

# Incorporating Maritime Into STEM Courses



A Guide for K-12 Educators



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## THE NEED

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Maritime is the backbone of our nation's global trade, pivotal to our domestic "blue highway" shipping industry, critical to supporting our nation's military and security, and one of the largest employers in the U.S. Yet it is an often overlooked and little understood industry; it offers students tremendous STEM-based career opportunities.

Incorporating maritime into your STEM courses can:

- raise students' awareness of this vital national industry,
- equip them with industry-validated knowledge and skills, and
- encourage them to pursue a career pathway early on in their academic career.

This paper provides educators with:

- deep background on the industry
- reasons to incorporate maritime into STEM courses
- creative ideas and approaches to incorporating maritime STEM for elementary, secondary and post-secondary level students
- resources to implement maritime inclusion in STEM courses

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*The Southeast Maritime and Transportation (SMART) Center is one of only 39 National Science Foundation Advanced Technological Education (NSF ATE) centers in the U.S. It is the only center focused solely on increasing the number of technicians in the maritime and transportation industry. This material is based upon work supported by the National Science Foundation under Grant No. DUE-1003068. Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.*

# WHAT IS MARITIME?

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America's maritime industry is made up of three primary sectors:

1. Shipbuilding and Repair – Skilled craft technicians work in shipyards and marinas of all sizes across the U.S. building, repairing, maintaining and modernizing our nation's fleet of military, merchant marine (non-military) and pleasure craft vessels. The average income for these industry jobs - \$73,000 - is 45% higher than the national average.
2. Port Operations and Maritime Logistics - There are 360 public and private ports in the U.S. facilitating the import-export business and domestic movement of goods which is the backbone of our nation's economy. The average salary of skilled craft and professional port-related jobs is \$46,300. These ports support 13 million jobs and according to American Association of Port Authorities (AAPA) President, Kurt Nagle, "the U.S. could see an increase of 3.5 million jobs."
3. Vessel Operations – This sector includes the movement of cargo (by container ships, roll-on/roll-off (Ro-Ro) vessels, barges carrying breakbulk on inland and near-shore waterways) and passengers (by ferries, cruise ships). Seagoing vessels represent the single largest mode of transportation for our country's international trade. Each year over 40,000 vessels move more than 2.3 billion tons of domestic and international cargo worth nearly \$2 trillion across 25,000 miles of domestic waterways. In 2011, the average annual wage for seafarers (\$43,000) was 75% higher than that for other transportation workers; over the last five years, seafarer wages have increased by 22% compared to 12% for other transportation workers and 15% for all U.S. occupations. Technicians with seagoing skills, competencies and U.S. Coast Guard (USCG) credentials are needed to operate, repair and maintain highly-technical deck and engineering department equipment as well as facilitate movement of offshore materials.

Combined, these three industry sectors generate enormous revenue for both our nation as a whole and individual states that have a large numbers of maritime industry employers. Overall the industry represents an annual economic impact of \$92.5 billion to our country's Gross Domestic Product (GDP), generating \$29 billion in wages and \$10 billion in tax revenues annually. Nearly 500,000 Americans are employed in these industry sectors.

Above all maritime is a STEM-based industry. Within every maritime industry sector there are numerous jobs that require workers to have STEM-based knowledge and/or experience. By simply breaking the industry down into skilled technical occupations, vessel operations occupations and professional (“white collar”) occupations it’s easy to see the wide variety of jobs that are all heavily STEM-intensive.

#### Skilled Craft STEM-Based Jobs

- Welders
- Electricians
- Machinists
- Painters/composites Technicians
- Quality Assurance Technicians
- Riggers
- Engineers
- Mechanic
- HVAC Technician
- Plumber
- Pipefitter
- Carpenter/Shipfitter



#### Vessel Operations STEM-Based Jobs

- Deckhand
- Tankerman
- Mate
- Pilot
- Captain



#### Professional STEM-Based Occupations

- Marine Engineers
- Marine Architects
- Purchasing Agents
- Planners/Estimators
- Project Management/Supervisor
- Logistics Analysts

# WORKFORCE CHALLENGES

Maritime industry employers are located in almost every state in the U.S. They are densely located in states that border the Atlantic Ocean, Pacific Ocean and Gulf Coast of Mexico – primarily for international shipping as well as near-shore operations supporting offshore oil and gas production companies - as well as states through which the Mississippi River and connected inland waterways flow, moving goods between American cities.

