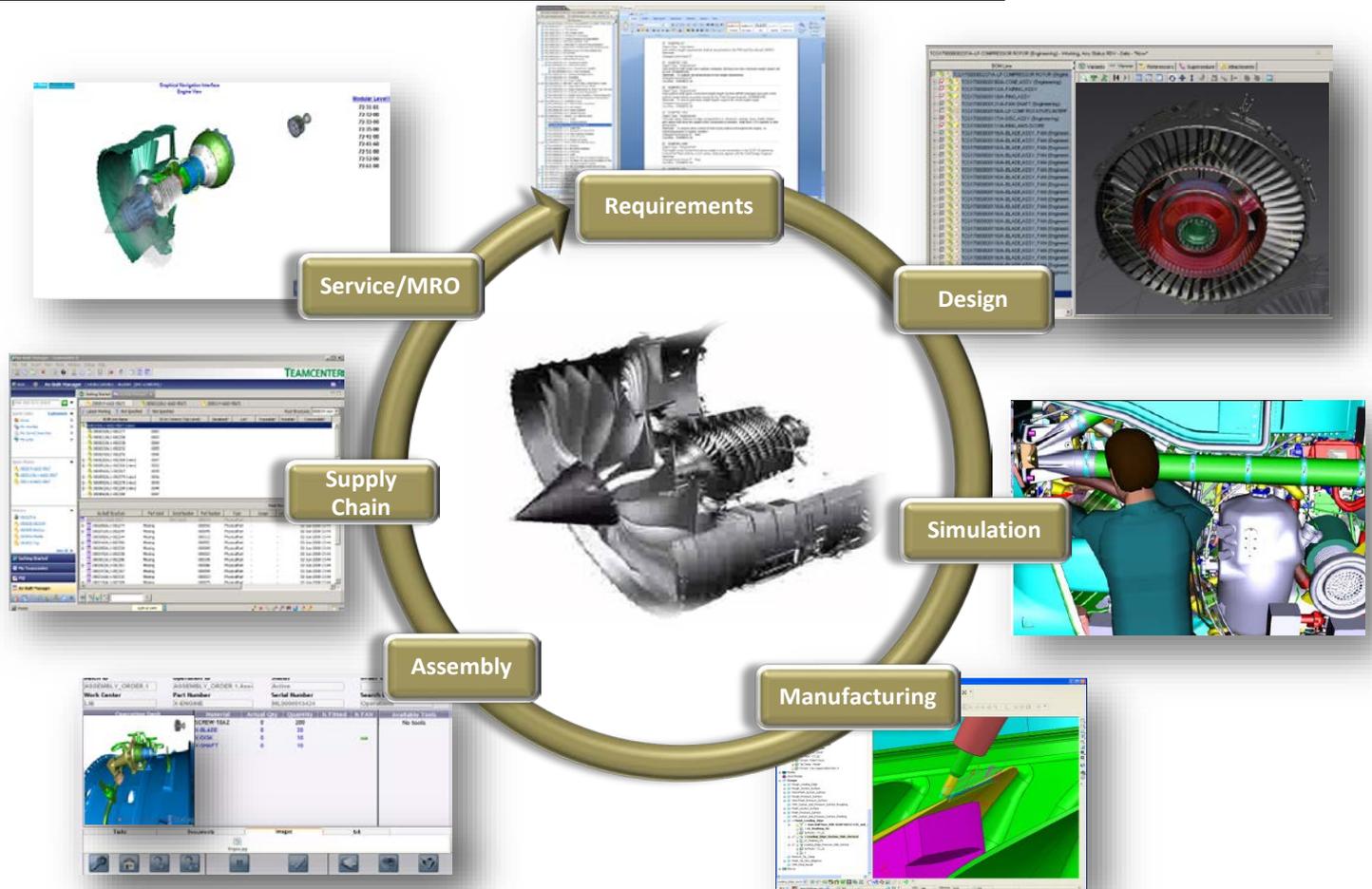


Nathan Hartman, Ed.D.

