

11/9/2021



Agenda

- Game overview
- Considerations
- Breakout groups
- Report outs



Game Overview
Seeding and Playoffs
Definitions
Safety
The Arena
Game Play
Robot
Scoring
Fouls
Key Dates
Discussion

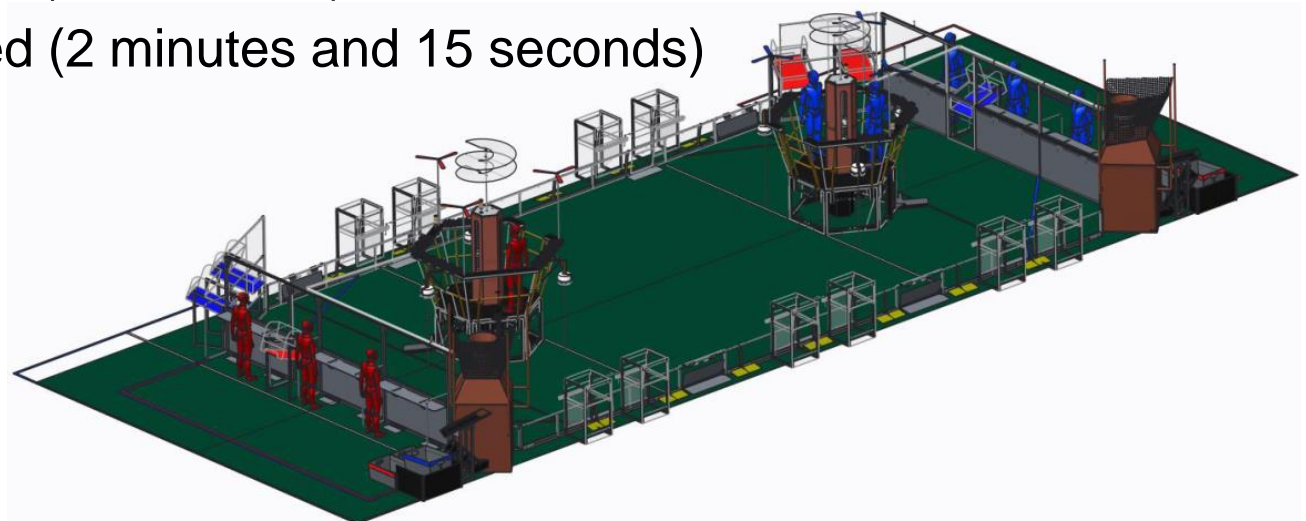
4





Game Overview

- *FIRST STEAMWORKS is played by two adventure clubs “alliances” of three teams each.*
- Each alliance prepares to take flight in three ways:
 - Build steam pressure
 - Start Rotors
 - Prepare for Flight
- There are two periods:
 - Autonomous (15 seconds)
 - Teleoperated (2 minutes and 15 seconds)



Game Overview - Autonomous

- Each *FIRST STEAMWORKS* match begins with a 15-second **autonomous period** in which robots operate independently of human control.
- During this period, robots attempt to take flight and can earn points as follows:

Action	Match Point Value
Cross the baseline	5
1 fuel in high efficiency goal	1, (1 kPa)
3 fuel in low efficiency goal	1, (1 kPa)
Rotor turning	60

kPa = kiloPascal pressure

Game Overview – Teleop Period

- During the remaining 2 minutes and 15 seconds of the match, called the **teleop period**, student drivers control robots. Teams on an alliance work together to build as much pressure and start as many rotors as possible. Leave enough time to latch on to their airship before the end of the match.

Action	Match Point Value
3 fuel in high efficiency goal	1, (1kPa)
9 fuel in low efficiency goal	1, (1kPa)
Rotor turning	40 each
Ready for takeoff	50 each

Game Overview – Ranking Points

- Alliances are ranked by a combination of their Win-Loss-Tie record:
 - 2 points win
 - 1 point tie
 - 0 points loss
- AND – the number of times they reach a 40 kiloPascal (kPa) pressure threshold
 - 40 kPa = 1 point
- AND – the number of times they start all rotors
 - 1 point

Game Overview – Ranking Points

Per qualification match per team	Points
Win	2
Tie	1
Loss	0
40 kPa pressure	1
Start all rotors	1

Seeding

- All teams seeded during qualification matches.
- Teams ranked in this order:

Order	Points
1	Ranking score
2	Cumulative sum of Match points
3	Cumulative sum of Auto points
4	Cumulative Touchpad score
5	Total accumulated pressure
6	Random sorting by FMS

Playoff Matches

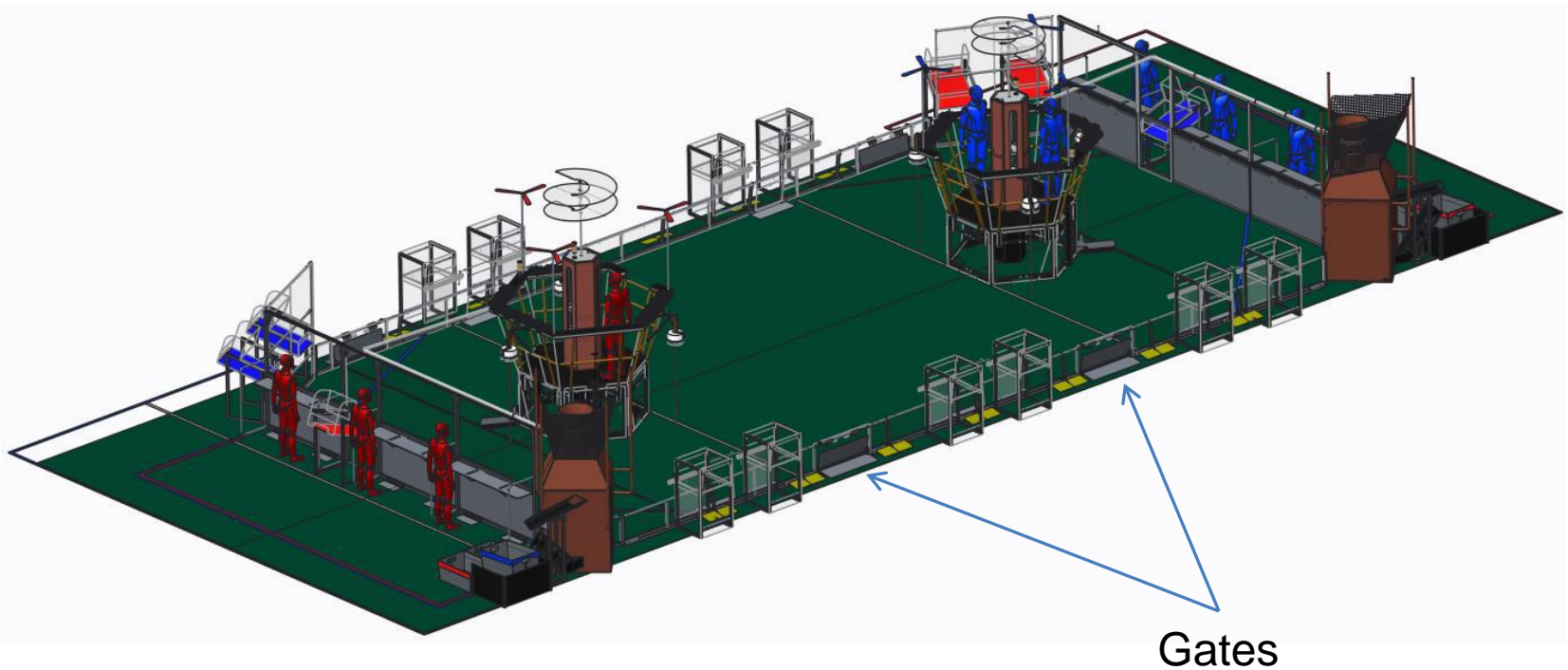
- Playoff Advancement
 - Alliances paired based on rank
 - 1 vs 8
 - 2 vs 7
 - 3 vs 6
 - 4 vs 5
 - First alliance to win two matches advances

Safety

- Robots whose operation or design is dangerous or unsafe are not permitted.
- Other safety rules are in the manual.

Game Overview - Arena

- *FIRST STEAMWORKS* is played on a 27 ft. by 54 ft. field.

