

POWERING
the **BLUE ECONOMY™**

**Marine Energy
Collegiate
Competition**

U.S. DEPARTMENT OF ENERGY

2021 Rules & Requirements



Preface

The U.S. Department of Energy Marine Energy Collegiate Competition: Powering the Blue Economy™ will be governed and adjudicated by this manual, which is intended to establish fair contest rules and requirements. In the case of a discrepancy with other competition materials or communication, this document takes precedence. The organizers reserve the right to change contest criteria, rules, and measurable outcomes.

While teams work on their deliverables, principal investigators, co-principal investigators, graduate student advisors, and members of industry secured by each team for support can provide feedback about the team's design so the students can identify fatal flaws, prove technical rigor, or demonstrate feasibility of their concept. Teams are highly encouraged to pursue mentorships and sponsorships early in the course of the competition as it will provide immense benefit to the learning and overall competition experience. However, only student team members may take an active role in any competition event. It is the role of the non-student team members to provide a supportive environment and the educational background necessary for the students to achieve success in the competition.

In addition, teams are encouraged to bring to the organizers' attention rules that are unclear, misguided, or in need of improvement. The organizers will seriously consider suggestions that are feasible, within their constraints, and are intended to improve the competition, its rules, fairness, measurable outcomes, or precision.

Table of Contents

Revision History	v
1 Introduction	1
1.1 Background	1
1.2 Purpose	1
1.3 Process.....	2
2 Competition, Contests, Products, and Awards	4
2.1 Overview of Product Submission Deadlines.....	4
2.2 Awards	5
3 Written Report: Business Plan and Detailed Technical Design Contests and Optional Build and Test Summary	6
3.1 Cover Sheet	7
3.2 Executive Summary	7
3.3 Business Plan.....	7
3.4 Detailed Technical Design	8
4 Optional Build and Test Challenge.....	10
4.1 Physical Design Constraints within Testing Facility.....	10
4.2 Safety Specifications	10
4.3 Marine Energy Device Challenge Testing	11
4.4 Marine Energy Device Performance Task	11
4.5 Marine Energy Device Durability Task	11
4.6 Marine Energy Device Safety Task.....	12
5 Presentations: Business Plan and Detailed Technical Design Contests and Optional Build and Test Summary	13
5.1 Elevator Pitch	13
5.2 Public Pitch	13
6 Posters: Business Plan and Detailed Technical Design Contests and Optional Build and Test Summary.....	15
Glossary	15
Appendix A. Application Requirements	16
Appendix B. Rubrics	17
Products	17
Written Report.....	18
Public Pitch.....	19
Poster	19
Optional Build and Test Challenge	20
Appendix C. Sample Safety and Technical Inspection	21
Appendix D. Roles and Responsibilities	23
Appendix E. Logistics.....	25
Competition Timeline.....	25
Event Schedule	25
Event Registration	25
Lodging	26
Local Resources	26
Team Booths.....	26
Shipping.....	26
Storing Items at the Event	26
Feedback.....	26
Appendix F. Safety and Conduct	27
Appendix G. Dispute Resolution	28
Appendix H. Communications and Contest Details	29
External Communications	29

Internal Communications	29
Branding	29
Confidentiality and Intellectual Property	30
Judging and Scoring	30
Submittals and Submission Locations.....	31
Submission Locations.....	31
PDF Requirements	31
Audiovisual Presentation Requirements.....	32
Electronic File-Naming Instructions	32
Appendix I. Alternative Competition Structure	33
Appendix J. Virtual Conference Participation Etiquette.....	34

List of Tables

Table 1. Contests and Products Overview.....	4
Table 2. Product Deadlines	5
Table B-1. Scoring Summary for the Business Plan and Design Competition Products (550 Points Total).....	17
Table B-2. Scoring Summary for the Optional Build and Test Challenge Products (100 Points Total).....	17
Table B-3. Scoring Rubric for the Written Report (250 Points Total)*, **	18
Table B-4. Scoring Rubric for the Public Pitch (225 Points Total)	19
Table B-5. Scoring Rubric for the Poster (75 Points Total)	19
Table B-6. Scoring Rubric for the Optional Build and Test Challenge (100 Points Total)	20
Table D-1. Roles and Responsibilities	23
Table E-1. 2020–2021 Competition Timeline and Related Activities	25

Revision History

This document is the original version, issued **XXXX**

1 Introduction

1.1 Background

The term “blue economy” is gaining traction among government, industry, and nonprofit sectors as an organizing principle that captures the interplay between economic, social, and ecological sustainability of the ocean. Interest in the blue economy spans multiple U.S. agencies, institutions, and businesses and is part of a global network of initiatives.¹ This interest is fueling investment in next-generation maritime or “blue” technologies—autonomous vehicles to further ocean exploration, deeper-water offshore aquaculture, battery and fuel cell technology for marine transportation, desalination and water treatment to serve coastal and island communities, and, increasingly, offshore renewable energy and alternative fuels such as biofuels derived from marine algae and hydrogen from seawater.

According to the U.S. Department of Energy’s (DOE’s) *Powering the Blue Economy* report,² marine energy could provide significant near-term value as an enabler to advance the goals of other blue economy industries. Achieving the Water Power Technologies Office’s (WPTO’s) vision of predictable and affordable power from oceans and rivers will require people, port facilities, and testing R&D assets that leverage the knowledge and workforce associated with coastal industries.

To help facilitate this process, DOE and the National Renewable Energy Laboratory (NREL) launched the Marine Energy Collegiate Competition: Powering the Blue Economy™ (MECC) in 2020. The competition directly aligns with DOE’s overall goals of improving:

- Energy affordability
- Energy technology integration
- Energy storage.

Specifically, the competition’s objectives are to bring together diverse groups of students from multiple disciplines to explore opportunities for marine energy technologies to benefit other existing maritime industries via real-world concept development experiences. Although few institutions offer marine-specific advanced degrees, having related experience is highly valuable for future prospects within a wide range of blue economy opportunities. Jobs across the blue economy include opportunities for researchers, scientists, engineers, educators, project managers, business, sales forces, and many others.

1.2 Purpose

The competition provides students with real-world experience in the marine energy industry and promotes workforce development by identifying the most promising near-term markets for marine energy to serve the blue economy and designing an appropriate marine energy device to serve market applications that could have commercial value within the next five years.

¹ For more information, please see the Economist Intelligence Unit’s “The blue economy” 2015 report: https://www.woi.economist.com/content/uploads/2018/04/m1_EIU_The-Blue-Economy_2015.pdf

² <https://www.energy.gov/eere/water/downloads/powering-blue-economy-report>

The competition supports multidisciplinary undergraduate and/or graduate student-led teams, leveraging business expertise in combination with technical skills to build cases for how marine energy can serve the blue economy. These efforts culminate in a written submission and a pitch of teams' market assessment and detailed technology design at the International Conference on Ocean Energy (ICOE) 2021 event in Washington, D.C., from April 28–30, 2021.³

If DOE and NREL decide an in-person event in spring 2021 is not feasible, the pitches and planned networking activities will be organized virtually. That decision will be made and communicated to the teams at least 3 months in advance of ICOE. Additionally, if the competition pitches do take place at ICOE as planned, student teams will still be offered the opportunity to present virtually if they prefer not to travel.

