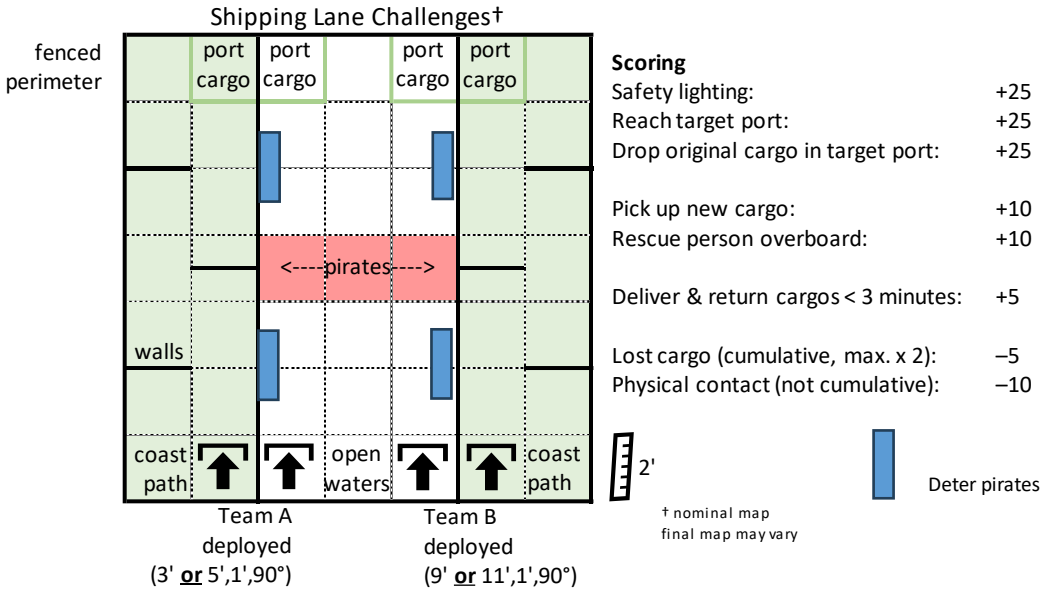
2026 Peter Gregson Design Challenge
Map and Rules (V2.0)



Key Subsystems Required

i. Lighting safety system
ii. Navigation system
iii. Cargo handling system
iv. Rescue system
v. Pirate deterrent system

Rules and Challenge Details

1. Robots must operate safely without endangering the users or the public. A pre-inspection of your robot will be performed, and only approved robots are permitted in the building/on the course.

2. No modifications to the course structure, obstacle, or features are permitted.

3. No pneumatic/hydraulic actuation, no gas/aerosol/liquid systems of any kind are permitted.

4. No voltages over 24V are permitted.

5. Only one physical robot can be deployed; it may then separate on the course if designed to do so.

6. Your team of 5 students is one group. One group is permitted 3 attempts on the course, OR, a total of 15-minutes, whichever condition is fulfilled first.

7. Only parts provided in the initial kit and those paid for from the flexible budget can be used. Small hardware and 3D printed parts are also acceptable. If in doubt, request confirmation in writing and in advance from the instructor.

8. The diameter and height of the robot must be less than 50 cm.

9. The robot must be autonomous, no manual controls or commands are permitted when deployed. **Robots must be delivered and ready by 9am, Challenge Day. Modifications will NOT be allowed once the robot is delivered.**

10. The Team must choose either the coastal path or the open ocean zone. The coastal path is clear of pirates as it is regularly patrolled; however, it is a longer distance and requires hugging the coast. The open ocean path is a shorter distance, but your ship/robot may encounter trouble enroute. The robot must be deployed in 1 of the locations, and once it is, this counts as 1 attempted deployment of the possible 3. A Team may choose either option for each attempt of their maximum of 3 attempts. The robot will be pointing up toward the target ports, at 90 degrees orientation, in all deployed positions.

11. The pirates may be pushed to the other side of the open waters zone by activating any of the 4 panels in blue boxes shown on the map. If Team A activates either of the blue boxes on their side (left), the pirates will oscillate between 7' < x < 10' (right). If Team B activates either of the blue boxes on their side (right), the pirates will oscillate between 4' < x < 7' (left). Activating a both Team A and B blue boxes within 30 seconds of each other will cause the pirates hide and oscillate in the middle for 30 seconds, 6' < x < 8', upon which time they will resume patrolling coast-to-coast (4' < x < 10'). Communication is established with frequency shift keying (FSK) to enable activation. Optically, a message of "BYE" must be transmitted to the receiver in the visible spectrum. For FSK, the two frequencies are 1kHz and 3kHz for the marks (high) and spaces (low) respectively transmitting at 110 bps, with 8 data bits and no parity or extra bits for control or framing.

