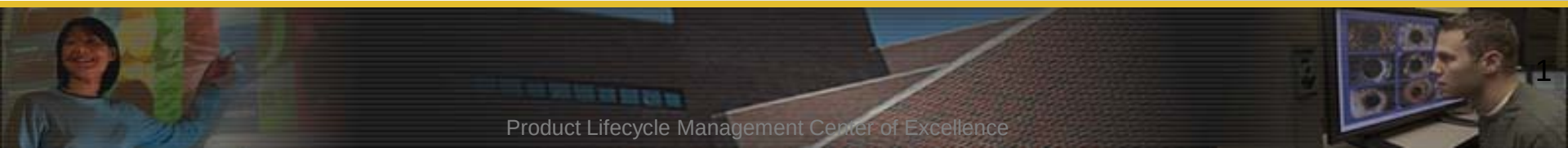
Digital Manufacturing and Curriculum Development

SME PLM Curriculum Modules

NSF Midwest Coalition for Comprehensive Design Education

WIRED Integrated Curriculum for Digital Manufacturing

Vukica Jovanovic PhD Student , MET



Product Lifecycle Management

Product Lifecycle Management is an integrated, information driven approach to all aspects of a product's life from its design inception, through its manufacture, deployment and maintenance, and culminating in its removal from service and final disposal .

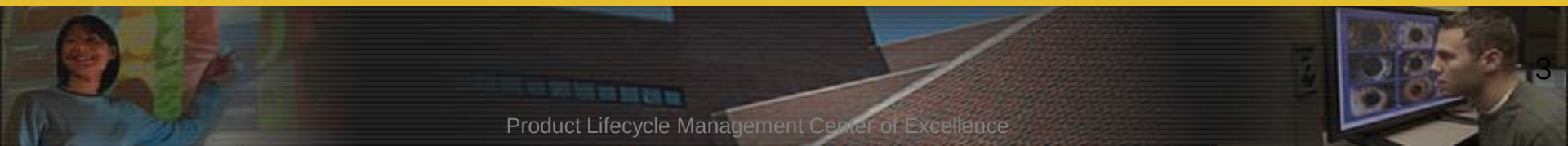
(Michael Grieves)

Curriculum Modules in Product Lifecycle Management (PLM)

for Engineering and Engineering Technology Students and Industrial Practitioners

Society of Manufacturing Engineers

$ 18,500,000

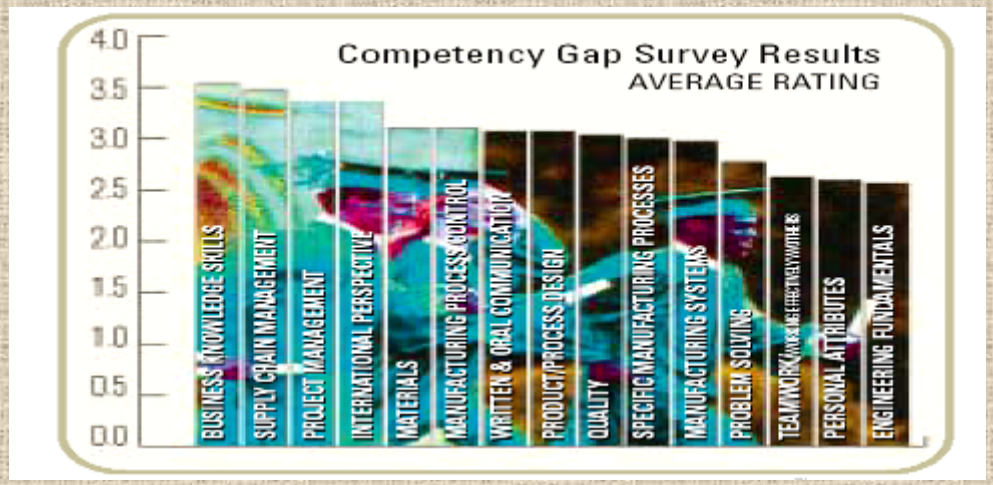


COT PLM Faculty Group















www.purdue.edu/dp/PLM/SME/curriculum.php

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The Product Lifecycle Management Center of Excellence

DP Centers | Welcome | Discovery | Learning | Engagement | Partners | Software | Resources | Projects | Facilities | PowerPoints | SME Project

SME Project

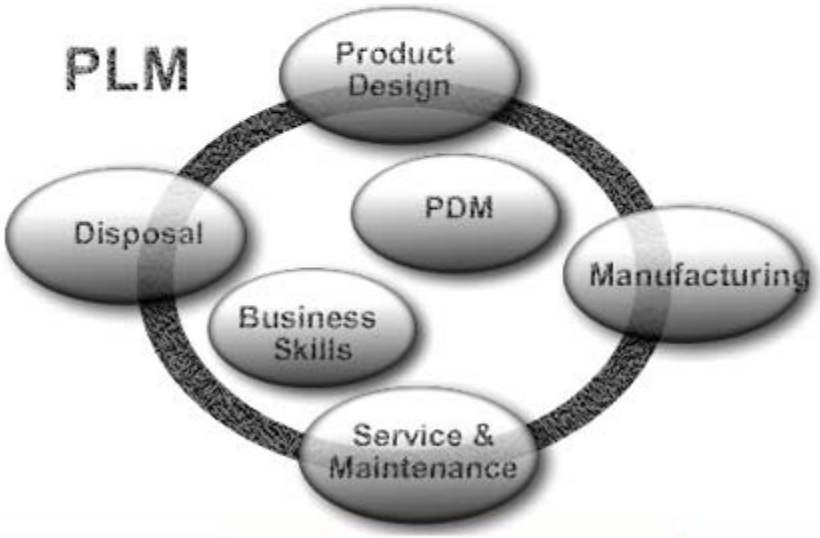
Curriculum Areas:

Click on the links for more modules:

All modules can be downloaded in a single ZIP file here.

Curriculum Areas:

- Introduction to PLM
- Business Knowledge and Skills
- Product Design
- Manufacturing
- Product Data Management
- Service and Maintenance
- Disposal and Recycling