1.3 Process

Competitors will identify a promising market within the blue economy (either a market identified in the WPTO *Powering the Blue Economy* report or another feasible market within the blue economy) and identify within that market the best marine energy application to address. Competitors will then evaluate the performance requirements for end users (i.e., potential future customers within the selected blue economy market) in that application by identifying and talking with a minimum number of end users. Teams will then complete a detailed design of a marine-energy-powered device to serve those end users. Teams will have the option this year to participate in a build and test challenge, which is described in greater detail later in this document. All the selected teams will be invited to ICOE 2021 to pitch their assessments and solutions to the marine energy industry.

Examples of the types of applications within selected *Powering the Blue Economy*TM markets (teams are not limited to the applications listed here):

Desalination Market Applications

- Disaster-relief systems
- Large-scale desalination systems
- Remote community systems

Aquaculture Applications

- Far offshore energy applications
- Sensors

Ocean Observation Applications

- Scientific observations
- Oil and gas infrastructure survey

³ <https://www.icoe-conference.com/>

- Weather buoys.

It is important to note that teams are welcome to advance existing technology through this competition or develop their own new design.

Specifically, participants will need to create:

- A market-research-supported business plan and detailed technical design of a marketable device powering any marine energy sector of the blue economy
- A public pitch that will be presented during the competition event at ICOE 2021, followed by Q&A from the panel of judges
- A poster summarizing the entire technical and business plan.

Optional Build and Test Challenge

Teams participating in the optional Build and Test Challenge will build an effective prototype that will be tested for performance at model scale and deliver measured results in an additional section of the written report not to exceed 10 pages.

Teams can reference the business plan and detailed-level technical design sections of the report for device description and operation and focus the test report section to include, at minimum, the following information:

- Design process, potentially including early concepts, requirements, design reviews, and any iterative loops
- Fabrication of the prototype
- Testing, including a list of instrumentation and methods used and a description of the measurements taken
- Analysis of raw measurement data into useful data
- A summary of lessons learned from the design, build, and test process.

2 Competition, Contests, Products, and Awards

The competition consists of all the aspects and activities leading up to, during, and following the in-person event at ICOE 2021. If circumstances do not allow for an in-person event, the competition will move to a virtual format. The competition also includes the subcontract project agreement between the competitively selected collegiate teams and NREL, as well as the challenges, products, and event.

During the event, teams compete through their live concept pitch, which summarizes the work completed in each contest: Business Plan, Detailed Technical Design, and the optional Build and Test. An overview of which product contributes to the scoring of each of the contests is presented in Table 1. Appendix B details the number of points a product contributes to the overall score.

Table 1. Contests and Products Overview

DELIVERABLES	CONTESTS		
	Business Plan	Detailed Technical Design	Optional Build and Test
Written Report			
Public Pitch	✓	✓	✓
Poster			

2.1 Overview of Product Submission Deadlines

This section gives an overview of when products should be delivered. Refer to each product section and the appendices for specific deadlines, format requirements, and submission instructions. Information on scoring and penalties can be found in Appendix B. The competition will run from Wednesday, April 28, through Friday, April 30, 2021; as stated, this rules document is written to ensure that learning will occur in the event that the in-person competition must become virtual. See Appendix I for more information regarding procedures for a virtual competition.

Table 2. Product Deadlines

Product	Submission Deadline
PRIOR TO COMPETITION:	
Applications to participate	September 30, 2020, 11:59 p.m. MT
Optional Build and Test commitment	December 1, 2020, 11:59 p.m. MT
High-level concept summary and team story	January 31, 2021, 11:59 p.m. MT
Written reports	April 14, 2021, 11:59 p.m. MT
DURING COMPETITION:	
Poster summarizing business plan and design	Bring to ICOE
PowerPoint and supporting audiovisual materials	Bring to presentation
POST-COMPETITION:	
Competition feedback report/survey	May 31, 2021, 11:59 p.m. MT

2.2 Awards

Awards will include, but not necessarily be limited to:

- First-place winner: The team that earns the highest combined score across the required products
- Second-place winner: The team that earns the second-highest combined score across the required products
- Third-place winner: The team that earns the third-highest combined score across the required products
- Community Outreach and Engagement Award: The team that earns the highest points in the Community Outreach and Engagement portion of the presentation
- Build and Test Challenge Winner: The team that earns the highest score on the optional Build and Test Challenge
- Individual product category winners (Written Report, Pitch, and Poster) will be recognized as well.

3 Written Report: Business Plan and Detailed Technical Design Contests (and optional Build and Test summary)

Each team must compile a single written report covering the business plan and detailed technical design (and optional build and test results), due by April 14, 2021, by 11:59 p.m. Mountain Daylight Time.

The following format requirements apply to the written report:

- Length must not exceed 30 pages (including the cover and appendices); pages submitted beyond this limit will not be reviewed.
 - Note: For teams participating in the optional Build and Test Challenge, reports must not exceed 40 pages and the additional 10 pages are specifically intended only for the test report.
- Pages should be 8.5 × 11 inches, paginated, single-sided, and with 1-inch margins at a minimum.
- Content should be at a minimum single-spaced.
- The body of the report must use at a minimum an 11-point font.
- Captions for figures and tables must be numbered for easy navigation.
- The final document must be packaged into a single, bookmarked PDF file (see Appendix H.)

Each individual section as outlined below should—where relevant—reference other sections. The written report is the primary means for a team to provide detailed information about its project to the judges. The judges have a limited opportunity at the competition event to evaluate the design and hear about how the market-research-supported business plan shaped the design. Cohesiveness of the report sections will be evaluated in the final score. The report is expected to include the following sections:

- Cover sheet
- Executive summary
- Business plan with market assessment
- Detailed technical design of the blue economy and marine energy concept
- ***Optional Build and Test Challenge only:*** Summary of Build and Test results.

Scoring criteria for the written report are provided in Appendix B. At the conclusion of the competition, team reports will be posted to the competition website for reference during future events.

3.1 Cover Sheet

Teams should begin the report with a one-page cover sheet that includes their affiliation and contact information. Indicate the team roles/hierarchy and approximately how many students, faculty, and others (e.g., sponsors, volunteers, or family members) are involved in the project.

3.2 Executive Summary

The executive summary discusses components from all sections of the report and includes a short description of the team project (maximum 350 words). The information in the executive summary is important to many communications-related aspects of the competition and should:

- Provide essential content for the organizers to use while developing various event materials (e.g., the website, event program, media kit, and signage)
- Enable teams to better answer questions from visitors at the competition event
- Help organizers and teams respond effectively to media inquiries.

