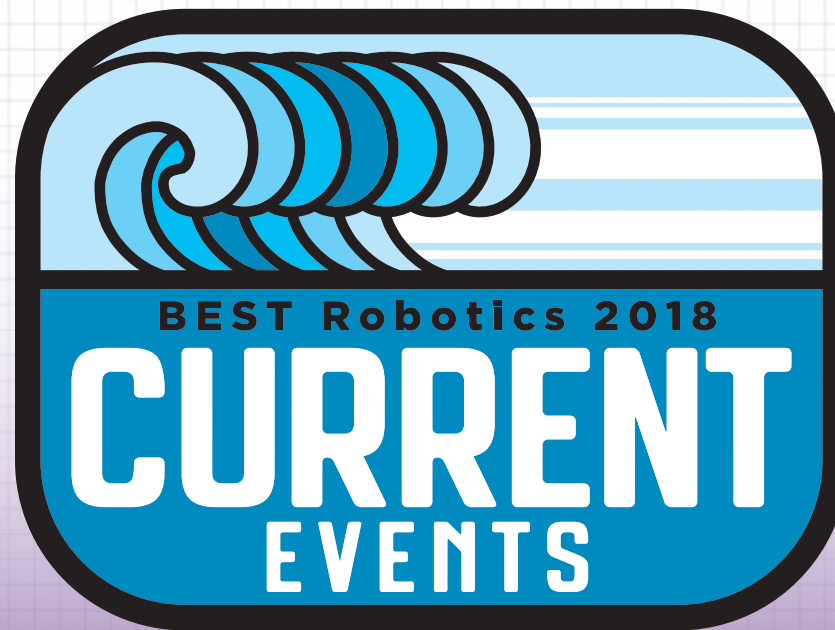


Game Introduction



September 8, 2018

Game Introduction



- A *gyre* | 'jī(ə)r | is a naturally occurring vortex of wind and currents that rotate in a clockwise direction in the northern hemisphere and counterclockwise in the southern hemisphere. These create a whirlpool effect, whose vortex moves more slowly at the center and that is where marine plastic debris collects.

Game Introduction



- In 1992, a shipping crate containing 28,000 plastic bath toys was lost at sea
- Those bath toys revolutionized our understanding of ocean currents
- 5 major gyres in the ocean worldwide
 - North Pacific Gyre is known as the Great Pacific Garbage Patch
- Recycled trash from the gyres to construct new artificial reefs

Game Objective



BEST has released a request for proposal (RFP) to design and prototype a robot that will ride the ocean currents and do the following:

- Remove, sort, recycle garbage and create reef blocks
- Install reef blocks on artificial reef structure
- Data collection relevant to ocean current and the health of sea turtles
- Demonstrate robotic flexibility and diversity