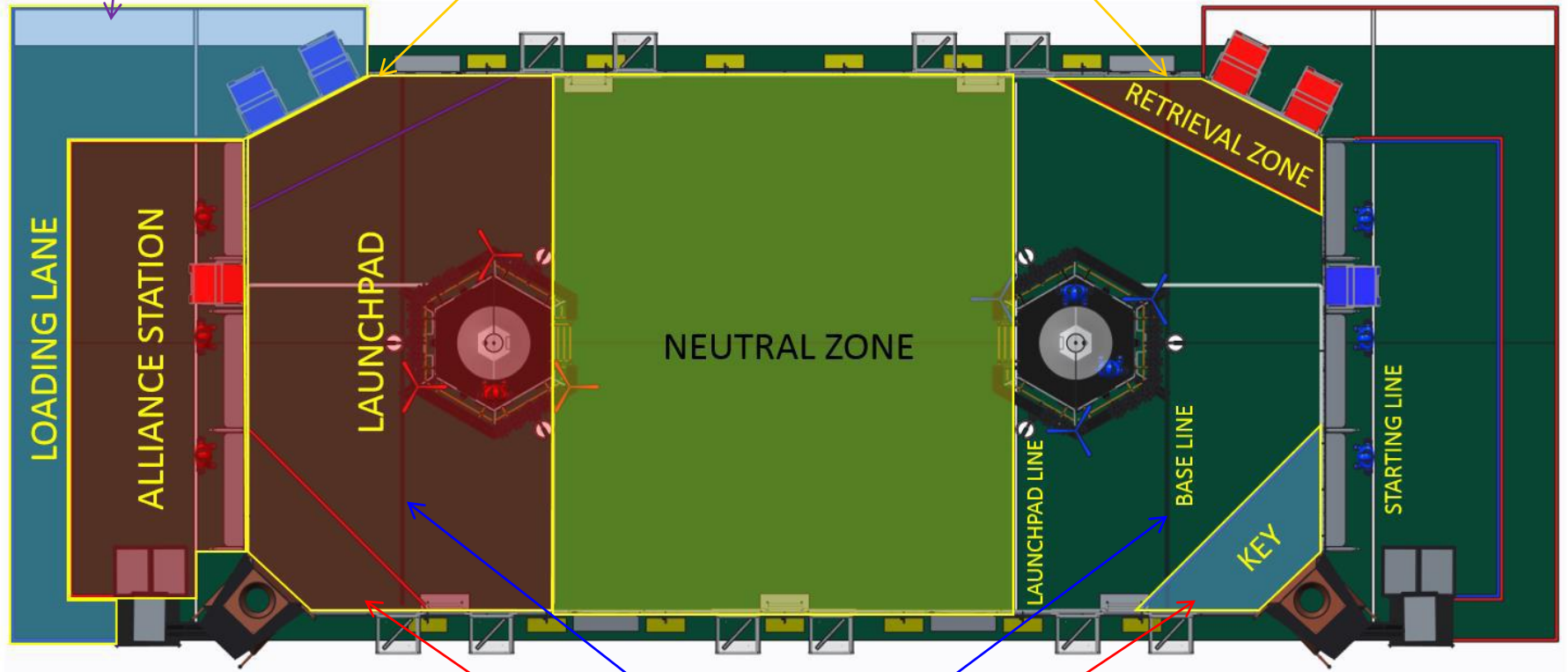


Game Overview - Arena

Note Loading Lane for opposing alliance

Retrieval Zone

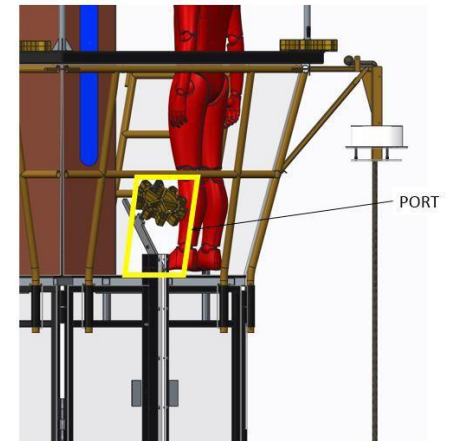
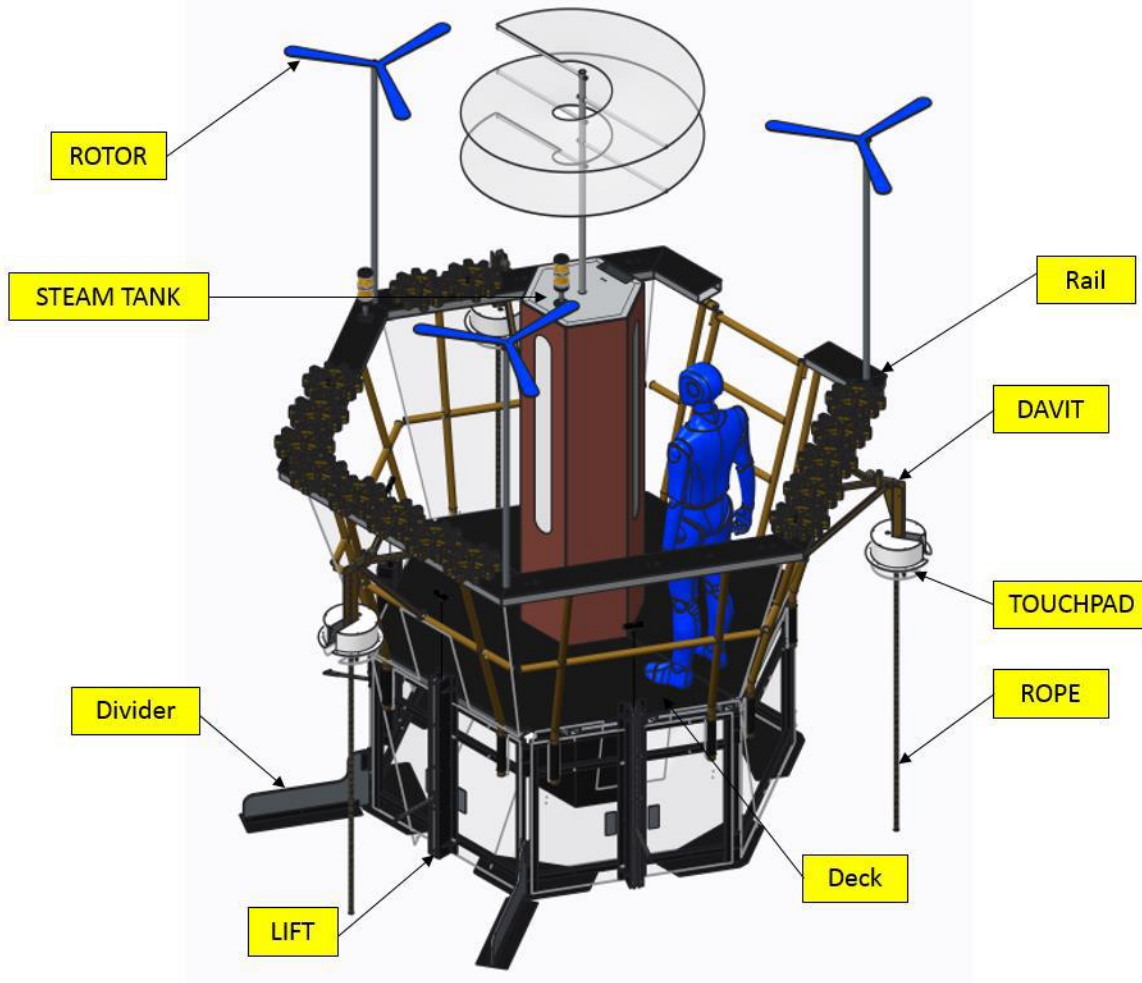
Scoring Table



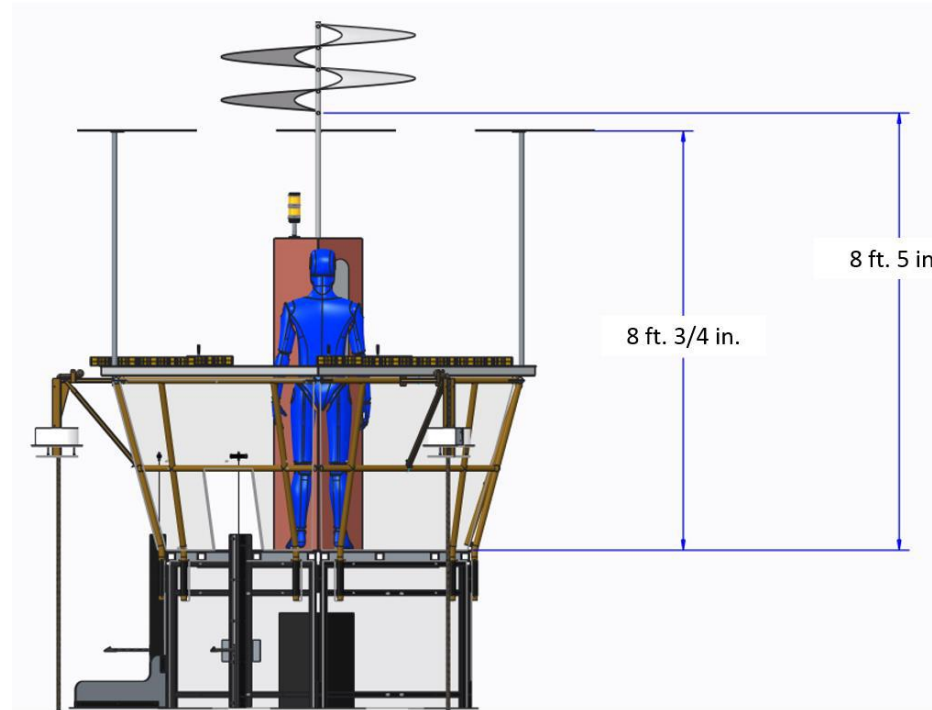
Baseline
9'4" from wall

Key

Game Overview - Airship



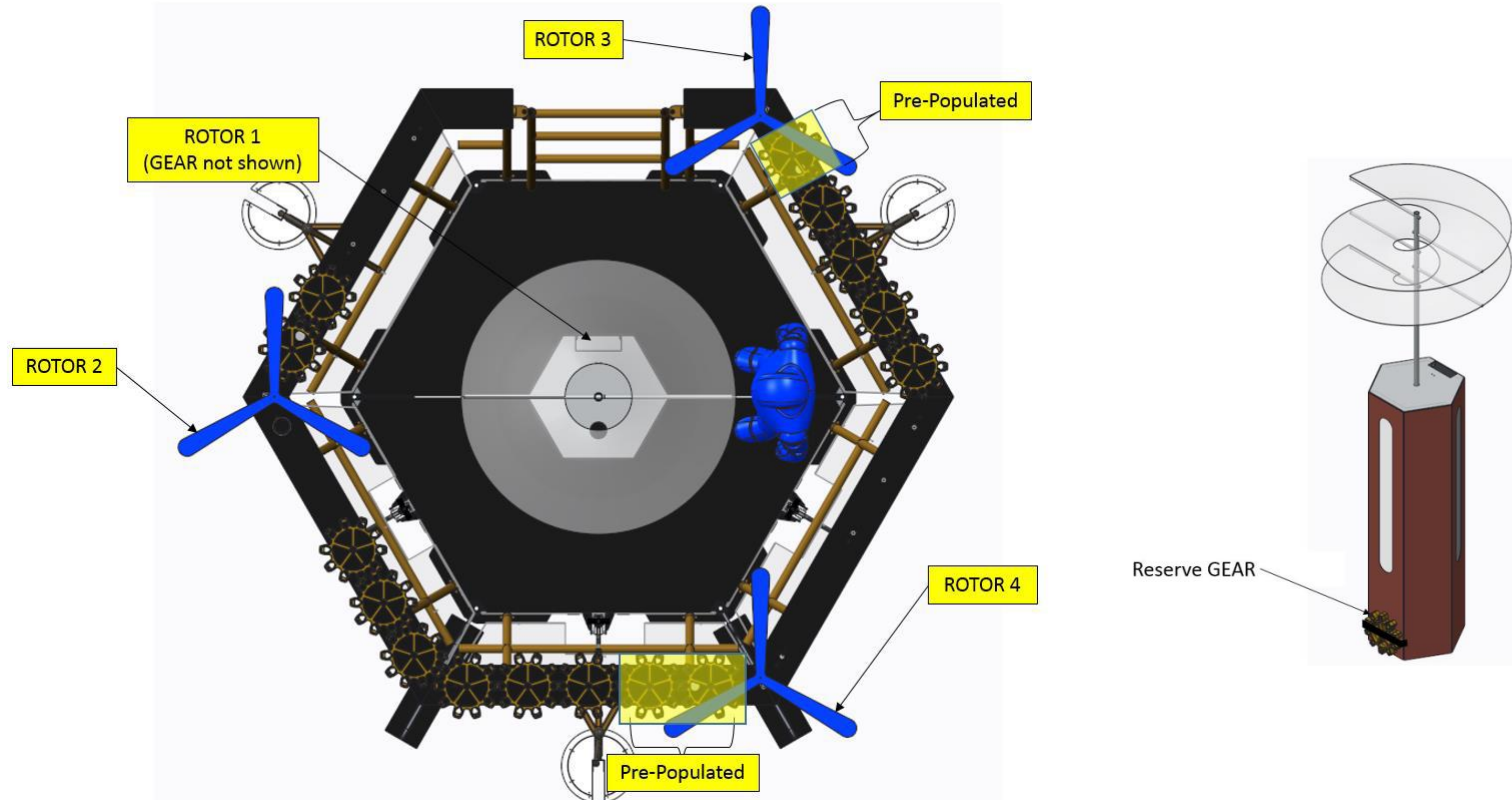
Game Overview – Airship Rotors



Four rotating airfoils mounted to each Airship:

- Center Rotor modeled after the Da Vinci Aerial Screw
- Three smaller rotors mounted to the rail

