The Enterprise Program
Multiyear, Multidisciplinary Experiential Learning

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Michigan Technological University

1885

1. Introduction

About Me

- Industry (1994-2006)
  - Automotive, consumer products, commercial vehicle
  - Engineering, program management, leadership, Six Sigma Black Belt
  - Inventor (10 patents)

- Higher Education (2006-present)
  - Corporate Relations
  - Program Director
  - Professor of Practice, Enterprise Faculty Advisor

- Education (lifelong!)
  - BSME, MBA, MSME
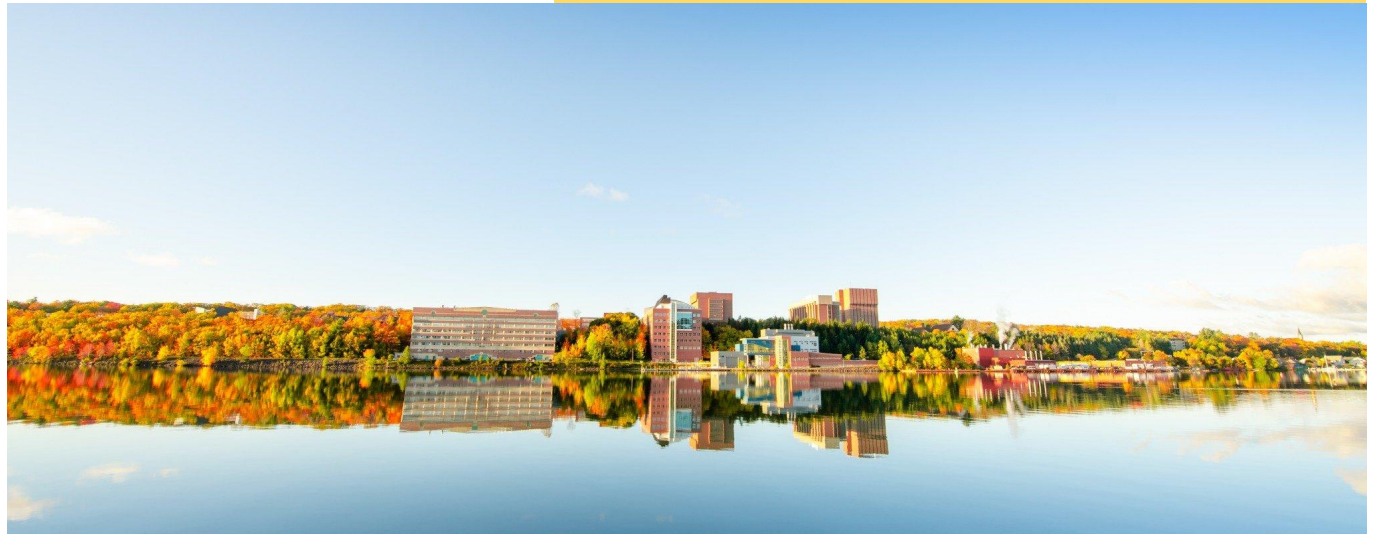 - Certified Six Sigma Black Belt

About Michigan Tech

About Michigan Tech

325.6"
2021-22
Snowfall Total

The Keweenaw Snow Thermometer
(Photo by Jim DuFresne, MLive.com)

- 5,778 undergraduate / 1,231 graduate
  - 59.7% Engineering
- 454 faculty / 1,085 staff
- 13:1 student to faculty ratio
- 93.8% graduate placement rate, $65,000 median starting salary
- $81.9 million research expenditures

2. What is Enterprise?

Enterprise Mission

What?	Provide an innovative learning environment that fosters development of *disciplinary, professional, and entrepreneurial skills*
How?	Application of student knowledge and interests on *client-sponsored, multidisciplinary, team-based projects*
Why?	*Produce career-ready graduates* -- sought by employers, who create societal value
For Whom?	*First-year through graduate-level students from ANY major*

Enterprise is...