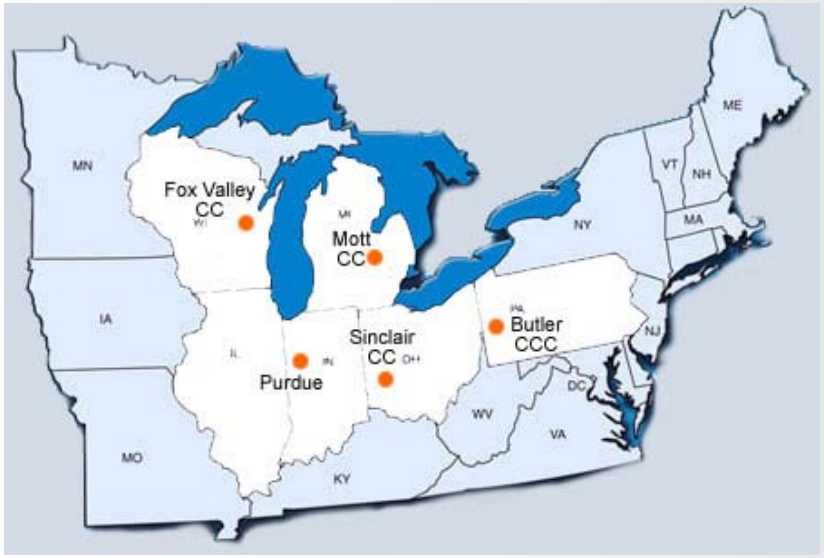
Done

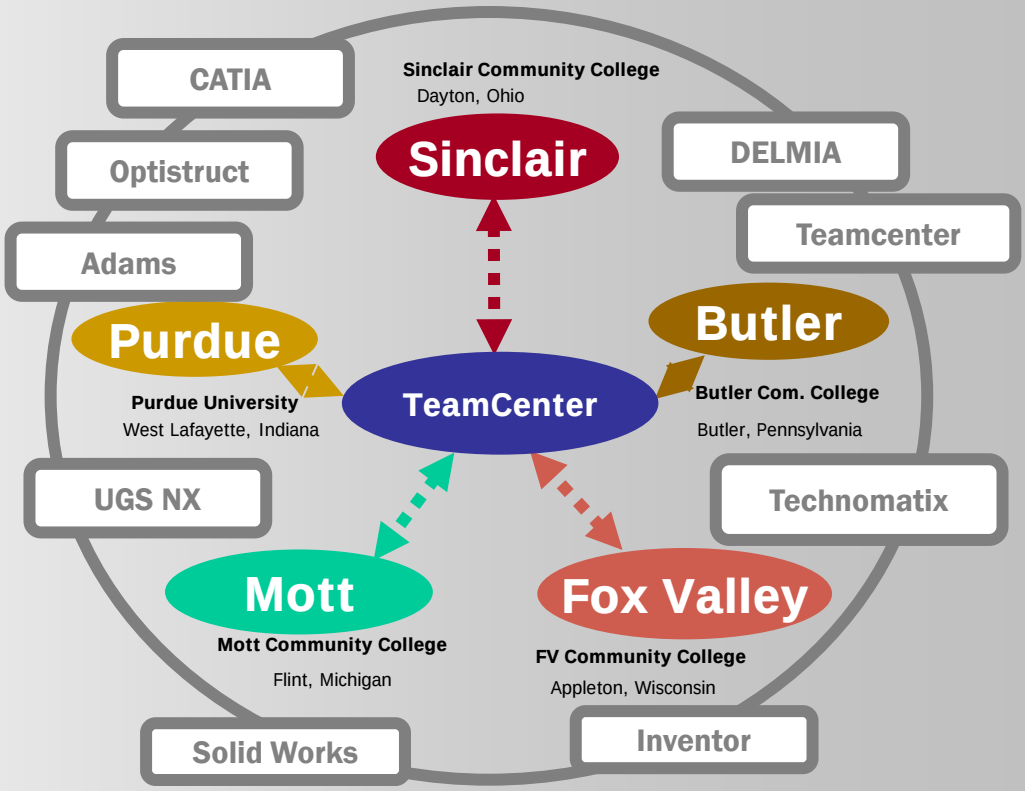
Midwest Coalition for Comprehensive Design Education

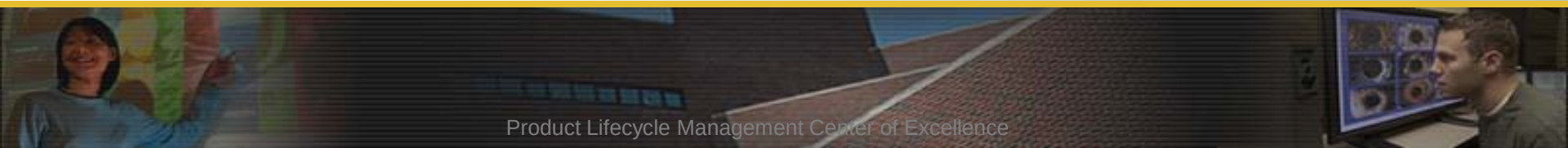
Advanced Technology Education Program, NSF Grant # 0603362

$ 1,500,000

Midwest Coalition for Comprehensive Design Education







www.e-create.org

e- Comprehensive product REalization in Advanced Technology Education

HOME | PEOPLE | CURRICULUM | PROJECTS | NEWS & EVENTS | RESOURCES | CONTACT US

Midwest Coalition for Comprehensive Design Education

The goal of the project is to develop and disseminate curriculum in the areas of comprehensive design for associate degree technician and baccalaureate degree technology students, as well as to develop and offer programs to improve the skills of the existing workforce.

The skills in the areas of:

- CAD
- Design for manufacturability and assembly
- Collaborative engineering
- Teamwork
- Managing change

are necessary for an increased competitiveness, as identified by the Society of Manufacturing Engineers and National Association of Manufacturers.

The partner institutions on the project will work collaboratively to identify, develop and deliver curriculum that will integrate comprehensive design education across associate degree technician and baccalaureate degree technology colleges, in order to increase the skill level in the manufacturing sector. They are utilizing and building upon their respective strengths of instructional module development and delivery to traditional and nontraditional student populations. The partner institutions are having regular meetings and videoconferences through which they are exchanging ideas on novel methods for course development and delivery as well as on the methods for collaboration in course delivery across different programs.

Done

Collaborative Product Development

Collaborative project

Prototyping phase

IndianaWired
Workforce Innovation in Regional Economic Development • TALENT DRIVING PROSPERITY

Development of Integrated Digital Manufacturing Curriculum

Workforce Innovation in Regional Economic Development (WIRED)

Opportunity Fund for North Central Indiana

$ 500,000

PURDUE UNIVERSITY

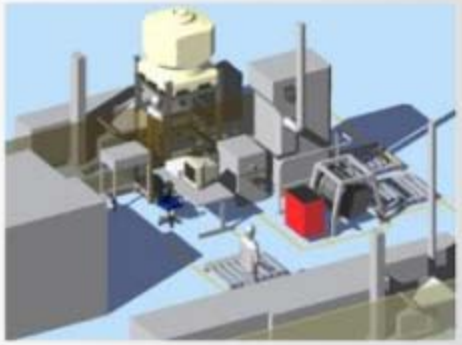
IVY TECH COMMUNITY COLLEGE

The Web Site: www.e-create.org/dm/dm.php

Distance Learning Modules

Factory Layout Planning

- Creation of layout from 3D models for:
  - Virtual 3D models: sales personnel
  - Photo-realistic images or animation
  - Potential customers
  - BOM: basis for price calculations



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Slide 7 / 17 | Playing 00:04 / 00:56

Introduction to Digital Manufacturing: Module 1: Unit 3

PURDUE UNIVERSITY

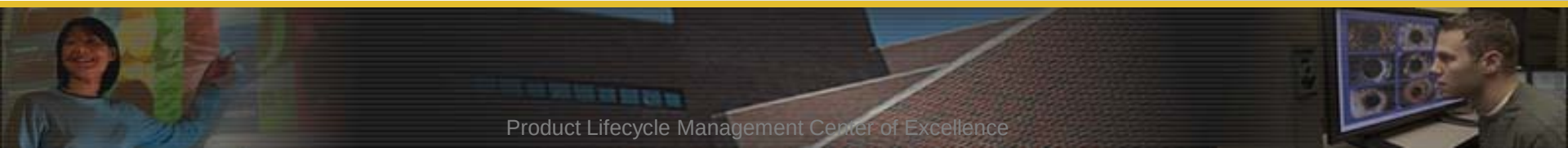
Vukica Jovanovic
Graduate Teaching and Research Assistant