Game Overview – Gear Sets



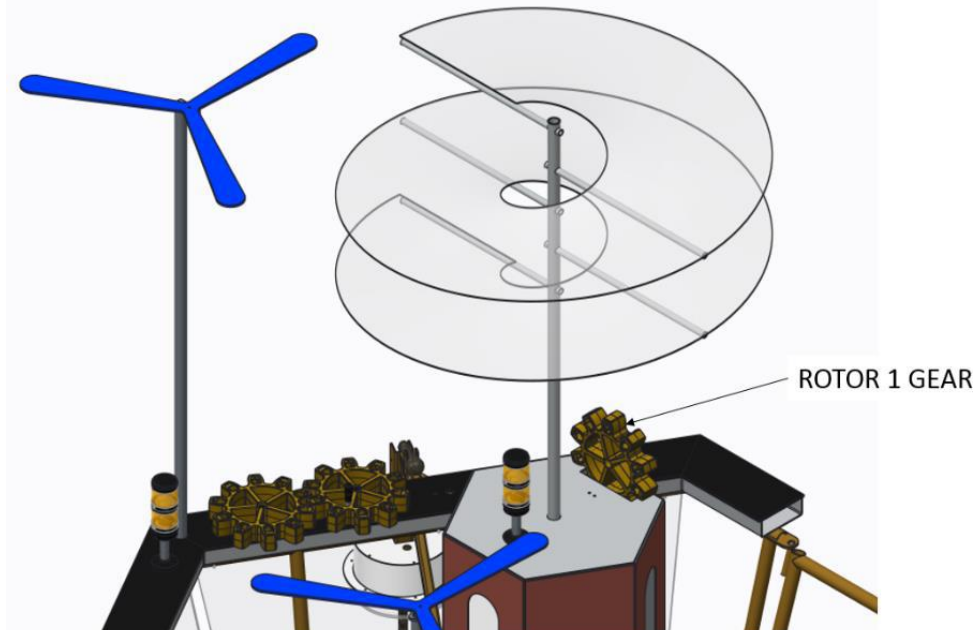
A Gear Set is a series of meshed gears that correspond to a specific rotor. The number of axles for each gear set depends on the rotor. (One reserve gear is staged on the Airship at the start of the match at the base of the steam tank and cannot be touched by pilot until teleop period.)

	Rotor 1	Rotor 2	Rotor 3	Rotor 4
Pre-populated gears	0	0	1	2
Pilot placed gears	1	2	4	6

Game Overview – Gear Sets and Rotors

Once a rotor is started, it remains turning for the duration of the match. Rotors only start if gears are installed in rotor order: 1, 2, 3, then 4. The order of gear placement within a rotor set is not important.

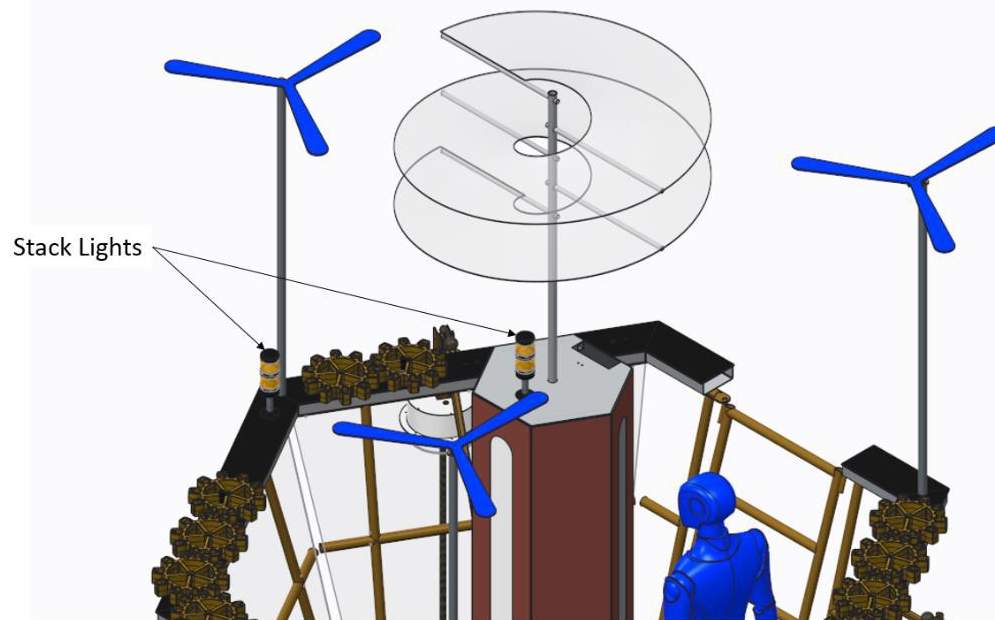
To start rotor 1, the pilot places the gear in the gear slot at the top of the steam tank, opposite the stack light for rotor 1.



Game Overview – Gear Sets and Rotors

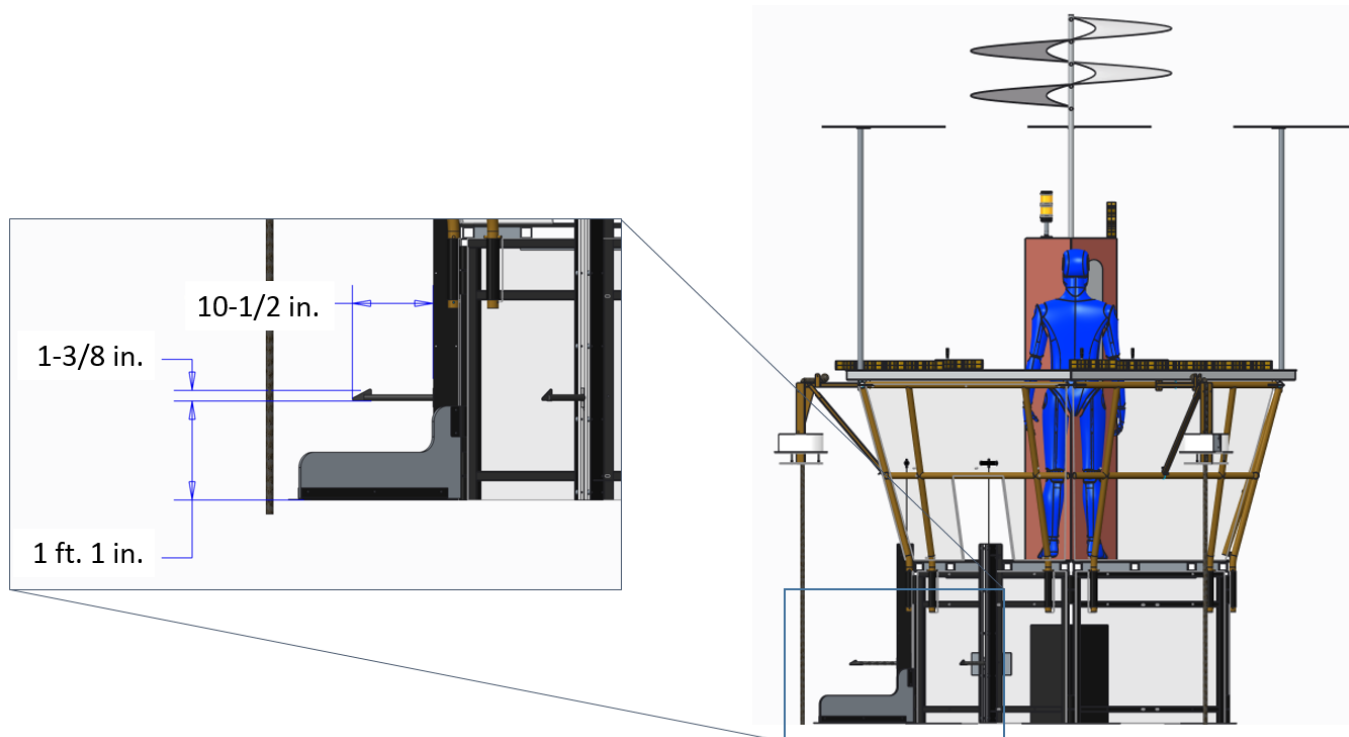
When a gear set for rotors 2, 3, or 4 is complete, a crank, a handle located with the first gear in the set, can be turned which engages the corresponding rotor.

A yellow stack light is installed next to rotors 1 and 2 and illuminates if its corresponding rotor is engaged during auto.



Game Overview – Lifts

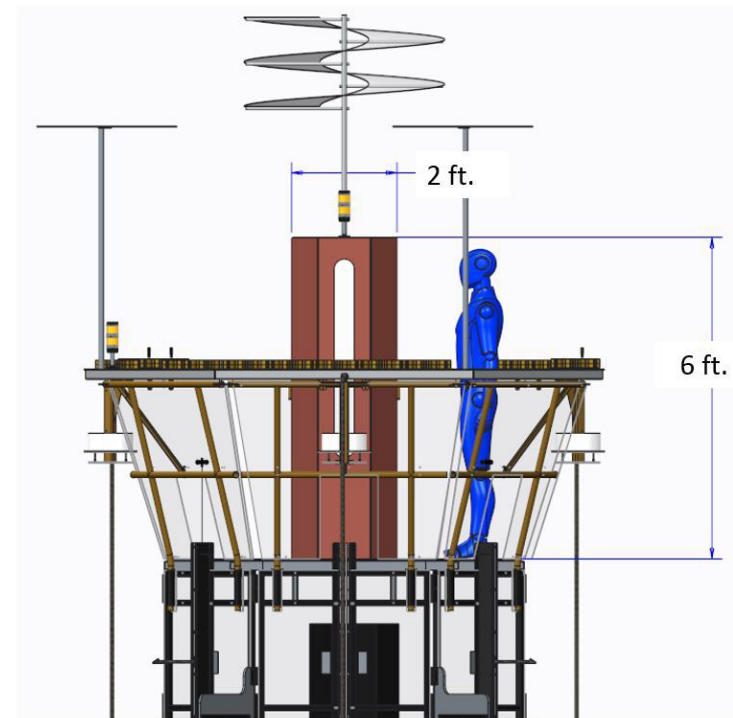
Lifts are used to transfer gears from the robots to the pilots. One lift is mounted to each of the three sides of the deck that face the player stations. Each lift consists of a peg, steel guide frame, carriage assembly, and cable. The cable is pulled by the pilot to raise the carriage to a port where the gear can be safely accessed.