The executive summary must not exceed two pages (including figures). It is recommended to write this section last to best capture the distinct and unique factors of the written report.

3.3 Business Plan

The business plan section of the written report should be readable, concise, and interesting. Competitors must assume that the market could be addressed in under five years and have real actionable needs. Concepts will be judged largely on whether teams completed a thorough market analysis and considered the potential shortfalls. At a minimum, it must include the following:

- **Concept Overview:** This section should include information about the concept, such as business model and vision, and a concise overview of the concept's value proposition (e.g., financial, social, and/or environmental).
- **Relevant Stakeholders:** This section should identify relevant stakeholders and end users. In addition, outreach and engagement should be conducted to understand the needs of the end users. This could include interviews, research, or surveys. The end result should be an identification of the power needs and any other technology considerations that can help to inform the design of a marine-energy-powered system.
- **Market Opportunity:** This section should characterize the overall market opportunity and explain how the concept will capture a portion of the relevant market. At a minimum, a definition of the problem or market gap should be included, along with an assessment of the specific market, market opportunity forecast, and potential solutions/competition analyses. It is critical that each team perform substantial market analysis that contains direct outreach to market stakeholders as noted above. Some specific questions this section may seek to answer include:
 - What specific market needs does the product meet and in what segments will the product compete? How does the team's particular concept meet the needs and desires of the indicated target market?

- How will a price for the concept be determined? How will the value proposition from the customers' perspective be considered? How is the pricing of the competition factored into the concept's pricing? How do state, federal, or other incentives come into play?
- **Development and Operations:** This section should describe the development of the concept and associated activities. Preliminary designs presented within the technical design section of the written report should be referenced insofar as they are relevant to the broader business plan. Some specific topics this section may seek to address include:
 - How will research and development be accomplished? What are the considerations in the manufacturing and deployment process? What partnerships could be leveraged? What are the significant risks and what is the approach to managing them?
 - Are there technical barriers to implementation? Teams should also include technical, social, and environmental impacts and/or opportunities here.
 - Discuss maintenance intervals and how this concept is compared to one or more differing power sources (e.g., diesel generator or cable-to-shore).
- **Financial and Benefits Analysis:** This section should outline the financial potential of the concept (including ancillary benefits), noting required capital, financing, and key assumptions (e.g., marginal costs, whether the team wishes to scale up, and the rate at which they wish to do so).

Particularly important are expected operating expenses and associated assumptions (e.g., maintenance schedule, expected time to failure). Full pro formas (though required in traditional business plans) are not required here; however, it is recommended that higher-level, longer-term summaries be used in the business plan narrative to communicate the attractiveness of the concept for investment.

3.4 Detailed Technical Design

The preliminary technical design section of the written report explains the proposed system/concept from an engineering perspective. Teams should provide detail that is adequate for a detailed review of the operating principles of the proposed system. At a minimum, the following topics should be included:

- A description of the design objective and how the design components support this objective, including the power production component, the load and related power needs, and any associated storage.
- A performance analysis that considers the power conversion capture efficiency with an attempt toward optimization across the available resource and the overall system efficiency (waves-to-electricity, waves-to-water, etc.). A time-domain⁴ or frequency-domain analysis is required to quantify power production in the expected operational sea

⁴For example, for WECs teams can utilize the Wave Energy Converter SIMulator (WEC-Sim) <https://wec-sim.github.io/WEC-Sim/>

states or other environmental conditions. A constant power conversion efficiency of the power take-off (PTO) or power conversion chain (PCC) can be used if adequate and appropriate technical or original equipment manufacturer specifications are cited to justify operational assumptions. This analysis can include other supplementary power sources in addition to marine energy, if applicable. It should include justification that the proposed power conversion technology is both cost-competitive at the location of the proposed market(s) and has a cost-optimal ratio of conversion capacity versus battery storage.

- An analysis of the expected device mechanical loading, power requirement, and load profile across time (and associated safety factors within the design, where applicable).
- Demonstration that the proposed technology is designed to withstand standard operating mechanical forces and moments.
- A description of how the technical design addresses the power or operational needs identified in the market analysis.
- Engineering diagrams of all mechanical components.

4 Optional Build and Test Challenge

Each team will have the opportunity, if desired, to build and test a scaled model of their concept. Teams need to notify competition organizers by December 1, 2020, if they are interested in competing in this challenge. Teams will have the final decision on what aspects of their concept they would like to test in an appropriate testing facility. At minimum, teams competing in the Build and Test Challenge will need to build and test a scaled model of the system component that is extracting energy from a marine energy resource. For example, a system that consists of a wave energy converter powering an offshore aquaculture farm would only be required to build and test the wave energy converter. The team can include a model of an aquaculture pen (or farm) in the experiment but will need to decide if time and budget allow.

Competition organizers will provide educational webinars and be available to answer questions; answers to technical questions will be made available to all teams.

Potentially helpful resources in designing the experimental testing campaign can be found below:

1. [Wave Energy Prize](#)
2. [Waves to Water Prize](#)
3. [North Carolina Renewable Energy Challenge](#)

Teams participating in the optional Build and Test Challenge can request support from NREL to connect them with nearby facilities to test their devices if the team does not have adequate on-site testing facilities at their institution.

4.1 Physical Design Constraints within Testing Facility

Given the wide variety of concepts expected in this competition, there are no firm restrictions on the scale of the model that a team can test in an appropriate experimental facility. Therefore, the organizers expect the model scale will be dependent on two factors: (1) the dimensions of the testing facility chosen and (2) the additional \$5,000 budget provided for the Build and Test portion. Teams are allowed to seek out additional funding to build a larger model or complete a greater number of experimental tests if desired; however, in scoring the Build and Test Challenge, the rubric will be focused on the quality of the model design, test plan development, instrumentation and measurement plan, and post-processing of measurement data rather than on the size and breadth of the experiment.

4.2 Safety Specifications

The competition staff requires that a safety inspection of the test article and load system by the competition organizers and the test facility be passed before the test article can be installed and tested at the chosen experimental facility. Appendix C contains a draft version of the safety and inspection sheet used to evaluate the test article and accompanying instrumentation. Although the test facility will make the final and official determination about whether a test article may be tested in the experimental facility, competition organizers can exclude teams from participating in this challenge if teams do not pass the safety inspection. The safety and inspection sheet must be submitted prior to initiating the experimental testing, and failure to submit the safety and inspection sheet will disqualify the team from the Build and Test Challenge.

4.3 Marine Energy Device Challenge Testing

The marine energy device testing consists of several individual device tasks. This section describes the requirement of the individual tasks in which the turbine is expected to perform and the parameters of the testing conditions.

Testing provides teams with the opportunity to demonstrate their marine energy device performance through objective tasks, and the testing outcomes help determine if they have succeeded in developing a durable, safe, high-performing machine (performance is a strong indicator of a marine energy device's ability to compete successfully in the marketplace).