Bio | Contact

Outline | Thumb | Notes | Search

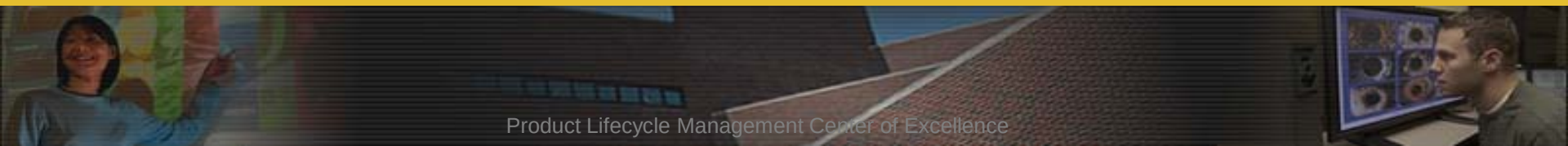
Slide Title	Duration
Introduction to Digital...	00:20
Digital Manufacturing:...	00:08
CAD: Computer-Aide...	00:30
CAD Software	06:10
CAM: Computer-Aide...	01:14
CAPP: Computer Aide...	02:14
Factory Layout Planni...	00:56
Ergonomics	01:37
Off-line Robot Progra...	01:04
Production Process Si...	00:46
Product Lifecycle Man...	00:45
Current Information ...	00:34

7 Minutes 23 Seconds Remaining



Module One: Digital Manufacturing: The Basic Terms

- Product Related Data Goes Digital
- Digital Manufacturing: What Does it Means?
- Define Basic Parts of Digital Manufacturing
- Digital Manufacturing Software Enablers
- Digital Manufacturing: The Case Study
- Digital Manufacturing Examples



Digital Manufacturing: The Basic Terms

HOME | DM HOME | MODULE 1 | MODULE 2 | MODULE 3 | MODULE 4 | MODULE 5 | MODULE 6

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Product Lifecycle Management Center of Excellence

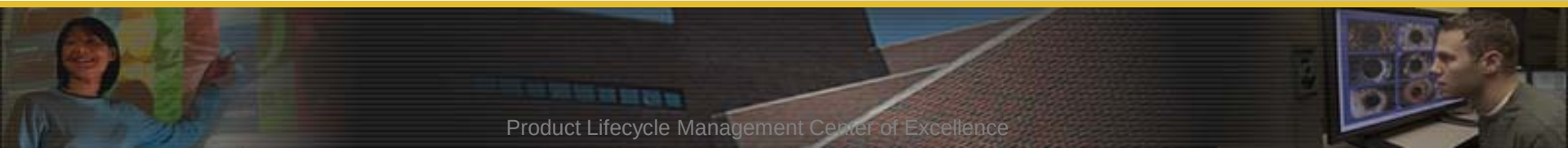
COURSE NAME :

Introduction to Digital Manufacturing

Module 1

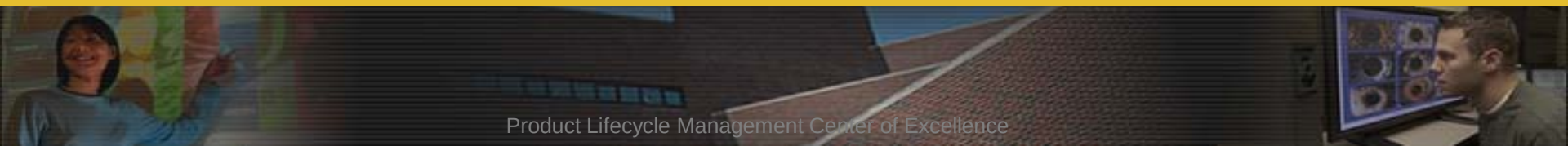
Digital Manufacturing: The Basic Terms

- Product Related Data Goes Digital
  - Lecture notes
  - Presentation
- Digital Manufacturing: What Does it Means?
  - Lecture notes
  - Presentation
- Define Basic Parts of Digital Manufacturing
  - Lecture notes
  - Presentation
- Digital Manufacturing Software Enablers
  - Lecture notes
  - Presentation
- Digital Manufacturing: The Case Study
  - Lecture notes
  - Presentation
- Digital Manufacturing Examples
  - Lecture notes
  - Presentation