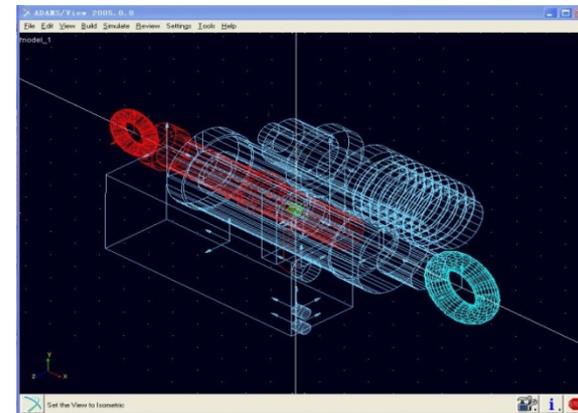
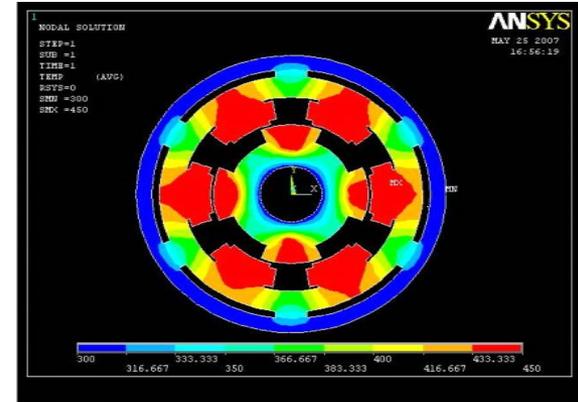
PLM AT PURDUE UNIVERSITY



CENTER OVERVIEW

PLM Center History

- Interdisciplinary Research Effort:
 - Technology, Engineering, Science,
- Started with 750K 3-year Purdue commitment
- Other Support:
 - Procter & Gamble
 - Eli Lilly
 - General Motors PACE Program
 - HP/EDS
 - Chrysler
 - Siemens PLM
 - PTC
 - Dassault Systemes
- 39 seed grants and faculty fellowships awarded since 2005
 - *College of Technology: 20.5 awards*
 - *College of Engineering: 11 awards*
 - *College of Science: 5.5 awards*
 - *Management: 1 award*
 - *Library Sciences: 1 award*



Funding Leverage

Historically, PLM Center seed funding has allowed faculty investigators to receive additional research funding.

- Dr. Mileta Tomovic – **\$274,000** from SME for the development of Curriculum Modules in PLM.
- Dr. Mileta Tomovic/Dr. Nathan Hartman – **\$1,500,000** from NSF-ATE to create and coordinate PLM education in leading Midwest community colleges.
- Dr. Elisha Sacks – **\$600,000** from NSF.
- Dr. Nathan Hartman – **\$35,000** from NIST.
- Dr. Nathan Hartman – over **\$750,000** from Rolls Royce
- Dr. Karthik Ramani – over **\$500,000** from NSF
- Dr. Nathan Hartman – over **\$250,000** from GE
- Dr. Nathan Hartman – over **\$350,000** from NIST
- Dr. Nathan Hartman – over **\$670,000** from DMDII

