IEEE Southeastcon 2018

IEEE USF: Hardware Competition Rules

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Manifest:

Terminology

Treasure map: Visual aid that helps define what steps the robot can take
Pirate: Robot
Ship: Raised portion of the field
Island: The lower portion of the field not painted blue
Doubloons: Points
Gangplank: Ramp from the ship to the island
Treasure Map: The string of 3 binary bits transmitted by the infrared sensor
Destination A / Lowering the bridge: Push button that lowers the bridge
Destination B / Location of treasure key: Pressure plate
Destination C / Rising the bridge: Push button that raises the bridge

Avast, Me Hearties!

A pirate begins the journey by reading a treasure map and lowering a gangplank onto the island. The pirate then crosses a narrow gangplank being careful not to fall into the shark infested waters. Once on the island, the map shows the path to the key; then the chest can be claimed! While on the island, the pirate can raise a flag to claim it for the crew. The pirate picks up the treasure, returns to the ship, and sets sail on the high seas.

Overview

The major tasks to complete are: reading the treasure map, lowering the gangplank, recovering the key, loading the treasure, raising the flag, and returning to the ship. The route taken while completing these tasks depends on randomly selected treasure map coordinates. Pirates will have the option of completing all the tasks listed in the coordinates, or forgo some tasks in the interest of strategy. However, the key must be retrieved before the treasure can be collected. The end goal is to collect the maximum number of doubloons in the least amount of time.

The Treasure Map

At the start of a round, the robot will receive coordinates for the route that must be taken to retrieve the treasure. The coordinates will be sent as an IR signal in a 8 bit message. The last 3 bits contain the coordinates. Teams will have to receive, display, and use the code that will be randomly generated at the beginning of every round. Each binary bit represents one of the three destinations (Figure 1). Only destinations listed by the coordinates will earn Doubloons. All combinations of destination routes are symmetrical, making all possible combinations equal in length.

