2024 Digital Ship Challenge

The Challenge
A local Norfolk shipping company would like your team to design and construct a cutting-edge container ship that will undertake the demanding journey of transporting goods and supplies across the Atlantic Ocean. The ship's success hinges on its ability to maintain buoyancy and stability across varying sea states and keep the shipping containers secure throughout the voyage.

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

Container Security: Develop a system to efficiently secure a minimum of 10 containers stacked in place during the voyage. The system should prevent shifting, sliding, or toppling of the containers even when the ship encounters rough seas.

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.
000
Judging Criteria
The challenge involves five 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, and the demonstrated ship performance.

Constraints*
Using a 1" to 8'0" scale, ships must meet the following dimensional constraints:
Overall beam (width): 10" max. (including any mechanisms to secure containers)
Overall length: 24" max. (bow to stern – not including eyehooks)

Ship must include the following spaces (all dimensions measured in L x W x H):
Bridge: 2" x 2" x 4" (must be above main deck)
Crew living quarters: 2" x 2" x 2" (above or below main deck)
Engine Room: 2" x 8" x 2" (must be below main deck)
Exhaust stacks: 2" x 2" x 6" (must be above main deck)
If the above constraints are not met, the team will be disqualified

Bow and stern must have an attachment for winch to pull ship through water (teams will be provided with eyehooks).

Shipping container: 1" x 1" x 5" with a weight of 2 oz. per box (provided at competition)
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 (student names and a team name) by October 9, 2023. Teachers will need to submit this information online at https://forms.gle/jV9uWKt9Ym23qTN39

Team Kickoff: Teachers will plan a kick-off event to bring students together and review competition rules. A Technical Advisor(s) will be assigned to each team; teachers will make arrangements with the Technical Advisor(s) to schedule a virtual or in-person kick-off meeting.

Project Completion Process

Teachers and Technical Advisors will create a schedule for the Technical Advisor(s) to meet with the students several times to provide feedback. This can be done in person or virtually.
A mid-year review session will be scheduled at VMASC. During this session, students will participate in a workshop and receive feedback on their progress. All teams and team members should plan to attend with documentation and prototype iterations.
(Proposed dates: Dec. 14 or Dec. 15: 9:00am – 1:00pm – lunch provided)

The Digital Ship Challenge will take place March 21, 2024 at VMASC. Doors will open for registration at 8:00 am and the opening ceremony will begin at 8:45am. Teams should bring their completed container 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 21, 2024 at VMASC. All criteria will be judged at the event, which will culminate in ship performance testing.

Schedule of events

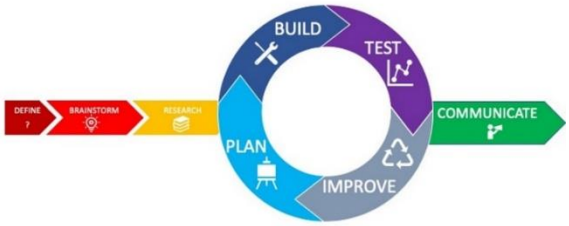
Team registration	October 9, 2023
Team + Technical Advisor(s) kick-off	By October 23, 2023
Technical Advisor(s) feedback sessions	As scheduled
Midyear review at VMASC	December 14/15, 2023
Technical Advisor(s) feedback sessions	As scheduled
Digital Ship Competition at VMASC	March 21, 2024

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 book 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 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. 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 has the opportunity to demonstrate that their hard work has resulted in an operational product that can successfully meet the challenge.

Teams will load their ship into the water pier side and maintain stability for 30 seconds. After 30 seconds, teams will connect their ship to the winch system.

Teams will then load and secure containers pier side. How many shipping containers can your ship hold pier side? The minimum containers (10) are worth 10 points, and for every container after an additional 1 point will be added. **If the minimum container quantity is not met, the team will be disqualified. **

After containers are loaded pier side, teams will move their ship to the center of the towing tank and maintain stability for 30 seconds.

Ships will then get underway and begin the simulated transatlantic journey. Along the transit, ships will encounter various sea states. Judges will look for continued buoyancy and stability of the ship, and security of loaded containers. Have you lost any containers at sea? Points will be deducted for each container lost at sea. If a ship sinks during the transit or completes the transit but has no remaining containers on board, no points will be awarded for that portion of the challenge.

Scoring

Engineering Notebook

Max. Points	Criteria
5	Title Page: Clearly states the name of the challenge, team name, team member names, name of school.
5	Table of Contents.
15	Chronological documentation: Provides record of all team activities related to planning, designing, production, and preparation for the challenge. It should clearly demonstrate the progression of work over time.
50	Content: Should include (but not limited to) brainstorming pages, sketches, technical drawings (CAD – including orthographic, isometric, and lines plan), calendar/schedule, roles, calculations, daily log, safety procedures (if applicable). It should cover all aspects of the engineering design process.
20	Clarity: All components of notebook should be clear and understandable. Pictures, diagrams, charts, etc. should be labeled and explained effectively.
15	Detail and organization: The notebook should be well-organized and exhibit a high level of detail. It should provide insights into the thought processes and decisions of the team while following the flow of the engineering design process.
5	References: If external sources are used, they should be appropriately cited in APA format.

Prototypes

Max. Points	Criteria
25	Designs from inception to final product are displayed (this includes all models or prototypes).

Oral Report

Max. Points	Criteria
10	Appropriate attire: All team members should be dressed professionally and on time.
20	Knowledge and preparedness: All team members should demonstrate a comprehensive understanding of all aspects of the challenge. They are well-prepared to speak on any part of the challenge.
10	Presentation duration: Team presents in the 5–7-minute time frame.
20	Content: The presentation features content from the engineering notebook, prototype iterations, and engineering design process.
20	Engagement and confidence: All team members should display confidence and be engaged while presenting. This includes maintaining eye contact, using a clear and audible voice, and conveying enthusiasm.
10	Question and answer session: The team should be prepared to answer questions from the judges after their presentation. Responses should be knowledgeable and reflect a deep understanding of the project.

Design

Max. Points	Criteria
20	Overall beam (width): 10" max.*
	Overall length: 24" max. (bow to stern)*
	Space for bridge: 2" x 2" x 4" (must be above main deck)*
	Space for crew living quarters: 2" x 2" x 2" (above or below main deck)*
	Space for engine room: 2" x 8" x 2" (must be below main deck)*
	Space for exhaust stacks: 2" x 2" x 6" (must be above main deck)*
	Eyehook attachment on bow and stern of ship*
20	Creativity and innovation: Ship design exhibits creative and innovation solution and demonstrates a unique and thoughtful approach to solving the challenge.
20	Quality of construction: High quality construction with attention to detail and precision, it is durable and reliable.
20	Finish and appearance: The finished ship has an aesthetically pleasing appearance and the overall finish and surface quality meets or exceeds expectations.

If the constraints are not met, the team will be disqualified

Demonstrated Performance

Max. Points	Criteria
20	Pier Side: Ship floating, stable, for 30 seconds
50	Pier Side: Minimum number of containers loaded (10) (stable, floating – 30 seconds)*
+1 pt per	Pier Side: Additional containers loaded Maximum time allowed for load out: 5 mins
50	Underway: Successful transit
30	Pier Side (transit complete): Sea state reduced, stable (no listing) ship floating for 30 seconds
-1 pt per	Pier Side: Containers lost

If minimum quantity of containers is not met, the team will be disqualified