Game Overview – Steam Tank

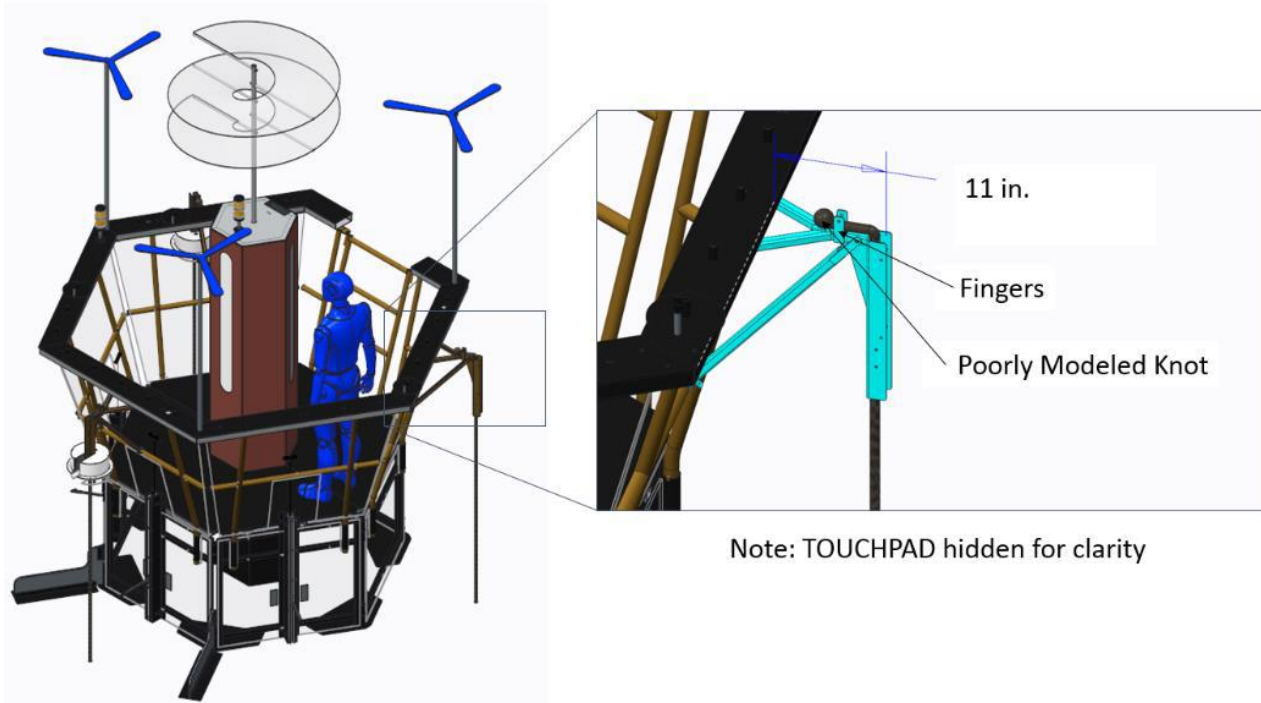
The steam tank is a 6-ft. tall hexagonal container with a diagonal dimension of 2 ft. centrally mounted on the desk. It is “filled” via a steam pipe that originates at the boilers. Lights indicate the pressure, in kiloPascals (kPa), that’s been generated by the alliance and stored in the steam tank.

LED Light Strips are used to indicate the amount of steam pressure generated by the boiler



Game Overview – Davit

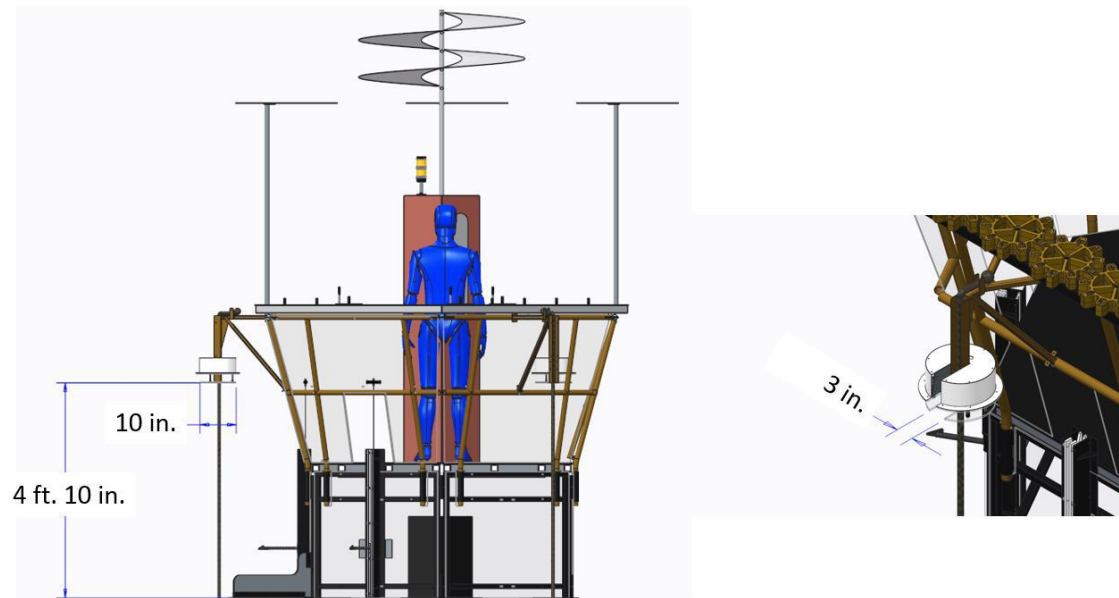
A Davit is one of three steel frames that attaches a rope to the airship.



Game Overview – Rope and Touchpad

A rope is a strong, thick string composed of twisted or braided strands of manila, hemp, flax, or the like secured to the airship. Teams can either use the provided rope or bring their own.

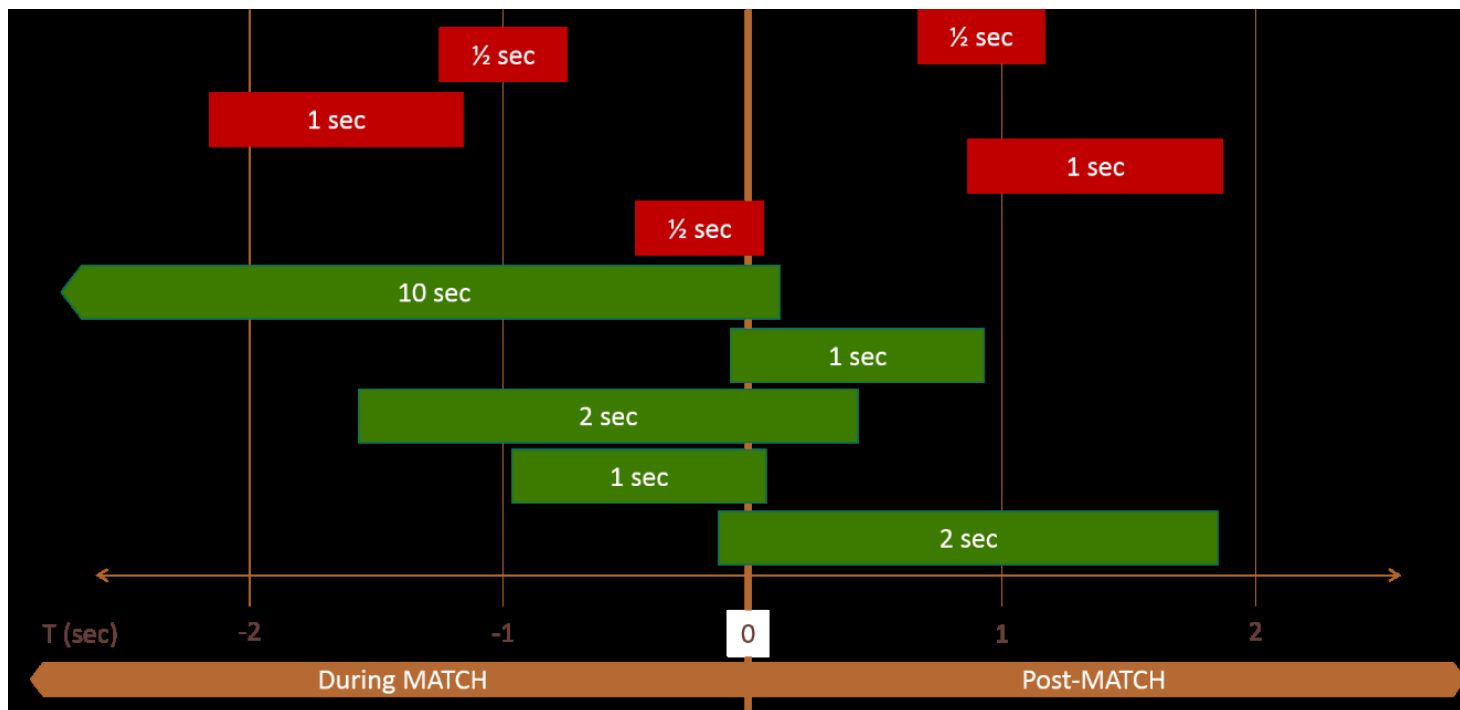
There is a touchpad at the top of each rope used to determine if a robot has successfully latched onto the airship.



Game Overview –Touchpad

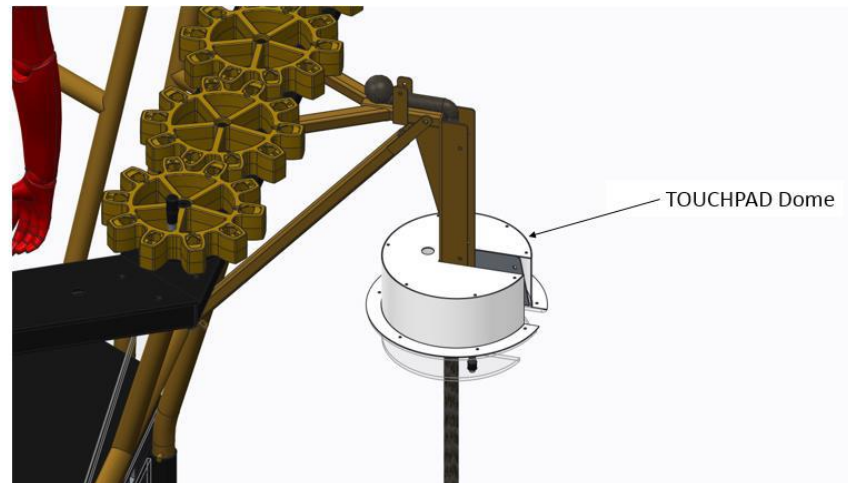
The touchpad plate must be pressed so the following conditions are met:

1. It's minimally displaced by $\frac{1}{2}$ in.
2. It's pressed for a duration of at least one sec.
3. It's pressed when the teleop period ends



