FRC Game Overview - 2022

ADAMBOTS

Adambots FRC Team 245

January 9, 2022

Agenda

1:00 PM – Game Overview Presentation

2:15 PM – Scoring Options and Strategy Discussion
- Strategy Helps Inform Design – Form Follows Function

2:45 PM – Preliminary Design Discussions

4:00 PM – Finished

Housekeeping

- Game Overview
- Safety
- Seeding and Playoffs
- Game Play Scoring
- Game Play Time
- Game Play
- Robot Rules
- General Rules
- Human Actions
- Considerations
- Key Dates
- Discussion

Stay on mute unless you have a question or input for discussion

Use your real name for login for attendance

- Game Overview
- The Arena
- Match Play
- Game Play Scoring
- Rule Violations
- Game Play
- Human Actions
- Tournaments
- Considerations
- Key Dates
- Discussion

You may ask questions at any time, but try not to ask before the subject is reviewed!

Game Overview

In RAPID REACTSM presented by The Boeing Company, two competing alliances process cargo for transportation. Each alliance is assigned a cargo color (red or blue, based on alliance affiliation) to process by retrieving their assigned cargo and scoring it into the hub. Human players assist the cargo retrieval and scoring efforts from within their terminals. In the final moments of each match, alliance robots race to engage with their hangar to prepare for transport!

Each match begins with a 15-second autonomous period, during which time alliance robots operate only on pre-programmed instructions to score points by:

• taxiing from their tarmac and

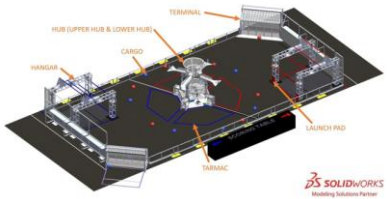
• retrieving and scoring their assigned cargo into the hub.

In the final 2 minutes and 15 seconds of the match, drivers take control of the robots and score points by:

• continuing to retrieve and score their assigned cargo into the hub and

• engaging with their hangar.

The alliance with the highest score at the end of the match wins!



