Enterprise Overview

Michigan Tech’s Signature Educational Program

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Enterprise & Senior Design Programs
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Agenda

- Overview of Michigan Tech
- Enterprise Program
- Data and Metrics
- Industry Involvement
- Moving Forward
- Questions & Discussion
Overview of Michigan Tech

Mission
We prepare students to create the future.

Vision
Michigan Tech will grow as a premier research university of international stature, delivering education, new knowledge, and innovation for the needs of our technological world.

At a glance:
• Founded in 1885 as Michigan Mining School
• Current enrollment: ~7000 undergraduate/1000 graduate
• Annual research expenditures: ~$42 million
• 5 major schools/colleges: Business, Forestry, Engineering, Arts & Sciences, Technology

Highlights:
• Science, Technology, Engineering, and Mathematics (STEM) focus
• Innovative, discovery-based learning models
• Nationally ranked engineering programs
• 18 major research agencies/institutes
• Average of 17 invention disclosures / $10 million research is highest in the state, among the best nationally
The Enterprise Program

www.enterprise.mtu.edu

The Enterprise Program is an innovative approach to undergraduate education that provides its students with an opportunity to develop technical, business, and interpersonal skills using a multidisciplinary team approach to address real-world projects in a business-like setting.

Program Objectives:

• Experience working in a diverse environment – diversity in education, language, major, culture, thinking style and personality type, gender, ethnicity

• Facilitate the transition from undergraduate education to professional career - provide opportunities to develop leadership and entrepreneurial skills

• Enable students to own a portion of their education that connects strongly to their career goals

• Give students a taste of rewards and accountability associated with creating new products and working with paying clients

• Utilize the students’ fundamental background in science and engineering in the context of solving problems where non-technical issues (i.e. cost, societal impacts, etc.) are of equal importance.

Background:

Program implemented in 2000 with grant funding under the NSF Action Agenda for Systemic Engineering Education Reform.
Enterprise Participation
Who Can Join?

• Motivated and hard-working undergraduates of any major can participate in Enterprise

• First through Fifth-year students can enroll in Enterprise courses

• First-year students can “try out” an enterprise by enrolling in a 1-credit orientation course (ENT1950-fall) and/or a 1-credit project course (ENT1960-spring)
Enterprise Operation

Enterprises are established as permanent organizations and operate like a real company in the private sector. Student teams work with Industry and Government to identify projects and specific problems to be addressed within the projects.

Members of an Enterprise Team operate the business by:

- solving problems
- performing testing and analyses
- managing multiple projects
- manufacturing parts
- managing to a budget and schedule
- developing business and marketing plans
- recruiting, hiring, and training new student “employees”

Aerospace Enterprise working on the Oculus
Enterprise Curriculum

The Enterprise Program consists of project work and instructional modules which mimic professional development workshops in industry. The Program has evolved into two levels of participation across the entire campus.

- **12 credit Concentration** presently available in each engineering program and in most non-engineering programs:
  - 6 credits of project work
  - 3 credits of modules in Teaming and Communications
  - 3 credits of elective instructional modules

- **20 credit Minor** in Enterprise presently available to all majors:
  - 6-7 credits of project work
  - 3 credits of modules in Teaming and Communications
  - 5 credits of modules in Business related topics
  - 5-6 credits of elective instructional modules

...Enterprise participation can count as an alternative to Senior Design for engineering majors.
Enterprise Course Modules

**Teaming, Communications and Business...**

ENT2961 - Teaming in the Enterprise
ENT2962 - Communication Contexts
ENT3962 - Communication Strategies
ENT3400 - Economic Decision Analysis
ENT3954 - Enterprise Market Principles
ENT3961 - Enterprise Strategic Leadership
ENT3963 - Entrepreneurship
ENT3964 - Project Management
ENT3971 - 7 Habits of Highly Effective People
ENT4951 - Project Budgeting
ENT4952 - Complex Communication Practices
ENT4954 - Global Competition

**Special Engineering Topics...**

ENT3972 - Electronic Circuit Design & Fab
ENT3955 - Conceptual Design Prob Solving
ENT3956 - Industrial Health & Safety
ENT3957 - Product/Process Design
ENT3958 - Ethics in Engineering
ENT3966 - Design for Manufacturing
ENT3967 - Product/Process Design II
ENT3969 - Project Phases of Design/Implementation
ENT3973 – Geo/Hydrological Techniques
ENT3974 – Fuel Cell Fundamentals
# Enterprise Teams