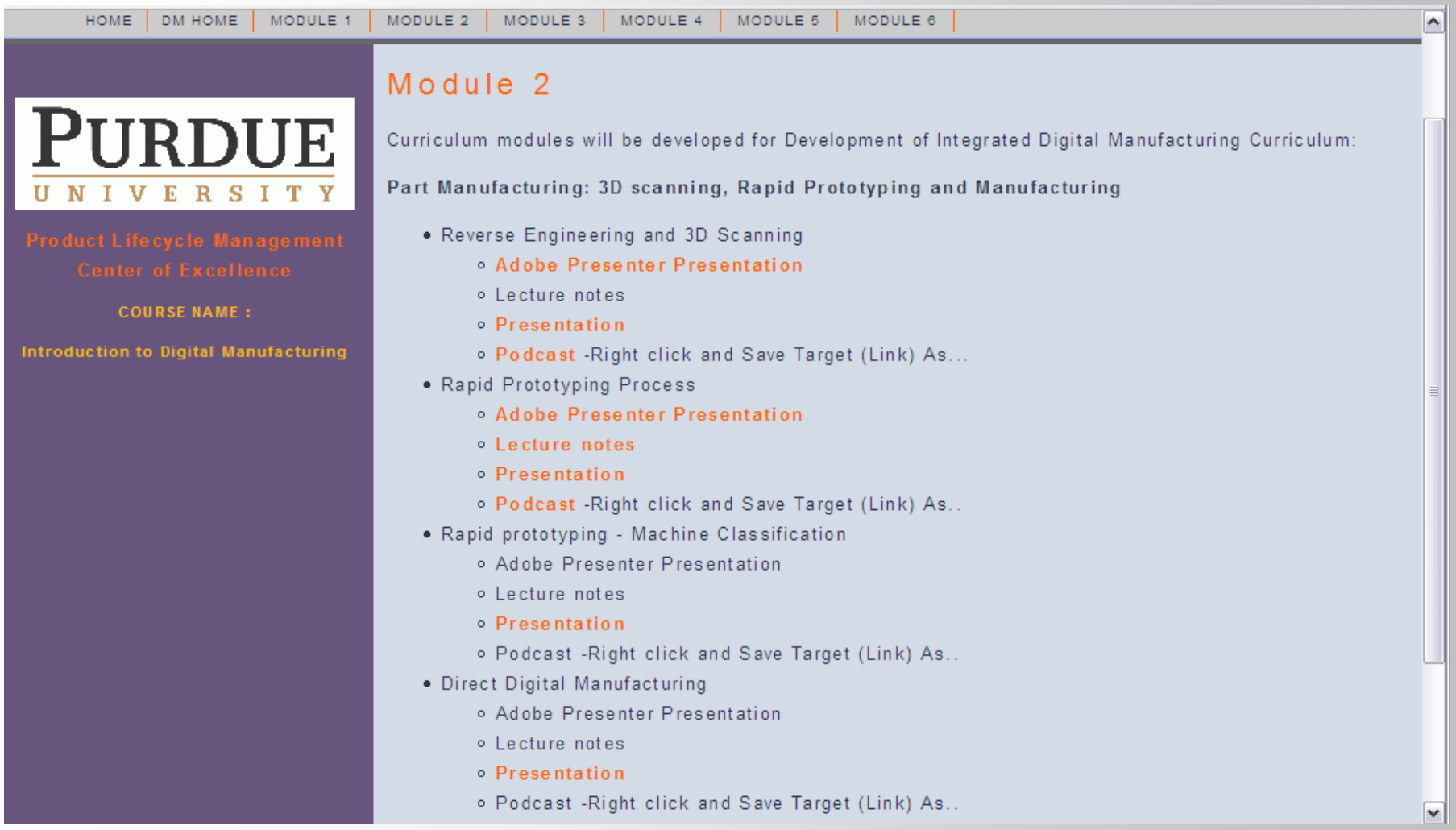


Module One: Digital Manufacturing: The Basic Terms

- Reverse Engineering and 3D Scanning
- Rapid Prototyping Process
- Rapid Prototyping – The Machine Classification
- Direct Digital Manufacturing

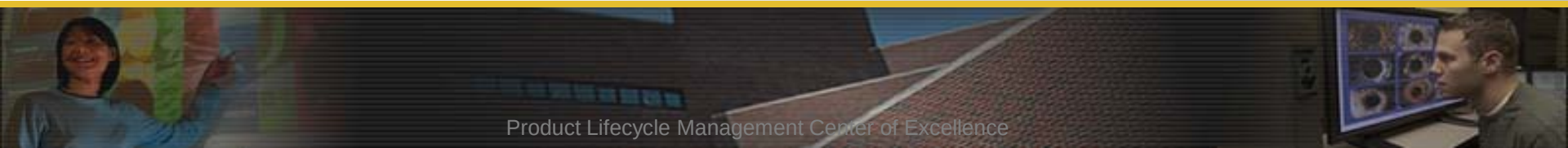


Digital Manufacturing: Part Manufacturing: Reverse Engineering, 3D scanning, Rapid prototyping, Direct digital manufacturing



Module Six: Digital Manufacturing and Ergonomics: Product and Process Optimization

- VI -1 :Product Design and Ergonomics
- VI - 2: Human Factor and Workspace Design
- VI - 3: Digital Human Model
- VI -4: Basic Ergonomic Analysis
- VI -5: Human Task Analysis
- VI - 6: Human Task Simulation
- VI - 7: Digital Manufacturing and Ergonomics: Examples



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Product Lifecycle Management
Center of Excellence

COURSE NAME :

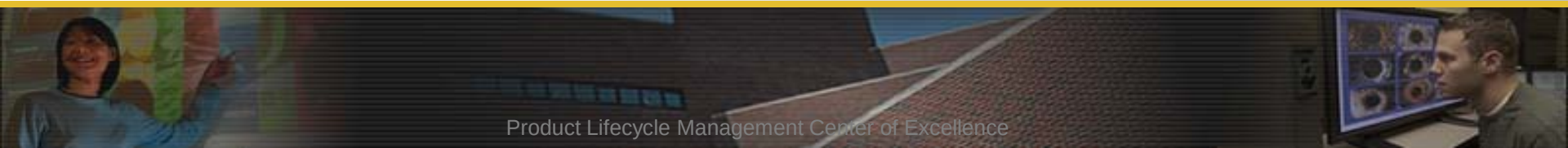
Introduction to Digital Manufacturing

Module 6

Curriculum modules will be developed for Development of Integrated Digital Manufacturing Curriculum:

Digital Manufacturing and Ergonomics: Product and Process Optimization

- VI -1 :Product Design and Ergonomics
  - Lecture notes
  - Presentation
- VI - 2: Human Factor and Workspace Design
  - Adobe Presenter Presentation
  - Lecture notes
  - Presentation
- VI - 3: Digital Human Model
  - Adobe Presenter Presentation
  - Lecture notes
  - Presentation
- VI -4: Basic Ergonomic Analysis
  - Lecture notes
  - Presentation
- VI -5: Human Task Analysis
  - Lecture notes
  - Presentation
- VI - 6: Human Task Simulation
  - Lecture notes
  - Presentation
- VI - 7: Digital Manufacturing and Ergonomics: Examples
  - Lecture notes
  - Presentation



al_manufacturing_unit_VI_2 - Mozilla Firefox

History Bookmarks Tools Help

http://e-create.org/dm/Module6/Intro_to_Digital_manufacturing_unit_VI_2/index.htm

AT580 STAT manfg Introduction to the Pr... STAT 501 — Experim... HEICO – leading supp... MET 451 RTS Onlin Lane Bryant RSS CGT IPS STAT Cost Managem

A Process for Protecting Employees (OSHA)

- Industrial ergonomics is moving away from
  a reactive approach, in which
  jobs that cause injuries are modified
- Proactive approach
  emphasizes assessing each job
  for feasibility and safety
  as the workplace and processes are designed

Intro_to_Digital_manufacturing_unit_VI_2

PURDUE UNIVERSITY

Vukica Jovanovic
Graduate research Assistant

Bio | Contact

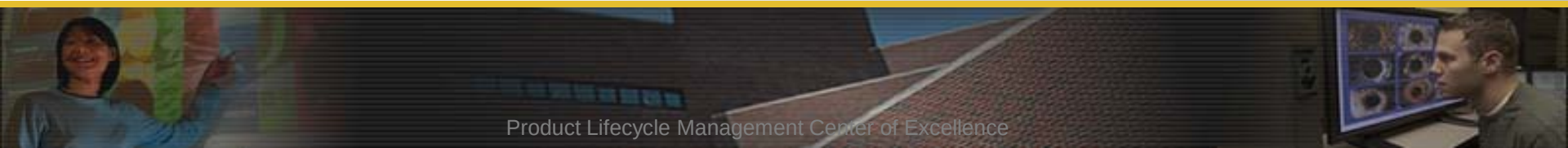
Outline | Thumb | Notes | Search

Slide Title	Duration
Digital Manufacturing ...	00:26
Human Factor and Wo...	00:10
Why Is It Important?	01:39
Principles of Human F...	00:49
A Process for Protecti...	00:25
Digital Human Model and User Interface	
Principles of Human F...	00:35
Human Factors Princi...	00:53
Cognitive Issues	00:26
A Process for Protecti...	01:24
Example: Standing Pl...	01:22