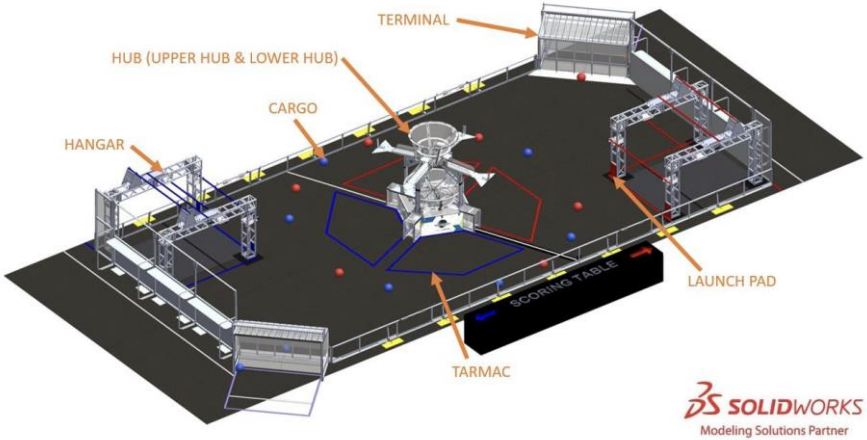
Game Overview - Arena

Field

Cargo

Field Management Equipment

Robot Management Equipment

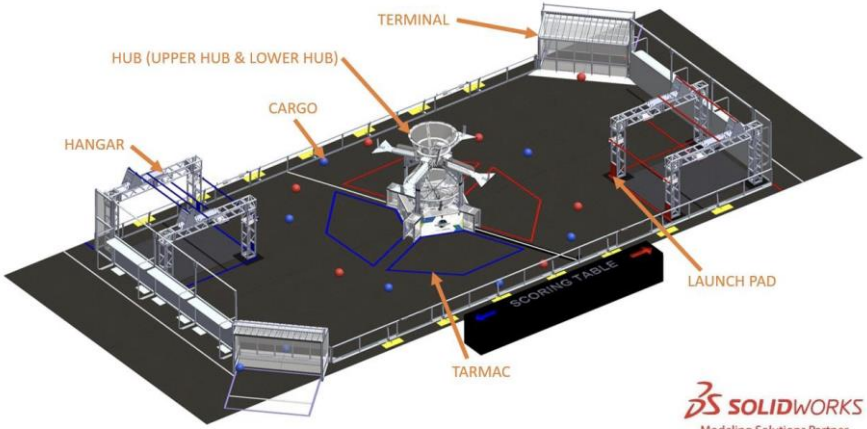


Field

Each FIELD for RAPID REACT is a 27 ft. (~823 cm) by 54 ft. (~1646 cm) carpeted area

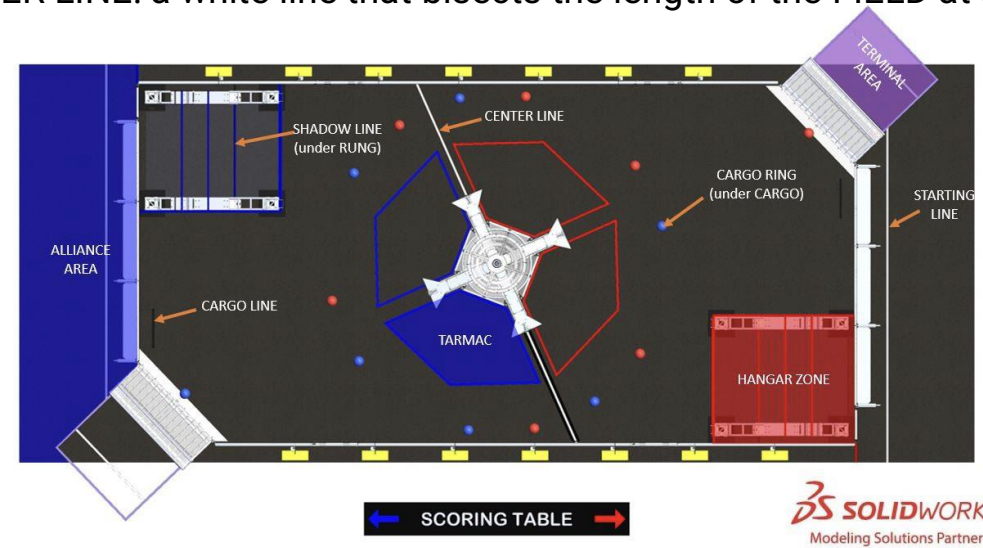
The FIELD is populated with the following elements:

- 1 HUB (including 1 UPPER HUB and 1 LOWER HUB),
- 2 HANGARS (a red HANGAR and a blue HANGAR),
- 2 TERMINALS, and
- 12 CARGO RINGS.



