutions might also be solutions that other enterprises can employ but there is no real effort made to ensure the solution is introduced outside of DoD.

Engaging the Institutes

- Although there are similarities between the needs of the DIB and the Commercial Industrial Base (CIB), the fact is that DoD systems are a special subset of the CIB.

- DoD systems are typically low volume complex system production runs. The CIB includes the DoD special case but also is concerned with the high volume, mass customization strategies that tend to dominate today's market place.

- There are many instances in which the institutes and ManTech will need to invest into applied research in their own domains, but there is great need to be collaborative and engaged with the other organization.

AME SP Interaction with Institutes

- The bottom line is that ManTech and the Institutes will partner "where it makes sense"

- Interaction and engagement are accomplished through common interactions between those individuals participating with each organization.

- There are four main areas in which the AME SP can interact with the DMDII (and other Institutes):

    – Strategic Alignment

    – Joint Projects

    – Customer / Supplier Relationship

    – Transition Partner

Questions?

Thank you for your time!