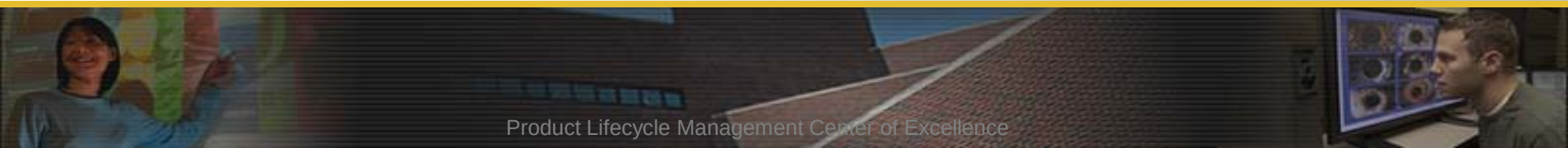
8 Minutes 16 Seconds Remaining

Product Lifecycle Management Center of Excellence

Slide 5 / 14 | Playing 00:06 / 00:25

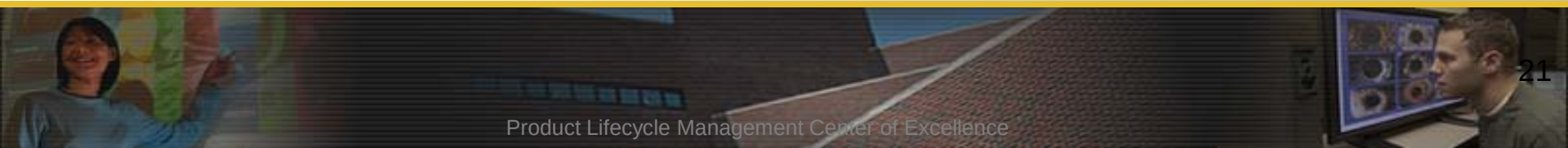


A Sample of DM Teaching Unit



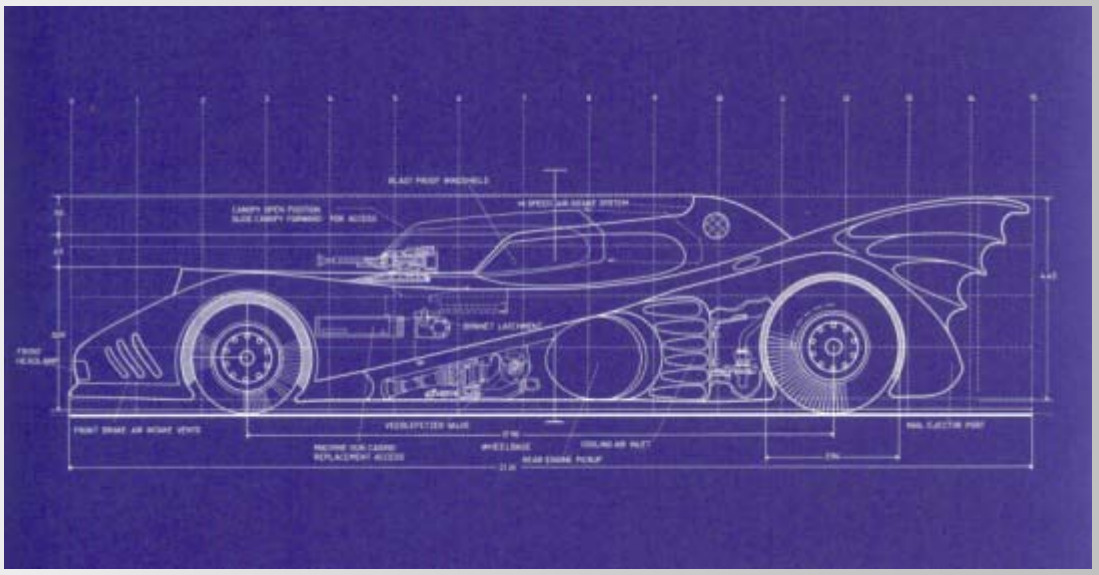
Digital Manufacturing: The Basic Terms

Unit 1: Product Related Data Goes Digital



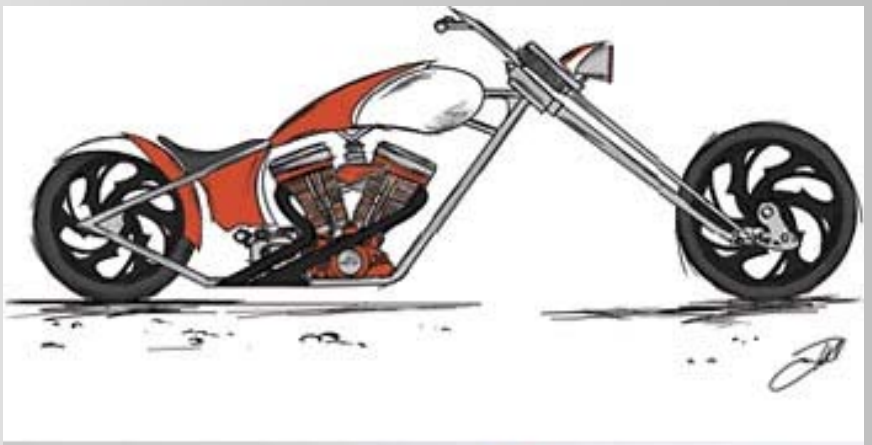
Digital vs. Paper-Based Data

- People are getting more connected
- Through Internet or local area networks
- Digital data instead of paper-based data

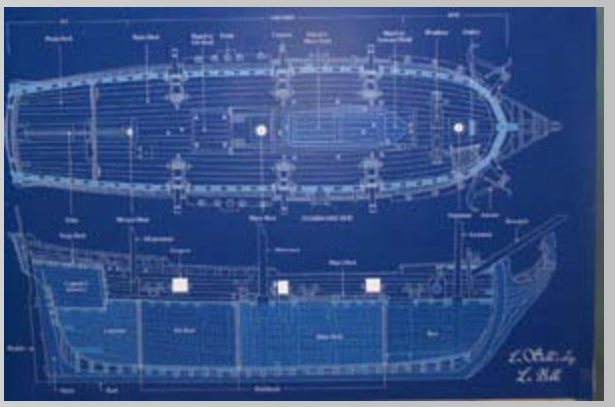


Product Related Data

- Initial brainstorming – ideation phase
- Artistic design sketches
- Blueprints
- Assembly drawings
- Manufacturing plans
- Assembly manuals
- Service and maintenance documents
- Cost estimations…



Blueprints

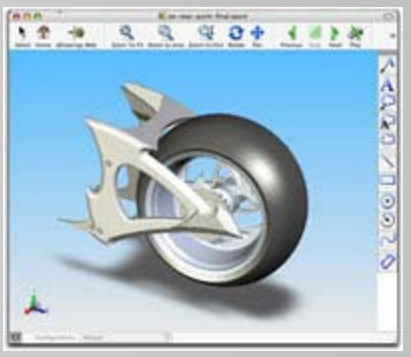


- Type of
  - paper-based reproduction usually
  - of a technical drawing
- documenting
  - an architecture or
  - an engineering design

- The term "blueprint"
  - the visual aspects of prints
  - contact printing process of cyanotype

