MAINE STATE LEGISLATURE

MAINE Ocean School

Plan for the

Joint Standing Committee
on Education and Cultural Affairs

of the Maine State Legislature

Submitted by:
Maine Ocean School Board of Trustees

Captain Eric Jergenson, *Chair*, Assistant Professor, Maine Maritime Academy
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Dr. Tom Marx, *Finance & Facilities Chair*, Former Superintendent of Schools SAD 28
Captain Mike Flanagan, *Representative of the MOS Foundation*, Merchant Marine since 1980
Major Rene Cloutier, Maine Marine Patrol

Submission Date:
15 February 2017

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MAINE Ocean School

February 15, 2017
Senator Brian Langley, Co-Chair
Representative Victoria Kornfield, Co-Chair
Members of the Joint Standing Committee on Education and Cultural Affairs

Dear Chairs and committee members:

This package is respectfully submitted by the Board of Trustees of the Maine School for *Marine Science, Technology, Transportation, and Engineering* (the Maine Ocean School) to meet Maine State Law, Title 20-A, section 8236, Subsection 2. It is offered for review and comment. This is a significant waypoint toward opening Maine's second magnet school for the 2018-2019 school year.

I am proud to present this program plan for our emerging school. It represents thousands of hours of work and a common vision. It combines the expertise and passion of our many dedicated volunteers. You will see that the authors, editors, committee members, and public have presented a vision to guide the Maine Ocean School's future teachers and administrators. This ocean-themed education strives to give our students valuable skillsets. Students will be exposed to essential life skills through immersion in a culture of being "good shipmates" and they will understand the great options they can pursue post high school. Whether they enter the work force or go on to higher education (or both!), our graduates will understand that careers both on and near the waters of the globe are within their grasp.

As you learn more about our vision you will recognize how this ocean-focused magnet school fits Maine. Our maritime heritage and trades alone make this school an important asset to the State. But that is not enough. Not by far. Our waterways hold vast resources and opportunities, and emerging technologies. This combination offers Maine's youth an opportunity to stay in Maine (or the option to return). Our school is a step in that direction. We offer a chance to redefine what is viewed as high-achieving. The school represents a step toward more students excelling in high school and beyond.

This program was created and vetted by Maine scientists, public school teachers and administrators, shipmasters and engineers, college students and professors, concerned parents and grandparents who want more for our kids. In particular, our Maine kids who "just want to work on the water". Let's give them this great opportunity. We need to remind our children that the harbors of Maine, their harbors, are connected to all the ports of the world. There is great opportunity for our kids to follow their dreams; they may come by sea. Thank you for efforts in helping turn this dream of working on the water into the reality of rewarding careers. Thank you for working for our Maine kids.

Sincerely,

Captain Eric Jergenson, Chair
Maine Ocean School, Board of Trustees

MAINE Ocean School

A public magnet school for marine science, technology, transportation, and engineering

The Case for the Maine Ocean School

ABSTRACT

The ocean is a powerful tool. Students naturally drawn to the ocean will excel in school when this interest is coupled with high school requirements. The Maine Ocean School exploits this combination of academic requirement and ocean passion to its fullest potential. We utilize our position as a residential, theme-based magnet school to excite students in core academics and focused studies in marine science, marine transportation, marine management, or marine engineering.

Our goal is to educate our children. Parents, teachers, and administrators share this common objective. The process of striving towards this goal, the process of discovering or designing the perfect formula has filled libraries with research and debate. The answer is not simple. The answer is not singular. But there are themes. Themes can act as catalysts for understanding. The chosen theme winds through the requirements for high school graduation and becomes a lens that clarifies the purpose of their education. A hands-on themed education can bridge the gap from confusing, abstract theory to the meaningful, practical experience. The ocean is our theme.

"How inappropriate to call this planet Earth when it is clearly Ocean."

- Arthur C. Clarke, author, underwater explorer

INTRODUCTION

The concept of the Maine Ocean School grew in the small coastal town of Searsport, Maine. This port boasts a great history filled with sea captains, shipyards, and hundreds of ships built in the harbor. Blue water captains from this small port were and are US merchant mariners the world over. This community was integral to the maritime trades of the 1800s and as a result, in 1852 the Searsport Union School was created to train seafarers. This coastal school no longer exists, but the spirit in which it all started still runs strong.

> "From the fact that the majority of young men (sic) on the sea coast of Maine especially, look to a sea life as the one with most promise, this school has been arranged especially (so all) will find it the best select school in the vicinity.....its location is pleasant and healthful, its apparatus ample and no pains will be wanting to make it a profitable and permanent to all who may give it patronage."[1]
>
> – Republican Journal May 10, 1853
> Regarding the Searsport Union School

The homeport of Searsport currently offers a marine museum, shipping terminal, boatbuilding facilities, marine research opportunities, and Penobscot Bay - our ocean laboratory. MOS students will be immersed in a shipboard culture where ship and shipmates come before self. Success in the marine fields, whether shipboard or shore-side, demand organization, attentiveness, and motivation. These traits earn safe and rewarding opportunities; water-oriented careers. Our students will have opportunities ranging from advanced placement courses to entry-level certifications in their fields of study. Their skills will be measurable and recognizable in both the ocean-based work forces and in the search for admission to higher education. MOS is dedicated to facilitating a diversity of post-secondary opportunities for our students, whatever the ocean calls them to pursue.

Our mission is to provide a theme-based high school education focused on Maine's maritime connection, with an emphasis on leadership, work ethic, and the transferable skills associated with careers involving the ocean.

(Unknown, Advertisement, 1853)

THE PROBLEM

There are several challenges that Maine high school students face. According to the 2014 *Education Indicators for Maine*: "Although 86% of our students are graduating from high school, less than half of them are proficient in reading and math."[2] This is a gap, a major gap.

Students graduating from high school are not ready to enter the work force or institutions of higher education. Is this a reality or just a perception? It is a common theme in education not only in Maine, but in the entire country. According to the Maine Economic Growth Council's *Measures for Growth – 2016* report, by 2020 Maine's percentage of residents over the age of 25 with a postsecondary degree will at least match New England's percentage of degree holding residents.[3] Right now we are behind, but soon will be average. But is average OK for our children? The same report then offers that "employers across the state and throughout the economy are struggling to find qualified workers."[4] Something is not quite right.

We are far from the only state with this challenge. The *Making Maine Work – Preparing Maine's Workforce* document compiled in 2014 emphasizes a McKinsey Center for Government statistic that nationally "72% of college and university leaders believed that graduates were ready for the job market, compared to only 42% of employers."[5] They then go on to recognize the great opportunity Maine has in "filling this gap." How will Maine accomplish this task of making *college* adept at creating skills needed by employers? Why not start with better preparation of our high school students?

Many of Maine's high school graduates do go on to higher education. Some are required to take gap courses in remedial subjects to meet the standards they should have mastered in high school. Add to the formula that college graduation rates in Maine were most recently "26.1% for Community Colleges, 47.7% for public colleges, and 67.4 % of private college (with 150% of normal time)."[6] Too many young people are starting college and are not finishing.

To summarize, we are experiencing gaps between classroom outcomes and job skills and between graduation rates and proficiency rates in preparation for high school completion. Finally, when our high school graduates get to college a large percentage do not finish. We need new ways to approach this problem.

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[2] (Education Indicators For Maine , 2014)
[3] (Maine Economic Growth Council Measures for Growth, 2016)
[4] (Maine Economic Growth Council Measures for Growth, 2016)
[5] (Making Maine Work – Preparing Maine's Workforce, 2014)
[6] (Education Indicators For Maine , 2014)

WORKING TOWARDS SOLUTIONS

Our vision is for Maine Ocean School to provide an ocean-related, theme-based education designed to actively engage and challenge its students. Graduates will be valued for their strong work ethic, knowledge, experience, and leadership capabilities. MOS will stay on the leading edge of innovative technologies and teaching strategies, and help support learning in our communities.

Science, Technology, Engineering, and Mathematics Initiatives (STEM) have been around for several years and offer a focus on the technology-based skills needed by high schools students. There are many faces to this program with the overarching goal of keeping the United States competitive in emerging technologies. These initiatives have permeated education at the national level. We expect this maybe a big part of the solution for Maine.

At the state-level there is a movement toward proficiency-based learning and proficiency-based diplomas. According to the Maine Department of Education's website the goal of this program is to "ensure that students acquire the knowledge and skills that are deemed to be essential to success in school, higher education, careers and adult life."[7] This is likely another part of the solution.

In individual school programs there are movements for a more technical-based education, some focusing on trades while others working to incorporate the career interests of their student-base. The "Eastern Maine Skippers Program (EMSP) is a regional school program built in and reaching students in their own communities (and) is designed to engage and inspire prospective commercial fishermen and others interested in marine careers"[8] is a great example of a local program hitting the problems head on. The Maine School of Science and Mathematics (MSSM) is Maine's first magnet school that caters to their students' love of math and science. Their great results come in the form of a high college placement rate, often to Ivy League schools. Focused, interest-driven education is definitely part of the solution.

[7] Maine Department of Education - http://www.maine.gov/doe/proficiency/
[8] Penobscot East Resource Center - http://www.penobscoteast.org/programs/eastern-maine-skippers-program

OUR PART OF THE SOLUTION

There is no one good answer to meeting the challenges faced by educational institutions today. But Maine does have a great new opportunity for making gains in the education of a select group. The creation of the Maine School of Marine Science, Transportation, Engineering, and Management (the Maine Ocean School) during the 127th Maine Legislature was a step in the right direction. Students who love the ocean and see a potential for a career on or near the water should pay attention.

This ocean-themed school is the second magnet school in Maine's history. MOS is designed as a residential program. As a result, many of the restrictions on time and format of education in traditional school schedules are eliminated. This allows us to explore a wide variety of educational models that will best serve our students. Our curriculum provides students to take every opportunity to partner with local industries and outside educational opportunities. Our students will not only meet the requirements for graduation in Maine, but exceed beyond these standards. Our tracks in Marine Science, Transportation, Engineering and Management (our version of STEM) are how we implement the traditional STEM initiative. Our students will have opportunities including field-work experiences, industry partnerships, and hands-on lab experiences both on the water and ashore.

It has been said that "competency-based learning, professional development, and certificates play an important role in improving the quality of the workforce."[9] MOS students will be immersed in such opportunities during their education. They will have the chance to pursue United States Coast Guard credentials as well as entry level certificates of training recognized by industries in multiple marine fields.

The Maine Ocean School is committed to the vision that our "graduates (will be) valued for their strong work ethic, knowledge, experience, and leadership capabilities. MOS stays on the leading edge of innovative technologies and teaching strategies, and helps to support learning in our communities"[10]. *Education Indicators for Maine* has made a goal for 2019 that "100% of students in Maine will graduate from high school prepared for success in post-secondary education and the work place."[11] Maine Ocean School takes that challenge to heart.

> *"Maine Ocean School is a public magnet school that provides a "hands-on, minds-on" education on the water, in the lab, and in the classroom. During your time at MOS, you will develop personally, academically, and professionally. Whatever your focus - marine science, transportation, engineering, or technology - you will graduate with the skills, knowledge, and tools to build the foundation for a successful future."*

[9] (Making Maine Work – Preparing Maine's Workforce, 2014)
[10] (Maine Icean School Vision Statement)
[11] (Education Indicators For Maine , 2014)

IN CONCLUSION

Maine Ocean School supporters have built a foundational educational plan and adopted a common mission and vision. Further development and execution of the strategic plan are the immediate organizational needs of MOS.

Planning has begun to implement programs and courses to be held in and around Searsport for summer 2017 for potential Fall 2018 MOS student entrants. The doors of the Maine Ocean School will open in the fall of 2018 as a full time magnet high school. Our journey is well underway.

> *"This ocean-themed education strives to give our students valuable skill sets. They will be exposed to essential life skills through immersion in a culture of being "good shipmates" and they will understand the great options they can pursue post high school. Whether they enter the work force or go on to higher education (or both!), our graduates will understand that careers both on and near the waters of the globe are within their grasp.*
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> *As you learn more about our vision you will recognize how this ocean-focused magnet school fits Maine. Our maritime heritage and trades alone make this school an important asset to the State. But that is not enough. Not by far. Our waterways hold vast resources and opportunities, and emerging technologies. This combination offers Maine's youth an opportunity to stay in Maine (or the option to return). Our school is a step in that direction. We offer a chance to redefine what is viewed as high-achieving. The school represents a step towards more students excelling in high school and beyond.*
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> *This program was created and vetted by Maine scientists, public school teachers and administrators, shipmasters and engineers, college students and professors, concerned parents and grandparents who want more for our kids. In particular, our Maine kids who "just want to work on the water". Let's give them this great opportunity. We need to remind our children that the harbors of Maine, their harbors, are connected to all the ports of the world. There is great opportunity for our kids to follow their dreams; they may come by sea. Thank you for efforts in helping turn this dream of working on the water into the reality of rewarding careers. Thank you for working for our Maine kids."*

– MOS Board of Trustees - Letter to the Joint Standing Committee on Education and Cultural Affairs

ADDITIONAL RESOURCES

Bangor Daily News: Mack Point Marine Intermodal Cargo Terminal – Searsport Maine

http://bangordailynews.com/2012/03/28/news/midcoast/searsport-seaport-connects-maine-to-world-of-commerce/

Bangor Daily News: *How one coastal Maine high school turned the ship around*

http://bangordailynews.com/2016/12/10/news/hancock/how-one-coastal-maine-high-school-turned-the-ship-around/

Bangor Daily News: Green Crab Project – Eastern Maine Skippers Program

http://bangordailynews.com/pressrelease/eastern-maine-skippers-program-kickoff-their-year-long-green-crab-project-on-hurricane-island-penobscot-bay/

MARAD high school curriculum

https://www.marad.dot.gov/wp-content/uploads/pdf/Maritime_High_School_Curriculum.pdf

The Working Waterfront: *Passing the Torch – helping the next generation of boatyard owners protect jobs, access*

http://www.islandinstitute.org/working-waterfront/passing-torch%E2%80%94helping-next-generation-boatyard-owners-protects-jobs-access

U.S. Department of Education, Office of Career, Technical, and Adult Education. (2015, August). Strengthening Skills Training and Career Pathways across the Transportation Industry. Washington D.C.: Author

https://s3.amazonaws.com/PCRN/docs/Strengthening_Skills_Training_and_Career_Pathways_Across_Transportation_Industry_Data_Report.pdf

Contents

I. Executive Summary

The Maine Ocean School (MOS) is a public magnet high school for marine science, technology, transportation, and engineering established by the 127th Legislature of the State of Maine. Its mission is to provide a theme-based high school education focused on Maine's maritime connection, with an emphasis on leadership, work ethic, and the transferable skills associated with careers involving the ocean. A dedicated team of volunteers and Board members have been developing the magnet school as an exciting addition to Maine's educational assets. The ocean-related theme that makes MOS unique will permeate all learning activities inside and outside of every classroom. The theme-based academic program will provide a complete high school curriculum that exceeds state standards in the required eight content areas: Career & Education Development, English Language Arts, Health & Physical Education, Mathematics, Science & Technology, Social Studies, Visual & Performing Arts, and World Languages. In addition to these core content areas, specialized academic "tracks" focused on Marine Science, Transportation, Engineering, and Management will be pursued by each MOS student based on their own interests. Regardless of their demonstrated interest, all students will be required to enroll in foundational "track" courses which not only provide an introduction to each marine discipline and career opportunities, but also provide exposure to the interdisciplinary nature of studies and careers related to the sea.

Our students will pursue a "hands-on, minds-on" education on the water, in the laboratory, and in the classroom. During their time at MOS, they will develop personally, academically, and professionally. Prospective students will be selected using several criteria that determine their potential for success at MOS. A foundational belief of the Board, as evidenced in the mission statement, is that an applicant's GPA is not the sole predictor of potential achievement. With that in mind, a unique admissions framework was created to provide applicants with an opportunity to present evidence that demonstrates their potential to succeed at MOS. Most importantly, all applicants will be required to demonstrate their interest in the ocean and pursuit of high school education focused on the ocean.

Our graduates will possess the skills, knowledge, and tools to build a foundation for a successful future. MOS will prepare graduates to pursue a multitude of post-secondary pathways; from enrolling in higher education to directly entering the workforce. The interdisciplinary, theme-based nature of MOS programs will provide the necessary knowledge for graduates to become successful in careers such as research scientists, navigation officers, marine engineers, maritime historians, entrepreneurs, boatbuilders, aquaculture technicians, equipment operators, ship captains, among many more. A variety of

credentialing and certification opportunities provided through MOS will ensure that graduates have the necessary skills to make them competitive in pursuit of post-secondary pathways.

Our supporters, partners, volunteers, and contributors include members of many local businesses, schools, cultural groups, and community organizations. Many of them have shown commitment to the school's success and have indicated interest in future partnerships. The enthusiasm and passion for Maine Ocean School is contagious, and the growing number of stakeholders are looking forward to educating our youth in ways that will further connect them to Maine's maritime identity.

II. Maine Ocean School Philosophy

Our mission is to provide a theme-based high school education focused on Maine's maritime connection, with an emphasis on leadership, work ethic, and the transferable skills associated with careers involving the ocean.

Our vision is for Maine Ocean School to provide an ocean-related, theme-based education designed to actively engage and challenge its students. Graduates will be valued for their strong work ethic, knowledge, experience, and leadership capabilities. MOS will stay on the leading edge of innovative technologies and teaching strategies, and help support learning in our communities.

The Board of Trustees (BOT) has determined that MOS will be a residential institution. A residential school offers a tight-knit community, builds a culture similar to shipboard living, and makes these educational offerings available to a geographically diverse student population throughout Maine. As such, the BOT charged that admissions priorities be set as: (1) students from the State of Maine; (2) students from other US states; then (3) international students. All Maine students will attend the school free of tuition charges. Students' families will provide room and board costs. However, the BOT are dedicated to making the cost of room and board affordable for all students.

MOS will open the first year accepting students in grades 10 and 11 with the intention to add grade 12 in the second year. The possibility of adding grade 9 will be considered as the school matures. We are aware that the transition to a boarding high school can be more challenging for younger students. This would require specialized support staff that the school may not be able to add during its initial years. The following school program has been designed as a four year high school with recognition of these transitions.

III. Title 20-A § 8236

By February 15, 2017, the Maine School for Marine Science, Technology, Transportation and Engineering shall submit a plan under the Maine Revised Statutes, Title 20-A, section 8236, subsection 2 to the joint standing committee of the Legislature having jurisdiction over education matters that outlines the statewide education programs provided by the school and guarantees opportunities and access to students and educators not residing full time at the school.

1. School year. *Operating on a calendar year that meets or exceeds the minimum number of statewide student instructional days;*

2. Courses of study; programs; plan. *A plan that outlines the statewide education programs provided by the school and guarantees opportunities and access to students and educators not residing full time at the school. The plan must include, but is not limited to, offering short courses, workshops, seminars, weekend instructional programs, distance learning and various other programs of short duration for teachers and students. The plan may include other innovative programs that meet the purpose of the school and assist in the professional development of the State's marine science, technology, transportation and engineering teachers;*

3. School admission. *Admittance of high school students and students pursuing a postgraduate high school year of education based on the enrollment criteria established by the board of trustees as provided in section 8235, subsection 11. Students who apply and are accepted by the school are allowed to attend as provided in section 5205, subsection 6;*

4. Extracurricular activities. *Participation in all extracurricular activities offered at the middle school and high school serving the Town of Searsport; and*

5. Telecommunications. *Utilization of distance learning technologies to allow transmission of certain specialty courses conducted at the school for the benefit of high-achieving students attending school units throughout the State.*

To address Title 20-A, section 8236, subsection 2 under the Maine Revised Statutes the MOS Board of Trustees formed a “Program Committee” with the following tasks (from MOS Bylaws - Appendix 1):

The Program Committee develops:

- *the school year calendar*
- *enrollment criteria*
- *admissions policies*
- *a plan that outlines the statewide education programs provided by the school.*

The plan must include, but is not limited to all offerings for full-time enrolled students, offering:

• short courses

• workshops

• seminars

• weekend instructional programs

• distance learning • various other programs of short duration for teachers and students.

The plan may include other innovative programs that meet the purpose of the school and assist in the professional development of the State's marine science, technology, transportation and engineering teachers.

The Program Committee will connect the board to the core programmatic functions of the School with the support of the school's deans of Faculty and Residential Life. The committee is responsible for advising the Executive Director on major program issues and for monitoring the effectiveness in meeting program objectives.

The Program Committee officially gathered on 15 July 2016 with eight attendees who reviewed the directive from the Legislature, starting with a discussion of the Sound School program in New Haven, CT as an example (http://sound.school/academics/). Maine Education Standards for High School diplomas and admissions standards for higher education (e.g., University of Maine and Maine Maritime Academy) were researched and discussed. The need for a hands-on, exciting program to meet and exceed state standards was agreed upon.

In addition to specific committee meetings, the Program Committee held two community workshops specific to program development: 19 November 2016, and 28 January 2017. The November meeting was an open public *Strategic Planning Workshop* where specific questions were pursued with community input. Questions asked of the group, in a focus-group/workshop setting, were:

- Where should the school be located?
- What age group should the school service?
- Should the school be residential?
- Should there be a random drug testing program?
- What can the MOS offer to the community?
- What assets are available in the community that would benefit the school?

Not only did we receive valuable feedback on these questions (e.g., *MOS offers an educated workforce of prepared and motivated students who are good ocean citizens*), which were subsequently incorporated into BOT and program decisions (e.g., *residential school seeking to*

serve all HS grade levels), but we established several new contacts within the community. Individuals stepped forward, engaged in the process, and made a very large difference in program design and development.

Since July 2016, the Program Committee has met 14 times and committee involvement expanded to include a list of 48 interested community members, all of whom have attended one or more meetings since July. BOT activities at the 5 November 2016 "***Launch"*** and 19 November 2016 "***Strategic Planning"*** workshop stimulated community interest in the school and engagement of community members in program development. The Program Committee has burgeoned to regular meetings of over 20 individuals. Several members have assumed leadership positions to develop portions of the program (Table 1). These leaders helped write and organize content areas and engaged additional expertise for feedback (Table 2). We worked together to conduct a final vetting of the program prior to this submission to the *Joint Standing Committee on Education and Cultural Affairs*. We held an open forum on 31 January 2017 where we facilitated feedback and discussion for all program content areas. The forum was publicly announced and specific invitations were sent to key community members, representing a wide range of ocean-related industries and educational institutions, who we thought would provide valuable feedback. Participants were asked to review content area documents in verbal and written form and all feedback has been incorporated into the documents contained herein. After the meeting, there were areas that still required review, so program area documents were sent to specialists for their input. We have incorporated all comments received to date.

Table 1. Leaders on program content areas for the Maine Ocean School Program.

Name	**Title, Affiliation, Education/Certification**	**Lead for Program Content Area**
Dr. John North Radway	9-12 English Teacher, Maimonides HS, MA	English and Language Arts
Sandi Cirillo	Art Educator, Friends of Sears Island	Visual and Performing Arts
Cipperly Good	Curator, Penobscot Marine Museum; Master of Arts	Social Studies & World Language
Teri Jergenson	HS Science Teacher, RSU 25	Science & Technology
Colleen Johnson	Middle School teacher, RSU 20	Mathematics & Admissions

Dr. Veronica Magnan	Educational Consultant, PhD in Education Policy, Planning and Administration	Career & Development & Marine Transportation
Lindsey Pinkham	Midcoast First Aid LLC, Owner	Physical Education
Cynthia Prosser	Math/Science Teacher, Grades 7-12, Union 69	Mathematics & Marine Transportation
Almon Rivers	Searsport Emergency Management Director, MSME US Navy	Marine Engineering Track
Dennis Weeks	Chief Engineer, Retired	Marine Studies Fundamentals
Dr. Gayle Zydlewski	Associate Professor, University of Maine, PhD Oceanography	Overall Program Development & Marine Science Track

Table 2. Significant edits and critical review were provided by the following individuals.

Contributor	**Title & Affiliation**	**Program Area Contributions**
Rachel Beckwith	ELA teacher, RSU 25	ELA
Genevieve Black	HS Science teacher, RSU 3	Science, Marine Science and Admissions
Christine Boone	Principal, Weatherbee School, RSU 22	Admissions
Kathleen Jenkins	ELA teacher, RSU 20	ELA
Katy Hunter	HS Science Teacher, RSU 25	Marine Biology and Physics
Jillian Liversidge	Spanish teacher, RSU 22	World Language
Jarlath McEntee	Vice President of Engineering, Ocean Renewable Power Company	Foundations & Marine Engineering
Seth Murray	Marine Electrician, Owner of Electrotechnical Services	Marine Engineering I & II

John-Michael Payne	Divemaster, PADI Pro# 336080	Physical Education
Catherine Robinson Hall, Esq.	Lecturer, Marine Policy, Williams College-Mystic Seaport Maritime Studies Program	Social Studies: Marine Policy
Dr. Leo Shea	Certified Vessel Safety Examiner	Career & Development
Carla Scocchi	UMaine RISE Center	All
Dr. Aaron Strong	UMaine, School of Marine Sciences, Marine Policy	Foundations, Social Studies, ELA
Yvonne Thomas	Education Director, Island Institute	Marine Science
Ginny White	HS Science Teacher, RSU 25	Marine Chemistry
Susan White	President, Friends of Sears Island	Admissions, General Program

Table 3. Workshop and committee meeting attendees who contributed to the Maine Ocean School program development.

Contributor	**Title & Affiliation**	**Program Area Contributions**
Catlin Ames	PhD Student, UMaine, Marine Biology Program	Science and Marine Science
Captain Michael Ames	Polar Tankers/ConocoPhillips	Foundations, Transportation, Management
David Black	Interested Citizen	Social Studies & Marine Management
Carrie Bray	Conservation Science Teacher, NY City DOE, MA in Zoology, MA Teaching	Program Overview, Science, Marine Science
Dr. Ann Cleveland	Professor, Marine Biology, Maine Maritime Academy	Science and Marine Science Track
Scott Cuddy	Board Member, RSU 22	Workshop, ELA, Marine Tracks
Chris Downing	Superintendent, RSU 20	All

Captain Mike Flanagan	Captain, Merchant Marine	Transportation, Management
Betty Fraser	Ed Tech, RSU 20	Admission
Parker Gassett	MS Student, UMaine, Dual Degree: Marine Biology & Policy	Science and Marine Science
Rep. James Gillway	Maine State Representative	All
Judith Jones	Maine Association for Charter Schools	All
Dr. Tanya Lubansky	Science Teacher, John Bapst Memorial High School, Bangor Maine	Marine Science
Dr. Tom Marx	Former Superintendent of Schools SAD 28	All
Greg Rossel	Instructor/Boat Builder	Marine Management, ELA
Captain Alec Schoettle	USCG Captain	Marine Transportation
Chris Tremblay	MS Student, UMaine, Marine Biology Program	Science and Marine Science
Dr. Becky VanBeneden	Director, School of Marine Sciences, University of Maine	Foundations and Marine Science Track
Marina Vander Eb	Education, University of Maine	Science & Marine Science

Note: *Others participated but are not listed based on concerns about being involved in program development outside of their home institutions.*

We have developed the framework for a high-achieving, ocean-themed, 4-year high school that exceeds state standards with specialized courses in Marine Science, Transportation, Engineering, and Management. The program is designed for students to enter careers in ocean fields, including trades, technical, and higher education (Appendix 2). The program has been reviewed and revised with faculty from the University of Maine (science and education), Maine Maritime Academy, local RSUs, and interested community members.

III.a. Title 20-A § 8236.2. Courses of study; programs; plan

> ***2. Courses of study; programs; plan.*** *A plan that outlines the statewide education programs provided by the school and guarantees opportunities and access to students and educators not residing full time at the school. The plan must include, but is not limited to, offering short courses, workshops, seminars, weekend instructional programs, distance learning and various other programs of short duration for teachers and students. The plan may include other innovative programs that meet the purpose of the school and assist in the professional development of the State's marine science, technology, transportation and engineering teachers;*

The program, course sequences and course descriptions below were developed to address and achieve the vision of MOS. The following documentation reflects the current perspectives of participants and we expect the spirit and philosophy reflected in this document will be applied when staff are hired to implement and further develop a school plan. We intend these documents to be used to write the job descriptions for the MOS's Executive Director, teachers and staff. We view this as a living document that will necessarily evolve as an Executive Director, faculty, and staff are hired. We expect to be a hub of learning in marine-related experiences for not only high school students but educators and other interested professionals in Maine.

Program Overview

The ***ocean-related theme*** that makes MOS unique will permeate all learning activities in and out of every classroom. The academic program will provide a complete high school program that exceeds state standards. In addition to required core content areas, specialized academic programs focused on *Marine Science, Transportation, Engineering,* and *Management* will be individually pursued by MOS students according to their interests and plans.

<u>The fundamental beliefs of the Maine Ocean School include:</u>

- **THE OCEAN.** Engaging subject matter cultivates motivation for lifelong learning.
- **COMMUNITY.** Collaboration & accountability promotes deeper understanding.
- **CHALLENGE.** Personal and academic growth begins with challenge.
- **SUCCESS.** Every student has an opportunity to turn potential into achievement.

These fundamentals will prepare students to make informed decisions regarding their post-secondary pathways. Hands-on experience in a variety of marine fields will be available to them during their time at MOS through directed study and internships. We hope that

engaging in their interests will guide them to seek the opportunity that best suits their interests and achievements.

