FIRST® POWER UP℠

FRC 2018 Game Overview and Thought Starters

Prepared by FRC Team 245

ADAMBOTS

FIRST® POWER UP℠

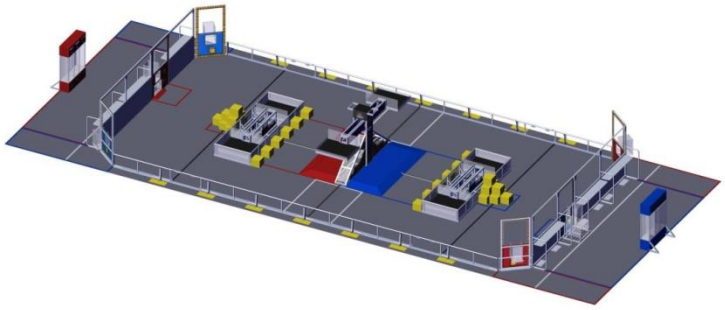
Agenda

- Game overview
- Considerations
- Breakout groups
- Report outs
- Next steps

- Game Overview
- Seeding and Playoffs
- Safety
- The Arcade
- Game Play
- Robot Rules
- General Rules
- Human Actions
- Considerations
- Ranking
- Key Dates
- Discussion

Game Overview

- *FIRST POWER UP is played by two alliances trapped in an 8bit video game! Teams use power cubes to defeat the boss.*
- Each alliance has three ways to help defeat the boss:
  - Owning the scale or their switch
  - Playing power ups
  - Climbing the scale tower
- There are two periods:
  - Autonomous (15 seconds)
  - Teleoperated (2 minutes and 15 seconds)



Game Overview - Autonomous

- Each *FIRST POWER UP* match begins with a 15-second **autonomous period** in which robots operate independently of human control.
- During this period, robots attempt an Auto Run and can earn points as follows:

Action	Match Point Value
Cross the Auto Line (a.k.a Auto-Run)	5
Switch Ownership	2, +2 points per second
Scale Ownership	2, +2 points per second

Game Overview – Teleop Period

- During the remaining 2 minutes and 15 seconds of the match, called the **teleoperated period**, student drivers control robots. They can also trade in their Power Cubes for Power Ups. During the final 30 seconds, teams work together to Climb to Face the Boss.

Action	Match Point Value
Switch Ownership	1, +1 point per second
Scale Ownership	1, +1 point per second
Power Cube in Vault	5 points
Boost Power Up Bonus	2 points per second
Parked on Platform	5 points
Successful Climb	30 points

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 achieve three climbs
  - 3 counted climbs = 1 point
- AND – the number of times during Autonomous they complete three Auto-Runs and gain Ownership of their Switch (a.k.a the Auto-Quest)
  - 1 point

Seeding

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

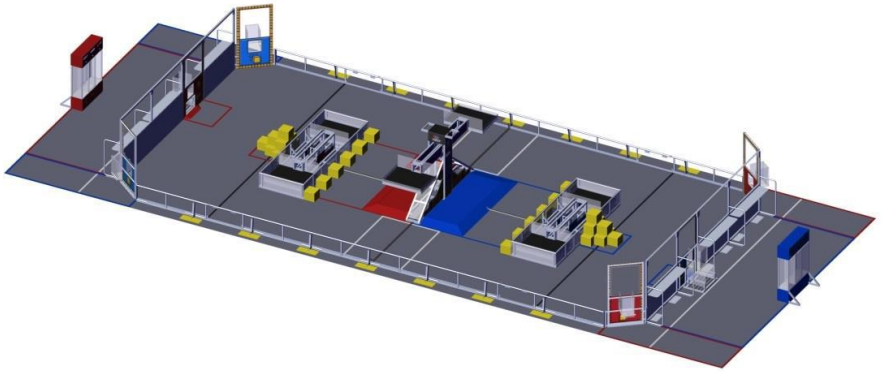
Order	Points
1	Ranking score
2	Cumulative parking and climbing score
3	Cumulative sum of Auto points
4	Cumulative sum of ownership
5	Cumulative sum of vault points
6	Random sorting by FMS

Safety

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

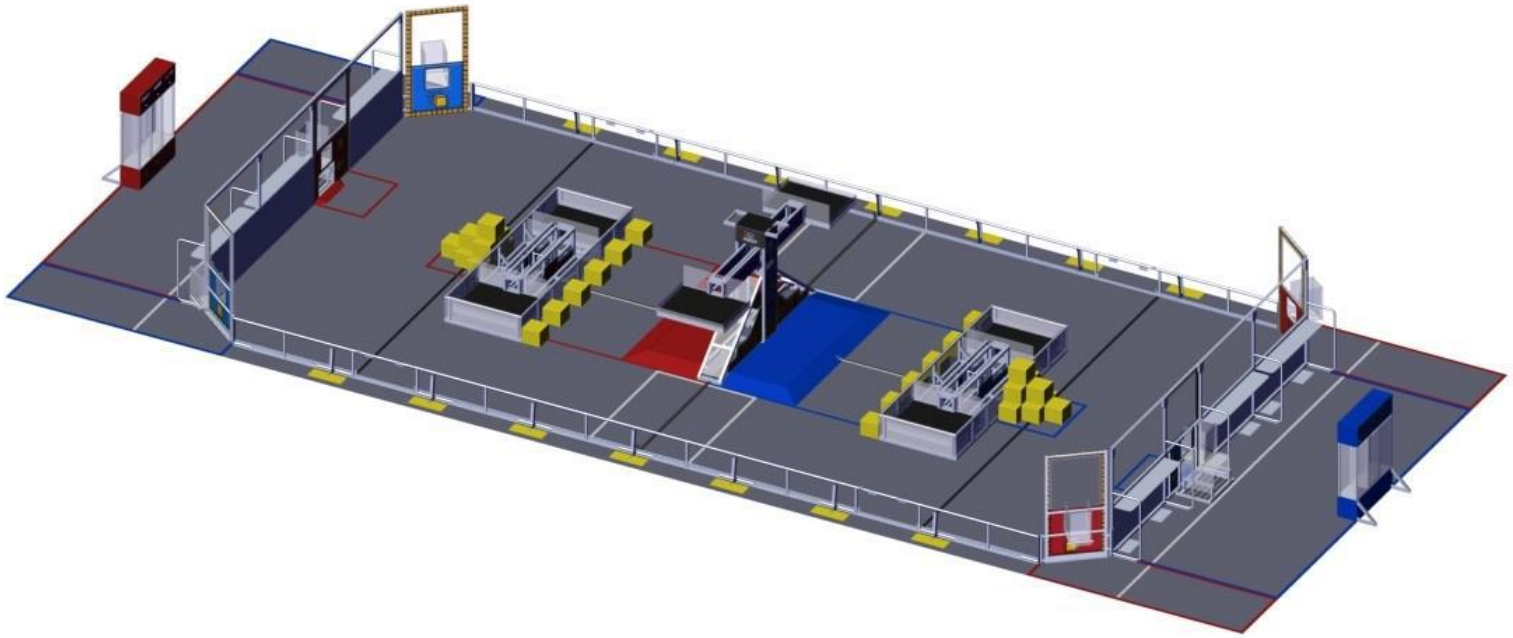
Game Overview - Arcade

- *Field*
- *Switches*
- *Scale*
- *Vaults*
- *Carpet*
- *Power Cubes*
- *Field Control Equipment*
- *Robot Control*
- *Scorekeeping*