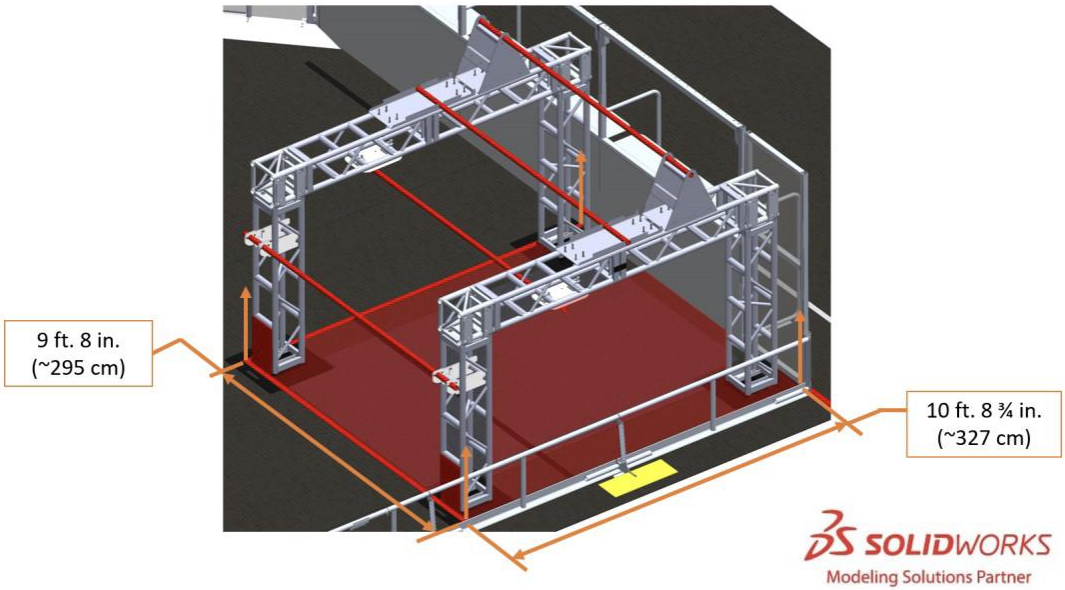
Field

- ALLIANCE AREA: a 30 ft. wide by 8 ft. 10 in.
- CARGO LINE: a 3 ft. black line that starts 1 ft. from the intersection of the TERMINAL and the ALLIANCE WALL
- CARGO RING: 1 of 14 small rings used to keep the CARGO in place prior to the start of the MATCH. Rings are ⅛ in. thick, 1¾ in. diameter O-rings
- CENTER LINE: a white line that bisects the length of the FIELD at angle



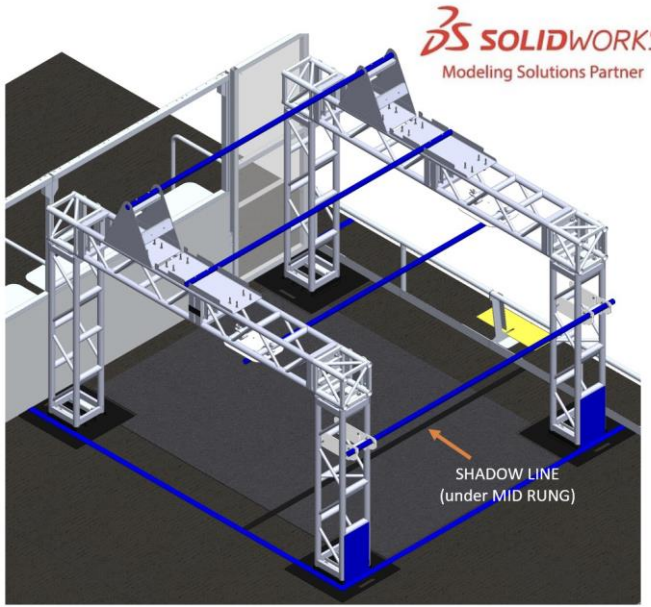
Field

- HANGER ZONE: a 9 ft. 8 in. wide, 10 ft. 8 ¾ in. deep, and infinitely tall volume defined by the alliance wall, guardrail, and alliance colored tape (included in zone).



