U.S. Department of Education
Institute of Education Sciences
SMALL BUSINESS INNOVATION RESEARCH PROGRAM

PHASE I PROGRAM SOLICITATION FOR FY 2018
REQUEST FOR PROPOSALS
RFP Number: 91990018R0006

ChesapeakeSTEM

PRIORITY 1: Education Technology Products For Use by Students or Teachers (or other Instructional Personnel) in Authentic Education Settings

ISSUE DATE: December 11, 2017
REVISED CLOSING DATE: February 12, 2018
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Feb 9, 2018
Eric Greene, President

Key Information for the Phase I Proposal in response to Solicitation 91990018R0006

A) Project Title: ChesapeakeSTEM
B) Name of the small business: Eric Greene Associates, Inc.
C) Small Business Address and Phone: 86 River Drive, Annapolis, Maryland, 2403 410-263-1348
D) Company Website URL: EricGreeneAssociates.com, ChesapeakeSTEM.org
E) Typed name, title, contact information (address, phone, and email), signature, and date of signature for the Principal Investigator:

Eric Greene, President date: February 8, 2018
Eric Greene Associates, Inc.,
86 River Dr., Annapolis, MD 21403
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F) Typed name, title, contact information, signature, and date of signature for a representative authorized to represent the small business concern in negotiations:

Eric Greene, President date: February 8, 2018
Eric Greene Associates, Inc.,
86 River Dr., Annapolis, MD 21403
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G) List the names and professional affiliations for all key members of the project team
   - Eric Greene, Eric Greene Associates, Inc,
   - Sarah Krizek, Annapolis Maritime Museum
   - Billy Schmidt, Modern Savage Design

Priority

√ PRIORITY 1: Education Technology Products For Use by Students or Teachers (or Other Instructional Personnel) in Authentic Education Settings

Technical abstract

In Maryland and Virginia, the states' economies are closely tied to the health of the Chesapeake Bay. The area needs future engineers and scientists to solve the challenges that 500 years of developmental stress has put on the Bay. ChesapeakeSTEM is designed to be an interactive web-based teaching aid to get kids visually excited about how engineering is applied on the Bay.

The mission of ChesapeakeSTEM.org is to educate students about engineering solutions to the challenges facing the Bay. Existing programs that focus on ecology and biology have made great progress to help us understand the Bay's ecosystem. However, some young people are more inclined to designing and building things – future engineers.

Information modules are being developed focusing on engineering disciplines that directly and indirectly influence the health of the Bay

ChesapeakeSTEM explores engineering disciplines, such as Civil Engineering or Renewable Energy with examples taken from issues confronting the Bay. The content is easily scrolled on a smartphone. SBIR Phase I research will:

- Add additional subject areas - Expand C-STEM subject areas from 5 to 15
- Develop laser-cut wood construction kits to accompany lessons
- Enhance website interactivity - Develop interactive online research and testing

Commercial potential

ChesapeakeSTEM.org is based on the open courseware model, making resources free over the Internet. This ensures access for less affluent students. There are many mechanisms for commercializing the site with sponsorships and ads but we will resist this temptation and instead earn a small profit on lesson kits built from laser-cut plywood.

ChesapeakeSTEM is focused on the Chesapeake Bay but the format is conducive to application in other regions of the country that closely identify with a beautiful natural resource, such as San Francisco Bay, the Rock Mountains or the Great Plains. Through professional societies, local STEM lecturers will be recruited to give STEM lectures that address regional environmental challenges. Phase II research will expand the ChesapeakeSTEM teaching model nationwide with STEMtalks.org.

Project Narrative – Technical Content

Abstract

The need for a workforce trained in STEM (Science, Technology, Engineering and Math) has never been greater. The concept of ChesapeakeSTEM is to engage kids to develop engineering solutions to challenges threatening the Chesapeake Bay. This allows them to associate STEM careers with protecting their environment – the Bay.

ChesapeakeSTEM.org is designed for smartphone and tablet use, with an emphasis on graphics and the device swipe feature for quick navigation. A limited number of subject modules have been developed to date. The proposed research will support development with an additional ten STEM subjects.

Early discussions with educators revealed the need for classroom activities to support media lessons. Since STEM is designed for future engineers, support activities are focused on building things. The Phase I research will support the development of teaching aids laser cut from thin plywood. This technology can produce complex geometries yet pays homage to IKEA for transportation efficiency. It is also a desirable Manufacturing Technology skill-set that can be mastered by urban youth to support the project.

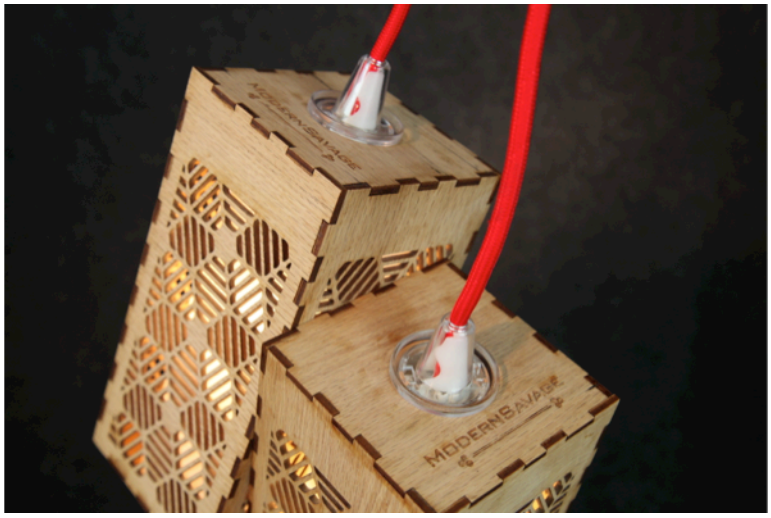


Figure 1. Hanging lamps designed, laser cut and assembled by ModernSavage Design.

A final project goal will be to develop a stand-alone online lesson tool based on 15 ChesapeakeSTEM modules. This will allow students to conduct further research on a topic or interactively solve problems.

Technical Content

ChesapeakeSTEM.org exposes kids to engineering solutions for challenges facing the Chesapeake Bay. The proposed research utilizes a classroom environment to present developed media and fabrication projects, all supported by smartphone-accessible content. Distance learning potential for ChesapeakeSTEM.org will be realized when the interactive features (further research, testing) are fully developed.

Phase I work plan

The phase I work plan is designed to make ChesapeakeSTEM.org a standalone distance-learning platform with ten additional STEM subjects covered. The development of the laser-cut lesson kits introduces a strong manufacturing component to the research.

Task 1. Develop additional teaching modules (10)

During the research period, ten additional learning modules will be developed that explore other STEM disciplines that impact the Chesapeake Bay. The Principal Investigator will use the same process used to develop the initial topic areas, which averaged about 120 man-hours each to produce. Engineering and related professional societies will be approached for topic suggestions.

The lessons are built using a PowerPoint platform stressing visual graphics to interest and maintain a student's attention. The pages are then used to create subject-specific web pages. The entire web page can be accessed via finger swiping navigation. The PowerPoint presentations also support STEM Talks and classroom instruction.
Additional reference files in adobe Acrobat (.pdf) format are also developed for each STEM topic.