Computer-Aided Design Drawings

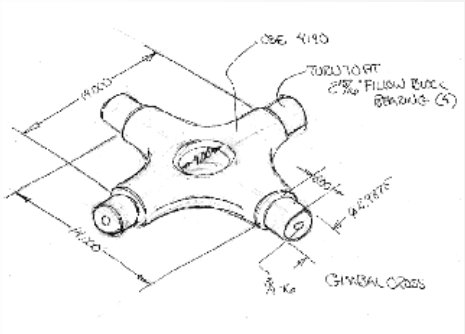
- More recently, designs created using Computer-Aided Design techniques may be transferred as a
- digital file directly to
  - computer printer
  - plotter



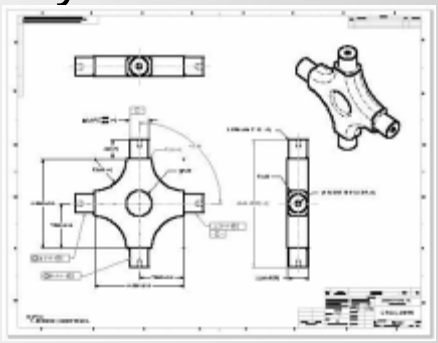
eDrawings Viewer

- In some applications paper is avoided

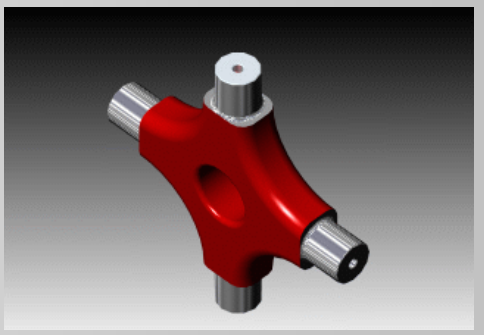
  work and analysis is done
  - directly from digital displays



Hand sketch



CAD drawing



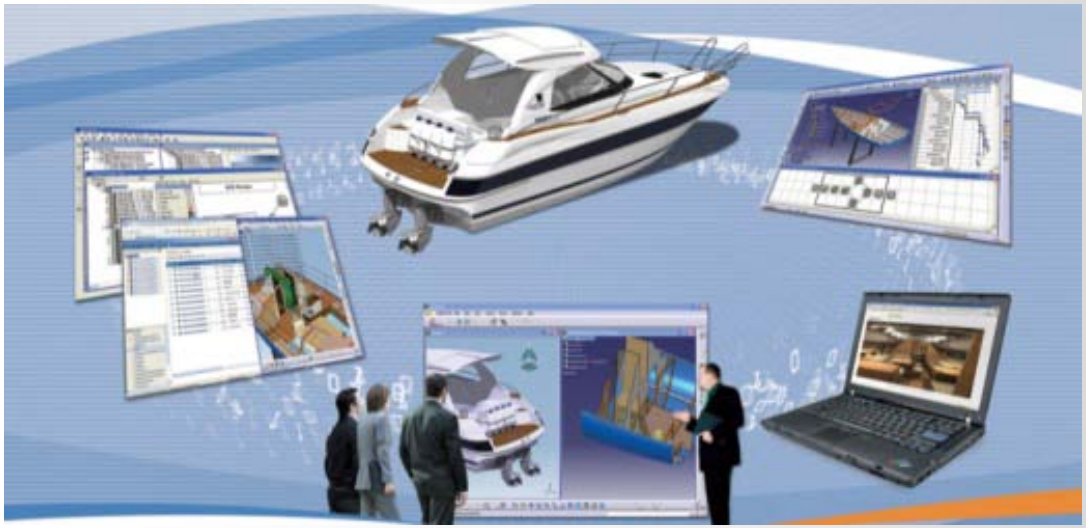
CAD 3D model

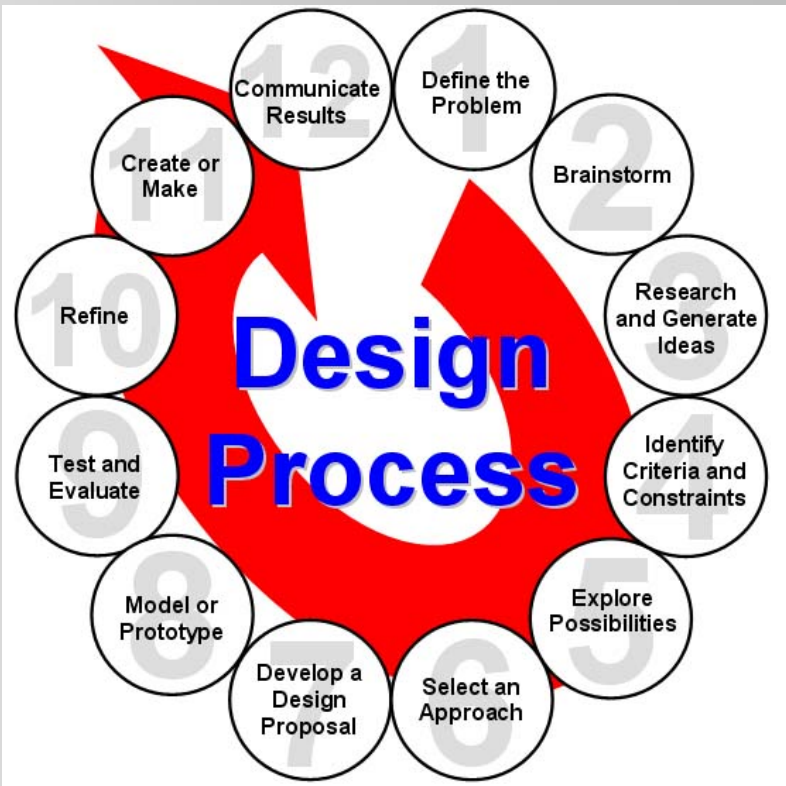
Digital Product Related Data

- Part and Assembly Modeling
- Surface Creation & Editing Tools
- 2D/3D Drafting & Detailing
- Photo-realistic Rendering (Materials, Environment)
- Display and Visualization
- Camera-based Animation
- Import/Export
- Object and Group Properties
    - Material
    - Center of Gravity
    - Volume
    - Weight
    - Density
    - Moments of Inertia

Cost vs. the Whole Product Lifecycle

- It is not just the COST that matters
- Changes in the whole product lifecycle
  should be considered
  not just the adjustments related to
  - savings
  - increasing productivity
  - cut of the production expenses