Each marine energy device, along with its corresponding load system, will be tested in the experimental facility chosen by each team. The challenge will include the following tasks: marine energy device performance, marine energy device durability, and marine energy device safety. While the prescribed order will be the same for each team, the exact amount of time spent on each task could vary between teams. Teams are not required to complete all tasks; however, addressing each task would demonstrate a holistic approach to the design of a complete system. Given that each team may have different levels of access and time at testing facilities, each team is required to complete at least one task, with suggested priority given in the order of the tasks listed.

4.4 Marine Energy Device Performance Task

The objective of this task is to test the marine energy device over a range of environmental conditions to develop a performance curve. Each marine energy device should be tested in various environmental conditions across the operational envelope for the given device. Each team is expected to test their device in at least six operational environmental conditions, which will be left to the team's discretion; supporting documentation will be required to detail the team's decision-making process for the conditions they chose. The suggested testing duration is at least 60 seconds per environment; however, this duration will be dependent on the scale of the model chosen for testing. Therefore, teams should scale the testing time assuming that the 60 seconds of data correspond to a model- to full-scale ratio of 20.

The measured performance for each device can vary and will be decided upon by each team. For example, the team can choose to measure electrical power output, pumped water, compressed air, or simply device response (e.g., amplitude of oscillatory motion, rotations per minute), as this is generally associated with improved power extraction. Each team will be responsible for selecting the sampling rate of their data acquisition systems and will need to include details on any additional filters applied between the measuring instrument and the data acquisition system to reduce noise. Teams are strongly encouraged to understand the mechanical or electrical loads at model scale in order to select appropriate instrumentation such that the expected measured values do not fall within the noise range of the instrumentation.

4.5 Marine Energy Device Durability Task

Marine energy devices are expected to perform over the long term and will be subjected to a wide variety of weather conditions. Producing power effectively and over the course of the device's lifetime are desirable design qualities. These devices must be designed to withstand extreme environmental conditions without damage to their mechanical and electrical

components. To control high mechanical and electrical loads, marine energy devices must be able to limit their response and output power in these particularly high energy sea states.

In this task, the marine energy device should be subjected to at least two environmental conditions that correspond to the upper limit of the operational envelope and an extreme or survival situation. Teams will be responsible for describing how and justifying why these sea states were chosen in the test report. In the first condition, the marine energy device should be able to effectively operate while ensuring the mechanical and electrical loads do not exceed normal operating conditions by no more than a factor of 3 over the mean mechanical and electrical loads across the operational envelope. In the second condition, the marine energy device will need to be placed in an extreme or survival state where no power is generated and mechanical loading is minimized, where measured loads should also attempt to stay within a factor of 3 over the mean mechanical loads measured in operational conditions.

4.6 Marine Energy Device Safety Task

Safety is of utmost importance to device designers and manufacturers. To be certified, marine energy devices must be able to safely shut down rapidly and with a fail-safe shutdown capability. Marine energy devices must shut down when disconnected from the grid as well as manually upon command. Each team may choose to address these shutdown scenarios with one or two systems or mechanisms.

In this task, the marine energy device will be required to safely shut down at one time during the testing period in any environmental condition. For each marine energy device, the shutdown process will be initiated once “on command.” It is important that when initiating the “on command,” the data acquisition system remains active and can continue to monitor the shutdown response of the system.

5 Presentations: Business Plan and Detailed Technical Design Contests (and Optional Build and Test Summary)

5.1 Elevator Pitch

Teams will have the opportunity to give a 90-second elevator pitch of their concepts to ICOE attendees at the beginning of the conference. Teams can show one PowerPoint slide that summarizes their concept to assist audience members in visualizing their design. This portion will not be scored by the judges. In the event that the competition moves to a virtual format, the elevator pitch will be given during the awards ceremony.

5.2 Public Pitch

In addition to the written report, each team will make one presentation on the market assessment, technology innovations being pursued, and business model of their project to a panel of judges, participating as mock project investors, via a live presentation on the ICOE 2021 convention floor. The public pitch will also include a summary of the team's community outreach and engagement efforts. This public pitch challenges teams to convince the panel of experts of the technical underpinnings, business case, and feasibility of commercialization of their system. The presentation should focus on the business plan, including the design parameters of the team's device. Teams should be prepared to discuss the extent of their market analysis and validation in their presentation to defend their concept.

Presentations are limited to 20 minutes, followed by up to 15 minutes for questions from the panel of judges. For teams participating in the optional Build and Test Challenge, an additional 5 minutes will be added to their presentation time exclusively to discuss results of the challenge (total of 25-minute presentation time). When pitching their marine energy project to prospective investors, teams should use their presentation to showcase maximum creativity and dynamism, highlighting the team strengths and unique approach. Such an approach will naturally involve a professional appearance and manner. Presenters should highlight their concept prototype and may use high-quality posters, maps, charts, or other visual aids or props to enhance their PowerPoint-based presentation using the 16:9 widescreen format. A laptop computer will be provided for digital presentations.

The public pitch deliverable comprises a PowerPoint with optional additional digital material packaged into a single zipped file (see Appendix H). These materials should be submitted on a USB flash drive to the event organizers during check-in, along with any drivers needed to support presentation animation. USB drives should be clearly marked with the team, faculty advisor, and student lead(s) names. Competition officials will make an effort to return the USB devices at the end of the competition, but this is not guaranteed.

The scoring criteria are provided in Appendix B, Table B-4. Penalties for late submission are also detailed in Appendix B.

5.2.1 Community Outreach and Engagement

During the public pitch, teams will spend 5 minutes summarizing their community outreach and engagement efforts. Because the team will often be required to present and summarize the purpose and impact of its work in a professional setting, this contest is designed to align with this expectation. These efforts can include, but are not limited to:

- Events
 - at your school to engage other students outside of your team
 - within your local community to share the importance of marine energy
 - presentations to a local middle or high school on marine energy
- Outreach
 - social media posts
 - articles in your school newspaper or local media outlets

Students should approach each outreach activity with a specific goal in mind (i.e. educate and excite younger students in the marine industry, inspire underclassmen to join future MECC teams, mentor younger students on the importance of marine energy, raise awareness in their community about marine energy, etc.) and report on how they achieved that goal in the final presentation.

During each event, teams are encouraged to capture high-quality photos and videos to present during the final presentation.

These engagement events may be done as in-person or virtual events.

6 Posters: Business Plan and Detailed Technical Design Contests (and Optional Build and Test Summary)

A poster summarizing the entire technical and business plan is required for each team. Teams will bring their poster to the event. Poster dimensions should be exactly 36 × 44 inches.