The MOS program starts with a **Core Sequence** built on Maine Department of Education Standards (http://www.maine.gov/doe/proficiency/standards/index.html). Since all Maine schools are required to provide a program of instruction aligned to the eight content areas of the Maine Learning Results (http://www.maine.gov/doe/proficiency/standards/maine-learning-results.html), we built our core program in these areas. Central to the program is not only the ocean theme, but the basic tenet of the unifying need for ***effective communication*** in all workforce opportunities. Therefore, building communication skills is a cornerstone of the program. Below are the areas and suggested course titles for a 4-year progression at the school (as envisioned in the school's mature years):

1. **Career & Education Development -** *content will be integrated in other course work, especially Marine Tracks:* Communication, Maritime Safety, Marine Regulations, Leadership & Problem-Solving, Decision-Making, Finance
2. **English Language Arts (ELA):** Ecology & Environment→ Trade, Exploration, & Cultural Diffusion → Commerce, Community, & Local Culture→ Philosophy & the Sea
3. **Health & PE:** General Health and Nutrition → Ocean Survival I & II → Maritime Safety; Swimming (Basic & Advanced); Sailing (4 courses); SCUBA (Basic & Advanced)
4. **Mathematics:**
    a. *Career Prep:* Foundations or Algebra I→ Geometry→Advanced Math→Business Math
    b. *College Prep:* Algebra I→ Geometry→Advanced Math→Pre-Calculus/Calculus I
    c. *Honors:* Geometry→Advanced Math → AP Calculus → AP Statistics
5. **Science & Technology:** Earth Science → Marine Biology → Marine Chemistry → Marine Physics
6. **Social Studies:** World Maritime History→ US Maritime History→ Civics→ Marine Policy & Resource Management
7. **Visual & Performing Arts:** Studio in Art: Marine Concentration → 2-D Art for Marine Scientists, Engineers and Boat Builders or Sea Chanteys → 3-D Art → Computer Arts for Marine Scientists, Engineers and Boat Builders or Marine Band
8. **World Language:** Communicating in Foreign Ports → Spanish or Latin I, II, III or Self-directed Languages

Other Electives: Computer Science, Introduction to GPS, R programming (statistics)

Another unique aspect of MOS will be the opportunity to explore and choose a **Marine Track** that will teach specialized skills and foster connections to post-secondary opportunities.
This represents the **Marine Track Sequence:**

Starting with the foundations of ocean careers:

Each grade 9 and 10 student will take the following courses:

Grade 9: *Foundations I (Marine Studies)*

Grade 10: *Foundations II (Science, Transportation, Engineering, Management)*

Each grade 11 student will select a track and take the following courses:

Grade 11: **Marine Studies I** in a *selected track*: (1) Science; (2) Transportation; (3) Engineering; OR (4) Management

Grade 12: **Marine Studies II** in a *selected track*: (1) Science; (2) Transportation; (3) Engineering; OR (4) Management

Marine Studies I courses in marine tracks will be hands-on applied methods courses to provide the skills needed for conducting a self-directed study in a diversity of ocean-related careers (www.mapyourcareer.org/maritime/life-at-sea.html) within the selected track. **Marine Studies II** courses will be mentor-guided and industry/academic partnered experiential learning where directed study skills will be applied to ocean careers, from those requiring a HS diploma to those requiring a PhD.

Certificate opportunities will be available in multiple courses and through workshop opportunities, which may include the Maine Certified Industry Standards of the Maine Career and Technical Education Program (e.g., *Biology Technician, Marine Maintenance, Small Engine Repair*). Specifically, in Foundations II students will be exposed to and have the opportunity to achieve the following: *Entry-Level USCG Merchant Mariner Credential (MMC) endorsed as Ordinary Seaman, Wiper and Stewards Department; Standards of Training, Certifications and Watchkeeping (STCW) endorsement of Basic Training (BT); Standards of Training, Certifications and Watchkeeping (STCW) endorsement of Security Awareness (SA); Transportation Worker Identification Credential (TWIC).*

For college-bound students, **College Level Examination Program** (CLEP) tests can be taken at the University of Maine. Available CLEP tests include 6 in Composition and Literature, 3 World Languages, 12 in History and Social Sciences, 7 in Science and Mathematics, and 5 in Business. These can be accepted as credits toward a degree at most higher education institutions. Most of these credits are accepted toward a degree at the University of Maine.

Collectively these opportunities and successes in the program will be documented by each student in a portfolio that will demonstrate their preparedness for post-secondary path.

III.b. Core content area sequencing and course descriptions

English Language Arts Sequencing and Course Descriptions

Grade	Career Prep	Honors/AP
9	Ecology and Environment	Ecology and Environment with Honors Option
10	Trade, Exploration, and Cultural Diffusion	Trade, Exploration, and Cultural Diffusion with Honors Option
11	Commerce, Community, and Local Culture	Commerce, Community, and Local Culture with Honors Option
12	Philosophy and the Sea	Philosophy and the Sea with Honors or AP Option*

* Offered through Maine AP4ALL: AP English Literature and/or AP English Language and Composition

Course Descriptions: *full descriptions of all courses are provided in* ***Appendix 4a***

English 9: Ecology and Environment

Course Description: Readings focus on the ocean itself—its ecology, its lifeforms, its temperament—as well as humanity's complicated relationship with a part of the Earth that can inspire, confuse, devastate, or soothe. Students will master the basic forms and tools of prose essay writing, and will analyze literary and critical texts through a number of different methods, focusing on the building blocks of clear, strong arguments.

Prerequisites: Successful completion of Middle School English or equivalent

English 10: Trade, Exploration, and Cultural Diffusion

Course Description: Pairing with a World History curriculum, readings focus on the many ways in which the ocean and navigation have made the world a smaller place, for better and for worse. The course explores the literature of global commerce, exploration, colonialism, and war. Students will practice more advanced forms of writing while also analyzing more complex arguments and engaging with literary texts on a deeper level.

Prerequisites: Successful completion of one experience in High School English

English 11: Commerce, Community, and Local Culture

Course Description: Readings explore the effect that the sea and seafaring has on local cultures and communities, including cities, towns, islands, and ships. Topics include maritime commerce, seafaring and the family, power, hierarchy, and authority. Students will deepen their writing skills by engaging with a number of new essay forms, as well as undertaking research projects that bring to life connections between literature and real communities.

Prerequisites: Successful completion of two experiences in High School English

English 12: Philosophy and the Sea

Course Description: Readings challenge students to explore complicated questions of philosophy, ethics, morality, and humanity's place in the world—and the watery parts of the world in particular. Topics and themes include ambiguity, redemption, obsession, and the unconscious. Students will construct nuanced arguments and engage with complex literary forms that change throughout history. Students will also engage with formal logic and rhetoric.

Prerequisites: Successful completion of three experiences in High School English

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Health and Physical Education Sequencing and Course Descriptions

Grade	Health & Safety	Physical Education - Swimming	Physical Education- Sailing
9	General Health and Nutrition	Basic Swimming	Basic Sailing
10	Ocean Survival I	Advanced Swimming	Performance Dinghy Sailing
11	Ocean Survival II	Basic SCUBA	Keelboat Sailing
12	Maritime Safety	Advanced SCUBA	Bareboat Sailing

- General Health and Nutrition, Basic Swimming, Ocean Survival I & II, and Maritime Safety are required of all students
- These courses may be offered in alternative scheduling formats
- The swimming requirements may be met by any PE -Swimming Course
- The sailing requirements may be met by any PE-Sailing Course (Bareboat)

Course Descriptions:

General Health and Nutrition

This course is a general health course that has an emphasis on the unique demands of life at sea. This includes mental health associated with long voyages, sleep cycle management, physical activity, and healthy food choices. Students will create personal logs including food choices, activity levels, and records of sleep cycles.

Prerequisites: N/A

Ocean Survival I - *a full description of this course is provided in* ***Appendix 4a***

This course is first in the Ocean Survival series that provide students with basic skills ocean survival. This course will provide instruction on ocean survival while including team work, leadership, use of flotation, use of survival craft and physical and emotional well-being.

Prerequisites: Basic Swimming

Ocean Survival II - *a full description of this course is provided in* ***Appendix 4a***

This course is a continuation of Ocean Survival I and provides advanced skills for ocean survival. The course will provide instruction on ocean survival while including launching life

boats, rowing and sailing of lifeboats, teamwork, leadership, long term survival in a craft, use of survival craft, and physical and emotional well-being of the student.
Prerequisites: Ocean Survival I

Maritime Safety* - *a full description of this course is provided in* ***Appendix 4a***
This course prepares students to be safe maritime, commercial fishing, or shipyard employees. Students will learn about maritime safety equipment and safety practices and procedures. An emphasis is placed upon: USCG and OSHA maritime safety regulations; health and environmental considerations; injury and fire prevention techniques and solutions; common maritime hazards and emergencies; and, the importance of weather and climate. Students will be trained in CPR, first aid and AED use.
Prerequisites: Ocean Survival II

***This course also covers standards in Career and Development

Basic Swimming - *a full description of this course is provided in* ***Appendix 4a***
This course provides students with basic skills in swimming and survival. This course will provide pool instruction in addition to classroom team work, development of leadership skills, use of flotation and physical and emotional well-being of the student. Pool time will be used to acquire the basic swimming skills and self confidence in the water. Students will be exposed to swimming strokes, survival positions, use of survival equipment (PFD's and make shift PFD's).
Prerequisites: N/A

Advanced Swimming- *a full description of this course is provided in* ***Appendix 4a***
This course is a continuation of basic swimming and provides students with more advanced swimming and survival skills. Students will simulate rescue in the water and cover post water rescue considerations. Instruction will be given on topics that cover personal safety, rescue devices, team working and basic first aid associate with water rescue emergencies.
Prerequisites: Basic Swimming

Basic Scuba - *a full description of this course is provided in* ***Appendix 4a***
This course provides students with basic SCUBA skills based on PADI Open Water Certification. Classroom topics will include dive safety, teamwork, leadership, types of equipment, principles of diving, type of diving, use of dive tables, and physical and emotional well-being of the student.
Prerequisites: Basic Swimming, Physical Fitness Test (Swim Test), Students. Students < 15 years will be restricted but can be fully certified at 15 years

Advanced Scuba- *a full description of this course is provided in* ***Appendix 4a***

This course is a continuation of SCUBA skills mastered in Basic SCUBA. In addition students will continue into more advanced skills required of PADI Advanced Open Water certification. Classroom topics will include team work, leadership, and types of equipment, technical dives, dive safety and physical and emotional well-being of the student. Students may be eligible for additional PADI Specialty certifications depending on dive parameters.
Prerequisites: Basic SCUBA, Open Water Certification (OW), Physical Fitness Test (Swim Test)

Basic Sailing - *a full description of this course is provided in* ***Appendix 4a***

This course introduces and develops basic sailing skills aboard a small dingy. A combination of lecture and on the water instruction will provide hands-on experience in rigging, sailing, and appropriate seamanship skills. Students will use correct terminology to describe actions and give (and receive) commands to the crew.
Prerequisites: Basic Swimming

Performance Dinghy Sailing - *a full description of this course is provided in* ***Appendix 4a***

This course builds on basic sailing skills and teaches the concepts and skills of dinghy racing. A combination of lecture and on-the-water instruction will provide hands-on experience in racing, sail trim, rules, and strategy. Students will learn to compete in a fleet racing scenario and an emphasis will be placed on furthering technical sailing skills.
Prerequisites: Basic Sailing and concussion training

Keelboat Sailing

This course is a continuation of skills from Basic Sailing applied to a larger keelboat. A combination of lecture and on-the-water instruction will provide students the opportunity to learn and practice close-quarter boat handling, reefing, person-in-the-water rescue, heavy weather sailing, and sail trim.
Prerequisites: Basic Sailing, Ocean Survival I

Bareboat Sailing

Bareboat sailing is a culmination of skills from all sailing courses in combination with navigations skills from Foundation courses. Students will plan an overnight sailing trip and plan all aspects of the course. This includes weather, tides, food storages, dockage, and navigation. Each student will take command of a leg of the trip.
Prerequisites: Basic Keelboat Sailing, Ocean Survival II

Mathematics Sequencing and Course Descriptions

Grade	Career Prep	College Prep	Honors/AP
9	Algebra I	Algebra I	Geometry
10	Geometry	Geometry	Advanced Math
11	Advanced Math	Advanced Math	Calculus I/AP Calculus AB
12	Business Math	Pre-Calc/Calc I	Biostatistics/AP Statistics

- Courses outside a sequence can be taken as electives, e.g., Biostatistics can be taken by Career Prep and College Prep students in addition to their designated sequence.
- Any courses can be taken concurrently as guided by instructors.
- Additional upper level math courses may be available through Tandberg connections to the Maine School of Science and Mathematics

Course Descriptions:

Foundations in Mathematics

This course will reinforce concepts and skills that students need in preparation for Algebra I. Students will investigate the rational and irrational number system, exponents, proportion, linear equations, functions, Pythagorean Theorem, geometric congruence, statistics, and the properties of geometric solids (cylinders, cones, and spheres). Students will apply these concepts and skills to real-world, hands-on situations in areas such as navigation, marine engineering, ocean water chemistry, and cargo handling.

Prerequisites: Successful completion of middle school math curriculum

Algebra I

This course will focus on developing algebra skills through the use of variables in real-world marine situations. Students will study linear and quadratic equations, inequalities and their graphs, systems of equations, functions, rational expressions, polynomials, and they will manipulate and interpret multivariable formulas. Emphasis is on the use of multiple modalities and application of these skills in areas such as marine engineering, interpreting data in oceanography and marine biology, and navigational problems involving rates and the physics of stability.

Prerequisites: Successful completion of CCSS middle school math curriculum

Geometry - *a full description of this course is provided in* ***Appendix 4a***
The focus of geometry is to develop a deeper understanding of the geometric concepts of congruence with proofs, right triangles, trigonometric functions, conics, graphing in 2-D and 3-D, dimension of regular and non-routine figures, and modeling theoretical and real-world situations. Students will apply these concepts and skills in areas such as boat building and design, fluid dynamics of hull and propellor designs, plotting and sampling the ocean, and all aspect of ocean and celestial navigation.
Prerequisites: Successful completion of Algebra I

Advanced Math (Algebra II/ Trigonometry)
This course continues the study of algebraic concepts developing deeper understandings of linear, quadratic, exponential, and trigonometric functions. Students will be working with all systems of numbers as they interpret, manipulate, and build functions algebraically and graphically. Complex numbers as well as vector and matrix quantities will also be explored in this course. Students will have the opportunity to delve into both categorical and quantitative data sets as they learn to interpret and make conclusions using statistics and the rules of probability. The concepts in this course can be applied to the physics of marine engineering, navigation, and stability. Data collected from the marine environment can be analyzed and interpret in large quantities and students will have the opportunity to investigate navigation in both the terrestrial and celestial spheres of reference.
Prerequisites: Successful completion of Algebra I and Geometry

Business and Finance Math
An understanding of finance and business is a critical skill that has immediate real-world applications as student enter the workforce and/or continuing education. Students will learn the basics of business acumen, including how to estimate the value of assets like machinery, businesses, and real estate, students will learn accounting skills, and the workings of the financial system.
Prerequisites: Successful completion of Algebra I and Geometry

Pre-Calculus
This course will offer the beginning opportunity to apply analytical geometry and calculus concepts to real-world marine problems. Students will learn to calculate limits, derivatives, and integrals. This course is designed for students preparing to enter Calculus I.
Prerequisites: Successful completion of Algebra I, Geometry, and Advanced Math

Calculus I/AP Calculus AB

The focus of this higher level math course is integral and differential calculus. Students will be expected to apply their skills to real-world ocean and marine life projects. AP Calculus AB will be concurrently offered through Maine AP4ALL and upon completion, students will have the option of registering for the AP Calculus AB exam for college credit. There is an additional fee for this exam.

Prerequisites: Successful completion of Algebra I, Geometry, and Advanced Math as well as successful completion of Pre-Calculus if taken.

Biostatistics/ AP Statistics

Biostatistics: This course will provide students the opportunity to apply statistical methods to the marine and biological sciences. The focus of this course is the study of populations, correlations, and predictions about rise and decline in populations, as it relates to marine science. AP Statistics will be concurrently offered through Maine AP4ALL and students will have the option of registering for the AP Statistics exam for college credit. There is an additional fee for this exam.

Prerequisites: Successful completion of Algebra I, Geometry, and Advanced Math

Science Sequencing and Course Descriptions

Grade	Courses
9	Earth Science
10	Marine Biology
11	Marine Chemistry
12	Marine Physics

- Honors courses will be offered as an accelerated component within a given course.
- AP Biology, Chemistry, Physics I, and Environmental Science courses will be offered through Maine DOE AP4ALL and in person as the need arises.

Course Descriptions:

Earth Science - *a full description of this course is provided in* ***Appendix 4a***

This is an inquiry-based course designed to teach the sciences/concepts involved in understanding the Earth, how it works, and its place in the universe. A variety of hands-on labs and models will be used to help build and show understanding of the sciences and concepts involved in the complex nature of the Earth.

Prerequisites: Successful completion of middle school science curriculum

Marine Biology

Biology of marine organisms will be explored from the perspective of whole organism function to species interactions and the importance of ecosystem dynamics. The principles of basic taxonomic differences and evolutionary relationships will be used to highlight the importance of biodiversity and the requirement of a healthy ocean for successful individuals, populations, and ecosystems.

Prerequisites: Successful completion of one High School science experience

Marine Chemistry - *a full description of this course is provided in* ***Appendix 4a***

This is an introductory chemistry class with a marine emphasis. Students explore the basic principles of chemistry which characterize the properties, reactivity, and quantitative analysis of matter and how it reacts. Emphasis will be put on understanding the role of chemistry in everyday life and the marine setting including the properties, composition, and origin of seawater. The processes that take place within the ocean and affect ocean chemistry will be explored.

Prerequisites: Successful completion of Algebra I and Marine Biology

Marine Physics - *a full description of this course is provided in* ***Appendix 4a***

In this course students will explore and analyze concepts of matter, energy, forces, and motion in physical systems through the application of scientific and engineering practices, and crosscutting concepts. Emphasis is placed on application to the marine setting with connections made to other areas of marine science.

Prerequisites: Successful completion of Algebra 1, and must enroll in Pre-Calculus or Advanced Math concurrently

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Social Studies Sequencing and Course Descriptions

Grade	Career Prep	College Prep
9	Civics/US Government	Civics/US Government-College Prep
10	US Maritime History	US Maritime History-College Prep
11	World Maritime History	World Maritime History-College Prep
12	Marine Policy	Marine Policy-College Prep

Course Descriptions:

World Maritime History

The earliest, and most efficient, way to transport large amounts of goods and people across vast distances is by watercraft. Imagine how homogenous we would be socially and economically had we not traversed the oceans in that age of discovery. This course explores how the sea connects all things, in this case the history of our global economics and immigration patterns.

Prerequisites: successful completion of middle school social studies curriculum

US Maritime History

The United States Maritime History class will cover our nation's history from colonial times to the present through the lens of maritime influences. The class will focus on the influence of these factors regionally: New England, Southern Atlantic Seaboard and Gulf of Mexico, Great Lakes and Inland Waterways, Pacific Northwest, Alaska and Hawaii. The students will use the Penobscot Marine Museum primary sources (archival documents, objects, photographs, etc.) and secondary sources to delve deeper into the history of our nation.

Prerequisites: Successful completion of middle school American History curriculum

Civics/American Government

"Civic education in a democracy is education in self government. Democratic self-government means that citizens are actively involved in their own governance; they do not just passively accept the dictums of others or acquiesce to the demands of others." Course will cover local, state, and national government civics education.

Prerequisites: successful completion of middle school social studies curriculum

Marine Policy- *a full description of this course is provided in* ***Appendix 4a***

Unbridled human interaction with the sea, marine resources, and with each other at sea and along the coastline has wreaked havoc. Policymakers over time have created regulations to mitigate human destruction of the marine environment and its resources and ease the tensions of human interaction in the marine environment, whether it be at work, at play or over property rights. This course will look at American Marine Policy from early colonization to the present.

Prerequisites: successful completion of middle school social studies curriculum

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Visual and Performing Arts
Sequencing and Course Descriptions

The spiraling strands of content, techniques, processes, materials, resources, and curricular connections are at the core of the creative process that is learning in the visual arts. As students engage in a four year visual arts marine curriculum, they will experience a focus on the elements and principles of design as they apply to courses such as drawing and painting for marine science, marine art history, 3-D modeling for transportation and engineering, and use of computer technology for marine design.

All art provides students with a foundation in creative problem solving, problem solving skills, cognitive thought and a form of personal expression. Along with an understanding of history, their environment and other cultures, students receive a broader understanding of the world around them.

Grade	Fine Arts	Music	Theater
9	Studio in Art: Marine Concentration	Introduction to Maritime Music History	Marine Musical Theater
10	2-D Art for Marine Scientists, Engineers, and Boatbuilders	Sea Chanteys Marine Band Individual Instruction	Spoken Word Theater
11	3-D Art for Marine Scientists, Engineers, and Boatbuilders	Sea Chanteys Marine Band Individual Instruction	Marine Opera
12	Computer Arts for Marine Scientists, Engineers, and Boatbuilders	Sea Chanteys Marine Band Individual Instruction	Marine Monologues

Course Descriptions:

Studio in Art: Marine Concentration - *a full description of this course is provided in* ***Appendix 4a***
9th grade marine-themed studio in art will focus on the application of the elements and principles of design through the creation of artwork using a variety of media and resources. Marine art history will be introduced to understand how artists and their artwork influenced

the culture of the time as well as the impact that these artists/artwork had on future cultures. Students will learn how to document the marine world using photo documentation and field notes. Students will engage in critical thinking skills and problem solving techniques as they learn the importance of aesthetics and criticism.
Prerequisite: Middle School Art Curriculum

2-D Art for Marine Scientists, Engineers, and Boatbuilders
This course will examine and experiment with various two-dimensional art styles used by marine scientists, engineers and architects. Students will create art notebooks for their career development track, such as marine ecology art and drafting and design for engineering and boat building.
Prerequisite: Studio in Art: Marine Concentration

3-D Art for Marine Scientists, Engineers, and Boatbuilders
This course will examine and experiment with various three-dimensional art styles used by marine scientists, engineers and architects. Students will create 3-D models for their career development track, such as welding, robotics, and boat building and engineering models.
Prerequisite: 2-D Art for Marine Scientists, Engineers, and Boatbuilders

Computer Arts for Marine Scientists, Engineers, and Boatbuilders
This course will examine and experiment with computer-aided art design styles used by marine scientists, engineers and architects. Students will create computer-aided designs for their career development track, such as AutoCAD boat building and engineering designs and marine scientific modeling software designs.
Prerequisite: 3-D Art for Marine Scientists, Engineers, and Boatbuilders

Introduction to Maritime Music History
This course will examine and experiment with various historical musical styles influenced by the sea and waterways. Class will include music for voice and instrument.
Prerequisite: successful completion of middle school music curriculum

Sea Chanteys
This course will examine the history and use of sea chanteys as a work tool on deck and source of entertainment and relaxation in the fo'c'sle. Students will learn and perform sea chanteys.
Prerequisite: Introduction to Maritime Music History

Marine Band and Individual Instruction
This course will examine and experiment with the instrumental music inspired by and written at sea for bands and individual instrumentalists. Students will learn and perform sea instrumental music.
Prerequisite: Introduction to Maritime Music History

Marine Musical and Spoken Word Theater
This course will examine and experiment with musicals, operas and spoken word theater pieces inspired by and written at sea. Students will learn and perform theatrical pieces.
Prerequisite: successful completion of middle school arts curriculum

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World Languages Sequencing and Course Descriptions

Grade	Courses
9 (or 10)	Communicating in Foreign Ports
10	Spanish I Latin I Self-directed Foreign Language I
11	Spanish II Latin II Self-directed Foreign Language II
12	*Additional courses as desired - Including AP courses through Maine AP4ALL*

Course Descriptions:

Communicating in Foreign Ports
This course will prepare students for communicating maritime terminology in foreign ports for transportation students and to foreign clients in the Maritime administration track. Key languages will be: Spanish, Chinese (Mandarin), Russian, French, German, Latin/Romance language roots (Italian and Portuguese), Japanese and English maritime phrases.
Prerequisites: successful completion of CCSS middle school foreign language curriculum

Spanish I
This course will prepare students for communicating with native Spanish speakers for transportation students and to foreign clients in the Maritime administration track. As the largest root language of our maritime nations, students will find use for this language.
Prerequisites: Communicating in Foreign Ports

Spanish II
This course will prepare students for communicating with native Spanish speakers for transportation students and to foreign clients in the Maritime administration track. As the largest root language of our maritime nations, students will find use for this language.
Prerequisites: Spanish I

Spanish III

This course will prepare students for communicating with native Spanish speakers for transportation students and to foreign clients in the Maritime administration track. As the largest root language of our maritime nations, students will find use for this language.

Prerequisites: Spanish II

Latin I

This course will prepare students in the Marine Science tracks for understanding key scientific phrases and Latin names of marine species.

Prerequisites: Communicating in Foreign Ports

Latin II

This course will prepare students in the Marine Science tracks for understanding key scientific phrases and Latin names of marine species.

Prerequisites: Latin I

Latin III

This course will prepare students in the Marine Science tracks for understanding key scientific phrases and Latin names of marine species.

Prerequisites: Latin II

Self-directed Foreign Language I

Students will have the opportunity to learn languages online or from available teachers onsite for languages they feel will enhance their ability to communicate in the maritime field. Students will take a standardized test upon completion of the course to evaluate their proficiency.

Prerequisites: Communicating in Foreign Ports

Self-directed Foreign Language II

Students will have the opportunity to learn languages online or from available teachers onsite for languages they feel will enhance their ability to communicate in the maritime field. Students will take a standardized test upon completion of the course to evaluate their proficiency.

Prerequisites: Self-directed Foreign Language I

Self-directed Foreign Language III

Students will have the opportunity to learn languages online or from available teachers onsite for languages they feel will enhance their ability to communicate in the maritime field. Students will take a standardized test upon completion of the course to evaluate their proficiency.

Prerequisites: Self-directed Foreign Language II

III.c. Marine Tracks

Marine Track Sequencing and Course Descriptions

Grade	Courses			
9	Foundations of Marine Studies I			
10	Foundations of Marine Studies II			
Choose a track	**Marine Science**	**Marine Transportation**	**Marine Engineering**	**Marine Management**
11	Marine Science I	Marine Transportation I	Marine Engineering I	Marine Management I
12	Marine Science II	Marine Transportation II	Marine Engineering II	Marine Engineering II

Course Descriptions:

Foundations of Marine Studies I

This course is the first in the series of Foundation courses that provides an overview and introduction to each of the four Marine Tracks taught at MOS and is required of all students. Additionally, this course will provide instruction in topics that are common to all tracks, including ethics, teamwork and leadership principles. This course lays the foundation for continued studies in Marine Science, Marine Transportation, Marine Engineering, and Marine Management and is intended to help the student determine which area of the marine industry is the best fit for their continued education.

The Foundations of Marine Studies I course is interactive, allowing for facility tours, guest speakers and class projects that are designed to expose students to various aspects of the marine industry, including institutions in higher learning, shipyards, boatyards, marine terminals and ports, marine related construction, marine research and government agencies.
Prerequisites: N/A

Foundations of Marine Studies II
This course is the second in the two-part series of Foundation courses that is required of all MOS students. The course is intended to expand the student's knowledge in topics that comprise the Marine Science, Marine Transportation, Marine Engineering, and Marine Management tracks. This course continues to lay the foundation for the student in determining their future course of studies in one of the Marine Tracks.

The Foundations of Marine Studies II course will be tailored to introduce students to professionals in their areas of interest. Students' ideas and desires will be addressed by bringing professionals from their areas of interest into the classroom and bringing the students to professional places of work to get a look into the daily lives of these professionals. They will also start building the credentials and setting the groundwork to ensure their interest in their developing track of choice. Qualifying students will be guided in applying for a Transportation Worker Identification Credential (TWIC) and an entry-level USCG Merchant Mariner Credential (MMC).
Prerequisites: Successful completion of Foundations of Marine Studies I

Marine Sciences I
This is a hands-on, applied methods course designed to provide the skills needed to conduct a self-directed study in Marine Science, **Marine Sciences II**. Students will build on their science knowledge and learn the basic theories (e.g., evolution, ecology, oceanography, aquaculture, fisheries) and laboratory skills to identify life in the sea, assess basic water quality measures (in the ocean and tank/culture systems), conduct controlled experiments, deploy and retrieve different gear types for physical (Acoustic Doppler Current Profiler - ADCP), chemical (Conductivity, Temperature Depth recorder - CTD), geological (Ponar grab), and biological (trawls and pots), keep accurate records, analyze results, and communicate them to varied audiences.
Prerequisites: Algebra, Marine Biology, Chemistry, Physics (last 2 can be concurrent), Foundations of Marine Studies I, Foundations of Marine Studies II

Marine Sciences II
As the second of a two-part course in the Marine Science Track this course will build on skills learned in **Marine Science I** to provide the student with experience in further pursuit in various fields of marine science. Hands-on learning experiences will be mentor-guided and industry/academic-partnered learning where directed study skills will be applied to ocean careers, from those requiring a HS diploma to those requiring a PhD. Career paths will be discussed and integrated with scientific areas of inquiry to determine the best hands-on

experience for each student. From this, Capstone/Senior Experiences will be formulated with a faculty mentor. These will be individualized to incorporate a laboratory, field, or industry-integrated research or field experience with an associated Marine Scientist. The student and mentor will determine the final product of this experience. All students in the Marine Science Track will take part in a presentation of their projects to stakeholders, either to the legislature in a Hall of Flags event or a Symposium with industry/institutional engagement.
Prerequisites: Successful completion of Foundations of Marine Studies I, Foundations of Marine Studies II, Marine Science Studies I
Co-requisite: Statistics

Marine Transportation I
This is the first of two directed studies courses in the Marine Transportation track. This course covers basic knowledge in areas related to the Marine Transportation field and prepares the student for more advanced studies in Marine Transportation.

This is an interactive course, allowing for tours, guest speakers, and class projects designed to expose students to various aspects of the marine industry.
Prerequisites: Foundations of Marine Studies I, Foundations of Marine Studies II

Marine Transportation II
This is the second of two directed studies courses of the **Marine Transportation** track. The course is intended to provide the student with the basic knowledge and understanding required for the further pursuit of the Standards of Training, Certification and Watchkeeping (STCW) endorsements of Rating Forming Part of a Navigational Watch (RFPNW) and Able Seafarer - Deck (AS-D). The Knowledge, Understanding and Proficiency (KUP) Assessment Guidelines for AS-D are used to develop objectives for this course.

This **Directed Marine Transportation Studies II** course is interactive, allowing for tours, guest speakers and class projects designed to expose students to various aspects of the marine transportation industry.
Prerequisites: Foundations of Marine Studies I, Foundations of Marine Studies II, Marine Transportation Studies I

Marine Engineering I
This instructor led course will prepare the participant to use engineering analysis, design, and evaluation processes to solve basic problems in the ocean related topics. Learning activities may include classroom discussion, laboratory practice or field activities.

