MGI In Advanced Manufacturing

MGI PI Meeting
12 January 2016

Megan Brewster, PhD
Senior Policy Advisor for Advanced Manufacturing, ORISE Fellow
Office of Science and Technology Policy

1

Take-Aways

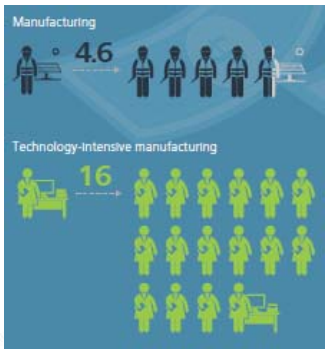
- National Network for Manufacturing Innovation
  - Manufacturing punches above its weight
  - There's innovation in manufacturing
  - 7 Manufacturing Innovation Institutes so far
- How MGI PIs can get involved with the Institutes
  - Participate in Requests for Information, workshops, etc.
  - Become an Institute member
  - Submit a project proposal
  - Volunteer to serve on a review panel
- How MGI PIs can get involved with advanced manufacturing generally
  - Let manufacturing challenges inspire your work
  - Participate in MForesight, an independent think tank
  - Many technical topics remain for engagement

2

Manufacturing Punches Above Its Weight

- Manufacturing: making something that can be "dropped on your foot"
- Advanced Manufacturing: when technology gives competitive advantage
- Manufacturing has the greatest multiplier effect: every $1 in manufacturing value added, $1.40 in additional value is created in other sectors (2016)
- Manufacturing has one of the highest job multiplier effects

Bureau of Economic Analysis



Deloitte/Council on Competitiveness

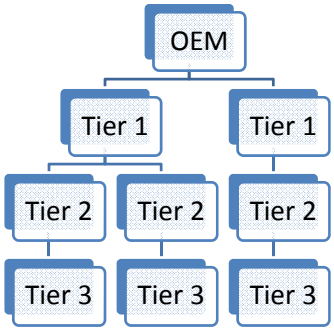
There's Innovation In Manufacturing

Then-1980s

Ford River Rouge Complex (1920s)

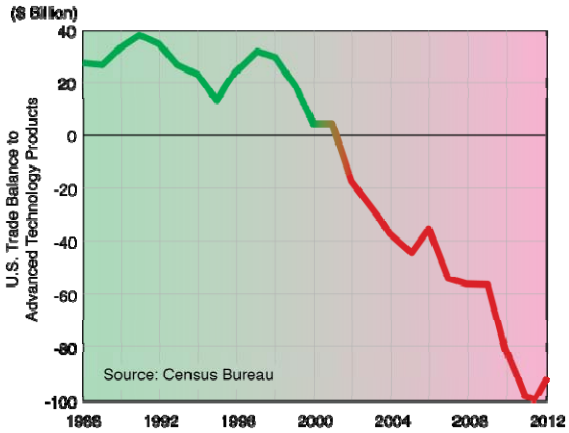
Library of Congress

1980s-Now



There's Innovation In Manufacturing

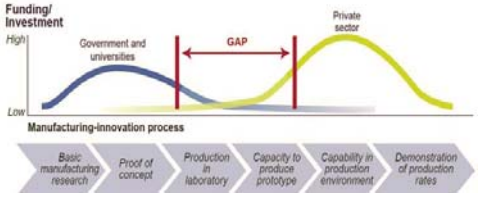
Shutterstock



There's Innovation In Manufacturing

President's Council of Advisors on Science and Technology

Market Failure in Pre-Competitive Applied Manufacturing R&D



National Network for Manufacturing Innovation creates the space for industry and academia to work on industry-relevant problems

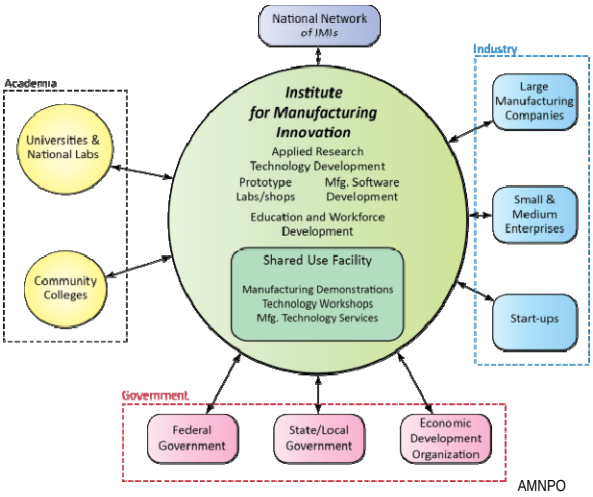
- Addresses the market failure of industry underinvestment in "pre-competitive" applied R&D
- Focuses on "de-risking" new technologies and materials to scale-up for U.S. manufacturers

6

7 Manufacturing Innovation Institutes So Far

Each institute has:

1) Clear, unique institute focus
2) Clear industry value proposition
3) Strong Partnerships
4) Ability to address critical challenges
5) A balanced portfolio of projects



AMNPO

Partnership: *Industry – Academia – Government*

Working better, together to create transformational technologies and build new products and industries

7 Manufacturing Innovation Institutes So Far

- Over $500M Federal funding catalyzed over $1,214M from consortia
- Institutes have attracted hundreds of companies and universities as active partners from across the country

Three more under way…

Fibers and Textiles | *Smart Mfg.* | *Topic TBA*

8

1st Institute: America Makes

National Additive Mfg Innov. Institute; Youngstown, OH

Prime Awardee: National Center for Defense Manufacturing and Machining

- Initial $30M federal investment matched by $50M industry, state/local*
- Strong leveraging of equipment, existing resources
- Strong business development
- Tiered membership-based model, low cost to small business and nonprofits

- **OVER 100 Participating partners!**

51

2nd Institute: PowerAmerica

Next Generation Power Electronics; Raleigh, NC

$70M public investment, $70M match

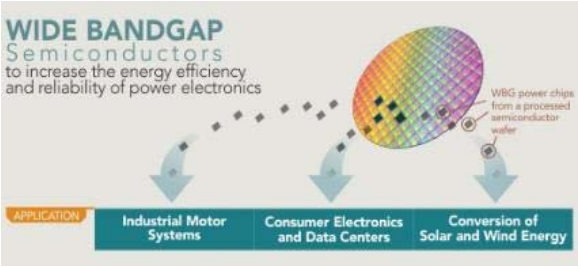
Lead: North Carolina State University

Hub Location: Research Triangle Park, NC

- **17 Industry Partners**
- **5 Universities**
- **3 Labs and Other Organizations**

Mission: Develop advanced manufacturing processes that will enable large-scale production of wide bandgap semiconductors, which allow power electronics components to be smaller, faster and more efficient than silicon.

Poised to revolutionize the energy efficiency of power control and conversion



10

3rd Institute: DMDII

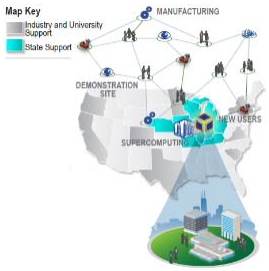
Digital Manufacturing & Design Innovation; Chicago, IL

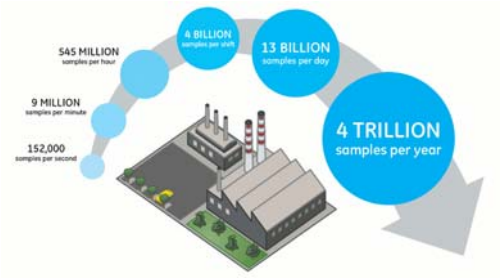
$70M public investment, ~$110M match

Lead: UI Labs

Hub location: Chicago, Illinois

- **41 Companies**
- **23 Universities and Labs**
- **9 Other Organizations**





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

11

4th Institute: LIFT

Lightweight Innov. For Tomorrow; Detroit, MI

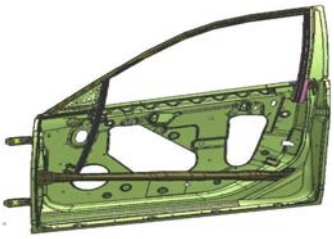
$70M public investment, $70M match

Lead: EWI

Hub location: Detroit, Michigan

Regional location: I-75 Corridor

- **34 Industry Partners**
- **9 Universities and Labs**
- **17 Other Organizations**



Mission: Provide the National focus on expanding US competitiveness and innovation , and facilitating the transition of these capabilities and new technologies to the industrial base for full-scale application.

Positioned to expand the US Industrial base for new products and technologies for commercial and USG demands that utilize new, lightweight high-performing metals

54

5th Institute: IACMI

Inst. For Adv. Composites Mfg. Innov.; Knoxville, TN

$70M Federal investment and more than $180 Non-Federal investment over five years

Objective

Develop and demonstrate innovative technologies that will, within 10 years, make game-changing advanced fiber-reinforced polymer composites. The Institute's negotiation is led by University of Tennessee-Knoxville. The full team includes: *57 Companies, 15 Universities and Laboratories, 14 Other Entities, w/ 36 Consortia Members.*

50% Lower cost

Using 75% Less Energy

And reuse or recycle >95% of the material

Application	Estimated Current CFC Cost	Institute CFC Cost Reduction Target (2018)[88]	CFC Ultimate Cost Target (2024)	CFC Tensile Strength	CFC Stiffness	Production Volume Cycle Time
Vehicles (Body Structures)	$26-33/kg	>35%	<$11/kg by 2025 ~60%	0.85GPa (123ksi)	96GPa (14Msi)	100,000 units/yr <3min cycle time (carbon) <5min cycle time (glass)
Wind (Blades)	$26/kg	>25%	$17/kg ~35%	1.903 GPA (276ksi)	134GPa (19.4Msi)	10,000 units/yr (at >60m length blades)
Compressed Gas Storage (700 bar – Type IV)	$20-25/kg	>30%	$10-15/kg ~50%	2.55 GPa (370ksi)	135 GPa (20Msi)	500,000 units/yr (carbon fiber)