Task 2. Design activity kits based on laser-cut flat stock technology

Initial ChesapeakeSTEM feedback from educators indicated that hands-on projects to reinforce the lesson are valuable, especially in the museum teaching environment. Projects that students can build are especially appropriate for kids inclined towards STEM topics.

The lesson kits will be designed to be built from wood pieces manufactured from thin plywood using laser-cutting technology. This manufacturing process is very scalable from prototype to production. Since the technology is completely computer-aided design (CAD), development of prototypes is quick.

Task 3. Present C-STEM Talks at Annapolis Maritime Museum (AMM) and AACO Public Schools

The Principal Investigator will work closely with the Annapolis Maritime Museum on the presentation and evaluation of presentations to students. The PI will also present the material as a guest speaker at Annapolis High School. We will focus initially on the museum environment, because the instructional format is more flexible than within a public school and the AMM is serving as a project partner to evaluate and improve ChesapeakeSTEM.

The presentations will be conducted using both a lecture and interactive format, depending upon the target audience. In the lecture format, local subject matter experts recruited via their professional society will make the presentations. Traditional educators will be used for the interactive presentations, using the ChesapeakeSTEM material as a teaching aid.

Task 4. Develop stand-alone online lesson tool based on 15 ChesapeakeSTEM modules
ChesapeakeSTEM is a few steps away from being an effective distance-learning tool. The site is designed to encourage additional research in topic areas that interest the student or support classroom assignments. A methodology for using the Internet to do scholarly research rather than clicking on suggested links will be established.

Interactive testing based on multiple-choice questions is rather straightforward to implement on the website. It is anticipated that included as a project deliverable will be a large quantity of multiple-choice questions for each topic. The questions can be based on ChesapeakeSTEM material or require the student to do further research.

Task 5. Revise education tools based on instructor feedback
Lesson material and presentation methodology will be revised on a continual basis throughout the contract period. Although we anticipate eventually having more presentations in the public school environment, the museum setting will be more intimate with less time constraints and therefore serve as the primary project test bed. With AMM as a project partner, in-depth program analysis can be achieved without asking public school teachers to add to their already heavy workload.

A two-camera recording of both the presentation and the student participation will be used to critique the lesson material and delivery. The design of the lesson aids that the students build will be an iterative process. The revised design will be documented in the final report and serve as the only non-free element of the STEM learning package. The kits can be sold to school districts or the design can be licensed for students to manufacture as part of a CAD/CAM training curriculum.

Task 6. Produce Final Report
The Draft Final Report will conform to APA style formatting. An electronic version suitable for annotation by commenter will be submitted. It is anticipated that the Government will review the Draft Final Report within fourteen (14) days of the receipt of the document for technical content compliance. The Final Report should serve as the final project milestone and will be developed in the following formats to ensure the instructional materials are disseminated to the widest possible audience.

a. Written Report
The Final Report will incorporate technical and editorial comments received from the Department of Education and the assembled Project Technical Committee.

b. Journal Paper
A draft article suitable for submission to a professional journal will also be developed. This article will summarize the major findings of the proposed research and advocate the value of the instructional material.

c. PowerPoint Presentation

A PowerPoint presentation providing an overview of the research will be developed and presented at the closing meeting. This presentation will also be suitable for presentation at educational conferences or symposia. The offeror has extensive experience conducting training seminars for industry and academia and would welcome the opportunity to promote the instructional material at any suitable forum.

Problem

Our kids are attached to their smartphone and tablets for social interaction and entertainment but the educational value of reaching an unlimited audience with visual learning content has been overlooked. This is especially true in the much-touted areas of STEM (Science, Technology, Engineering and Math).

The challenge for educators is to link the fantastic images that we see on the Internet with the real world environment. ChesapeakeSTEM.org is designed to show that there may be engineering solutions to environmental challenges with career paths closely aligned to subject lessons.

The product, its implementation, and the intended outcomes

ChesapeakeSTEM is geared towards middle and high school student, with a wider range of appeal to younger and older learners through it graphics-intensive format. The Internet-based platform is primarily focused on the student but the content also serves as lesson presentation material, either by traditional educators or by guest speakers. Guest speakers will be local professionals who would like to mentor their craft with students in their community.

The teaching aids developed to accompany the STEM lesson modules will for the most part, be built by students, especially in the museum-learning environment. The teaching aids will be constructed from laser-cut thin plywood pieces using non-toxic wood glue.

The primary platform for ChesapeakeSTEM is a smartphone or tablet. While ChesapeakeSTEM.org is a standalone resource, Internet access allow the student to conduct further research on presented topics. The PowerPoint presentations are also suitable for classroom presentation.

The ChesapeakeSTEM teaching modules are designed to be presented in a 60-minute format. 90-minute class periods would allow for a good question and answer period. Initial presentations in a classroom environment will provide feedback on how much classroom time is needed to deliver each 30-slide presentation. The sessions that involve building a teaching aid will last longer and may be first tried in the museum science-camp environment.

ChesapeakeSTEM is offered as open courseware, and is therefore free to all users. The resources required for implementation include a minimum of 60 minutes of classroom presentation time and whatever time it takes for instructors to familiarize themselves with the instructional material.

The intended outcome of the instructional program is to get kids excited about engineering careers than can help solve the problems facing the Bay. In the mean time, they also learn how to research STEM topics on the web in support of their interests or classroom assignments.

Theoretical and empirical support

The Internet is the most powerful teaching tool available to us today. Open Courseware is a concept being embraced worldwide to disseminate information. By offering ChesapeakeSTEM direct to kids on their smartphones, they can review the content at their own pace.

Related R&D by the project team

This proposal aims to add new and unique components to a prototype that already exists and is functioning. ChesapeakeSTEM.org has been developed around an initial core of five STEM subject fields: Aquaculture, Civil Engineering, Naval Architecture, Pollution Remediation and Renewable Energy.

ChesapeakeSTEM.org is currently functioning without any of the proposed interactive features. However, the lessons can currently be viewed and downloaded.

For a video demonstration of ChesapeakeSTEM.org visit https://youtu.be/kkziClZwXys

The current working prototype is in the developmental phase. Although a working prototype with five lesson modules has been released on the web, no formal launch at the institutional level has occurred yet.

The additional ten STEM subject modules and the enhanced web interactive features will bring ChesapeakeSTEM.org to a level of content that we feel is consistent with a full-semester high school level course.

Ensuring it stays academic

Many teachers have a zero-tolerance policy when it comes to phones out during class, since they assume—most of the time correctly—that their students are using them to text friends or update their various social media sites. But there's a simple way to ensure that students use devices for educational purposes: change the classroom dynamic from lecturing at the front of the room to having no traditional front of the classroom at all. During class, Ken Halla roams around the his ninth-grade World History and AP Government classroom helping students with their work, all the while overseeing everything to make sure that they're staying on task. "It's harder to do the negative behaviors when the phones are out and the teacher is walking around," he says. [http://www.nea.org/tools/56274.htm]

ChesapeakeSTEM.org is a unique learning platform because the wide-ranging STEM topics are all presented with respect to issues facing the Chesapeake Bay. Students can apply STEM problem solving to a place they call home and enjoy everday.