This course is interactive, allowing for tours, guest speakers and class projects designed to expose students to various aspects of the marine engineering industry.

Prerequisites: Algebra 2, and Chemistry; Physics; must enroll in Precalculus or higher math concurrently; Foundations of Marine Studies I; Foundations of Marine Studies II

Marine Engineering II

This instructor led course will prepare the participant to expand the use engineering analysis, design, and evaluation processes to solve more complex problems in the ocean related topics (e.g., marine electrical systems, ocean energy conversion, research support systems). Learning activities may include classroom discussion, laboratory practice or field activities.

This course will include a student selected, mentor-guided and industry/academic-partnered experiential learning activity to apply directed study skills to solving a specific ocean related problem.

Prerequisites: Marine Engineering

Marine Management I

This instructor led course will prepare the student to use communications, team-building, financial management, and planning processes to support the ocean related topics (e.g., port logistics, marina management, ship and personnel scheduling). Learning activities may include classroom discussion, practical exercises, or field activities and are intended to build a skills-base to prepare students for management roles and decision-making in those roles.

This course is interactive, allowing for tours, guest speakers and class projects designed to expose students to various aspects of the marine management industry.

Prerequisites: Foundations of Marine Studies I, Foundations of Marine Studies II

Marine Management II

This instructor led course will prepare the student to use advanced communications, team-building, financial management, and planning processes to support the ocean related topics. Learning activities may include classroom discussion, practical exercises, or field activities and are intended to enable the active application of skills to prepare students for management roles and decision-making in those roles.

This course will include a student selected, mentor-guided and industry/academic-partnered experiential learning activity to apply skills to solving a specific ocean related business problem.

Prerequisites: Foundations of Marine Studies I; Foundations of Marine Studies II; Marine Management I

Grades 9 & 10 Marine Track Courses

Foundations of Marine Studies I

Course Description: This course is the first in the series of Foundation courses that provides an overview and introduction to each of the four Marine Tracks taught at MOS and is required of all students. Additionally, this course will provide instruction in topics that are common to all tracks, including ethics, teamwork and leadership principles. This course lays the foundation for continued studies in Marine Science, Marine Transportation, Marine Engineering, and Marine Management and is intended to help the student determine which area of the marine industry is the best fit for their continued education.

The Foundations of Marine Studies I course is interactive, allowing for facility tours, guest speakers and class projects that are designed to expose students to various aspects of the marine industry, including institutions in higher learning, shipyards, boatyards, marine terminals and ports, marine related construction, marine research and government agencies.
Prerequisites: N/A

Topics:

Introduction to Marine Science
Introduction to Ship and Maritime Terminology
Introduction to Ethics, Leadership and Teamworking Skills
Introduction to Marine Transportation
Introduction to Marine Engineering
Introduction to Marine Management
Marine Careers: Introduction to shoreside and seagoing careers related to Marine Science, Marine Transportation, Marine Engineering and Marine Management.

Foundations of Marine Studies II

Course Description: This course is the second in the two-part series of Foundation courses that is required of all MOS students. The course is intended to expand the student's knowledge in topics that comprise the Marine Science, Marine Transportation, Marine Engineering, and Marine Management tracks. This course continues to lay the foundation for the student in determining their future course of studies in one of the Marine Tracks.

The Foundations of Marine Studies II course will be tailored to introduce students to professionals in their areas of interest. Students' ideas and desires will be addressed by bringing professionals from their areas of interest into the classroom and bringing the students to professional places of work to get a look into the daily lives of these professionals. They will also start building the credentials and setting the groundwork to ensure their interest in their developing track of choice. Qualifying students will be guided in applying for a Transportation Worker Identification Credential (TWIC) and an entry-level USCG Merchant Mariner Credential (MMC).

Prerequisites: Successful completion of Foundations of Marine Studies I

Topics:

Leadership, ethics and Managerial Skills
Personal Safety Training
Ocean Survival Skills
Small Boat Handling
Environmental Awareness
Security Awareness
Introduction to Regulations
USCG Entry Level Merchant Mariner Credential (MMC) Application
USCG Approved Basic Training

Educational, Industry Standards & Sources:

Industry Standards addressed:

- United States Coast Guard (USCG)
- Standards of Training, Certification and Watchkeeping (STCW)
- Code of Federal Regulations (CFR's)
- Occupational Safety and Health Administration (OSHA)
- United Nations Environment Programme (UNEP)
- Transportation Security Administration (TSA)

Grades 11 and 12 Marine Track Courses

Marine Science I

Course Description (*a more detailed course description can be found in* ***Appendix 4b***)**:** This is a hands-on, applied methods course designed to provide the skills needed to conduct a self-directed study in Marine Science, **Marine Sciences II**. Students will build on their science knowledge and learn the basic theories (e.g., evolution, ecology, oceanography, aquaculture, fisheries) and laboratory skills to identify life in the sea, assess basic water quality measures (in the ocean and tank/culture systems), conduct controlled experiments, deploy and retrieve different gear types for physical (Acoustic Doppler Current Profiler - ADCP), chemical (Conductivity, Temperature Depth recorder - CTD), geological (Ponar grab), and biological (trawls and pots), keep accurate records, analyze results, and communicate them to varied audiences.

Prerequisites: Algebra, Marine Biology, Chemistry, Physics (last 2 can be concurrent), Foundations of Marine Studies I, Foundations of Marine Studies II

Topics:

Oceanography
Biodiversity & Ecology
Human uses of marine resources of the ocean
Aquaculture & Fisheries
Scientific project management

Recommended Texts:

Townsend, D.W. 2012. Oceanography and Marine Biology: An Introduction to Marine Science. Sinauer Associates, Sunderland, MA.

Karban, Richard, Mikaela Huntzinger, and Ian S. Pearse. *How to do ecology: a concise handbook*. Princeton University Press, 2014.

Educational, Industry Standards & Sources:

Ocean Literacy Principles Addressed:

- Ocean Literacy Principle #2: The ocean and life in the ocean shape the features of Earth.
- Ocean Literacy Principle #4: The ocean made the Earth habitable.
- Ocean Literacy Principle #5: The ocean supports a great diversity of life and ecosystems.

NOAA Ocean Literacy Standards

Marine Science II

Course Description (*a more detailed course description can be found in* ***Appendix 4b***)**:** As the second of a two-part course in the Marine Science Track this course will build on skills learned in Marine Science I to provide the student with experience in further pursuit in various fields of marine science. Hands-on learning experiences will be mentor-guided and industry/academic-partnered projects where directed study skills will be applied to ocean careers, from those requiring a HS diploma to those requiring a PhD.
Prerequisites: Algebra, Marine Biology, Chemistry, Physics, Statistics (any of the last 3 can be concurrent), Foundations of Marine Studies I, Foundations of Marine Studies II

Possible Topics Covered - *The course will be student-interest-directed and will be tailored for the needs of those taking the course*

- Review of concepts from Marine Sciences I
    - Oceanography, Biodiversity & Ecology, Human uses of marine resources of the ocean, Aquaculture & Fisheries, Scientific project management
    - Choose a focus area, or integrate areas
- Experimental Design
- Data analysis and interpretation
- Scientific writing

Details: Career paths will be discussed and integrated with scientific areas of inquiry to determine the best hands-on experience for each student. From this, Capstone/Senior Experiences will be formulated with the faculty mentor (to be identified in Marine Sciences I). These will be individualized to incorporate a laboratory, field, or industry-integrated research or field experience with an associated Marine Scientist. The student and advisor will determine the final product of this experience. All students in the Marine Science Track will take part in a presentation of their projects to stakeholders, either to the legislature in a Hall of Flags event or at an organized Symposium with industry/institutional engagement.

Resources:

University of Maine links to College preparation - primarily Kahn Academy resources
Maine INBRE - IDeA Network of Biomedical Research Excellence - Laboratory Training Courses

Educational, Industry Standards & Sources:

Ocean Literacy Principles Addressed:

- Ocean Literacy Principle #2: The ocean and life in the ocean shape the features of Earth.
- Ocean Literacy Principle #4: The ocean made the Earth habitable.
- Ocean Literacy Principle #5: The ocean supports a great diversity of life and ecosystems.

NOAA Ocean Literacy Standards

Marine Transportation I

Course Description (*a more detailed course description can be found in* ***Appendix 4b***)**: Marine Transportation I** is the first of two courses in the Marine Transportation program. This course covers basic knowledge in areas related to the Marine Transportation field and prepares the student for more advanced studies in Marine Transportation.

Marine Transportation I is an dynamic course that integrates classroom lectures, instructional tours, guest speakers, interactive teambuilding, and hands on experiences designed to expose students to multiple aspects of the marine transportation industry. **Prerequisites:** Foundations of Marine Studies I, Foundations of Marine Studies II, Algebra I, and English 9

Topics:

- Introduction to Marine Transportation
- Introduction to Nautical Science
- Ship Construction
- Basic Seamanship
- Basic Navigation
- Basic Meteorology
- Basic Rules of the Road
- Basic Ship Stability
- Basic Ship Handling
- Basic Cargo Handling

Educational, Industry Standards & Sources *(Maine educational standards do not exist for this topic area)*::

USCG Standard of Training, Certification, and Watchkeeping (STCW)
Safety of Life at Sea (SOLAS)
Knowledge, Understanding and Proficiency Assessment Guidelines (KUP)
Title 46 of the Code of Federal Regulations (CFR)
Ocean Literacy Principles (OLP)
American Boat & Yacht Council Standards (ABYC)
Maine Learning Results: Career and Education Development Standards

Possible Outcomes: e.g. certificates, essential knowledge and practice in seamanship skills, facility with methods, materials and technology associated with Marine Transportation

Marine Transportation II

Course Description (*a more detailed course description can be found in **Appendix 4b***)**:** This is the second of two courses in the Marine Transportation program. The course is intended to provide the student with the basic knowledge and understanding of the materials, methods, and skills required for the further pursuit of the Standards of Training, Certification and Watchkeeping (STCW) endorsements of Rating Forming Part of a Navigational Watch (RFPNW) and Able Seafarer - Deck (AS-D). The Knowledge, Understanding and Proficiency (KUP) Assessment Guidelines for AS-D are used to develop objectives for this course.

Marine Transportation II is a dynamic course that has elements including classroom lectures, interactive team building, instructional tours, guest speakers and class projects designed to expose students to various aspects of the marine transportation industry.
Prerequisites: Foundations of Marine Studies I, Foundations of Marine Studies II, Marine Transportation Studies I, Algebra I, and English 9

Topics:

- Marine regulations
- Topics in navigation
- Contribute to watchstanding duties and requirements
- Contribute to berthing, anchoring and mooring operations
- Contribute to Deck Operation fundamentals
- Contribute to the safe operation of deck equipment and machinery
- Apply occupational health and safety precautions
- Apply precautions and contribute to the prevention of marine pollution
- Operate survival craft and rescue boats
- Contribute to shipboard maintenance and repair
- Bridge Resource Management (BRM)
- Capstone/Senior Experience

Educational, Industry Standards & Sources *(Maine educational standards do not exist for this topic area)*:

USCG Standard of Training, Certification, and Watchkeeping (STCW)
Rating Forming Part of a Navigational Watch (RFPNW)
Knowledge, Understanding and Proficiency Assessment Guidelines (KUP)
Title 46 of the Code of Federal Regulations (CFR)
Ocean Literacy Principles (OLP)
American Boat & Yacht Council Standards (ABYC)
Maine Learning Results: Career and Education Development Standards

Possible Outcomes: e.g., Certificates of competence in the field, informed knowledge and practice in vessel operations skills, confident facility with methods, materials and technology with Marine Transportation issues, and readiness to go onto the water as a seaman at many different levels.

Marine Engineering I

Course Description (*a more detailed course description can be found in* ***Appendix 4b*****):** This instructor led course will prepare the participant to use engineering analysis, design, and evaluation processes to solve basic problems in the ocean related topics described below. Learning activities may include classroom discussion, laboratory practice, and shop or field activities. This course is interactive, allowing for tours, guest speakers and class projects designed to expose students to various aspects of the marine engineering industry.
Prerequisites: Algebra 2, and Chemistry; Physics; Foundations of Marine Studies I & II; Must enroll in Advanced Math, Precalculus, or higher Math Concurrently

Topics: Students will learn the purpose and safe use of tools such as the following:

- Apply math, science, chemistry, physics, and material to problem analysis
- Engineering terminology
- Engineering data sources
- Graphics and mechanical drawing
- Workplace Safety
- Application of tools
- Technical Report Writing and Presentations

Standards addressed in this topic area: *The Maine Performance Based Learning Science Reporting Standards from which these standards were adapted incorporated the Maine Learning Results criteria, NGSS standards, and the Maine Guiding Principles*

- MLR Standards: A1; A2; B1; B2
- Maine Guiding principles: A;
- Maine Performance Based Learning Science Reporting Standards: 8
- NGSS: HS-ETS 1; HS- LS2-7; HS-LS4-6; HS-ESS3-2; HS-ESS3-4; HS-ETS1-4; HS-PS2-3; HS-PS2-6; HS-PS4-5
- Ocean Literacy Principles: OLP 6

Educational, Industry Standards & Sources:

- Maine Performance Based Learning Science Reporting Standards
- Ocean Literacy Principles
- Federal Regulations
- American National Standards Institute (ANSI) standards
- Industry consensus standards, for example:
    - Institute of Electrical and Electronics Engineers (IEEE)
    - American Welding Society (AWS)
    - American Society of Mechanical Engineers (ASME)
    - National Fire Protection Association (NFPA)

Possible Outcomes: Further education in Marine Engineering.

Marine Engineering II

Course Description: This instructor led course will prepare the participant to use engineering analysis, design, and evaluation processes and tools developed in Marine Engineering I to solve more complex problems in the ocean related topics described below. Learning activities may include classroom discussion, laboratory practice, shop practice, or field activities.
This course will include a student selected, mentor-guided and industry/academic-partnered experiential learning activity to apply directed study skills to solving a specific ocean-related problem.

Prerequisites: Marine Engineering I

Topics: Students may address problems with systems or activities including but not limited to:

- Workplace safety
- Vessel construction and operations
- Marine propulsion
- Marine support systems
- Waterborne structures
- Water transportation systems
- Ocean related energy-conversion systems
- Ocean environmental protection

Standards addressed in this topic area:

- **MLR Standards**: A1; A2; B1; B2
- **Maine Guiding principles:** A;
- **Maine Performance Based Learning Science Reporting Standards: 8**
- **NGSS:** HS-ETS 1-1; HS-PS3-3; HS-ETS1-3; HS-ETS1-4; HS-ETS1-2; HS-PS1-6
- **Ocean Literacy Principles**: OLP 6

Educational, Industry Standards & Sources:

- Maine Performance Based Learning Science Reporting Standards
- Ocean Literacy Principles
- Federal Regulations
- ANSI standards
- Industry consensus standards (e.g., IEEE, AWS, ASME, NFPA, ABS)

Possible Outcomes: Further education in Marine Engineering. This course should provide the student with the basic knowledge and understanding of the materials, methods, and skills required for the further pursuit of the Standards of Training, Certification and Watchkeeping (STCW), endorsements of Rating Forming Part of a Navigational Watch (RFPNW), and Able Seafarer - Engineering (AS-E).

Marine Management I

Course Description: This instructor led course will prepare the student to use communications, team-building, financial management, and planning processes to support the ocean related topics described below. Learning activities may include classroom discussion, practical exercises, or field activities and are intended to build a skills-base to prepare students for management roles and decision-making in those roles.

This course is interactive, allowing for tours, guest speakers and class projects designed to expose students to various aspects of the marine management industry.
Prerequisites: Foundations of Marine Studies I, Foundations of Marine Studies II

Topics: Students will address issues with activities including but not limited to the following:

Ethics
Communication
Introduction to marine business
Small craft construction
Ship construction and shipbuilding
Support services
Waterfront support
Port logistics
Intermodal transportation
Research project support
Ship/facility staffing & personnel Scheduling
Personnel management
Accounting

Educational, Industry Standards & Sources *(Maine educational standards do not exist for this topic area)*::

- Maine Performance Based Learning Science Reporting Standards
- Ocean Literacy Principles
- Federal Regulations
- ANSI standards
- Industry consensus standards (e.g., IEEE, AWS, ASME, NFPA)

Marine Management II

Course Description: This instructor led course will prepare the student to use advanced communications, team-building, financial management, and planning processes to support the ocean related topics described below. Learning activities may include classroom discussion, practical exercises, or field activities and are intended to enable the active application of skills to prepare students for management roles and decision-making in those roles.

This course will include a student selected, mentor-guided and industry/academic-partnered experiential learning activity to apply skills to solving a specific ocean related business problem.

Prerequisites: Foundations of Marine Studies I; Foundations of Marine Studies II; Marine Management I

Topics: Students may address issues with activities including but not limited to the following:

International Maritime Organization
Law of the Sea
Marine marketing
Human resource management
Workboat operations
Marina management
Research project management
Transportation facility management processes
Ship scheduling

Educational, Industry Standards & Sources *(Maine educational standards do not exist for this topic area)*:**:**

- Maine Performance Based Learning Science Reporting Standards
- Ocean Literacy Principles
- Federal Regulations
- ANSI standards
- Industry consensus standards (e.g., IEEE, AWS, ASME, NFPA)

III.d. Other Programs

Summer Programs

Summer Programs will be vital to the recruitment efforts of MOS. They will be equally important in ensuring that the prospective students also understand both the special offerings of the school and the challenges a theme-based, residential program can offer. Efforts will be made to provide a comprehensive view of the school and all tracks that are offered so students are informed of the possibilities. This is a process that will continue through our Foundations Track courses in their 9th and 10th grade years.

Our extended vision for summer programs will include a variety of offerings ranging from 6th to 9th grade. Although programs may have a particular focus, for example a program for field research in science, an effort will be made to introduce students to other areas of study within the focuses of MOS.

Our vision for the school includes vessels, waterfront facilities, residential housing, and dedicated staff to meet the needs of our summer programs. These are all in development and will not be a reality for our immediate needs. We do however remain committed to offering programs during summer 2017 by partnering with local institutions to showcase the local opportunities for our potential students. A preliminary plan for this summer is as follows:

We will use a day-format field trip for potential students and parents. The new staff and current Board of Trustees will meet and spend the day with parents and students by taking a bus trip from Belfast to Stockton Spring. In Belfast and Searsport we will observe local management and engineering activities at shipyards and the Mack Point Marine Intermodal Cargo Terminal. We will travel to Sears Island and have a walking tour with Marine Biologists and volunteers from the stewards of the island, *Friends of Sears Island* where we will witness the local flora and fauna the area has to offer. We will then travel to Stockton Harbor to again observe the beach and shore side habitats at Stockton Harbor Sailing Center. This establishment will also provide activities associated with marine transportation: sailing, kayaking, boat handling. We will finish up by returning to Searsport for a wrap up and traditional lobster bake at the Hamilton Learning Center.

There are many opportunities in the Searsport area to add to this format, program and events. While we currently are challenged by limited facilities, resources, and hosting facilities, we are confident that support will be easier with committed staff as we move forward with the formal formation of this school.

Other Offerings

Formal workshops and training will be offered in class and out of class for students. We plan to make as many of these available (formally or informally) to educators and others out of

school time periods. We are considering a partnership with Maritime Training Services to make ready-made course materials available (e.g., Maritime Regulations 101, Environmental Awareness, Risk Assessment). Other possible training courses and connections will be made with USCG Licensing training courses (both on and off campus) and US Sailing Instructor Certifications - United States Sailing Association.

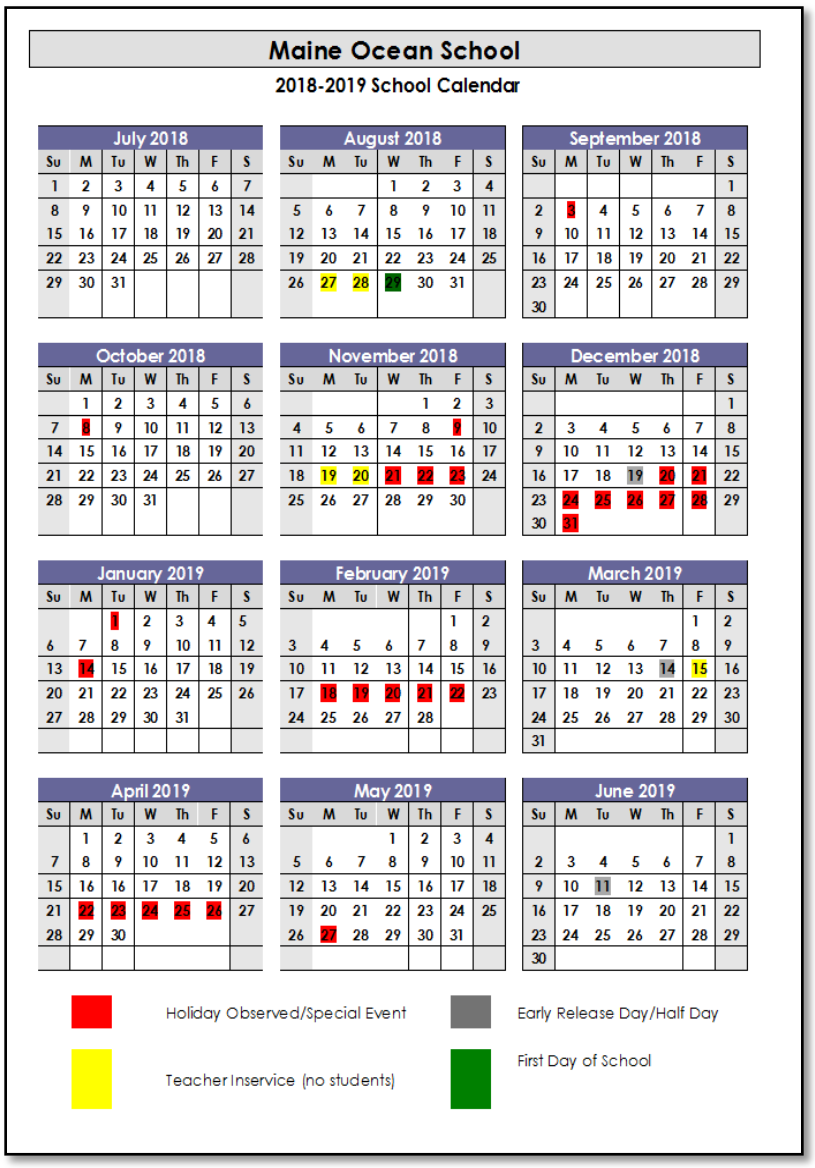
IV. Additional work on subsections of Title 20-A § 8236

IV.a. Title 20-A § 8236.1. School Year

1. School year. *Operating on a calendar year that meets or exceeds the minimum number of statewide student instructional days;*

This area was not a primary focus of the committee, but has been discussed and the following ideas are currently being considered. We view this as a living document that will necessarily evolve as an Executive Director, curriculum development staff, and other staff are hired.

The school year has been envisioned to encompass the traditional academic months of September through June with options or even required summer coursework. Summer coursework would be encouraged for Grade 11 students working on directed studies with partners inside and outside of the school. Graduating students may have the option of staying for a summer term to compete career path goals that may not have been achieved with the completion of their High School diploma and portfolio development.



August 27, 28	Teacher Inservice Days
August 29	First Student Day
September 3	Labor Day
October 8	Columbus Day
October 11	Progress Reports
November 9	Veterans Day
November 19-23	Thanksgiving Break
November 19,20	Teacher Inservice Days
December 1	Trimester 1 Ends
December 19-Jan 1	Winter Holiday
January 1	New Year's Day
January 14	Martin Luther King, Jr.
January 25	Progress Reports
February 18-22	Winter Break
March 15	Trimester II Ends
April 22-26	Spring Break
May 3	Progress Reports
May 27	Memorial Day
June 11	Trimester III Ends
175 Student Days	183 Teacher Days

Summer sessions will be offered.

We have envisioned a trimester schedule for those students in grades 9-11 with a 4-day alternating block schedule and one day (presently Fridays) with class or project work in Marine Tracks. For those in grades 9-11, trimesters could consist of three months, 60 days each from September to June. School days would consist of an alternating 2-day block schedule with 90-minute class periods and a one-hour lunch to provide flexibility and more contact time with faculty or among faculty. This would allow 12 core courses and 12 electives to be covered every year. An example trimester schedule is shown below:

<table>
<tr><th>Day</th><th>Monday</th><th>Tuesday</th><th>Wednesday</th><th>Thursday</th><th>Friday</th><th>Saturday</th><th>Sunday</th></tr>
<tr><td>Alternating Days</td><td>A</td><td>B</td><td>A</td><td>B</td><td>TRACK</td><td colspan="2" rowspan="8">Clubs and workshops</td></tr>
<tr><td>Blocks
(45-90 min)</td><td colspan="5"></td></tr>
<tr><td>1: 8 - 9:30</td><td>Math</td><td>Science</td><td>Math</td><td>Science</td><td rowspan="6">Marine Foundations or Tracks courses</td></tr>
<tr><td>2: 9:35 - 11: 05</td><td>ELA</td><td>Social Studies</td><td>ELA</td><td>Social Studies</td></tr>
<tr><td>3: 11:10-11:55</td><td colspan="4">LUNCH</td></tr>
<tr><td>4: 12:00 - 12:45</td><td colspan="4">Advisor or Study Hall</td></tr>
<tr><td>5: 12:45 - 14:15</td><td>World Language</td><td>Science lab</td><td>World Language</td><td>Study Hall</td></tr>
<tr><td>6: 14:20 - 15:05</td><td>PE/sports</td><td>Elective 1</td><td>PE/sports</td><td>Elective 1</td></tr>
<tr><td>15:15 - 18:00</td><td colspan="5">Waterfront/club time</td><td></td><td></td></tr>
<tr><td>18:30 - 19:30</td><td colspan="5">Dinner</td><td></td><td></td></tr>
<tr><td>20:00-22:00</td><td colspan="5">Clubs and workshops / Elective 2</td><td></td><td></td></tr>
</table>

The MOS program is designed to prepare students for post-secondary opportunities in a variety of careers (Appendix 2). As such, we expect to provide even more flexibility to grade 12 students for final preparation of final projects and career portfolios. One possible scenario is to provide two 75 day semesters to finalize core courses and electives, leaving a third trimester (e.g., May and June) to finalize marine track projects and/or internships. Also, we would expect students in their final year (as part of career development) to mentor underclassmen in grades 9-11. We envision grade 12 students to participate in core and track courses on Fridays. These track Fridays also provide the ability to take students to other sites/partner facilities (Appendix 3) for experiential learning or bring partners and specialists in on a dedicated day of the week.

This non-traditional scheduling, with shorter times to complete content areas (3 months instead of 4.5), is expected to enhance allocated and engaged times for students and faculty, a strategy that has been shown to enhance learning (Aronson et al. 2005).

IV.b. Title 20-A § 8236.3. School admission

> ***3. School admission.*** *Admittance of high school students and students pursuing a postgraduate high school year of education based on the enrollment criteria established by the board of trustees as provided in section 8235, subsection 11. Students who apply and are accepted by the school are allowed to attend as provided in section 5205, subsection 6;*

While this was not a required focus for meeting the 15 February 2017 deadline, we were fortunate to find a group of interested teachers and community members who were very excited to develop an admissions framework. As such, we built on that energy and developed the following approach to admissions. Again, we view this as a living document that will necessarily evolve as an Executive Director, admissions staff, and teachers are hired.

Development of the MOS admissions process:

The Board of Trustees, in collaboration with committee members, have determined the criteria all applicants must meet in order to be considered for admittance into the Maine Ocean School. After careful evaluation of other schools' admissions processes and through many discussions during planning meetings, it was agreed that the admissions process should not be limited to an applicant's GPA (grade point average), as is customary in many other magnet schools. The foundational belief, as evidenced in the mission statement of MOS, is that an applicant's GPA is not the greatest predictor of potential achievement. Because of this belief, further discussions outlined the four criteria all applicants will be evaluated upon for admittance into MOS. The desire of the BOT and committee members was to provide a framework in which an applicant can present evidence that supports their potential to succeed at MOS.

Objective Criteria for Admissions:

1. *The* ***Application*** which will include the student's demographic information and official transcript(s) from an accredited high school (or middle school once we accept 9th grade students). If applicant is a home-schooled student, then a copy of standardized test scores filed with the local superintendent's office need to be included in lieu of transcript.

2. ***Essay/Video*** in which the applicant discusses their interest in the ocean, how attendance at MOS aligns with their future goals, and a discussion of collaborative involvement within their current school and community.

3. Three ***References*** will be requested from the applicant to provide the admissions committee with objective information about the applicant's leadership skills, work ethics, interpersonal skills, collaboration with peers and adults, potential for success, and academic preparedness. It is the contention of the BOT and the committee members that these references will offer valuable information through their first-hand knowledge of the prospective student in the areas of academics, community/civic organizations, and/or work.

4. An ***Interview*** of the applicant will provide the admissions committee an opportunity to meet with the applicant and ask questions related to the applicant's desire to be a student at MOS. The admissions committee will be assessing the applicant on their ability to make eye contact with committee members; ability to clearly articulate goals; self-reflective statements concerning strengths and learning styles and approaches will be discussed; and applicant's habits of work will be included in this process.

Finally, the committee will review the applicant's entire application, including their GPA and transcripts, to determine areas of strengths and weaknesses. These will be assessed to ascertain if these strengths align with the content of MOS program and to determine whether identified weaknesses can be addressed before or early after admission to assure success at MOS. For example, a foundational math course has been included in the core math area of the program for those who might require extra support with the necessary skills required for higher math courses at MOS.

Evaluation Measures:

We want to ensure an objective procedure when evaluating all collected data from applicants. As such, several rubrics were created which coincide with each of the criteria, with the exception of GPA, they are: ***Essay/Video Rubric; Reference Rubric; and Interview Rubric.*** A final ***Meta Rubric*** was designed for simplicity to record data from each measure. All rubrics will be made readily available to applicants to provide as much transparency within the admissions process (rubrics are included below).

All applicants will receive written notice of admission to MOS. Those applicants who are not admitted will receive written notification with an explanation of how to address the weaknesses in their application package (e.g., summer programs) for a more successful reapplication within the next school year.