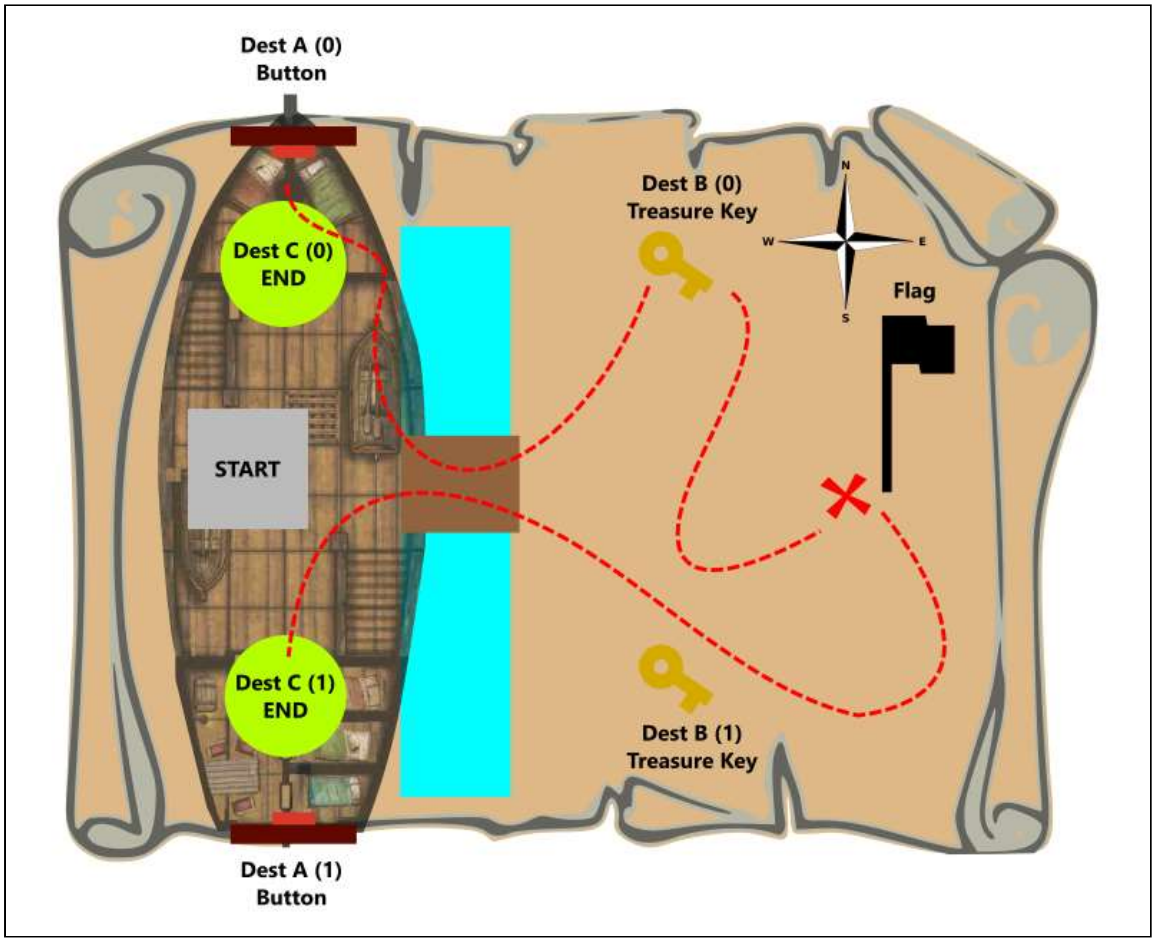

Figure 1: SoutheastCon18 Treasure Map

The Route:

The robot starts over an infrared LED (Figure 2) where it receives the 8-bit signal. The received signal must then be displayed on the robot. There are two possible locations: left (A0) and right (A1), for each destination (Figure 1). The route taken will depend on the coordinates the robot receives (see Table 1). The robot must go to each destination in alphabetical order: A-B-C. If a player accomplishes task at B first, they are no longer eligible to receive doubloons for Destination A.

At Destination A, the robot will press a limit switch to “lower the gangplank” and cross the water. A green light above the button will indicate whether a robot successfully pressed the correct station. Successful completion of Destination A will indicate it is safe to cross the gangplank. If the robot crosses the bridge without completing Destination A, no doubloons will be earned for this section.

At Destination B, the robot will find the key to unlock the treasure chest by depressing a lever to activate a limit switch. A green LED next to the lever will confirm successful pad activation, and the robot may proceed to treasure chest if desired.

For maximum doubloons the robot must retrieve the treasure chest and raise the flag. The robot can earn doubloons by either delivering the chest to the ship or pushing it a short distance from its starting position. The treasure chest will be located at the same position for every match. Additionally, the robot may rotate the wheel to raise the flag.

The treasure chest and flag are optional stages to earn extra doubloons. The chest requires the completion of Destination B prior to any manipulation. However, the flag may be raised at any point during the match.

At Destination C, the robot will press a limit switch to signal the end of the round. Destination C will utilize the same buttons as Destination A with a 2 second period where the button is disabled; pressing the button after this period will result in the end of the round.

Table 1: Coordinate Locations on Treasure Map

Route	Code (Right=LSB)	Destination A Location	Destination B Location	Destination C Location
1	0 0 0	A (0)	B (0)	C(0)
2	0 0 1	A (0)	B (0)	C(1)
3	0 1 0	A (0)	B (1)	C(0)
4	0 1 1	A (0)	B (1)	C(1)
5	1 0 0	A (1)	B (0)	C(0)
6	1 0 1	A (1)	B (0)	C(1)
7	1 1 0	A (1)	B (1)	C(0)
8	1 1 1	A (1)	B (1)	C(1)