Maritime employers provide a wide range of technically-challenging and good-paying careers. For example maritime industry workers in Washington State earn on average \$70,800 – nearly 36% more than the average worker's income of \$52,000.

However, the industry is facing a critical talent pipeline shortage. The average maritime industry worker is at or within 3-5 years of retirement age. The entire industry is facing a significant “silver tsunami” as older workers leave the workforce taking decades of experience and knowledge with them. Unfortunately the exponential growth and focus on knowledge and service industries as well as the educational focus on guiding all high school students into a four-year college degree pathway over the past 30-40 years, has created a steadily shrinking infill of talent for the maritime industry workforce pipeline.

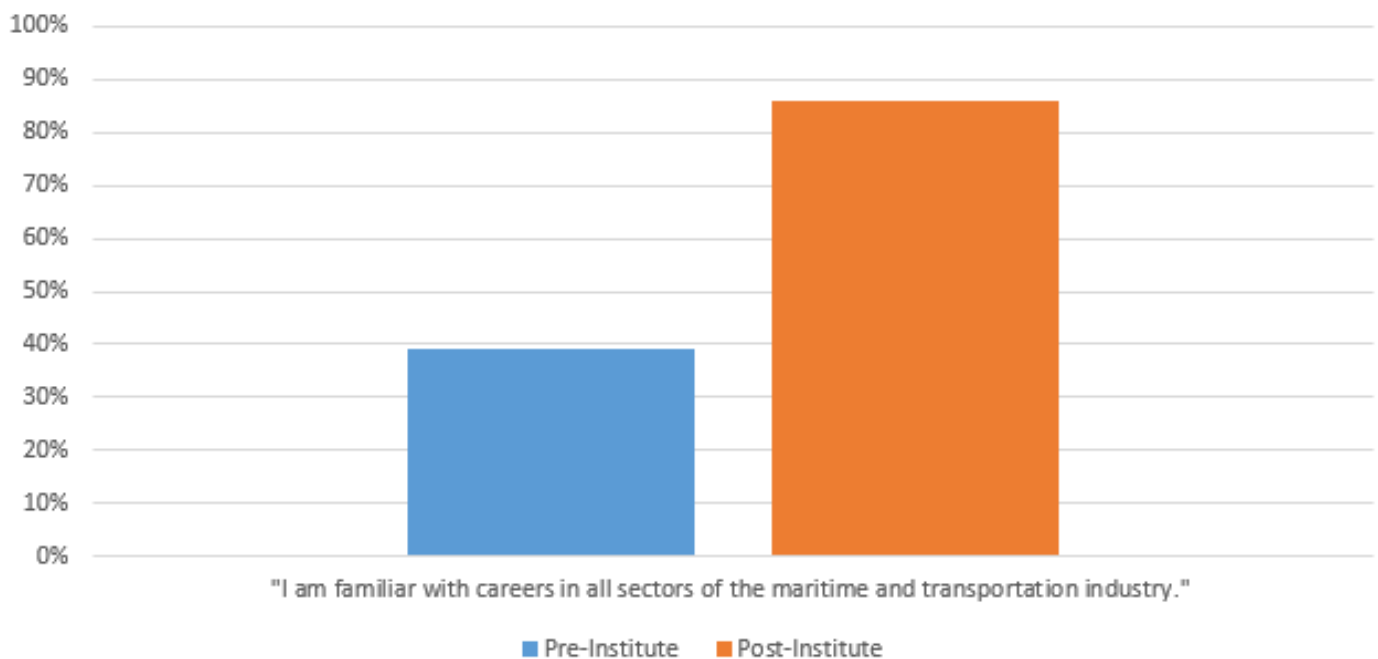
At the same time, today's maritime workplace has undergone rapid technological advancements. Most educators and student influencers (guidance counselors, career coaches, teachers, and parents) have an outdated paradigm of maritime industry work and workplaces.

Today's maritime industry technicians are required to demonstrate increasing levels of proficiency with technical knowledge and skills. Tour any modern shipyard and you're likely to see technicians using AutoCad and 3-D modeling software to design piping and HVAC systems, and technical software and computer programs to design shipboard fluid systems, propulsion and auxiliary systems. Computer proficiency is generally required for all technician-level positions.