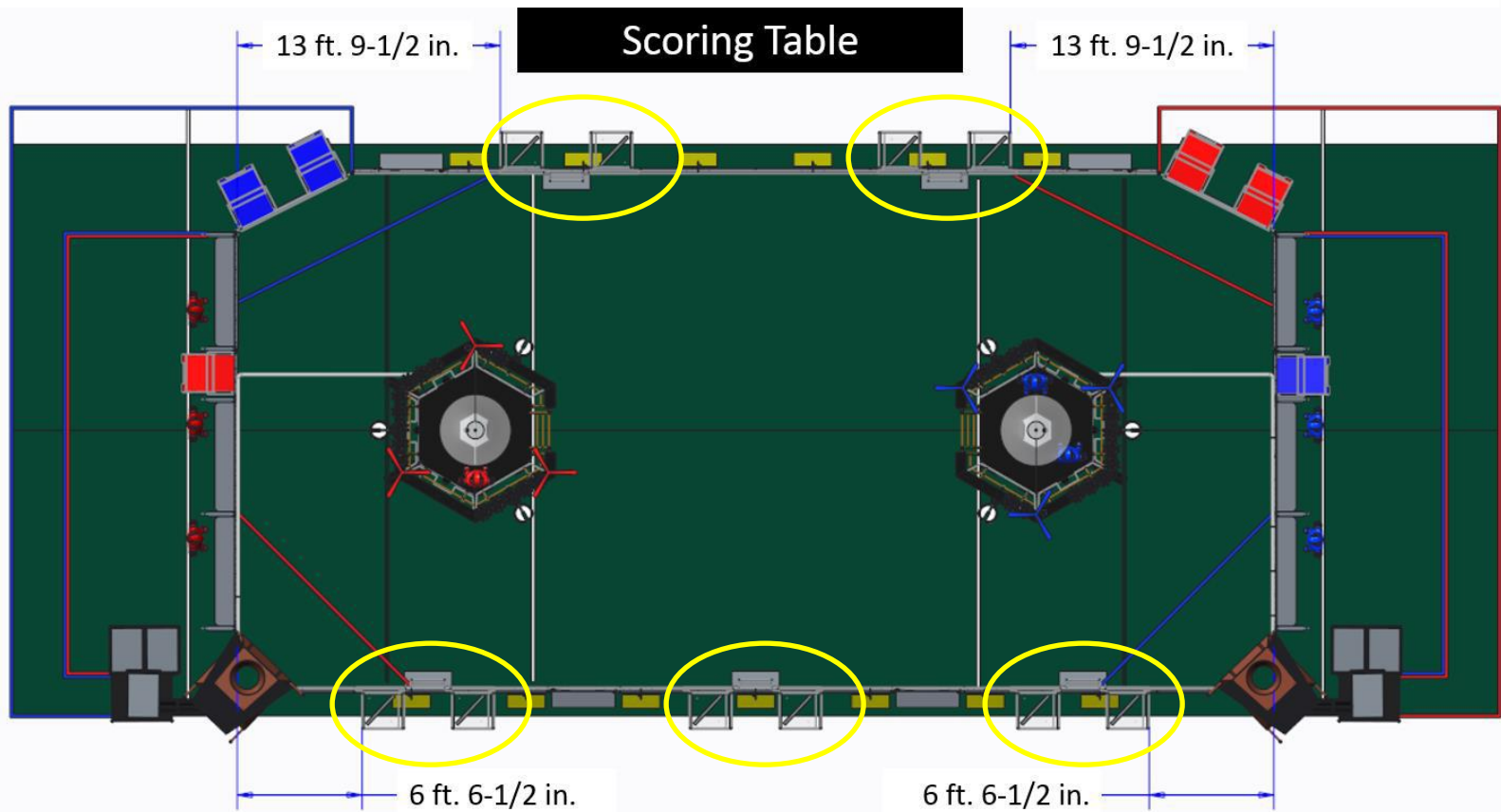
Game Overview –Touchpad

A plastic dome is mounted above the touchpad and indicates if the associated robot is ready for takeoff using lights.



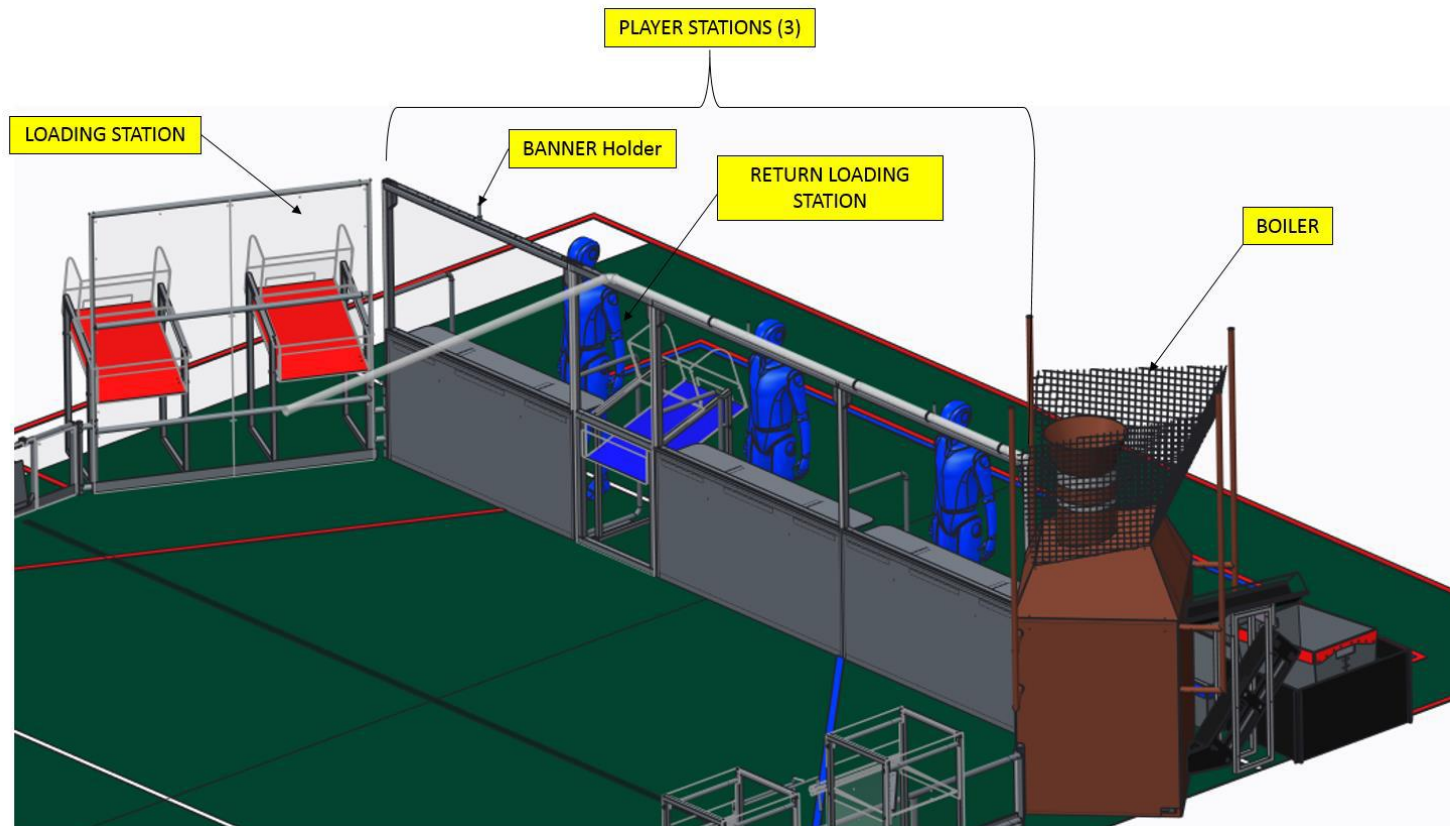
Game Overview – Hoppers

A hopper is a pair of containers located just outside the field and used to store fuel at the start of the match. There are five hoppers located alongside and outside the guardrail.



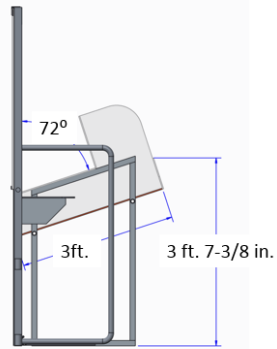
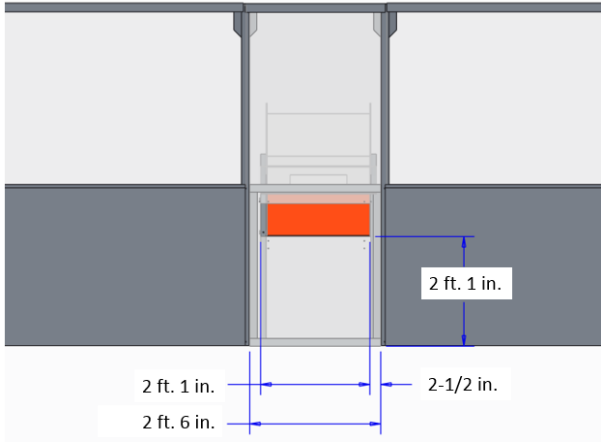
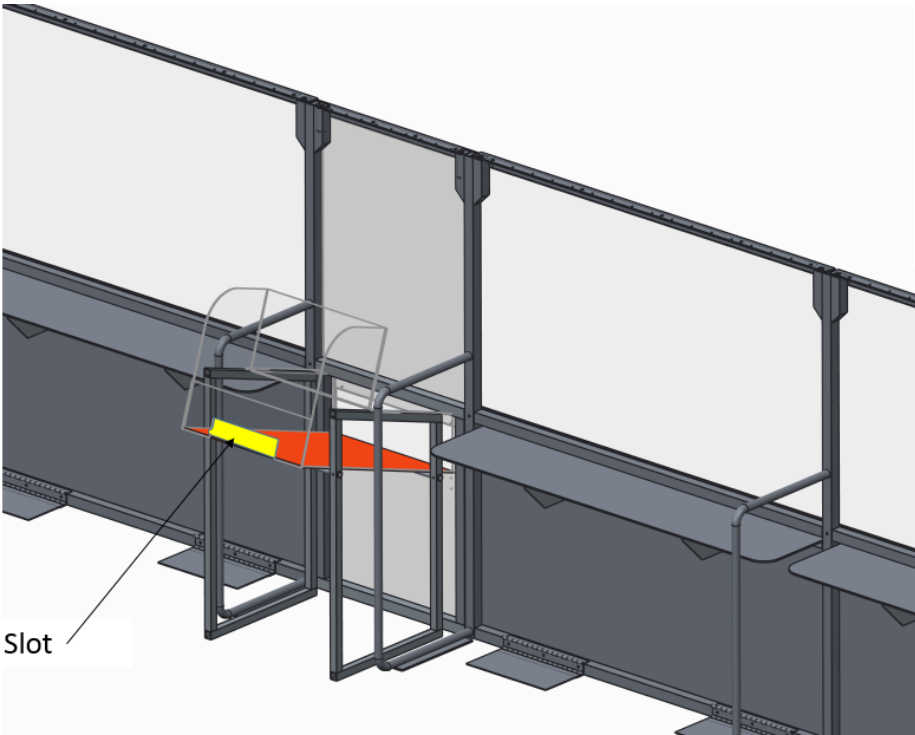
Game Overview –Alliance Wall

The alliance wall is the physical structure and consists of a boiler, three player stations, an overflow loading station and a return loading station.