<table>
<thead>
<tr>
<th>Team Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Aerospace Enterprise</td>
<td>Satellite and other aero-based projects</td>
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<tr>
<td>Alternative Fuels Group</td>
<td>Alternative fuels for industrial and commercial applications</td>
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<tr>
<td>AquaTerraTech</td>
<td>Ground water evaluation and planning</td>
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<tr>
<td>Automotive Systems Engineering</td>
<td>Engineering consulting services</td>
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<tr>
<td>Blue Marble Security Enterprise</td>
<td>Homeland security technologies</td>
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<tr>
<td>Board Sport Technologies</td>
<td>Innovative boarding products, materials, and processes</td>
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<tr>
<td>Challenge X</td>
<td>Hybrid electric SUV design and competition</td>
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<tr>
<td>Clean Snowmobile Challenge</td>
<td>Noise/emissions reduction</td>
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<tr>
<td>Consumer Products Manufacturing</td>
<td>Disposable consumer products</td>
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<tr>
<td>Entrepreneurial Enterprise</td>
<td>Identification, assessment, and marketing of new technologies</td>
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<tr>
<td>Formula SAE Car</td>
<td>Indy-style race car design and competition</td>
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<tr>
<td>Husky Construction Enterprise</td>
<td>Low-cost, energy efficient construction solutions</td>
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<tr>
<td>Husky Game Development</td>
<td>Gaming products and technologies</td>
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<td>IT Oxygen</td>
<td>Internet-based solutions for technical education</td>
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<tr>
<td>Innovative Castings Enterprise</td>
<td>Casting methods and materials</td>
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<tr>
<td>Integrated Microsystems</td>
<td>Wireless integrated microsystem technologies</td>
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<tr>
<td>International Business Ventures</td>
<td>Business development services with international collaboration</td>
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<td>Mini-Baja SAE</td>
<td>Mini-baja vehicle design and competition</td>
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<td>NVH Enterprise</td>
<td>Noise and vibration reduction for industry</td>
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<tr>
<td>Pavement Design</td>
<td>Design, materials development, and construction</td>
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<tr>
<td>PrISM</td>
<td>Integrated sustainable manufacturing</td>
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<tr>
<td>Robotic Systems Engineering</td>
<td>Robotic manufacturing technology</td>
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<tr>
<td>STC/Arts Enterprise</td>
<td>Documentation, media development, and communication solutions</td>
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<tr>
<td>Wireless Communication</td>
<td>Wireless communications, hardware, and software development</td>
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New Enterprise Teams in 2008

- Automotive Computing Enterprise (ACE)
- Cin/Optic Media Enterprise
- Green Campus Enterprise
- NanoTech Innovations
- The FERM – Forestry and Environmental Resource Management
- U2Explore

**Students and faculty from all 5 major schools and colleges at Michigan Tech participate in Enterprise.**
Minors and Concentrations Awarded

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<tr>
<th></th>
<th>00-01</th>
<th>01-02</th>
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<tr>
<td>Total</td>
<td>5</td>
<td>9</td>
<td>23</td>
<td>39</td>
<td>55</td>
<td>59</td>
<td>56</td>
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Retention with Enterprise

3rd Year Retention Rate ~ Fall ‘01 Engineering FTIACs:
- 93.2% for Enterprise students
- 67.2% for non-Enterprise students
  (Difference is highly significant, p<0.0001)

2nd Year Retention Rate ~ Fall ‘02 Technology FTIACs
- 100% for Enterprise students
- 59.6% for non-Enterprise students
  (Difference is significant, p<0.05)
Graduation Rates – Enterprise Vs. Non-Enterprise Students

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<thead>
<tr>
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<th>2005-06</th>
<th>2006-07</th>
<th>2007-08</th>
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<tr>
<td></td>
<td>Cohort</td>
<td>Rate</td>
<td>Cohort</td>
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<tr>
<td>Enterprise</td>
<td>127</td>
<td>86.6</td>
<td>183</td>
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<tr>
<td>Non-Enterprise</td>
<td>779</td>
<td>70.6</td>
<td>774</td>
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Student Benefits

- Hands-on learning, on REAL projects
- Team-based projects = ‘soft-skills’ development
- Mentorship from, and accountability to, an industry sponsor as the client
- Multi-year experience (Enterprise) allows students to practice different roles in the organization
- ...Valuable career preparation!