Game Players



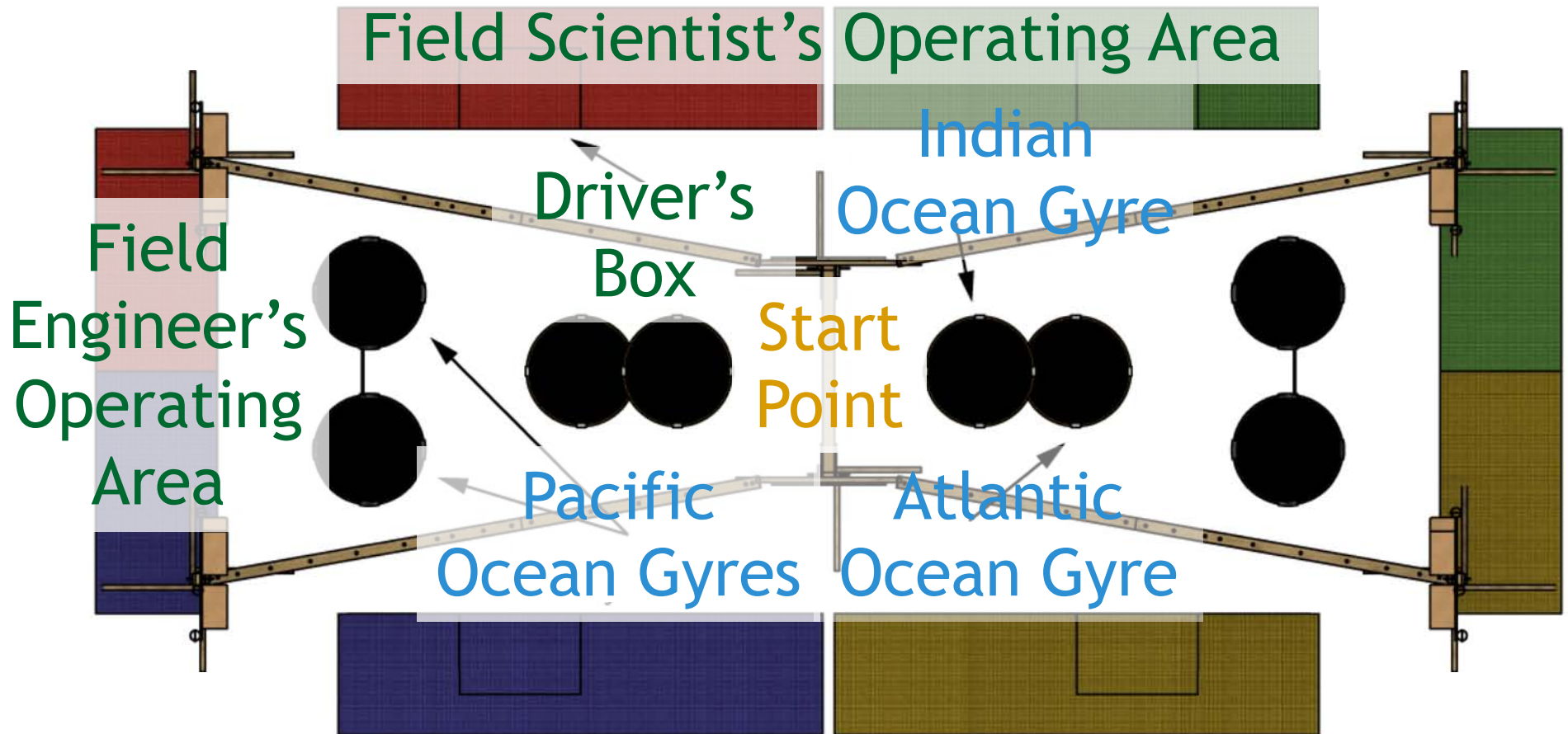
- 3 players per team on the field this year
 - Driver
 - Field Scientist
 - Wildlife Habitat Box
 - Fishing Net
 - Field Notes for Current Flow analysis
 - Only one allowed to handle sea turtles
 - Field Engineer
 - Recycling Box
 - Reef Building Materials



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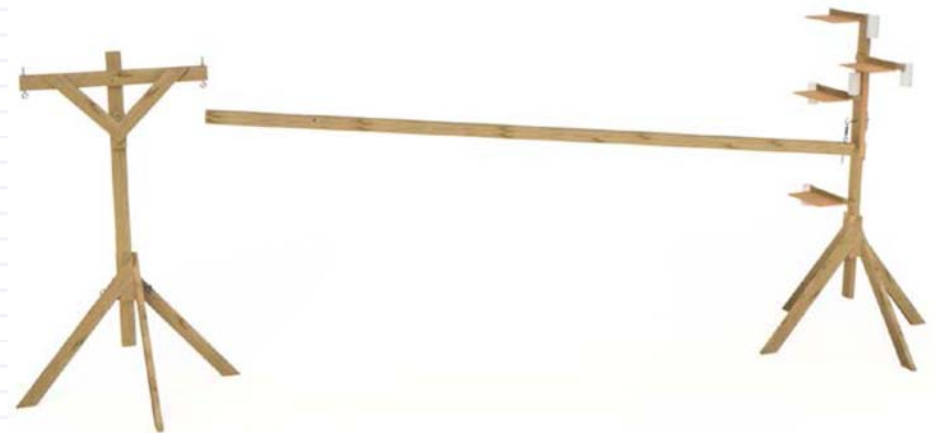
Game Field



Currents



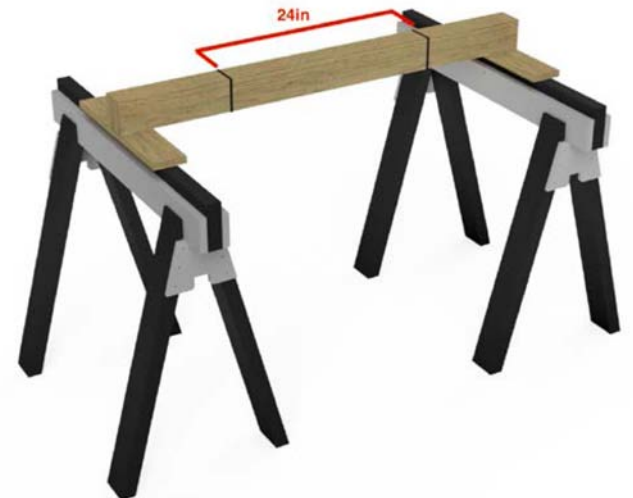
- Not Fixed, will rotate left or right with some vertical moment
- Gyres can be on left or right side
- Lowers to load robot
- Starting pin pulled by field scientist during 30 second startup period
- Rubber duckies float on the currents