13

6th Institute: AIM Photonics

American Inst. for Mfg Integrated Photonics; Rochester, NY

Integrated Photonics Institute for Manufacturing Innovation

- **Date Launched:** 7/27/2015
- **Founding Organization:** Research Foundation, State University of New York
- **Funding**: Federal $110m, Matching $500m
- **Partners: 75**

Objective

Develop and demonstrate innovative manufacturing technologies for:

- Ultra high-speed transmission of signals for the internet and telecommunications
- New high-performance information-processing systems and computing
- Sensors and imaging enabling dramatic medical advances in diagnostics, treatment, and gene sequencing

7th Institute: Next Flex

Flexible Hybrid Electronics Mfg Institute; San Jose, CA

Awardee: FlexTech Alliance

- Funding: Federal $75m
- Matched with > $90m
- Partners: A consortium of 162 including companies as diverse as Apple and Lockheed Martin, major research universities including Stanford and MIT, and non-profits
- Date Launched: 8/28/2015
- *Poised to advance the state of the art in the design, manufacturing, integration of electronics and sensors, and assembly, and test automation through technology platform demonstrations of complex flexible hybrid electronics on non-traditional conformal, bendable, stretchable, and foldable substrates.*

Objective:

Hybrid electronics will allow combinations of flexible surfaces with solid electronic components such as chips and sensors.

Take-Aways

- National Network for Manufacturing Innovation
  - Manufacturing punches above its weight
  - There's innovation in manufacturing
  - 7 Manufacturing Innovation Institutes so far
- How MGI PIs can get involved with the Institutes
  - Participate in Requests for Information, workshops, etc.
  - Become an Institute member
  - Submit a project proposal
  - Volunteer to serve on a review panel
- How MGI PIs can get involved with advanced manufacturing generally
  - Let manufacturing challenges inspire your work
  - Participate in MForesight, an independent think tank
  - Many technical topics remain for engagement

16

Many Topics Remain For Engagement

Enabling Technologies
bio-inspired manufacturing
bioprocessing
cryogenic techniques
cyber security
cyberphysical manufacturing
manufacturing equipment (customizable)
mechatronics
MEMS/NEMS and embedded technologies
nano/bio manufacturing
nano/micro manufacturing
surface engineering
manufacturing facilities/wafer fab

Manufacturing Systems
automation technologies
autonomy
digital manufacturing
digital model-based manufacturing
dynamic machine tool management
manufacturing strategy development
robotics and autonomy
sensors (for diagnosis and control, harsh conditions, remote sensing)
servo technologies
smart/intelligent manufacturing (sensor-integrated manufacturing)

Sustainable Manufacturing
energy efficiency/shortage
repair welding
thermoplastic recycling
reducing greenhouse gases
wastewater reclamation and reuse

Manufacturing Processes
additive manufacturing
assembly and joining (multi-material joining, solid state welding and joining)
coating and deposition (printing, roll-to-roll processing)
composites manufacturing
electron beam processing
laser processing (cutting, marking, sintering, tracking and welding)
machining and precision machining
near-net shape technologies (casting, extrusion, forging, forming, hydroforming, molding, rolling)
polymeric-based web conversion
powder metallurgy
separations and purification
surface finishing and peening
wide bandgap manufacturing

Metrology and Characterization
advanced metrology
in-situ metrology
materials characterization (thin film and bulk stoichiometry)
non-destructive evaluation

Product Development/Manufacturing Software/Tools
"big data"
design tools and informatics
information technology systems
modeling and simulation
rapid prototyping
mass customization/custom electronics

Industry Sectors **RFI by AMNPO**
chemical
cyber security
electronics (custom, assembly, flexible, nano, organic, printed)
electro-optical devices
energy (clean/renewable/alternative, energy-conversion equipment, biofuels, fuel cells, grid technologies and integration, natural gas, solar cells, wind)
energy storage/batteries
fluid power/pneumatics
food
healthcare (biomedical devices, nanomedicine, personalized medicine, pharmaceuticals, tissue engineering)
high-performance computing
maritime technologies
national security and terrorism
optics and photonics (imaging, photonic integrated circuits)
thermal processing and HVAC
transportation (natural gas vehicles)
water and water distribution

Materials
"smart" materials, advanced magnets, amorphous metals, bio/biomedical, ceramics
Chemicals, coatings, thin films/surface treatments, composites, electro-optical materials, lightweight materials, metamaterials, nanomaterials, next-generation semiconductors, photovoltaics, powder, superalloys

17