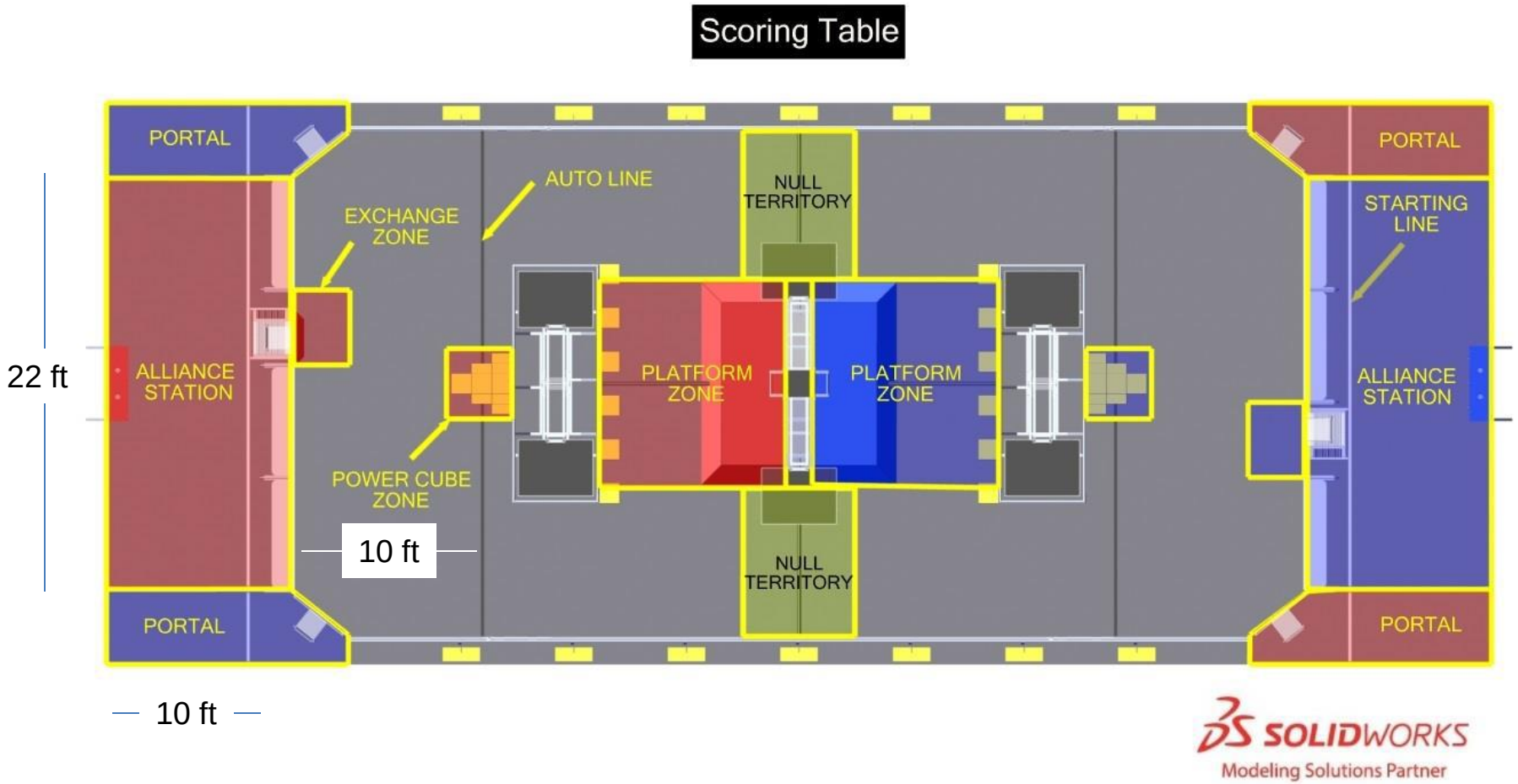
Game Overview – Arcade Field

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



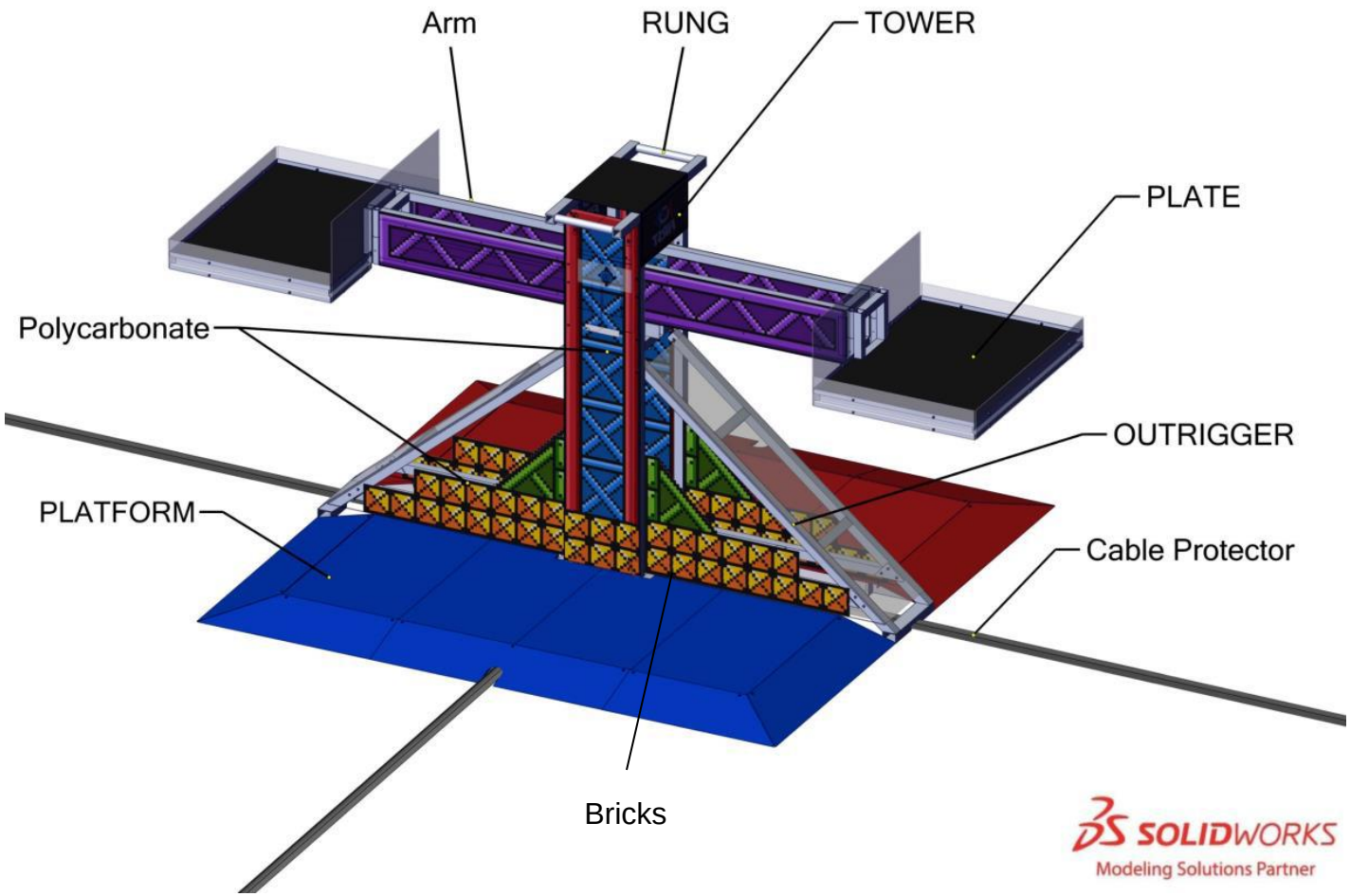
SOLIDWORKS
Modeling Solutions Partner

Game Overview - Arcade

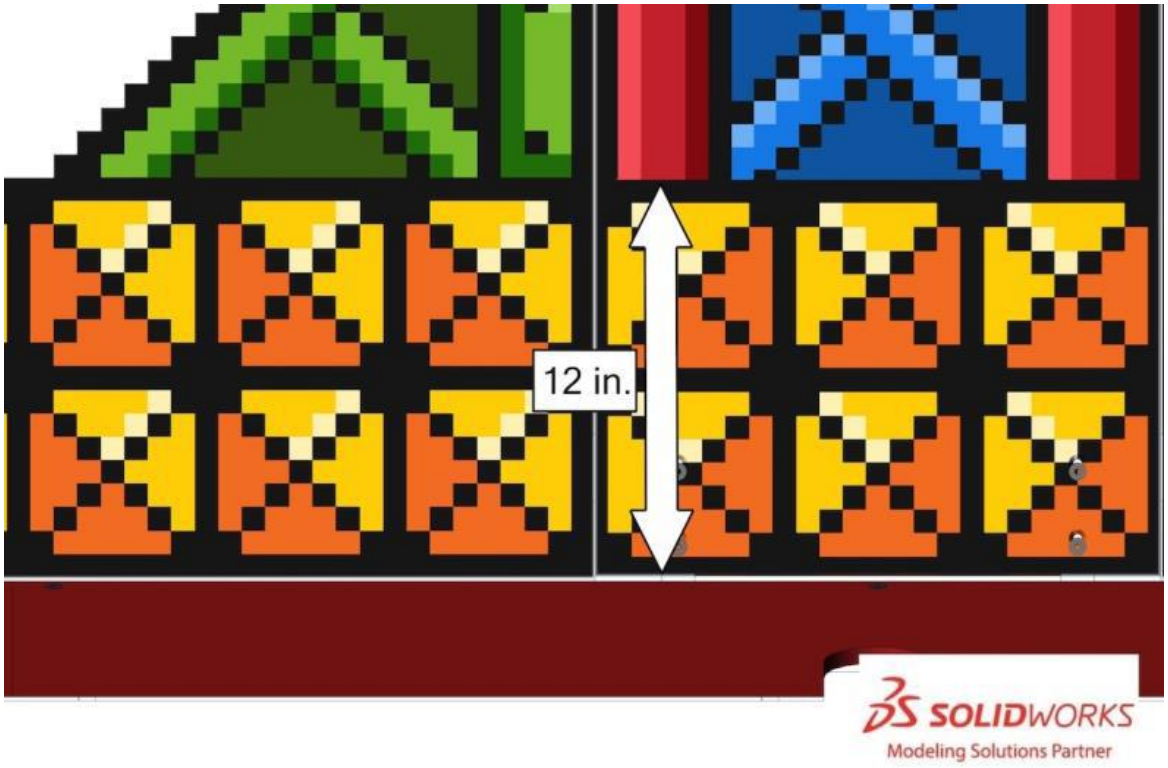


SOLIDWORKS Modeling Solutions Partner

Game Overview - Scale

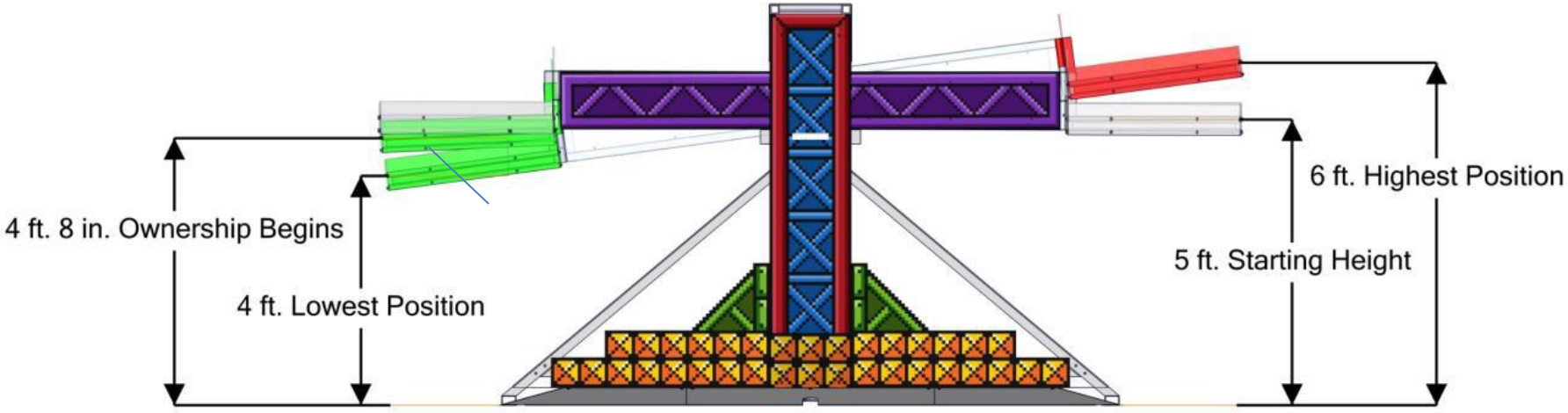


Game Overview – Bricks



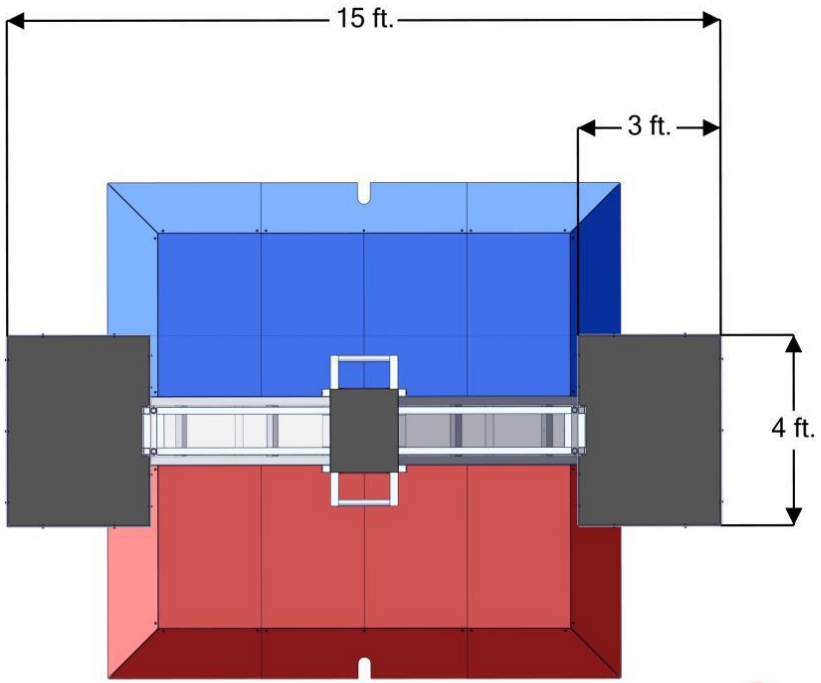
Game Overview – Scale Plates

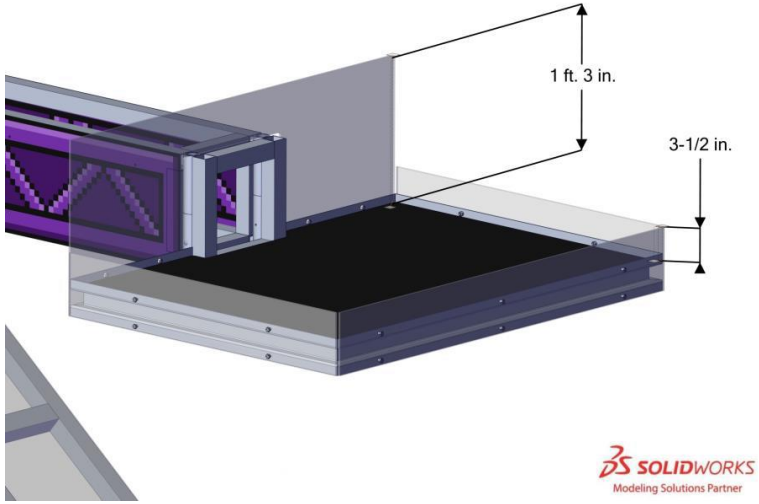
Note: The location of the Power Cubes on the Scale is a factor in its position