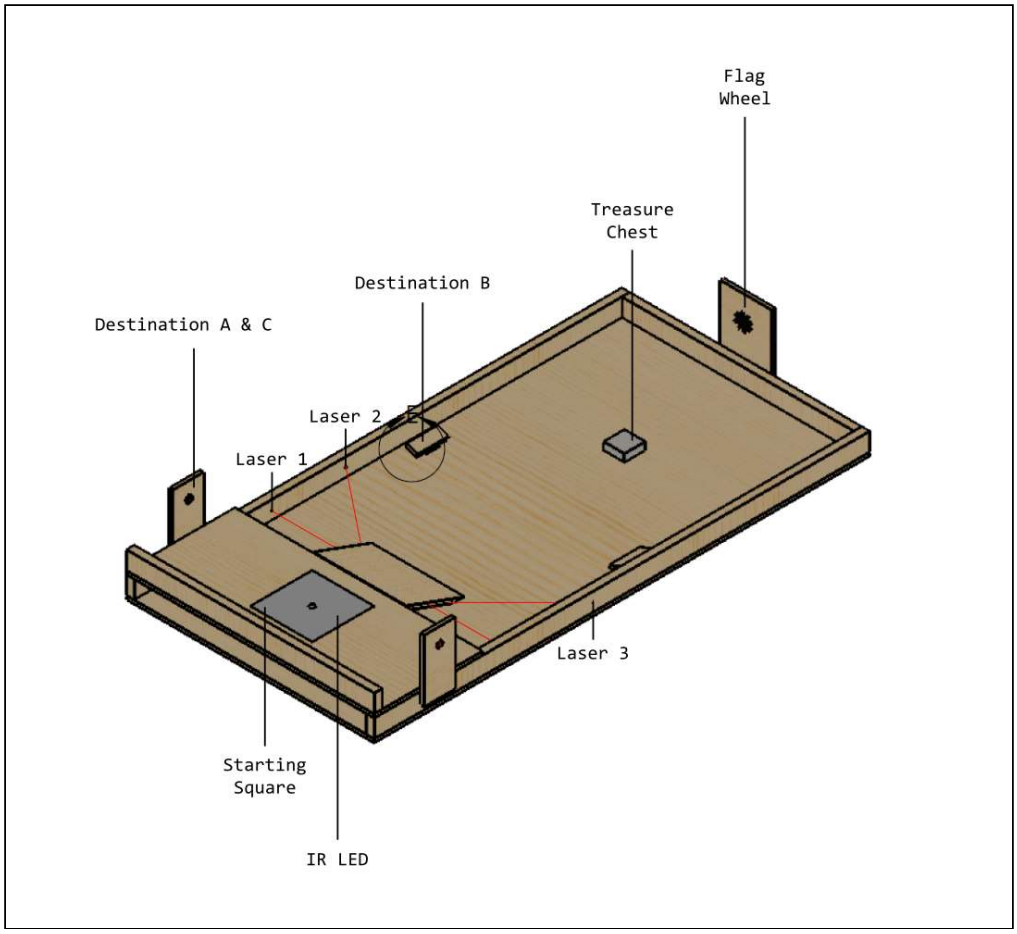

Figure 2: SoutheastCon18 Playing Field

Destination A: Button, Destination B: Treasure Key**, Destination C: Button

*The laser hits a LDR mounted on the bridge

**The treasure key is actually a pressure pad, and pressing the correct one opens the chest

***The robot needs to turn the wheel to raise the flag

Playing Rules:

The game is about earning doubloons (see Table 8 for doubloons breakdown) by completing objectives. Scores can also be influenced by how a team wants to play the game. Teams can earn a basic number of doubloons by doing the bare minimum of objectives; they can earn more doubloons by completing more tasks.

- Robot must be autonomous - No wired or wireless communications during competition other than IR receiver mounted on the bottom center location on robot to receive coordinate location.
- Robot must remain a single unit and can not be modular.
- Any contact the robot makes with the 'water' will result in the round ending. Any doubloons earned up to that time will be kept. Water contact will be determined by an automated process that takes input from a sensor detecting a laser.
- Team members may end the round at any time. This occurs when a team member makes contact with their robot.
- A team making contact during play or tampering with another team's robot will result in the offending teams' disqualification and zero doubloons earned for the that round.
- No two teams may occupy a playing field at the same time.
- A round ends when the robot presses the Destination A pushbutton a second time or reaches the four minute time limit.
- Each team competes in two rounds before a final round on the Saturday of the conference.
- The final round with the top four teams will be held on Saturday night during the awards banquet.
- Teams can only activate or complete a stage or destination one time.
- Before each round, Teams will have a 15 minute window, after their score is displayed, to file an appeal with the judges/timekeepers if they believe a scoring error exists. If an appeal is declined, Teams will be deducted 250 doubloons from their round scores. After an appeal judges/timekeepers decisions are final.
- Robots must be present at the Starting sequester location fifteen minutes before the beginning of a round. At the end of a round teams must place robots in the End sequester location. Robots will be released from sequestering within 15min of all teams completing Rounds 1 and 2. Being late for sequestering will result in 250 doubloons deduction for that round. If a team has not reported for sequestering before the first team of the round begins, that team will not be allowed to compete in that round, and may only earn doubloons collected outside of round (eg. team shirts, logo and flag).
- Teams must adhere to the the IEEE code of conduct or they will be disqualified from competition.
- Only 2 team members are allowed within the designated playing area at a time. Violations will result in a 250 doubloon deduction for the round. Team members in the playing area must wear team shirts to get t-shirt points.
- Team shirts used for hardware competition must display the same Team Logo as the flag in order to get doubloons credit for the shirts.