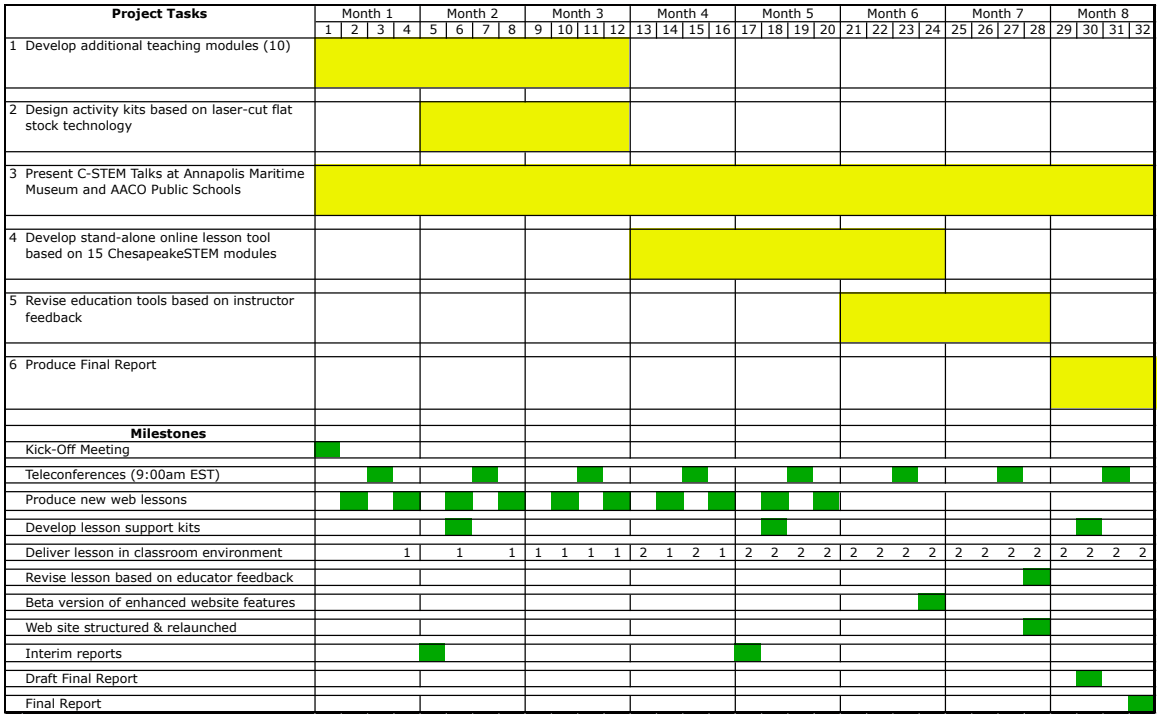
Potential commercial application

With fifteen STEM education modules completed and a fully interactive website, ChesapeakeSTEM only requires outreach to local professionals to deliver STEMtalks.org material across the nation. The endorsement letter from SNAME (see Section H.) shows how a volunteer team of mentors is available from the country's senior labor pool to serve as a guest speaker at local area high schools.

The commercial success of the research relies on the ingenuity and resourcefulness of the teaching aids, which will be manufactured to meet demand. The development of the teaching aids will be strongly based on CAD/CAM (Computer-aided design and manufacturing), which is a valuable skillset for today's manufacturing jobs.

Project timeline

The project tasks will occur mostly concurrently by the project team. The lesson modules will be developed on an ongoing basis over the 8-month period of performance. The lesson aids and website upgrades will progress concurrently. Feedback from lessons will happen as they are presented. The following illustration shows the project timeline and key milestones.



Development of the prototype

The ChesapeakeSTEM prototype will build upon the existing website by adding to and revising it throughout the 8-month contract performance period. The existing five lesson

modules will be expanded to fifteen. Because the Principal Investigator will be building the website, improvements to the user interface and content can occur on a continual basis as feedback from educators and students is received. Each lesson module is created in PowerPoint and formatted into a roughly 30-slide presentation complete with individual graphic element transitions. These can be presented to students either by the Principal Investigator in a TED Talk format or by traditional educators. All initial presentations will be videotaped and critiqued for refinement.

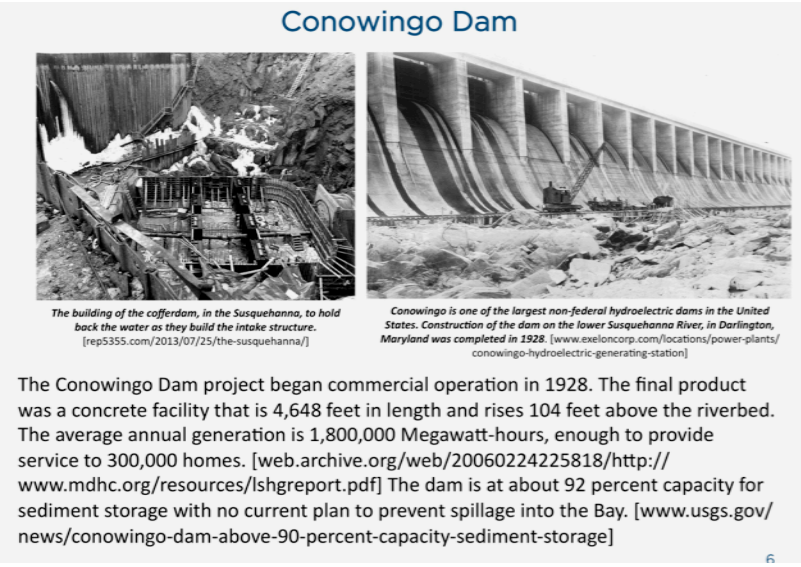
Teaching aids for the initial five subject areas will be developed using innovative computer-aided design (CAD) and computer-aided manufacturing (CAM). To simplify manufacturing and transportation, wood that can be recycled will be used to construct the teaching aids. Students will assemble various things from pre-cut wood kit pieces to support the lesson. Examples may include a boat to teach naval architecture principles or an apparatus for evaluating the drainage characteristics of various materials.

Presently, the website has additional reference material in .pdf form available at the bottom of each page. This encourages students to do additional research on topics of interest or as part of an assignment. ChesapeakeSTEM intentionally lists reference URL's rather than provide a link, which often distracts students. The refined prototype will have an enhanced reference capability that guides students on how to use existing Internet search tools for scholarly research. At the end of each lesson there are a page of questions related to the subject and another page on topics specific to the Chesapeake Bay. Currently, answers are expected in essay or discussion format. This section will be expended to include questions that can be answered interactively with the website, leading to an online testing capability.

Examples from the five STEM topics that have been developed to date follow.