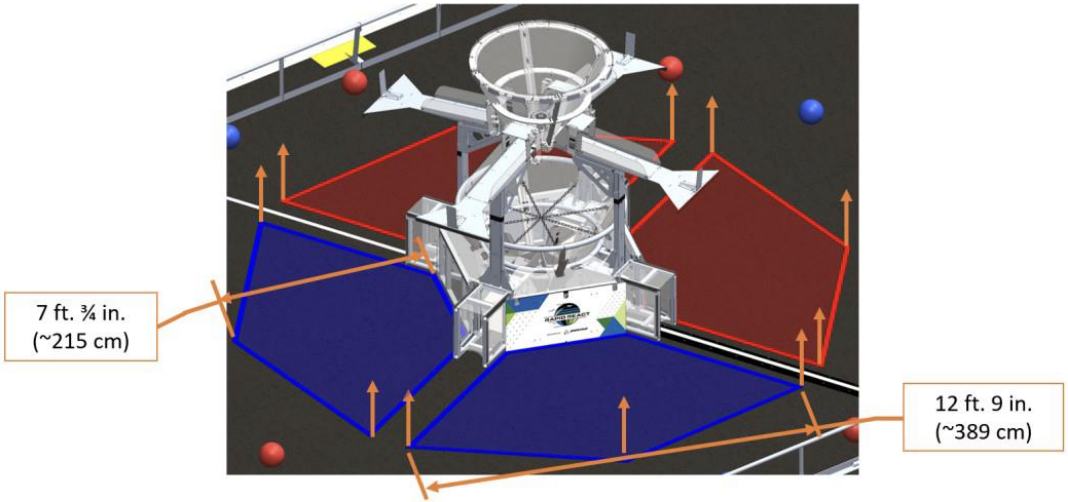
Field

- SHADOW LINE: a black line that lies directly below the MID RUNG



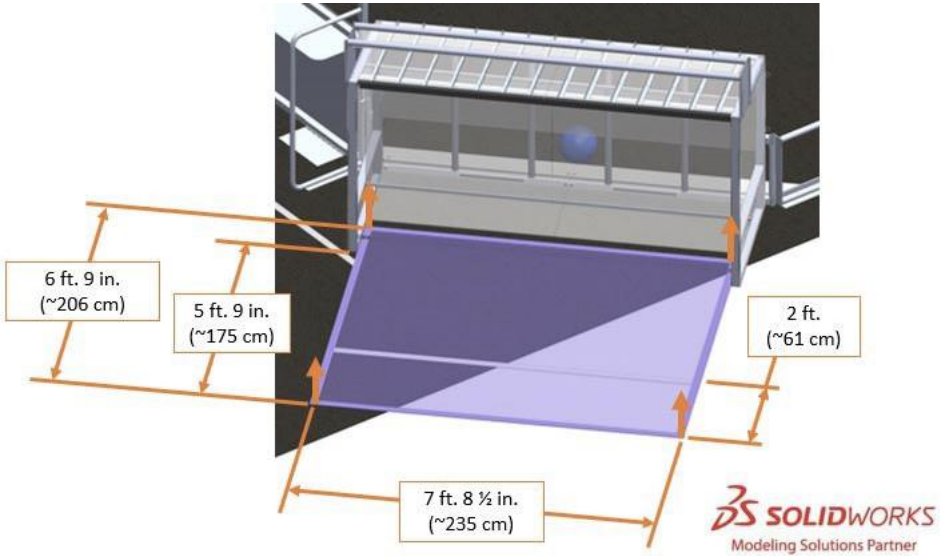
Field

- TARMAC: 1 of 4 12 ft. 9 in. wide by 7 ft. ¾ in. deep infinitely tall volumes bounded by and including the alliance colored tape



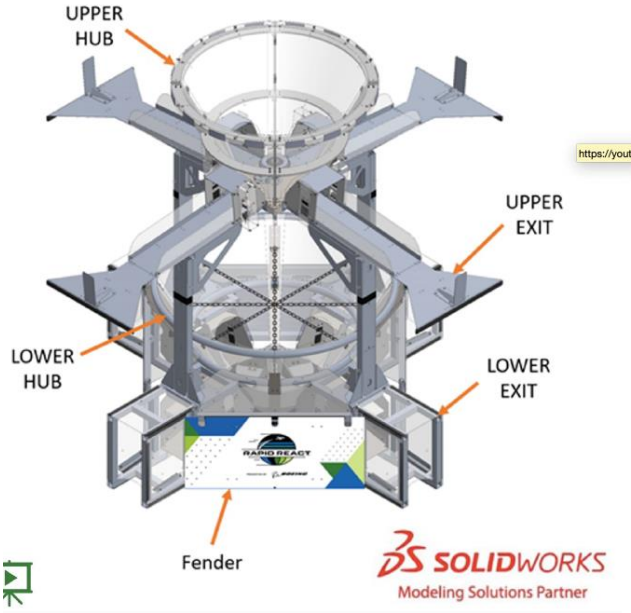
Field

- TERMINAL AREA: 7 ft. 8 ½ in. wide by 6 ft 9 in. deep and infinitely tall volumes bounded by and including purple tape
- TERMINAL STARTING LINE: a white line spanning the width of the terminal area and located 2 ft from the back of the terminal area