Game Overview –Overflow Loading Station

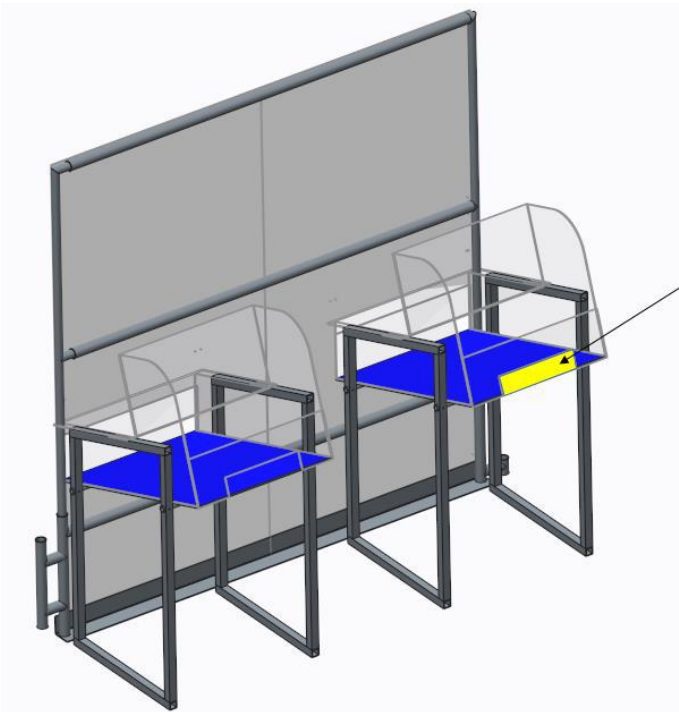
Located two player stations away from each boiler. Used to feed fuel from the overflow bin on to the field.



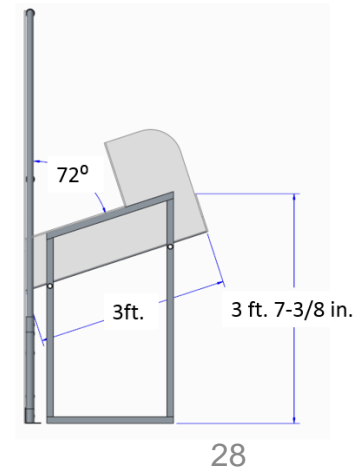
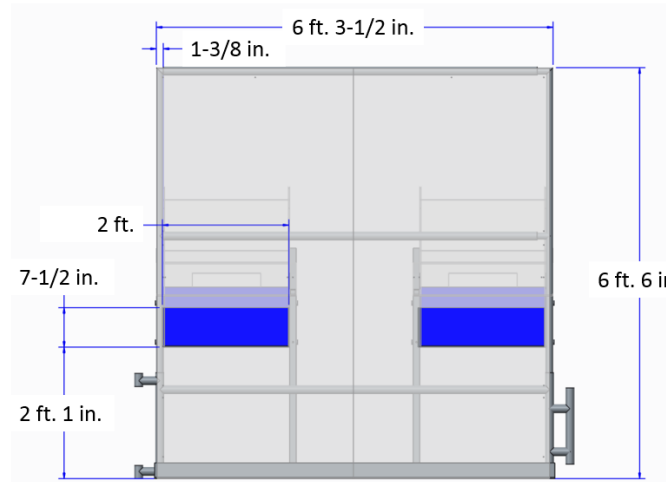
Game Overview – Return Loading Station

Located in each of the two corners of the field opposite the boilers.

Used to feed fuel and gears on to the field.



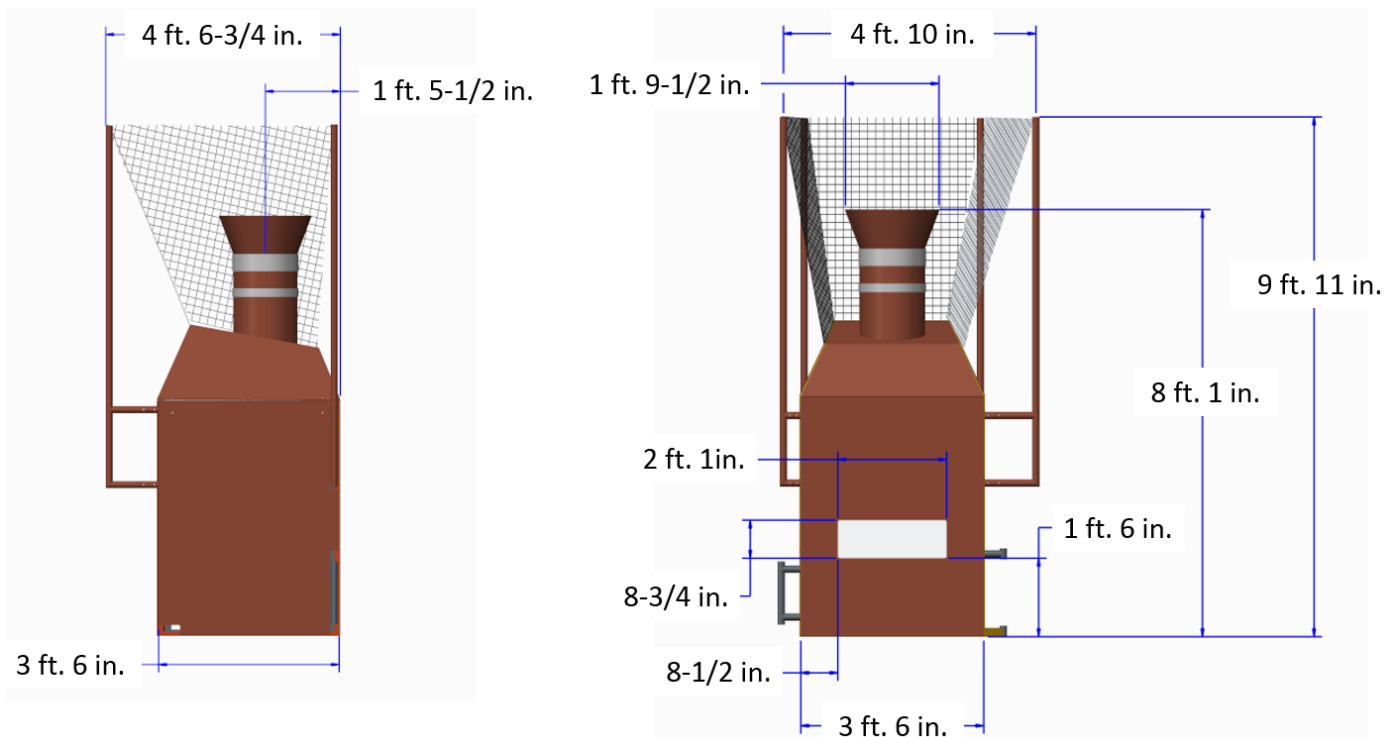
Gear Slot



Game Overview – Boiler

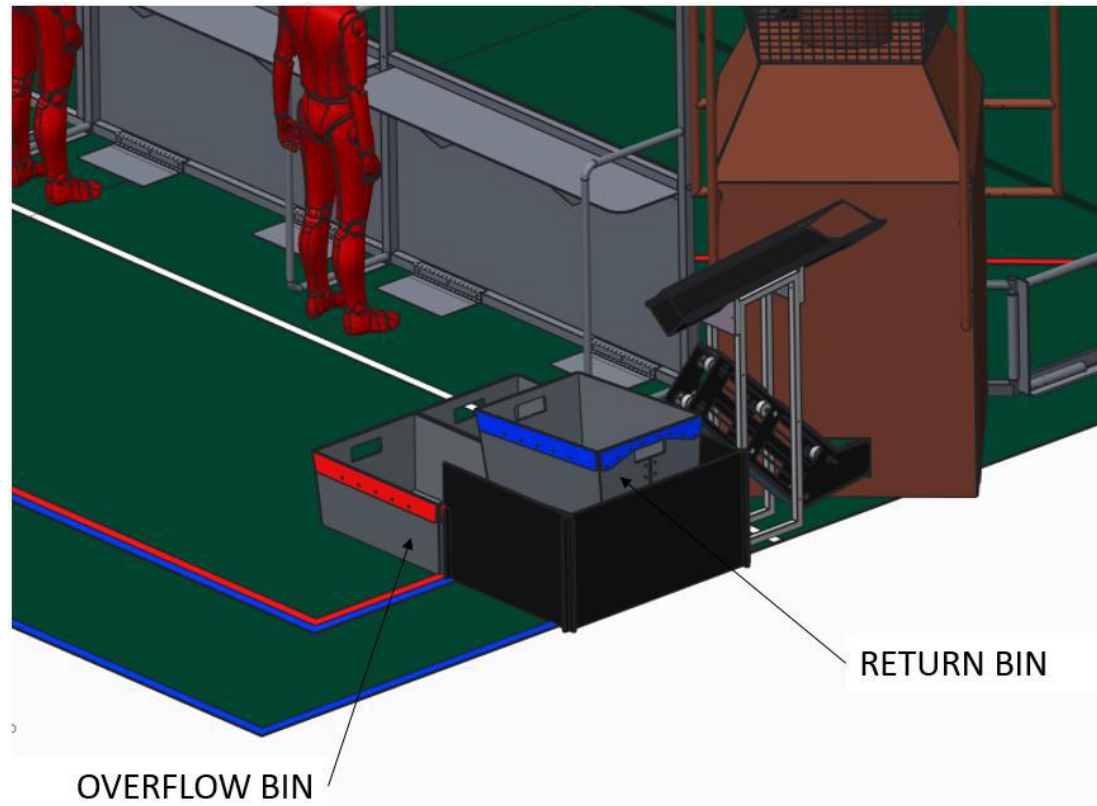
Boiler converts fuel to steam. There are two openings, or goals, for loading fuel into the boiler;

- The high efficiency goal
- The low efficiency goal



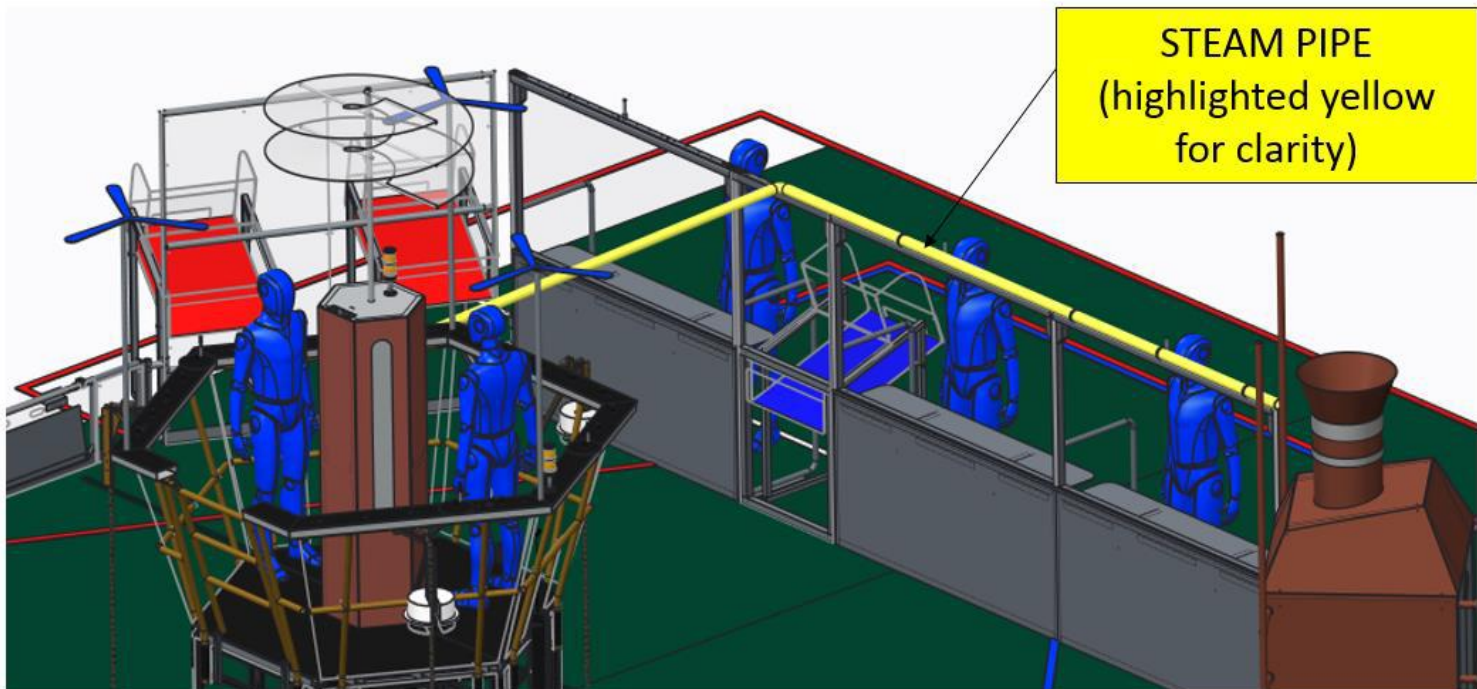
Game Overview – Return and Overflow Bins