Compounding hiring difficulties for maritime employers is the general lack of industry career awareness by both students and student influencers. Through the SMART Center's annual Summer Maritime and Transportation Institute, even educators who lived and worked within a 50-mile radius of major maritime employers recorded less than a 40% awareness of the industry or its careers prior to the Institute. Fortunately the intensive week-long Institute has consistently succeeded in significantly raising participants' industry and career awareness as measured through pre- and post-Institute surveys. For example through the 2011 SMART Institute educator awareness rose by 122.58%; over five years of Institutes participants' awareness increased on average 68.2%.

2011 SMART Institute Survey - Career Awareness



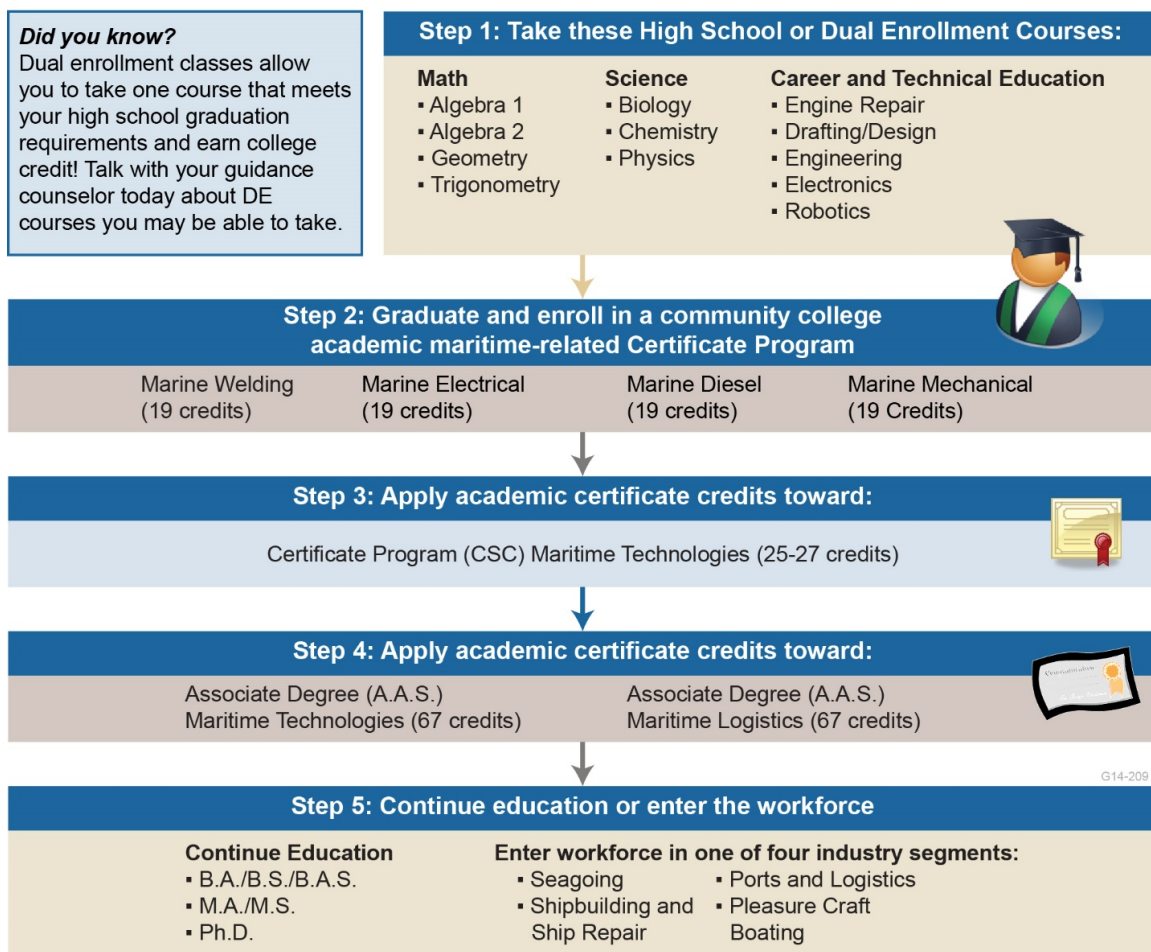
## LACK OF CLEAR PATHWAYS

Topping off the industry pipeline challenge there are few clear standard career pathways from high school either directly into the industry or to post-secondary education and employment. However with the new focus on creating "guided pathways" at the community college level there is an opportunity to utilize successful models of integrating maritime into a 2+2+2 pathway that begins with high school dual enrollment courses through 2-year stackable college certificates and degree programs that can articulate to a 4-year degree program.