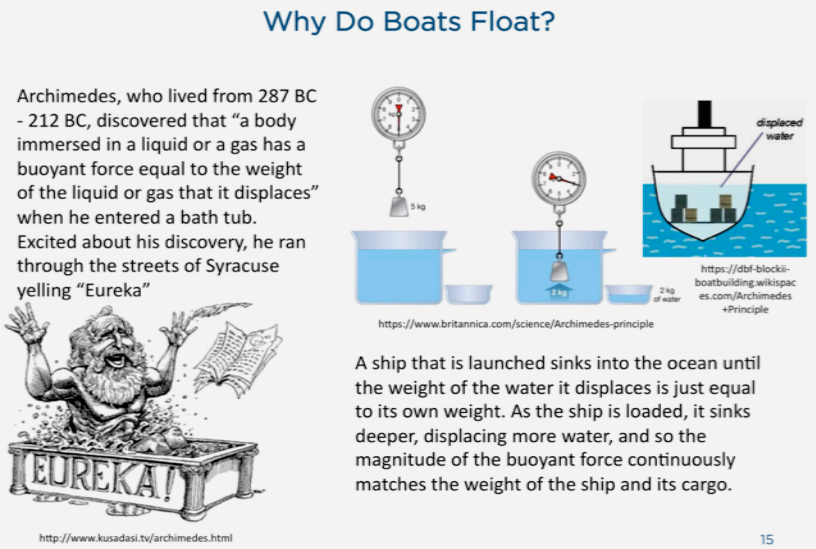
Civil Engineering – bridges, breakwaters, docks and floodgates

The infrastructure of the Chesapeake Bay is constantly trying to keep up with population growth in the area. Climate change creates the additional challenge of sea level rise and more frequent severe storms. Designing and building new systems as well as maintenance of existing structures, requires innovative solutions.



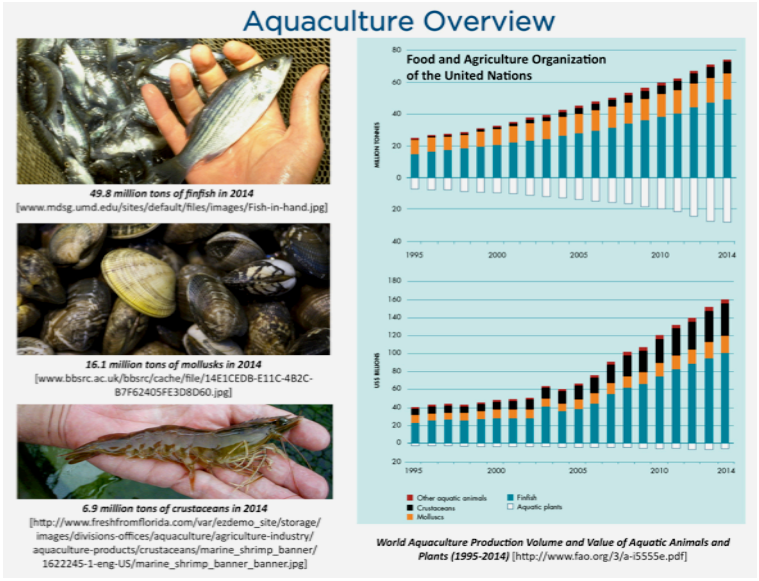
Naval Architecture – the design of boats and ships

Boats have played an integral role in the development of commerce and recreation on the Bay. The challenge for today's designers is to develop more efficient recreational boats and ferry systems that can compete with our overtaxed highway system. Basic naval architecture principles are explored, along with a history of boats on the Bay. Students will be introduced to careers in designing, building, operating and maintaining boats and ships.



Aquaculture – fish and shellfish farming

Wild fisheries on the Bay are increasingly being augmented with aquaculture systems to meet the demands for Chesapeake Bay seafood. New technologies are being developed worldwide to farm seafood in a sustainable manner. The unique challenges of designing aquaculture systems for the Bay are presented along with examples of working systems.

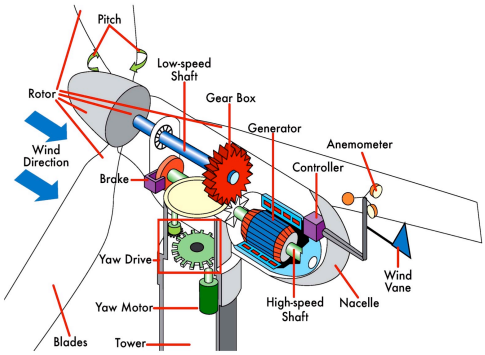


Renewable Energy – water and wind

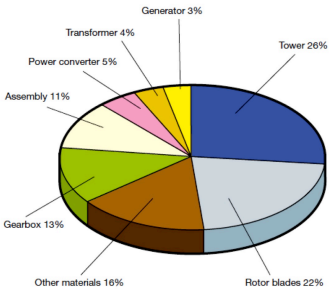
Maryland is committed to a greenhouse gas emission reduction target of 40 percent by 2030. This is good news for the Bay and will spur the development of offshore wind turbines on the Atlantic Continental Shelf. Marine hydrokinetic energy from wave buoys and water turbines are also being developed worldwide. The Conowingo Hydroelectric Plant in the lower Susquehanna River traps sediment and nutrients that runoff from the watershed is near capacity and requires an engineering solution.

How Wind Turbines Work

When wind blows past a turbine, the blades capture the kinetic energy and rotate, turning it into mechanical energy. Most wind turbines use a gearbox that spins a generator to produce the electricity. Alternatively, direct drive wind turbine use magnets to convert energy without a gearbox. Steel towers up to 150 meter tall support the hub, attached blades and a nacelle that houses mechanical components. [awea.org/wind-power-101#How-wind-turbines-work]



Wind turbine components
[sites.lafayette.edu/egrs352-sp14-wind/files/2014/04/howitworks.jpg]

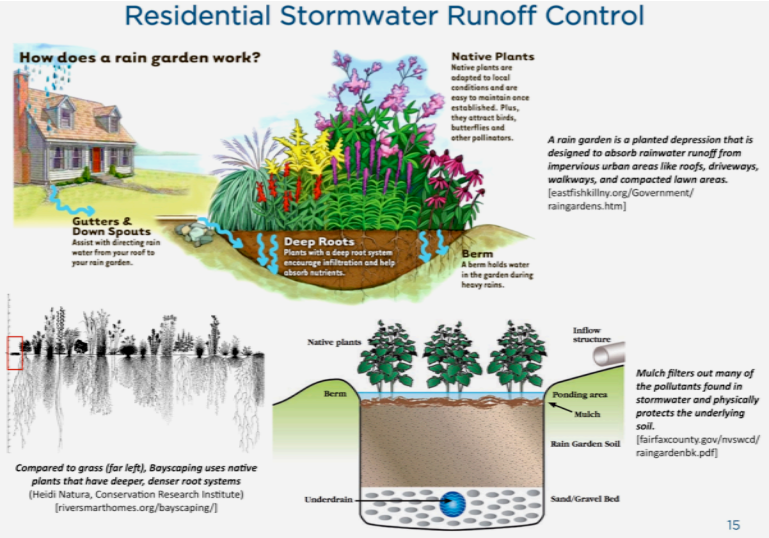


Breakdown of wind turbine component costs
[tesla-institute.com/index.php/renewable-energy-articles/213-main-components-of-a-wind-turbine]

4

Pollution Remediation – water and air quality

Engineers are responsible for the design of water treatment plants and air pollution controls fitted to power plants and transportation systems. These efforts directly help the Bay and also serve to slow global temperature rise. Innovative solutions to limit storm water runoff into the Bay are also needed.



