The Challenge
Your team has been contracted by a leading maritime logistics company to design and construct a support vessel that can maintain stability in open ocean conditions. The vessel must be capable of holding a specified weight of supplies, which may be at times unbalanced, while remaining stable at sea.

Real World Examples
Stability at sea is an everyday challenge for commercial and naval vessels. As wind travels uninterrupted across the open ocean, larger waves are generated. Additionally, the deeper water allows for larger waves. These conditions make working at sea extremely challenging. For example, consider the work being done right off the coast of Virginia Beach to install the foundations for wind turbines 27 miles out to sea. How do these ships remain stable as these large structures are installed and maintained? Or consider the recent events in the Middle East. To assist with the delivery of humanitarian aid to the people in Gaza, the US military constructed a floating pier that spans 3 miles off the coast into the Mediterranean Sea. How do vessels remain stable alongside this pier as their supplies are offloaded?

Things to Consider
Buoyancy and Stability: The ship must stay afloat and maintain stability while loading and unloading supplies at sea. Consider the ship's hull design, ballast systems, and stabilization mechanisms to ensure it remains afloat and minimizes rolling and pitching.

Unbalanced Load: Commonly ships will have an unbalanced load. This means that there is an unequal amount of weight to the right or left of the ship's centerline. How would you offset the unbalanced load to maintain stability?

Stability in Saltwater: How does the salinity of water affect buoyancy and overall stability of ships? Pay attention to weight distribution across your ship to prevent capsizing and carefully design the shape of your hull for maximum performance. Conduct tests in saltwater environments to observe and adjust your design for optimal stability.

Inclining Test: The inclining test determines how much a ship tilts when weights are moved around on board. This helps calculate the ship's center of gravity and ensures it stays stable during operations. This is crucial for the ship's safety and stability at sea.

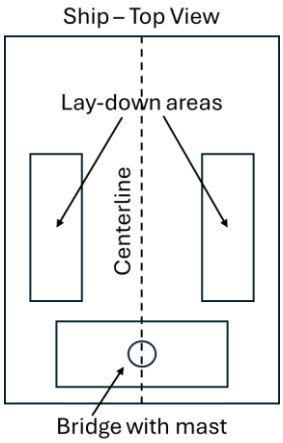
This challenge is not limited to existing ship designs. You are encouraged to think creatively and innovatively to design and develop a ship that excels in all aspects of the challenge. Exploring innovative ideas for the ship's construction materials is also highly encouraged.

The Digital Ship Challenge organizers would like to stress that the majority of work on all phases of the project is to be designed and constructed by the students.

Judging Criteria
The challenge involves six main components which will be judged: an engineering notebook, prototype iterations, oral report on the day of the competition (5-7 mins.), ship design and construction, the demonstrated ship performance, and the maritime maintenance mania challenge.

Constraints
Overall beam (width): 18" max.
Overall length: 18" max. (bow to stern)
Overall height: 18" max.

Ship must include the following spaces (all dimensions measured in L x W):
Lay down area port side (left of centerline): 1"x 5" – clearly mark the lay down area on your vessel.
Lay down area starboard side (right of centerline): 1" x 5" – clearly mark the lay down area on your vessel.
Bridge with mast: 6" mast on top of the bridge, the bridge must be above main deck, aft of lay down areas, and allow for clear visibility above any supplies in the lay down areas.



*If the above constraints are not met, a penalty will be assessed. *

Supply container: 1" x 5" (L x W) with a maximum weight of 5 oz. (provided at competition). The maximum height of supplies will not exceed 2".
Depth of water will be a maximum of 14".

Team Registration

Team selection: Individual schools will determine how they will select their teams.
Maximum number of students per team is four.

Teams must officially register by September 27, 2024. Teachers will need to submit this information online at https://forms.gle/3UaDVJSJMgTUC9jH7

Project Completion Process

Teachers and Mentor(s) will create a schedule for the Mentor(s) to meet with the students several times to provide feedback. This can be done in person or virtually.
A mid-year workshop will be scheduled at OERI (formally VMASC). During this session, students will participate in a career panel, receive feedback on their progress, and have the chance to ask questions regarding the challenge. All teams and team members should plan to attend with documentation and prototype iterations.
(December 19, 2024: 9:00am – 1:00pm – lunch provided)

The Digital Ship Challenge will take place March 15, 2025, at OERI. Doors will open for registration at 8:00 am and the opening ceremony will begin at 8:45am. Teams should bring their completed ship to the competition ready to be tested and be prepared to present. Full details about the day of the event will be emailed to teachers after the registration deadline.