Application for Admission

The mission of MOS is *to provide a theme-based high school education focused on Maine's maritime connection, with an emphasis on leadership, work ethic, and the transferable skills associated with careers involving the ocean.*

Student Name_____ Grade level for 2018/2019 _____

Date of Birth_____ Gender_____

Student Address_____
Street Address City State Zip Code

Current School Attending_____

Current GPA:_____ Please attach a copy of official transcript - *to be used for placement within the school program structure.*

Mother's/Guardian's Name_____

Father's/ Guardian's Name_____

Home Phone_____ Cell_____

Parent Email_____

Work/Volunteer Experience_____ Date: From_____to_____

Work/Volunteer Contact Name_____ Number_____

I understand that:

- **Maine natives will be given preference for admissions to MOS**
- **All application documents must be submitted no later than _____, by 3pm at the MOS office.**
- **Student admission will be determined by the Admissions Committee based on student's application, essay/video score, interview, and references.**

Essay/Video Rubric

The mission of MOS is *to provide a theme-based high school education focused on Maine's maritime connection, with an emphasis on leadership, work ethic, and the transferable skills associated with careers involving the ocean*.

Guiding Question	1	2	3	4
Why do you want to study the ocean and marine life?	Applicant provided limited evidence of desire to study the ocean and marine life.	Applicant articulated purpose and perhaps intent, but did not expound beyond this.	Applicant could provide some evidence for purpose of study in a cohesive and coherent manner.	Applicant clearly articulated and provided evidence for studying the ocean and marine life; applied purpose of study to goals in life.
Why do you feel that you are a good fit for MOS?	Applicant expresses desire to be a student at MOS, but no discussion of how they will participate and guide their learning through collaboration with faculty, staff, and peers.	Applicant can describe their role at MOS, primarily as it relates to academics. Little discussion concerning their desire to be part of a team and work in concert with classmates and faculty to further their personal goals.	Applicant clearly expresses role at MOS. Is able to provide examples of how they work collaboratively with peers (academically, within the school community, through civic activities -give examples.	Applicant provides specific examples of team approach, collaboration, and growth and development.
How will you use your experiences at MOS in your future endeavors?	Applicant's goals do not align with a career in ocean and/or marine science.	Applicant's goals for future are vague concerning ocean and/or marine science.	Applicant clearly connects MOS education to their future goals in the field of ocean and/or marine science.	Applicant has mapped out a clear path between their matriculation from MOS and a clear future career in ocean and/or marine science.
Who has been the greatest influence in your life? Explain how this person has impacted you.	Applicant is unable to clearly articulate their choice and the strengths and positive qualities of the person or persons.	Applicant can identify a person or persons who demonstrate positive qualities and have had a measure of impact on society.	Applicant has identified a person or persons, who has demonstrated qualities of strong character, high morals, and has led an altruistic life. The applicant draws from their choice those qualities they wish to embody.	Applicant has chosen a person or persons who exemplify strong character traits and clearly express a desire to cultivate those traits within themselves.
Score				

Rating Scale: 1: Does not meet MOS mission and standards of success.
2: Partially or somewhat meets the MOS mission and standards of success.
3: Meets MOS mission and standards of success.
4: Exceeds MOS mission and standards of success.

Reference Rubric

The mission of MOS is to *provide a theme-based high school education focused on Maine's maritime connection, with an emphasis on leadership, work ethic, and the transferable skills associated with careers involving the ocean.*

Background Information

1. **Applicant Name_____ Reference Name_____**
2. **How do you know the applicant?_____**
   _____
3. **How long have you known applicant?_____**

Rubric

	Never	Rarely	Often	Always
Leadership Skills Applicant possesses leadership skills as evidenced through their conscientiousness, willingness to learn from respected adults and peers, and a team approach to projects.				
Preparedness Applicant is well organized, carefully plans for class projects, completes projects on time, and exhibits same qualities with community commitments.				
Collaboration Applicant is a "team player." Applicant enjoys working and collaborating with peers and asks for assistance, when appropriate, from adults.				
Ethical Applicant is trustworthy, honest, and dependable.				
Interpersonal Skills Applicant demonstrates an ability to communicate effectively and willingly with all peers and faculty members.				

Interview Rubric

The mission of MOS is to *provide a theme-based high school education focused on Maine's maritime connection, with an emphasis on leadership, work ethic, and the transferable skills associated with careers involving the ocean.*

Questions will be developed to target the categories below.

Category	1	2	3	4	Row Total
Ocean Interest	Experiences & education do not mention student interest in ocean related fields.	Experience or education clearly demonstrates that the candidate has interest in any ocean related field.	Experience and education clearly demonstrate that the candidate is interested in ocean related fields.	Experience, education, and awards highlight obvious interest in ocean related fields. Ocean interest is a strength for the candidate.	
Leadership	No demonstration of potential for leadership experience.	Candidate articulates limited experience as a leader.	Candidate provides evidence of leadership opportunities.	Candidate articulates and provides evidence of leadership opportunities that were sought out by the applicant.	
Community	No examples of community involvement.	Candidate is unable to articulate any connection to community organizations.	Candidate discusses connections to community service.	Candidate demonstrates a strong commitment to community as evidenced in their involvement in community-based organizations.	
Communic-ation	The candidate demonstrated limited communication skills. He/she could not make eye contact, was unintelligible, or did not answer all questions.	The candidate demonstrated satisfactory communication skills. The candidate answered all questions, but some were incomplete or off	The candidate demonstrated proficient communication skills: eye contact was made appropriately, the candidate spoke with appropriate volume, speed, and used body	The candidate demonstrated confidence in communication: excellent eye contact, clear answers including evidence, strong interpersonal skills: sense of humor, articulate, answered	

		topic and did not align with question. He/she made eye contact and was easy to understand.	language to convey answers with interest.	all questions with detail.	
Habits of Work	The candidate did not reference habits of work and demonstrated a "fixed" mindset.	The candidate referenced habits of work but was inconsistent or could not provide concrete examples.	The candidate articulated examples of habits of work in answering specific questions. Any one of the following was articulated: persistence, quality work, timely work.	The candidate articulated a growth mindset through several references of Habits of Work. Two or more examples of the following were articulated: Persistence, quality work, timely work.	
Reflective Learner (Understand-ing Oneself)	The candidate does not reflect on who they are as a learner or understand personal learning profile.	The candidate reflects on personal learning and growth when required.	The candidate articulated that he/she is aware of their learning style and responds appropriately to feedback.	The candidate articulated that he/ she: Understands own learning style and uses this information to accelerate personal learning: seeks out feedback and guidance from available experts: reflects on own learning regularly and without external prompting.	
Self-Directed Learner (Improving Oneself)	The candidate articulated that, with support and guidance, he/she works toward self-improvement.	The candidate articulated that he/she works toward self-improvement independently but with limited success.	The candidate articulated that he/she is a self-directed learner and strives to continually improve.	The candidate articulated that he/she sets personal learning goals, self-monitors goals, and then meets them.	
Overall Total Score					**Total**

Meta Rubric for Admissions

Measures	Example	Application	References	Essay/video	Interview
Ocean interest	ANY/passion				
Leadership	• Captain of a team • President of a club • Team lead at work • Athletic/Team leader				
Community	• Social justice • Volunteer • Girl/Boy/Cub/Brownies Scouts • Any civic organization • Sports/Organized extra-curricular activity				
Habits of Work completion/ timeliness	• Meets deadlines • Trustworthy				
Habits of Work Preparedness	• Punctuality • Necessary materials				
	Total Score				

IV.c. Title 20-A § 8236.4. Extracurricular activities

There are many opportunities for extracurricular activities at MOS. Initial inquires and conversations have been held with the Superintendent's Office for RSU 20 regarding student participation within the sports programs of the Searsport High School. The model of the working relationship between the Maine School of Science and Mathematics (MSSM) and the Limestone High school (RSU 39) provides a precedent for this cooperation within the state of Maine. The Superintendent's office was supportive and encouraging of this relationship.

In support of this collaboration with RSU 20, MOS will also bring some offerings of its own. These sports programs will also be open to area schools. Among these are a dinghy sailing program, as part of New England Schools Sailing Associations (NESSA) program and their championship series. Presently there are several high school sailing programs operating in the down east and mid coast regions of Maine and our geographic location is ideal for hosting regattas and local events.

In addition to a competitive sailing program, there are opportunities for rowing and crew-based programs. Area rowing organizations have strong ties with high school programs in the Camden/Rockland area and there is a rowing community in Belfast which already has a strong youth program. It is also within MOS's mission to support the efforts of our future students to create the sports programs they wish to explore beyond traditional offerings.

There is a wide variety of afternoon and weekend activities on the protected waters of Stockton Harbor, Searsport Harbor, and MOS waterfront facilities. These areas are in direct support of program goals and will be offered to all students in the form of clubs or special functions. These include but are not limited to:

a. Rowing
b. Small boat sailing
c. Weekend overnight sailing trips
d. Kayaking
e. Small powerboat handling
f. Robotics and ROV
g. Boat building
h. Field research
i. Outdoor clubs

We believe strongly that access to the ocean in these programs is a great opportunity for students to apply the skills learned in more formal settings and serves to reinforce their commitment to the pursuit of their ocean-based learning and future career pathways.

IV.d. Title 20-A § 8236.5. Telecommunications

The program committee conducted some research into this area, but it has not been a large focused effort. Committee members consulted with local area schools and Maine School for Science and Mathematics (MSSM) and learned that Tandberg systems are used effectively within the state for remote learning. The school will pursue options as it is approved and moves forward with a staff. We recognize and have discussed options for formalizing relationships associated with distance learning with MSSM and the Hutchinson Center in Belfast, ME. Committee members are also active in and familiar with remote learning opportunities at the University of Maine using Polycom systems. These have some drawbacks and the University is pursuing new telecommunication systems. Multiple sources suggested the use of Google applications (e.g., Hangouts, Classroom) for connecting to multiple sites and people. Since the pace of change in this technology is rapid, the BOT expects to continually consider the many options as the field advances.

IV.e. Strategic Planning

MOS is poised to move ahead with its strategic plan and process. With the submission of this program plan, individual energy will be harnessed for the next steps in our goal of opening in fall 2018. Some of our major projected waypoints are as follows:

Spring 2017

- Continued development of year 1 and 2 budget proposals
- Create job description and hire an Executive Director
- Summer programs planning for 2017
- Continued planning and implementing of Maine Ocean Schools Foundation's (MOSF) fund raising efforts
- Continue school implementation plan
- Develop and define industry partners
- Continued development of the Board of Tustees

Summer 2017

- Deliver summer programs in support of school enrollment/recruitment
- Development of School Plan – (Executive Director with BOT support)
- Develop official partnerships
- Implement a teacher and staff hiring plan
- Align curriculum needs with facility requirements (classrooms, administration, and residential needs)

Fall 2017

- Courses & Distance Learning for prospective students begins
- Hire teachers and staff
- Student recruitment for Fall 2018 begins

Winter 2017 – Summer 2018

- Admission process begins – accepting applications for Fall 2018
- Courses & Distance Learning for prospective students continues

Summer 2018

- Summer Programs
- Gap courses for incoming students

Fall 2018

- Maine Ocean School Opens– Sophomore and junior classes

These waypoints are not all-inclusive of the goals of MOS, but are important common goals for our immediate future. We are presently working on an implementation plan align our vision of what the Maine Ocean School WILL be when we reach full enrollment to have the resources to support the incoming students. This plan will help us to meet the foreseen challenges of starting a school from the bottom up, so we can meet and grow in a manner consistent with our final goals for the school.

Regular meeting between the MOS BOT and the directors of the MOS Foundation will continue as we realize the needs and responsibilities that each side of this joint effort will lead in securing funding and resources for the school. This cooperation will be especially important as the Finance & Facilities Committee increases efforts to create and support our projected budget.

Appendix 1: Maine Ocean School Governance

Maine Ocean School
Board of Trustees Bylaws

Article I
Organization

Section 101. Membership. (20A MRSA §8234) In appointing members to the board of trustees, the Governor shall give proper consideration to achieving statewide geographical representation and gender equity. The Board of Trustees consists of 17 voting members and 2 non-voting members as follows:

A. The Commissioner of Education or the commissioner's designee;
B. The Chancellor of the University of Maine System or the chancellor's designee;
C. A member of the regional school unit board of the regional school unit in which the school is located, who must be from the community in which the school is located, or the member's designee, selected by that board;
D. One member who is a citizen of the Town of Searsport and has an active interest in education, appointed by the Governor;
E. Three members who are teachers, one of whom is a full-time teacher at the school who is a nonvoting member and is annually elected by members of the school's faculty and 2 of whom are teachers in the State representing different geographic regions of the State, appointed by the Governor. Both full-time and part-time teachers at the school may vote in the election of a faculty member to serve on the board of trustees, and the election must be by secret ballot;
F. Ten members of the general public appointed by the Governor, at least 4 of whom must be scientists, engineers or mathematicians and be employed within the marine business or industrial marine community and one of whom must be a parent of a student. All appointments under this paragraph are subject to review by the joint standing committee of the Legislature having jurisdiction over education matters and subject to confirmation by the Legislature;
G. One student member who has been elected as the presiding officer of the student body of the school. The student member is a voting member, except that the student member may not participate as a board member in executive sessions and may not vote in a public proceeding on any matter that was discussed or considered during an executive session; and
H. The executive director of the school, who serves as the clerk of the board of trustees and is a nonvoting member.

Section 102. Quorum. (20A MRSA §8234) A quorum for the transaction of business by the Board of Trustees is constituted by the attendance of 5 voting members, and all official actions of the Board of Trustees require a majority vote of those members present and voting.

Section 103. Terms. (20A MRSA §8234) The terms of the members of the Board of Trustees who are appointed by the Governor are for 4 years unless otherwise designated. The terms of the 2 teachers appointed are staggered. The terms of the 10 members of the general public are staggered. Members may be appointed for consecutive terms.

Section 104. Conflict of Interest. (20A MRSA §8234) Every Board of Trustees member, and every member of a committee established by the Board of Trustees, shall avoid conflicts of interest by disclosure or by abstention, and as otherwise prescribed by state code and Robert's rules.

Section 105. Officers. The Board of Trustees shall choose a Chair and Vice-Chair from among its members annually. The Chair and Vice-Chair shall be elected by written ballot held by the Clerk. Nominations will be accepted by the Governance Committee.

The Chair shall preside at all meetings of the Board of Trustees, shall have the right to vote on all questions, shall appoint board members to serve on and/or chair committees, may appoint and remove non-board members to committees, and shall have such other powers and duties as the Board may prescribe from time to time.

Clerk (20A MRSA §8234) The Executive Director of the School serves as the clerk of the Board of Trustees and is a nonvoting member. The clerk shall have the following authorities and responsibilities:

- have custody of the seal of the School
- attest to and affix said seal to such documents as required in the business of the school including but not limited to the following documents issued pursuant to the authority of the school:
    - deeds
    - bonds
    - mortgages
    - agreements
    - contracts
    - diplomas
    - transcripts
    - resolutions
    - certificates
    - minutes
    - bylaws
- give proper notice of all meetings of the Board of Trustees
- keep a record of the appointment of all committees, and the Board of Trustees and members of the administrative and teaching staffs
- keep a record of the minutes of all Board of Trustees and each of its committees
- elect an assistant clerk from among the staff of the school, and delegate various responsibilities of their position to the assistant clerk.

Treasurer (20A MRSA §8235) The Board of Trustees may appoint a treasurer, who need not be a member of the Board of Trustees. The Treasurer shall have the following roles and responsibilities:

- maintain custody of the funds of the Maine Ocean School (MOS)
- make payments as the Board of Trustees may authorize
- delegate any of the duties to such person(s) acting under the supervision of the Treasurer as the Board of Trustees may approve
- see that records are so made and kept as to give a full and accurate history of the financial transactions of MOS and so as to present, accurately, its financial condition
- render such periodic and other reports as the Board of Trustees may require
- have authority to endorse for transfer in the name and on behalf of MOS bonds and other securities and evidence of indebtedness standing in the name of MOS, as authorized by the Board of Trustees
- at the expense of MOS, give such bond for the faithful performance of their duties as the Board of Trustees may require.

Section 106. The Executive Director of the School. The Executive Director shall be the administrator and executive head of the School, subject to the policies, rules, and regulations of the Board of Trustees, and he/she shall be responsible for carrying out all policies, rules and regulations of the Board of Trustees. The Executive Director shall bring such matters to the attention of the Board of Trustees as are appropriate to keep the Board fully informed to meet its policymaking and regulatory responsibilities

Section 107. Committees. The following shall be the standing committees of the Board of Trustees:

- Executive Committee

- Program Committee
- Finance & Facilities Committee
- Governance Committee

The Chair of the Board of Trustees shall appoint members and committee chairs. The Board of Trustees may establish other committees and subcommittees as needed and delegate to them such responsibilities, as it deems appropriate.

Each committee is advisory to the Board and is not authorized to act on behalf of the board. All committee meetings are open to the public and have an opportunity for the public to comment. The Chair of the Board shall be a nonvoting ex-officio member of each committee of the board. The School Executive Director or a delegate may attend any committee meeting but may not vote.

An attendance of 50% or more of appointed trustee members on the committee shall constitute a quorum for conducting business as a committee. An attendance of 50% or more of appointed trustee members on any subcommittee shall constitute a quorum for conducting business as a subcommittee. Each committee and subcommittee shall keep public minutes of their work.

The charges of the Board Committees are as follows:

Finance and Facilities Committee
The Finance and Facilities Committee:
- develops an annual budget
- reviews monthly financial reports
- strives to develop a three-year budget projection
- addresses the State's appropriation, financial curtailments, and related financial issues
- sees that the Treasurer submits quarterly financial statements to the Governor, the joint standing committee of the Legislature having jurisdiction over education matters, and the joint standing committee of the Legislature having jurisdiction over appropriations and financial affairs
- shall see that a financial audit of the school is conducted by an independent auditor and accepts the audit from the auditor on behalf of the Board. The committee presents the audit to the Executive Committee, which sends it to the Board for its consideration
- oversees the appropriateness of any school grounds and facilities and makes recommendations and requests to the full Board of Trustees.

Program Committee
The Program Committee develops:
- the school year calendar
- enrollment criteria
- admissions policies
- a plan that outlines the statewide education programs provided by the school. The plan must include, but is not limited to all offerings for full-time enrolled students, offering:
    - short courses
    - workshops
    - seminars
    - weekend instructional programs
    - distance learning
    - various other programs of short duration for teachers and students.

  The plan may include other innovative programs that meet the purpose of the school and assist in the professional development of the State's marine science, technology, transportation and engineering teachers.

The Program Committee will connect the board to the core programmatic functions of the School with the support of the school's deans of Faculty and Residential Life. The committee is responsible for advising the Executive Director on major program issues and for monitoring the effectiveness in meeting program objectives.

Governance Committee
The Governance Committee maintains oversight on:

- school policies
- Board membership
- committee structure
- bylaws
- state statute
- Board meeting review
- Board member self-evaluation
- new Board member identification and orientation
- other issues concerning board operations.

The Governance Committee oversees the school's efforts to:

- raise public awareness
- identify the need for private and philanthropic funds
- recruit students through unified messaging and branding.

It encourages relationships with internal and external partners, including the MOS Foundation, to advance these goals.

Executive Committee
The Executive Committee:

- plans Board meetings, the patterns of meetings, and determines their agendas
- addresses time sensitive issues
- coordinates the work of the other committees
- is responsible for the annual review of the Executive Director.

The committee may act with the authority of the Board between Board meetings, but may not amend the bylaws. The Executive Committee shall consist of the Chair of the Board of Trustees, the Vice-Chair, the Clerk, and the Chairs of the other standing committees. The Executive Committee shall meet as called by the Chair and report all of its actions to the Board of Trustees. Minutes of the Executive Committee shall be distributed promptly after each meeting to the Board of Trustees. The Executive Committee is not authorized to make decisions on behalf of the full Board of Trustees, unless the meeting has been properly posted as a full Board of Trustees meeting.

Article II
Meetings

Section 201. Regular Meetings. (20A MRSA §8234) There shall be at least four regular meetings of the Board of Trustees each year. These meetings shall be held on a date and time determined by the Board. A notice specifying the time and place of each regular meeting of the Board shall be transmitted by the Clerk to each member of the Board, as well as posted on the MOS calendar at least seven days in advance of the regular meeting date. Any matter of business may be considered at a regular meeting of the Board.

Whenever an appointed member of the Board shall fail for any reason other than ill health, excused absence, or service in the interest of the nation or state, to be present at three successive regular meetings of the Board, the Board may recommend that the Governor deem their position vacant and appoint a replacement. In order to consider removing a member who is not subject to the Governor's appointment, the board must vote in an open

meeting. Two-thirds of the seated members present and voting must vote in favor of the action. The Chair of the Board shall be the officer who grants approval of requests for excused absences.

Members of the Board of Trustees are compensated pursuant to Title 5, section 12004-C, subsection 9.

Section 202. Special Meetings. The Chair may request, in writing to the Board members, a special meeting of the Board of Trustees and, upon the concurrence of not fewer than five voting members of the Board, the clerk shall call such a special meeting. A notice specifying the time and place of the special meeting of the Board shall be transmitted by the clerk to each member of the Board at least seven days in advance of the meeting date. If, in the opinion of the Chair, an expedited meeting is necessary, then three days' notice by telephone, or other electronic means is required to notify the board and the public. Any matter of business may be considered at a special meeting of the Board.

In the case of special meetings, the notice shall state the purpose of the meeting, and no business shall be transacted at such meeting that does not relate to the purpose stated.

Section 203. Conduct of Business. (20A MRSA §8234) A quorum for the transaction of business is constituted by the attendance of five Board Members and all official actions of the Board require a majority vote of those members present and voting. If at any time there are two concurrent meetings that hold a quorum the meeting with the highest ranking officer (Chair or Vice-Chair) shall be the official board meeting.

The Chair shall preside over all regular and special meetings of the Board of Trustees, except that, in the absence of the Chair, the Vice-Chair shall preside. In the absence of both the Chair and Vice-Chair a presiding officer shall be elected by a majority from the membership of the Board of Trustees in attendance.

All voting members of the Board of Trustees may vote on all matters coming before the Board for consideration. The student member may not vote in a public proceeding on any matter that was discussed or considered during an executive session. No member may vote by proxy.

Any member may participate, in any meeting by visual and/or audio teleconferencing provided the equipment used permits the distance member to hear all discussions, and to be heard by everyone present including members present by teleconference from other locations. Any meeting at which part of the members participate by teleconference, or other technological means, shall be subject to state law concerning public access to such meetings and applicable "Right to Know" law. Participation in a meeting by visual and/or teleconferencing does not constitute an official presence for purposes of a quorum, and a vote on any matter of business cannot be accepted via teleconference.

Except as modified by specific rules and regulations adopted by the Board of Trustees, the most recently revised edition of Robert's Rule of Order shall constitute the rules of the parliamentary procedure applicable to all meetings of the Board of Trustees.

Section 204. Open and Executive Session. All meetings of the Board and its committees shall be open to the public; however, the Board reserves the right to convene in executive session on a majority vote of the members present and voting for a designated purpose. The student member may not participate as a board member in executive sessions and may not vote in a public proceeding on any matter that was discussed or considered during an executive session. Nothing in this section shall be used to defeat the "Right to Know" law.

Section 205. Honorary Trustee. The Board of Trustees may from time to time honor a retiring trustee or other citizen who has provided exceptionally distinguished service with the title of Honorary Trustee. Nominations for the title of honorary trustee will be brought to the Board for its approval by the Governance committee. The committee will consider such criteria as length of service on the board and/or service which is particularly significant in promoting the well-being of the School.

An Honorary Trustee may attend all regular board meetings, but may not vote on any motion or other actions and shall not be counted for quorum purposes. An Honorary Trustee may not attend executive sessions unless invited

because of some particular experience or expertise pertinent to the matters to be discussed in the executive session.

There are no fixed terms nor any attendance requirements nor any entitlement to compensation or reimbursement for expenses for Honorary Trustees.

Article III
Powers and Duties

Section 301. General Powers and Duties. (20A MRSA §8235) The Board of Trustees shall have the power to manage the property and business of the School and shall have the power to carry out any other functions which are permitted or required in Title 20A, section 8235, or the provisions of these bylaws not inconsistent therewith.

Specific power and duties outlined in Title 20A, section 8235 includes the following and are assigned to the following committees:

A. *Policies.* To develop and adopt policies and rules, including bylaws, necessary for the operation of the school. This responsibility will be under the purview of the Governance Committee.
B. *Administration.* To oversee the administration of the school, including the hiring of teachers and administrative support staff. This responsibility will be under the purview of the Executive Committee and full board.
C. *Financial Management.* To appoint a treasurer, who need not be a member of the board of trustees, and to accept donations, bequests or other forms of financial assistance for any educational purpose from a public or private person or agency and to comply with rules and regulations governing grants from the Federal Government or from any other person or agency. This responsibility will be under the purview of the Finance and Facilities Committee.
D. *Budget Development.* To prepare and adopt an annual budget for the operation of the school and to exercise budgetary responsibility and allocate for expenditure by the school and programs under its jurisdiction all the resources available for the operation of the school and its programs. This responsibility will be under the purview of the Finance and Facilities Committee.
E. *Indemnification*. To indemnify the trustees, officers, teaching staff and employees affiliated with the school and to purchase and maintain insurance to indemnify any such person to the extent provided in Title 13-B, section 714. This responsibility will be under the purview of the Executive Committee.
F. *Bonds.* To require security for the faithful performance of duties by the officers, trustees, employees and other agents of the school who are entrusted with the custody of the school securities or authorized to disburse the funds of the school. The security must consist of a bond, either a blanket bond or individual bond with a surety bond, or bonds having a minimum limitation of $100,000 coverage for each insured person. The expense of a bond is assumed by the school. This responsibility will be under the purview of the Finance and Facilities Committee.
G. *Property Management*. To lease and to acquire by purchase any property, lands, buildings, structures, facilities or equipment and make improvements to facilities necessary to fulfill the purposes of this chapter. Any lease or lease-purchase agreement must have a term not to exceed 10 years and must be subject to annual appropriation of funds. The regional school unit that includes the Town of Searsport retains ownership of the Searsport High School and shares those facilities with the school. This responsibility will be under the purview of the Finance and Facilities Committee.
H. *Certificates and Diplomas.* To offer courses of study and grant diplomas and certificates on completion of courses of study. This may be done in cooperation with the sending school. This responsibility will be under the purview of the Program Committee.
I. *Contracts and Agreements.* To enter into any contracts and agreements, to the extent that funds are available, in the execution of its powers under Title 20A section 8235. This responsibility will be under the purview of the Executive Committee and full board.

J. *Delegation*. To delegate duties and responsibilities as necessary for the efficient operation of Title 20A, section 8235. This responsibility will be under the purview of the Executive Committee to take action, and be ratified by the Board.
K. *Criteria for Enrollment.* To establish criteria to be used in determining eligibility of applicants for enrollment. The criteria must include methods of ensuring gender equity in student selection. This responsibility will be under the purview of the Program Committee.
L. *Student Conduct.* To prepare and adopt procedures, rules, and regulations to ensure the smooth operation of student conduct standards. This responsibility will be under the purview of the Program Committee.
M. *Geographical Basis.* To develop and adopt an admissions policy to ensure that students from all over the state have an equal opportunity to attend the school. This responsibility will be under the purview of the Program Committee.
N. *Fees and Charges*. To establish and collect necessary fees and to set policies relating to other appropriate charges for students. To establish and collect necessary fees is the responsibility of the Finance and Facilities Committee. To set policies relating to other appropriate charges for students is the responsibility of the Governance Committee.
O. *Benchmarks and Assessments.* To establish benchmarks and methods of assessing progress in the levels of academic achievement in marine science, technology, transportation and engineering for students who participate in school programs and to establish benchmarks and methods of assessing progress in the professional development of teachers who participate in school programs. This responsibility will be under the purview of the Program Committee.
P. *Reports.* To report annually to the Governor, the joint standing committee of the Legislature having jurisdiction over education matters and the joint standing committee of the Legislature having jurisdiction over appropriations and financial affairs on the results of the assessment in subsection 15 and the general status of the school and to provide a financial audit of the school conducted by an independent auditor. The Executive Director will be responsible for submitting these reports.
Q. *Quarterly financial statements.* To submit quarterly financial statements to the Governor, the joint standing committee of the Legislature having jurisdiction over education matters and the joint standing committee of the Legislature having jurisdiction over appropriations and financial affairs. This responsibility will be under the purview of the Finance and Facilities Committee. To assist in this responsibility the Executive Director will submit monthly financial reports to the Finance and Facilities Committee.
R. *Sue or be sued.* To sue or be sued in the name of the school. This responsibility falls under the purview of the Executive Committee and the full board.
S. *Other.* To do any other act necessary or useful for carrying out its powers, duties or purposes. This responsibility falls under the purview of the Executive Committee to be ratified by the full Board.

Section 302. Powers and Duties of the Executive Director of the School. The Executive Director shall have the power, on behalf of the Board of Trustees, to perform all acts and execute all documents to make effective the actions of the Board or its Executive Committee. The Executive Director, on behalf of the Board of Trustees, will have the authority to hire, evaluate and dismiss the staff of the Maine Ocean School.

Article IV
Discrimination

In administering its affairs, the School shall not discriminate against any person on the basis of race, creed, color, national or ethnic origin, sex, sexual orientation, age, or disability.

Article V
Amendment of Bylaws

These bylaws may be amended at any regular or special meeting of the Board of Trustees by an affirmative vote of two-thirds of the membership in attendance, provided notice of the substance of the proposed amendment is sent to all trustees seven days prior to the meeting at which the amendment is to be voted upon.

Date Adopted: October 1, 2016

MOS Board of Trustees

Appendix 2: Maine Ocean School Skills and Careers

Skills offered by MOS and the ocean-related careers that use them

For science careers, job opportunities for High School students include, but are not limited to: animal care and lab assistant, marine educator, aquaculture or aquarium technician, environmental tourism director, fisherman, fisheries observer. For those choosing a higher degree, community college would provide opportunities as a lab or research technician and university would open doors to science and technical writing, bioinformatics, research associate, regulatory affairs, and environmental health and safety (http://www.mapyourcareer.org/pdf/MYC-2013-Life.pdf).