Glossary

Competition	The competition is all aspects and activities leading up to, through, and following the event. It is the subcontract project agreement between the competitively selected collegiate teams and NREL, and it is the contests, products, and event, collectively referred to for a given year as the U.S. Department of Energy Marine Energy Collegiate Competition: Powering the Blue Economy™.
Event	The event is when and where the teams compete in the contests.
Products	Products are what the team builds, writes, submits, and brings to compete in the competition. These include a written report, public pitch, and poster.
Team booth	Each team is provided an assigned area, known as a team booth, to use as a central location throughout the competition to practice their presentation, regroup, and showcase their hard work throughout the year to the public. There will be electrical outlets available in the team booth area to allow students to access computers and other equipment that the teams deem necessary.

Appendix A. Application Requirements

Interested teams must submit an application to participate in the competition to the competition's email address (Water.Competition@nrel.gov) by September 30, 2020, by 11:59 p.m. Mountain Daylight Time. Teams will not be eligible to compete if an application is not submitted by the deadline. Applications will be reviewed and judged by National Laboratory researchers using the following criteria:

- Educational Objective and Integration (25%)
- Organization and Project Planning (25%)
- Team Diversity and Inclusivity (25%)
- Institutional Support and Fundraising (10%)
- Communications and Outreach (15%).

More application details and a template for the application can be found on the [competition website](#).

Appendix B. Rubrics Products

Table B-1. Scoring Summary for the Business Plan and Design Competition Products (550 Points Total)

Competition Contests	Total Scores	Products		
		Written Report (250)	Public Pitch (225)	Poster (75)
Business Plan	310	150	125	35
Detailed Technical Design	240	100	100	40

Table B-2. Scoring Summary for the Optional Build and Test Challenge Products (100 Points Total)

Competition Contests	Total Scores	Products	
		Written Report (75)	Virtual Pitch (25)
Build and Test Challenge	100	75	25

Written Report

Table B-3. Scoring Rubric for the Written Report (250 Points Total)*, **

Description	Possible Points	Score
Business Plan (150 points)		
Market deployment feasibility (marketability, buildability, public/market acceptance, identification of stakeholders and end users, cost competitiveness in comparison to other energy sources)	60	
Risk recognition and management (e.g., recognition of failure maintenance, operational expenses)	35	
Innovation, creativity, and originality and presentation (i.e., how well the plan is presented in writing)	15	
Number of end-user interviews/surveys and quality of inputs received	20	
Financial analysis and documentation	20	
Subtotal	150	
Detailed Technical Design (100 points)		
Design objective description	15	
Power performance analysis	15	
Mechanical and electrical loads analysis and associated safety factors	15	
Optimization of system (e.g., power/storage capacity to overcome resource intermittency issues)	15	
Engineering diagrams, including mechanical and electrical drawings	20	
Incorporation of environmental and sustainability factors	10	
Incorporation of user needs as part of the design system	10	
Subtotal	100	
Total	250	

* 5% of total allowable points, distributed evenly across each contest section, will be deducted for each day the report is late.

** Formatting requirements are in place to ensure an equal amount of space for all teams to tell their stories to the judges. Reports not formatted to the requirements in Section 3 that are deemed to be utilizing more than the allotted space will be penalized at the discretion of the judges proportional to the infraction. Furthermore, extra pages will be ignored.

Public Pitch

Table B-4. Scoring Rubric for the Public Pitch (225 Points Total)

Description	Possible Points	Score
Business Plan and Detailed Technical Design (175 points)		
Compelling narrative of inspiration and purpose behind the business plan	25	
Demonstrates thorough market analysis and triple bottom line risk assessment	40	
Demonstrates consideration of risks, issues, and challenges along with design assumptions	40	
Practiced and polished presentation style, professional appearance and manner, clear communication of technical topics to broader energy community	20	
High-quality graphics, media, and props to support presentation	20	
Ability to answer judges' questions accurately and thoroughly	30	
Subtotal	175	
Community Engagement and Outreach (50 points)		
Demonstrated execution of community engagement and outreach plan	30	
Execution of a community event, virtual or in-person	20	
Subtotal	50	
Total	225	

Poster

Table B-5. Scoring Rubric for the Poster (75 Points Total)

Description	Possible Points	Score
Poster (75 points)		
Poster and model are visually appealing	20	
The concept is clearly understood	20	
Important elements of business plan and detailed technical design (and optional Build and Test summary) are represented on poster	20	
Ability to host the poster and engage in Q&A with the viewer	15	
Total	75	

Optional Build and Test Challenge

Table B-6. Scoring Rubric for the Optional Build and Test Challenge (100 Points Total)

Description	Possible Points	Score
Optional Build and Test Challenge		
The team clearly described the scaling factors considered in designing and fabricating the model-scale device	20	
The team clearly described the development of an experimental test plan and how the test plan would allow for the collection of data to prove the team’s stated objective	20	
The team demonstrated the test plan was executed successfully and describes how the instrumentation and measurement design was completed	20	
The team clearly described how the raw measurements, recorded during model testing, were post-processed to generate useful data that characterizes the device performance	20	
The team described lessons learned during execution of the Build and Test Challenge and what device modifications, new tests, or changes in recorded measurements the team would consider if their concept were to go through a second round of experimental testing	20	
Total	100	

DRAFT

Appendix C. Sample Safety and Technical Inspection

A sample of the sheet used to evaluate the model marine energy devices prior to the competition is provided on the following page. Teams are required to work through this process in advance of the competition with a qualified research technician, advisor, or similar university personnel as the final midyear project milestone; however, the competition organizers have the final say in approving the Safety and Technical Inspection sheet after being submitted by each Team. The competition organizers may ask a Team to revisit the Safety and Technical Inspection sheet they believe there are safety concerns that have not been addressed. The sample safety and technical inspection sheet is meant to provide guidance and by no means captures all the potential safety requirements each test facility may have.

Teams are also strongly encouraged to conduct a hazard identification (HAZID) and assessment⁵ on their own design, installation procedure, and test plan which is consistent with how safety plans are completed in the industry. During this process, each Team would develop a Risk Assessment Matrix (RAM) and develop mitigation strategies for any of the identified risks⁶. Given the wide variety of possible designs, the risk identification processes will help those Team members involved in the build and test to identify the inherent and unique risks for their design and testing procedure. If possible, Teams should have their HAZID reviewed by a qualified expert to audit and possibly help guide in the process.

⁵ <https://www.osha.gov/shpguidelines/hazard-identification.html>

⁶ Teams are directed to the [Marine and Hydrokinetic Technology Development Risk Management Framework](#) for additional information.