Project Submission: Competition will be held March 15, 2025, at OERI. Engineering Notebooks are due March 7, 2025, by 4pm. They are to be dropped off at OERI for judging prior to the challenge. Teachers, please make arrangements with Jennifer Renne for drop off of the notebooks. All other criteria will be judged at the event, which will culminate in ship performance testing.

Schedule of events

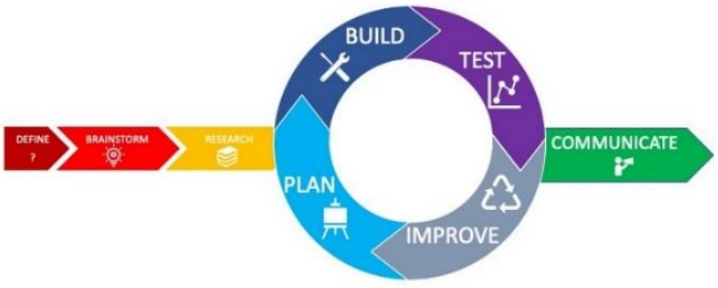
Team registration	September 27, 2024
Virtual Advisor Meeting	October 1, 2024
Mentor(s) feedback sessions	As scheduled.
Midyear review at OERI	December 19, 2024
Mentor(s) feedback sessions	As scheduled.
Engineering Notebook Deadline (drop off)	March 7, 2025
Digital Ship Competition at OERI	March 15, 2025

If you have any questions, please contact Jennifer Renne at jrenne@odu.edu or 757-817-9975.

Criteria Information Sheet

The scoring for each section will vary. The information below gives an indication of what the judges will be looking for at the competition. For maximum points, all criteria for each section must be fulfilled.

Engineering Notebook: A binder that will formally document, in chronological order, all of the team's work that is associated with the planning, designing, production, and preparation for the challenge. Notebooks should contain EVERYTHING you do/think related to the challenge and should follow the VDOE Engineering Design Process:



This includes, but is not limited to, having brainstorming pages, sketches, technical drawings (CAD), research notes, calendar/schedule, roles of team members, calculations, daily log, safety procedures (if applicable). The technical drawings that the judges will be looking for are orthographic, isometric projections, and lines plan, all complete with appropriate annotations. The technical drawings should be printed on no larger than a B size template. Teams may include other plans if they feel it is necessary.

-Be clear
-Be detailed
-Be organized
-Include a title page, table of contents, and any references (citations in APA format)

Prototype Iterations: Designs from inception to final product should be brought including all models (can be cardboard or paper) and prototypes.

Oral Report: Team members will be dressed appropriately and be prepared to speak on any part of the challenge at their assigned time. The team will be given 5-7 minutes to make a presentation. Afterwards, time will be allotted to answer questions. The engineering notebook and prototype iterations should play a large part in the presentation. The Digital Ship Challenge organizers discourage the use of PowerPoint or Google Slides in this context.

Design and Construction, judges will be looking for the following:

-Achievement of design specifications and constraints.
-Creativity and innovation of design.
-Quality of construction.
-Finish and appearance.

Demonstrated Performance: This is the most exciting part of the Digital Ship Challenge! Each team will have the opportunity to demonstrate that their hard work has resulted in a ship design that can successfully meet the challenge.

Maritime Maintenance Mania: This day-of-event challenge will require students to work together in their teams and race against the clock to complete a ship repair challenge that demonstrates their problem-solving skills. This year's challenge will require the use of Sphero Programming, through either the use of a Sphero Bolt or Sphero RVR. Teams will be provided all materials and the Sphero at the event.

Scoring

All scoring for this year's challenge will be provided and reviewed at the Mid-Year Workshop.

All hands on deck – let's build a sea-worthy stable support vessel!