In a maritime career, building a career starts with working on the water (something you will do plenty of at MOS). However, there are land-based maritime careers as well (see our marine management track!). There are opportunities at MOS for maritime training that could result in an entry-level job or apprenticeship. From there, you would move up based on your experience and, for sea-based jobs, hours logged out on the water. Example of these careers can be found here: http://www.mapyourcareer.org/maritime/career-path.html

In a marine engineering career, job opportunities for High School students include operation, maintenance, or construction of vessels and vessel propulsion and support systems. These include entry level jobs or apprenticeships. This program also prepares students for further education in ocean-related engineering either at sea or in shore-based support facilities. http://www.mapyourcareer.org/pdf/myc-2013-maritime.pdf

Below are some of the skills you would acquire in our marine tracks SOME of the career opportunities they would offer:

Track	Skills	Applicable Careers
MOS requirement	Effective oral and written communication	Most/all
	Entering data into a database using computers, e.g., MS Excel, MS Access	Most
Marine Science	Basic water quality assessments, tank maintenance, preliminary plumbing	Entry-level aquaculture technician; Aquarium technician; Entry level field technician for state, federal, NGO
	Organism identification, basic microscope	Entry level field technician for state,

	work, data literacy	federal, NGO
	Organism identification, familiarity with the water and interactions of trophic levels	Entry level fisherman/sternman, lobstering
	Collecting scientific information while onboard a vessel	Entry level fisherman/sternman, lobstering;
	Deployment and recovery of oceanographic equipment	Research vessel crew member; Other at sea labs
	Participation in ocean fishing activities; Observing ocean fishing activities; Participation in fishery research cruises; Recording data on marine mammal sightings and fishing activities; Tallying incidental take of marine mammals, sea turtles, and seabirds from fishing platforms; Collecting biological samples and specimens from postmortem animals;	Fisheries observer Fisheries research technician
	Communication skills, knowledge of biodiversity and marine environmental policies	Tourism: Guide/ranger (e.g., whale watching, offshore fishing guide) Environmental Outreach Coordinator
	Application of the scientific method, experimental design, reading primary literature, data literacy, group discussion	Undergraduate marine science major
	Familiarity with computer software (MS Excel, MS Word, MS PowerPoint, MS Access, R, Matlab)	All marine science careers listed above
	Database management and computer programming	Government job (NOAA, USGS); private industry/consulting (Stantec);
	Mapping	Marine/coastal GIS and planning
Marine Transport-ation	**Skills**	**Applicable Careers**
	AB certification, watchkeeping training, logbook keeping, weather reporting, line handling	Ordinary Seaman/ Able Bodied Seaman

	Navigational skills, ship handling, logbook keeping, communication skills, line handling	Third Mate/Second Mate/Chief Mate/Captain
	Ship design and construction	Shipbuilder/ Naval Architect
	Marine and International communications skills	Radio Operator/ Port Communications
	Weather reporting, logbook keeping, storm tracking and analysis	Meteorologist; Lobsterman
	Collecting scientific information while onboard a vessel	Lobsterman
	Navigation, ship handling,	Ferry Operator
	Navigation, ship handling, weather reporting, communications, watchkeeping, logbook keeping, ship design and construction, navigational rules, emergency procedures and communications	Undergraduate marine transportation major; Tall ships/ small vessel operations
Marine Engineering	Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process; Stand watch	Deck Engineer; Marine Engineer; Naval Architect; Marine Architect Small boat operations and maintenance
	Knowledge of ships systems and components; the tools used to operate and maintain them; engineering watchstanding practices; report writing and presentation skills;	Engine/equipment operator; Welder; Ship Fitter; Rigger; Plumber; Machinist; Electrician; Mechanic; Hull Technician Small boat operation and maintenance Marine Engineer; Naval Architect; Marine Architect
	Knowledge of research vessel support systems; the tools used to operate and maintain them; some skills needed to fabricate unique research devices	Metal/composite fabricator; equipment operator; machinist; Electrician; Mechanic Marine/System Engineer
Marine Manage-ment	Communication Skills; knowledge of work planning tools; Cost estimating; Knowledge of waterfront activities and personnel;	Order Clerk; Shipping and receiving clerk; truck and ship loaders; Port security Officer; Longshoreman; Warehouse worker

	Planning and Scheduling tool usage; Knowledge of personnel management laws and regulations; knowledge of the skills and knowledge needed to support port and shipyard functions; knowledge of small craft construction	Shipyard Planner/Scheduler; Marina operator; Lobsterman/Fisherman; Ocean product marketer; Fish Hatchery operator/technician; Ship Agent; Freight forwarder
	Familiarity with ocean related scientific activities; report writing; Communications skills; Team Building; knowledge of marine research and ship related terminology	Ship scheduler; Purser; Science project support administrator;

Appendix 3: Potential Partners in Maine

Maine-based partners for projects & post-secondary opportunities

Following is a list of Maine-based organizations with aligned interests to Maine Ocean School. Some have been involved in program development (starred bullets ☆), showing some commitment to the school's success and an indication of future partnership opportunities. Others are identified as partners that are in the state, but have yet to be engaged.

Marine Science Track

- ☆ University of Maine:
    - School of Marine Sciences faculty - Orono, Darling Marine Center
    - Sea Grant, Aquaculture Research Institute and the NSF EPSCoR SEANET program
- ☆ Maine Maritime Academy, Ocean Studies faculty
- ☆ Ecology of Penobscot Bay on Sears Island: Friends of Sears Island
- ☆ Fisheries:
    - Maine Lobstermen's Association - Leadership Institute
    - Penobscot East Resource Center - Eastern Maine Skippers Program
- ☆ Allied Whale/College of the Atlantic - build a mentorship program
- Pathways to Science opportunities for HS students
- Mount Desert Island Biological Laboratory HS programs
- Jackson Laboratory HS Summer program
- American Fisheries Society - Hutton Junior Fisheries Biology Program
- Aquaculture: Maine Aquaculture Association
- Marine Mammal surveys and oceanographic surveys: Frenchman Bay Research Boating
- Marine Mammal conservation & data analysis: Marine Mammals of Maine
- Hurricane Island - science education, applied research, and leadership development

Marine Transportation Track

- ☆ Sailing: Stockton Harbor Sailing Center
- ☆ Training and Licensing: Downeast Maritime Inc
- ☆ Ship simulator: Maine Maritime Academy - Discovery Voyage Program
- ☆ Ship repair: Front Street Shipyard

- Shipping: EIMSKIP
- Boat building: Belmont Boatworks
- Boat building: French & Webb
- Pilot, tug assist & chain of command: Penobscot Bay Tractor Tug Company

Marine Engineering Track

- ☆ Maine Maritime Academy
- ☆ Renewable Energy - Ocean Renewable Power Company
- ☆ University of Maine,
    - School of Engineering faculty - in Orono
    - Foster Center for Student Innovation
- Billings Diesel and Marine, Stonington
- Cummins Northeast (they are in scarborough though)

Marine Management Track

- Marine Supply: Hamilton Marine, Searsport
- Port management: Maine Port Authority, Searsport, Eastport, Portland
- Port management: Front Street Shipyard

Appendix 4a: Example Course Descriptions for CORE Sequences

The following are examples of detailed course descriptions that have been prepared and vetted by several Program Committee volunteers with expertise and interest in each content area (recognized in Tables 1-3, pages 9-11). Detailed course descriptions such as these have not yet been finalized for every course offering listed in all sequences, but we submit these 23 examples for your review at this time. All course descriptions are subject to modification upon hiring of MOS faculty and staff, but are included here to represent the intention for course implementation in the classroom.

English Language Arts Sequence

English 9: Ecology and Environment

Course Description: Readings focus on the ocean itself—its ecology, its lifeforms, its temperament—as well as humanity's complicated relationship with a part of the Earth that can inspire, confuse, devastate, or soothe. Students will master the basic forms and tools of prose essay writing, and will analyze literary and critical texts through a number of different methods, focusing on the building blocks of clear, strong arguments.

Prerequisites: Middle School English

Skills: Communication, research, commerce, engineering, command, leadership, management

Topics Covered:

Mechanics and Grammar
Building Blocks of Essay Writing
Literary Analysis
Critical Reading
Oral Communication

Details:

Mechanics and Grammar

- Parts of speech
- Punctuation for nuance and clarity

- Sentence structure and syntax
- Vocabulary acquisition and usage

Building Blocks of Essay Writing

- Argument and informational essay structure
- Strong introductions (including thesis statements)
- Topic development
- Strong conclusions
- Style and tone
- Writing process

Literary Analysis

- How story elements interact
- Analyzing plot structures
- Identifying and analyzing themes
- Understanding context

Critical Reading of Informational Text

- Determining central ideas
- Identifying supporting textual evidence
- Mapping argument structures
- Identifying erroneous, fallacious, or misleading arguments
- Recognizing persuasive rhetoric
- Identify and analyze historical and cultural significance

Oral Communication

- Collaborative discussion
- Oral presentation skills
- Speaker evaluation

Literature and Environment

- The complex relationship between civilization and nature
- Human dependence on the ocean
- Human impact on the ocean and maritime environments
- Non-human points of view

Literature and Environment

Students will demonstrate mastery of literary comprehension and analysis skills through:

1. Collaborative discussion (one on one, small groups, and class)
2. Narrative, Information, and Argumentative Writing
3. Presentations

Text Resources:

1. Bishop, Elizabeth, *Poems*
2. Benchley, Peter, *Jaws*
3. Junger, Sebastian, *The Perfect Storm*
4. Martell, Yann, *Life of Pi*
5. Masefield, John, *Salt-Water Poems and Ballads*
6. Scheffer, Victor, *The Year of the Whale*
7. Whitty, Julia, *Deep Blue Home*
8. Various songs & shanties pertaining to the year's theme

Common Core Standards:

Mechanics and Grammar

1. CCSS ELA Literacy 9-10.1
2. CCSS ELA Literacy 9-10.2
3. CCSS ELA Literacy 9-10.3
4. CCSS ELA Literacy 9-10.4
5. CCSS ELA Literacy 9-10.5

Building Blocks of Essay Writing

1. (Argument) CCSS.ELA-LITERACY.W.9-10.1 (Informational) CCSS.ELA-LITERACY.W.9-10.2
2. (Argument) CCSS.ELA-LITERACY.W.9-10.1.A (Informational) CCSS.ELA-LITERACY.W.9-10.2.A
3. (Argument) CCSS.ELA-LITERACY.W.9-10.1.B (Informational) CCSS.ELA-LITERACY.W.9-10.2.B
4. (Argument) CCSS.ELA-LITERACY.W.9-10.1.E (Informational) CCSS.ELA-LITERACY.W.9-10.2.F
5. CCSS.ELA-LITERACY.W.9-10.1.D
6. CCSS.ELA-LITERACY.W.9-10.5

Literary Analysis

1. CCSS.ELA-LITERACY.RL.9-10.3
2. CCSS.ELA-LITERACY.RL.9-10.5
3. CCSS.ELA-LITERACY.RL.9-10.2
4. CCSS.ELA-LITERACY.RL.9-10.6

Critical Reading

1. CCSS.ELA-LITERACY.RI.9-10.2

2. CCSS.ELA-LITERACY.RI.9-10.1
3. CCSS.ELA-LITERACY.RI.9-10.5
4. CCSS.ELA-LITERACY.RI.9-10.8
5. CCSS.ELA-LITERACY.RI.9-10.6
6. CCSS.ELA-LITERACY.RI.9-10.9

Oral Communication

1. CCSS.ELA-LITERACY.SL.9-10.1
2. CCSS.ELA-LITERACY.SL.9-10.4
3. CCSS.ELA-LITERACY.SL.9-10.3

Examples of how Maine Guiding Principles will be met:

- **A. A Clear and Effective Communicator:** Learns writing skills necessary to communicate clearly, succinctly, and unambiguously
- **B. A Self-Directed and Lifelong Learner:** Uses modern and historical texts to understand that new and unforeseen problems and challenges will emerge in decades to come
- **C. A Creative and Practical Problem Solver:** Understands many of the problems facing authors and characters, and can imagine and articulate multiple solutions
- **D. A Responsible and Involved Citizen:** Recognizes the complex relationship between humans and the environment, and understands the importance of environmental stewardship
- **E. An Integrative and Informed Thinker:** Forgers connections between English and other disciplines such as Science and Social Studies; uses real-world facts to better understand works of literature

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English 10: Trade, Exploration, and Cultural Diffusion

Course Description: Pairing with a World History curriculum, readings focus on the many ways in which the ocean and navigation have made the world a smaller place, for better and for worse. The course explores the literature of global commerce, exploration, colonialism, and war. Students will practice more advanced forms of writing while also analyzing more complex arguments and engaging with literary texts on a deeper level.
Prerequisites: One year of high school English

Skills/careers: Communication, research, commerce, engineering, command, management

Topics Covered:

Literature and Global Culture
Advanced Mechanics and Grammar
Composition Across Forms
Advanced Literary Analysis
Comparison of Texts
Oral Communication

Details and Standards:

Advanced Mechanics and Grammar

- Varying sentence structure for clarity and effect
- Advanced use of dependent clauses for brevity
- Tone, voice, and style
- Vocabulary Acquisition and Usage

Composition Across Forms

- Argument essays
- Personal essays
- Essays that compare works of literature to the real world

Advanced Literary Analysis

- Character and history
- Thematic ambiguity
- Nonlinear plots and non-standard literary forms

Comparison of Texts

- Allusion
- Texts as responses to other texts
- Reimagining common themes across texts

Oral Communication

- Collaborative discussion
- Oral presentation skills
- Use of digital media
- Speech adaptation

Literature and Global Culture

- Literary representations of international trade, historical and modern
- Literary representations of exploration, and literary works by explorers
- Cultural mixing as a result of trade, exploration, and colonization

Literature and Global Culture

Students will demonstrate mastery of literary comprehension and analysis skills through:

1. Collaborative discussion (one on one, small groups, and class)
2. Narrative, Informational, Argumentative, and Creative Writing
3. Presentations

Text Resources:

1. Brown, Eli, *Cinnamon and Gunpowder*
2. Dana, Richard Henry, *Two Years Before the Mast*
3. Homer, *The Odyssey*
4. Melville, Herman, *Benito Cereno*
5. O'Brien, Patrick, *Master and Commander*
6. Rhys, Jean, *Wide Sargasso Sea*
7. Walcott, Derek, *Poems*
8. Songs & shanties pertaining to the year's theme

Standards:

1. http://www.corestandards.org/ELA-Literacy/RL/9-10/6/
2. http://www.corestandards.org/ELA-Literacy/RI/9-10/9/

Advanced Mechanics and Grammar

1. http://www.corestandards.org/ELA-Literacy/L/9-10/3/
2. http://www.corestandards.org/ELA-Literacy/L/9-10/1/b/
3. http://www.corestandards.org/ELA-Literacy/W/9-10/2/e/
4. http://www.corestandards.org/ELA-Literacy/L/9-10/2/
5. http://www.corestandards.org/ELA-Literacy/L/9-10/4/

Composition Across Forms

1. http://www.corestandards.org/ELA-Literacy/W/9-10/1/
2. http://www.corestandards.org/ELA-Literacy/W/9-10/3/
3. http://www.corestandards.org/ELA-Literacy/W/9-10/2/
4. http://www.corestandards.org/ELA-Literacy/RL/9-10/6/

Advanced Literary Analysis

1. http://www.corestandards.org/ELA-Literacy/RL/9-10/3/
2. http://www.corestandards.org/ELA-Literacy/RL/9-10/2/
3. http://www.corestandards.org/ELA-Literacy/RL/9-10/5/

Comparison of Texts

1. http://www.corestandards.org/ELA-Literacy/L/9-10/5/
2. http://www.corestandards.org/ELA-Literacy/RL/9-10/6/
3. http://www.corestandards.org/ELA-Literacy/RL/9-10/9/

4. http://www.corestandards.org/ELA-Literacy/RL/9-10/7/
5. http://www.corestandards.org/ELA-Literacy/RI/9-10/7/

Oral Communication

1. http://www.corestandards.org/ELA-Literacy/SL/9-10/1/
2. http://www.corestandards.org/ELA-Literacy/SL/9-10/4/
3. http://www.corestandards.org/ELA-Literacy/SL/9-10/6/
4. http://www.corestandards.org/ELA-Literacy/SL/9-10/5/

Examples of how Maine Guiding Principles will be met:

- **A. A Clear and Effective Communicator:** Writes with a clear, confident voice, and defends positions and opinions with clear and convincing evidence
- **B. A Self-Directed and Lifelong Learner:** Independently explores the global historical forces to which works of literature respond
- **C. A Creative and Practical Problem Solver:** Analyzes and articulates actions that could have altered historical events on a global scale
- **D. A Responsible and Involved Citizen:** Applies lessons learned from literary texts to contemporary global situations in the real world
- **E. An Integrative and Informed Thinker:** Compares literary works to themes from history and Social Studies, and understands connections between past and present as well as between disparate parts of the globe

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English 11: Commerce, Community, and Local Culture

Course Description: Readings explore the effect that the sea and seafaring has on local cultures and communities, including cities, towns, islands, and ships. Topics include maritime commerce, seafaring and the family, power, hierarchy, and authority. Students will deepen their writing skills by engaging with a number of new essay forms, as well as undertaking research projects that bring to life connections between literature and real communities.
Prerequisites: Two years of high school English

Skills/careers: Communication, research, commerce, engineering, command, leadership, management

Topics Covered:

Literature and Community
Advanced Formal Writing
Advanced Literary Analysis
Advanced Critical Reading
Historical and Contemporary Research

Details:

Literature and Community

- Local commerce as literary motive
- Literary representations of small communities
- Regional literature, “local color,” and setting-as-character

Advanced Formal Writing

- Constructing and defending complex thesis statements
- Mixed essay forms (e.g., personal/persuasive, journalistic/argumentative)
- Literary imitation

Advanced Literary Analysis

- Complexly motivated characters
- Ambiguous symbols, metaphors, and irony
- Experimental literary forms

Advanced Critical Reading

- Identifying and outlining complex arguments
- Identifying advanced rhetorical strategies
- Constructing contrary responses to critical arguments

Oral Communication

- Collaborative discussion
- Oral presentation skills
- Speaker evaluation

Historical and Contemporary Research

- Local literary culture and tradition
- Using archives and libraries for independent research
- Understanding an author's social and historical motives

Literature and Community

Students will demonstrate mastery of literary comprehension and analysis skills through:

1. Collaborative discussion (one on one, small groups, and class)
2. Narrative, Informational, Argumentative, and Creative Writing
3. Presentations
4. Community-based literary/historical research projects

Text Resources:

1. Clampitt, Amy, *Poems*
2. Conrad, Joseph, *The Secret Sharer*
3. Jewett, Sarah Orne, *The White Heron* and other stories
4. Linda Greenlaw, *The Hungry Ocean*
5. Melville, Herman, *Billy Budd*
6. O'Neill, Eugene, *Anna Christie*
7. Shakespeare, William, *The Merchant of Venice*
8. Songs & shanties pertaining to the year's theme

Common Core Standards:

Literature and Community

1. CCSS.ELA-LITERACY.RL.11-12.2
2. CCSS.ELA-LITERACY.RL.11-12.3
3. CCSS.ELA-LITERACY.W.11-12.1

Advanced Formal Writing

1. CCSS.ELA-LITERACY.RL.11-12.1 / CCSS.ELA-LITERACY.RI.11-12.1
2. CCSS.ELA-LITERACY.W.11-12.1
3. CCSS.ELA-LITERACY.W.11-12.5
4. CCSS.ELA-LITERACY.W.11-12.4
5. CCSS.ELA-LITERACY.W.11-12.3

6. CCSS.ELA-LITERACY.W.11-12.10

Advanced Literary Analysis

1. CCSS.ELA-LITERACY.RL.11-12.9
2. CCSS.ELA-LITERACY.RL.11-12.7
3. CCSS.ELA-LITERACY.RL.11-12.10 / CCSS.ELA-LITERACY.RI.11-12.10
4. CCSS.ELA-LITERACY.RL.11-12.5
5. CCSS.ELA-LITERACY.RL.11-12.6
6. CCSS.ELA-LITERACY.RL.11-12.4
7. CCSS.ELA-LITERACY.W.11-12.2

Advanced Critical Reading

1. CCSS.ELA-LITERACY.RI.11-12.2
2. CCSS.ELA-LITERACY.RI.11-12.3
3. CCSS.ELA-LITERACY.RI.11-12.4
4. CCSS.ELA-LITERACY.RI.11-12.5
5. CCSS.ELA-LITERACY.RI.11-12.6

Oral Communication

1. CCSS.ELA-LITERACY.SL.11-12.1
2. CCSS.ELA-LITERACY.SL.11-12.4
3. CCSS.ELA-LITERACY.SL.11-12.5
4. CCSS.ELA-LITERACY.SL.11-12.6

Historical and Contemporary Research

1. CCSS.ELA-LITERACY.W.11-12.7
2. CCSS.ELA-LITERACY.RI.11-12.7
3. CCSS.ELA-LITERACY.RI.11-12.8
4. CCSS.ELA-LITERACY.RI.11-12.9
5. CCSS.ELA-LITERACY.W.11-12.10
6. CCSS.ELA-LITERACY.W.11-12.9
7. CCSS.ELA-LITERACY.W.11-12.8
8. CCSS.ELA-LITERACY.W.11-12.6
9. CCSS.ELA-LITERACY.W.11-12.3
10. CCSS.ELA-LITERACY.SL.11-12.5

Examples of how Maine Guiding Principles will be met:

- **A. A Clear and Effective Communicator:** Argues positions with confidence and clarity, whether writing about works of literature or about local events within contemporary communities

- **B. A Self-Directed and Lifelong Learner:** Researches and understands complex local systems in the real world, while using literary texts as points of reference and comparison
- **C. A Creative and Practical Problem Solver:** Imagines and articulates real-world solutions to problems facing small communities, informed by readings
- **D. A Responsible and Involved Citizen:** Identifies complex issues of commerce and community in the local area
- **E. An Integrative and Informed Thinker:** Draws broad and specific connections between local communities of past time periods and the challenges facing human communities in the more globalized present era

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English 12: Philosophy and the Sea

Course Description: Readings challenge students to explore complicated questions of philosophy, ethics, morality, and humanity's place in the world—and the watery parts of the world in particular. Topics and themes include ambiguity, redemption, obsession, and the unconscious. Students will construct nuanced arguments and engage with complex literary forms that change throughout history. Students will also engage with formal logic and rhetoric.
Prerequisites: Three years of high school English

Skills/careers: Communication, research, commerce, engineering, command, leadership, management

Topics Covered:

Literature and Philosophy
Advanced Argumentative Writing
Advanced Comparative Literary Analysis
Critical Reading as Conversation
Interdisciplinary Textual Thinking

Details:

Literature and Philosophy

- Morality and moral ambiguity in literature
- Heroes and antiheroes
- Human rights and human prerogatives
- Representations of the irrational and the unconscious

Advanced Argumentative Writing

- Formal logic in expository prose
- Combining literary evidence with factual/historical evidence to defend complex claims
- Hands-on use of advanced rhetorical strategies for persuasion

Overview of Technical Writing

- Conventions of technical writing in several disciplines
- Log entries, technical reports, memoranda
- Concise communication through precise terms

Advanced Comparative Literary Analysis

- Comparing character types in different contexts, settings, and forms

- Understanding how historical context changes literary possibilities
- Understanding how literary form can alter meaning

Critical Reading as Conversation

- Forms and uses of literary criticism
- Understanding and outlining arguments about arguments
- Recognizing assumptions about the intended audience of a critical essay

Interdisciplinary Textual Thinking

- Literary ethics and modern science
- Literary ethics and modern industry
- Literary ethics and contemporary history

Literature and Philosophy

Students will demonstrate mastery of literary comprehension and analysis skills through:

1. Collaborative discussion (one on one, small groups, and class)
2. Narrative, Informational, Argumentative, and Creative Writing
3. Presentations
4. Interdisciplinary project-based work

Text Resources:

1. Coleridge, Samuel Taylor, "The Rime of the Ancient Mariner"
2. Conrad, Joseph, *Lord Jim*
3. Lowell, Robert, "The Quaker Graveyard in Nantucket"
4. Melville, Herman, *Moby Dick*
5. Shakespeare, William, *The Tempest*
6. Songs & shanties pertaining to the year's theme

Common Core Standards:

Advanced Argumentative Writing

1. CCSS.ELA-LITERACY.RL.11-12.1 / CCSS.ELA-LITERACY.RI.11-12.1
2. CCSS.ELA-LITERACY.W.11-12.1
3. CCSS.ELA-LITERACY.W.11-12.5
4. CCSS.ELA-LITERACY.W.11-12.4
5. CCSS.ELA-LITERACY.W.11-12.3
6. CCSS.ELA-LITERACY.W.11-12.10

Advanced Comparative Literary Analysis

1. CCSS.ELA-LITERACY.RL.11-12.9
2. CCSS.ELA-LITERACY.RL.11-12.7
3. CCSS.ELA-LITERACY.RL.11-12.10 / CCSS.ELA-LITERACY.RI.11-12.10

4. CCSS.ELA-LITERACY.RL.11-12.5
5. CCSS.ELA-LITERACY.RL.11-12.6
6. CCSS.ELA-LITERACY.RL.11-12.4
7. CCSS.ELA-LITERACY.W.11-12.2

Critical Reading as Conversation

1. CCSS.ELA-LITERACY.RI.11-12.2
2. CCSS.ELA-LITERACY.RI.11-12.3
3. CCSS.ELA-LITERACY.RI.11-12.4
4. CCSS.ELA-LITERACY.RI.11-12.5
5. CCSS.ELA-LITERACY.RI.11-12.6

Oral Communication

1. CCSS.ELA-LITERACY.SL.11-12.1
2. CCSS.ELA-LITERACY.SL.11-12.4
3. CCSS.ELA-LITERACY.SL.11-12.5
4. CCSS.ELA-LITERACY.SL.11-12.6

Interdisciplinary Textual Thinking

1. CCSS.ELA-LITERACY.W.11-12.7
2. CCSS.ELA-LITERACY.RI.11-12.7
3. CCSS.ELA-LITERACY.RI.11-12.8
4. CCSS.ELA-LITERACY.RI.11-12.9
5. CCSS.ELA-LITERACY.W.11-12.10
6. CCSS.ELA-LITERACY.W.11-12.9
7. CCSS.ELA-LITERACY.W.11-12.8
8. CCSS.ELA-LITERACY.W.11-12.6
9. CCSS.ELA-LITERACY.W.11-12.3
10. CCSS.ELA-LITERACY.SL.11-12.5

Examples of how Maine Guiding Principles will be met:

- **A. A Clear and Effective Communicator:** Tackles large questions of ethics, morality, and philosophy with clarity, specificity, and convincing arguments
- **B. A Self-Directed and Lifelong Learner:** Imagines and articulates ethical dilemmas that may exist in future career paths
- **C. A Creative and Practical Problem Solver:** Analyzes the actions of characters in literary texts, and understands the far-reaching consequences of those actions
- **D. A Responsible and Involved Citizen:** Identifies ethical quandaries within contemporary industries, and can articulate multiple perspectives on a given issue
- **E. An Integrative and Informed Thinker:** Finds and understands connections between abstract questions raised by texts and similar questions in the real world

PE: Health & Safety Sequence

Grade 10: Ocean Survival I

Course Description: This course is first in the Ocean Survival series that provide students with basic skills ocean survival. This course will provide instruction on ocean survival while including team work, leadership, and use of flotation, use of survival craft and physical and emotional well-being of the student.

Prerequisites: Basic Swimming

Topics:

Marine Environment
Emergency Drills
Types of Survival Craft
Survival Suits
Mental and Physical Complications of Survival
Personal Survival Kits
Life Rafts
Survival in Raft
Rescue and landfall

Details:

Marine Environment

- Cold water vs. warm water
- How weather affects emergencies

Emergency Drills

- Emergency Signals
- Importance of muster and knowing job
- Flow of emergency drills

Types of Survival Craft

- Life Rafts
- Life Boats
- Life Floats

Survival Suits

- Basic Construction/components
- Donning/Doffing
- Limitations

Mental and Physical Complications of Survival

- 10 Commandments of Survival
- 1-10-1 Principle
- Understanding cold water submersion

Personal Survival Kits

- Contents and size
- Why they are important

Life Rafts

- Parts
- Automatic Deployment
- Manual Deployment
- Righting the Raft
- Boarding the Raft Survival in the Raft
- Sea Anchors

Survival in Raft

- How to get water
- Inventory of supplies
- Signaling
- Food
- Team working under stress

Rescue and landfall

- Helicopter Rescue
- Vessel Rescue
- Reaching Land

Educational, Industry Standards & Sources:

USCG Standards of Training, Certification and Watchkeeping (STCW)
Safety of Life at Sea (SOLAS)
Title 46 of the Code of Federal Regulations
Maine Physical Education Standards

Possible Outcomes: Certificates in Basic Training

Grade 11: Ocean Survival II

Course Description: This course is a continuation of Ocean Survival I and provides advanced skills ocean survival. This course will provide instruction on ocean survival while including launching life boats, rowing and sailing of lifeboats, team working, leadership, long term survival in a craft, use of survival craft, and physical and emotional well-being of the student.
Prerequisites: Ocean Survival 1

Topics:

Lifeboats
Propulsion of lifeboats

Drills involving lifeboats
Emergency communications
Signaling devices
Environmental emergencies

Details:

1. Lifeboats
    a. Types of lifeboats
    b. Methods of Launching
        i. Gravity davits vs free fall
    c. Parts of the lifeboats
    d. Equipment
2. Propulsion of lifeboats
    a. Sail
    b. Oars
    c. Engine
3. Drills involving lifeboats
    a. Timing
    b. USCG requirements
    c. When passengers are involved
4. Emergency communications
    a. VHF radio
    b. MF Rradio
    c. Emergency Positioning Indicating Radio Beacons (EPIRB)
    d. Search and Rescue Transponders (SART)
5. Signaling devices
    a. Flares
    b. Orange Smoke
    c. Dye
    d. Non Pyrotechnics means
6. Environmental emergencies
    a. Hyperthermia
    b. Hypothermia
    c. Frost Bite
    d. Trench Foot
    e. Dehydration

Educational, Industry Standards & Sources:

USCG Standards of Training, Certification and Watchkeeping (STCW)
Safety of Life at Sea (SOLAS)
Title 46 of the Code of Federal Regulations
Maine Physical Education Standards
Possible Outcomes: Certificates in Lifeboatman

Grade 12: Maritime Safety

Note: *this course meets Maine Career & Development Educational Standards as well as PE Standards*

Course Description: The Maritime Safety class prepares students to be safe maritime, commercial fishing, or shipyard employees. Students will learn about maritime safety equipment and safety practices and procedures. An emphasis is placed upon: USCG and OSHA maritime safety regulations; health and environmental considerations; injury and fire prevention techniques and solutions; common maritime hazards and emergencies; and, the importance of weather and climate. Students will be trained in CPR, first aid and AED use.