Experiential

Multidisciplinary teams, multi-year participation, hands-on projects with open-ended solutions
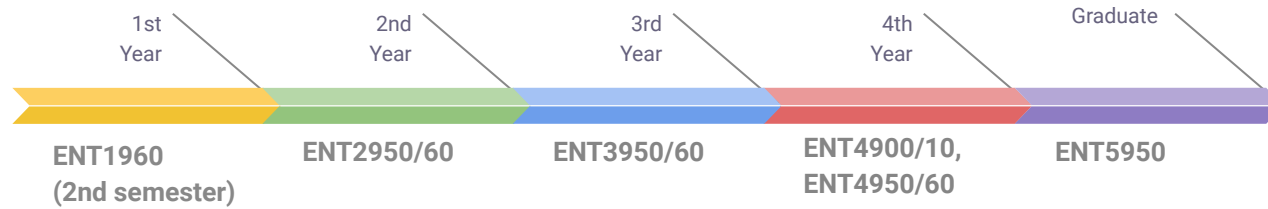
Student-driven

Organizations of students in a business-like setting, faculty advisors coach and guide

Industry-supported

Projects, financial support, industry professionals as clients and mentors, recruiting opportunities

Program Design

1st Year	2nd Year	3rd Year	4th Year	Graduate

ENT1960 (2nd semester) — **ENT2950/60** — **ENT3950/60** — **ENT4900/10, ENT4950/60** — **ENT5950**

< Project work

an "employee" of the enterprise (1-2 credits per semester)

Course modules >

Personalized "employee" development (1-2 credits each)

Technical / Professional	Business / Innovation	Interpersonal
• Alternative Energy • Design for Manufacturing • Industrial Health and Safety • Lean/Six Sigma/Continuous Improvement	• Global Competition • Marketing • Project Management • Ideation/Human Centered Design • Lean Start-up • Finance & Budgeting	• Teaming • Communication • Strategic Leadership • Ethics • Personal Brand Management • 7 Habits of Highly Effective People

Enterprise Options

—

Capstone / Senior Design
Enterprise Concentration
Enterprise Minor

Enterprise Options

—

Capstone / Senior Design
Enterprise Concentration
Enterprise Minor

Project
Work

(4-6 credits)

Enterprise Options

—

Capstone / Senior Design
Enterprise Concentration
Enterprise Minor

Project
Work &
Modules

(9-12 credits)

Enterprise Options

—

Capstone / Senior Design
Enterprise Concentration
Enterprise Minor

Project
Work &
Modules

(18 credits)

A "typical" enterprise...
(is anything but typical!)

35 students

5 unique majors

22% women

Enrollment by Class: 2020-21

Graduate
1.0%

First year
2.3%

Second year
9.0%

Third year
26.0%

Fourth year
61.6%
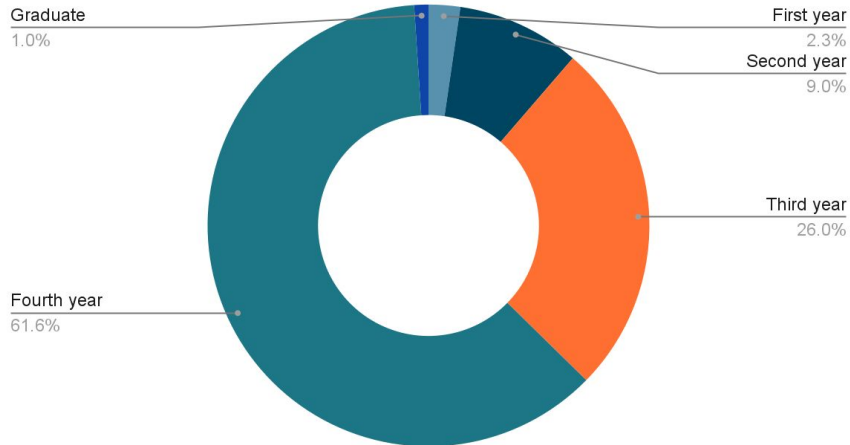
Each enterprise is a permanent organization that works with internal and external stakeholders to:

- Discover, develop, and evaluate solutions to meet client needs
- Manage multiple projects, schedules, and budgets
- Recruit, develop, and retain members

The **Multiplanetary INnovation Enterprise (MINE)** seeks to design, test, and implement robotic technologies for extracting and using local resources, construction, and characterization in extreme environments. These environments currently include Lunar, Martian and flooded subterranean environments on Earth.