Compliance Testing



- Robot mounts on board for compliance testing
- Robot must be < 8 inches vertically above the top of the current at the start of the match
- Configuration can change during match (without human assistance)



Mounting Robot



- Team must mount the robot
 - All members can work together
- Have 30 seconds to mount the robot
- Shorter teams can request help with lowering the current
- Can bring 2 non-powered hand tools to assist in mounting/unmounting the robot
 - Keep tools in Field Scientist area during game
- Field Scientist pulls starting pin before start

Gyres



- Two robots share access to one set of gyres
- Circular and may spin about the Z-axis and wobble in the XY plane and vary in height
- Contains all garbage, recyclable items and wildlife (not rubber duckies)
- Item placement is random and can shift based on wave motion
- Only robots can touch gyres



Field Scientist (FS)



- Use Wildlife Habitat box and/or fishing net for catching sea turtles, garbage, rubber duckies
- Perform duck current flow analysis
 - Communicate with other FS
- Only player that can touch wildlife
 - Communicate bonus item to teammates
- Allowed to bring in 2 note pages on a clipboard and a writing instrument
- Habitat box can be placed outside FS area

Field Engineer (FE)



- Use Recycling box to retrieve garbage and microplastics from the robot
- Build Reef Blocks and filament tubes
- Place complete reef building items on receiving platform for robot to move
- Recycling box and reef blocks can be placed outside FE area

Ocean Floor

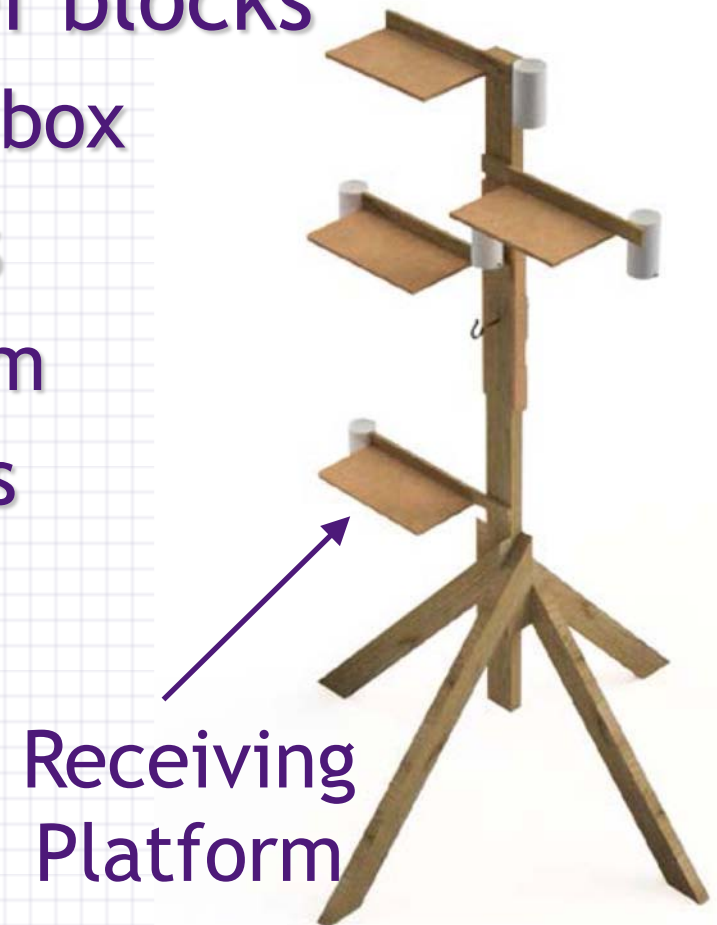


- Area under currents, outside FS and FE areas
- FS can use the fishing net to reach out into the ocean floor to retrieve items adrift at sea
- Robots can touch game pieces on the floor
- FE can not retrieve garbage from the ocean floor
- If a box drops on floor, FS or FE can grab the box (from within their area)

Artificial Reef Structure



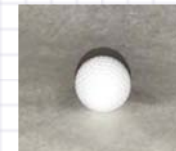
- Located near FE area
- Completed homogenous reef blocks
 - All items touching bottom of box
- Attaching reef blocks/tubes
 - FE place on receiving platform
 - Robot moves to upper shelves
 - Only robot or FE can touch
- Either FE or robot can touch reef blocks/tube at a time