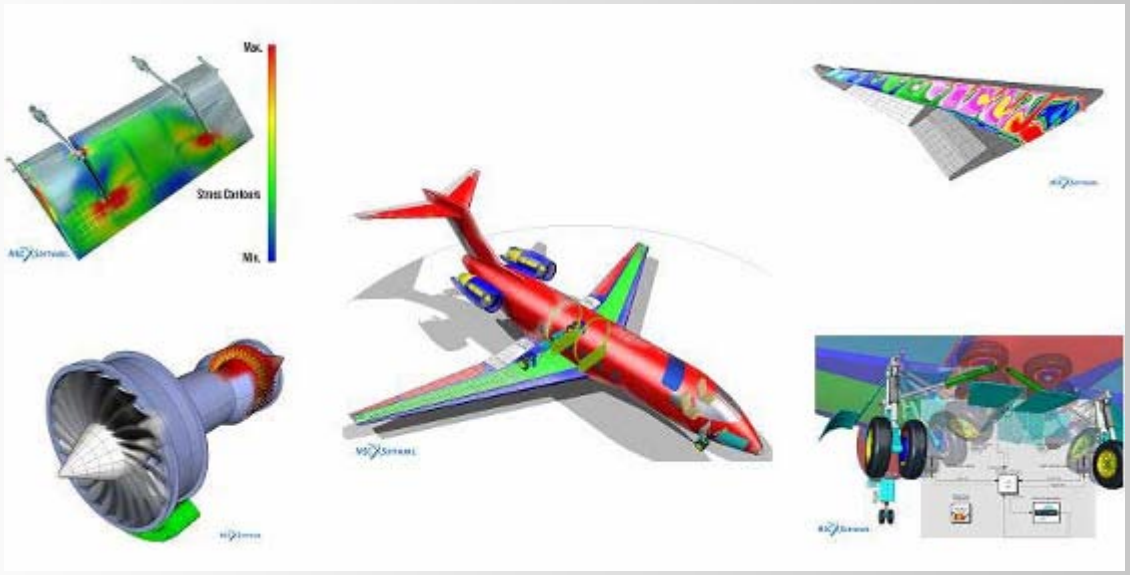




ITEA Standards for Technological Literacy

Implementing Changes

- Product structure can be complex
- Hard to implement changes which
  - affect production
  - need lot of time
  - recourses
  - finances

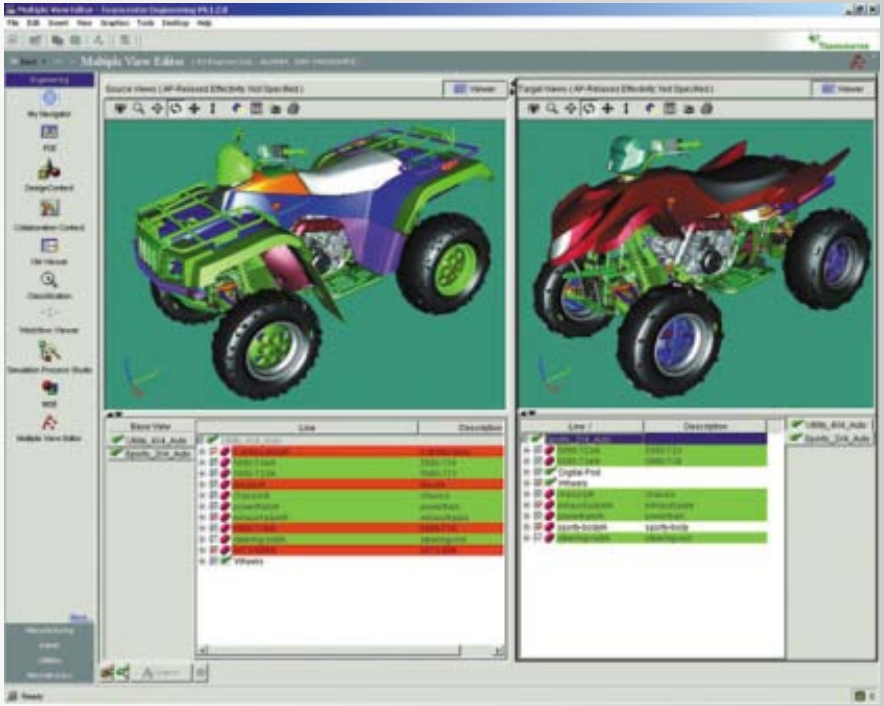


Product Changes Constantly

- Designing a product
    - for manufacturability & assembly

  involves collaboration among various engineers

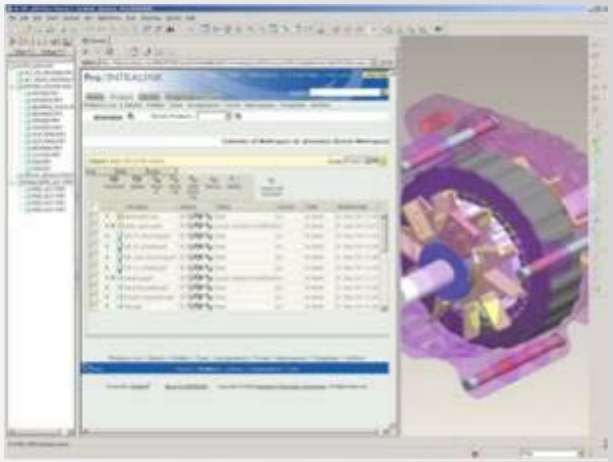
  needs to be documented



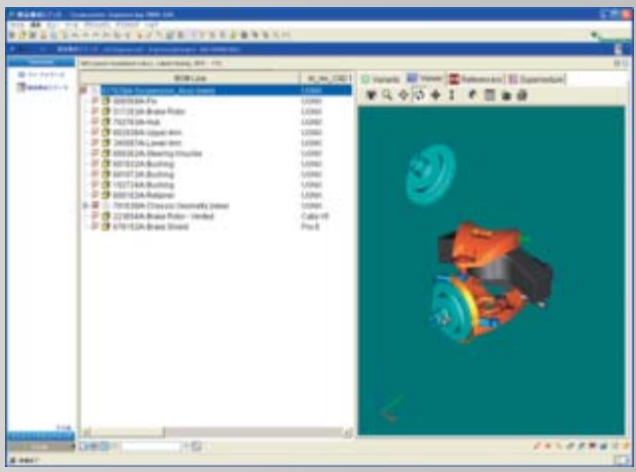
Sharing the Data

- Information needs to be accurate
- Faster than it was before “digital era”