SOLIDWORKS Modeling Solutions Partner

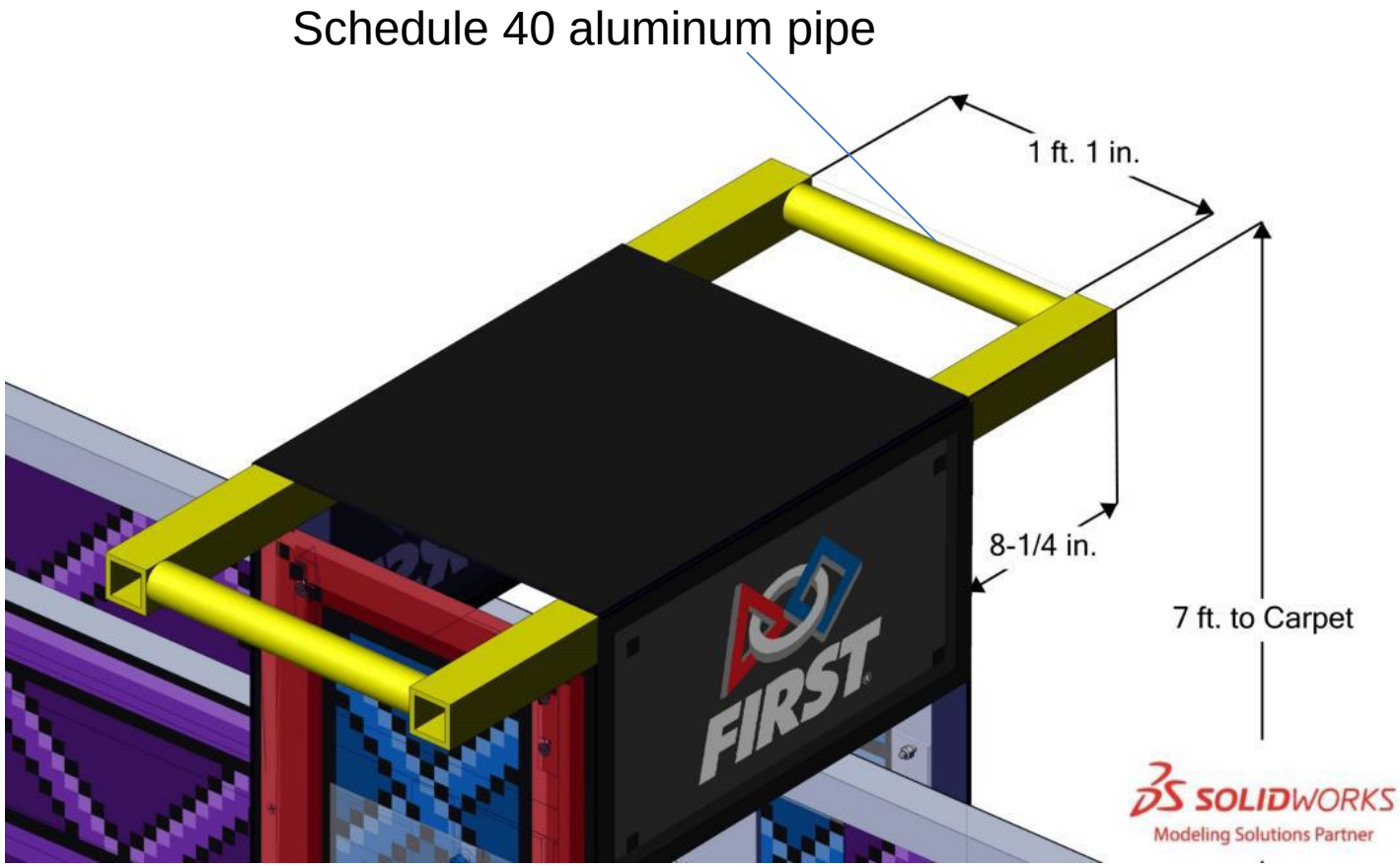
Game Overview – Scale Plate



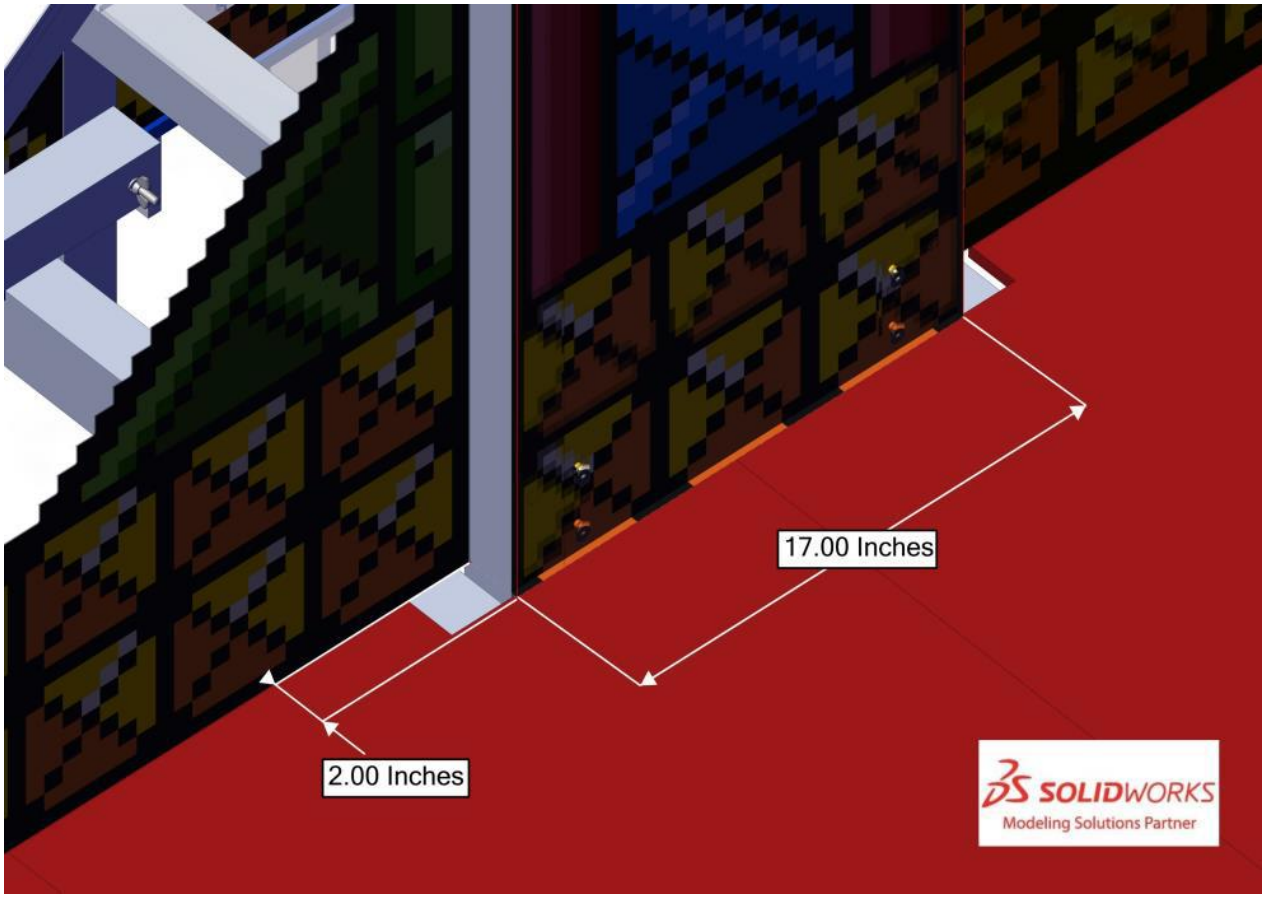


SOLIDWORKS
Modeling Solutions Partner

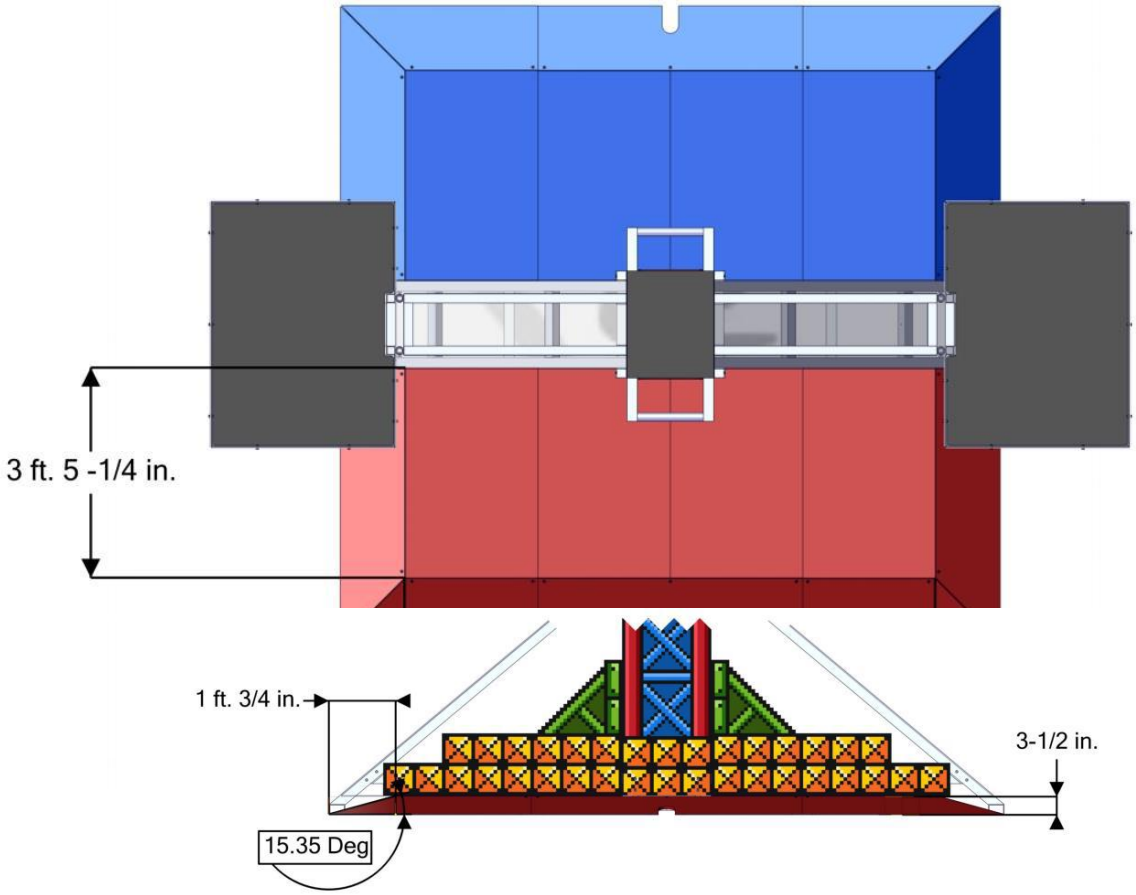
Game Overview – Rungs



Game Overview – Tower

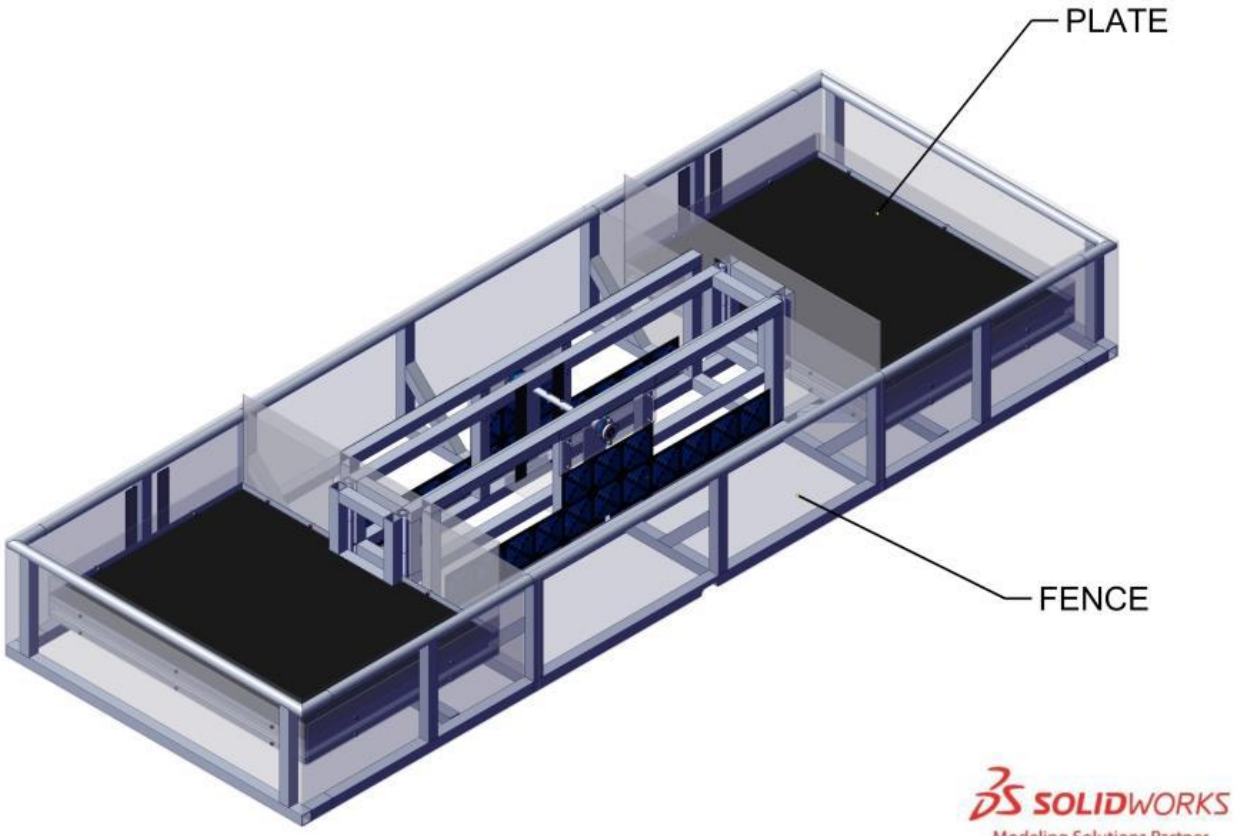