Topics Covered:

USCG and OSHA maritime safety regulations
Safety equipment and applications
Weather and climate safety practices
Fire prevention and control; handling fuel, fumes, and volatile/toxic materials
Emergency procedures at sea and at the shipyard. Common hazards and safe solutions for work performed during ship maintenance and repair on board and ashore

Details and Standards:

Topic #1 USCG and OSHA

- A2: Students will know and understand the laws and regulations of these agencies in relation to their maritime careers
- A3: Students will demonstrate teamwork as an application of the USCG and OSHA laws and regulations
- C3: Students will write incident reports based on the simulations demonstrated in the teamwork exercises

Topic #2 Safety equipment and applications

- A2: Students will learn the names and functions of common maritime safety equipment

- A2: Students will know how to operate safety equipment necessary for different kinds of vessels and shipyard applications
- C3: Students will demonstrate competency in the use of common safety devices

Topic #3 Weather and climate safety practices

- A2: Students will learn about and understand the interaction between weather and climate and how it affects safety in the marine environment
- A3: Students will demonstrate the importance of teamwork for safety during adverse weather and climate conditions
- C3: Students will demonstrate competency in the use of weather and climate safety practices

Topic #4 Fire prevention and control, handling fumes

- A2: Students will study and understand fire prevention and control procedures on vessels and in shipyards
- A2: Students will study and understand proper safe handling of fuels, fumes, and volatile/toxic materials on vessels and in shipyards
- C3: Students will demonstrate competency in the use of fire prevention and control equipment and procedures on vessels and in shipyards
- C3: Students will demonstrate competency in the safe handling of fuels, fumes, and volatile/toxic materials on vessels and in shipyards

Topic #5 Emergency procedures, common hazards and solutions

- A2: Students will study and understand maritime emergency procedures and other solutions used to prevent common maritime hazards on vessels and in shipyards
- A3: Students will demonstrate the importance of teamwork when using maritime related emergency procedures on vessels and in shipyards
- C3: Students will demonstrate competency in the use of emergency procedures during common maritime hazards

MLR Guiding Principles Met in this Course:

A. A clear and effective communicator
B. A self-directed and lifelong learner
C. A creative and practical problem solver
D. A responsible and involved citizen mariner
E. An integrative and informed thinker

PE: Swimming Sequence

Grade 9: Basic Swimming

Course Description: This course provides students with basic skills in swimming and basic survival. This course will provide pool instruction in addition to classroom work team working, leadership, use of flotation and physical and emotional well-being of the student. Pool time will be used to acquire the basic swimming skills and self confidence in the water. Students will be exposed to swimming strokes, survival positions, use of survival equipment (PFD's and make-shift PFD's).

Prerequisites: N/A

Topics:

Introduction to swimming
Swimming strokes
Treading water as an individual
Treading water as a group
Personal Flotation Device (PFD) use

Details:

1. Introduction to swimming
    a. Why is it important to know how to swim
    b. Evaluation of students' skills
2. Swimming strokes
    a. Back stroke and modified backstroke
    b. Side stroke
    c. Breaststroke
3. Treading water as an Individual
    a. HELP Position
    b. Survival Position
    c. Basic PFD Use
4. Treading water as a group
    a. Huddle Position
    b. Centipede Movement
    c. Survival Formations (Star, Raft and Circle)
5. PFD Use
    a. Type I PFD
    b. Type III PFD
    c. Inflatable PFD

d. Type IV PFD- Towable Devices

Educational, Industry Standards & Sources:

USCG Standards of Training, Certification and Watchkeeping (STCW)
Safety of Life at Sea (SOLAS)
Title 46 of the Code of Federal Regulations
Maine Physical Education Standards

Grade 10: Advanced Swimming

Course Description: This course is a continuation of basic swimming and provides students with more advanced swimming and survival skills. Students will simulate rescue in the water as well as covering post water rescue considerations. Students will be provided instruction on topics that cover personal safety, rescue devices, team working and basic first aid associate with water rescue emergencies.

Prerequisites: Basic Swimming

Topics:

Principles of rescue
Rescue types
Rescue techniques
Removal from the water
Post rescue considerations
Post rescue considerations

Details:

1. Principles of rescue
    a. Signs Someone is in Distress
    b. Personal Safety Considerations
    c. Environmental Considerations
2. Rescue types
    a. Conscious Victim
    b. Unconscious Victim
    c. Multiple Victims
    d. Suspected Spinal Injury
3. Rescue Techniques
    a. Approaching from Behind
    b. Approaching from in front
    c. Unconscious Persons

    d. Backboard Rescues
4. Removal from the water
    a. Use of Backboard
    b. Use of Jason's Cradle
    c. Use of make-shift harnesses
    d. Correct lifting techniques
5. Post rescue considerations
    a. CPR and AED
    b. Dry Drowning
    c. Hypothermia
    d. Rewarming Techniques
    e. Wellbeing of the rescuers

Educational, Industry Standards & Sources:

USCG Standards of Training, Certification and Watchkeeping (STCW)
Safety of Life at Sea (SOLAS)
Title 46 of the Code of Federal Regulations
YMCA Lifeguarding Standards
Maine Physical Education Standards

Grade 11: Basic SCUBA

Course Description: This courses provide students with basic SCUBA skills based on PADI Open Water Certification. Classroom topics will include dive safety, teamwork, leadership, types of equipment, principles of diving, type of diving, use of dive tables, and physical and emotional well-being of the student.

Prerequisites: Basic Swimming, Physical Fitness Test (Swim Test), Students

Topics:

Dive equipment
Principles of diving
Dive tables
Types of diving discussions
Dive safety
Wildlife diving
Diver physiology

Details:

1. Dive equipment

    a. Regulators
    b. Tank
    c. Wet vs dry suits
    d. Fins, mask and snorkel
    e. Buoyancy Compensation Devices (BCD)'s
2. Principles of diving
    a. Cold vs warm water
    b. Underwater environments
    c. Dive partners
3. Dive tables
    a. Reading tables
    b. Rates of ascent
    c. Dive computers
4. Types of diving discussions
    a. Free diving
    b. Compressed air diving
    c. Mixed gas diving
5. Dive safety
    a. Shallow water diving blackouts
    b. Having partners and tenders
    c. Decompression sickness
    d. Wild life respect
    e. Near drowning/drowning
6. Wildlife diving
    a. Identification of species
    b. Respect
7. Diver physiology
    a. Circulatory system
    b. Respiratory System

Educational, Industry Standards & Sources:
PADI (Professional Association of Diving Instructors) Standards
Maine Physical Education Standards

Possible Outcomes: PADI Open Water Certification

Grade 12: Advanced SCUBA

Course Description: This course is a continuation of SCUBA skills mastered in Basic SCUBA. In addition students will continue into more advance skills required of PADI Advanced Open Water certification. Classroom topics will include team working, leadership, and types of equipment, technical dives, dive safety and physical and emotional well-being of the student. Students may be eligible for additional PADI Specialty certifications depending on dive parameters.

Prerequisites: Basic Scuba, Open Water Certification (OW), Physical Fitness Test (Swim Test)

Topics & Details:

1. Night Diving
    a. Tide/Currents
    b. Lack of Light
2. Diving off Vessels
    a. Distance from Shore
    b. Safety Considerations
    c. Signals for Divers
3. Deep Water Diving
    a. Accent Rates
    b. Safety Equipment
    c. Mixed Gas
4. Diving Emergencies
    a. Environmental Injuries
    b. Sea life Injuries
    c. Decompression sickness
5. Diver Physiology
    a. Circulatory
    b. Respiratory
6. Rescue Diving
    a. Specialized CPR

Educational, Industry Standards & Sources:

PADI (Professional Association of Diving Instructors) Standards
Maine Physical Education Standards

Possible Outcomes: PADI Advanced Open Water Certification (AOW) w/ Specialties

PE: Sailing Sequence

Grade 9: Basic Sailing

Course Description: This Physical Education course introduces and develops basic sailing skills aboard a small dingy. A combination of lecture and on the water instruction will provide hands on experience in rigging, sailing, and appropriate seamanship skills. Students will use correct terminology to describe actions and give (and receive) commands to the crew.
Prerequisites: Basic Swimming

Topics & Details:

1. Boat Equipment
    a. Identify boat, sails, and rigging components
    b. How weather affects emergencies
2. Emergency Drills
    a. Emergency Signals
    b. Safety Position
    c. Crew Safety
3. Capsizing and self-rescue
    a. Capsize drills
    b. Scoop recovery
    c. Entanglement training
4. Close quarter maneuvering
    a. Departing the dock or mooring
    b. Departing the dock or mooring
5. Sailing Skills
    a. Tacking
    b. Gybing
6. Points of Sail
    a. No-Go
    b. Close-hauled
    c. Reaching
    d. Running
7. Capsizing and self-rescue
    a. Capsize drills
    b. Scoop recovery
8. How Sails Work

    a. Push
    b. Pull
    c. Brake
9. Rules between Sailboats and other vessels
    a. Port vs Starboard tacks
    b. Windward vs Leeward
    c. Power and Manpowered vessels
10. The sailing environment
    a. Buoys and obstructions
    b. Tides and Currents
    c. Weather

Educational, Industry Standards & Sources:

United States Sailing Association – Basic Sailing Certification

Maine Physical Education Standards

Possible Outcomes: Certificate – Basic Sailing US Sailing

Level 1 Basic Sailing Certified Instructor

Grade 10: Performance Dinghy Sailing

Course Description: This course builds on basic sailing skills and teaches the concepts and skills of dinghy racing. A combination of lecture and on the water instruction will provide hands on experience in racing sail trim, rules, and strategy. Students will learn to compete in a fleet racing scenario and an emphasis will be placed on furthering technical sailing skills
Prerequisites: Basic Sailing

Topics & Details:

1. Racing Rules
    a. Port vs Starboard
    b. Buoy Rounding
    c. Starting Lines
    d. Penalties
2. Race Course Tactics
    a. Starting Line
    b. Rounding Buoys
    c. Windward / Leeward Legs
3. Performance Sail Trim
    a. Jib
    b. Mainsail
    c. Spinnaker
4. Upwind Sailing
    a. Tacking
    b. Sail trim
5. Downwind Sailing
    a. Gybing
    b. Sail Trim
6. Speed enhancing maneuvering
    a. Roll Tacks
    b. Roll Gybe
7. Sailing environment
    a. Wind shifts
    b. Sailing in current
    c. Favored tacks

8. Steering with Weight and Sails
    a. Pivot Point
    b. Center of Lateral Resistance

Educational, Industry Standards & Sources:

United States Sailing Association – Level 2 Sailboat Racing
Maine Physical Education Standards
Department of Education Concussion Training
https://www.cdc.gov/headsup/youthsports/athletes.html

Possible Outcomes: US Sailing Certificate – Level 2 Coach

Math Sequence

Grade 10: Geometry

Course Description: The focus of geometry is to develop a deeper understanding of geometric concepts of congruence with proofs, right triangles, trigonometric functions, conics, graphing in 2-D and 3-D, dimension of regular and non-routine figures, and modeling theoretical and real-world situations. Students will apply these concepts and skills in areas such as boat building and design, fluid dynamics of hull and propellor designs, plotting and sampling the ocean, and in all aspects of ocean and celestial navigation.
Prerequisites: Algebra I

Topics:

Congruence
Similarity, Right Triangles, and Trigonometric Functions
Circles and Conic Sections
Expressing Geometric Properties with Equations
Geometric Measurement and Dimension
Modeling with Geometry

Details:

Congruence

- Experiment with transformations in the coordinate plane
- Understand congruence in terms of rigid motions
- Prove geometric theorems
- Make geometric constructions
    - Modeling navigational situations using vectors and right triangles
    - Analyzing the effects of wind and current on a vessel's course

Similarity, Right Triangles, and Trigonometry

- Understand similarity in terms of similarity transformations
- Prove theorems involving similarity
- Define trigonometric ratios and solve problems involving right triangles
    - Calculating the angles of wind, current, and vessel course
    - Calculating the altitude of celestial bodies
- Apply trigonometry to general triangles
    - Calculating the distance to a location using right triangles

Circles

- Understand and apply theorems about circles
- Find arc lengths and areas of sectors of circles
    - Calculate and navigate using arc lengths and central angles of navigational stars

Expressing Geometric Properties with Equations

- Translate between the geometric description and the equation for a conic section
- Use coordinates to prove simple geometric theorems algebraically
    - Use coordinates to plot and calculate location

Geometric Measurement and Dimension

- Explain volume formulas and use them to solve problems
    - Use volume formulas to calculate amounts of cargo and rate of loading/off loading
- Visualize relationships between two-dimensional and three-dimensional objects

Modeling with Geometry

- Apply geometric concepts in modeling situations
    - Model real-life situations involving navigation, cargo, engineering, and the marine environment
    - Model sample spaces for data collection
    - Model fluid dynamics of hull and propellor design

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Common Core Standards:

Congruence

CCSS.MATH.CONTENT.HSG.CO.A.1, CCSS.MATH.CONTENT.HSG.CO.A.2, CCSS.MATH.CONTENT.HSG.CO.A.3, CCSS.MATH.CONTENT.HSG.CO.A.4, CCSS.MATH.CONTENT.HSG.CO.A.5, CCSS.MATH.CONTENT.HSG.CO.B.6, CCSS.MATH.CONTENT.HSG.CO.B.7, CCSS.MATH.CONTENT.HSG.CO.B.8, CCSS.MATH.CONTENT.HSG.CO.C.9, CCSS.MATH.CONTENT.HSG.CO.C.10, CCSS.MATH.CONTENT.HSG.CO.C.11, CCSS.MATH.CONTENT.HSG.CO.D.12, CCSS.MATH.CONTENT.HSG.CO.D.13

Similarity, Right Triangles, and Trigonometric Functions

CCSS.MATH.CONTENT.HSG.SRT.A.1, CCSS.MATH.CONTENT.HSG.SRT.A.2, CCSS.MATH.CONTENT.HSG.SRT.A.3, CCSS.MATH.CONTENT.HSG.SRT.B.4, CCSS.MATH.CONTENT.HSG.SRT.B.5, CCSS.MATH.CONTENT.HSG.SRT.C.6, CCSS.MATH.CONTENT.HSG.SRT.C.7, CCSS.MATH.CONTENT.HSG.SRT.C.8, CCSS.MATH.CONTENT.HSG.SRT.D.9, CCSS.MATH.CONTENT.HSG.SRT.D.10, CCSS.MATH.CONTENT.HSG.SRT.D.11

Circles

CCSS.MATH.CONTENT.HSG.C.A.1, CCSS.MATH.CONTENT.HSG.C.A.2, CCSS.MATH.CONTENT.HSG.C.A.3, CCSS.MATH.CONTENT.HSG.C.A.4, CCSS.MATH.CONTENT.HSG.C.B.5

Expressing Geometric Properties with Equations

CCSS.MATH.CONTENT.HSG.GPE.A.1, CCSS.MATH.CONTENT.HSG.GPE.A.2, CCSS.MATH.CONTENT.HSG.GPE.A.3, CCSS.MATH.CONTENT.HSG.GPE.B.4, CCSS.MATH.CONTENT.HSG.GPE.B.5, CCSS.MATH.CONTENT.HSG.GPE.B.6, CCSS.MATH.CONTENT.HSG.GPE.B.7

Geometric Measurement and Dimension

CCSS.MATH.CONTENT.HSG.GMD.A.1, CCSS.MATH.CONTENT.HSG.GMD.A.2, CCSS.MATH.CONTENT.HSG.GMD.A.3, CCSS.MATH.CONTENT.HSG.GMD.B.4

Modeling with Geometry

CCSS.MATH.CONTENT.HSG.MG.A.1, CCSS.MATH.CONTENT.HSG.MG.A.2, CCSS.MATH.CONTENT.HSG.MG.A.3

Resources:

1. ***Geometry of Navigation*** (Horwood Series in Mathematics & Applications) by Roy Williams
2. ***Longitude: The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time*** by Dava Sobel
3. **The Mathematical Dynamics of Celestial Navigation and Astronavigation** http://teachersinstitute.yale.edu/curriculum/units/2007/3/07.03.09.x.html
4. **The Motion of the Observer in Celestial Navigation** George H. Kaplan, U.S. Naval Observatory http://aa.usno.navy.mil/publications/reports/Kaplan1996a.pdf
5. **Discovering Central Angles and Arcs Using Traditional Polynesian Navigation and Star Trails** https://ethnomath.coe.hawaii.edu/pdf/High_School_10_Discovering_Central_Angles_and_Arcs_Using_Traditional_Navigation_and_Star_Trails.pdf

Examples of how Maine Guiding Principles will be met:

- **A. A Clear and Effective Communicator:** Students will communicate real-world and theoretical geometric ideas with proof-based logic, efficient use of equations, as well as with written language

- **B. A Self-Directed and Lifelong Learner:** Students will be able to use geometric principle to analyze and solve real-world problems
- **C. A Creative and Practical Problem Solver:** Students will solve non-routine problems and real-world problems individually and as a team member, they will recognize and understand that there are many solutions to the same problem
- **D. A Responsible and Involved Citizen:** Students will use geometric reasoning to solve real-world problems that affect themselves as well as others and the environment. Proof-based logic, if-then, is grounded in cause and effect and strengthens cause and effect analysis skills
- **E. An Integrative and Informed Thinker:** Applying geometric principles and reasoning to real-world problems and working in teams integrates multiples subject areas and encourages students to search for needed information and think creatively

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Science Sequence

Grade 9: Earth Science

Course Description: This is an inquiry based course designed to teach the sciences/concepts involved in understanding the Earth and how it works, and its place in the universe. A variety of hands-on labs and models will be used to help build and show understanding of the sciences and concepts involved in the complex nature of the Earth.

Prerequisites: Successful completion of Middle School science curriculum

Skills: Collaboration, scientific writing, application of the scientific method, project management

Topics:

Earth History
Plate Tectonics
Atmospheric and Ocean Systems
Climate Change
The Universe

Details:

Earth History

- Geologic Time – Earth's timeline with major events- including ocean formation
- Paleoclimates – parameters that affect climate change, evidence to determine climate conditions
- Earth's Orbital Variations and the effects on global climate- relationship between axial tilt and latitude on temperature; orbital parameters that affect the intensity of sunlight that reaches a point on Earth

Plate Tectonics

- The role of Earth's composition in the location of volcanoes and earthquakes
- Driving forces of plate motion – describe the movement of material in the mantle, explore densities role in material movement, model movement motion
- Plate interactions – relate volcanoes, earthquakes and plate boundaries to motion
- Changing geography- evidence to support changing geography, development of lan
- Volcanoes and Atmosphere – explain ways in which volcanoes influence climate, ocean formation

Atmospheric and Ocean Systems

- Global patterns- cause and distribution of global wind and patterns in weather
- Meteorology and weather effects
- Ocean Surface circulation – Role in energy transport and direction, explore the Coriolis Effect relative to wind and ocean patterns, introduce oceanography concepts
- Deep Ocean Circulation – Cause of deep ocean currents, densities role in circulation
- Present day climate and role of ocean circulation on climate change

Climate Change

- Effects on global climate – Identify and define local and global climate change, what causes it to change/vary, time frame of climate change
- Global climate and the role of carbon dioxide- define and discuss the difference between correlation and causation.
- Explore the role of humans on climate change: energy consumption and environmental impacts
- Glaciers and sea level–Explore changing levels in the sea and ice caps
- Sea level effects on landscapes–melting ice, changes to shorelines and elevation
- Local effects of climate change–influence of glaciers to Maine landscape, past and present effects of climate change on Maine
- Marine engineering issues resulting from (coastal erosion, depositions, dredging, etc.)

The Universe

- Explore how distance is measured in space (size and scale)
- The known universe and evidence supporting current understanding
- Electromagnetic spectrum and role in understanding space
- Stars and navigation
- Sun, moon and tidal effects (including energy potential)

Students will demonstrate mastery of:

1. Collaborative discussion (one on one, small groups, and whole class)
2. Scientific Writing
3. Projects and tests
4. Scientific Method

Recommended Text Resources:

1. Benbow, Carpenter, Hoover, Smith, Southard. 2012, EarthComm 2nd Edition. It's About Time Publishing, Mount Kisco, New York.
2. Allison, DeGaetano, Pasachoff. 2006, Earth Science. Holt, Rinehart, Winston, New York.
3. Online resources:
    a. World Ocean Observatory, Ocean Curriculum

Maine Learning Results Standards (MLR) and Next Generation Science Standards (NGSS):

Earth History

1. MLR: A1b, A3, A4a, A4b, C1a, C1b, D3a, D3h, D2a
2. NGSS: DCI ESS1.B, HS-ESS1-4, DCI ESS2.E, HS-ESS2-7, HS-ESS2-4, DCI ESS2.A, HS-ESS2-2, DCI ESS1.C, HS-ESS1-6, DCI ESS1.B, HS-ESS1-4, DCI PS1.C, HS-PS1-8

Plate Tectonics

1. MLR: A1a, A1b, A2, A4a, A4b, B1a, B1b, B1c, B1d, D2b, D2c, C1a
2. NGSS: DCI ESS2.B, HS-ESS1-5, DCI ESS2.A, DCI ESS2.E, HS-ESS1-6, DCI ESS2.B/ ESS2.A, HS-ESS2-1, DCI ESS1.C, ESS3.B, & PS3.D, HS-ESS2-2, DCI ESS1.C, ESS2.A, &ESS2.B, HS-ESS2-3

Atmospheric and Ocean Systems

1. MLR: A1a, A2, A4a, B1a,c,f, D2a,c D3l
2. NGSS: DCI ESS2.D, HS-ESS3-1, ESS2.A, HS-ESS2-3, HS-ESS2-4, ESS2.C, HS-ESS2-5

Climate Change

1. A1a,b, A2, A3, D2a,c,d, D3c
2. NGSS:DCI ESS2.A, D, E, ESS3.A,C, D & EST1.B, HS-ESS3-1, HS-ESS3-2,3,4,6, ESS2-2

The Universe

1. MLR: D1a,D1b, D1c, D1d
2. NGSS: ESS1.A, PS2.C, PS4.C , PS4.A , PS4.B, ESS2. D, PS3.A, B, D, PS1.C, ESS1-1,ESS1-2, ESS1-3

Examples of how Maine Guiding Principles will be met:

- **A. A Clear and Effective Communicator:** Learns to communicate scientifically and argumentatively through projects, labs and written conclusions to show understanding
- **B. A Self-Directed and Lifelong Learner:** Research and group work
- **C. A Creative and Practical Problem Solver:** Experiments, lab work, research, etc.
- **D. A Responsible and Involved Citizen:** Recognizes the complex relationship between humans and the environment, and understands the importance of environmental stewardship
- **E. An Integrative and Informed Thinker:** Earth is a system of interacting spheres that interact and react to changes.

Grade 11: Marine Chemistry

Course Description: This is an introductory chemistry class with a marine emphasis. Students explore the basic principles of chemistry which characterize the properties, reactivity, and quantitative analysis of matter and how it reacts. Emphasis will be put on understanding the role of chemistry in everyday life and the marine setting including the properties, composition, and origin of seawater. The processes that take place within the ocean and affect ocean chemistry will be explored.

Pre-requisites: High School Biology

Topics:

Measurement
Properties and states of matter (PS1-5)
Atomic structure (PS1-2)
Moles and molarity (PS1-7, PS1B)
Periodic trends (PS1.A)
Chemical bonds 1-2
Chemical reactions (PS1-2, PS1.B)
Acids and bases 1-7
Stoichiometry (PS1-7, PS1B)

Details:

Measurement: metric, significant figures, precision and accuracy, density review, etc

- Convert from one unit to another unit using SI units.
- Use various temperature scales, calculate seawater density, and explain the difference between quantitative and qualitative data.
- Record data using the correct number of significant figures.

Properties and States of Matter: cycling of nutrients (salts, minerals), phase changes of water

- Classify different types of matter and explain various properties of matter along with describing different changes in energy that take place during phase changes in the ocean.
- Students will explore how long elements are in the ocean for and how this will affect salinity, temperature and density distributions (i.e. salt cycle).

Atomic Structure: ocean ion formation and salinity

- Relate the structure of the atom to its properties and location on the Periodic Table.

- Describe the structure of atoms, identify mass numbers, atomic numbers and how they relate to isotopes.
- Students will understand and identify the specific elements in the ocean and their importance.
- Relate the structure of atoms to ion formation and salinity.

Moles and Molarity: quantify the amount of salts and minerals in ocean water

- Calculate moles, atoms, grams of different elements and compounds, and be able to convert from one to the other (ex. 5 g NaCl = _____ molecules NaCl).
- Calculate the molarity of a given solution.
- Explain how to make a certain amount of a solution with a given molarity.

Periodic Trends: elements in ocean water and synthetic pollutants found in ocean

- Define, identify, and explain periodic properties.
- Identify elements in synthetic pollutants and ions in ocean water.

Chemical Bonds: characteristics of water due to hydrogen bonds, shellfish calcium carbonate

- Compare and contrast the different types of chemical bonding and draw diagrams/ give examples of different types of bonds (hydrogen, oxygen, carbon).
- Importance of Hydrogen bonding in water properties (adhesion, cohesion, the effect on viscosity).
- Relationship between type of bond and ocean nutrient cycling.

Chemical Reactions: dissolution of ions and minerals, nutrient cycling (primary production, aquaculture)

- Identify the five major types of chemical reactions, predict the products, and balance chemical equations.
- Explain the various effects that factors such as catalysts and concentration have on chemical reactions and relate this to salinity, temperature and density distributions in the ocean.

Acids and Bases: coastal and ocean acidification

- Determine acidic and basic compounds.
- Identify properties of acids and bases and calculate the PH/POH of acids and bases (relate to marine chemicals used in industry).
- Relate acid/base properties to the ocean by explaining the carbonate system, distribution of carbonate parameters in the oceans and the concept of ocean acidification and climate change and understand the process of salt formation in the ocean.

Stoichiometry: calculating ion concentrations (i.e. salts, mercury) and dissolved gases in ocean water

- Use a balanced chemical equation to predict the mass of products in a reaction (concentration of ions found in salt water).
- Identify limiting reactants (amount of CO_2 needed to increase ocean acidification).
- Calculate theoretical and percent yields.

Students will demonstrate mastery of:

1. Collaborative discussion (one on one, small groups, and whole class)
2. Laboratory teamwork
3. Science writing
4. Projects and tests
5. Scientific Method

Suggested Resources:

1. Wilbraham, Staley, Matta, Waterman. 2008. Chemistry. Prentice Hall, Boston, MA.
2. Online:
    a. MIT Open Courseware, Marine Chemistry
    b. World Ocean Observatory, Ocean Curriculum
    c. http://marinebio.org/oceans/ocean-chemistry/
3. Ocean Carbon and Biogeochemistry Program, www.us-ocb.org

NGSS Standards:

NGSS standards addressed in course: PS1.A, PS1.B, HS-PSP-1-2, HS-PS1-5, HS-PS1-6, HS-PS1-7

Examples of how Maine Guiding Principles will be met:

- **A. A Clear and Effective Communicator:** Learns to communicate scientifically and argumentatively through projects, labs and written conclusions to show understanding
- **B. A Self-Directed and Lifelong Learner:** Research and group work, application to real world situations
- **C. A Creative and Practical Problem Solver:** Experiments, lab work, research , etc.
- **D. A Responsible and Involved Citizen:** Recognizes the complex relationship between humans and the environment, and understands the importance of environmental stewardship
- **E. An Integrative and Informed Thinker:** Marine chemistry can be used to collaboratively understand and solve real world situations.

Grade 12: Marine Physics

Course Description:
In this course students will explore and analyze concepts of matter, energy, forces, and motion in physical systems through the application of scientific and engineering practices, and crosscutting concepts. Emphasis is placed on application to the marine setting with connections made to other areas of marine science when applicable.
Pre/Co-requisites: Successful completion of higher math

Skills/careers: The skills and knowledge described here are vital for careers in Marine Engineering and Marine Transportation. Broad understanding is needed for Marine Management and detailed knowledge may be necessary for Marine Science activities.

Topics:

Force and motion
Matter, energy and work
Scientific and engineering
Waves

Details:

Force and Motion (using a vessel in the water):

- Explain and apply the ideas of relative motion and frame of reference.
- Distinguish between, give examples of, and apply speed, velocity, momentum, and acceleration.
- Use vector models to demonstrate the relationship of unbalanced forces (buoyancy, center of effort, lift, drag).
- Using a model, show the relationship between buoyancy, displacement, weight, and stability of vessels in the water.
- Distinguish between friction and fluid resistance and provide examples of the application of these phenomena in the maritime world.
- Apply forces acting on vessels to real life situations (docking, collisions, propulsion systems, etc)

Matter, Energy and Work

- Relate work and the conservation of energy to simple machines and mechanical advantage.
- Describe kinetic energy, potential energy and energy contained in a field or matter and apply these concepts to solve energy problems.

- Describe the relationship between electric and magnetic fields and forces, and give examples of how this relationship is used in modern maritime technologies.
- Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance.
- Describe nuclear reactions, including fusion and fission, and the energy they release.
- Describe Radioactive decay and half-life.
- Describe the relationship among, heat, temperature, and pressure in terms of the actions of atoms, and molecules; apply this to marine setting

Waves

- Describe and apply characteristics of waves including wavelength, frequency, and amplitude.
- Describe and apply, in a marine setting, an understanding of how waves interact with other waves and with materials including reflection, refraction and absorption (sound waves, sound pollution, sonar applications, even light waves)
- Describe the relationship between electric and magnetic fields and forces, and give examples of how this relationship is used in modern technologies.
- Describe the energy contained by fields (electromagnetic waves).
- Investigate magnetism and apply to navigation.