Enovia

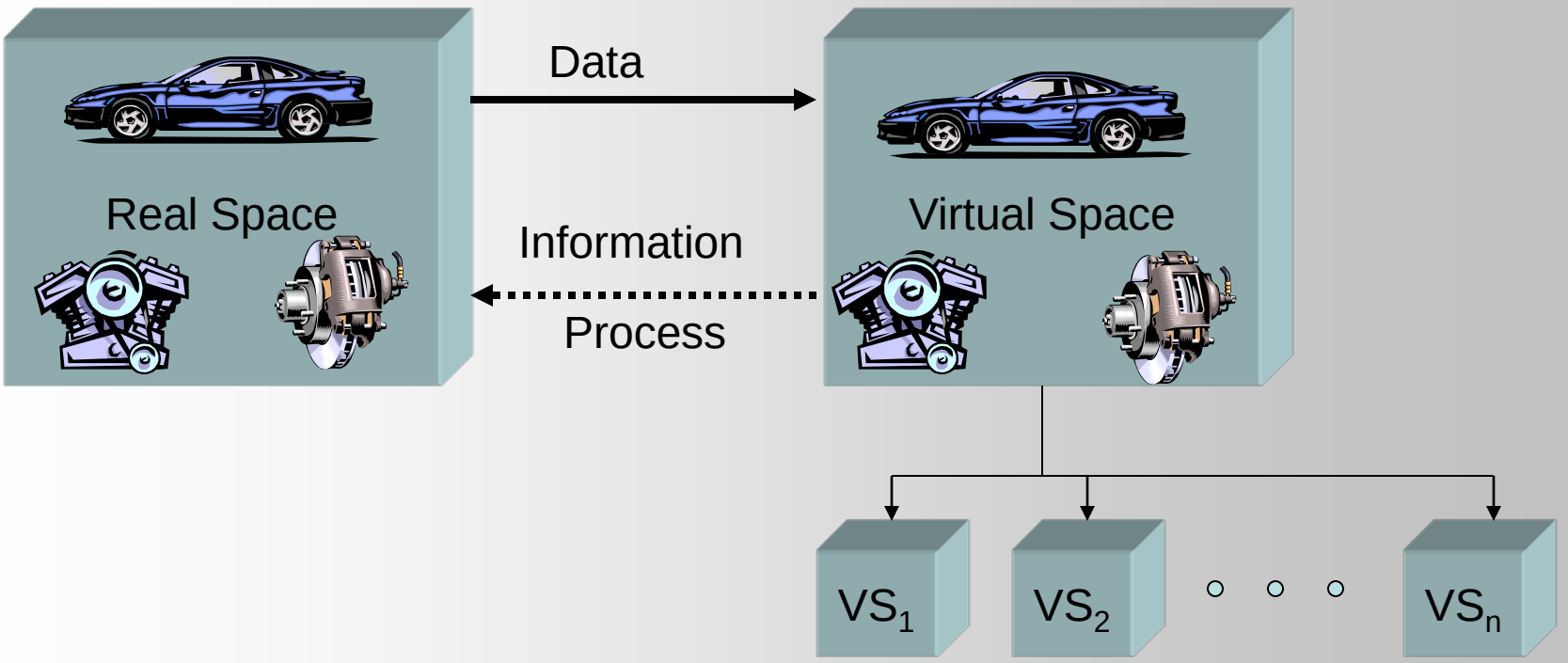


PTC Pro/E Intralink



Teamcenter

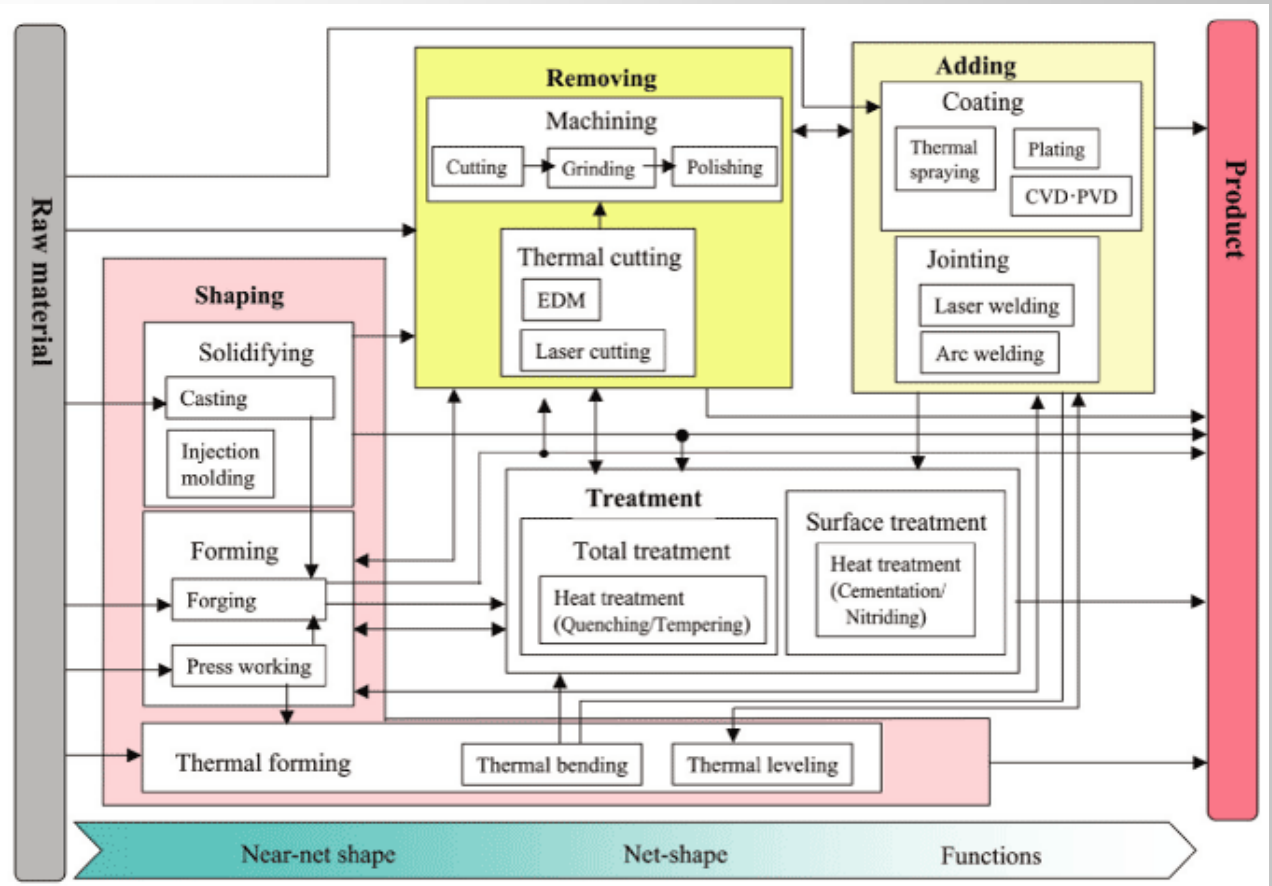
Information Mirroring Model



Source: Grieves, M. (2006). Product Lifecycle Management: Driving the Next Generation of Lean Thinking. New York, McGraw-Hill.

Manufacturing Processes

- from row material to final product (mechanical part)



Supported by CAD/CAM/CAE

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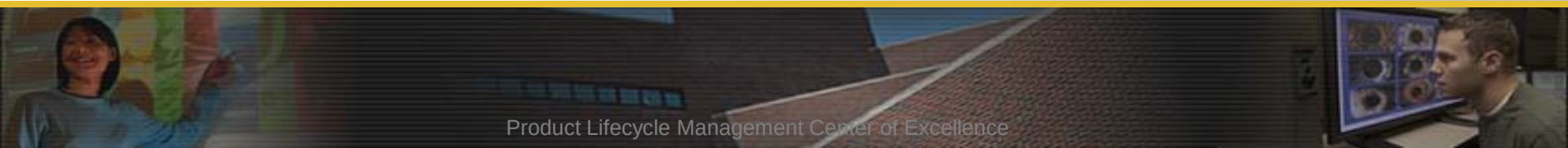

Acknowledgments

The author wishes to acknowledge the support from the Workforce Innovation in Regional Economic Development (WIRED) Opportunity Fund for North Central Indiana DOL Grant Agreement #: HG-15848-07-60 for “Development of Integrated Digital Manufacturing Curriculum.”