Game Overview – Platform

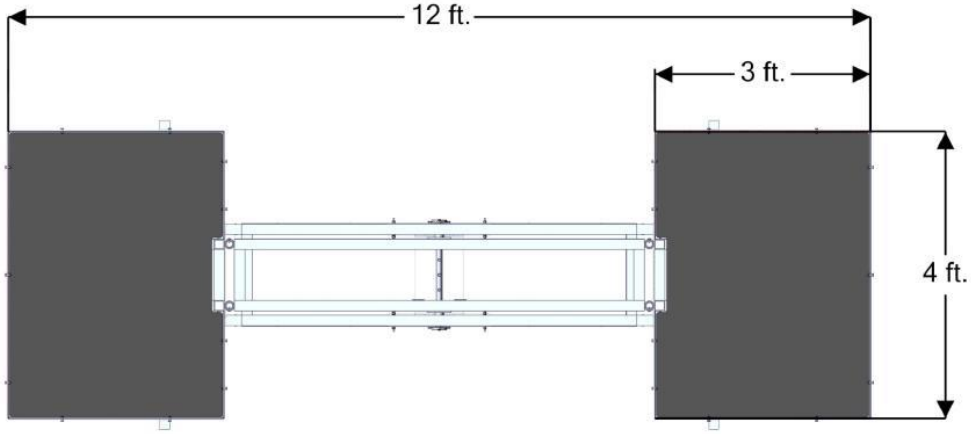


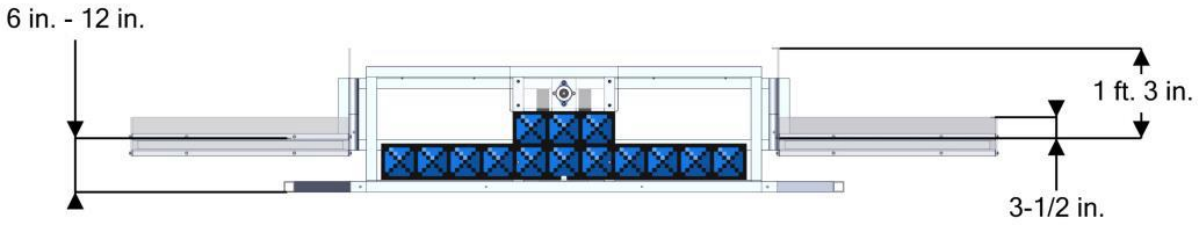
Game Overview – Switch

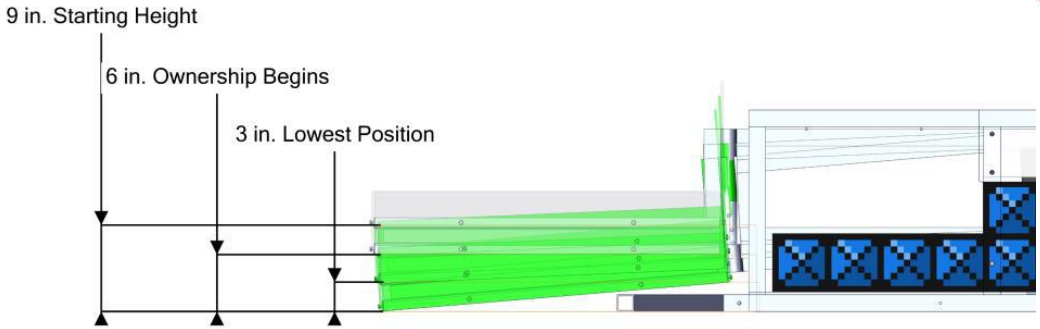
2 switches on field, one per alliance.
An alliance's switch is the one located closest to its alliance station.