MINE works in multidisciplinary groups to develop technology to perform tasks in extreme environments on Earth and on other planets. We participate in NASA's lunabotics competition, build and test robotic vehicles and technologies directly related to state of the art research for a variety of customers (Government, Commercial, Internal).
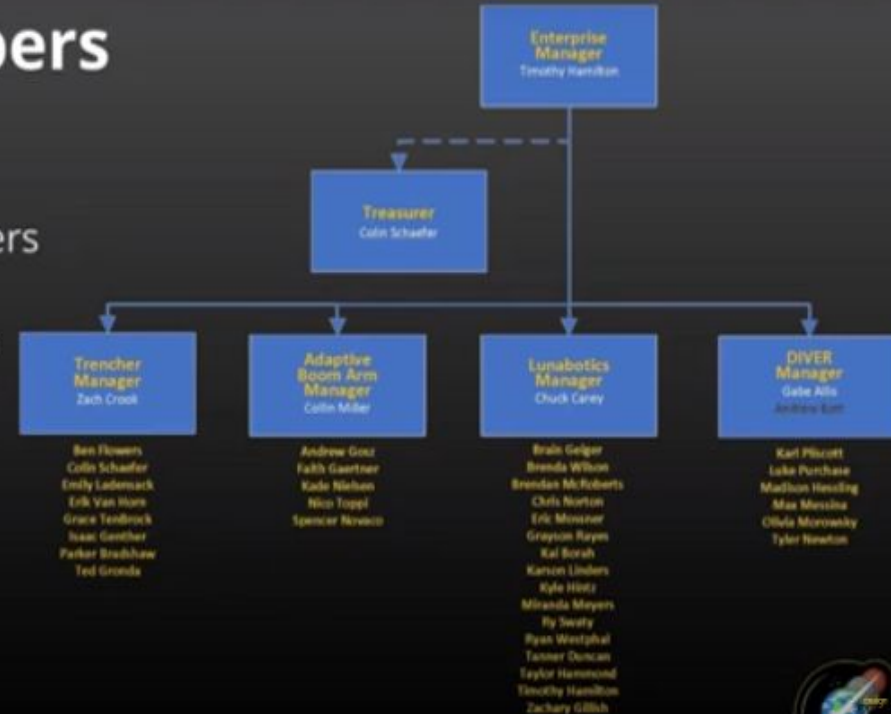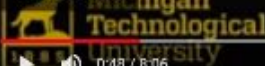
Environment & Sustainability

Built World

Hotforest

Green Campus

Communications

Cin/Optic Media

Wireless Communication

Technology

Alternative Energy Enterprise

Multiplanetary INnovation Enterprise (MINE)

Open Source Hardware

Materials & Manufacturing

Advanced Metalworks

Consumer Product Manufacturing

BoardSport Technologies
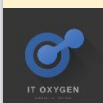
General & Expedition Adventure Research

Software, Electronics, & Robotics

Blue Marble Security

Husky Game Development

ITOxygen

Robotic Systems

Strategic Education through Naval Systems Experiences (SENSE)

Transportation & Mobility

Aerospace

Supermileage Systems

Blizzard Baja

Clean Snowmobile Challenge

Formula SAE

Velovations

Human Health & Interface

Innovative Global Solutions

Humane Interface Design

(new Fall 2021!)

26 enterprises, 900 students, 35+ majors!

Multidisciplinary Reach

Enrollment by College: Fall 2021

Sciences and Arts 3.8%
Business 1.7%
Computing 16.4%
Engineering 77.8%
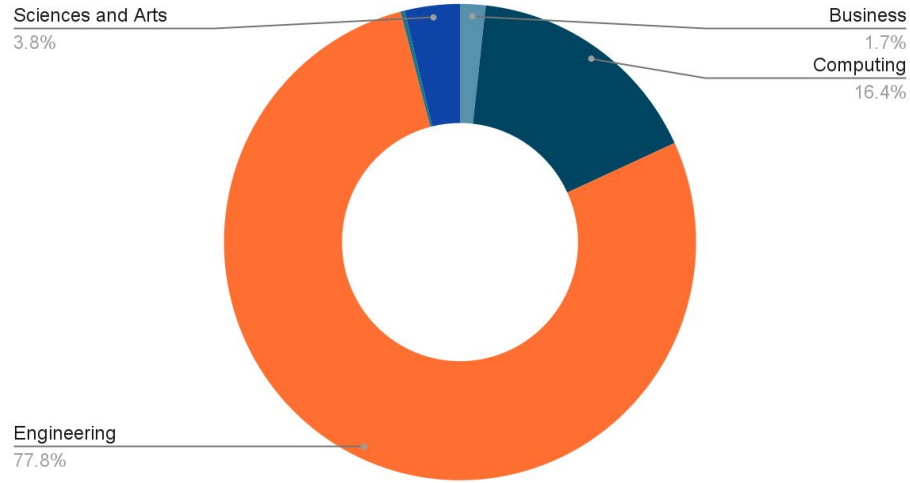
Majors by College: Fall 2021

