

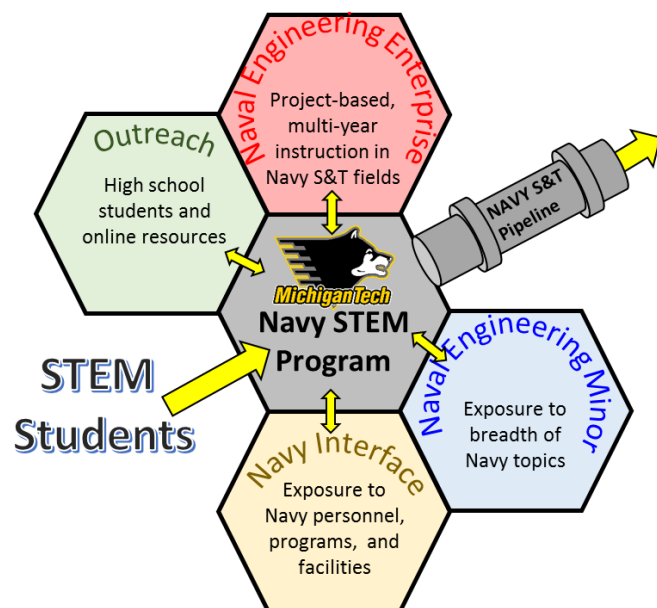
Developing a talent pipeline: Inspiring future naval engineers and scientists using real-world project based instruction

Releasable to the Public

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Approach

A multi-tiered approach for attracting young engineers and scientists to naval STEM fields is proposed. Our approach develops project-based instruction through Michigan Tech's Enterprise program, develops a minor in Naval Engineering, interfaces students with Navy personnel, facilities, and programs, significantly contributes to online resources for Navy STEM students, and engages high school students to pursue Navy related STEM fields. This program will be nationally scalable for universities who do not offer naval architecture or ocean engineering majors. The program will be designed with flexibility and agility in mind to quickly adapt to new and emerging Navy S&T needs.



Technical Objective

The goal of this proposal is to create an undergraduate science and engineering program at Michigan Technological University (MTU) that focuses students in STEM topics of Navy interest, provides real-world problem-solving based learning, and compels students to seek employment within the Navy upon graduation or pursue graduate research in Navy STEM fields. The primary deliverable of this program is to create a pipeline of diverse STEM graduates, hired into STEM fields within the Navy, capable of supporting the warfighter mission on day-one.

Relevance

Development of new engineers and scientists in STEM fields is of critical long-term importance to the Navy and Navy supported industries in maintaining technological superiority in theater. This technological superiority directly influences the capability and safety of the warfighter. Unfortunately, many STEM graduates are either unaware of Navy careers, or are unprepared for problems facing the Navy STEM workforce. This proposal aims to provide a steady flow of highly motivated and trained civilian and uniformed Navy engineers and scientists to the Navy's workforce of the future, capable of supporting the warfighter on day-one. Focus areas will initially be ***underwater acoustics, noise control for noise induced hearing loss, autonomy and control, and unmanned vehicle design***. Each of these fields are critical to the

S&T strategic plan of the Navy and the Navy's Force of the Future. S&T focus areas initially include *Assure access to the Maritime Battlespace, Autonomy and Unmanned Systems, and Warfighter Performance*, and can expand in the future. Future expansion of the successful program will include other Navy S&T focus areas such as computer science (Big Data), materials science, electrical engineering, and others.

Implementation

Our approach develops project based instruction through Michigan Tech's Enterprise program, develops a minor in Naval Engineering, interfaces students with Navy personnel, facilities, and programs, significantly contributes to online resources for Navy STEM students, and engages high school students to pursue Navy related STEM fields. This program will be nationally scalable for universities who do not offer a naval architecture or ocean engineering major.

The Enterprise program at Michigan Tech is student-driven, multidisciplinary teams that work like companies on real-world projects. A typical Enterprise consists 20-60 undergraduate students per year with students devoting 12-20 credit hours over their undergraduate careers. We propose an Enterprise focused in naval engineering and science that would provide students real problems of Navy interest. Funding to start the Naval Engineering Enterprise would be provided through this grant, and sustained funding would be provided through industry sponsorship, and future project-specific faculty grants. This funding model has been successful with the 27 current MTU Enterprise teams. The Enterprise project topics will be widely defined to allow for an agile program that can rapidly adapt to current and future Navy S&T needs.

To supplement the Enterprise initiative, we propose a minor program in Naval Engineering at MTU. The credits earned through the Enterprise program combined existing and new course offerings will qualify students for a minor. This will help them to gain employment in Navy STEM careers and be ready for on-the-job success from day-one. Initially, we envision the minor to encompass Mechanical Engineering core courses and senior level electives both within Mechanical Engineering and other engineering fields. Power electronics, water resources, advanced materials science, advanced computing, and other courses will be part of the minor program to provide well-rounded naval engineers to the workforce. In addition, this will provide a training ground for exceptional students to gain skills for graduate work in Navy STEM fields. One thrust area for both the Enterprise initiative and the development of Naval Engineering minor program will be online course content. The web content will consist of videos of projects and demonstrations, course notes, and live-streamed lectures for distance education students. This provides scalability of our course content to any naval engineers interested in continuing education and provides a robust recruiting tool for incoming students. In addition it acts as a recruiting tool for industrial Enterprise sponsors.

We intend to provide our students with meaningful experiences outside of the classroom by partnering with Navy laboratories, industry, and other institutions of higher education. We plan to invite current Navy STEM employees to visit MTU and interface with our students. We will sustain meaningful connections with other Navy-based higher education institutions, such as

the University of Michigan and others. These connections will be used to enrich student learning through collaborative projects, summer internships, and/or intercollegiate student competitions.

We will take advantage of the unique facilities at Michigan Tech to educate our students in Navy S&T thrust areas. Michigan Tech is located on the shores of the Keweenaw Waterway with direct access to Lake Superior. The GLRC provides state-of-the-art laboratories and a fleet of 4 surface ships, 2 ROV's, and an IVER 3 fully autonomous underwater vehicle. With Lake Superior less than an hour's ride from the GLRC aboard the R/V Agassiz, researchers spend their time where it matters most: on the water. We are uniquely positioned to offer students hands-on, on-water experiences "out our back door" in order to supplement classroom education. Based on our unique northern ice-bound coastal climate, we are equipped to give students project experience with underwater communications, autonomous vehicle operations, and other topics relating to future Navy under-ice arctic missions. Finally the GLRC houses one of the most powerful supercomputers in the region, Superior, that can be used to solve many big-data problems.

Participation from on campus organizations such as veteran services and the newly formed Pavlis Honors College at Michigan Tech will be pursued. We will seek to integrate our outstanding students' experiences with existing Navy undergraduate programs such as the Naval Research Enterprise Internship Program (NREIP) program.

This is a three year effort. In the first year, the Enterprise program will be developed and projects and students will be recruited for the second year. Courses will be evaluated for a minor program, new courses will be developed, where necessary. The minor program will begin the university approval process. Collaborations with other universities will be pursued. The Enterprise program and minor program will begin in year two with significant online presence established. Year three will see continuation and expansion of the initiatives and provide program assessment metrics. Sustaining sponsors will have been recruited for the Enterprise program and course development for the minor program will be complete and ready for ongoing course offerings.