Used to store and transport fuel that has exited the boiler. Once fuel is process, it exits the boiler into a return bin. Each loading lane has three return bins. To prevent a return bin from overflowing, human players may replace it with an empty return bin.



Game Overview – Steam Pipe

Clear PVC pipe that transfers steam from the boiler to the steam tank on the airship. It contains strips of lights which display the transfer of steam. As the rate of fuel being scored inside the boiler increases, the animation become faster.



Game Overview – Game Pieces

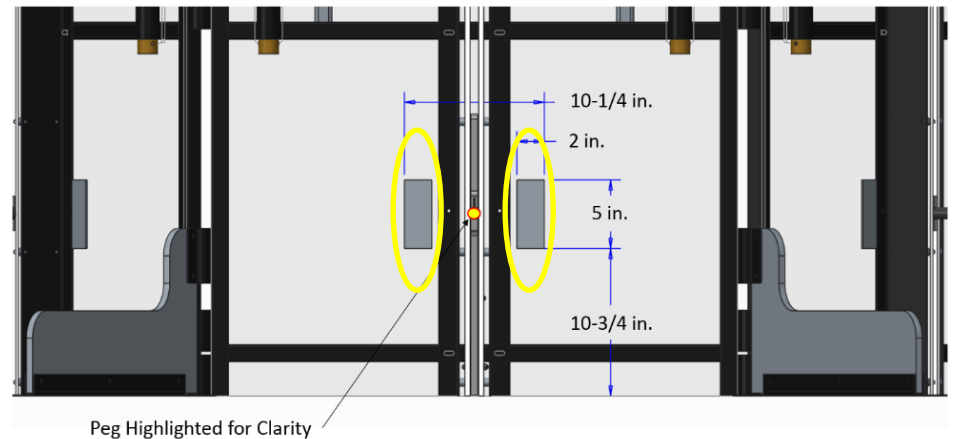
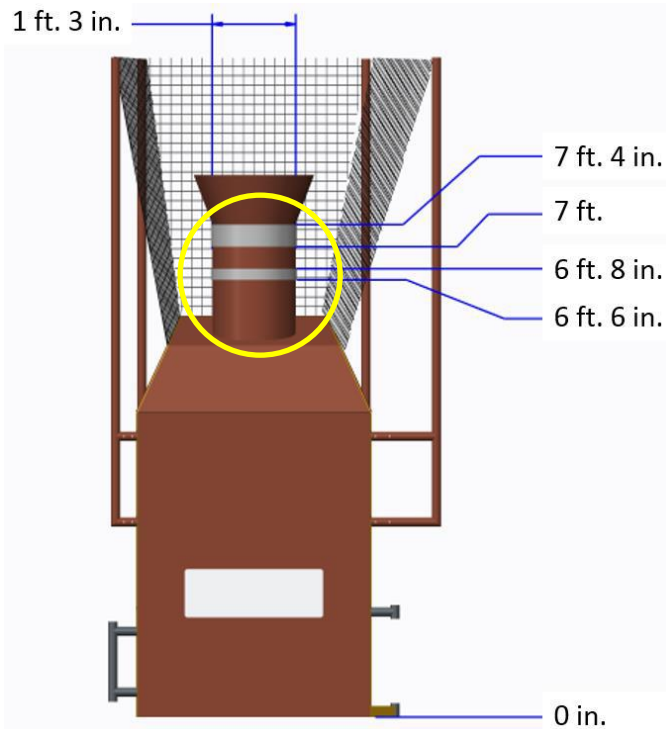
Fuel is represented by a polyethylene ball.

A gear is a toothed wheel used to start rotors on the airship.



Game Overview – Vision Targets

Vision targets are marked using reflective material and highlight the locations of high goals and lift pegs.



The Game – Robot Positioning

When a drive team loads their robot onto the field they may elect to:

- pre-load one gear in or on their robot and
- pre-load up to ten fuel in or on their robot

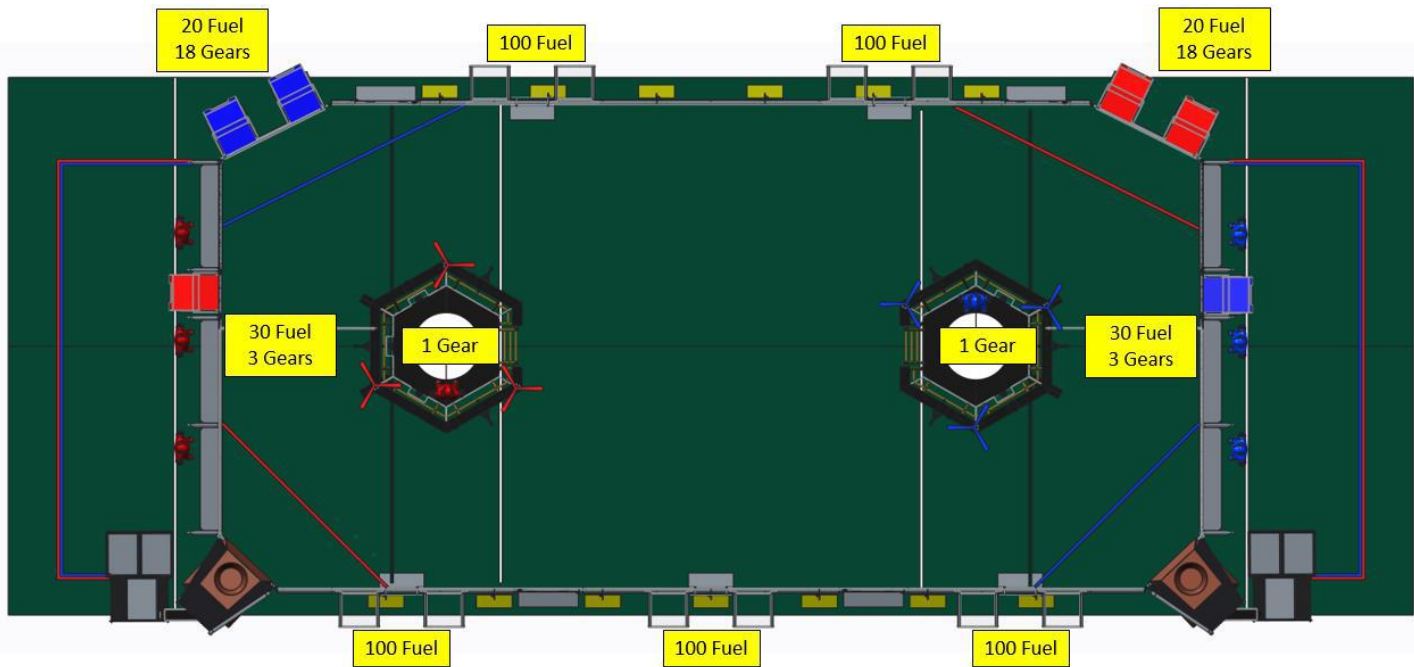
When placed on the field robot must be:

- In compliance with all robot rules (pass inspection)
- The only item left on the field by the drive team
- Confined to its starting configuration
- Set on the carpet
- In contact with its alliance wall diamond plate, and
- In possession of not more than 10 fuel and 1 gear.

The drive team may elect to switch one of the ropes on the airship to use their own rope.

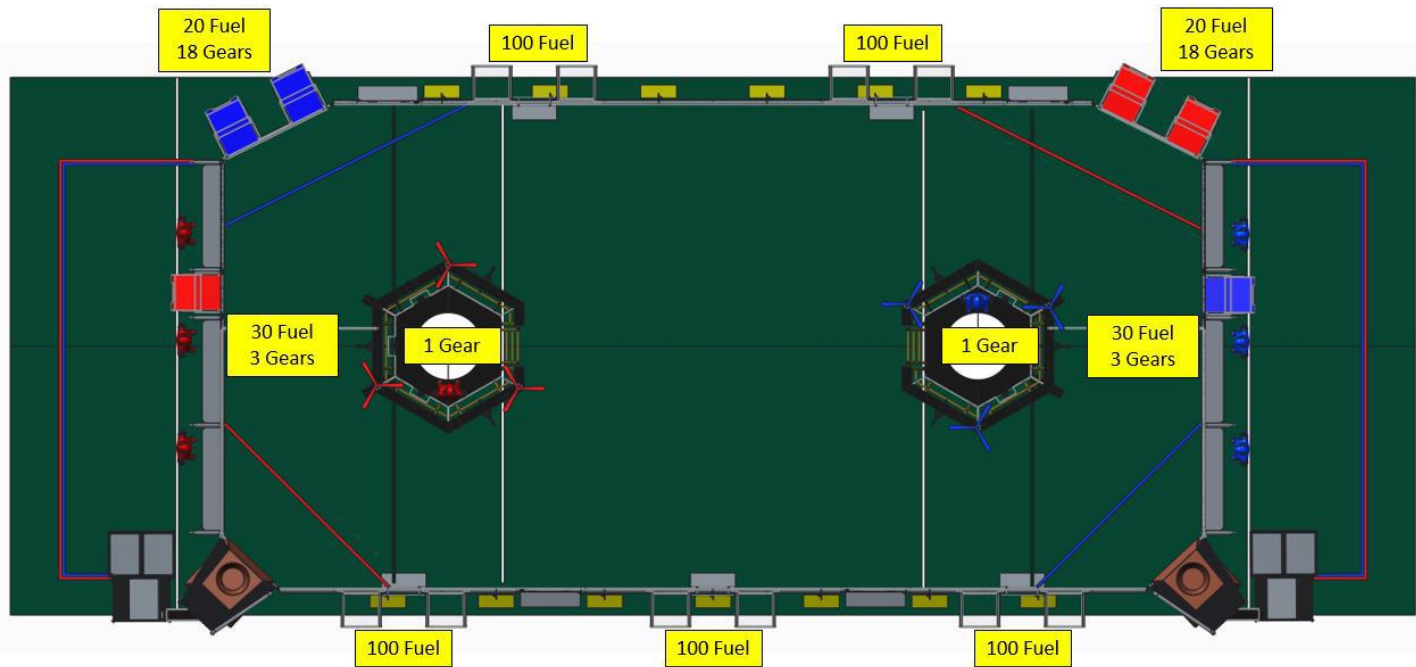
Game Play – Available Fuel

- Ten available for each team to preload in their robot (any not preloaded are stage in the bin in the loading lane)
- Twenty in each loading lane
- One hundred in each hopper (fifty in each hopper container)



Game Play – Available Gears

- One available to each team to preload in the robot (any not preloaded are staged with the gears in the loading lane)
- Eighteen in each loading lane
- One in each airship



Penalty Assignment

- Upon a rule violation, a Foul will be assessed

Action	Penalty
Foul	5 points credited to opponent
Tech Foul	25 points credited to opponent
Yellow Card	A warning – subsequent yellow card within the same tournament phase will lead to a red card
Red Card	Penalty assessed and a team is disqualified for the match
Disabled	Robot will be commanded to deactivate all outputs
Disqualified	The status of a team, as determined by the head referee, in which team receives zero match points in qualification match or causes their alliance to receive zero match points in a playoff match.