- Any teams found to be deliberately exploiting the field's automatic scoring system will be removed from the competition.

Doubloon earning locations:

- Start Pad (when display shows correct sequence)
- Button (Destination A) - "lowers bridge"
- Crossing Bridge
- Key (Destination B) - "unlocks treasure chest"
- Treasure chest
- Flag being raised
- Return to Ship and raise the bridge (Destination C)

Doubloons earned outside of round:

- Team Shirts - Hardware Team handlers must wear Team Shirts throughout hardware competition. 75 doubloons will be issued for every round.
- Team Flag - Team must provide a flag to be placed on the ship section of the field during a team's run (must include IEEE logo and school logo/colors)
- Team Logo - The same logo should be displayed on the team flag, team shirts, and robot.

Robot Specifications:

The robot must not be greater than 12"x12"x12" at the start. It cannot extend to more than 20"x20"x20" during the competition. The robot must not include any form of wireless communication and the robot cannot fly.

Flag Specifications:

The flag must display the team logo, and may be no larger than 8"x12" and may be any shape within those dimensions. The flag may be constructed from laminated paper or fabric. Flags constructed of flimsy material will not be accepted for points credit. Flags must be attached to a flagpole no longer than 2 feet and no wider than 1 inch in diameter.

Field Specifications:

All directions are with referenced to Figure!

The field will be 8'x4' area.
1 count: Plywood Sheet 4' x 8" ¾ thickness
1 count: Plywood Sheet 4' x 4" ¾ thickness
4 count: 8'x2"x4"
Decking screws

Initial Signal:

Coordinates are sent as an IR signal based off the NEC protocol. The message starts with an initial burst of 9ms, a space of 4.5ms, 8 bits that contain the message, and an ending burst. The first 5 bits of the message will be sent as logical 0s, and the last 3 bits will define the coordinates to follow based on logical 1s and 0s as detailed in the possible routes below. The message will be sent every 5 seconds. The following figure describes the signal:

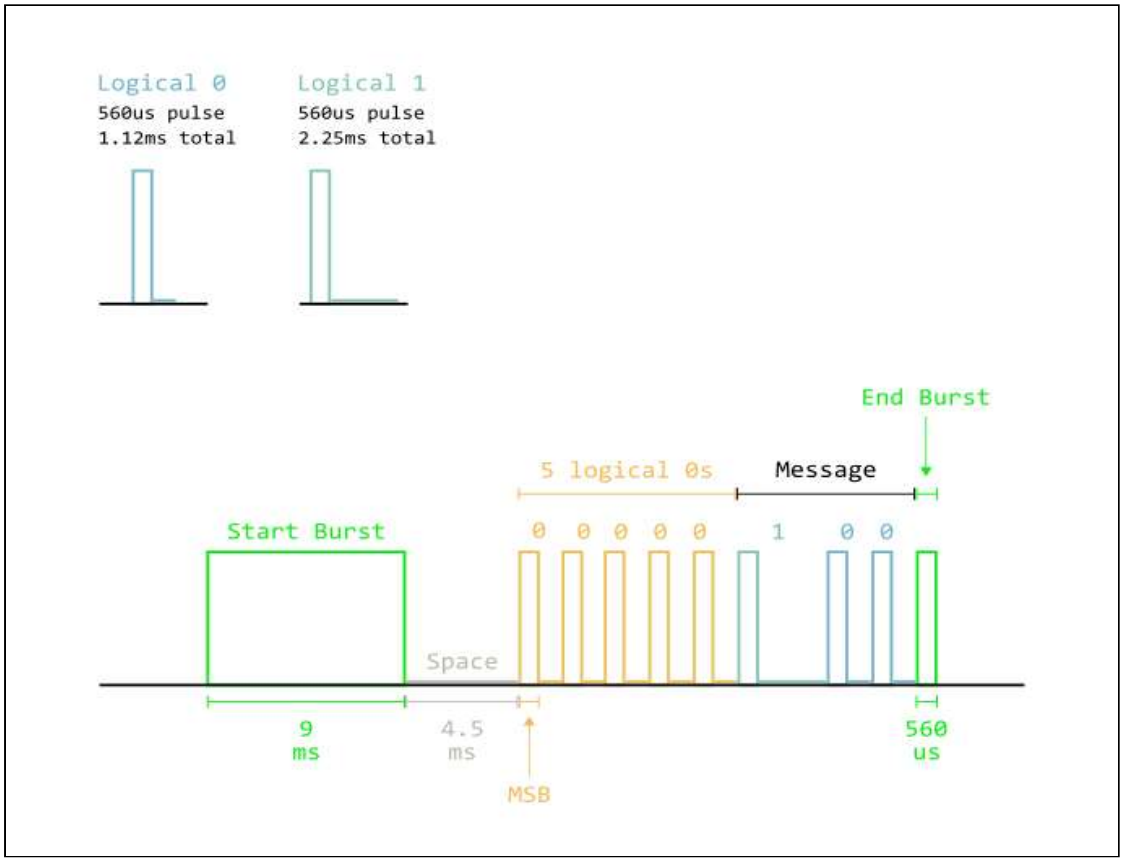

Figure 3: IR Signal Spec Description

Destination A and C:

Destination A and C utilize the same button. The button is a round arcade style button on a 6” x 12” piece of ¾” plywood. This piece is centered 12” from the outside Western edge of the field with 9” above the top of the top of the ship. The button is centered 6” above the top of the ship and on the centerline of the short side of the 6” x 12” plywood piece.

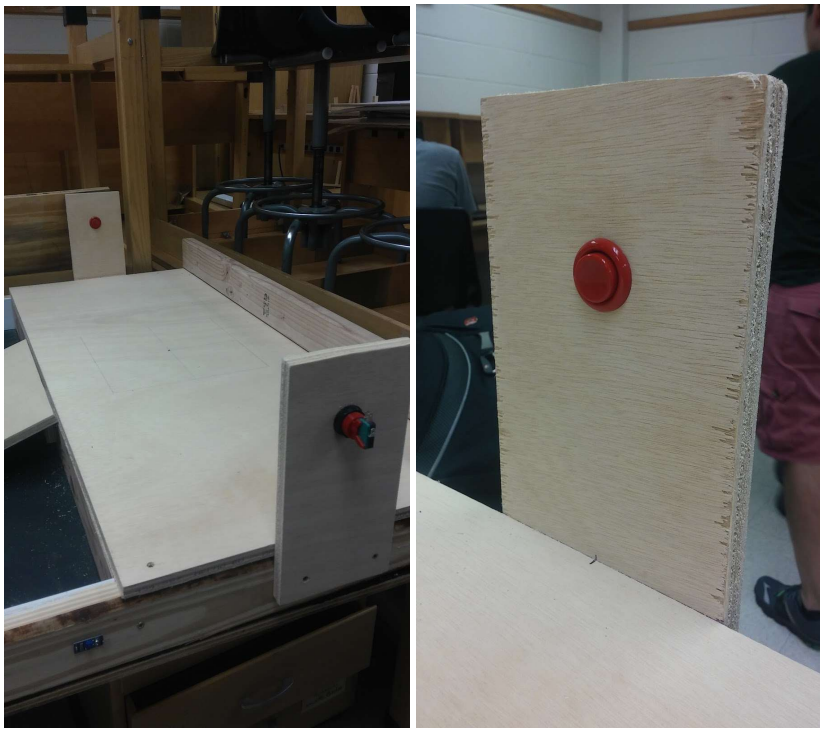

Figure 4: Destination A and C

Table 2: Destination A/C Parts	
Part Description	Part Number/Details
Destination A/B Button	Model # 1568-1476-ND https://www.digikey.com/products/en?keywords=1568-1476-ND

The Water:
It encompases the area surounded by the ship on the West, the inside of the stage walls on the North and South, not including the ramp. The East boundary is marked by the waterline connecting the 24.5" mark on the South and North walls and the 9.5" mark from the ship adjacent to the bridge.

Table 3: The water materials	
Part Description	Part Number/Details
Light Detection Signal Switch	Wangdd22 - LYSB01E6W0HPU-ELECTRNCS https://www.amazon.com/gp/product/B01E6W0HPU/ref=oh_aui_detailpage_o01_s00?ie=UTF8&psc=1
Mini Lasers	Ketofa WYHP https://www.amazon.com/gp/product/B00R73MC1S/ref=oh_aui_detailpage_o01_s00?ie=UTF8&psc=1

Destination B:
Destination B is going to be a 6" x 2.25" rectangle made from ¾" plywood. It is centered 42" from the West outermost part of the stage, and 1.50" from the inside of stage border. The plywood rectangle will be attached using a hinge centered at 42" from the West outer part of stage and 3.00" from the inside of the stage border.