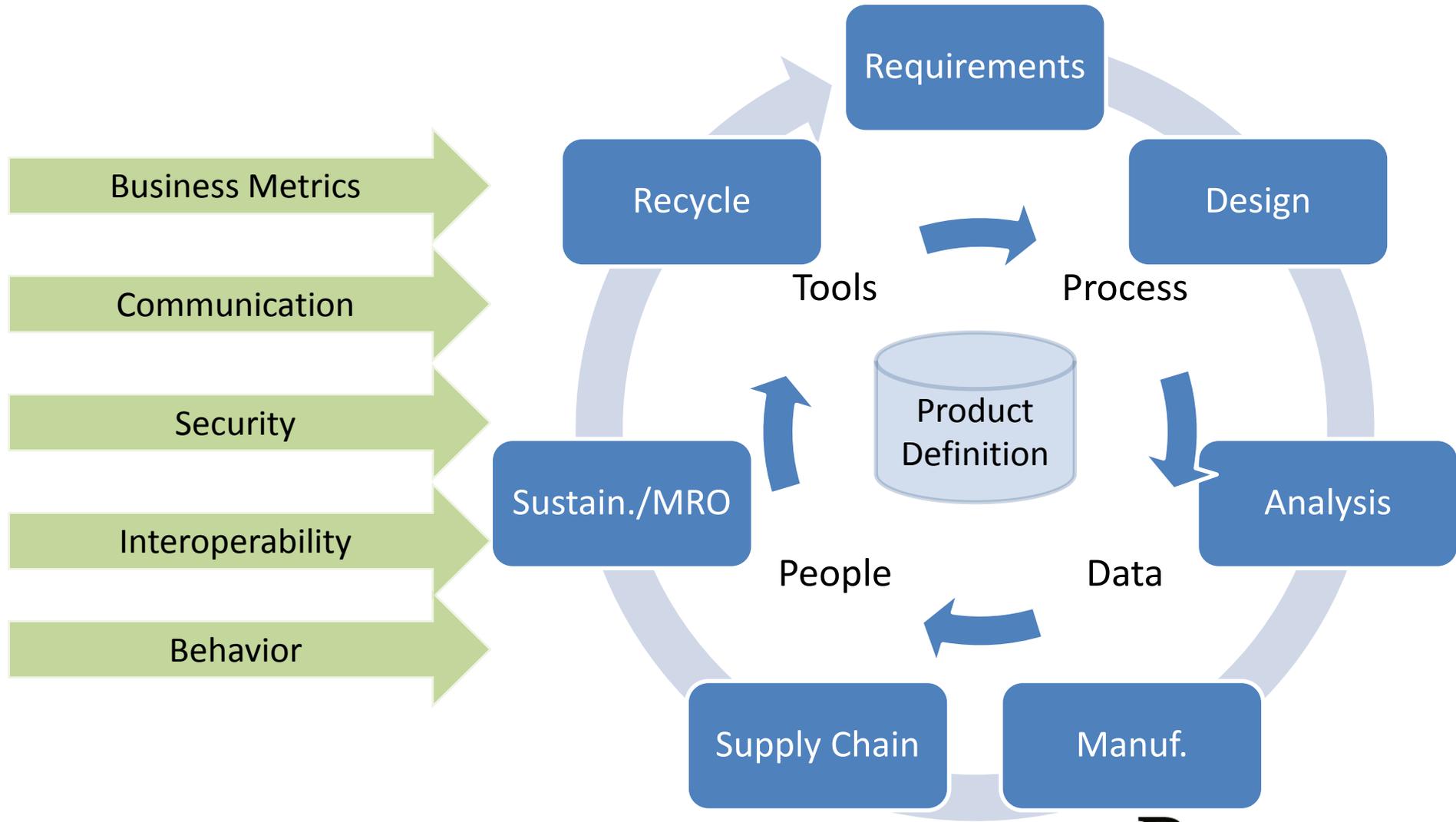
Mission

The mission of Purdue University's Product Lifecycle Management (PLM) Center is to promote the advancement and implementation of PLM technologies and processes through research and education in partnership with industry.

The objectives of the Purdue PLM Center are:

- Establishing industry partnerships that guide, support, and validate PLM research and education activities;
- Enabling PLM adoption and practice by industry;
- Enabling collaboration between faculty, students, and industry partners to conduct research projects that attempt to advance PLM practice;
- Assisting with the integration of PLM into academic curricula;
- Facilitating the pursuit of PLM career opportunities by Purdue graduates;
- Serving as a knowledge base and thought leader for the PLM discipline

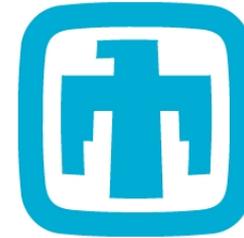
What is PLM?