The purpose of guided pathways is to change the trajectory of poor completion rates at the community college level. Currently fewer than four of every 10 enrolled students complete any type of degree or certificate within six years. By creating a more structured, coherent set of pathways, community colleges can more successfully inform and lead students to academic credential attainment in programs that lead to job placement. Guided pathways – particularly pathways that begin with a dual enrollment component at the high school level – are ideal for producing the type of educated, skilled technicians needed in the maritime industry.

The SMART Center’s host institution Tidewater Community College (TCC) has a solid guided pathway program that has been shaped by deep employer involvement to ensure curriculum alignment and embedded industry credentials. The SMART Maritime Technologies Pathway at TCC exposes students to the industry beginning in high school through (1) dual enrollment courses, (2) linked 2-year college certificates with embedded industry credentials that lead to an A.S./A.A.S. degree and articulate to a 4-year B.S. degree, and (3) teacher and student influencer resources provided through the SMART Institute and online through the SMART Center website.

**Get on the SMART Career Pathway from High School to the Maritime and Transportation Industry!**



# CORE STEM HIGH SCHOOL COURSES

Regardless of the maritime industry sector students may be interested in pursuing, there are core STEM courses that employers and educators have identified as critical to preparing prepare students for either immediate employment or enrollment in maritime technologies-related post-secondary programs.

## Math

Geometry, Trigonometry,  
Algebra, Calculus, Statistics

## Science

Engineering, Robotics,  
Chemistry, Physics,  
Computer Simulation,  
Computer-Aided Design



# BENEFITS OF INTEGRATING MARITIME IN STEM COURSES

There are numerous positive reasons to integrate maritime industry information including career information into your STEM courses:

1. Increased Motivation for Learning – One of the most common complaints teachers regularly hear from students is “how will I ever use this in real life?” The implication is that students don’t view something as worth their time to learn if they don’t see the long-term application to their personal lives. By incorporating actual job information and career pathways into curriculum teachers can create direct connections for students between what they’re studying and real-life applications.
2. Meeting National and State Standards – Increasingly Common Core and other national or state STEM standards emphasize integration of real-life skill, knowledge and application into core academic areas. Incorporating maritime and transportation industry background, real-life scenarios and career information into STEM lessons can help meet those standards while providing students with interesting and relevant future occupational information.



3. Introduction of “Soft” or Employability Skills- Because career information incorporation is typically done in the context of project-based learning (PBL) which often involves activities beyond reading and writing, you can foster and raise students’ awareness of critical “soft” or new hire skills sought by employers including:

- Communication skills
- Teamwork
- Interpersonal skills
- Work ethic

4. Lesson Extension – Creatively incorporating real-world industry and career information into a STEM lesson plan provides you with the opportunity to expand beyond the original subject area to other core academics such as language arts and social studies. For example, if you included information on vessel operations careers in a science lesson plan on estimating depth of water level you could extend the concepts by assigning your students to read a portion of maritime literary classics such as Carry On Mr. Bowditch or Moby Dick.

5. Industry Engagement – With a looming workforce shortage employers are eager to connect with students as early in their schooling as possible. It’s in their self-interest to come alongside educators and school systems to ensure that students are gaining the knowledge and skills they’ll need to succeed in the workplace. By connecting with local employers you can benefit from their:

- Validation and feedback for existing curriculum or modules
- Input and assistance in co-designing new curriculum
- Material support (in-kind donations)
- Financial support (direct funding or grants for professional development, purchasing materials, paying for field trip expenses, etc.)



# VEHICLES TO INTEGRATE MARITIME INTO STEM COURSES

## 1. SMART Center Digital Resources

The SMART Center provides a wide array of digital maritime information, educational tools and career awareness materials that can easily be incorporated into existing lesson plans or used as a foundation to create new classroom STEM materials.

The SMART Center website (<http://www.maritime-technology.org/>) was built specifically to provide educators and student influencers with free tools and resources to guide students into the maritime industry.