Usability of the prototype
The usability of the prototype will be based on student and educator feedback.

The prototype will be demonstrated in both a public school environment and via museum education programs.

The Phase II effort will focus on refining the utility and usability of the website and expand the regional outreach beyond the Chesapeake Bay.

Potential problems
The project relies heavily on the skills of the Principal Investigator, as he has created the web content to date. The eight-month project plan calls for 880 hours of the Principal Investigator's time, which is about half of available hours. This provides a sufficient margin should the progress of the project slip at any point and require additional resources.

The offeror has successfully completed research projects of this complexity and duration on time and on budget as Principal Investigator for five Ship Structure Committee projects. Mr. Greene has also served as Program Manager for a $7 million, multi-year U.S. Navy research project, producing all the technical reports and programmatic documents for the effort. He is currently Convener for the IEC TC 114 team developing design standards for hydrokinetic devices.

Although the offeror will rely on the expertise of the Project Technical Committee and subject matter experts that the Department of Education assigns to the project (if any), the Principal Investigator will be solely responsible for the quality of the Instructional Materials and adherence to contract terms and schedule.

Project Team – Biographical Summary of Each Key Project Team Member
We have assembled a project team with a wide range of applicable skills to complete the proposed research.

Eric Greene, Eric Greene Associates
Mr. Greene has developed the content for and designed the website ChesapeakeSTEM.org. The project mixes his love for the Chesapeake Bay with a desire to inspire future engineers.

Eric Greene was awarded a B.S. in Naval Architecture and Marine Engineering, from the Massachusetts Institute of Technology in 1979. Mr. Greene founded Eric Greene Associates, Inc. in 1988 to advance our understanding of composite materials for marine structures. Engineering advanced materials for marine structures, understanding the performance of composites in fires, composites education and ocean renewable energy are the primary areas of corporate expertise. Mr. Greene currently serves as the convener for the team developing international design guidelines for ocean renewable energy devices. Mr. Greene authored the highly acclaimed book ***MARINE COMPOSITES***, which is available for download at the website www.EricGreeneAssociates.com. He recently served as Principal Investigator for his sixth Ship Structure Committee project.

Some recent projects include:

- Convener for International Electrotechnical Commission (IEC) TC 114, Marine Energy Devices responsible for development of technical specification
- Assisted Maritime Technical Services in the development and presentation of U.S. Coast Guard Inspector training material.
- National Academy of Sciences committee member for Benchmarking the Technology and Application of Lightweighting for DoD Transportation Systems
- Developed and presented a lecture series in the Netherlands on marine composite construction for the megayacht industry
- Developed American Boat and Yacht Council training material for composites technicians to NOCTI standards
- Under contract with the American Bureau of Shipping, assisted in the development of the ABS Naval Vessel Rules
- Maintained www.EricGreeneAssociates.com as a repository of Marine Composites research material for international scholars

Mr. Greene was an Adjunct Professor at Webb Institute in 2013. Webb offered a course in Composite Materials for seniors during the spring semester. Mr. Greene developed course content and provided 18 hours of lectures on campus. The course material was the culmination of Marine Composites training material developed by Mr. Greene over the past thirty years.

Mr. Greene loves sailing, fishing, paddle-boarding and hiking the Chesapeake Bay. As Convener for IEC TC 114 team writing design guidelines for hydrokinetic energy devices, he is helping in a small way to reduce our dependence on carbon-based energy sources.

Sarah Krizek, Annapolis Maritime Museum
Ms. Krizek is a lifelong Marylander, growing up sailing and exploring the Chesapeake Bay. These early experiences on the water have created a passion for the Bay and a desire to share this with children of all ages. Ms. Krizek has worked in the field of outdoor and environmental education for over 15 years. She graduated from the University of Maryland with a Bachelor of Science in Natural Resource Management and Environmental Education. After graduation, Ms. Krizek worked at the Audubon Naturalist Society (ANS) in Chevy Chase, MD. There she started as a summer camp intern and progressed to the Children and Family Director.

Ms. Krizek moved to Eastport and started working at the Annapolis Maritime Museum & Park, located on Back Creek. She now serves as the Education Director and hopes to inspire children to learn and protect the Chesapeake Bay. During her tenure with AMM, Sarah has grown the Education Department by over 180% establishing fee-based programs both during the school year and summer. In her role, Ms. Krizek also manages several local and national grants, develops partnerships with local organizations, and serves on the board of the Back Creek Conservancy and Maryland Association of Environmental and Outdoor Education (MAEOE). While away from the museum you might spot her with her husband Matt enjoying the local Eastport Community, sailing on their 49' Kenner Skipjack or out with their Mastif, *Blue*.

Billy Schmidt, Modern Savage Design
Mr. Schmidt has sixteen years of experience creating a multitude of one-of-a-kind design and fabrication projects including numerous interactive exhibits for natural history, science and children's museums as well as many other projects that range from CO_2 Laser manufacturing to engineering and architectural drawings, permaculture and garden designs, custom designed weather instruments, a solar powered atmospheric water generating backpack prototype, kinetic wind sculptures, technical theater sets, sensor triggered environments, time-lapse crystal formation photography, creative and production support for film, video and other media as well as creative commercial and residential construction projects.

Mr. Schmidt began chasing thoughts of innovation while working at the Field Museum of Natural History. Here he designed and built electronics, exhibits, and produced other educational and scientific content. This allowed him to work closely with a vast range of scientists and PhD's, anthropologists, botanists, entomologists, teachers, artists and other amazing specialists and allowed access to vast collections and libraries, along with expertise and equipment that aided these pursuits.

Years later in San Diego, having spent more than a decade sharply honing these skills by building custom interactives, electronics and one-off devices for individuals, museums, aquariums, universities, research institutes and many others, Mr. Schmidt participated in a weekend workshop at CAlit2 which became the catalyst for San Diego serving as base for a multi-year, multi-state NSF funded innovation research project called Art of Science Learning, in which he participated in for more than two years.

Priority Area 1, Education Technology Products Used by Students or Teachers (or other Instructional Personnel) in Authentic Education Settings

The proposed research for ChesapeakeSTEM falls into the following topic areas:

- ***STEM (science, technology, engineering, math)***
- ***technical or vocational skills to increase career readiness***
- ***improved study skills***

When Phase I research is complete, ChesapeakeSTEM.org will be an interactive website that makes it easier for students and teachers to find, organize, and use open educational resources.

Types of Products

ChesapeakeSTEM is a web- or mobile-based product to support and improve the efficient and effective implementation of already existing technology within standard instructional practice. It is designed to supplement existing curricula or instruction**.** The teaching aids designed to go along with each STEM subject are designed to be built by students from laser-cut wood pieces.