Business 10.5%
Computing 15.8%
Sciences and Arts 36.8%
Engineering 31.6%
Forest Res. and Env 5.3%
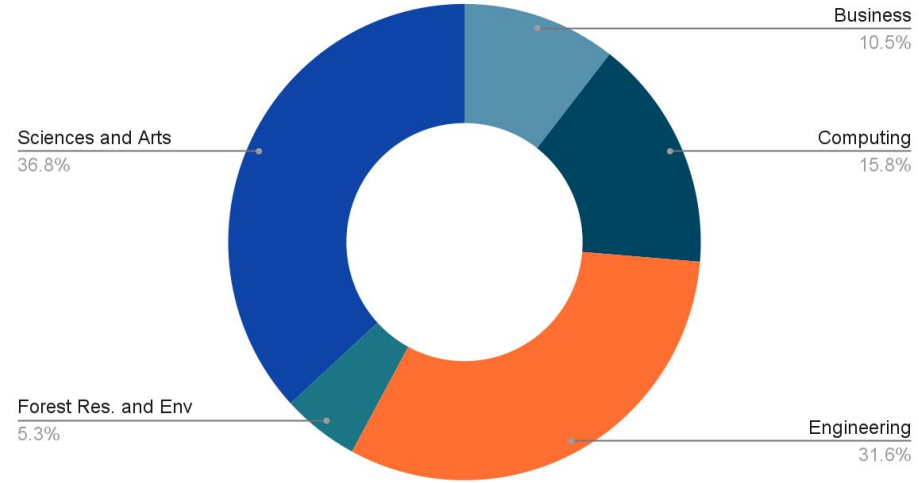
[Some of] our program partners

OSHKOSH · CLIFFS · aramco · AIRTECH INTERNATIONAL INC. Vacuum Bagging & Composite Tooling Materials · 3M

JOHN DEERE · Kimberly-Clark · MERCURY · GENERAL MOTORS

Whirlpool CORPORATION · DENSO · LIBBEY · FCA FIAT CHRYSLER AUTOMOBILES · IPETRONIK · SUSSEX IM

DEVCOM GROUND VEHICLE SYSTEMS CENTER · Halla Mechatronics · iTC A FORTIS COMPANY · Cummins · Ford · LEAR CORPORATION · Henkel · OHM

SYSTEMS ENGINEERING RESEARCH CENTER · Altair · nexteer AUTOMOTIVE · ArcelorMittal · KOHLER Engines

Milwaukee · DERINGER·NEY · MAGNA · NUCOR · FEV

Student Benefits

- **Apply -** education to industry-relevant projects
- **Develop -** professional, interpersonal, and leadership skills through multi-year project experiences
- **Network and Collaborate-** with industry professionals, multidisciplinary teams
- **Cultivate & Affirm -** curiosity and career interests

Program Sponsor/Partner Benefits

- **Mentor & Engage -** with tomorrow's leaders and professionals
- **Market & Promote -** your organization to the campus community
- **Access -** students, faculty, and University resources
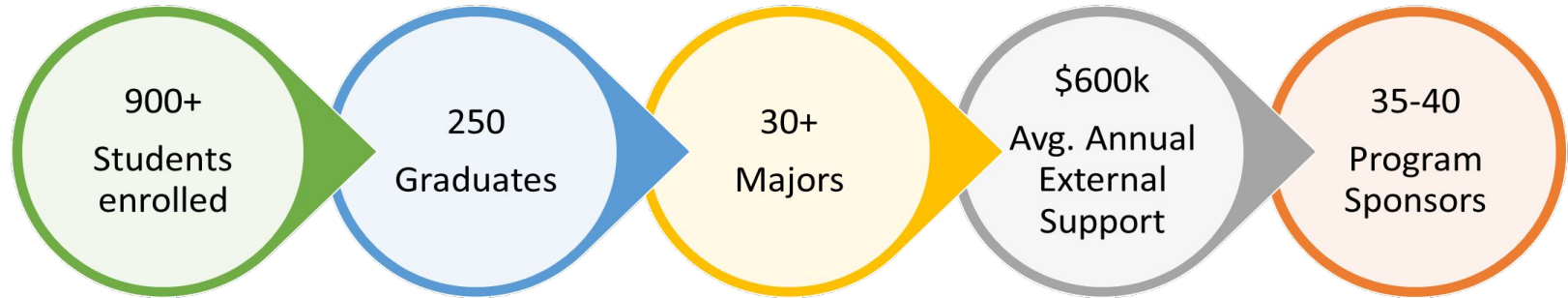- **Partner -** with Michigan Tech to infuse experiential learning with industry-relevant application