Industrial Partners



P&G



**Sandia
National
Laboratories**



Rolls-Royce

TEXTRON

Gulfstream[®]

Software Tools

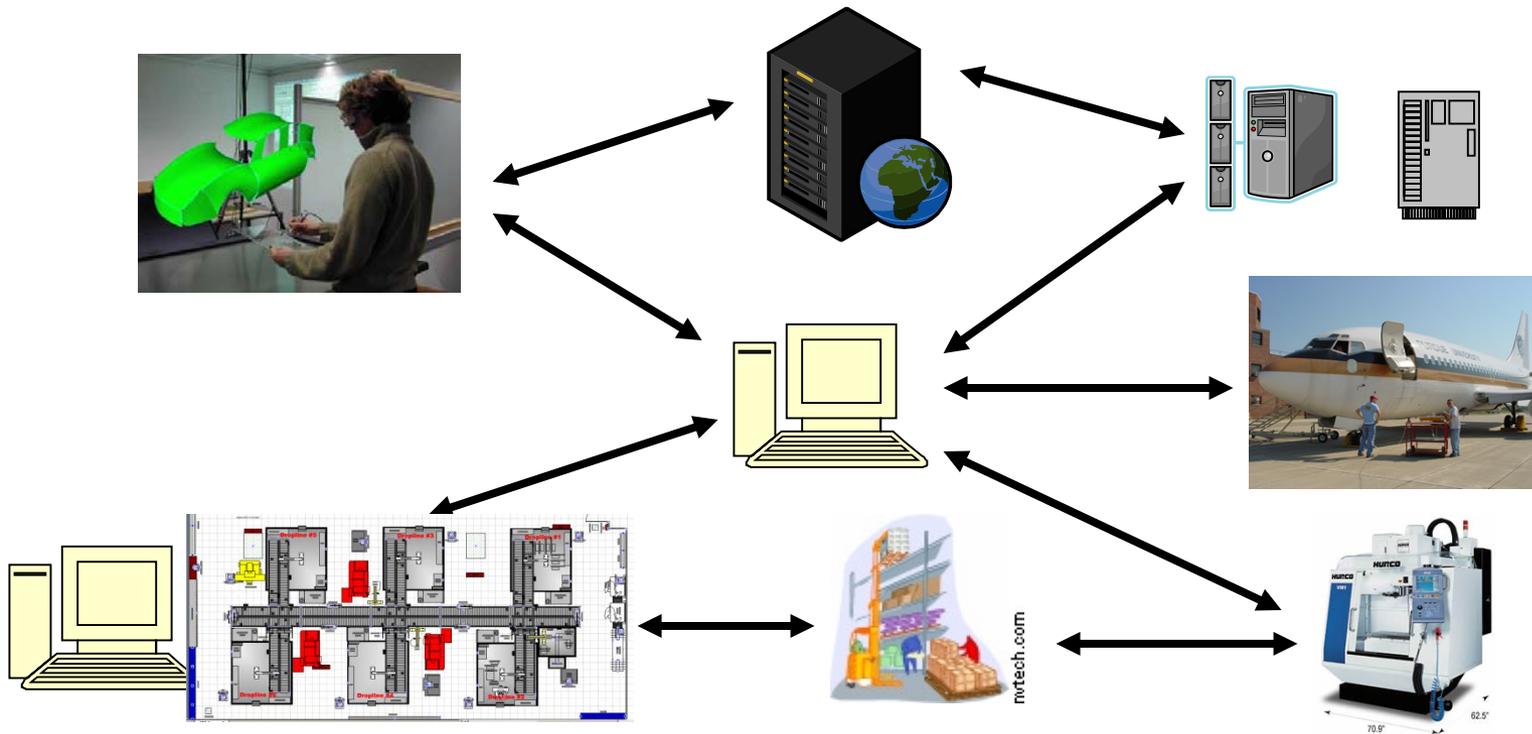
- Purdue is an active participant in GM's Partners for the Advancement of Collaborative Engineering Education (PACE) program
- Purdue has the following PLM software tools installed and accessible by faculty and students.
 - **Autodesk:** *Inventor, Revit*
 - **Dassault Systèmes:** *CATIA, Solidworks*
 - **PTC:** *Creo, Windchill*
 - **Siemens:** *NX, Knowledge Fusion, Solidedge, TeamCenter, E-Factory, TC Community, TC Unified, Tecnomatix, Factory View, Jack, TC Visualization, TC Concept*
 - **Fluent:** *Fluent, Gambit, Icepak, Fieldview, Fidlap,*
 - **LSTC:** *LS Dyna*
 - **MSC Software:** *Nastran, Adams, Patran*
 - **Altair Engineering:** *Hypermesh, Optistruct, Motionview, Hypergraph*
 - **Other:** *JT, 3D PDF, Engineous I-sight, Abaqus, Ansys, Rhinoceros 3D, StudioMax, TecPlot, Kubotek, KeyCreator, Kubotek Spectrum, ITI CADIQ*
- SAP Academic Alliance