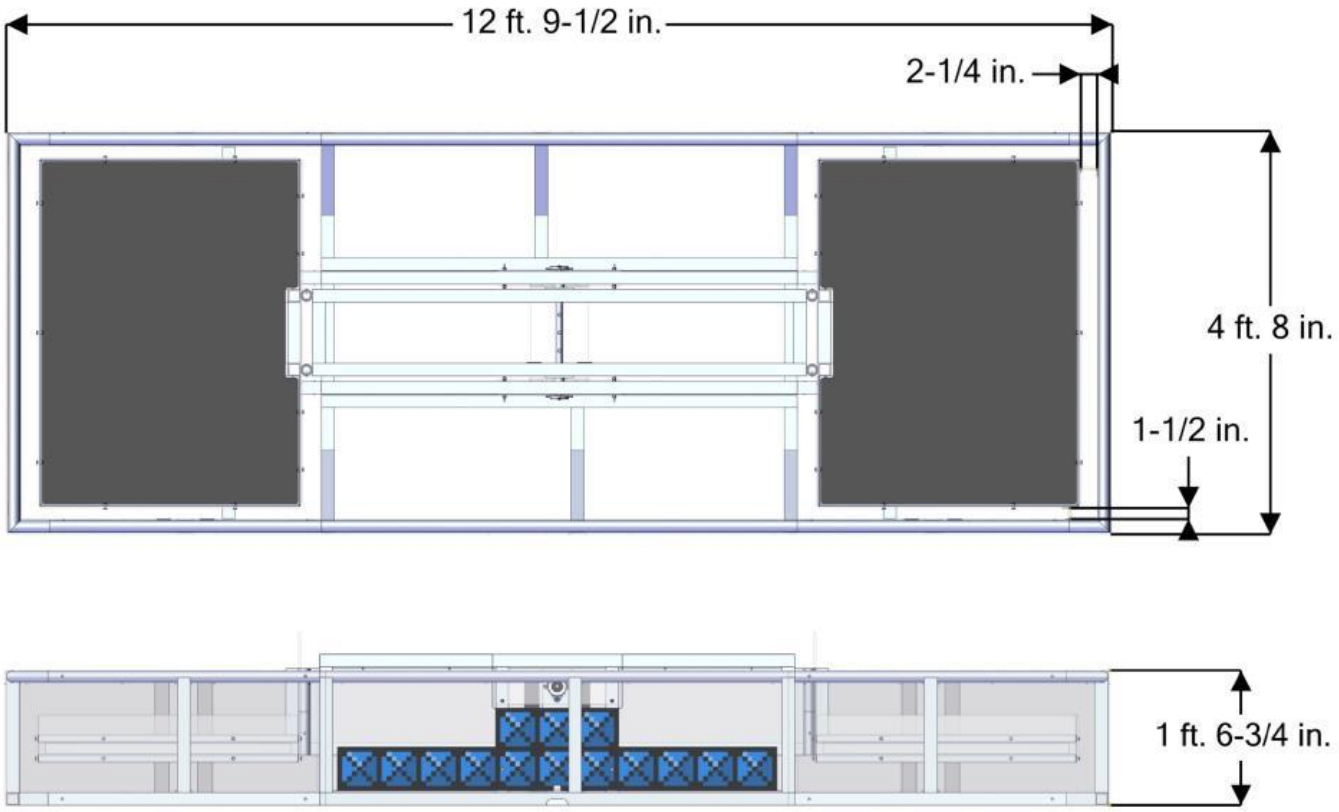
Game Overview – Switch Plate







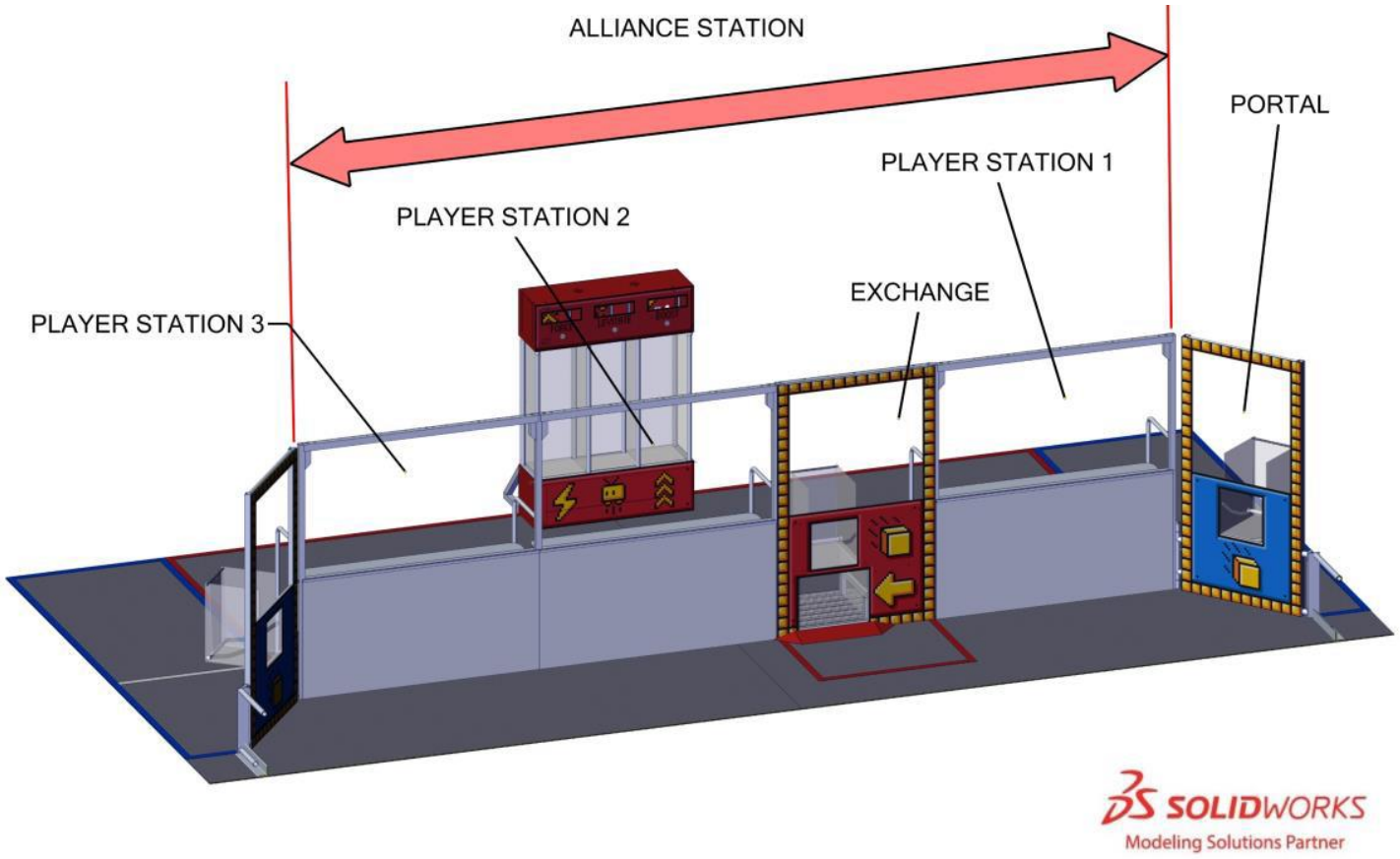
Game Overview – Fence



Game Overview –Switch Plate Lighting

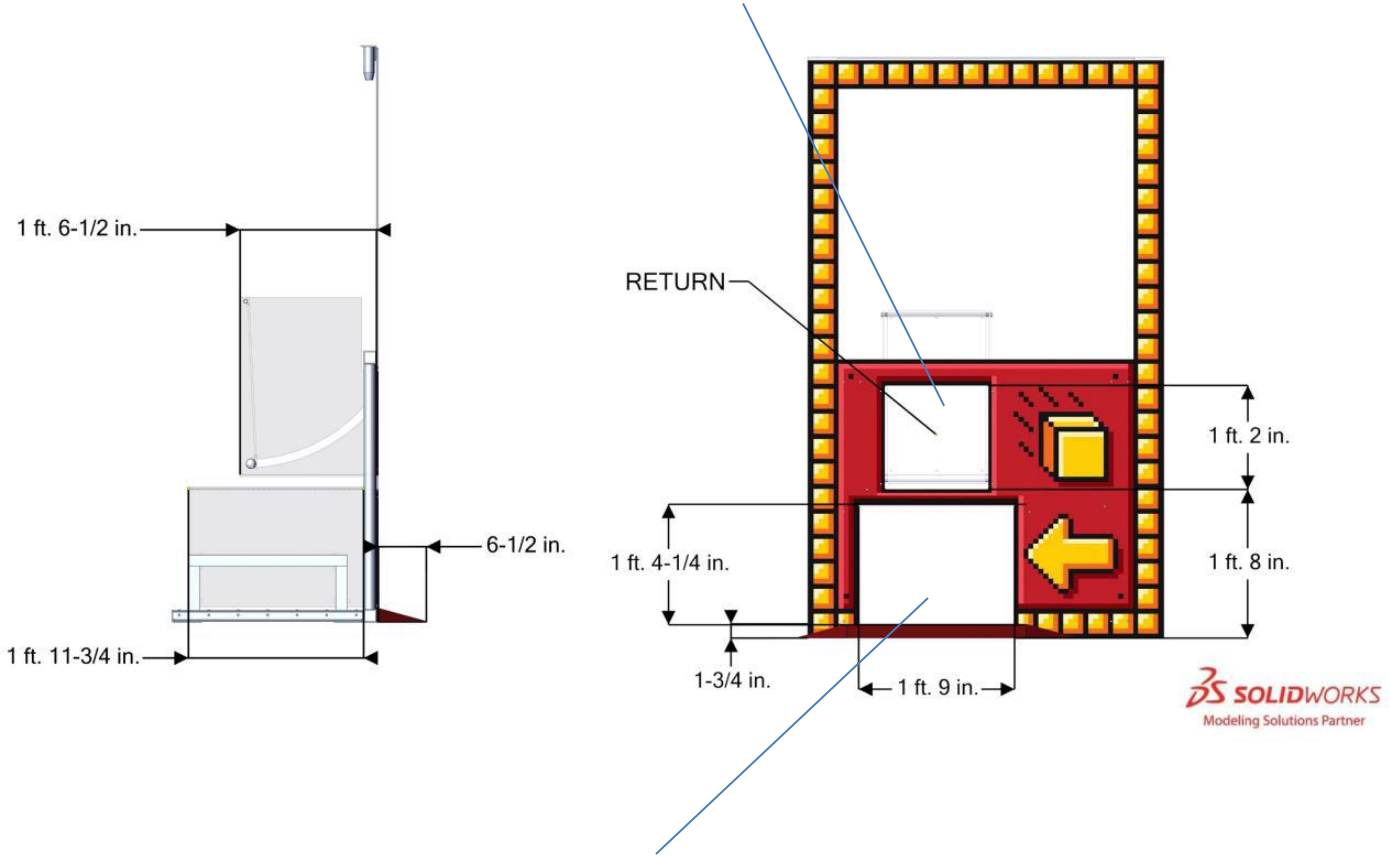
Color	Auto	Teleop	Post-Match
Blue at 100% brightness	Alliance color	Alliance color	N/A
Blue (pulsing)	Blue Ownership	Blue Ownership	N/A
Blue (pulsing) with solid red corners	Blue Force Power Up is active	Blue Force Power Up is active	N/A
Blue at 25% brightness	Red Ownership	Red Ownership	N/A
Blue (chase pattern)	N/A	Blue Boost Power Up is active	N/A
Red at 100% brightness	Alliance color	Alliance color	N/A
Red (pulsing)	Red Ownership	Red Ownership	N/A
Red (pulsing) with solid red corners	Red Force Power Up is active	Red Force Power Up is active	N/A
Red at 25% brightness	Blue Ownership	Blue Ownership	N/A
Red (chase pattern)	N/A	Red Boost Power Up is active	N/A
Purple (pulsing)	N/A	N/A	Field is safe for Field Staff
Green	N/A	N/A	Field is safe for all

