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**, Susan Bulkeley Butler Chair in Operations Management & Department Head, 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, Susan Bulkeley Butler Chair in Operations Management & Department Head, 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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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 work space for Next Generation Manufacturing Research, Education, and Technology Adoption located in the Purdue Research Park.

**IN-MaC Technology Adoption Thrust**
- Staff Engineer (or Faculty) Consulting
- Technology Adoption MEP & Faculty Labs
- TRL 4–7 Next Gen Manufacturing Research
- TRL 1–3 Next Gen Manufacturing Research

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

**IN-MaC Education Thrust**
- Respond
- Diagnose
- Prescribe
- Prevent
- Predict
- Discover

**Timeline:**
- Days
- Weeks
- Months
- Year
- Years

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

IN-MaC
Indiana’s Next Generation Manufacturing Competitiveness Center

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