Scientific and Engineering Practices

- Apply an understanding of systems to explain and analyze man-made and natural phenomena.
- Evaluate the effectiveness of a model by comparing its predictions to actual observations from the physical setting, living environment, and the technological world.
- Methodically plan, conduct, analyze data from, and communicate results of in-depth investigations; and then use a systematic process, tools, equipment, and a variety of materials to create a technological design and produce a solution or product to meet a specific need.

Standards addressed:

Force and motion

- **MLR Standards**: D4b, D4a
- **NGSS**: HS-PS2
- **Maine Guiding principles**: C;E
- **Ocean Literacy Principles**: OLP 1

Matter, Energy, Work

- **MLR Standards**: D3a; D3i, k,j; D4f; D4c; D3b; D3d; D3d; D3a; D3g; D3h; D3l;D4dD4f
- **NGSS**: HS-PS 1; HS-PS 3;

- **Maine Guiding principles**: C; D; E
- **Ocean Literacy Principles**: OLP 3; OLP6; OLP7

Waves

- **MLR Standards**: D4c, D4d, D4e, D4f
- **NGSS**:HS- PS 2, HS-PS 4
- **Maine Guiding Principles**: C; D; E
- **Ocean Literacy Principles**: OLP 3; OLP 6, OLP 7

Social Studies Sequence

Grade 12: Marine Policy

Course Description: Unbridled human interaction with the sea, marine resources, and with each other at sea and along the coastline has wreaked havoc. Policymakers over time have created regulations to mitigate human destruction of the marine environment and its resources and ease the tensions of human interaction in the marine environment, whether it be at work, at play or over property rights. This course will look at American Marine Policy from early colonization to the present.
Prerequisites: successful completion of middle school social studies curriculum

Skills/careers: Critical thinking and historical context to today's marine policies and regulations, Merchant Marine, Marine Scientist, Marine Policymaker, Shoreside Industry Worker: boat builder, ship chandler, Supercargo

Topics:

- Fisheries and Marine Resource Regulations
- Renewable Energy Regulations
- Marine Protected Areas
- Anti-Pollution Regulations
- National Environmental Policy Act
- Endangered Species Regulations
- Marine Spatial Planning/Coastal Zone Management
- Right of Ways
- Coastal Zone Hazard Prevention
- American Merchant Marine Workers Rights Legislation
- Port Security
- Piracy
- Climate Change
- Law of the Sea
- Regulatory Agencies

Details: Course will meet the Maine State Learning Result Standards and Guiding Principles. Examples of meeting the objectives as follows:

A1 and Guiding Principle A, B and E: Research paper on Marine Mammal Act and Native Rights to Seal Hunting based on primary source material.
A2 and Guiding Principle C and E: Mock trial of right of Japanese to hunt whales and Greenpeace's (un)civil disobedience to physically block that right.
A3 and Guiding Principle D: Service-learning project to educate public on Eurasian Milfoil in our local lakes through a poster campaign at boat launches.
B1: Compare the Jones Act, protecting American Merchant Mariners injured at sea with the ability to receive worker's compensation, with similar regulations in other countries.
B2: Evaluate the court case Bell v. Town of Wells in the right to shoreline access for fishing, fowling and navigation in Massachusetts and Maine.
B3: Analyze history of treaties with Native peoples over access to historic fishing grounds.
C1: Explain and analyze trade policies leading to the Jones Act regulations prohibiting foreign-flagged vessels from carrying trade goods directly from one US port to another.
C2: Analyze the role of zoning committees in balancing coastal recreation, commercial, and residential uses, and taking into account climate change, sea level rise, and hazard mitigation, also known as marine spatial planning.
D1: Evaluate the impact of pollution, renewable energy installations and oil platforms on the physical and cultural environment.
D2: Analyze the dynamic relationship between marine protected areas and the subsistence harvesters who rely on the areas for their livelihoods.
E1: Read primary sources of harvesters appealing for and fighting against fisheries management regulations as the fishing stocks decrease.
E2: Identify and critique privateering and piracy laws that protect domestic harassment of enemy shipping and vilify foreign harassment of our shipping in times of war.

MLR Standards Met in This Course:
A1 Researching and Developing Positions on Current Social Studies Issues
A2 Making Decisions Using Social Studies Knowledge and Skills
A3 Taking Action Using Social Studies Knowledge and Skills
B1 Knowledge, Concepts, Themes, and Patterns of Civics/Government
B2 Rights, Duties, Responsibilities, and Citizen Participation in Government
B3 Individual, Cultural, International, and Global Connections in Civics and Government
C1 Economic Knowledge, Concepts, Themes, and Patterns
C2 Individual, Cultural, International, and Global Connections in Economics
D1 Geographic Knowledge, Concepts, Themes, and Patterns
D2 Individual, Cultural, International, and Global Connections in Geography
E1 Historical Knowledge, Concepts, Themes, and Patterns

E2 Individual, Cultural, International, and Global Connections in History

MLR Guiding Principles Met in this Course:

A. A Clear and Effective Communicator
B. A Self-Directed and Lifelong Learner
C. A Creative and Practical Problem Solver
D. A Responsible and Involved Citizen
E. An Integrative and Informed Thinker

Arts Sequence

Grade 9: Studio in Art

Course Description: 9th Grade marine themed studio in art will focus on the application of the elements and principles of design through the creation of artwork using a variety of media and resources. Marine art history will be introduced to understand how artists and their artwork influenced the culture of the time as well as the impact that these artists/artwork had on future cultures. Students will learn how to document the marine world using photo documentation and field notes. Students will engage in critical thinking skills and problem solving techniques as they learn the importance of aesthetics and criticism.
Prerequisites: Successful completion of a Middle School arts curriculum

Skills/Careers: Critical thinking, evaluation, Marine artists, Photographer, Journalist, Lecturer/Research presentations, Website Designer

Topics:

Marine Art History
Cultural reflection
Composition evaluation
Creative problem solving
Multiple disciplinary analysis
Aesthetics and Criticism: Opinion vs. Judgment
Analysis and Synthesis
Graphic Design

Maine Visual Arts Standards Met in this Course:

- A1-Students will research and explain how arts and artists reflect and influence culture and periods of time
- A2-Students evaluate all the features of composition
- A3-Students compare the effects of media and their associated tools, techniques, and processes, using elements, principles and expressive qualities in art forms and genres
- B1-Students choose multiple suitable media, tools, techniques and processes to create a variety of original art works. Understand chemistry of materials.
- C1-Students apply and analyze creative problem solving and creative thinking skills to improve or vary their own work and/or the work of others.

- D1c-Demonstrate an understanding of the difference between a personal opinion and an informed judgment
- D1d-Research and explain how art and artists reflect and shape their time.
- E2-Students analyze skills and concepts that are similar across disciplines.
- E5-Students demonstrate positive interpersonal skills and reflect on the impact of interpersonal skills on personal success in the arts

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World Language Sequence

Grade 9 or 10: Communicating in Foreign Ports

Course Description: This course will prepare students for communicating maritime terminology in foreign ports for transportation students and to foreign clients in the Maritime administration track. The course will be available to students in 9th or 10th grade. Key languages will be: Spanish, Chinese (Mandarin), Russian, French, German, Latin/Romance language roots (Italian and Portuguese), Japanese and English maritime phrases.

Topics:

Maritime terminology
Glossary of common maritime phrases in key languages

Details:

- Communicate key maritime phrases in foreign languages.
    - Communication
    1. Interpersonal
        2. Interpretive
    3. Presentational
    4. Language Comparisons
- Understand foreign cultures
    - Cultures
    1. Practices and Perspectives
    2. Products and Perspectives
    3. Comparisons with Own Culture
- Make connections between career tracks and foreign languages
    - Connections
    1. Knowledge of Other Learning Results Content Areas
    2. Distinctive Viewpoints
- Understand the importance of culture and language in the 21st century.
    - Communities

Standards:

A. Communication
    - Express themselves verbally to foreign speakers.
    - Understand commands and instructions given verbally by foreign speakers.

- Write and understand written key phrases in foreign ports.
- Look for common roots in maritime phrases around the world.

B. Cultures

- Cultural overview of foreign ports.
- Political overview of foreign ports.
- Archeological overview of foreign ports.
- Economic overview of foreign ports.

C. Connections

- Connect foreign language needs for various career tracks.
- Read and follow instructions written in key foreign languages for completing a task.

D. Communities

- Read and provide commands from and to dockworkers in foreign ports.

Examples of how Maine Guiding Principles will be met:

A1: Students will communicate with merchant mariners and shore-side businesses using maritime vocabulary.

A2: Students will comprehend conversations, narratives, and recorded material in maritime contexts.

A3: Students will communicate with sufficient accuracy in form and pronunciation that could be understood by native speakers accustomed to interacting with language learners.

A4: Students use their understanding of the nature of language to enhance their communication in the target language.

B1: Students identify and explain how perspectives of a culture(s) are related to cultural practices of a culture(s) in which the target language is spoken.

B2: Students explain how political structures, historical artifacts, literature, and/or visual and performing arts reflect the perspectives of a culture(s) in which the target language is spoken.

B3: Students explain how products, practices, and perspectives of a culture(s) in which the target language is spoken contribute to the culture in which the student lives.

C1: Students use the target language to enhance their knowledge of prospective career tracks.

C2: Students locate authentic resources and describe ideas about the target language and associated culture(s) that are available only through sources in the target language.

D1: Students demonstrate an understanding and use their knowledge of the target language to communicate with target language speakers and to understand the importance of culture and language in the 21st century.

Grades 10-12: Spanish I, II, & III

Course Description: This course will prepare students for communicating with native Spanish speakers for transportation students and to foreign clients in the Maritime administration track. As the largest root language of our maritime nations, students will find use for this language.

Prerequisites: Middle school foreign language and Communicating in Foreign Ports

Skills/careers: Merchant Marine, Marine Businesses, Effective Communicator

Topics Covered:

Maritime phrases in Spanish
Business phrases in Spanish
Proficiency in speaking, reading and writing Spanish

Details:
Course will meet the Maine State Learning Result Standards and Guiding Principles.
Examples of meeting the objectives as follows:
A1: Students will communicate with native Spanish speakers.
A2: Students will comprehend conversations, narratives, and recorded material in Spanish.
A3: Students will communicate with sufficient accuracy in form and pronunciation that could be understood by native speakers accustomed to interacting with language learners.
A4: Students use their understanding of the nature of language to enhance their communication in Spanish.
B1: Students identify and explain how perspectives of a culture(s) are related to cultural practices of a culture(s) in which Spanish is spoken.
B2: Students explain how political structures, historical artifacts, literature, and/or visual and performing arts reflect the perspectives of a culture(s) in which Spanish is spoken.
B3: Students explain how products, practices, and perspectives of a culture(s) in which Spanish is spoken contribute to the culture in which the student lives.
C1: Students use Spanish to enhance their knowledge of prospective career tracks.
C2: Students locate authentic resources and describe ideas about the target language and associated culture(s) that are available only through sources in Spanish.

D1: Students demonstrate an understanding and use their knowledge of Spanish to communicate with Spanish speakers and to understand the importance of culture and language in the 21st century.

MLR Standards Met in This Course:

Communicate in Spanish.

- A. Communication
  1. Interpersonal
  2. Interpretive
  3. Presentational
  4. Language Comparisons

Understand foreign cultures

- B. Cultures
  1. Practices and Perspectives
  2. Products and Perspectives
  3. Comparisons with Own Culture

Make connections between career tracks and foreign languages

- C. Connections
  1. Knowledge of Other Learning Results Content Areas
  2. Distinctive Viewpoints

Understand the importance of culture and language in the 21st century.

- D. Communities
  1. Communities

MLR Guiding Principles Met in this Course:

A. A Clear and Effective Communicator
B. A Self-Directed and Lifelong Learner
C. A Creative and Practical Problem Solver
D. A Responsible and Involved Citizen
E. An Integrative and Informed Thinker

Grades 10-11 or 11-12: Latin I, II

Course Description: This course will prepare students in the Marine Science tracks for understanding key scientific phrases and Latin names of marine species.

Prerequisites: Middle school foreign language and Communicating in Foreign Ports

Skills/careers: Marine Sciences, Effective Communicator

Topics Covered:

Latin names of marine species
Latin roots of scientific phrases
Proficiency in speaking, reading and writing Latin
Latin roots of Romance languages

Details:
Course will meet the Maine State Learning Result Standards and Guiding Principles.
Examples of meeting the objectives as follows:
A1: Students will pronounce Latin names of marine species correctly.
A2: Students will comprehend conversations, narratives, and recorded material in Latin.
A3: Students will communicate with sufficient accuracy in form and pronunciation that could be understood by Latin speakers accustomed to interacting with language learners.
A4: Students use their understanding of the nature of language to enhance their communication in Latin.
B1: Course will provide a cultural overview of use of Latin in Marine Science terminology.
B2: Students explain how political structures, historical artifacts, literature, and/or visual and performing arts reflect the perspectives of a culture(s) in which Romance Languages are spoken.
B3: Students explain how products, practices, and perspectives of a culture(s) in which Romance Languages are spoken contribute to the culture in which the student lives.
C1: Students use Latin to enhance their knowledge of prospective career tracks, especially Marine Science.
C2: Students will read and comprehend Latin scientific tracts.
D1: Students demonstrate an understanding and use their knowledge of Latin to communicate with Romance Language speakers and to understand the importance of culture and language in the 21st century.

Grades 10-12: Self-directed Language Study

Course Description: Students will have the opportunity to learn languages online or from available teachers onsite for languages they feel will enhance their ability to communicate in the maritime field. Students will take a standardized test upon completion of the course to evaluate their proficiency.

Prerequisites: Middle school foreign language and *Communicating in Foreign Ports*

Skills/careers: Merchant Marine, Marine Businesses, Effective Communicator

Topics:
Proficiency in speaking, reading and writing in a foreign language of student's choice.

Details:
Course will meet the Maine State Learning Result Standards and Guiding Principles.
Examples of meeting the objectives as follows:
A1: Students will communicate using Foreign Language.
A2: Students will comprehend conversations, narratives, and recorded material in Foreign Language.
A3: Students will communicate with sufficient accuracy in form and pronunciation that could be understood by Foreign Language speakers accustomed to interacting with language learners.
A4: Students use their understanding of the nature of language to enhance their communication in Foreign Language.
B1: Students identify and explain how perspectives of a culture(s) are related to cultural practices of a culture(s) in which Foreign Language is spoken.
B2: Students explain how political structures, historical artifacts, literature, and/or visual and performing arts reflect the perspectives of a culture(s) in which Foreign Language is spoken.
B3: Students explain how products, practices, and perspectives of a culture(s) in which Foreign Language is spoken contribute to the culture in which the student lives.
C1: Students use Foreign Language to enhance their knowledge of prospective career tracks.
C2: Students locate authentic resources and describe ideas about the target language and associated culture(s) that are available only through sources in Foreign Language.
D1: Students demonstrate an understanding and use their knowledge of Foreign Language to communicate with Foreign Language speakers and to understand the importance of culture and language in the 21st century.

MLR Standards Met in This Course:

Communicate in Foreign Language

- A. Communication
  - 1. Interpersonal
  - 2. Interpretive
  - 3. Presentational
  - 4. Language Comparisons

Understand foreign cultures

- B. Cultures
  - 1. Practices and Perspectives
  - 2. Products and Perspectives
  - 3. Comparisons with Own Culture

Make connections between career tracks and foreign languages

- C. Connections
  - 1. Knowledge of Other Learning Results Content Areas
  - 2. Distinctive Viewpoints

Understand the importance of culture and language in the 21st century.

- D. Communities
  - 1. Communities

MLR Guiding Principles Met in this Course:

A. A Clear and Effective Communicator
B. A Self-Directed and Lifelong Learner
C. A Creative and Practical Problem Solver
D. A Responsible and Involved Citizen
E. An Integrative and Informed Thinker

Appendix 4b: Marine Track Sequence - Detailed Course Descriptions

Grade 9: Foundations of Marine Studies I

Course Description: The **Foundations of Marine Studies I** course is the first in the series of Foundation courses that provides an overview and introduction to each of the four Marine Tracks taught at the Maine Ocean School and is required of all Maine Ocean School students. Additionally, this course will provide instruction in topics that are common to all tracks, including ethics, teamwork and leadership principles. This course lays the foundation for continued studies in Marine Science, Marine Transportation, Marine Engineering and Marine Management and is intended to help the student determine which area of the marine industry is the best fit for their continued education.

The Foundations of Marine Studies I course is interactive, allowing for facility tours, guest speakers and class projects that are designed to expose students to various aspects of the marine industry, including institutions in higher learning, shipyards, boatyards, marine terminals and ports, marine related construction, marine research and government agencies.
Prerequisites: N/A

Topics:

1. Introduction to Marine Science
    a. Marine resources of the ocean
    b. Biodiversity & ecology
    c. Aquaculture & fisheries
    d. Oceanography
    e. Experimental design and data analysis
2. Introduction to Ship and Maritime Terminology
    a. Types and classifications of vessels
    b. Common abbreviations and international Regulations
    c. Vessel nomenclature
    d. Basic vessel safety
    e. Ship organization
    f. Tour of a ship, tug or other vessel
    g. The Merchant Marine

3. Introduction to Ethics, Leadership and Teamworking Skills
    a. Ethics and ethical behavior
    b. Importance of teamwork
    c. Team-working skills
    d. Importance of leadership
    e. Leadership skills
4. Introduction to Marine Transportation
    a. Introduction to Marine Transportation
    b. Introduction to Nautical Science
    c. Introduction to Basic Seamanship
    d. Introduction to Vessel Navigation
    e. Deck Department
    f. Ships command structure
5. Introduction to Marine Engineering
    a. Marine propulsion
    b. Marine mechanical systems
    c. Marine electrical systems
    d. Marine mechanical systems
    e. Auxiliary Systems
6. Introduction to Marine Management
    a. Project management (science, engineering, and transportation)
    b. Marine business and accounting
    c. Port & terminal logistics
    d. Marine support services
    e. Ship and small craft construction
7. Marine Careers
    a. Introduction to shoreside and seagoing careers related to Marine Science, Marine Transportation, Marine Engineering and Marine Management.
        i. Employment Opportunities
            1. Marine Science Careers
                a. Fisher-person
                b. Marine researcher
                c. Marine biologist
                d. Aquaculturist
                e. Environmental scientist
                f. Conservation biologist
                g. Marine educator

    h. Tourism director
    i. Marine/coastal GIS and coastal planning
2. Mariner Careers - Transportation & Engineering
    a. Vessel Manning Structure and Progression
    b. Deck, Engine and Stewards Departments
    c. USCG Merchant Mariner Credential (MMC), Licensing and Endorsements
    d. Transportation Worker Identification Credential (TWIC)
    e. “Hawespipe” path
    f. Maritime Academy Path
    g. Employment Opportunities – Commercial Deep Sea, Inland Waterways, Tug & Barge, Offshore Supply, Offshore Drilling, Great Lakes, Cruise Industry, Govt. Agencies, Comm. Fishing, etc.)
3. Shipbuilding & Repair Careers - Transportation, Engineering, Management
    a. Shipyard Trades
    b. Shipyard Management
    c. Shipyard Engineering, Architecture and Design
    d. Quality Assurance
    e. Shipyard Health and Safety
    f. Computer Applications
    g. Employment Opportunities
4. Port Operations Careers - Management
    a. Port Operations and Safety
    b. Logistics
    c. Health and Safety
    d. Computer Applications
    e. Employment Opportunities
5. Small Boat Careers
    a. Small Boat Design
    b. Small Boatyard Management
    c. Marina Management
    d. Employment Opportunities
6. Service Related Careers - Science, Engineering, Transportation or Management
    a. US Navy

b. NOAA - National Oceanic and Atmospheric Administration
c. US Geological Suvey (USGS)
d. United States Maritime Administration (MARAD) of the US Department of Transportation
e. US Army Corps of Engineers (USACOE)

Grade 10: Foundations of Marine Studies II

Course Description: The **Foundations of Marine Studies II** course is the second in the series of Foundation courses that is required of all Maine Ocean School students. The course is intended to expand the student's knowledge in topics that comprise the Marine Science, Marine Transportation, Marine Engineering and Marine Management tracks. This course continues to lay the foundation for the student in determining their future course of studies in one of the Marine Tracks.

The Foundations of Marine Studies II course is interactive, allowing for tours, guest speakers and class projects designed to expose students to various aspects of the marine industry, including institutions in higher learning, shipyards, boatyards, marine terminals and ports, marine related construction, marine research and government agencies such as the USCG, Maine Department of Environmental Protection and the Fish and Game. Qualifying students will be guided in applying for a Transportation Worker Identification Credential (TWIC) and an entry-level USCG Merchant Mariner Credential (MMC).
Prerequisites: Foundations of Marine Studies I

Topics:

1. Leadership, ethics and Managerial Skills
    - Leadership concepts
    - Leadership Techniques
    - Leadership Skills
    - Ethics
    - Communications
    - Application of Leadership and Management techniques
2. Personal Safety Training
    - Importance of Safety
    - OSH/USCG/ ABS Standards
    - Personal Protective Equipment (PPE)
3. Ocean Survival Skills
    - Hypothermia
    - Personal Floatation Devices (PFD)
    - Survival Suits
    - Life-rafts and Lifeboats
4. Small Boat Handling

5. Environmental Awareness
    - MARPOL, OPA 90
    - Climate Change
6. Security Awareness
    - Transportation Security Administration (TSA)
    - Transportation Worker Identification Credential (TWIC)
    - International Ships Port Security Code (ISPS)
7. Introduction to Regulations
    - United States Coast Guard (USCG)
    - Standards of Training, Certification and Watchkeeping (STCW)
    - Code of Federal Regulations (CFR's)
    - Occupational Safety and Health Administration (OSHA)
    - United Nations Environment Programme (UNEP)
8. USCG Entry Level Merchant Mariner Credential (MMC) Application
9. USCG Approved Basic Training

Educational, Industry Standards & Sources:

Industry Standards addressed:

- United States Coast Guard (USCG)
- Standards of Training, Certification and Watchkeeping (STCW)
- Code of Federal Regulations (CFR's)
- Occupational Safety and Health Administration (OSHA)
- United Nations Environment Programme (UNEP)
- Transportation Security Administration (TSA)

Possible Outcomes:

- Entry-Level USCG Merchant Mariner Credential (MMC) endorsed as Ordinary Seaman, Wiper and Stewards Department
- Standards of Training, Certifications and Watchkeeping (STCW) endorsement of Basic Training (BT)
- Standards of Training, Certifications and Watchkeeping (STCW) endorsement of Security Awareness (SA)
- Transportation Worker Identification Credential (TWIC)

Selected Track: Marine Science

Grade 11: Marine Science I - Detailed

Course Description: This is a hands-on, applied methods course designed to provide the skills needed to conduct a self-directed study in Marine Science, **Marine Sciences II**. Students will build on their science knowledge and learn the basic theories (e.g., evolution, ecology, oceanography, aquaculture, fisheries) and laboratory skills to identify life in the sea, assess basic water quality measures (in the ocean and tank/culture systems), conduct controlled experiments, deploy and retrieve different gear types for physical (Acoustic Doppler Current Profiler - ADCP), chemical (Conductivity, Temperature Depth recorder - CTD), geological (Ponar grab), and biological (trawls and pots), keep accurate records, analyze results, and communicate them to varied audiences.

Prerequisites: Algebra, Marine Biology, Chemistry, Physics (last 2 can be concurrent), Foundations of Marine Studies I, Foundations of Marine Studies II

Topics:

1. Oceanography
    a. Atmospheric Circulation & Ocean Currents
    b. Weather & Climate
    c. Waves & Tides
    d. Marine sediments & Origins of water
    e. Nutrients
    f. Carbon cycling
2. Biodiversity & Ecology
    a. Evolution
    b. Organism identification and classification: Taxonomy
    c. Ecology
        i. Marine habitats & communities
        ii. Ecosystem dependencies - trophic interactions
        iii. Predation & competition
        iv. Disturbance & succession
    d. Conservation and Sustainability Science
3. Human uses of marine resources of the ocean
    a. Direct harvest: plants (seaweed) to vertebrates (whales)

b. Indirect effects of humans on the ocean: bycatch to oil spills
c. Indirect effects of land-based activities: plastics to climate change

4. Aquaculture & Fisheries
    a. Water quality
    b. Systems maintenance
    c. Seaweed, shellfish, finfish
    d. Gear & technology
    e. Product processing
    f. Stock assessment & management (conceptually)
5. Scientific project management
    a. Experimental design and data literacy
        i. Data entry, management, and quality assurance and control
    b. A group project will be developed at the beginning of the semester and followed through the semester in preparation for Marine Science II
    c. Establish a mentor and partner for Marine Science II and project
        i. Opportunity to initiate project over the summer

Recommended Texts:

Townsend, D.W. 2012. Oceanography and Marine Biology: An Introduction to Marine Science. Sinauer Associates, Sunderland, MA.

Karban, Richard, Mikaela Huntzinger, and Ian S. Pearse. *How to do ecology: a concise handbook*. Princeton University Press, 2014.

Other Resources:

SEA Semester Academic lesson plans in Marine Biology and Oceanography
NOAA Ocean Literacy Program - Science and Technology
Aquaculture curricula - Maine Aquaculture Association
Allied Whale curriculum - College of the Atlantic

Educational, Industry Standards & Sources:

Ocean Literacy Principles Addressed:

- Ocean Literacy Principle #2: The ocean and life in the ocean shape the features of Earth.
- Ocean Literacy Principle #4: The ocean made the Earth habitable.
- Ocean Literacy Principle #5: The ocean supports a great diversity of life and ecosystems.

NOAA Ocean Literacy Standards

Possible Outcomes:
Skills:

- Basic water quality assessments (chemistry), tank maintenance, preliminary plumbing
- Basic microscope work
- Organism identification (taxonomy and phylogeny)
- Surveying intertidal diversity
- Familiarity with the water and interactions of trophic levels
- Observing ocean fishing activities
- Participation in fishery research cruises
- Recording data on marine mammal sightings and fishing activities
- Tallying incidental take of marine mammals, sea turtles, and seabirds from fishing platforms
- Data literacy
    - Collecting biological samples and specimens from postmortem animals (e.g., size, plastics, toxins, age, gender)
    - Entering data into a database using computers
    - Basic data presentation and analysis
- Integration of stakeholder knowledge and participation
- Knowledge of above building communication skills functions such as participation in ocean fishing activities

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Grade 12: Marine Science II - Detailed

Course Description: As the second of a two-part course in the Marine Science Track this course will build on skills learned in Marine Science I to provide the student with experience in further pursuit in various fields of marine science. Hands-on learning experiences will be mentor-guided and industry/academic-partnered projects where directed study skills will be applied to ocean careers, from those requiring a HS diploma to those requiring a PhD.

Prerequisites: Algebra, Marine Biology, Chemistry, Physics, Statistics (any of the last 3 can be concurrent), Foundations of Marine Studies I, Foundations of Marine Studies II

Possible Topics Covered - *The course will be student-interest-directed and will be tailored for the needs of those taking the course*

- Review of concepts from Marine Sciences I
    - Oceanography

    - Biodiversity & Ecology
    - Human uses of marine resources of the ocean
    - Aquaculture & Fisheries
    - Scientific project management
    - Choose a focus area, or integrate areas
- Experimental Design
- Data analysis and interpretation
- Scientific writing

Details: Career paths will be discussed and integrated with scientific areas of inquiry to determine the best hands-on experience for each student. From this, Capstone/Senior Experiences will be formulated with the faculty mentor (to be identified in Marine Sciences I). These will be individualized to incorporate a laboratory, field, or industry-integrated research or field experience with an associated Marine Scientist. The student and advisor will determine the final product of this experience. All students in the Marine Science Track will take part in a presentation of their projects to stakeholders, either to the legislature in a Hall of Flags event or at an organized Symposium with industry/institutional engagement.

Resources:

University of Maine links to College preparation - primarily Kahn Academy resources
Maine INBRE - IDeA Network of Biomedical Research Excellence - Laboratory Training Courses

Skills:

- Direct application of the Scientific Method
    - Developing scientific questions and testing hypotheses
- Organism identification, basic microscope work, data literacy
- Organism identification, familiarity with the water and interactions of trophic levels
- Knowledge of above, plus effective communication skills functions such as participation in ocean fishing activities;
- Recording data on marine mammal sightings and fishing activities;
- Tallying incidental take of marine mammals, sea turtles, and seabirds from fishing platforms;
- Collecting biological samples and specimens from postmortem animals; and entering data into a database using computers.
- Analyzing and interpreting carefully collected data.
- Written and verbal communication of results to peers and industry representatives.

Possible Certificates:

- HACCP (Hazard Analysis and Critical Control Point)
    - Online Institutes of America Training for students
- ServSafe ®
- GIS - online certificate program for K-12
- MS Excel - online tutorial

Selected Track: Marine Transportation

Grade 11: Marine Transportation I - Detailed

Course Description: Marine Transportation I is the first of two courses in the Marine Transportation program. This course covers basic knowledge in areas related to the Marine Transportation field and prepares the student for more advanced studies in Marine Transportation.

Marine Transportation I is a dynamic course that integrates classroom lectures, instructional tours, guest speakers, interactive teambuilding, and hands on experiences designed to expose students to multiple aspects of the marine transportation industry.