Hardware Resources

- High level view:

- 6 Servers
- 12 CPUs
- 52 Physical Cores / 80 Logical Cores
- 200GB Memory
- 13TB Storage Capacity (2 external arrays plus direct attached storage)
- 30 Server Gigabit ports, all gigabit networking for PLM server to clients

Server	CPUs	Physical Cores	Logical Cores	RAM (GB)	Storage (TB)	Networking ports	Misc
Dell PowerEdge R710	2	12	24	96	8	8	7.75TB in external arrays, 0.25 local
HP Proliant DL380 G7	2	8	16	24	1.33	8	
Dell PowerEdge T710	2	8	16	32	1.2	8	
Dell PowerEdge 2900	2	8	8	16	1	2	
Dell PowerEdge 2900	2	8	8	16	1.25	2	
Dell PowerEdge 2900	2	8	8	16	0.25	2	



RESEARCH PROGRAM

Research Projects – Overview

- **Process Overview:**

- Topics generated by Industrial Advisory Board (IAB) members at spring (~February) IAB meeting
- Faculty Fellows generate statements of work in conjunction with Industry Board
- Board and faculty refine SOW in time for Fall semester
- Performance period follows academic year (August to May) generally
 - *Project status update at spring IAB meeting*
 - *Final report presentation at fall IAB meeting*

- **Faculty Fellows**

- Typical award \$40,000 per year
- Initial two-year term, reviewed each year
- Aligned with research thrusts and desired outcomes established by the board