Student Resume

EDUCATION
Michigan Technological University, Houghton, M
B. S, in Electrical Engineering, CS Minor, Fall 2003
Cumulative G.P.A of 3.36
Recipient MTU Ambassador Student Scholarship
for exceptional academic achievement

WORK EXPERIENCE
Wireless Communication Enterprise, MTU
Project Engineer January 2002-Present
Programmed a chip for a wireless snow alarm
As project manager, managed relations
with industry, enterprise staff and team
Built a communicating transmitter and receiver
Designed an RF amplifier and Butterworth filter
Served as Financial Manager, responsible for
project accounting and procurement

“I think joining the WCE was the best
decision I made as an undergraduate. The scope of the
tasmishing. As a result
t of enterprise my skills range from
design engineering and project
management to technical writing
and documentation.
I have interacted with many other
incoming graduates from other
universities and no university has
any program that even closely
resembles ours.”

~Enterprise Alum
Industry Involvement

Industry involvement and sponsorship is critical to the Enterprise program. There are numerous ways for industry to get involved, all of which enhance an organization’s visibility with the workforce of tomorrow...

**Typical support:**

- **Project/team sponsorships** - range from ~$5-40K depending on duration, team size, and project budget
  - Typical projects are $15K
  - Intellectual property rights can be addressed at the project outset
  - Deliverables are educational in nature and include a written report, presentation, and (project-dependent) prototype

- **In-kind support** – donation of hardware, materials, services, etc.
Industry Benefits

- Additional project resources on non-critical path projects
- Fresh perspectives to industry challenges
- Recruiting – exposure to a team of students for co-op, intern, and full-time hire needs
- Sponsor visibility and recognition
- A gateway for a broader relationship with Michigan Tech
- A direct hand in shaping undergraduate education and tomorrow’s workforce

“Engineering today is about team work, communication and working with the public. Unfortunately, these skills are not taught in many of the engineering programs at our Universities. The Enterprise program at MTU combines all these skills in the program and better prepares students for entering the professional workforce. It is one of the most impressive programs that I have seen in all my travels to Universities across the country.”

~Patricia Galloway, President ASCE
CEO, Neilsen-Wurster Group

“I believe that the Michigan Tech Enterprise is a leading program in preparing engineering students with leadership skills, attitudes, and valuable insights to enable rapid personal and professional excellence. I also believe that this program supports a critical U.S. Engineering educational need to prepare students to thrive in the fast paced, rapidly changing environment that is facing all U.S. industry.”

~Randy Hill, VP Product & Technology
Kimberly-Clark Corporation
Industry Sponsors

Enterprise support past and present:

Ford Motor Company
General Motors Corporation
Kimberly-Clark Corporation
Environmental Protection Agency
Keweenaw Bay Indian Community
Society of Manufacturing Engineers
Sun Microsystems
National Center for Mfg Sciences
SBC Ameritech
Visteon Corporation
NCIIA
Cummins
Rockwell Collins
Microporous Products, L.P.
Volvo Construction Equipment
Robert and Ellen Thompson
Patrick Eddy
Winsert, Inc.
BAE Systems
Heyer America
DENSO N.A. Foundation
General Electric
Cleveland Cliffs
Robert Bosch Corporation
Chrysler LLC
Guidant / Boston Scientific
Mercury Marine
TRW
Deere & Company
Alwin Manufacturing
Eastern Alloys
Superior Controls
Everett Industries
USG Interiors, Inc.
Caterpillar
Aaron K. Ellison
Marquette General Health Systems
Copper Country ISD
GE Aviation
V.I.O. Inc.

Samsung
General Dynamics
Toyota
Bechtel
MDOT
Norsk-Hydro
Delphi Automotive
T² Communications
TACOM
American Electric Power
ThyssenKrupp
Anchor Coupling
Terex Handlers
Roehl Transport
Oshkosh Corporation
3M
ArcelorMittal USA
Keystone Healthcare
Altair Engineering
Moving Forward

Several initiatives are in progress as we strive for continuous improvement and growth of this innovative educational approach.

- Curriculum and assessment improvements, across disciplines
- High School Enterprise Program
- International Projects and Collaboration
- Graduate Level Enterprises
- Entrepreneurial Initiatives with MTEC SmartZone Business Incubators
- Adaptation of the Enterprise model, and collaboration with, other colleges and universities around the world
Questions & Discussion