Prerequisites: Foundations of Marine Studies I, Foundations of Marine Studies II
Algebra I, and English 9

Topics:

1. Introduction to Marine Transportation
    - History of sailing, fishing, and whaling
        - Jones Act 1920
        - Merchant Marine Act of 1936
    - International and Domestic Oversight
        - IMO, USCG, ABS, NCB, CFR, OPA '90, SOLAS, STCW, MARPOL
    - Voyage Abstracts
        - Sea time and port time
        - SBE, Departure, Arrival, FWE
    - Tramp, Liner, Passenger, Cargo, Towing industries
2. Introduction to Nautical Science
    - Review of Maritime Safety Course
    - Emergency Procedures
        - Importance of training and drills
        - Emergency signals
        - Lifeboat types
    - Line Handling
        - Commands and care
        - Block and Tackle
    - Marlinspike Knot Tying
3. Ship Construction

- Vessel Types
- Anchor Types

4. Basic Seamanship
    - Basic Seamanship Safety Course
    - Operations and Personnel
    - Lookout Procedure
    - Ship's Log
5. Basic Navigation
    - Types of charts
    - Navigational Signals
    - Types of Compasses
    - Variation & Deviation
    - Lines of position
6. Basic Meteorology
    - Weather reports
    - Accurate weather reporting and log book keeping
7. Basic Rules of the Road
    - Emergency signals
    - Right of way hierarchy
    - Lights/Shapes
    - 33 CFR Inland Rules
8. Basic Ship Stability
    - Stability Diagrams
    - Load Lines & Draft Marks
9. Basic Ship Handling
    - Steering a vessel
    - Helm commands
10. Basic Cargo Handling
    - Cargo types
        - Drybulk and breakbulk
        - Liquid and LNG
        - Containerization
        - Hazardous Materials
    - Intermodal transportation

Educational, Industry Standards & Sources:

USCG Standard of Training, Certification, and Watchkeeping (STCW)
Safety of Life at Sea (SOLAS)
Knowledge, Understanding and Proficiency Assessment Guidelines (KUP)
Title 46 of the Code of Federal Regulations (CFR)
Ocean Literacy Principles (OLP)
American Boat & Yacht Council Standards (ABYC)
Maine Learning Results: Career and Education Development Standards

Possible Outcomes: e.g. certificates, essential knowledge and practice in seamanship skills, facility with methods, materials and technology associated with Marine Transportation

Grade 12: Marine Transportation II - Detailed

Course Description: Marine Transportation II is the second of two courses in the Marine Transportation program. The course is intended to provide the student with the basic knowledge and understanding of the materials, methods, and skills required for the further pursuit of the Standards of Training, Certification and Watchkeeping (STCW) endorsements of Rating Forming Part of a Navigational Watch (RFPNW) and Able Seafarer - Deck (AS-D). The Knowledge, Understanding and Proficiency (KUP) Assessment Guidelines for AS-D are used to develop objectives for this course.

Marine Transportation II is a dynamic course that has elements including classroom lectures, interactive team building, instructional tours, guest speakers and class projects designed to expose students to various aspects of the marine transportation industry.

Prerequisites: Foundations of Marine Studies I, Foundations of Marine Studies II, Marine Transportation Studies I, Algebra I, and English 9

Topics:

1. Marine Regulations
    - Navigational Rules
    - Navigational Signals
    - Able Seaman - Introduction
    - Weather Reporting
    - Ship's Log book
2. Topics in Navigation
    - Review of Marine Safety protocols
    - Terrestrial Navigation
    - Electronic Navigation
    - Celestial Navigation
3. Contribute to watchstanding duties and requirements
    - Review STCW watchkeeping requirements.
    - While underway, lookout terminology
    - During Anchor watches
    - During terminal operations.
    - Bridge Team Management/Coordination
4. Contribute to berthing, anchoring and mooring operations
    - Line handling and terminology

        - Types of lines/wires/arrangements
    - Helm commands
    - Perform berthing, anchoring, and mooring aboard a vessel or in simulation
    - Embark/Debarking of Marine Pilots
5. Contribute to Deck Operation fundamentals
    - Bunker/Fuel transfers
    - Perform cargo management and handling operations aboard a vessel or in simulation
    - Vessel security in port, at anchor or underway.
6. Contribute to the safe operation of deck equipment and machinery
    - Line handling and deck equipment terminology
    - Line handling commands
    - Deck equipment terminology and usage
    - Deployment and retrieval of scientific equipment
7. Apply occupational health and safety precautions
    - Personal safety and responsibilities
    - Basic Safety Training (First Aid/CPR/AED)
    - Hazard Communications
8. Apply precautions and contribute to the prevention of pollution of the marine environment
    - History of development of pollution regulations
    - MARPOL Annex VI Regulations
    - USCG and EPA inspections
    - Use all environmental safety precautions while aboard a vessel or in simulation
9. Operate survival craft and rescue boats
    - Emergency procedures and signals
    - Lifeboat Commands
    - PFDs and Survival Suits
    - Survival Craft and Rescue Boat Equipment
10. Contribute to shipboard maintenance and repair
    - Safety Management System (SMS)/Shipboard record keeping
    - Vessel systems and operations
    - Perform basic maintenance duties aboard a vessel
11. Bridge Resource Management (BRM)
    - Chain of Command
    - Teamwork
    - Communication

- Risk Analysis
- Problem Solving

12. Capstone/Senior Experience
    - Student directed and advisor guided capstone research or field experience
    - Student and advisor will determine final product of this experience
    - Student will create a portfolio illustrating their acquisition of knowledge

Educational, Industry Standards & Sources:

USCG Standard of Training, Certification, and Watchkeeping (STCW)
Rating Forming Part of a Navigational Watch (RFPNW)
Knowledge, Understanding and Proficiency Assessment Guidelines (KUP)
Title 46 of the Code of Federal Regulations (CFR)
Ocean Literacy Principles (OLP)
American Boat & Yacht Council Standards (ABYC)
Maine Learning Results: Career and Education Development Standards

Possible Outcomes: e.g., Certificates of competence in the field, informed knowledge and practice in vessel operations skills, confident facility with methods, materials and technology with Marine Transportation issues, and readiness to go onto the water as a seaman at many different levels.

Selected Track: Marine Engineering

Grade 11: Marine Engineering I – Detailed

Course Description: This instructor led course will prepare the participant to use engineering analysis, design, and evaluation processes to solve basic problems in the ocean related topics described below. Learning activities may include classroom discussion, laboratory practice, and shop or field activities.

This course is interactive, allowing for tours, guest speakers and class projects designed to expose students to various aspects of the marine engineering industry.

Prerequisites: Algebra 2, and Chemistry; Physics; Foundations of Marine Studies I; Foundations of Marine Studies II; Must enroll in Advanced Math, Precalculus, or higher Math concurrently

Topics: Students will learn the purpose and safe use of tools such as the following:

- Apply math, science, chemistry, physics, and material to problem analysis
- Engineering terminology
- Engineering data sources
    - Technical libraries
    - Equipment manuals
- Graphics and mechanical drawing
    - Computer Aided Design Software
    - Print Reading
- Workplace Safety
    - Machine Shop Equipment/Practices
    - Laboratory Equipment/Practices
- Application of tools
    - Hand Tools
    - Fabrication Devices (e.g., 3-D Printers)
    - Power Tools
    - Meters and other measuring devices
- Technical Report Writing and Presentations

Scientific and Engineering Practices

- Design, evaluate, and refine a solution for reducing the impacts of human activities on the ocean environment and marine life.
- Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on ocean systems.

- Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
- Evaluate or refine a technological solution that reduces impacts of human activities on ocean systems.
- Use a computer simulation to model the impact of proposed solutions to a complex real-world ocean problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
- Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
- Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
- Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

Standards addressed in this topic area:
The Maine Performance Based Learning Science Reporting Standards from which these standards were adapted incorporated the Maine Learning Results criteria, NGSS standards, and the Maine Guiding Principles

- MLR Standards: A1; A2; B1; B2
- Maine Guiding principles: A;
- Maine Performance Based Learning Science Reporting Standards: 8
- NGSS: HS-ETS 1; HS- LS2-7; HS-LS4-6; HS-ESS3-2; HS-ESS3-4; HS-ETS1-4; HS-PS2-3; HS-PS2-6; HS-PS4-5
- Ocean Literacy Principles: OLP 6

Educational, Industry Standards & Sources:

- Maine Performance Based Learning Science Reporting Standards
- Ocean Literacy Principles
- Federal Regulations
- American National Standards Institute (ANSI) standards
- Industry consensus standards, for example:
    - Institute of Electrical and Electronics Engineers (IEEE)
    - American Welding Society (AWS)
    - American Society of Mechanical Engineers (ASME)
    - National Fire Protection Association (NFPA)

Possible Outcomes: Further education in Marine Engineering.

Grade 12: Marine Engineering II – Detailed

Course Description: This instructor led course will prepare the participant to use engineering analysis, design, and evaluation processes and tools developed in Marine Engineering I to solve more complex problems in the ocean related topics described below. Learning activities may include classroom discussion, laboratory practice, shop practice, or field activities.
This course will include a student selected, mentor-guided and industry/academic-partnered experiential learning activity to apply directed study skills to solving a specific ocean-related problem.
Prerequisites: Marine Engineering I

Topics: Students may address problems with systems or activities including but not limited to:

- Workplace safety
  - Facility
  - Vessel safety
- Vessel construction and operations
  - Mechanical systems
  - Electrical systems
  - Control Systems
  - Auxiliary Systems
- Marine propulsion
  - Gasoline and diesel engines
  - Propeller designs and types
  - Tractor tug arrangements
  - Nuclear ship and submarine propulsion systems
  - Electrical ship drives
- Marine support systems
  - Moorings & buoys
  - Deployment & retrieval
  - Antifouling treatments
- Waterborne structures
  - Bridges
  - Platforms
- Water transportation systems
  - Applications
  - Fluid dynamics
  - Pumps
- Ocean related energy-conversion systems
  - Tidal power
  - Wave power
  - Wind power

- Ocean environmental protection
    - Regulatory controls
    - Biological impacts

Scientific and Engineering Practices

Define and delimit engineering problems

- Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

Develop possible solutions

- Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts AND use a computer simulation to model the impact of proposed solutions to a complex real-world ocean problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Optimize the Design Solution

- Design a solution to a complex real world ocean problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- Refine the design of an ocean system by specifying a change in conditions that would produce more efficient, less harmful results.

Standards addressed in this topic area:

- **MLR Standards**: A1; A2; B1; B2
- **Maine Guiding principles:** A;
- **Maine Performance Based Learning Science Reporting Standards: 8**
- **NGSS:** HS-ETS 1-1; HS-PS3-3; HS-ETS1-3; HS-ETS1-4; HS-ETS1-2; HS-PS1-6
- **Ocean Literacy Principles**: OLP 6

Educational, Industry Standards & Sources:

- Maine Performance Based Learning Science Reporting Standards
- Ocean Literacy Principles
- Federal Regulations
- ANSI standards
- Industry consensus standards (e.g., IEEE, AWS, ASME, NFPA, ABS)

Possible Outcomes: Further education in Marine Engineering. This course should provide the student with the basic knowledge and understanding of the materials, methods, and skills required for the further pursuit of the Standards of Training, Certification and Watchkeeping (STCW), endorsements of Rating Forming Part of a Navigational Watch (RFPNW), and Able Seafarer - Engineering (AS-E).

Appendix 5: Maine Ocean School Foundation

The Maine Ocean School Foundation is a not-for-profit organization established to support, enhance, expand, and enrich students' educational experiences through private donations, gifts, and grants. MOS Foundation helps to carry out the mission and vision of Maine Ocean School by raising private funds to support programs beyond the core school budget. The Board of Directors meets quarterly.

Board of Directors:

4 Members from Searsport

- **Captain Monèt Brazier**, Chair: Maine Maritime Academy Class of 2010, Licensed Deck Officer, Maine Licensed Real Estate Auctioneer, Assistant Harbormaster
- **Representative James Gillway,** Maine House, District 98; Searsport Town Manager
- **Dr. James A Stevenson**, PhD, MD, Physician
- **RuthAnn Brazier,** Event coordinator, Former Head of Undergraduate Dining - Harvard University, Former Board Member of Western Maine Community Action

4 Members from Stockton

- **Barbara Money**, 36 years Real Estate Professional in Silicon Valley, CA. Retired 2008. Active volunteer in events and fundraising in local communities in Mid-Coast Maine
- **Peter Hardester**, Retired 2004, Pacific Gas & Electric, 39 yrs. AutoCad Software instructor 15 yrs. Engineering Estimator, System Operator, Construction Supervisor

4 General Public

- **Captain Mike Flanagan**: Unlimited Licensed Master, BS Political Science University of Colorado 1984, Captain USNR retired
- **Tom Marx,** BA Columbia College, Masters Harvard University, PhD University of Iowa. 42 years as Superintendent of Schools
- **William P. Shideleff,** Certified Public Accountant, PA
- **Ellie Flagg**, Bangor Savings Bank Branch Manager

MOS Executive Director: TBD

MOS Student (non-voting): TBD

Ad from the Republican Journal May 10, 1853

Searsport Union School

This institution will commence its Second Term on the first Monday of Sept. to continue for 10 weeks under the care of that distinguished and popular teacher L.M. Stewart A.M. and Graduate of Dartmouth College.

From the fact that the majority of young men on the sea coast of Maine especially, look to a sea life as the one with most promise, this school has been arranged especially, but not exclusively, for their benefit. Ladies and girls and all young men and boys will find it the best select school in the vicinity. The morals of the pupils will be assiduously regarded- there being a chapel in which Sabbath services and a Sabbath School is conducted, connected to the Institution.

Its location is pleasant and healthful, its apparatus ample and no pains will be wanting to make it a profitable and permanent school to all who may give it patronage.

French, Spanish and other languages taught if required. No scholar admitted for less than a half term. Tuition $3 per term; board $1/50 per week.

Per order of the Executive Committee
James Blanchard

Appendix 6: Letters of Support

Town of Searsport, Board of Selectmen
University of Maine, Office of Innovation and Economic Development
University of Maine, School of Marine Sciences
Island Institute
Friends of Sears Island
C. Greg Rössel Carpenetry
Brenna Vines, 10th Grader

Office of Innovation and Economic Development

THE UNIVERSITY OF MAINE

5717 Corbett Hall, Room 430
Orono, Maine 04469-5717
Tel: 207-581-2201
Fax: 207-581-1479
www.umaine.edu

February 8, 2017

Committee on Education and Cultural Affairs
c/o Legislative Information
100 State House Station
Augusta, ME 04333

RE: Letter of Support – Maine Ocean School

Dear Senator Langley, Representative, Kornfield and Distinguished Members of the Joint Standing Committee on Education and Cultural Affairs,

Please accept this letter in support of the Maine Ocean School.

The University of Maine is pleased to collaborate with this initiative and to extend and include many existing formal and informal programs currently available to Maine high schools, especially in marine science, technology, and engineering into the planning and implementation. The geographic proximity of the Searsport location facilitates collaborative opportunities with our existing programs in Orono, the Hutchinson Center in Belfast, the Darling Marine Center in Walpole and field research opportunities in Penobscot Bay as well as with industry and NGO partners in the region.

A school with such a focus would provide a unique opportunity to students with the education focus, experience and career awareness of these disciplines and prepare them as good candidates for post-secondary education within University of Maine in Engineering, Marine Sciences, Aquaculture and other related programs. The Maine Ocean School will also prepare students to directly enter the workforce into marine related jobs available in many Maine companies within the fishing, aquaculture, renewable energy, and boat building/composites manufacturing sectors.

The University of Maine has extensive offerings in this space and will continue to contribute to curriculum development, and hope to offer capstone/student projects and field trips/field research experiences. It is possible to have UMaine graduate students contribute to teaching and to serve as mentors to project teams. In addition, many of the programs listed below have summer jobs for high school students that could further add work/field experience opportunities.

Examples of existing UMaine programs that could contribute to the offerings of the Maine Ocean School include:

The University of Maine College of Engineering (COE):

- The COE has worked on development and implementation of STEM curricula in at Maine high schools (i.e. Bangor High School STEM Academy and Thornton Academy STEM program). These programs can be extended to the Maine Ocean School.

- The UMaine COE has expertise Marine Engineering, Composites and Transportation. Specifically, our National Science Foundation EPSCoR funded *Storm Water Monitoring* program has created high school teaching materials and real field experiments and monitoring programs directly impacting Marine Sciences and fisheries. This effort can be further augmented by the activities of the new Alfond Wind/Wave Laboratory and the Advanced Manufacturing Center for Structural Composites especially useful for coastal engineering, marine structures and boat/ship building.

- The UMaine COE is also working with the Maine Department of Education and the UMaine College of Education on a pathway to enable engineering and technology students to obtain Maine teaching certification with a STEM endorsement. This offers UMaine Engineering Technology students the opportunity to teach in Maine schools and perhaps serve as student teachers and future faculty for the Maine Ocean School.

The University of Maine School of Marine Sciences (SMS):

- The University of Maine SMS sees programming at the Maine Ocean School as a way to attract more students, especially students from coastal communities with traditional fishing and maritime related activities, to pursue Marine

Science college programs. This new high school will prepare students early on to use the ocean as a model to teach and train them a set of skills that will be needed for coastal communities. SMS has been working with the school to develop their curriculum and will work to make courses eligible for college credit at UMaine.

- UMaine SMS college students are interested in incorporating marine science into the K-12 science education. The creation of this new high school will allow some of our SMS students to work with the school and to gain valuable classroom teaching experience. UMaine SMS has already discussed opportunities to have some SMS students offer some guest lectures and design and help some lab and field experiments at the new school and along the coast.

- UMaine SMS has existing marine science courses and conducts experiments at the Hutchinson Center in Belfast: e.g., Concepts in Oceanography, SMS 110, which often includes area high school students. Hutchinson Center has coordinated a course (INT 188) focusing on marine and environmental science last summer, which had 12 high school students from that area. With the creation of this new high school, UMaine SMS and the Hutchinson Center can formalize partnerships.

The University of Maine –Sea Grant, Aquaculture Research Institute and the NSF EPSCoR SEANET program:

- There is a range of opportunities to connect to science-based programming related to marine and coastal issues though the Maine Sea Grant Program, the Aquaculture Research Institute (ARI), and through the Sustainable Ecological Aquaculture Network (SEANET). The Director of these programs (Paul Anderson) is willing to meet and discuss synergies as planning for this school progresses.

- All three of these programs have experience working in K-12 environments providing ideas for experiential learning and curriculum development. There are ample examples over the past 20 years that have included students and teachers from K-12 institutions along Maine's coast to conduct field investigations and monitoring activities.

- Educators often find UMaine professional staff helpful in developing classroom, laboratory, and field lessons related to a range of themes including: fisheries science, aquaculture, marine invasive species, water quality, climate change, ocean acidification, coastal erosion, etc.

- Explicit partnerships and opportunities can be explored to match our capacity with the school's interests so that the student experience is enriched with the most current knowledge and scientific method combined with a place-based context. All of these programs are back-stopped by excellent faculty researchers and college-level students.

- There are also wet lab facilities being managed by these UMaine entities that can be considered for field trips at the University of Maine in Orono, The Center for Cooperative Aquaculture Research in Franklin, the Darling Marine Center in Walpole. This includes strong relationships with industry partners in fisheries and aquaculture business visits. Possibilities exist to support student businesses in conjunction with our business incubators as these facilities

- The NSF EPSCoR funded SEANET program, has a five-year duration that began in August, 2014 and has some explicit goals related to K-12 and STEM education in the context of sustainable aquaculture. These activities are managed by the UMaine EPSCoR Office in conjunction with the SEANET research office and the UMaine Cooperative Extension 4-H program. SEANET includes a range of offerings including curriculum support, training field kits for use in classrooms, and connections to the research projects.

The University of Maine Hutchinson Center in Belfast:

- The University of Maine Hutchinson Center in Belfast has state-of-the-art biology and chemistry laboratories that can be available for introductory, early-college, or dual-credit lab science or technology courses.

- The Hutchinson Center has developed and offers an early-college course, "Integrated STEM research and career exploration", for high school juniors and seniors, and (with School of Marine Sciences) offers an introductory Oceanography Lab course -- both taught in summer and available to local high school students.

- The Hutchinson Center has developed relationships with mid-coast STEM businesses and for the past three summers has placed students in STEM job shadowing opportunities within an area from Augusta and Waterville to Rockland and Blue Hill.

- The Hutchinson Center regularly collaborates with the UMaine School of Marine Sciences, Center for Research in STEM Education and with the Climate Change Institute. It is part of the Division of Lifelong Learning, which is at the forefront of developing online formats for courses and programs at the University of Maine.

The University of Maine Foster Center for Student Innovation:

- The Foster Center is developing dual credit courses in Innovation Engineering that could be offered through the Maine Ocean School. The Center offers counseling to students pursing innovation and entrepreneurship and directly placing students with Maine's most innovative companies.

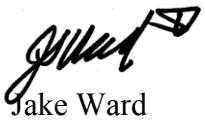
This is a brief list of existing programs that provide immediate collaboration opportunities as the new school develops. In addition to these Marine and Engineering specific components, the University of Maine and the University of Maine System offer a range of programs specific to STEM education as well as multiple credit and dual-credit offerings to Maine high school students that could be considered. As a founding partner in the Bridge Year Program, there is existing curriculum and faculty training ready to deliver immediately.

The leadership of the above programs is actively engaged in collaborating with Maine's K-12 community and looks forward to working with the Board of the Maine Ocean School. Of course UMaine Professor Gayle Zydlewski is the Chancellor's Designee to the Maine Ocean School Board of Trustees and is the best ambassador to help facilitate the connections and the collaborations.

Please feel free to contact me or any of the following people for more discussion.

Dr. Mohamad Musavi, Associate Dean, UMaine College of Engineering, (581-2217), mohamad.musavi@umit.maine.edu
Dr. William Ellis, Associate Director, UMaine School of Marine Sciences (581-4360), William.ellis@umit.maine.edu
Paul Anderson, Director, UMaine Aquaculture Research Institute and Maine Sea Grant, (581-1435), panderson@maine.edu
Dr. Molly Schauffler, Hutchinson Center Science Program Coordinator, (338-8038), mschauff@maine.edu
Dr. Habib Dagher, Director, Advanced Structures and Composites Center, (581-2121), hd@maine.edu
Renee Kelly, Assistant Vice President Innovation and Economic Development (581-2201), rwkelly@maine.edu

Sincerely,



Jake Ward
Vice President
Innovation & Economic Development

School of Marine Sciences

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10 February 2017

Committee on Education and Cultural Affairs
c/o Legislative Information
100 State House Station
Augusta, ME 04333
RE: Letter of Support – Maine Ocean School

To the Chairs of the Joint Standing Committee on Education and Cultural Affairs,

The School of Marine Sciences (SMS) at the University of Maine offers our strong support of your efforts to establish the Maine Ocean School, a public magnet high school for marine science, technology, transportation and engineering. We commend Dr. Zydlewski for her leadership in bringing her passion and a focus on the oceans to Maine's high school students.

We at SMS are committed to continue our involvement in establishing this program and offer future support of the Maine Ocean School. SMS faculty will continue to serve of the Ocean School Board of Trustees. In addition, a number of faculty and graduate students will continue to work on the curriculum development.

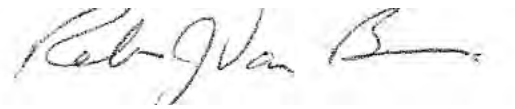
Our faculty will serve as mentors in oceanography, marine biology, aquaculture and marine policy for students' internships and school projects. We look forward to developing opportunities for internships and continuing their education in the marine sciences. The Ocean School also offers teaching opportunities for our graduate students.

Ocean School students will have remote access big data sets through the University of Maine Ocean Observing System (UMOOS) as well as satellite data.

SMS is currently developing a number of on-line courses which we can make available for qualified students. We look forward to welcoming graduates of this program as majors in marine science at the University of Maine.

Please don't hesitate in contacting me if you would like any additional information.

Sincerely,



Rebecca J. Van Beneden
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University of Maine
Orono, ME 04469-5706

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ISLAND INSTITUTE

February 7, 2017

Joint Standing Committee on Education and Cultural Affairs
100 State House Station
Augusta, ME 04333

Dear Senator Langley, Representative Kornfield, members of the committee:

The Island Institute supports the formation of the Maine Ocean School because the Maine Ocean School will help prepare Maine's students for marine related careers as well as higher education opportunities. The Maine Ocean School's mission *to provide a theme-based high school education focused on Maine's maritime connection, with emphasis on leadership, work ethic and transferable skills associated with careers involving the ocean* aligns very well with the Island Institute's strategic priority – *to enhance leadership and workforce development*.

As a community development organization located in Rockland, ME, the Island Institute works to sustain both island and coastal communities in Maine and to exchange ideas and experiences to further the sustainability of communities here and elsewhere. Education is critical to the future of Maine's communities. We work closely with island and coastal school and see and hear about the critical need to better prepare Maine's students for the many marine-related career opportunities available to them. Island and coastal students could be particularly well served by the Maine Ocean School because for so many of them, working on the water is already the driving force in their lives. Attending a school in which every class has a relevant marine-connection has the potential to be transformative and to create a new generation of academically successful and well-prepared mariners.

For many years, I have participated in discussion and planning around marine studies efforts, from integrated ocean-themed lessons and units at the elementary level to broader programs such as Fisherman's Academy at RSU 13, Eastern Maine Skippers Program and most recently, the Island Institute's aquaculture education collaborations with Hurricane Island Center for Science and Leadership, Herring Gut Learning Center and the Aquaculture Research Institute at UMaine, among others. There are excellent resources available and a good deal of high quality marine-based teaching and learning happening across the coast, but it is largely done in isolation or very small pockets of collaboration.

With the Maine Ocean School, the Maine Legislature has an opportunity to support an excellent marine-themed education to the students who attend the school, and also to be the catalyst to develop a comprehensive K-12 marine studies framework for our state. This would allow students to be ready to succeed at the Maine Ocean School

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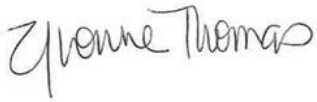
when they reach high school age, or be better prepared to participate effectively in marine-themed educational opportunities in their home communities.

The Maine Ocean School will have a significant and lasting impact on the Maine's students and marine-based workforce of the future. The Island Institute strongly supports the Maine Ocean School and I urge you to do the same.

Please do not hesitate to contact us if you have any questions or would like to know more about the work mentioned in this letter.

Sincerely,



Yvonne Thomas
Education Director

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Friends of Sears Island

P.O. Box 348, Searsport, ME 04974 www.friendsofsearsisland.org

TO: Joint Standing Committee on Education and Cultural Affairs
FROM: Friends of Sears Island
DATE: February 6, 2017

To Whom It May Concern:

Friends of Sears Island (FOSI) is the state-designated land manager of the 601-acre Conservation Area on Sears Island. We would like to register our support for the Maine Ocean School (MOS) in Searsport. FOSI is committed to working with the school to provide educational opportunities for students on Sears Island, and their partnership will help FOSI fulfill its mission to "encourage educational uses of the island." Several FOSI board members have been involved in the planning of the MOS, serving on the Program/Curriculum and the Admissions committees. The planning effort has made tremendous progress since the committees started meeting less than a year ago. The local community's interest in, and enthusiasm for a school dedicated to marine studies, has been steadily growing—and we expect this momentum to continue.

Sears Island has been used as a living lab for several years—mainly due to its easy access (from a causeway) and because it has a diversity of habitats and plant and animal species that reside there, making it an ideal study site for students. Searsport District High School regularly used the island for their class "Sears Island: Issues and Possibilities," and students designed projects specifically for the island. Unity College has used Sears Island for several of its classes, with students conducting research projects both on land and in the waters surrounding the island. The same is true for University of Maine faculty and for participants in the UMaine Cooperative Extension 4-H program, Belfast High School students, and others. Sears Island would be an invaluable resource to MOS students, offering many hands-on opportunities, whether they are following the marine science, engineering, management, or transportation academic programs.

In conclusion, FOSI sincerely hopes that the Maine Ocean School will become a reality.

Sincerely,

Susan K. White

Susan K. White, President

C. GREG RÖSSEL

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207-948-2841

Senator Langley and Representative Kornfield
Chairs of the Joint Standing Committee on Education and Cultural Affairs
State House
Augusta, Maine 04333
February 9, 2017

Dear Senator Langley and Representative Kornfield

I am writing to offer my full and enthusiastic support for the new Maine Ocean School in Searsport.

The sea has been in Maine's DNA and its brand for hundreds of years. Whether for its deep water mariners, its fisheries, boat yards, ship builders or marine scientists, the label "Maine" is synonymous worldwide with quality. One could not design a better, textbook economic driver. The related businesses are sustainable, decentralized and diversified. The major sea ports are located at key positions on the coast offering access to deep waters and year-long access. The fishing ports are distributed along the entire length of our coast line. Boat yards are ubiquitous – in cities and small villages, small islands and on rivers providing good paying work with benefits. The combined trades support a myriad of other trades and businesses– whether it be marine mechanics, chandleries, sail makers, truckers, small grocery stores and much more. The maritime industries also are post card photogenic and something that tourists expect and come here to see as part of their Maine experience.

That said, in many ways our state has neglected this resource. Perhaps it is because of its distributed nature. It doesn't have the presence of, say, a paper plant or large industrial facility. Perhaps we have forgotten to market the industry to ourselves. At a time when the state is justifiably concerned about young people moving away from Maine to search for work, the marine professions in Maine can't find enough skilled employees. Indeed, too often, our high school students aren't even aware of the potential and possibility of the great careers that are literally in their back yard.

The Ocean School will offer wide based high school education ranging from the sciences -- oceanography, aquaculture, and meteorology. Transportation – ship handling, marine propulsion and electronics. Management skills – from vessel construction and marine business to communication. And these are all dynamic, cutting-edge careers for the 21st century.

I hope that the full legislature will also support this new school that is not only an investment in Maine's economy today but also, more importantly, Maine's future.

Sincerely,

Greg Rossel

Brenna Vines - Grade 10 - MVHS - 2017

A school like this would offer many new and exciting opportunities that aren't available to students who attend a normal public high school. If I could attend a high school that not only offers a complete high school curriculum, but also focuses on marine science, I definitely would. Someone, like myself, who is interested in ocean science would be able to blossom in a school where the academic programs are built around marine science but don't lack the needed high school standards.

In my opinion, the coolest thing that the school has to offer are the activities covered in health/PE. The fact that the students who attend this ocean school get the opportunity to learn survival at sea, sailing, etc is amazing. From my personal experience, and observations of the students around me, the majority of students who attend a normal high school don't get much out of PE. If students had the option to sail, learn survival, etc, then students would most definitely learn from this. Not only would they learn in the moment, but the information they receive could be used in their future lives.

The marine themed standards would better prepare someone who is planning on going into the ocean science field much better than a normal high school would. I have no doubt that the students who attend this ocean school will come prepared every day, excited and ready to learn, None of the knowledge would go to waste, every student would use what they learn at some point in the future, whether it is in their career or in everyday life. Anyone who is passionate about marine science would be thrilled to have the opportunity to attend a high school themed around ocean science.