When Phase I research is complete, ChesapeakeSTEM.org will include adaptive software components and analytics capabilities that provide differentiated or personalized learning opportunities.

ChesapeakeSTEM is designed to be for use in school or through formal programs in conjunction with schoolwork (e.g., homework, after-school programs, distance learning programs, on-line programs).

The country has a shortage of kids studying for STEM careers, especially among woman and minorities. Reaching kids early to see if they have an affinity for solving problems and building things is a major goal of ChesapeakeSTEM.org.

Anecdotal response to the website has been quite positive. We look forward to formal material presentation with student and educator feedback.

We will add an additional ten STEM modules during the Phase I research, as well as add the interactive research and testing features to the website. The Phase II effort will extend STEMtalks.org to the rest of the country, initially targeting an additional ten geographic focal points.

Middle and high school students are the primary target audience, but younger children with proper supervision may benefit as well.

ChesapeakeSTEM is accessible from anywhere with a smartphone. The website will eventually serve as a launch site for further research by the user.

The intended outcome for ChesapeakeSTEM.org is to get more kids, especially girls and minorities, interested in STEM careers to help the Bay.

The theory underlying ChesapeakeSTEM.org is that you can maintain the attention span of young learners with content that is heavily favored with graphic illustrations and photographs. Our empirical evidence of today's youth shows a strong attraction to visuals over text on the Internet. Captioned illustrations are a tested format for initial research beyond the image.

Phase I research will focus on expanding the capabilities of the prototype by adding ten additional teaching modules and upgrading interactive website features. The prior R&D that went into ChesapeakeSTEM.org will serve as the template for future STEM teaching modules.

Free open courseware in itself is not unique to the Internet but exciting content assembled to focus on a national treasure such as the Chesapeake Bay creates a unique learning platform that is both accessible directly by the student or to form the basis of a talk or class lesson.

Current Internet content aimed as aids for teachers usually follow formulaic formats, highlighting lesson plans geared for the educator. ChesapeakeSTEM from the onset targets students as the end-user, making each page visually interesting and content rich.

The only way to ensure success on the Internet is to offer a product or service for free. Open courseware follows this model. The commercial success of the STEMtalks franchise rests with the teaching aids being developed during Phase I. STEMtalks.org will expand the subject content model to include other national geographical landmarks, such as estuaries and mountain ranges across the country, as touchstones.

Professional societies are targeted with grooming the next generation of STEM professionals to solve society's environmental and infrastructure issues. Support from SNAME is an endorsement for our Naval Architecture subject module. We hope to reach out to other engineering and scientific groups for involvement with future STEM modules.

The success of the Phase I research is much enhanced by the Annapolis Maritime Museum and Park's enthusiastic letter indicating their willingness to participate in Phase I research. We also appreciate the support shown by the Anne Arundel County public schools.

Mr. Greene has overseen multi-million dollar DoD research projects, both technically and programmatically. He has developed and presented training materials at both commercial and classroom forums. Endorsement letters from SNAME and NREL highlight Mr. Greene's ability to manage large information-based research projects.

A. Documentation and Status of Previous Phase II Awards

No previous Phase II awards

B. Letter of Agreement for Participation

January 2, 2018

Reference: U.S. Department of Education
Institute of Education Sciences
SBIR Phase I RFP Number: 91990018R0006

To whom it may concern,

The Annapolis Maritime Museum & Park has been aware of ChesapeakeSTEM for over a year and we support their mission as it aligns closely with our educational mandate. The Annapolis Maritime Museum & Park aims to inspire a love of and respect for the Chesapeake Bay for generations to come. The Museum's mission is to educate youth and adults about the Annapolis area's rich maritime heritage and the ecology of the Chesapeake Bay through programs, exhibits and community events. The Education Center at the Annapolis Maritime Museum & Park reaches over 8,000 children annually and strives to foster a connection between people and the environment by leading hands-on activities that inspire positive outdoor experiences and stimulate critical thinking.

ChesapeakeSTEM is a valuable resource for our education program, providing high-quality scientific information to teachers and students. We are happy to participate in the proposed Phase I research by offering our teaching platform where area students come to learn about the Bay. Our knowledgeable education staff will monitor the C-STEM talks and offer suggestions for improvement of both the web-based teaching material and the hands-on projects. As a minimum, we will support the presentation of the five (5) subject modules developed to date and up to ten (10) more as they are developed. Ideally, we hope to reach multiple target audiences with each presentation. This partnership between the Annapolis Maritime Museum & Park and ChesapeakeSTEM will stregthen both organizations position to educate youth about the issues facing the Chesapeake Bay.

Sincerely,

Sarah Krizek
Education Director

amaritime.org • 410.295.0104 • P.O. Box 3088 • **ANNAPOLIS MARITIME MUSEUM** • 723 Second Street • Annapolis, Maryland 21403

ANNE ARUNDEL
COUNTY PUBLIC SCHOOLS
2644 Riva Road, Annapolis, MD 21401 | 410-222-5000 · 301-970-8644 (WASH) · 410-222-5500 (TDD) | www.aacps.org

February 9, 2018

U.S. Department of Education
Institute of Education Sciences
SBIR Phase I RFP Number: 91990018R0006

Dear Sir or Madam:

I am happy to provide a letter of support for ChesapeakeSTEM. Although I have only recently become aware of this resource, it is a resource that our secondary education program will be able to use. The materials I reviewed provide a high-quality scientific information to teachers and students. It will be of specific use to our new and premier Environmental Science course.

Sincerely,

Valerie Wesner

Valerie Wesner
Coordinator of Science, K-12
Anne Arundel County Public Schools

C. Biographical Summary Certification and Résumé Pages

Eric Greene, Principal Investigator

Eric Greene was awarded a B.S. in Naval Architecture and Marine Engineering, from the Massachusetts Institute of Technology in 1979.

Eric Greene Associates, Inc., President, 1987-Present

Mr. Greene founded Eric Greene Associates, Inc. to advance our understanding of composite materials for marine structures. Engineering advanced materials for marine structures, understanding the performance of composites in fires, composites education and ocean renewable energy are the primary areas of corporate expertise. Eric Greene Associates, Inc. clients range from the recreational megayacht industry to the military, allowing for technology transfer between diverse industries. Mr. Greene authored the highly acclaimed book ***MARINE COMPOSITES***, which is available for download at the website www.EricGreeneAssociates.com. He recently served as Principal Investigator for his sixth Ship Structure Committee project.

Webb Institute, Adjunct Professor, 2013

Webb offered a course in Composite Materials for seniors during the spring semester. Mr. Greene developed course content and provided 18 hours of lectures on campus. The course material was the culmination of Marine Composites training material developed by Mr. Greene over the past thirty years.

Structural Composites, Inc., Naval Projects Program Manager, 1990-2008

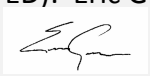
Mr. Greene served as the Program Manager for the DDG-51 Composite Twisted Rudder project. In this capacity, Mr. Greene was responsible for securing $7 million in funding from various Government resources and managing all technical and programmatic aspects of the project. Previously, Mr. Greene managed an SBIR Phase II project titled "Fire Performance of Composite Materials for Naval Applications."

