UPDATE June 2017

IN-MaC
Indiana’s Next Generation Manufacturing Competitiveness Center

Connecting Statewide and National Resources for Manufacturing Knowledge Creation and Delivery
IN-MaC A Three Thrust Approach

Three Thrusts

- Long-term Research Innovation
- Education & Workforce Development
- Technology Adoption & Transfer

Partnership

- Purdue - Ivy Tech - Vincennes

Collaboration with

- Global Manufacturing Leaders
- Small to Medium Manufacturing Enterprises and the State
IN-MaC Leadership

Co-Executive Directors
- Nathan W. Hartman, Dauch Family Professor of Advanced Manufacturing and Director, Product Lifecycle Management Center, Purdue Polytechnic Institute
- John W. Sutherland, Fehsenfeld Family Head of Environmental and Ecological Engineering

Executive Committee
- Gary R. Bertoline, Dean, Purdue Polytechnic Institute
- David Hummels, Dean, Krannert School of Management
- Mung Chiang, The John A. Edwardson Dean, College of Engineering
- Ananth Iyer, Professor, & Chair Operations Management, Krannert School of Management
- Julie K. Griffith, Vice President for Public Affairs, Purdue University
- Amy R. Noah, Vice President for Development
- Ronald J. Steuterman, Managing Director
IN-MaC Thrust Leadership

Research

• Nathan W. Hartman, Dauch Family Professor of Advanced Manufacturing and Director, Product Lifecycle Management Center, Purdue Polytechnic Institute
• Ananth Iyer, Professor, & Chair Operations Management, Krannert School of Management
• John W. Sutherland, Fehsenfeld Family Head of Environmental and Ecological Engineering

Technology Adoption

• Dhananjay Sewak, Purdue Manufacturing Extension Partnership

Education and Workforce Development

• Robert Nida, IN-MaC Education and Workforce Development Thrust Director
  • Susan Smith, VP for Technology Division, Ivy Tech Community College
  • David Tucker, VP for Workforce Development/ Community Services, Vincennes University
  • Niaz Latif, Dean, College of Technology and Professor, Mechanical Engineering Technology, Purdue University Northwest
Technology Adoption & Transfer
Enhancing Competitiveness Today Thrust Led by Dhananjay, Purdue Manufacturing Extension Partnership

IN-MaC’s Tech Adoption Program is Designed to Assist Indiana’s Employers

- **Partnership**
  - IN-MaC Provides $20-40K
  - Company provides 50% match in Cash or In-Kind Commitment to Project

- **Focused on Utilization of MFG Technologies**
  - Applies to any company with employment base in Indiana

- **Project Profile**
  - High TRL Technologies
  - 6-8 Month Execution Timeframe
  - Must Utilize Manufacturing Related Technology

- Extends the TAP 40 Consulting Program; a Bridge to Full Blown Research Projects
Technology Adoption & Transfer
Thrust Led by Dhananjay, Purdue Manufacturing Extension Partnership Enhancing Competitiveness Today

Focus Areas for 2016–17

- **Digital Engineering**
  - Finite element methods
  - Materials characterization
  - Computational fluid dynamics

- **Product Lifecycle Management**
  - Supply chain integration
  - Inventory optimization
  - ERP/CAD data integration

- **Production Systems & Modeling**
  - Manufacturing floor optimization and layouts
  - Production line simulations
  - Warehouse systems
Technology Adoption & Transfer
Projects Underway or Completed

- **Project Status**
  - Completed (46)
  - In Process (9)

- **Campuses Represented**
  - West Lafayette (37 projects)
  - IU-Purdue Ft. Wayne (11 projects)
  - Purdue North Central (1 project)

- **Purdue Personnel Involved**
  - 32 Faculty (24 WL, 9 IPFW, 1 PNC)
  - 8 AP Staff (5 WL, 3 IPFW)
  - 1 Post Doc
  - 33 Graduate Students
  - 4 Undergraduate Students

Activity Inception (Sept 2013) through June 30, 2017
Technology Adoption & Transfer
Selected quotes from participating Indiana companies

Don Dumoulin, CEO/Owner, Precise Mold and Plate, Columbus, IN
“...delighted to be awarded an IN-MaC grant in 2013, ...already seeing dramatic results. ...our IN-Mac work set has helped build our overall capacity...1Q revenue up over 50% versus last year...big believers in the power of the IN-Mac and our expert team from Purdue University.”

Craig S. Carson, CEO, Jeco Plastic Products, Plainfield, IN
“The direct, immediate result of the IN-Mac support is an initial order of over $110,000 in tooling and $150,000 in parts currently outsourced in China. The growth prospects within 12 months are for 3–5 times that amount. We anticipate adding three high paying jobs (approximately $40,000 annual salaries) within the next 12 months as a result of this program.”
Research

Thrust Led by:

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- **Ananth Iyer**, Professor, & Chair Operations Management, Krannert School of Management
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Three Focus Areas:

- Digital Twin
- Personalization
- Market Viable Manufacturing Processes

Manufacturing Cluster Hire of Six Faculty is Underway
Research Three Focus Areas

- **Digital Twin**
  - Forms a digital mirror to the physical product including its geometric, behavioral, and contextual definitions

- **Personalization**
  - Advances the connectivity and availability of computational resources with potential to allow personalized products with efficiency of mass production