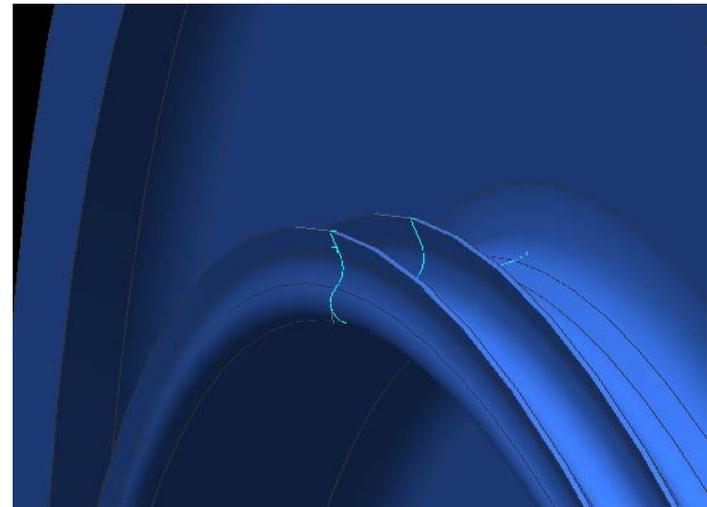
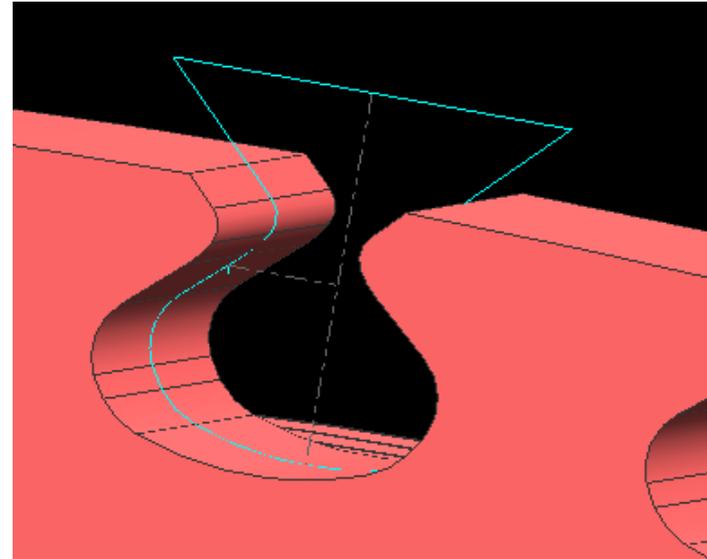
Sample Research Projects

- **Data Management:**

- **PDM Investigation, Evaluation, Implementation, and Demonstration for PLM –**
Dr. Craig Miller (Computer Graphics Technology)
- **Exploratory Research in Database Systems Support for Product Lifecycle Management –** *Dr. Walid Aref (Computer Science)*
- **Implementing ontology-based information sharing in Product Lifecycle Management –**
Dr. John Springer (Computer & Information Technology) & Dr. Nathan W. Hartman (Computer Graphics Technology)

- **Visualization:**

- **Cutting Edge Visualization for Product Lifecycle Management –**
Dr. Voicu Popescu and Dr. Chris Hoffmann (Computer Science)
- **Creation of Design Spaces and Exploration Through Visualization and Configuration –**
Dr. Karthik Ramani (Mechanical Engineering)
- **PLM Visualization on Mobile Devices –**
Dr. Voicu Popescu (Computer Science) and Dr. Nate Hartman (Computer Graphics Technology)



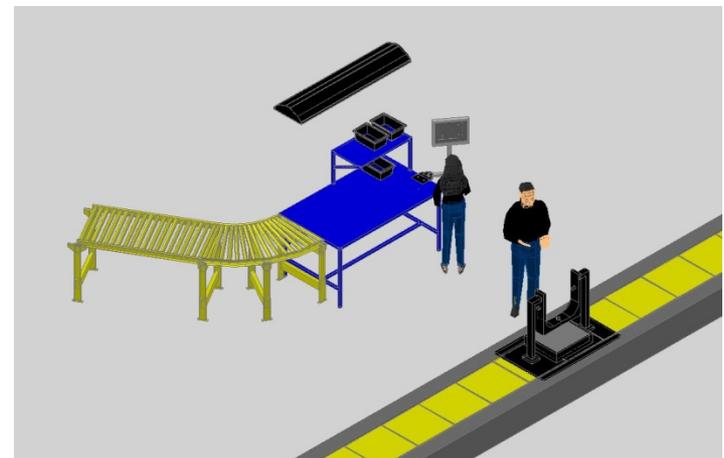
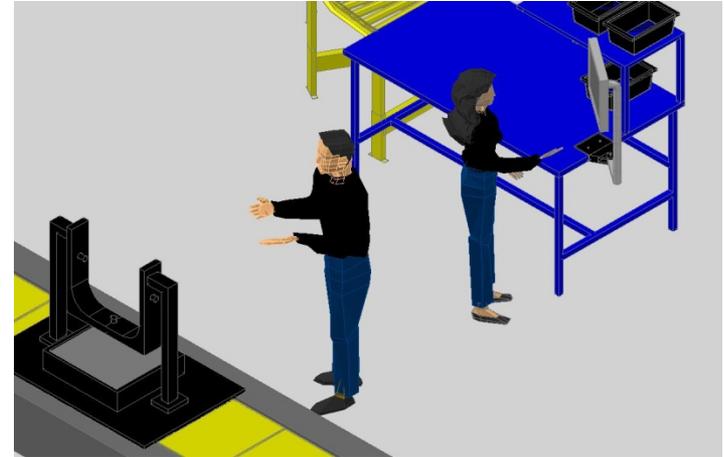
Sample Research Projects