Game Overview –Alliance Wall



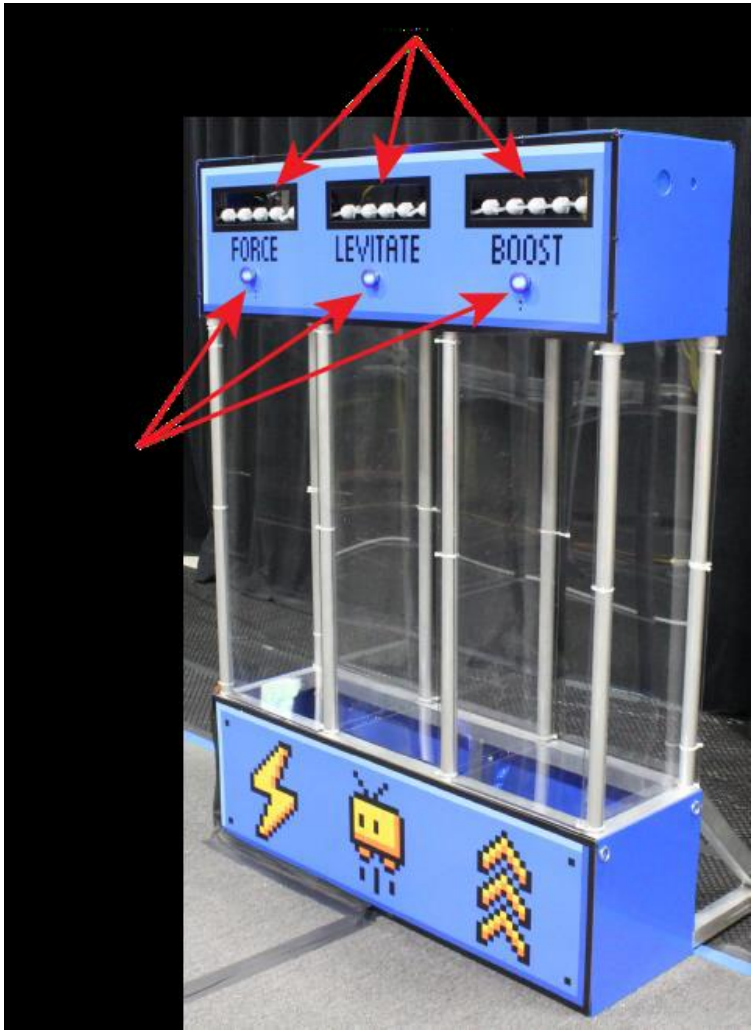
Game Overview – Exchange

Return used by human player to deliver power cube to robot



Robot delivers power cubes to human player using lower opening

Game Overview – Vault



Used to turn power cubes into power ups

If power cubes placed logo side up, three will fit

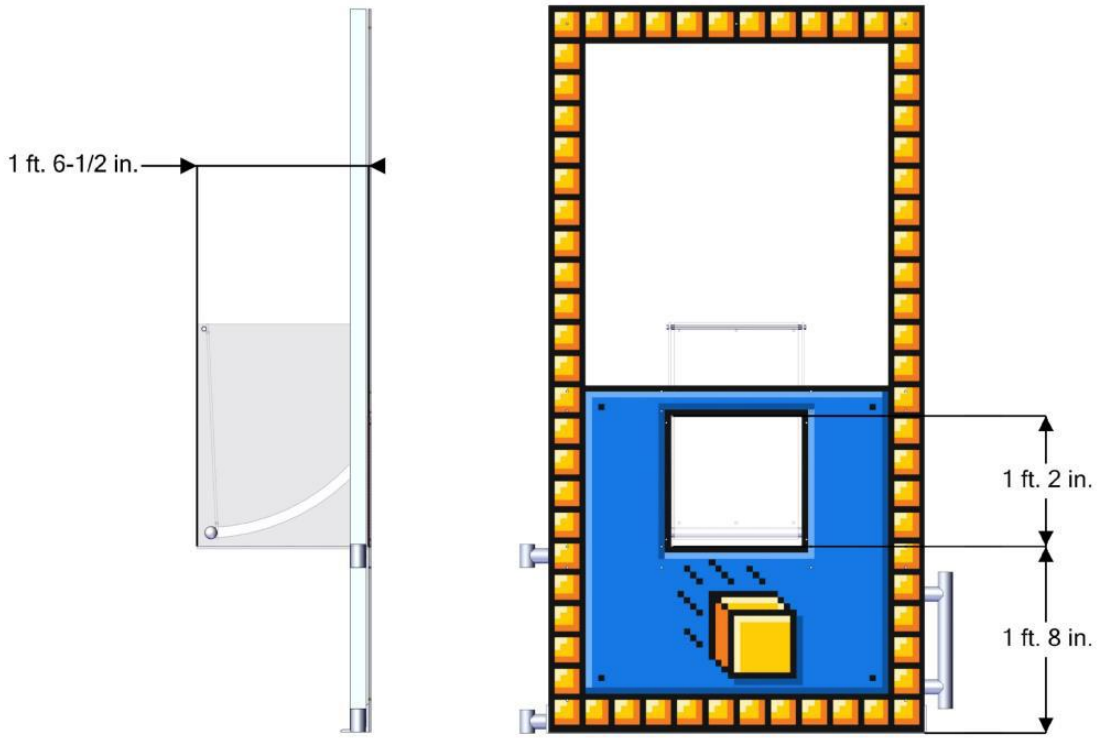
Game Overview – Vault Lighting

The lights illuminate one bulb per POWER CUBE and show one (1), two (2), three (3) or none (0) by lighting up from left to right.

To play a POWER UP, the button corresponding to the column and associated POWER UP is pressed by the HUMAN PLAYER.

Once played, all five (5) lights in the corresponding column are illuminated in the ALLIANCE color. If an ALLIANCE plays a POWER UP during the time when an opposing ALLIANCE's POWER UP is active, the POWER UP is queued, indicated by five (5) pulsing lights.

Game Overview – Portal



SOLIDWORKS Modeling Solutions Partner

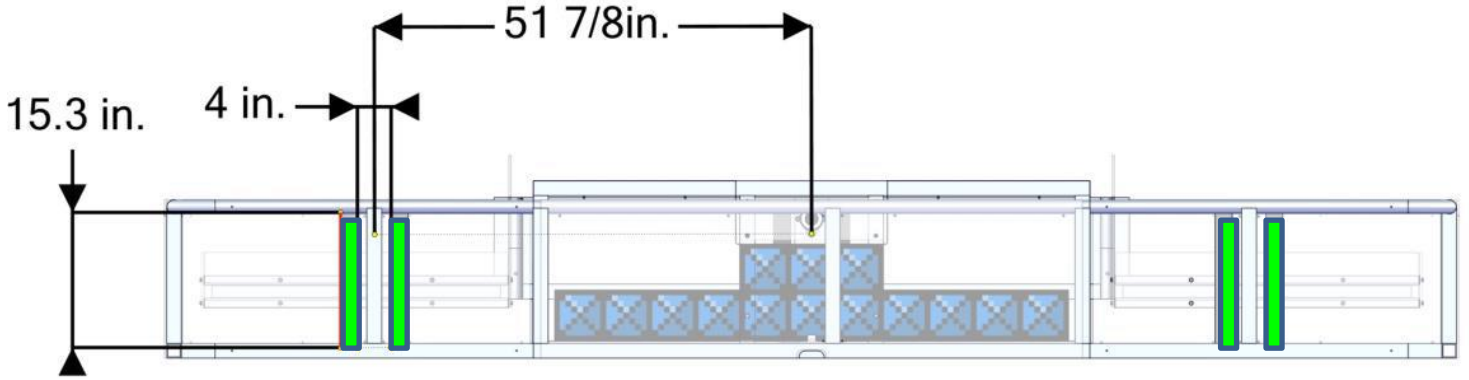
Game Overview – Power Cube

13” x 13” x 11” x 11” Milk Crate covered in yellow nylon cover.

Weighs 3.5 lbs.

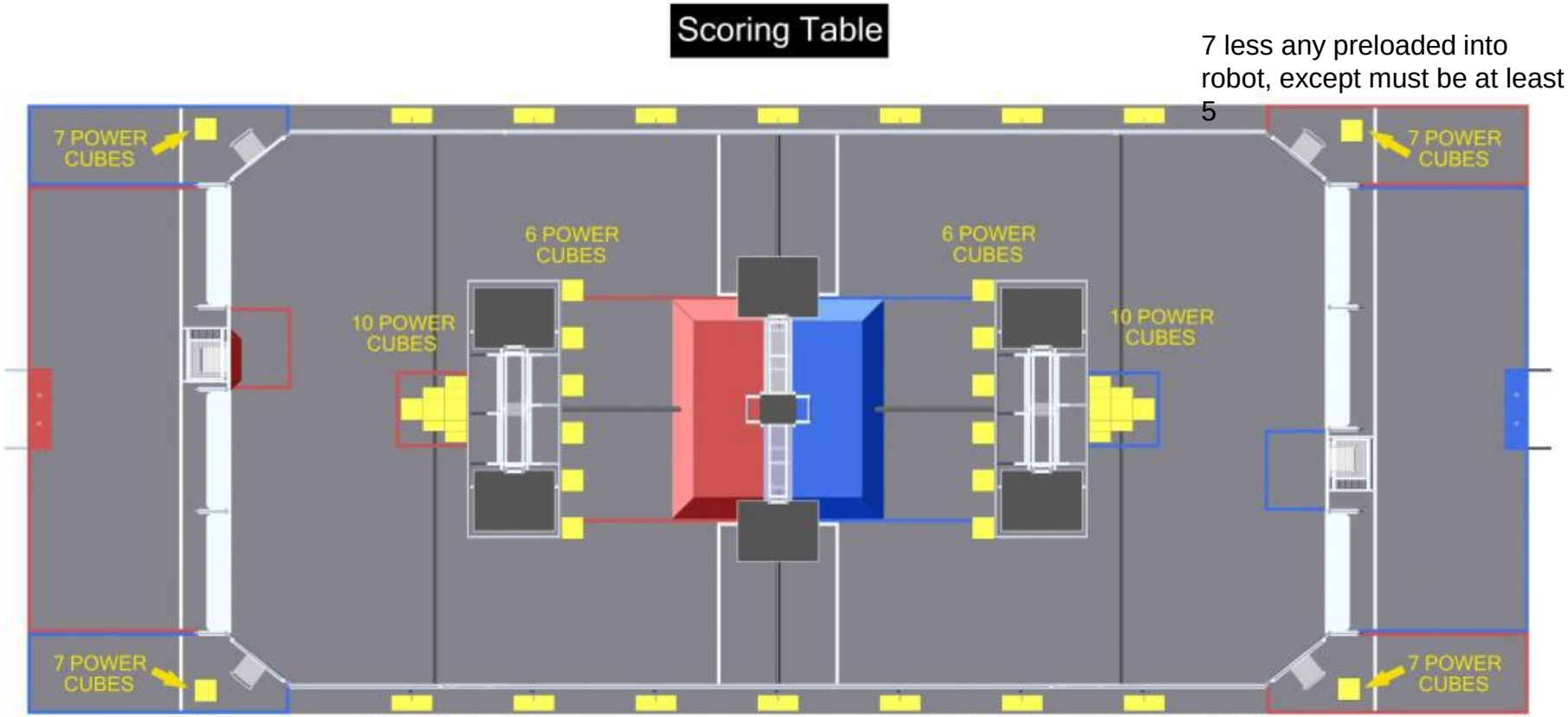
Logo covers open face.