Society of Naval Architects and Marine Engineers, member since 1979.
International Electrotechnical Commission (IEC) TC 114, Marine Energy Devices, Convener.

1. "Introduction to Marine Composites" SSC's Sustainability & Stewardship: Vessel Safety & Longevity through Ship Structure Research, Maritime Institute of Technology, Linthicum, MD, 2014.
2. "Composites for Marine Energy Systems," presented at Lehigh University, Feb., 2011.
3. "U.S. Marine Composites……think BIG," plenary session, 4th International Conference on Advanced Engineered Wood and Hybrid Composites, Bar Harbor, ME, 2008.
4. Full Day Composites Education Course presented at Composites 2004, American Composites Manufacturing Association's Annual Convention, Tampa Convention Center, Oct. 2004.
5. MARINE COMPOSITES Overview Course presented at the 6th Annual Multi-Agency Craft Conference at the Naval Amphibious Base, Little Creek, Norfolk, Virginia, 2003
6. "Naval Composites," International Boat Builders Exhibition, Ft Lauderdale, FL, 2003.

(1) Certifications (1-page)

Each individual on the project team must certify the following statement by providing the information below:

> *"I hereby certify that this information is accurate to the best of knowledge and belief."*
>
> Individual's Name (TYPED): Eric Greene
>
> Written signature: 
>
> Date: February 6, 2018

Each employee of the offeror with the authority to bind the offeror must certify the following statement by providing the information below:

> *"I hereby certify that (FILL IN THE COMPANY NAME) has verified the foregoing information that is accurate to the best of our knowledge and belief."*
>
> Individual's Name (TYPED): Eric Greene
>
> Individual's Title (TYPED): President, Eric Greene Associates, Inc.
>
> Written signature: 
>
> Date: February 6, 2018

William Schmidt, Educational Craftsman
Mr. Schmidt is a trained traditional studio artist, engineer and constant learner who majored in ceramics, printmaking and 3D design with major diversions in mycology, agriculture and botany, chemistry and photography. Interests include architecture, carpentry, mold making, steel and foundry work, painting, prop making, time-lapse photography and plant cell culture to name just a few. Mr. Schmidt has developed a wide spectrum of computer related skills including coding for custom hardware, working as a certified Apple technician and going on to design an install networked equipment, sensors and clustered computers for unique interactions, visualization and content display.

San Diego Children's Discovery Museum, Exhibits and Facility Manager 2011-2016
Mr. Schmidt oversaw the design and fabrication of museum exhibits, operations of the facility, mobile museum exhibits and satellite location development.

The Field Museum of Natural History, Chicago, IL Interactive Exhibit Designer2004–2008
Mr. Schmidt was in charge of conceptualization, design and production of exhibits, media, and various special projects.

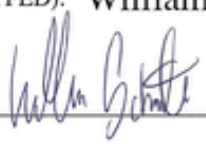
Modern Savage Design & Savage Burn Media, Owner and Installation Artist, 1999–2018
Modern Savage Design focuses on design, development, construction, and installation of custom projects, sets, props and artwork ranging from kinetic sculptures, mechanical interactives, garden and irrigation design, living environmental controls, time-lapse photography, media production, carpentry.

Art of Science Learning Fellowship, 2014 - 2015
The Art of Science Learning is a National Science Foundation funded initiative that uses the arts to spark creativity in science education and the development of an innovative 21st Century STEM workforce. It involves a yearlong 300-hour, application only, fellowship funded by NSF to study innovation and the arts in a STEM based curriculum concept. This was held in three cities and based around local museum and creative campuses in San Diego, CA, Chicago, IL and Worcester, Mass.
[http://www.artofsciencelearning.org/]
The programs had local themes for the teams to tackle in each city, all with very different outcomes. In San Diego, the theme was water. For the 130+ participants, the program was comprised of weekly 6-8 hour workshops and other programming that eventually led to the formation of 10 separate groups working to produce various products and projects from iPhones apps, waterfFilters and sensors to our atmospheric water generating backpack. We designed and prototyped several iterations based on solid-state electronics. These are personal, portable, solar powered atmospheric dew collectors that fit in a backpack. We secured $3,750 as seed money to develop this further. The conclusion included a launch and pitch event to a group of community partners and investors. Our team was selected to move to the next round and join the San Diego Incubator for Innovation, a program of the Balboa Park Cultural Partnership.

Each individual on the project team must certify the following statement by providing the information below:

"I hereby certify that this information is accurate to the best of knowledge and belief."

Individual's Name (TYPED): William Schmidt

Written signature: 

Date: 2/7/2018

Each employee of the offeror with the authority to bind the offeror must certify the following statement by providing the information below:

"I hereby certify that Modern Savage Design *has verified the foregoing information that is accurate to the best of our knowledge and belief."*

Individual's Name (TYPED): William Schmidt

Individual's Title (TYPED): Owner, Lead Designer

Written signature: 

Date: 2/7/2018

Sarah Maguire Krizek, Environmental Education
Ms. Krizek received her B.S. in Natural Resources Management, Environmental Education, and Park Management from the University of Maryland.

Annapolis Maritime Museum, Education Director, 2013-Present

- Develop and implement the Education Center vision, programs, and strategy including annual goals and objectives.
- Oversee the day-to day operations of Education Center reaching over 8,000 youth annually, targeting children in prekindergarten to eighth grade. Successfully grew education programs by 176% in four years.
- Manage $200,000 annual education budget. Increased revenue by over 35% by strengthening fee-based programs, and writing and implementing federal, state and private education grants.
- Design and develop education curriculum for the Museum's education center on the ecology of the Chesapeake Bay and maritime.
- Align Education Center curriculum with county environmental literacy, science and history standards. Create and implement education policies including a lost child, first aid, and discipline procedures.

Montgomery County Recreation - Recreation Specialist, 2012-2013

- Supervised Summer Leadership Challenge Camp and Volunteer Counselor program for teens reaching over 600 teens and supervising 30 staff by creating and implementing training, hiring staff, developing curriculum and promoting programs
- Managed and organized youth basketball leagues for Montgomery County Recreation including scheduling practice times and games, hiring staff and working with volunteer coaches

Audubon Naturalist Society - Children and Family Program Director, 2009-2012

- Coordinated registration, staffing, lesson plans, supplies, materials, and budgets for children and family programs including nature birthday parties, homeschool, scouts, after-school classes, weekend family programs, and youth volunteer programs
- Instructed and developed nature inspired lessons, natural history walks and activities for families and children about Maryland's local flora and fauna in an outdoor setting
- Worked as part of a team to promote annual nature fair, coordinating nature related booths and activities

Audubon Naturalist Society, Children and Family Program Coordinator, 2006-2009

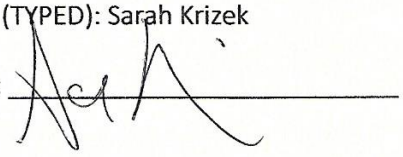
- Managed Nature Inspired Birthday Party program, significantly increased the number of birthday parties from 40 to 105 in one fiscal year.
- Assisted with hiring and training of camp instructors, interns and contract naturalists. Coordinated and supervised contract naturalist who lead programs.