- **Design:**

- **Configuration Driven Design for Knowledge Re-use During Product Lifecycle –**
Dr. Karthik Ramani (Mechanical Engineering)
- **Next Generation DHM for Assessing Short Duration Events in Work Analysis & Design –** *Dr. Vince Duffy (Industrial Engineering)*
- **Development of the Airfoil Seed Generator**
Dr. Nathan W. Hartman (Computer Graphics Technology)
- **A Procedure of Analysis of Feasibility and Uncertainty in Distributed Product Development Environments –**
Dr. Ganesh Subbarayan (Mechanical Engineering)

- **Education:**

- **PLM Cross Functional Certification and Training: Efficacy and Competency Profile –**
Dr. Darrel Sandall and Dr. Abe Walton (Organizational Leadership and Supervision)
- **PLM Collaboration Training Using Advanced Distance Learning Strategies –**
Dr. Edie Schmidt (Industrial Technology)



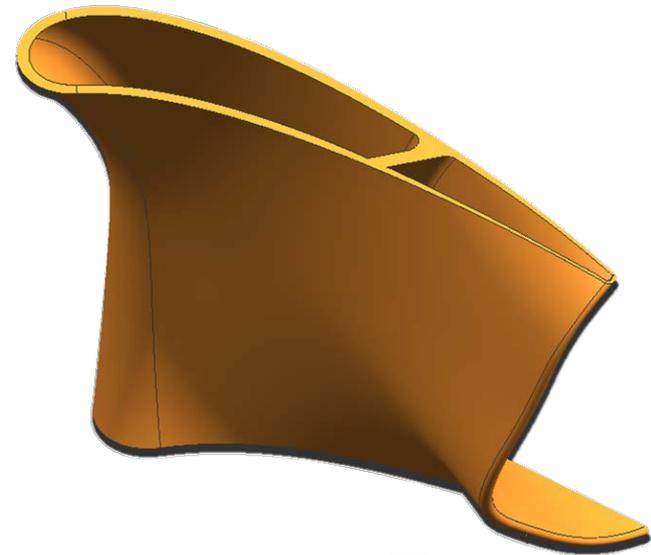
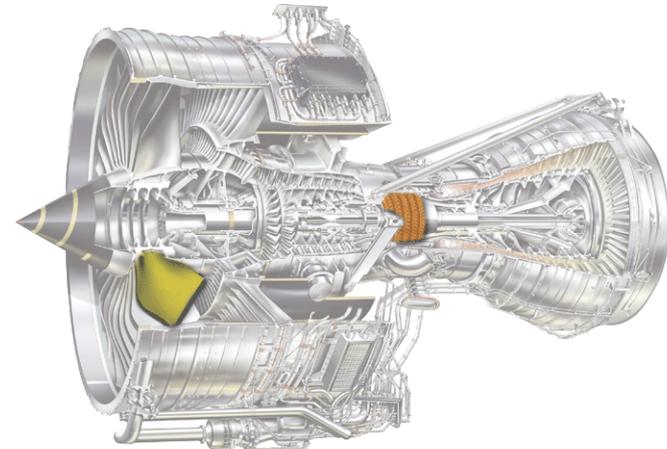
Sample Research Projects