MECC 2021 Safety and Technical Inspection Sheet

Team Name: _____

SAFETY - cannot practice or test if noncompliant

- Wiring is deemed safe and uses adequate gauges—no electrocution or overheating hazard
- Electrical systems are tied to earth ground w/ 100 kohm or lower resistor
- Energized electrical components are adequately shielded—both electrically and mechanically
- Proper heat rejection
- Voltage is ≤ 48 V DC at electrical load connection to data acquisition system or other monitoring systems at all times
- All mounting fixtures fit without having to be forced
- For any electrical load: all charging or bulk energy storage follows industry-accepted best practices (i.e., safe circuitry overvoltage/undervoltage protection, flame/spill containment)

Electrical

- All electrical components outside the wet testing space are contained in enclosures (no tape)
- Cable passthroughs in enclosures provide strain and chafe protection (e.g., cable glands)
- MHK model device electronics and load electronics in separate enclosures
- All external wiring is in cable form and utilizes commercial connectors
- All electrical components are mechanically secured to enclosures

MHK model device

- MHK model device for testing is substantively the same as in the report
- MHK model device side of any electrical load: no batteries, excessively large capacitors (indiv. or combo ≤ 10 J)
- Capable of installation in the wet testing facility in one assembly to minimize the chance of shifting pieces in the water.
- Designed to be safely lifted by no more than two team members. If the device weighs more than what two team members can safely lift, adequate lifting points for a crane or equivalent hoist will need to be designed and inspected. Each team will need to evaluate each member's ability and fitness for physical work and material handling.
- Able to be fully assembled outside of the wet testing facility to allow for mechanical and electrical system checks to be completed before entering the water. It may be necessary for a team to design a dry test stand or mount where the device can be attached without risk of accidental movement (do not simply place on a tabletop).

Mechanical

- Review model design, installation, and test plan to minimize pinch points, sharps, entrapment, entanglement, etc.
- Review model design, installation, and test plan to ensure there are appropriate safety measures are in place if using an energized system (hydraulic pressure, compressed air, etc.)

Personal Protection Equipment (PPE)

- Verify that all team members working on the build and test challenge have access to appropriate PPE such as gloves, eye protection, closed toe shoes, appropriate work clothing, basic medical kit, etc.

Environmental

- Review installation and testing plan to account for the additional risk of working in or near water.
- Ensure all materials, oils, fluids, etc. used in the build are test are properly handled and disposed of at completion.

Wiring

- Wiring will reach the data acquisition system for measurements that is placed out of the wet testing facility.
- Emergency-stop terminated with standard JST female receptacle with male pins (test fit to data acquisition system)
- Emergency-stop signal (JST connector wiring) never draws more than 3 A and uses normally closed polarity during operation (students to describe)

Load

- Team-supplied electrical or other load is certified for desired use

Inspecting Safety Personnel Printed Name and Signature: _____

Date and time: _____

*noncompliance checkboxes should be circled above

Collegiate Team Faculty Advisor Printed Name and Signature: _____

Date and time: _____

Appendix D. Roles and Responsibilities

Table D-1 shows the competition roles, who is performing in each role, and what the role entails.

Table D-1. Roles and Responsibilities

Role	Individual(s) Assigned	Responsibilities
Collegiate Team	Multiple	<p>Carries out work on the project within the rules and requirements of the competition, based on direction and advice from their fellow team members, Student Leader(s), and Faculty Advisor(s)/Technical Monitor.</p> <p>Teams may consist of a combination of undergraduate students and graduate students, but teams must be at least 50% undergraduates.</p> <p>Expected team size is 6–8 participants, but there is no limit to the number of participants per team. However, for each team, the number of students participating in the judged pitches may be limited based on timing restrictions.</p> <p>Interdisciplinary teams are highly encouraged in the following areas of study: engineering, business, marketing, communications, policy, and social sciences.</p> <p>International institutions are welcome to apply, but no more than 25% of the final teams selected to participate will be led by an international institution. International teams will not be eligible to receive support funding from DOE/NREL and must provide their own support.</p>
Collegiate Team Student Leader(s)	Maximum of two per team	<p>Attends informational sessions with the Faculty Advisor, represents the team when communicating with competition organizers and other teams, and disseminates information received from the competition organizers over the course of the entire project, including monitoring communications. Multiple student leaders are allowed, but at least one must be an undergraduate.</p>
Collegiate Team Faculty Advisor(s) (and Technical Monitor for the purposes of funding support)	Minimum of one per team	<p>Serves as the lead faculty member and primary representative of a participating institution in the competition. This person also engages with competition organizers and provides guidance to the team throughout the project and ensures that the Student Leader disseminates information received from the competition organizers.</p> <p>The Faculty Advisor advises and provides input and coaches the students on the skills necessary to compete in the various aspects of the competition.</p> <p>Some teams may specify multiple Faculty Advisors who contribute to the team, but only one person should be identified as the Technical Monitor for contractual purposes.</p>

Role	Individual(s) Assigned	Responsibilities
Collegiate Team Co-Advisors(s) or Supporting Faculty	Multiple	Supports the Faculty Advisor and Student Leader(s) in the above duties but typically does not directly engage with DOE/NREL competition staff.
Competition Managers	Jenn Garson, DOE Allison Johnson, DOE	Represents DOE and has final decision-making authority in all aspects of the competition.
Competition Operations Manager	Arielle Cardinal, NREL	Leads correspondence with the collegiate teams regarding contracts, contest questions, and team expectations. During the competition, the Operations Manager is the primary point of contact for questions related to engagement with the judges, logistics, and protocol. Tasks include developing team schedules and coordinating/collating scores and team feedback from the contests in time for the awards ceremony and supporting the collegiate teams, judges, Competition Managers, and Head Rules Official. Reports to the Competition Managers.
Head Rules Official	Elise DeGeorge, NREL	The Head Rules Official and chair of the rules panel. The only official authorized to write and modify the rules. This individual reports to the Competition Managers.
Rules Panel	Anonymous subset of the competition organizers	Rules panel members, a subset of the competition organizers and/or contest judges, are solely authorized to interpret the rules. If there is any doubt or ambiguity as to the wording or intent of these rules, the decision of the rules panel shall prevail.
Communications and Outreach Point of Contact	Jenny Wiegele, NREL	Coordinates all aspects of media representation, website management, publications, signage, and outreach.
Technical Competition Staff	Michelle Fogarty, NREL Ben Maurer, NREL Nathan Tom, NREL	Performs all duties to ensure a safe, effectively communicated, and fair competition. The Competition Staff, including the Competition Managers and Operations Manager, will work to ensure a seamless event.
Contest Judges	To be announced prior to the competition.	Conduct and evaluate each individual contest at the competition.

Appendix E. Logistics

Many logistical details will be provided throughout the course of the academic year leading up to the event. While organizers will make concerted efforts to inform teams, teams are responsible for familiarizing themselves with the details provided and proceeding accordingly. Some of these topics are detailed in the following subsections.

Competition Timeline

The 2020–2021 competition timeline is shown in Table E-1.