Educators can use the site to access and download:

a. Digital Career Guide – The SMART Center Career Guide and Resource Handbook is a 120-page publication that provides:

- Deep overviews of each industry sector
- Feature stories about current employees working in the industry
- Information on maritime post-secondary education providers
- Pre- and post- assessments to gauge student learning

Educators can also order print copies of the handbook from the SMART Center website. The handbook is part of a larger Educator Toolkit which also includes a set of visual career pathway tools and DVDs of the 20 2-minute “Make the SMART Choice” videos about academic pathways and careers in every industry sector.

b. “Make the SMART Choice” DVD Segments – The SMART Center has produced more than 20 2-minute videos featuring industry sectors as well as current employees working in those fields.

c. SMART Website-Based Repository – The SMART Center website hosts the only maritime and transportation industry-specific repository connected to the National Science Digital Library (NSDL). The repository includes materials produced both by the SMART Center and SMART Center Institute alumni as well as curated materials from industry leaders including employers, trade associations and industry-connected educational institutions. The site provides:

- Modules
- Labs
- Science fair experiments
- Industry research
- Curriculum
- Presentations for classroom use

## 2. National Courses/Curriculum

There are several national courses, programs and curriculum that educators can integrate directly into their existing STEM courses or utilize to create entirely new programs of study:

- MARAD (U.S. Maritime Administration) national high school curriculum - The U.S. Maritime Administration has created a program of studies ([https://www.marad.dot.gov/wp-content/.../Maritime\\_High\\_School\\_Curriculum.pdf](https://www.marad.dot.gov/wp-content/.../Maritime_High_School_Curriculum.pdf)) for a maritime-based high school program, “structured to provide knowledge about the maritime industry and demonstrate career opportunities available to high school graduates within the industry.” The program outline lays out curriculum for courses that should be offered at each high school grade level to complement a school's existing program of studies and suggestions for advanced career track projects (i.e. capstone projects, internships, etc.). The successful Port of Houston Partners in Maritime Education (PHPME) program has significantly and rapidly increased the number of students on a maritime industry career pathway after implementing MARAD curriculum at six local high schools. According to the Maritime Primary and Secondary Education Coalition (MPSEC) more than 67 schools in 18 states offer maritime programs.



*Numerous schools across the U.S. offer academically rigorous programs based on maritime education and inclusion in core subjects. Schools include (clockwise top right): Port of Los Angeles High School (San Pedro, CA), Maritime Academy of Toledo (Toledo, OH), New York Harbor School (Brooklyn, NY), Jefferson High School Magnet Program (Tampa, FL)*



- Project Lead the Way – PLTW provides educators with relevant, problem-based learning programs that challenge students to explore real-world challenges in computer science, engineering and other STEM-related pathways. Through its high school level Engineering program (<https://www.pltw.org/our-programs/pltw-engineering>) students learn to solve problems and think critically about issues that are easily transferable to the maritime and transportation industry.

- NCCER Maritime Skilled Trade Curriculum – NCCER (National Center for Construction Education & Research) provides industry-validated curriculum geared primarily for post-secondary level students in key maritime industry occupations such as:

- o Structural Fitter
- o Pipefitter
- o Rigger

### 3. Project-Based Learning Resources

Incorporating project-based learning is one of the easiest ways to begin integrating maritime into your STEM curriculum. Project-based learning is ideal for numerous reasons but particularly because the teaching method incorporates key 21st century workplace skills such as:

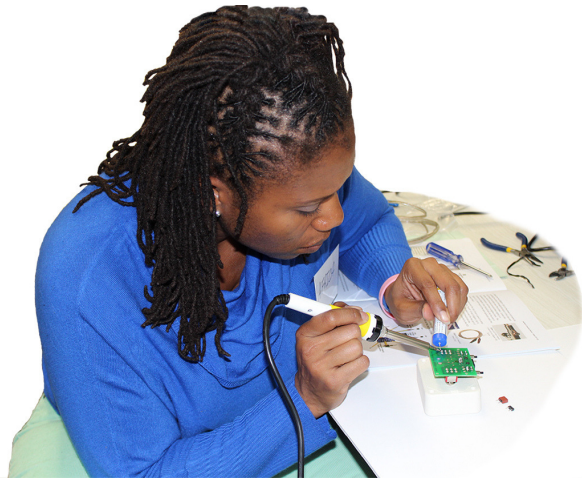
- Critical thinking
- Problem solving
- Creativity and innovation
- Collaboration, teamwork and leadership
- Cross-cultural understanding
- Communication and media literacy
- Computing and IT technology
- Career and learning self-direction



In addition to the SMART Center website which provides many PBL materials, there are numerous websites that provide PBL resources and materials that could easily be adapted for maritime and transportation-related lessons and projects including:

- Virginia Institute of Marine Science (VIMS) Bridge Website ([http://www2.vims.edu/bridge/search/bridge1output\\_menu.cfm?q=lesson&Audience=school](http://www2.vims.edu/bridge/search/bridge1output_menu.cfm?q=lesson&Audience=school))
- SEA Semester from Woods Hole Oceanographic Institute (<https://www.sea.edu/academics/k-12>)
- NOAA Ocean Explorer Modules and Lessons (<http://oceanexplorer.noaa.gov/edu/welcome.html>)
- New Jersey Sea Grant Consortium (<http://njseagrant.org/education/resources-for-educators/lesson-plans/>)  
note: this is primarily focused on marine ecology but that can be applied to port and maritime environmental work
- Buck Institute for Education ([www.bie.org](http://www.bie.org))
- Houghton Mifflin PBL Space (<http://college.cengage.com/education/pbl/index.html>)
- High Tech High (<https://www.hightechhigh.org/student-work/student-projects/>)
- Global School Net ([www.globalschoolnet.org](http://www.globalschoolnet.org))
- Intel Teach Elements (<https://www.intel.com/content/www/us/en/education/k12/teach-elements.html>)
- Virtual Schoolhouse (<http://www.virtualschoolhouse.net/projects.htm>)
- Learning Reviews (<https://www.learningreviews.com/educational/free-teaching-resources/project-based-learning-lesson-plans-examples>)
- PBL Lab (<http://pbl.stanford.edu/index.html>)
- Teachers Pay Teachers (note: this site offers individual resources for a small fee) (<https://www.teacherspayteachers.com/Browse/Type-of-Resource/Lesson-Plans-Bundled/Search:project+based+learning>)

4. Sea Perch – Sea Perch ([www.seaperch.org](http://www.seaperch.org)) is an underwater robotics program that provides students with an excellent, hands-on STEM-based construction project to build a remotely operated vehicle (ROV). The project can be done in class or in an out-of-school or after-school setting. Students can compete in a series of local and regional competitions to qualify for the national competition. The kit comes with all necessary materials, tools and curriculum. While it is a for-fee resource there is the opportunity to apply for an online grant to defray the cost of the program.



5. MARAD/Propeller Club “Adopt a Ship” - In addition to providing a national high school curriculum outline for maritime programs, MARAD offers educators a unique “Adopt a Ship” project in conjunction with The Propeller Club (<https://www.marad.dot.gov/education/adopt-a-ship-program/>). The program includes the application, a “how-to” manual for teachers, glossary of maritime terms and suggested classroom activities.

6. Special Events – Providing students with unique opportunities that supplement and extend their in-class learning can bring the maritime industry to life. Consider:

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- Guest Lecturers – Invite a local industry employer or worker in to speak to your class. Local maritime employers or industry trade associations often have speaker bureaus or an informal list of people who you could ask to come speak with your students. Guest speakers typically:

- o Provide insight on daily job tasks, working conditions, etc.
- o Describe the educational pathways leading to employment
- o Describe career pathways for upward mobility within their company
- o Bring a visual presentation and perhaps handouts
- o Bring samples of materials/tools used on the job site
- o Provide a time for student Q&A

- National Maritime Day – National Maritime Day is recognized annually on May 22. MARAD holds an annual celebration and shares web-based resources and information on how educators can recognize the day with creative classroom events. Check with local ports, museums and maritime-related sites for special events.

# OUTSIDE THE CLASSROOM

The most effective way of giving students a real-life idea of a future STEM-based maritime career is to literally get out of the classroom and into the workplace. There are numerous ways to give students a taste of what maritime industry career options could interest them.

Industry Worksite Tours - The most direct way to help students understand the connection between the classroom and a future career is to tour a local maritime employer worksite. While there may be restricted areas due to security or safety concerns, employers are eager to work with local school systems to engage students.

If your school is located near a U.S. Coast Guard (USCG) base reach out to learn how your school group could schedule a field trip. Visit <https://militarybases.com/coast-guard/> for a list of USCG bases across the U.S.

For more information on developing effective, sustainable partnerships with industry employers visit the SMART Center website ([www.maritime-technology.org](http://www.maritime-technology.org)) to download the “Creating Education-Industry Partnerships in Maritime” booklet.