(1) Certifications (1-page)

Each individual on the project team must certify the following statement by providing the information below:

"I hereby certify that this information is accurate to the best of knowledge and belief."

Individual's Name (TYPED): Sarah Krizek

Written signature: 

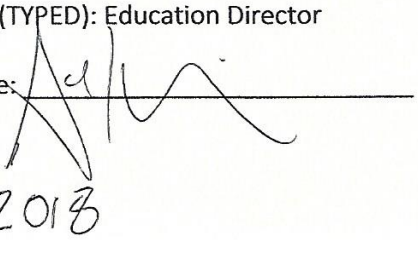
Date: 2/9/2018

Each employee of the offeror with the authority to bind the offeror must certify the following statement by providing the information below:

"I hereby certify that (FILL IN THE COMPANY NAME) has verified the foregoing information that is accurate to the best of our knowledge and belief."

Individual's Name (TYPED): Sarah Krizek

Individual's Title (TYPED): Education Director

Written signature: 

Date: 2/9/2018

H. Letters of Endorsement – (Maximum 3 letters)

SNAME
THE INTERNATIONAL COMMUNITY FOR MARITIME AND OCEAN PROFESSIONALS

February 2, 2018

Eric Greene
Naval Architect
Convener, IEC MT 62600-2
Annapolis, Maryland

Mr. Greene,

Thank you for sending the example lesson and referring me to your Youtube video to review. It is a pleasure to recommend your educational initiative to others. As you are aware SNAME is composed of professionals from all aspects of the U.S. and international maritime and ocean community. Most members would be very open to assisting with your efforts and sharing their interest and experiences with students on a personal level. Our industry is filled with people with passion for their profession and if provided with some inspiring educational materials such as you are developing would join efforts in their community to share their passion for the things maritime. Our pipeline supply of interested and skilled professionals into the maritime industries has dwindled in recent years. Cultivating interest in our youth is thus a very high priority by many in order to ensure talented and dedicated entry level candidates into our industries.

I know the value of outreach educational efforts to youth from personal experience working at the Department of Transportation with the Garrett Morgan Technology and Transportation Futures Program (1997-2001). We shared education outreach efforts among the employees of all of the modes of transportation during that period. The personal involvement of those in the Department's agencies armed with a few educational tools made an inspiring impact on the interest of youth in maritime and other transportation related fields. Your materials looks really exciting and naval architecture and transportation issues provide a hook for interest by youth in engineering fields. Engagement with real transportation examples helps make all subjects in school instantly relevant to young people.

Your long interest in the Chesapeake Bay, love of sailing, and your strong professional background providing extensive structural research efforts that have assisted SNAME members in the design of ships for the U.S. Merchant Marine and the U.S. Navy are well known to many in the Society. You will be able to easily enlist volunteer assistance for this worthwhile effort.

Recent efforts by SNAME with the initiation of numerous student sections in the U.S. and abroad, will be further complemented with expanded education efforts in the near future as the Society is currently poised to begin a new focus on education. The timing of your efforts should be just perfect for reaching out to fellow SNAME members to give STEM talks and become mentors to today's youth.

Sincerely yours,

Alexander C. Landsburg
T&R Program Coordinator | SNAME
Alexandria, VA, USA | Athens, GR | www.SNAME.org
Direct +1. 703-997-6715 | Main +1.703.997.6701 | Cell +1.301.807.5760 | Home +1.301.593.2414

CELEBRATING 1893 | 2018
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HONORING THE PAST | INFLUENCING THE FUTURE

THE INTERNATIONAL COMMUNITY FOR MARITIME AND OCEAN PROFESSIONALS

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Eric Greene
Naval Architect
Convener, IEC MT 62600-2
Annapolis, Maryland

Mr. Greene,

I am enthusiastic to recommend your "CheseapeakeSTEM.org" educational initiative for consideration of an SBIR award. We recognize that educating young adults in the field of renewable energy can help to strengthen our future workforce and partnerships. NREL, is the nation's premier federal laboratory dedicated to the R&D, commercialization, and deployment of renewable energy and energy efficiency technology. Staff at NREL have over 30 years of experience in renewable energy and a wealth of knowledge available to provide input to your project.

The Wind Energy program at NREL has been involved in education and training programs for many years and we see a great value in these efforts. STEM initiatives help support both the Nations' energy independence goals while also leading the world in energy innovation. In addition, they help to ensure that a broad range of diverse individuals entering the workforce are aware that the wind energy field offers well-paying jobs from construction in rural America, manufacturing across the Midwest and south, to research and technology innovation nationwide.

As a longtime partner to NREL through your effort in developing standards for the Marine Energy industry, we are confident that you will be able to develop a robust and informative program.

Sincerely,

Walt Musial
Technical Lead – Offshore Wind Program
National Renewable Energy Laboratory

15013 Denver West Parkway
Golden, CO 80401
Phone 303-275-3000

NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

Gavin Buckley, Mayor
160 Duke of Gloucester Street
Annapolis, MD 21401
410-263-7997
mayorbuckley@annapolis.gov

February 9, 2018

Mr. Eric Greene
Naval Architect
Convener, IEC MT 62600-2
Annapolis, MD 21401

Dear Mr. Greene:

Thank you for your outstanding efforts to educate and involve more children in future studies and possible careers in Science, Technology, Engineering and Math (STEM) fields. The city especially appreciates your focus on the Chesapeake Bay and for finding engineering solutions for its future health and vibrancy. As you, your colleagues and organization are well aware, the bay is a driving force in our economy and the cultural and social lives of Annapolis residents. We realize the fate of the bay and our city rests in the hands of today's leaders and our future leaders, who are now just learning how to protect our future.

ChesapeakeSTEM.org shows issues facing the Chesapeake and its waterways in graphic form that highlights STEM careers through a smartphone platform. As the parent of two young boys, I know first-hand how effective using phone-based technology can be and it is a great way to teach environmental science to Annapolis area children. Your efforts are inspiring future scientists, engineers, naval architects, and more.

Anne Arundel County Public Schools has an excellent STEM program and will be a logical partnership to present ChesapeakeSTEM material in a classroom environment. Eric Greene Associates has also partnered with the Annapolis Maritime Museum and Park to present ChesapeakeSTEM lessons to students in its new Back Creek facility.

The City of Annapolis is surrounded by water. It is our great asset, but it is also our greatest threat. Looking forward, the City of Annapolis will have significant challenges with sea level rise and we are already experiencing unprecedented flooding episodes. We happy to see this illustrated in the Civil Engineering module (see attached). We strongly support this Annapolis-based initiative to get our kids interested in discovering engineering solutions to the challenges facing our historic city and our environment.

If I can be of any further assistance to you or your colleagues, I can be reached in Annapolis City Hall at 410- 263-7997.

Sincerely,

Gavin Buckley, Mayor