Game Pieces



- Worth 10 pts
 - Soup cans
 - 8 ounce bottle block
 - 16 ounce bottle block
 - 1 liter bottle block
 - Rubber Ducky
 - Sea Turtle (in FS area only)
- Worth 5 pts
 - Microplastics (golf balls)



Reef Boxes and Filament Tubes



- Worth 25 pts
 - Completed Reef Box
- Worth 50 pts
 - Completed Filament Tube
- Worth 100 pts
 - Installed Reef Box and Filament Tubes



Wildlife Game Piece



- 2 turtle available in each half field
- Sea turtle garbage item worth double points
 - Different item in each round
 - All turtle have same item
- Only FS can handle wildlife
 - Place in wildlife habitat box
 - Turtle in FE recycle box do not count
 - Rubber duckies are not wildlife
- Caps marked with bonus garbage item
 - South BEST may use paper stuffed inside the hole



Duck Current Flow Analysis



- 24 possible currents flow scenarios
- Communicate with FE and other FS
- FS identifies match's current flow scenario
- Correct flow selection worth 150 pts
- Vacant quadrant info available if team receives their ducky (ask referee)

		Current flow order			
		1	2	3	4
Flow Scenario	A	Green	Red	Yellow	Blue
	B	Green	Red	Blue	Yellow
	C	Green	Blue	Red	Yellow
	D	Green	Blue	Yellow	Red
	E	Green	Yellow	Blue	Red
	F	Green	Yellow	Red	Blue
	G	Yellow	Red	Green	Blue
	H	Yellow	Red	Blue	Green
	I	Yellow	Blue	Red	Green
	J	Yellow	Blue	Green	Red
	K	Yellow	Green	Blue	Red
	L	Yellow	Green	Red	Blue
	M	Blue	Red	Yellow	Green
	N	Blue	Red	Green	Yellow
	O	Blue	Green	Red	Yellow
	P	Blue	Green	Yellow	Red
	Q	Blue	Yellow	Green	Red
	R	Blue	Yellow	Red	Green
	S	Red	Green	Yellow	Blue
	T	Red	Green	Blue	Yellow
	U	Red	Blue	Green	Yellow
	V	Red	Blue	Yellow	Green
	W	Red	Yellow	Blue	Green
	X	Red	Yellow	Green	Blue

Number of Pieces Known	Probability of Guessing Correct Current Flow
0	4%
1	17%
2	50%
3	100%

Scoring



- 3 options (sequential order)
 - Garbage in boxes
 - wildlife habitat, recycling boxes, partial reef blocks/filament tubes
 - Completing reef blocks or filament tubes
 - Attaching reef block to reef structure by robot
- Boxes held by FS, FE or robot will not count
- Sea turtle item worth double points
 - Different item in each round

Flexibility Bonus



- Operational diversity leads to additional bonus
- Worth 200 pts
 - 2 installed reef boxes using different types of garbage
 - Install both a reef box and a filament tube
- Worth 400 pts
 - 4 installed reef boxes (all different types of garbage) and a filament tube

Interaction with Other Robots & Field



- Multiple robots access limited game pieces
- Robots are expected to get in each other's way
- Do not steal game pieces in the grasp of or contained on another robot
- Do not remove reef blocks installed on another team's artificial reef
- Do not use the playing field items for support or balance

Advanced Competition Challenge



- Changing ocean conditions
 - Current Surge: adjust height of outer current to lower eye bolt
 - Ocean Swell: lower Atlantic Ocean gyre 11.5"
 - Turtle Migration: move sea turtles to Pacific Ocean gyre (1 turtle in each gyre)
- Adjustment notification announced 5 mins prior to round of play
 - At Hub: adjustment after Wildcard round
 - At Regional: adjust after Wildcard and Semifinals

Sample Scoresheet



SAMPLE Scoresheet

Team #: _____ Round: _____

Duck Current Flow Analysis: (circle one)

☐ Late?

A	B	C	D	E	F	G	H	I	J	K	L
M	N	O	P	Q	R	S	T	U	V	W	X

Sea Turtle Bonus (circle if rescued): 8oz 16oz 1L Microplastic

To be filled in by referee

Item	# Collected	# Reef boxes complete	# Reef boxes installed
Cans			
8oz bottle			
16oz bottle			
1L bottle			
Microplastics			
Rubber duckies			
Turtles			

Scoresheet Verification



- FS has scoresheet during match
 - Mark content of sea turtle
 - Circle current flow scenario
 - Give scoresheet to referee at match end
- Driver, FE and FS must remain in designated areas until referee indicate completion
- Referee will review score with driver
- Driver signs scorecard indicating agreement