Non-Employer Field Trips – There are related field trip possibilities that can give students a glimpse into STEM-based maritime careers such as:

1. Maritime Museums –  
There are numerous maritime museums across the U.S. These sites can help you find one near you:

o List of U.S. Maritime Museums ([https://en.wikipedia.org/wiki/List\\_of\\_maritime\\_museums\\_in\\_the\\_United\\_States](https://en.wikipedia.org/wiki/List_of_maritime_museums_in_the_United_States))

o Maritime Museums (<http://www.maritimemuseums.net/>)

If you don't live near a maritime or marine museum check with any local museum to see if they have plans to bring in a related exhibit, or if the curators there can help you access maritime related materials for classroom use.



There are also numerous online museum exhibits and resources to incorporate into your STEM courses including:

- o Council of American Maritime Museums ([www.councilofamericanmaritimemuseums.org](http://www.councilofamericanmaritimemuseums.org))
- o WebExhibits ([www.webexhibits.org](http://www.webexhibits.org))
  
- o International Council of Maritime Museums (<http://icmmonline.org/>)
  
- o Maritime Heritage – International Museums (<http://www.maritimeheritage.org/maritime-museums.html>)

2. Marine Environmental Centers – Increasingly ports and maritime employers (shipbuilding and repair companies, vessel operations sites, etc.) are committing resources to ensure that their worksite activities do not compromise local water (i.e. bay, harbor, river, ocean) quality. Marine environmental centers typically provide student groups with hands-on activities to learn about the ecology of local water sources and what maritime companies can do to preserve water quality.

## **EXTENDED LEARNING**

There are numerous extended maritime learning opportunities outside the classroom that can build on the maritime foundation you have laid for your students such as:

- Summer Camps - Look for local marine-themed summer camps or STEM camps that incorporate a maritime element. If you do not have a good working relationship with local employers and maritime-connected resources you may want to create your own. Download a copy of the “Connecting Summer Camps to Career Pathways” paper on the SMART Center website for tips and a model from San Jacinto College.
  
- Internships – Many maritime employers, museums, and trade associations offer summer internships for high school and post-secondary students. These internships – either paid or unpaid – provide students an immersive opportunity for students to explore the industry and evaluate whether or not they’d like to pursue academic and career pathways in that sector after graduation. Contact your local maritime-related trade association, chamber of commerce or major employers to compile a list of opportunities for your students or explore opportunities posted on <https://www.edumaritime.net/career-internships>.



# SPOTLIGHT: PORT OF LONG BEACH ACADEMY INTERNSHIP PROGRAM

Recognizing the need to partner with local educators to reach, equip and attract the next generation of port workers, the Port of Long Beach created a partnership with the Long Beach Unified School District; the result was the Port of Long Beach Academy of Global Logistics (AGL) at Cabrillo High School. AGL combines academic curriculum with industry-relevant information to support academic and career development.

The program is part of the Long Beach College Promise (“The Promise”) which is a partnership between Long Beach Unified School District, Long Beach City College (LBCC), California State University Long Beach (CSULB) and the City of Long Beach. These partners have committed to "making higher education attainable for every student" through a wide variety of programs and benefits including a tuition-free first year for incoming LBCC students, guaranteed CSULB admission to qualified Promise students, and outreach services starting in 6th grade.

AGL students learn about and engage with the port and marine operations sector of the maritime industry and are able to easily move into a related academic and career pathway including certificates, certifications and degrees offered by LBCC and CSULB.

One component of the AGL program is a paid 8-week summer internship program for selected juniors and seniors. In addition to hands-on work students participate in mentoring sessions and earn a Personal Enrichment Training Certificate from the Pacific Gateway’s Youth Opportunity Center for completing curriculum in key “soft skills” and “life skills” areas such as workplace ethics, career exploration and financial literacy.



## National Standards Resources

There are several national standards resources that can help you align maritime material with existing STEM curriculum and/or help you create new material for classroom implementation. Check out:

- a. Common Core State Standards Initiative – Specific high-quality math standards by grade level (<http://www.corestandards.org/Math/>)
- b. Next Generation Science Standards (NGSS) – Grade level K-12 science content standards
- c. National Council of Teachers of Mathematics (NCTM) - Focal Points  
NCTM provides in-depth principles and standards for school mathematics by grade level for a nominal fee (<http://www.nctm.org/Standards-and-Positions/Principles-and-Standards/>). In addition NCTM's Curriculum Focal Points (<http://www.nctm.org/curriculumfocalpoints/>) are mathematical topics that have been identified as critical for each grade level (pre-K through Grade 8) by NCTM.
- d. National Research Council (NRC) - National Science and Engineering Standards (NSES). The NSES offers free downloadable resources (with creation of a Free MyNAP Account) on standards for math and science education (<https://www.nap.edu/topic/350/education/math-and-science-education>)
- e. International Technology and Engineering Education Association (ITEEA) and National Association of Educational Progress (NAEP) - provides a complete set of free Technological Literacy Standards (<https://www.iteea.org/10/39197.aspx>)