Game Play – Drive Team

- Set of up to five people from the same team
 - Coach – 1 per drive team (pre college student or adult mentor)
 - Driver – max of four
 - Human Player – max of four
 - Pilot – max of one

Game Play – General Rules

- Robot and team must follow safety rules
- The following actions are prohibited with regards to interaction with arena elements (not game pieces)
 - Grabbing
 - Grasping
 - Attaching
 - Grappling
 - Hanging
 - Becoming entangled
 - Damaging
 - Deforming

Robot Rules

- Maximum robot size, including bumpers and all extensions, must be constrained to one of two volumes:
 - 36" x 40" x 24" tall
 - 30' x 32' x 36' tall
- The robot must be constrained to the maximum inspected volume at all times during the match
- The robot weight must not exceed 120 lbs excluding bumpers, bottery and its associated half of the Anderson cable

Robot Rules

- Robots may not contact an opposing robot, regardless of who initiates the contact, if the opposing robot is in contact with one of its own alliance's ropes
- Two or more robots may not isolate or close off any major facet of match play
- Robots may not pin opponent's robot for more than five seconds
- A robot with any part inside its opponent's retrieval zone may not contact an opposing robot, regardless of who imitates the contact
- Robots may neither fully nor partially support the weight of other robots strategically or repeatedly
- Robots may not intentionally detach or leave parts on the field

Robot Rules

- A robot may not be in their opponent's key for more than five seconds (if any robot is breaking the plane of the line with bumpers, it is considered in the key)
- No more than one robot may be fully supported by a rope
- A robot may only pull on a rope if/once the rope is supported only by the Davit, the carpet, the robot, or any combination thereof
- During the final thirty seconds of a match, robots may not contact an opposing alliance's rope

Robot Rules

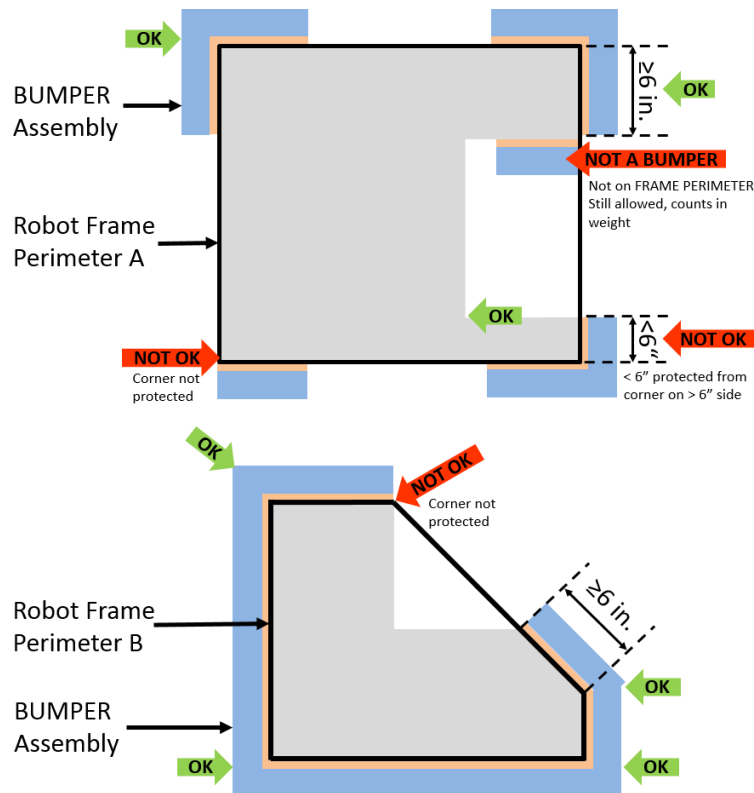
- A robot may only launch fuel while in their launchpad
- A robot may not launch a gear
- Robots may not intentionally put fuel in an airship
- Any gear transferred to a pilot during the match must be done so via a lift
- Robots may not control more than one gear at a time
- Robots may not use forced air to affect the movement of fuel that is outside the volume of the robot
- During Auto, no part of a robot's bumpers may enter their opponents launchpad
- During Auto, pilots may not remove the reserve gear from the slot in which it begins the match

Human Actions

- A robot shall be operated solely by the drivers and/or human players of that team
- Pilots may not throw gears from the airship
- Once a rotor is started, the pilot may not remove any gears used to start it
- Pilots may not deploy ropes until there are 30 or fewer seconds left in the match
- Pilots may only start rotors 2, 3, and 4 by turning the crank installed in the first gear in the set

Bumper Rules

- Robots are required to use bumpers to protect all outside corners of the frame perimeter.



Considerations

- What is important to do?
 - For auto period scoring
 - For teleop period scoring
 - For making it into the Playoff round
 - For tie breaking in ranking points
 - For durability and reliability
 - To win engineering awards
- Form follows function:
 - Decide what function(s) we want to perform before deciding on what form to make the robot

Considerations

- What can be done so that the robots will be done in time to practice (five weeks)?
- Should we plan to use the camera?
- Think about how you would do it if only humans played
- What is impact of limited size restrictions?

Considerations

- What worked well in the past that we should repeat?
- What didn't work well in the past that we should avoid?
- What can be programmed?
- What do we know how to do?
- What can be done effectively?

Considerations

- Based on scoring and tie breaking, what are two or three key strategies:
 - Ability to maximize elimination round points
 - Autonomous programming for mobility or scoring
 - Ability to collaborate with Alliance partners
- Take enough time to know what we want to do (knowing why we want to do it) before we decide how to do it.

FIRST Steamworks Rewards

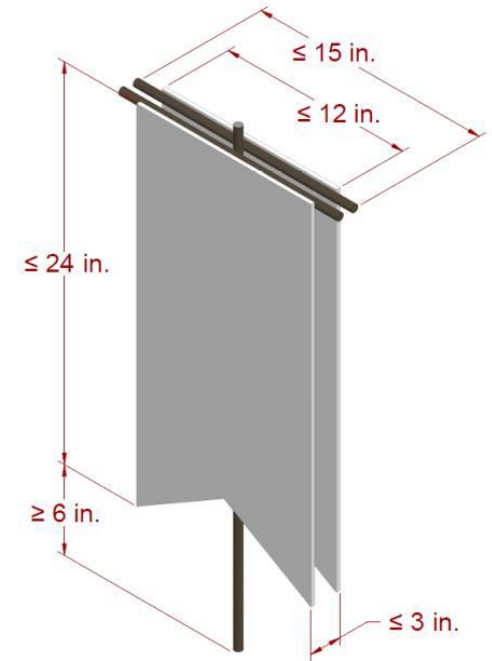
Action	Criteria	Auto Points	Teleop Points	Ranking Points
Auto mobility	For each robot that breaks base line vertical plan	5		
Pressure accumulation	3 fuel in low goal	1 + 1 kPa		
	1 fuel in high goal	1 + 1 kPa		
	9 fuel in low goal		1 + 1 kPa	
	3 fuel in high goal		1 + 1 kPa	
	If alliance exceeds 40 kPa		20 (playoffs)	1 (qualifications)
Rotor engagement	For each rotor turning	60	40	
	If all 4 rotors turning		100 (playoffs)	1 (qualifications)
Ready for takeoff	For each touchpad triggered		50	
Win				2
Tie				1

Key Dates

- Robot Bag and Tag date is:
 - February 21, 2017 at 11:59 PM Eastern Time

Other consideration

- Team standard
- Theme opportunity for drive team
- Theme opportunity for pit structure
- Theme opportunity for shirts



Strategy and Design Development

1. Taking next couple of days to “really, really, really think about the problem” before we solve the problem.
2. All engineering team leaders are also on the Strategy Team and will be involved in the strategy development in the next week.
3. Today we are gathering information from what we know today.

Design Selection

- After input reviewed and input from various teams, Game Strategy and Scouting team, etc.:
 - AdamBots Design selection committee:
 - Cyber Cats Design selection committee:

Strategy Discussion Groups

1. There are 8 design groups
 - A. Engineering mentors and students should split up so all teams about equal
 - B. Business only students and mentors welcome to stay and contribute, but not required
2. List what is important to do **and why**
3. Also list what we do not need to do **and why**

DO NOT TRY TO DESIGN A ROBOT – THIS IS A STRATEGY DISCUSSION ONLY!

Design Groups

Group	Student Leads	Mentor Leads
Cyber Cats	Lucas Beutler	Mr. Carlson, Mrs. Carlson, Mrs. Graham
AdamBots 1	Michaela Fung	Mr. Hildebrandt, Mr. Hess, Mr. Bueltel
AdamBots 2	Tony Montagna, Trinity Fung	Mr. Merlo, Mr. Garstick, Mr. Engle, Mr. Katti
AdamBots 3	Nadya Barghouty	Mr. Cesiel, Mr. Kubiak, Mr. Sarkar
AdamBots 4	Aliza King	Mr. Sochanski, Mrs. Harpster, Mr. Slaby
AdamBots 5	Scott Guest	Mr. Del Rose, Mr. Wolschendorf, Mr. Keerthy, Mr. A. McBride, Mr. Parimi
AdamBots 6	Gabe Kubiak, Sean Hennessee	Mr. Torres, Mr. Crame, Mr. Markel
AdamBots 7	Megan Sochanski, Keerthi Sreenivasan, Jack Bueltel	Mr. May, Mrs. Parimi, Mr. Drummer, Mrs. McGruder

Strategy Discussion Groups

1. You have until 4:00 PM to prepare for review
2. Include breaks
3. At 4:00 PM, we will go around the room and have each team present their items
4. When done, we need to clean up the room as if we were never here