Game Overview – Vision Targets



SOLIDWORKS
Modeling Solutions Partner

The Game – Power Cube Staging



7 less any preloaded into robot, except must be at least 5

Preloaded power cube must be in or on robot such that it is fully and only supported by robot

Game Play – Scoring

Primary method of scoring is by placing power cubes on the plates of the switch or scale to establish ownership.

Alliances earn points when ownership is established and additional points for each additional second of ownership.

Switch located closest to its alliance station is considered that alliance's switch. **While any robot can place power cubes on the plates of either switch, an alliance can only have ownership of, and accumulate points, for their switch.**

Note that points for the switch and scale are accrued over time and not a direct function of the number of power cubes placed on the switch or scale.

Points are not taken away when ownership changes, but rather stop accumulating (if balanced) or start accumulating for the opposite alliance if they take ownership of the **scale**.

Game Play – Scoring

Action	Criteria	Match Point Value Auto	Match Point Value Teleop	Ranking Points
Auto-Run	For each robot that breaks the vertical plane of the auto line with its bumper at any point in the auto stage	5	-	-
Ownership	Scale Alliance's switch	2 + 2/sec 2 + 2/sec	1 + 1/sec 1 + 1/sec	- -
Vault	For each power cube placed in the vault	-	5	-
Parking	For each robot fully supported by the scale (either directly or transitively), not at all in the opponent's platform zone, and has not climbed	-	5	-
Climbing	For each robot fully supported by the scale (either directly or transitively) with bumpers fully above the bricks at T=0, and not at all in the opponent's platform zone	-	30	-
Face the Boss	All three alliance robots have climbed or two have climbed and the alliance has played the levitate power up	-	-	1
Auto Quest	Alliance complete three auto-runs and has ownership of their switch at T=0 of the auto stage	-	-	1
Win	Alliance's final match score exceed their opponents	-	-	2
Tie	Alliance's final match score equals their opponents'	-	-	1

Match points in teleop stage are increased if the boost power up is played

Game Play – Power Ups

Name	Number of Power Cubes	Effect	Duration (seconds)
LEVITATE	3	An additional climbing robot, up to a maximum of three robots is credited to the alliance at the end of the match	N/A
FORCE	1	Alliance earns ownership points from their switch regardless of plate position	10
	2	Alliance earns ownership points from the scale regardless of plate position	10
	3	Alliance earns ownership points from the switch and scale regardless of plate position	10
BOOST	1	Increases the points for ownership of the alliance's switch from one point per second to two points per second	10
	2	Increases the points for ownership of the scale from one point per second to two points per second	10
	3	Increases the points for ownership of both the alliance's switch and the scale from one point per second to two points per second	10

Game Play – Power Cubes Exchange

Robots can deliver power cubes to human players through exchange. Once delivered, the human player may:

- place it into vault
- return the power cube to the field using the return
- keep the power cube inside the alliance station to use later or not use at all

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 cared 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 – an operator and controller of the robot
  - Human Player – power cube manager
  - Technician (New Role) – resource for robot troubleshooting, setup, and removal from the field – 1 per team

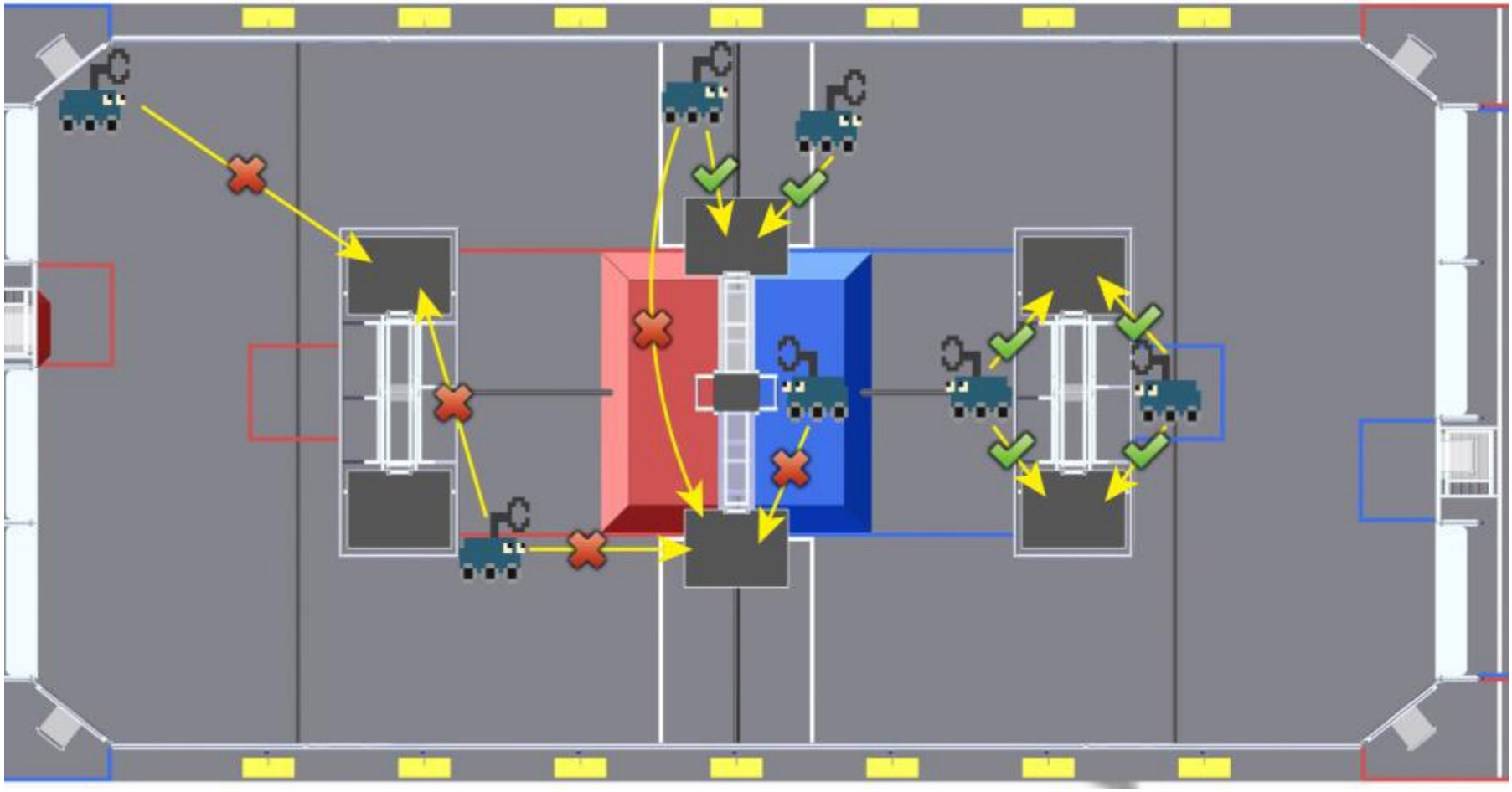
Game Play – Logistics

- Any power cube that leaves the field, except through the lower opening of the exchange, will not be returned to match play.

Robot Rules

- Robots may not extend more that 16 in beyond their frame perimeter (except during endgame in platform zone).
- Robot my not intentionally detach or leave parts on the field.
- Robots must be in compliance with bumper rules throughout the match.
- Robots must be removed from the field by hand.
- Launching power cubes is not permitted except:
  - When any part of its bumpers are inside its alliance's null territory, and it's attempting to place a power cube on the scale plate in its alliance's null territory, or
  - When any part of its bumpers are contacting a fence, and it's attempting to place a power cube on the nearest plate of that fence's switch, or
  - When any part of its bumpers are inside its alliance's exchange zone, and it's attempting to place a power cube in its alliance's exchange tunnel.

Robot Launching Rules



Robot Rules

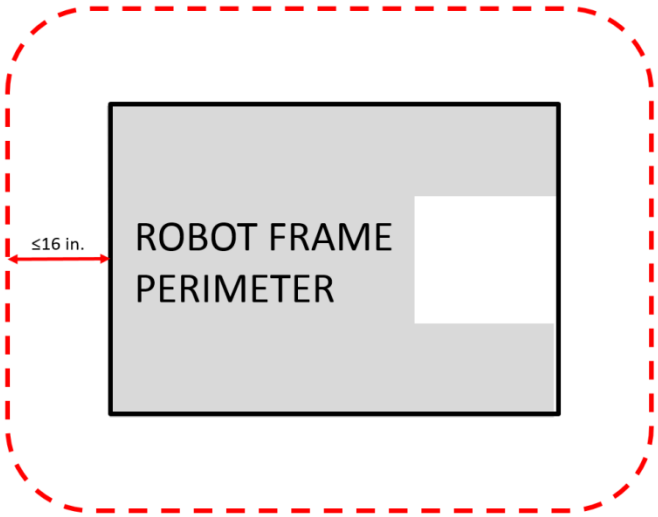
- Strategies aimed at the destruction or inhibition of robots via attachment, damage, tipping, or entanglements are not allowed.
- Initiating deliberate or damaging contact with an opponent robot on or inside the vertical extension of its frame perimeter, include transitively through a power cube, is not allowed.
- Two or more robots may not isolate or close off any major component of match play, e.g. blocking the exchange, shutting down all access to power cubes, etc.
- Fallen robots have one 10-second grace period in which they may not be contacted by an opponent robot.
- Robots may not pin an opponent robot for more than 5 seconds

Robot Rules

- Robot may not block their opponent's exchange zone for more than five seconds.
- A robot whose bumpers are breaking the plane of its null territory and not breaking the plane of the opponent's platform zone may not be contacted by an opposing robot, regardless of who initiates the contact.
- Unless during the endgame, or attempting to right a fallen alliance partner, robots may neither fully nor partially strategically support the weight of partner robots.
- During the endgame, robots may not contact an opponent alliance robot, completely contained within their alliance's platform zone, regardless of who initiates the contact.