Table E-1. 2020–2021 Competition Timeline and Related Activities

Month/Year	Competition Activity
September 10, 2020	Release of competition rules and requirements
September 23, 2020	Informational webinar
<u>September 30, 2020</u>	<u>Applications to participate are due</u>
October 9, 2020	Selection notification
October 2020–April 2021	Concept development
<u>December 1, 2020</u>	<u>Notification to NREL if participating in optional Build and Test Challenge due</u>
<u>January 31, 2021</u>	<u>High-level concept summary and team story due</u>
<u>April 14, 2021</u>	<u>Written reports due</u>
April 27, 2021	Dry run presentations (optional)
<u>April 28–30, 2021</u>	<u>Competition takes place at ICOE 2021 in Washington, D.C.</u>
June 2021	Review meeting/conference call to review the competition and make recommendations for a possible next event.

Event Schedule

The event schedule is currently evolving and the viability of having an in-person competition will be evaluated on a regular basis, but teams will be required to participate in the following:

- 90-second elevator pitch on exhibit hall floor for all ICOE attendees
- Live pitches
- Poster presentation session
- Announcement of winners (with additional live pitch of the winning team to be made at an ICOE 2021 conference session).

Event Registration

All individuals attending the event will be required to register with the organizers. The number of individuals that can attend from each team will be limited based on constraints such as event space. This limit will apply to all attendees from each university, including students, PIs, Co-PIs,

advisors, and mentors. The limit for attending participants for the 2021 event will be provided closer to the competition date.

Lodging

Organizers will investigate desirable, cost-effective lodging options and provide information to teams for consideration. It is ultimately up to each team to book appropriate accommodations.

Local Resources

Each team is responsible for considering what local resources may be needed and identifying reasonable options near the event. These resources may include:

- Printing shops
- Shipping services
- Transportation services.

Team Booths

Teams will be provided with a space to use as their home base during competition. There will be electrical outlets in the team booth area to allow students to operate tools, test equipment, or use computers. Teams are expected to set up a professional space in their team booths to highlight the team's branding. This can include the concept design, posters, team logo, and school information. The team booths are the teams' chance to showcase all the work they have put into their project over the course of the year and the best way to communicate their efforts to the industry, especially at a final industry networking event such as ICOE 2021.

Shipping

It is each team's responsibility to transport materials to the event safely and on time. It is also each team's responsibility to arrange return transport of these items. It is advised that teams consider how to ensure access to these items quickly upon arrival at the event and that they consider the safest way to transport fragile items, minimizing risk of damage.

Storing Items at the Event

Organizers are not responsible for the security of supplies stored at the event space. If teams wish to avoid transport of supplies to and from the event each day, they are advised to explore reasonable options to store and secure these items appropriately. Gear that could aid in this might include lockable totes.

Feedback

Throughout the organization and execution of the event, organizers will request feedback from participating teams, judges, volunteers, and others. This feedback is taken very seriously both during the year and for future competitions as we work to improve the organization and execution of the event. To support that continued improvement, it is crucial that participating teams seriously consider and convey both positive and critical feedback. All participants should expect and plan to provide feedback at the conclusion of the event. Consider opportunities to capture and provide individual and/or team feedback to organizers throughout the year as well.

Appendix F. Safety and Conduct

The competition is a forum for students with an interest in marine energy and/or related blue economy industries to showcase innovative ideas and further develop their knowledge. The event is designed to be safe, fair, and competitive, as well as a fun learning experience and a professional growth opportunity. Each team is responsible for the safety of its operations in accordance with the subcontract agreement. Participants are expected to conduct themselves in the spirit of the competition by being team players both within their own teams and among competitor teams.

Teams must follow Occupational Safety and Health Administration rules for safety equipment based on expected activities (see NREL/university subcontract, Appendix B Clause 8: Worker Safety and Health Requirements, for more information). Organizers may issue a stop work order at any time during the project if a hazardous condition is identified.

There will be electrical outlets available in the team booth area to allow students to access computers and other equipment that the teams deem necessary.

As part of the culture of DOE and NREL, renewable energy and sustainability go hand in hand—a common public perception as well. As a result, the competition is about renewable energy, and we expect that participants will embrace and showcase sustainability where possible during all aspects of the event (e.g., reducing waste in packaging for shipping, reusing packaging materials used in transporting items to the competition, and eliminating the use of nonrecyclable materials such as foam packing peanuts). In addition, we encourage team members to engage in common sustainable activities such as recycling paper and beverage containers. Team creativity to support this mission is encouraged, but not scored.

For those teams who opt to build a prototype, they are encouraged to display their device during the competition. These teams are responsible for the transport of their marine energy device and all necessary tools and equipment as well as for any damage to or loss of such items. Shipping information will be provided before the competition event.

Appendix G. Dispute Resolution

Disputes involving but not limited to competition format, rules, scoring, or behavior are a serious matter and will be treated as such. Disputes must:

- Be submitted to the Competition Operations Manager by the collegiate team Student Leader
- Be submitted via email and, if possible, be accompanied by an in-person notification of the email at the event
- Include a clear description of the action being protested, referencing the appropriate section of this rules document.

Once submitted, the Competition Operations Manager will meet with the Head Rules Official and initiate an internal review of the dispute. Disputes will be discussed among at least three judges and/or competition organizers, who will gather appropriate information through interviews or other means and issue a final ruling. If it is concluded that the issue has a broader impact on the entire competition, the Head Rules Official will consult with all necessary members of the DOE/NREL organizing team to determine next steps.

If the Head Rules Official makes a decision that may directly or indirectly affect the strategies of some or all of the teams, the decision will be recorded in the “Decisions on the Rules” section of the Slack User Group channel (discussed further in Appendix H) within 24 hours. If the dispute is handled during the competition event, an announcement at the next major address to teams (e.g., opening or closing remarks for the day, lunch) may be substituted for the Slack post.

The Head Rules Official has the final say in all disputes.

Appendix H. Communications and Contest Details

External Communications

The MECC [website](#) will showcase the various elements of the competition, ongoing collegiate team engagement, and information about how to participate in future competitions. The website will also feature important documents such as this manual and the Marine Energy Collegiate Competition application template.

Internal Communications

It is each team's responsibility to stay abreast of the latest competition communications from the organizers. Communication between the teams and the organizers occurs via one or more of the following:

- **Slack User Group:** Official communications suitable for viewing by all team members and organizers will be posted on the Slack User Group channel. Instructions for joining the Slack User Group will be provided by NREL to the teams following each team's commitment to participate.
- **Box:** This tool is used by the organizers and teams to transfer large files such as competition products. Notification of, or requests for, file transfers are made via the Slack User Group or email.
- **Virtual meetings:** Teams are strongly encouraged to participate in scheduled virtual meetings with the organizers. Invitations and instructions for participation in these meetings are provided by the Competition Operations Manager via email and the Slack User Group.
- **Meetings during event:** Briefing meetings will be held each day competition events are scheduled during the conference.
- **Email:** The official email address for the competition is Water.Competition@nrel.gov; questions should be sent directly to this email address and answers that may be of interest to all teams will be posted on the Slack User Group. For expediency and to protect confidentiality, the organizers may choose to communicate with teams via team members' email addresses as listed in the Slack User Group database; however, most official communications occur via the Slack User Group channel.