# SPOTLIGHT: PORT OF HOUSTON PARTNERS IN MARITIME EDUCATION (PHPME)

The Port of Houston Partners in Maritime Education (PHPME) program is a high school through graduate school career pathway equipping students with the education, skills and credentials needed to succeed in the maritime industry. The program was launched in 2009 to address the local maritime industry's aging workforce. Six high schools in four school districts adjacent to the Houston Ship Channel offer the pathway and four post-secondary institutions (both two-year and four-year) have linked pathway degree programs.

Students gain deep awareness of maritime industry careers, learn valuable STEM-based industry skills and knowledge, use state-of-the-art simulation equipment, and earn industry-valued credentials and dual credit. Outside the classroom students tour industry worksites, do paid internships, and earn college scholarships.

The four-year curriculum is based on the MARAD. The curriculum was reviewed and approved by the Texas Education Agency and is available for any Texas public high school to offer. All instructors have extensive experience in the maritime industry. The pathway introduces students to seven expanded industry sectors:

- 1) Maritime Logistics
- 2) Piloting & Deck Operations
- 3) Maritime Human Resources and Business Management
- 4) Maritime IT Systems
- 5) Marine Engineering Technology
- 6) Maritime Systems Engineering
- 7) Fish & Wildlife Resources Management

High school students earn dual credit toward a degree program at one of the two-year or four-year college partners:

- Houston Community College: Academic certificates and A.A.S. degrees in Logistics and Global Supply Chain or Maritime Specialization program; students can also earn APICS Global Logistics Associate Certification or MSSC Certified Logistics Technician Certification.
- San Jacinto College (SJC): Associate's degrees in Maritime Logistics and Maritime Technology which combines U.S. Coast Guard and Standards of Training Certification and Watchkeeping (STCW) with the academic rigor of a two-year college degree; students can earn numerous critical USCG credentials and certifications.

- Texas A&M Maritime Academy at Galveston (TAMUG): Maritime-related undergraduate degrees in science, engineering, business or transportation and professional industry licensing. Graduate programs in Marine Biology, Marine Resources Management and Maritime Administration and Logistics.

- Texas Southern University (TSU): Port Houston partnered with TSU to develop a four-year degree in Maritime Transportation Management and Security; it addresses three nationally-recognized priorities—logistics, security and environment—in a single curriculum. It is Houston’s first university degree program in the field and the first such program at any historically black college and university in the country. PHPME students can earn scholarships to TSU for the Maritime Transportation Management and Security program.

The Ash Center for Democratic Governance and Innovation at Harvard University’s John F. Kennedy School of Government recognized the PHPME program with a “Bright Idea” award in 2015. The PHPME board enjoys broad community support with several community and employer partners assisting in developing and sustaining the program including:

- participating in the program’s annual Maritime and Logistics Youth Expo where they engage directly with students and raise awareness of post-secondary maritime education programs and careers through print and digital materials, discussion and hands-on experiments and demonstrations

- serving on the PHPME Speaker’s Bureau and regularly present at school career days to educate students about the industry

- providing funds for schools to purchase needed training equipment and scholarship funds to students pursuing a post-secondary maritime education. Employers have donated training equipment to maritime program high schools and colleges including diesel engines for marine machine repair work, a bridge simulator, and an on-land barge setup.



In addition the 5-course high school pathway curriculum has embedded career guidance and advising information, tools and resources so that students receive a true overview of all facets of maritime industry to help them choose a post-secondary academic or employment option that best meets their interest and needs.

## Results

The PHPME program was launched with the first class in 2009. One hundred seventeen seniors were in the program's first graduating class of 2013. Since then approximately 500 high school students have graduated from the program. There are 1200 students enrolled in the program between the six participating high schools for the 2017-18 school year.

San Jacinto College graduated its first students from the credit mariner pathway program which is part of the PHPME pathway in 2017. The 33 graduates earned both an AAS degree and mariner-required industry certifications and credentials from the USCG. San Jacinto has recorded a 300% growth in its for-credit maritime technologies program enrollment as a result of the program's concerted career awareness marketing campaigns.



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