Faculty Advisor/Mentor Benefits

- **Engage -** with students in student-led, discovery-based learning
- **Develop & Strengthen -** teaching, mentoring skills
- **Network & Collaborate-** with industry to build broader relationships
- **Identify & Recruit -** potential students for your research programs

Program Impact

Annual >>>

900+ Students enrolled

250 Graduates

30+ Majors

$600k Avg. Annual External Support

35-40 Program Sponsors

<<< Lifetime

92.0% Graduation Rate

95.8% 3rd Year Retention

4,821 Alumni and Counting!

$10M+ Post-Grant External Support

$750k Initial NSF Grant

2. How Did We Get Here?
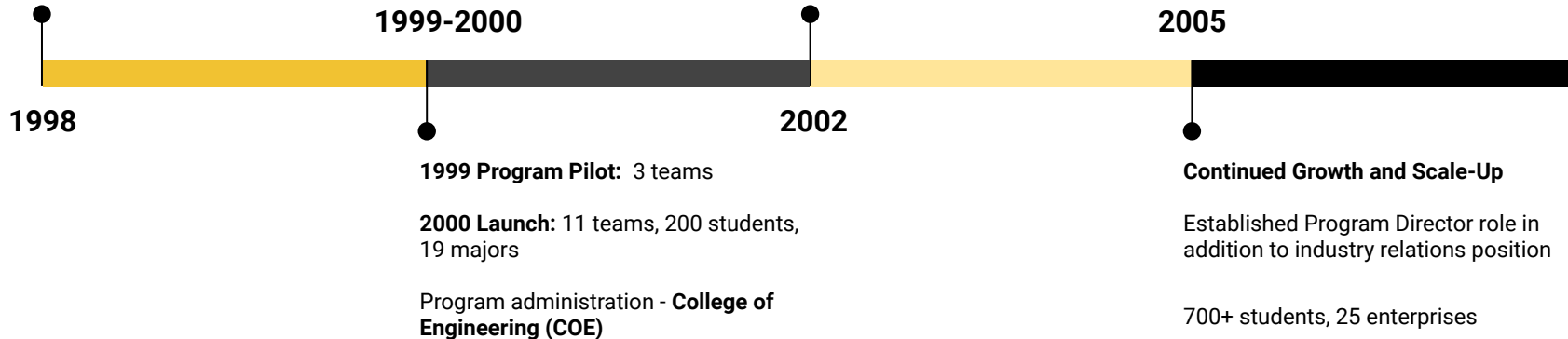
Program Timeline

NSF Award #9872533: $749,976

Redesigning Engineering Education with Active Learning and Integration Through the Engineering Enterprise (REEALITEE)

M. Plichta, C. Anderson, B. Joyce, B. Barna, S. Sorby

NSF Grant Concludes

Industry sponsorship model in place, dedicated Industry Projects Coordinator

1999-2000

1998

2002

2005

1999 Program Pilot: 3 teams

2000 Launch: 11 teams, 200 students, 19 majors

Program administration - **College of Engineering (COE)**

Continued Growth and Scale-Up

Established Program Director role in addition to industry relations position
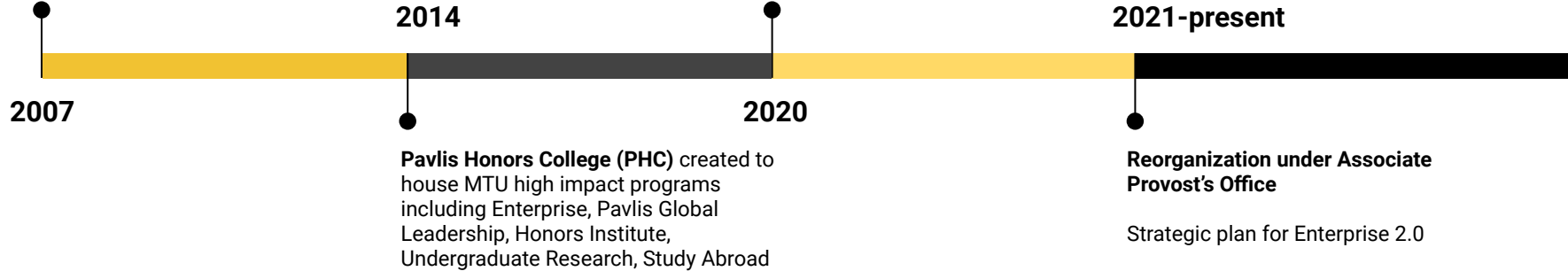
700+ students, 25 enterprises