Branding

Teams are encouraged to develop an online presence and branding platform for their team to showcase their work throughout the year, and this platform should be shared as part of the Community Outreach and Engagement element of the competition.

This platform may include web pages, social media, outreach material, and team T-shirts. Regular updates and engagement with school and external media are recommended, and efforts will be shared by NREL and DOE channels as allowed. In addition, teams will be asked to report on these efforts through the scored community engagement and outreach requirement. Teams must receive permission in order to use the competition logo or name as part of individual school/team branding and platform; requests should be sent to Water.Competition@nrel.gov.

Teams are expected to set up a professional space in their team booths to highlight the team's branding. This can include the concept design, posters, team logo, and school information. The team booths are the teams' chance to showcase all the work they have put into their project over the course of the year and the best way to communicate their efforts to the industry, especially at a final industry networking event such as ICOE 2021.

Confidentiality and Intellectual Property

There are portions of the competition that are decidedly open to the public for purposes of generating interest and providing general information. In addition, team members should keep in mind that various media outlets may be present during the competition. Any information made known and/or discussed should be expected to receive widespread and uncontrolled dissemination. Teams should consider in advance what level of information regarding all aspects of their concept they desire to have publicly available versus information that provides a competitive advantage, is critical to their performance in the competition, or is of a "proprietary" nature and essential to potential future business endeavors.

Team members agree to the use of their names, likenesses, content, graphics, and photos in any communication materials issued by the organizers and event sponsors.

Content and images (graphics and photos) as well as any publications in which the content and images appear may be viewed and made available to the general public via the websites of DOE, NREL, and event sponsors with unrestricted use.

The organizers and event sponsors will make all reasonable efforts to credit the sources of content and images, although they may be published without. To ensure proper usage of and credit for images, teams should submit photos and graphics through the competition Box folder.

Judging and Scoring

A panel of judges is responsible for scoring team performance in each contest (e.g., detailed technical design, business plan). The judges will have expertise related to the content they are responsible for evaluating. The panel will include diverse backgrounds that allow the judges to evaluate performance from a variety of angles.

Competition organizers will ensure that, to the extent possible, judges will not:

- Have personal or financial interests in, or be an employee, officer, director, or agent of any entity that is a registered participant in the competition
- Have a familial or financial relationship with an individual who is a registered participant
- Provide advice to teams, although they can provide clarification on the judging process
- Discuss team performance with other teams or their advisors.

Names of the selected judges will be announced prior to the Marine Energy Collegiate Competition.

Judging Rubrics

Judges will use detailed scoring rubrics to evaluate team performance in each of the categories. These rubrics give all participants a clear idea of what they will be evaluated on in each contest.

Products submitted prior to the event will be thoroughly reviewed and evaluated by the judges. Each judge will complete a rubric independently after the team's presentation or based on the review of submitted products. At the completion of each event segment, judges will discuss each team's performance before finalizing the rubrics. The team of judges will submit one unified rubric to the Head Rules Official for scoring purposes.

Team Feedback

In an effort to provide as much feedback as possible, teams will receive copies of the scored rubrics, which will be provided following completion of the competition. Teams will also receive a short narrative derived from the judges' deliberations after each team's presentation. Teams will also receive copies of notes judges may have written on the individual rubric forms.

Submittals and Submission Locations

Submittals are considered on time if they are received by the Competition Managers by the respective due date stated in this document.

All products must be saved in the formats indicated (see each product section) and submitted to organizers.

Submission Locations

Products due ahead of competition must be delivered to the competition Box folder (a link will be provided in the Slack User Group channel). A folder for each team will be created, and it will be the team's responsibility to provide email addresses for each student that needs upload access to the account.

Teams can submit early copies and updated revisions until the deadline. Each folder will be closed, or "unshared," after the submission deadline. If a report is submitted after the deadline, 5% of total allowable points, distributed evenly across each contest section, will be deducted for each day the report is late.

PDF Requirements

PDFs must meet the following criteria:

- Embedded fonts
- A minimum resolution of 300 dpi on all images.

Points to remember:

- Creating a PDF from scans, or by outputting the content into a raster image format (e.g., .jpg, .tiff, .png, or .gif) and then creating a PDF from the images is not acceptable.

- All-raster PDFs are large files at 300 dpi but are of unacceptable quality at lower resolutions and are not scalable without degradation. These types of PDFs should be avoided.

Audiovisual Presentation Requirements

Audiovisual presentation format requirements include the following:

- If used, videos should be of a .MOV or H.264 compressed .MP4 (MPEG-4) file type with a resolution of 720 × 480
- Presentations should be of 16:9 aspect ratio
- No background music that violates U.S. copyright laws; all incorporated music must be an original or royalty-free composition and proof of licensing must be submitted with the final file and transcript.

Electronic File-Naming Instructions

The required file-naming convention for all electronic files is:

[TEAM ABBREVIATION]_[PRODUCT]_[SUBMISSION DATE (YYYY-MM-DD)].[EXTENSION]

Example: A report submitted by California Maritime Academy on April 23, 2021, would have the following file name: MARITIME_Report_2021-04-23.PDF.

Appendix I. Alternative Competition Structure

In the event of a cancellation of ICOE 2021, this document will be updated to reflect changes resulting in the cancellation. All of the required products will remain unchanged, but the event and deliverable schedule may be updated. Should there be extenuating circumstances for some but not all teams, a hybrid solution between a standard competition and virtual will be developed and further enumerated to the teams with as much advanced notice as feasible.

The primary goal of the competition is to maximize learning, and the organizers will work with each team to determine what is possible.

DRAFT

Appendix J. Virtual Conference Participation Etiquette

The following best practices are highly recommended for remote participation in any event:

- Teams are responsible for knowing their meeting point of contact and ensuring that connections and technology all work prior to their start time. Test your internet connection, audio and video capabilities, and ability to use the virtual meeting program before your presentation time. The organizers have built in transition time, but it is limited.
- Use a hard-wired internet connection (i.e., ethernet cord). Wi-Fi connections can be used but are not ideal because they are prone to more connection issues.
- Mute your audio connection (phone and/or computer) when you are not intending to speak. The organizers will mute participants with excessive background noise.
 - Ensure you are only using one audio connection. Connect to audio via your phone OR your computer, but not both. Connecting with two audio connections results in electrical feedback that is very uncomfortable for all involved.
- Teams are encouraged, but not required, to use their webcam for presenting. Audio narration of slides is also acceptable.
 - Ensure you have a clean background while streaming video (e.g., no inappropriate or offensive images in the background or people walking around).
 - Avoid window backdrops because of lighting.
 - Be sure you look professional in your dress and speak professionally during your presentation.
 - Refrain from distracting behavior while sharing your video and/or audio, such as drinking or eating.