- **Operations / Processes:**

- **PLM Metrics, Phase I, II, and III –**
Dr. Cynthia Tomovic (Organizational Leadership and Supervision)
- **Models to Support Auto-ID Based Process Control Systems in PLM –**
Dr. Edie Schmidt (Industrial Technology)
- **Integration of PLM and ERP for BOM management**
Dr. Edie Schmidt (Industrial Technology) and Dr. Hank Kraebber (Mechanical Engineering Technology)
- **Integrated Sensing and Diagnostics for Product Life Cycle Health Management of Gas Turbine Engines : Application to Wire Harnesses and Connectors –**
Dr. Doug Adams (Mechanical Engineering)

- **Sustainability:**

- **Product Lifecycle Management: Roadmap to Global Sustainability –**
Dr. Scott Homan (Organizational Leadership and Supervision)
- **Value Characterization across the Product Lifecycle to Support Green PLM and New Business Creation –**
Dr. John Sutherland (Environmental and Ecological Engineering) and Dr. Larry Nies (Civil Engineering)
- **Energy and Sustainability Models in PLM –**
Dr. Karthik Ramani (Mechanical Engineering)



Proprietary Projects

- PLM Center Director and staff can assist IAB members and other companies interested in sponsoring research projects. These projects provide several benefits to industry sponsors:
 - Ability to meet company specific needs
 - Companies often recruit and hire graduate student research assistants
 - Greater insights into faculty research areas and future collaboration possibilities
 - Include non-disclosure agreements
 - Intellectual property agreements

EDUCATION

PLM Curriculum Topics

- 3D Modeling
- Analysis and simulation
- Product data management
- Product lifecycle management
- Virtual collaboration
- Standards/interoperability
- Web development/front-end & back-end infrastructure
- Machine-tool manufacturing
- Additive manufacturing
- Manufacturing process planning
- Quality management/LEAN
- Supply-chain modeling and development
- Maintenance/MRO
- Sustainability

PLM Professional Education Programs

- Three 5-week classes covering model-based definition, product data and configuration management and data management for digital manufacturing.
- Delivered online – instructor-led or self-paced
- Offered through the Purdue Continuing Education Program.
- <https://polytechnic.purdue.edu/product-lifecycle-management/education/plm-certificate>



MEMBERSHIP

Industrial Partner Membership

- Membership - \$50,000 per year
- List of benefits outlined on the following slide
- Intellectual Property Agreement
 - General PLM Center of Excellence agreement signed by all members
 - Specific IP agreements for company projects when appropriate and required

Member Benefits

- Opportunity for Collaboration / Discussion with other IAB Members to Gain Input and Feedback from their Expertise
- Contribute to Definition of Research Project Topics and Vote for those to receive Funding
- Obtain Early Access to Research Results, Including Publications and White Papers
- Short Course from the research Project results
- The opportunity to propose other projects to be funded independent of the Seed Grants
- Engage in PLM Benchmarking / Roadmapping Activities with Purdue PLM-related faculty as appropriate
- On-site Faculty Presentation / Seminar
- The opportunity to propose Capstone / Independent Study Projects in appropriate departments
- Student Recruitment
- Attend Annual Conferences, Seminars, Training Forums, Demonstrations of Latest Technologies and Participate in Panel Discussion being held at Purdue in PLM-related areas
- Guest Lectures for Classes in order to share expertise, increase company recognition among Purdue students having interests in PLM careers, and build ties to Purdue faculty

Contact

<https://polytechnic.purdue.edu/product-lifecycle-management>

To join the Center or for more information on PLM related activities at Purdue, please contact:

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