12. There will be a simulated person overboard in a life raft that will be randomly placed for rescue. There will be 1 rescue object in each coastal region, and 2 in the open ocean. The life raft will measure 2 inches wide x 4 inches long x 2 inches tall and will be printed from 3D printers using PLA or similar. A step model is provided on Brightspace. Lifeboat <35g.

13. The cargo objects will be rectangular and measure 3 inches wide x 6 inches long x 3 inches tall and will be printed from 3D printers using PLA or similar. The cargo objects will also have metal washers approximately 1 inch in diameter on either end on the top that permits detection and magnetic attachment. There will also be 1-inch-tall and 0.5-inch-deep recesses that run along the length on either side of the cargo for physical grabbing (think i-beam). A step model is provided on Brightspace. When the ship (robot) is deployed, it will be preloaded with the initial cargo that it must drop off at the target port. It then must pick up the other cargo and return it to the home port. Cargo <160g.

14. The pirate obstacle will be moving at a maximum speed of 0.1 m/s, translationally between the pink regions shown on the map. It will have a maximum diameter of 20 inches and will return a LiDAR signal between a height of 3 to 12 inches off the floor surface.

15. A Team will be randomly selected for being Team A or Team B, but the robot must be able to run from all positions.

Scoring Details

16. **[25 pts]** Awarded if the robot has an operational LED light system that ensures safe operation. All necessary COLREGS lights with correct placement and colour will award 10pts, no partial marks. Another indicator light-set for threat levels will award another 15pts. The indicator light interface colours must be in the visible spectrum, and, have at least 3 threat levels—far (no threat in radius, r >= 4 ft.), near (potential threat in radius, 2 ft. < r < 4 ft.), and close (collision threat in radius, r =< 2 ft).

17. **[25 pts]** Maximum awarded if the robot reaches the target port locations on the opposite side of the deployment, whether coastal zone or open ocean. No cargo need be dropped off or picked up for these points. No partial points are awarded for partial distances. The condition is met when any part of the robot is within 1 ft of the target port tile center. The locations are shown in the map. A robot must be deployed in the coastal zone, or the open ocean zone.

18. **[25 pts]** For dropping off the initial cargo in any of the opposite side target ports. Any part of the cargo box that cross the 2 ft. x 2 ft. demarked zone gives full marks.

19. **[10 pts]** Maximum awarded if the robot correctly finds and picks up the new cargo from the target port, and leaves port with the load. To do this, the robot must locate the cargo in the 2 ft. x 2 ft. demarked zone, correctly position itself, and then physically grab or restrain the cargo to remove it from the port. The cargo will be placed at the center of the port location, oriented at 90 degrees (pointing toward the home port). No part of the new cargo must remain in the port demarked zone for points to be awarded. There are no partial points for partial completion of this task.

20. **[10 pts]** Maximum for rescuing a person overboard in a life raft. The robot must locate this randomly placed person in a life raft and then bring them to any port for rendering aid. Finding the stranded person and indicating so (e.g. flashing lights) awards 5 pts. Physically attaching to the life raft and successfully bringing the person to a port awards the last 5 pts.

21. **[5 pts]** Maximum awarded for swift operation, as cargo transportation is a time-sensitive task with direct implications to cost. Time is of the essence and robots that perform both a) the drop off of the original cargo to the target port, and, b) the delivery of the return cargo to the home port within 3 minutes will be awarded 5 points.

22. **[-5 pts]** For each lost cargo. As there are 2x cargo packages, this could cumulatively be -10 pts if both packages were lost to the sea or to the pirates. If you recapture cargo, this deduction does not apply.

23. **[-10 pts]** Any physical contact with the fence or obstacles results in forfeiting a maximum of 10 points as the robot will be deemed unsafe. If your robot is carrying objects, they are deemed part of your robot. This deduction happens only once per attempt; i.e. attempt 1 hit does not carry-over to future attempts 2 or 3. These points are non-cumulative.

APPROVED REVISIONS AND ADDITIONAL DETAILS
REMOVES AMBGUITY ARISING FROM IMPLEMENTATION AND QUESTIONS

Format

R##. Month Day, Year. Revision Description. Implications to scoring and design requirements, if any.
Original Document Version: V##.
New Document Version: V##.

R01. January 20, 2026. A) Added the weight of Lifeboat and Cargo, B) Changed Robot Starting Orientation to 90deg, and C) Opposite Port Cargo now located in center of port square with any 90deg. Design Challenge Clarifications, no impact to rubric or scoring.
Original Document Version: V1.0
New Document Version: V2.0