Program Timeline (cont.)

Interdisciplinary Initiative

Program moved out of COE into newly formed Institute for Leadership and Innovation (ILI)

Matrixed reporting into Vice President for Research and Provost

Enterprise Program's 20th anniversary

Program operating at steady state of ~800-900 students annually, financially self-sustaining

2014

2021-present

2007

2020

Pavlis Honors College (PHC) created to house MTU high impact programs including Enterprise, Pavlis Global Leadership, Honors Institute, Undergraduate Research, Study Abroad

Reorganization under Associate Provost's Office

Strategic plan for Enterprise 2.0

The "Perfect Storm"

- NSF Support
- Industry Need
- Engineering, Business, Humanities Collaboration
- ABET EC 2000
- Academic Calendar Changes
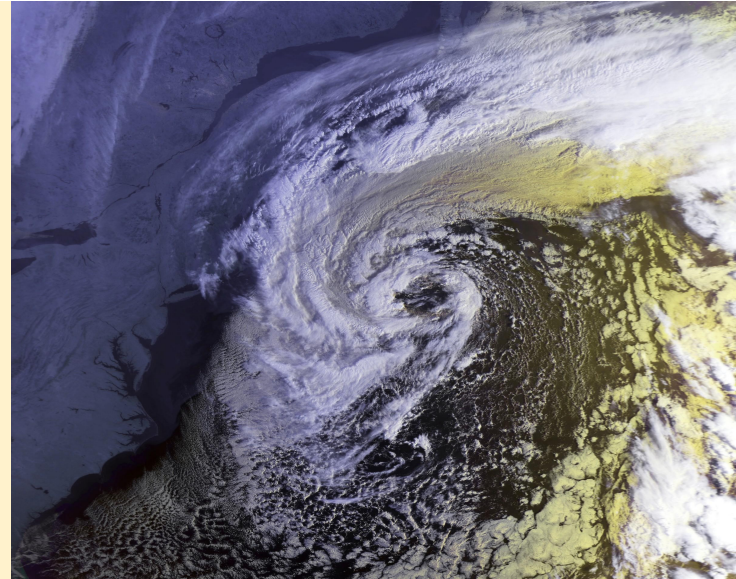
A Good Starting Point

- Engaged faculty with ideas!

- Competition teams

- Support of engineering depts.

Choice & Flexibility...
fosters motivation, engagement, and value creation

- Students -

- Sponsors -

- Faculty -

Organizational Enablers

- **Dedicated industry liaison / fundraising role**
- **Internal governing board**
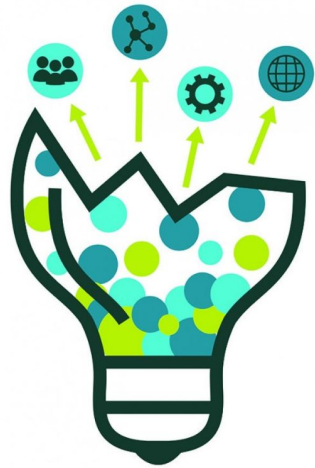- **Small, high-STEM university**
- **Industry network**

3. Where Next?

First-year focus

- **Earlier student involvement**
- **Exploration of interests**
- **University retention!**

Beyond Capstone: "Next-Gen Gen-Ed"

IDEA hub
Innovate | Design | Engage | Act

- *"Essential Education"*
- Pathway, capstone experiences for ALL majors
- Enterprise satisfying Gen-Ed learning outcomes

Operational Refinements and Standards

- **Faculty recognition/credit**
- **Project/program software**
- **Revisit the funding model**
- **Coordinate external engagement**

Questions

mtu.edu/enterprise

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