Table 4: Destination B Parts	
Part Description	Part Number/Details
Everbilt 2-1/2 in. Zinc Plated Narrow Utility Hinges	Model # 15399 Internet #202033983 Home Depot SKU #649171
Everbilt Spring Assortment Kit	Model # 13554 Internet #203133714 Store SKU #471864 http://www.homedepot.com/p/Everbilt-Spring-Assortment-Kit-84-Pack-13554/203133714

Figure 5: Destination B

Flag Destination:

The flag will be raised via a 3D printed pirate ship wheel attached to a rotary encoder. The encoder will be located on a 10” x 15” piece of ¾” plywood. This piece is centered 24” from the Northern edge of the field, mounted on the outside of the 2x4 with 10.875” of the board above the Eastern 2x4. The rotary encoder is centered 7” from the top of the 2x4 and on the centerline of the short side of the 10” x 15” plywood piece.

Table 5: Flad Destination Parts	
Part Description	Part Number/Details
Rotary Encoder - Illuminated (RGB)	Mfr's Part #: COM-10982 ROHS https://www.sparkfun.com/products/10982

Treasure Chest

The treasure chest is a 4” x 4” x 1 ⅞” electrical conduit box filled with eight, 4 ounce pyramid fishing sinkers. The chest will sealed with a 4” square blank cover. For each round the chest will be located 18” from the inside of the eastern wall, centered on the North-South axis.

Figure 6: Treasure Chest

Table 6: The water materials	
Part Description	Part Number/Details
4 in. 30.3 cu. in. Steel Square Electrical Box	Model # 521711-25R, Home Depot Store SKU #338834)
4 in. Square Blank Cover, Flat	Model # 8752, Home Depot Store SKU #87679
4 - ounce pyramid sinker weights to be painted gold	Walmart

Table 7: Treasure building material		
Steel Square Electrical Box	Square Blank Cover	4 - ounce pyramid sinker weight (4 shown)
		

Scoring:

Teams will earn doubloons based on completing tasks and actions as specified in the Playing rules and Table 8.

Two Qualifying Rounds: Round 1, and Round 2

1. Both qualifying rounds will be scored by the same criteria.
2. There shall be multiple identical playing fields. Teams will compete at the same time on separate fields.
3. Rounds will be 4 minutes each max.
4. Each team will have randomly generated coordinates each round.
5. Number of Doubloons determines elimination round qualification

Elimination round: Round 3

1. The top 4 teams with the best scores after the qualifying rounds will proceed to the semi-finals.
2. The two teams with the highest semi-final scores will proceed to the finals.
3. The team with the highest overall score wins.
4. Semi-finals and final will occur during the banquet on Saturday.

Table 8: Scoring (per round)		
Action	**Doubloons**	**Notes**
Time remaining.	240 to 0	Doubloons will be issued based on the number of seconds the team has remaining after completing the round. Formula: Doubloons earned =240 - Completion time (seconds).
Display Correct Code	30	Correct binary code displayed on LCD Screen.
Activate Destination A	50	Maneuver robot to press correct button.
Cross Bridge from ship	200	Crossing the bridge while the indicator LED is green. (if correct stage A is selected)
Cross Bridge from ship without active Destination A	90	Crossing the bridge while the indicator LED is red
Activate Destination B	150	Maneuver robot onto correct pressure pad. Cannot proceed to pick up/ move treasure chest without completing this step.
Pick up and store Treasure Chest	240	Successfully picking up and storing the treasure chest in or on the robot. Destination B must be completed first. If completed, not eligible for treasure chest moving points(130).
Move Treasure Chest	130	Move the treasure chest out of its designated area without storing it (robot does not have to be back in end location with treasure chest to earn these doubloons). Not eligible if pick up and Store doubloons are claimed.
Raise Flag	220	Raise the flag to the top of the flagpole by turning the captain's wheel.
Finish on Destination C	50	Finish in the correct location without the treasure chest
Finish on ship with treasure chest.	240	Finish on the ship with the treasure chest and robot completely within the confines of the ship.

Team Shirts	75	Hardware Team handlers must wear Team Shirts throughout hardware competition. 75 doubloons will be issued for every round.
Team Flag	75	Team must provide a Team Flag with (school colors or mascot, IEEE logo, Round #). Total of 3 team flags will be required one for each round, assuming team qualifies for elimination round.
Team Logo	75	Must match Team Flag and be visibly identifiable on the robot. Must contain school colors or mascot, and IEEE logo. 75 doubloons will be issued for each round.

- Point values are subject to change