- **Market Viable Manufacturing Processes**
  - Translate newly invented materials and complex electro-mechanical systems with embedded software to manufacturing processes at market volumes and cost
Research Federal Funding Successes

IN-MaC is Purdue’s Link to the Digital Manufacturing Design Innovation Institute (DMDII) awarded Sept 2014
- National Network for Manufacturing Innovation (NNMI)
- Awarded to UI Labs: 5 years / $70 Million Total
- IN-Mac providing up to $671K in cash cost share

Partner on Institute for Composites Manufacturing Innovation (IACMI), NNMI awarded Jan 2015
- Manufacture of Composite Materials and Shapes
- Indiana Component is a Composites Modeling & Mfg Simulation Technology Area, led by R. Byron Pipes, Materials Engineering
- $15 million cost share provided by IEDC

Partner on the NEXTFLEX (new name for Flexible Hybrid Electronics Institute), NNMI awarded August, 2015
- Led by Ali Shakouri, Director, Birck Nanotechnology Center
- 5 yrs / $75 Million Total; Awarded to FlexTech Alliance
- Birck Center is a resource center for the Institute
- IN-MaC providing up to $500K in cash cost share
SME Focused Consortia

- **Purpose:** IN-MaC’s SME Focused Consortium Program (SCP) is designed to address specific areas of next generation manufacturing that are of interest to Indiana based small to medium manufacturers (< 500 employees).

- **Governance:** Each SCP will be led by a faculty member or research scientist chosen for their knowledge in the specific focus area who is accountable to both the SCP membership and the Co-Executive Directors of IN-MaC.

- **Voting provide input to the SCP leader on the following items:**
  - Research Theme Guidance
  - Educational Offerings Guidance
  - High Level Funds Allocation via Annual Budget Process
  - Changes to Membership Agreement (2/3 majority)

- **Membership Levels**
  - Observer: $5,000
  - In-State Member: $15,000 (matched by IN-MaC)
  - Out-of-State Member: $30,000
  - IN-MaC Governing Member: $75,000
SME Focused Consortia

In Launch Phase

- **Simulation-based Engineering of Materials and Structures (ICSEMS);** Led by Thomas Siegmund, Professor, School of Mechanical Engineering
- **Developing Smart Business Ecosystems;** Led by Ananth Iyer, Susan Bulkeley Butler Chair in Operations Management
- **Advanced Lyophilization Technology Consortium (LyoHUB);** Led by Elizabeth Topp, Professor and Head, Industrial and Physical Pharmacy
- **Consortium for Materials Processing Research;** Led by Qingyou Han, Professor, School of Engineering Technology (SoET)
- **Surface Engineering and Enhancement (CSEE);** Led by Dr. David Bahr, Professor and Head of School of Materials Engineering

Under Development

- **Consortium for Next Generation Manufacturing Education;** Led by Geanie Umberger, PhD, MSPH, RPh, Associate Dean for Engagement, Purdue Polytechnic Institute & Clinical Professor, Dept. of Leadership, Technology and Innovation
- **Design and manufacture of granular agricultural fertilizers with enhanced functionality;** Led by Kingsly Ambrose, Ag & Biological Engineering
- **Consortium for Energy and Resource Efficient Manufacturing;** Led by Fu Zhao, Assoc. Professor, Mechanical Engineering & Environmental and Ecological Engineering
Education & Workforce Development

Funded Projects

- Additive Manufacturing Capacity Development
- Advanced Manufacturing Leadership Development Program for High School teachers-College of Education
- Model-based Definition Certificate Program-College of Technology
- Meeting Workforce Needs for Mechatronics Technicians-Purdue University Northwest
- In partnership with Ivy Tech, Develop and Staff a “Wonder Lab” Focused on Entrepreneurship and 3D Printing at RUCKUS, a Maker Space Being Developed in Indianapolis’ Circle City Industrial Complex-College of Liberal Arts
- Motorsports STEM-A program using electric powered go-karts to drive interest in STEM topics in grades 9–12-Davidson School of Chemical Engineering
- Advanced Manufacturing and Workforce Development
**IN-MaC Operationalizing the Vision**

- **IN-MaC** has a state/regional/national scope and seeks to be the external interface point for Next Generation Manufacturing at Purdue.
- **MEP** is the local dissemination arm for IN-MaC technology adoption and for federal E&WD content.
- **The Indiana Manufacturing Institute** is a collaborative workspace for Next Generation Manufacturing Research, Education, and Technology Adoption located in the Purdue Research Park.

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**IN-MaC Technology Adoption Thrust**

- **Staff Engineer** (or Faculty) Consulting
- **Technology Adoption** MEP & Faculty Labs

**IN-MaC Research Thrust**

- **TRL 4–7** Next Gen Manufacturing Research
- **TRL 1–3** Next Gen Manufacturing Research

**IN-MaC Education Thrust**

- **Assessment** < 1 day
- **Seminar** < 1 day
- **Workshop** Days/Weeks
- **Certificate** Days/Weeks/Months
- **Degree** > Years

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*Note: time line concept and Respond, Diagnose bubble sequence was developed by Purdue MEP.*

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Discussion

**IN-MaC**
Indiana’s Next Generation Manufacturing Competitiveness Center

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