Robot Rules

- Starting configuration, the maximum robot size (excluding bumpers) must be constrained to a volume of:
  - 33 inches x 28 inches x 55 inches tall
- Robots may not extend more than 16 in. beyond their frame perimeter except during the endgame.
- The robot weight must not exceed 120 lbs.
  - Excludes bumpers and battery and cable



Game Play – General Rules

- Robot and team must follow safety rules
- The following actions are prohibited with regards to interaction with arcade elements (not power cubes or rungs)
  - Grabbing
  - Grasping
  - Attaching
  - Hanging
  - Becoming entangled
  - Damaging
  - Deforming
- Robots may not deliberately use power cubes in an attempt to ease or amplify the challenge associated with field elements (stacking underneath plate, climbing on power cubes, using power cubes to explicitly impede opponent mobility).

Game Play – General Rules

Robots may not control more than one power cube at a time. Moving or positioning a POWER CUBE to gain advantage is considered "control." Examples include, but are not limited to:

-"carrying" (holding a POWER CUBE inside a ROBOT)

-"herding" (intentionally pushing a POWER CUBE to a desired location or direction)

-"trapping" (holding a POWER CUBE against a FIELD element in an attempt to shield or guard it)

-"launching" (shooting POWER CUBES into the air, kicking across the floor, or throwing in a forceful way)

Examples of interaction with POWER CUBES that are not "control" include, but are not limited to:

-"bulldozing" (inadvertent contact with POWER CUBES while in the path of the ROBOT moving about the FIELD)

-"deflecting" (being hit by a POWER CUBE that bounces into or off of a ROBOT)

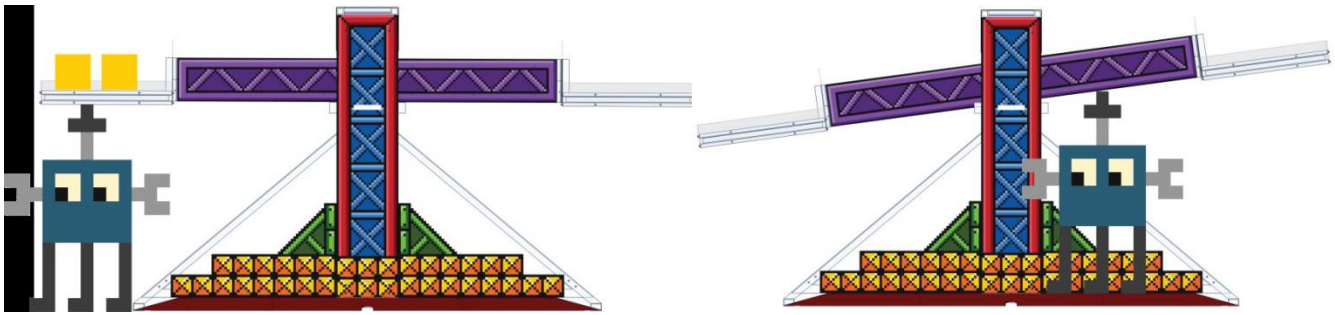
-"plowing" (brief contact with a large quantity of POWER CUBES while attempting to break up a pile, or gain access to an area of the FIELD. Sustained contact or contact after the brief plowing action will be subject to "herding")

-"nudging" (contact with a POWER CUBE that is on a PLATE while attempting to place additional POWER CUBES on that PLATE)

If a POWER CUBE becomes lodged in or on a ROBOT, it will be considered controlled by the ROBOT. It is important to design your ROBOT so that it is impossible to inadvertently or unintentionally control more than the allowed maximum.

Game Play – General Rules

- Robots may not remove power cubes, or cause power cubes to be removed, from the opponent's power cube zone.
- Strategies aimed at removing power cubes from plates are prohibited.
- Except via the placement of power cubes, robots may not affect the movement of plates.

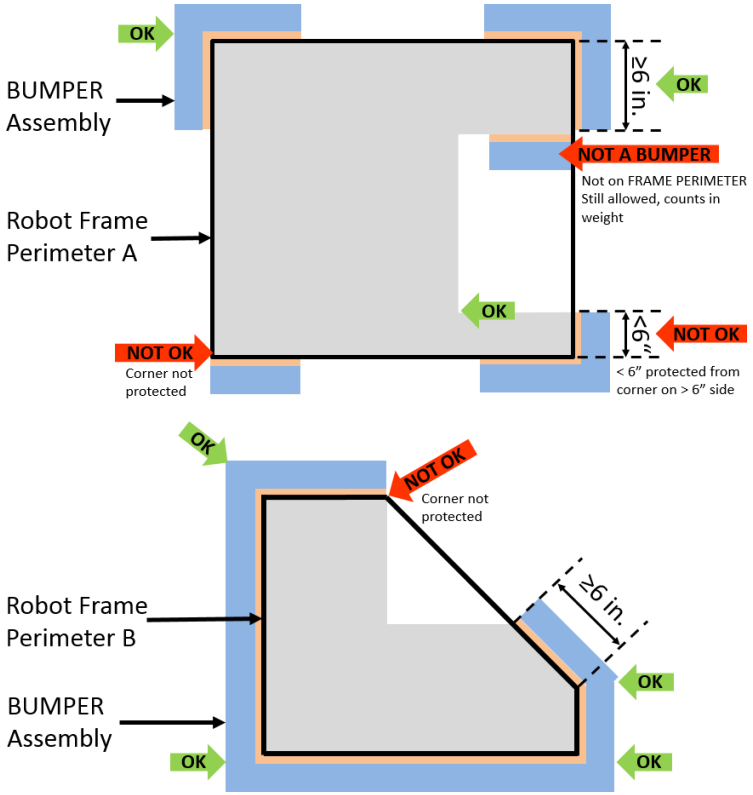


Human Actions

- A robot shall be operated solely by the drivers and/or human players of that team
- Drive teams must wear proper identification while in the arcade.
- Only bring things to match you are allowed to bring.
- Technicians may not verbally coach or use non-powered signaling devices (not an additional coach, driver or human player).
- Teams may not modify power cubes.
- Teams may not sit or stand on power cubes.

Bumper Rules

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



Ranking

Teams are ranked in order, using the sorting criteria:

Qualification MATCH Ranking Criteria

Order Sort	***Criteria***
1st	Ranking Score
2nd	Cumulative PARKING and CLIMBING score
3rd	Cumulative sum of AUTO points
4th	Cumulative sum of OWNERSHIP points
5th	Cumulative sum of VAULT points
6th	Random sorting by the FMS

District teams are ranked throughout the season based on the points they earn at their first two home District events they attend, as well as at their District Championship. Points are awarded to teams as follows:

District point assignment

Category	***Points***
Qualification Round Performance	(For a typically sized District event, this will result in a minimum of four (4) points being awards for
Qualification round performance.	For events of all sizes, a maximum of twenty-two (22) points will be awarded.)
ALLIANCE CAPTAINS	Equal to 17 minus the ALLIANCE CAPTAIN number (e.g. 14 points for ALLIANCE #3 Captain)
Draft Order Acceptance	Equal to 17 minus the Draft Order Acceptance Number (e.g. 12 points for the Team that is 5th to accept an invitation)
Playoff Advancement	Points awarded based on team participation in individual playoff rounds, and whether or not the ALLIANCE advances.
Judged Team Awards	• 10 points for Chairman's Award • 8 points each for Engineering Inspiration and Rookie All Star Awards • 5 points each for all other judged Team awards
Team Age	• 10 points for Rookie Teams • 5 points for second-year Teams

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 (driving robot after 4 weeks)?
- Should we plan to use the camera to either help drivers or use vision tape?
- Think about how you would do it if only humans played
- What is impact of limited size restrictions?
- For each function, consider impact on rest of robot functions, space, weight, balance, etc.
- Decide what we don’t want to do and eliminate it from further consideration
- Trying to do everything usually means you sacrifice doing a few things really well

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?
- Are we building two robots
  - First one is prototype plus one to drive when robot in bag
  - Second one is done with CAD and made to look good
- What needs to be done in CAD first vs. done and then use CAD to improve the second robot

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
  - Assist alliance with ranking points
- Take enough time to know **what** we **want** to do (knowing why we want to do it) before we decide how to do it.

Game Play – Scoring

Action	Criteria	Match Point Value Auto	Match Point Value Teleop	Ranking Points
Auto-Run	For each robot that breaks the vertical plane of the auto line with its bumper at any point in the auto stage	5	-	-
Ownership	Scale Alliance's switch	2 + 2/sec 2 + 2/sec	1 + 1/sec 1 + 1/sec	- -
Vault	For each power cube placed in the vault	-	5	-
Parking	For each robot fully supported by the scale (either directly or transitively), not at all in the opponent's platform zone, and has not climbed	-	5	-
Climbing	For each robot fully supported by the scale (either directly or transitively) with bumpers fully above the bricks at T=0, and not at all in the opponent's platform zone	-	30	-
Face the Boss	All three alliance robots have climbed or two have climbed and the alliance has played the levitate power up	-	-	1
Auto Quest	Alliance complete three auto-runs and has ownership of their switch at T=0 of the auto stage	-	-	1

Need to get power cubes on alliance side of scale

Need to get power cubes on alliance side of switch

Need to get power cubes through exchange

Need to climb to help alliance?

Need to climb to help alliance?

Need to get power cubes through exchange

Need to get power cubes on alliance side of switch

Match points in teleop stage are increased if the boost power up is played

Need to get power cubes through exchange

Key Dates

- Robot Bag and Tag date is:
  - February 20, 2018 at 11:59 PM Eastern Time

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
  - Use tools to compare options
  - Recognize that almost everything we think of will be done by someone

Strategy Discussion Groups

1. There are 6 discussion groups (business team members welcome to join a group)
   - Mechanical 1, 2, and 3,
   - Controls and Programming,
   - Electrical,
   - CAD
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!

Strategy Discussion Groups

1. You have until 3:30 PM to prepare for review
2. Include breaks
3. At 3:30 PM, we will go around the room and have each team summarize their discussion
4. Game Strategy and Scouting will document and summarize results
5. Project Management will start process of schedule management
6. When done, we need to clean up the room as if we were never here