

Building an Agile Ocean Technician Workforce for Today and Tomorrow

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Abstract— Globally, the needs and requirements of marine technicians from decades past are significantly different from the skills and competencies of today’s workforce. In the past, the typical “technician” for the industry came from trade focused skills including electronics and hydraulics or a technical trade focused two-year associates degrees from community colleges. Supporting today’s technical marine based workforce requires agile approaches and a shift from traditional knowledge transfer to a competency-based approach that needs to adapt to diverse learner profiles and backgrounds.

Keywords—workforce development, education, marine technology, microcredentials

I. INTRODUCTION

There exists a significant gap between the marine industry workforce needs and the development and output of people prepared to meet this demand [1]. The landscape of workforce preparation has change and the role of academic institutions and related programming needs to adapt at a faster pace while utilizing multiple modes of delivery. The methods for preparing these skilled marine industry workers is ripe for innovation and transformation including the redesign of academic programs and course content along with the inclusion of rapid training programs, short courses, embedded certifications, microcredentials, and other competency based approaches.

Table 1 Drivers for today’s education

Traditional – who we have been	Future – Who we are becoming
Placed Based	Content Based
Time Based	Competency based
Knowledge Transfer	Synthesis and Application
Public good	Private good
Long Development Cycles	Short Development Cycles
Risk Averse	Risk Taking
Reactive	Proactive

It is the latter of these changes that are opening new opportunities for broader markets of learners and a more diverse

workforce. These approaches can be highly successful if connected with key industry perspectives and with robust public/private partnerships and other industry networks.

II. DEVELOPMENT OF MARINE TECHNOLOGY PROGRAMMING

Over the past decade, Northwestern Michigan College’s Great Lakes Water Studies Institute has adopted these strategies in the development of multiple degree pathways supporting the growing demand for qualified technicians in the marine space. These methods have proven successful with workforce preparation and graduate success, with 100% of all graduates of the marine technology programs finding immediate employment opportunities upon completion (or near completion). Employer feedback resonates with the need for specific skills and practical experiences that encompass the spectrum of “job readiness”. These skills emphasize core fundamentals that fall outside marine specific technical skills and can be obtained at colleges and universities throughout the world.

Tier I skills include:

- GIS
- Electronics
- CADD
- Programming/Robotics
- Computer/IT



Figure 1 MTS-NMC Marine Technology Workshop participants mobilizing a ROV

It should be noted that none of the above skills are specific a marine concept or application. Rather, these fundamental skills represent the foundation of many technicians and are core to troubleshooting competencies utilized in all marine technology applications and operations.

Additionally, while availability at all institutions may be limited, other prominently requested skills and competencies include:

Tier 2 Skills

- Field/land surveying fundamentals
- UAS Surveying
- Project management/planning

These types of skills and competencies are consistently found throughout the United States though often at varying levels of maturity and ability.

As seen with the majority of Northwestern Michigan College (NMC) graduates working in this field, the typical operational duties include mobilization and deployment of marine technology systems, integration of sensor packages for geophysical data collection, and data processing. The Bachelor of Science in Marine Technology (BSMT) at NMC has addressed these priorities through a blend of innovative programming, leveraging of partnerships, and substantial investment in people, facilities and assets. As previously written, these efforts have resulted in 100% employment of all graduates in the marine industry across multiple industry sectors.

Marine technology specific skills and competencies include:

Tier 3 Skills

- Basic/intermediate underwater acoustics
- Sonar system(s) mobilization, calibration, and data collection
- Marine platforms (ROV, AUV, ASV, buoys) mobilization and operations
- Data processing
- Marine Business and Project Management



Figure 2 MTS - NMC Marine Technology Workshop participants mobilizing a multibeam sonar

These latter skills and competencies are found at very few institutions and are difficult to develop without key personnel, proper facilities, and readily available access to water and equipment.

III. GLOBAL IMPLEMENTATION

To contribute to the global growth of the workforce, the program has engaged in global partnerships resulting in several tangible results and benefits to the college and NMC industry networks. NMC annually delivers marine technology specific courses to students at Yellow River Conservancy Technical Institute (YRCTI) located in Kaifeng, China. These are short course, highly targeted delivery methods, that augment coursework delivered in China. Several companies support these efforts providing exposure to and procurement of their products by the host school.



Figure 2 - NMC - YRCTI Marine Technology Training Kaifeng, Hunan, PRC

Global delivery underscored the need for accessing and delivering education and training with competency-based, time independent delivery methods. Preparing tomorrow's marine technologist, regardless of discipline or language must continue to focus on the applied competencies required for success in the industry.

IV. MICROCREDENTIAL DEVELOPMENT & IMPLEMENTATION

It cannot be understated the value of microcredentials, certifications, and stackable training opportunities for supporting the ocean technology workforce needs. As evidenced in the MTS-NMC summer workshop, numerous attendees were highly influenced by the experience and ability to utilize the equipment in an applied manner. Feedback included students seeking to add an associates degree to an existing bachelor's degree, this reverse transfer scenario amplifies the power of short course training to further engage new ocean technicians into the workforce. Northwestern Michigan College, intend to continue the partnership with MTS and issue microcredentials to their registered students throughout the academic year.

Table 2 ROV Competencies

Foundational (Camp)	Intermediate	Advanced
History and Types	Tether Management Systems	Major systems repair and integration
Applications and Industries	Thruster Repair and maintenance	Subsea Positioning systems
ROV System Requirement	System Troubleshooting	Mission and project management
Hardware identification	Ballasting	Mission execution
Mobilization and pre-dive checks	Manipulators	Advanced Missions including live boating, confined space, entanglement
Basic sensors	Pilot and Navigating	Onboard sensor data collection
Operations, Launch and retrieval	Vessel and ROV operations	

Preparing tomorrow’s marine technologist must continue to focus on the applied competencies required for success in the industry. This viewpoint led to the partnership with the Marine Technology Society’s stackable microcredentials program. NMC will continue to work with MTS as part of teams working to develop the Fundamental microcredentials for sonar and ROVs, and also continue to host summer workshops for students to earn the first round of Fundamental microcredentials issued.



Figure 3 NMC Bachelors Capstone Project Execution

NMC will continue the partnership by “mapping” the existing curriculum against the competencies identified by the working groups and issue microcredentials in addition to course credit in the future. The process will continue as additional microcredentials are added to the MTS portfolio. NMC sees the value of microcredentials across sectors and will only help to accelerate job placement and contribute to the development of a globally competitive STEM, and specifically an ocean technician workforce prepared to support the exploration, research and development that lies ahead.

V. CONCLUSIONS

Multiple methods for developing an ocean technology workforce will be required for meeting global demand. The MTS microcredential framework creates accessible and flexible pathways to learning and vocational training and support these efforts by engaging a broader and more diverse audience through recognition of skills and competencies as opposed to traditional degrees. The cross training/upskilling provided through the microcredentials framework is intended to form workers capable of generating innovation and new applications and/or refinements of existing technology, and development of new technologies.



Figure 4 MTS-NMC Workshop participants

Competency based approaches and strong public-private partnerships will continue to provide value to this effort

Recognition of the value of MTS microcredentials across sectors is intended to accelerate job placement and contribute to the development of a globally competitive STEM, and specifically an ocean technician workforce prepared to support the exploration, research and development that lies ahead.

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