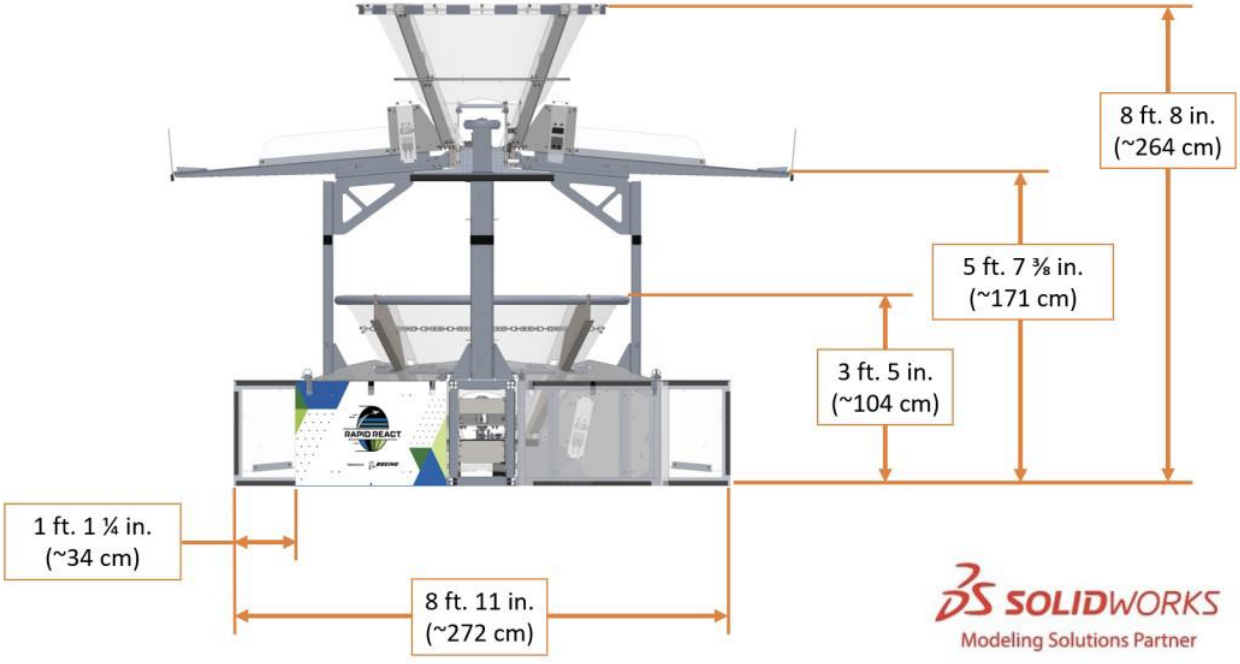


Field

- The HUB is centered on the FIELD. It consists of 2 funnel-shaped goals (an UPPER HUB and a LOWER HUB), UPPER and LOWER EXITS, and 4 fenders. The HUB is 8 ft. 11 in. wide by 8 ft. 11 in. deep by 8 ft. 8 in. tall.
- An agitator extends up the center of each HUB and rotates during the MATCH.
- An UPPER EXIT is 1 of the 4 extensions on which CARGO leaves the UPPER HUB, and a LOWER EXIT is one of the 4 tunnels from which CARGO leaves the LOWER HUB.
- 4 legs, each centered under an UPPER EXIT, support the UPPER HUB. The maximum ROBOT height defined in G106 is marked with black tape on each leg (i.e. the bottom edge of the tape is 4 ft. 4 in. (~132 cm) above FIELD carpet). A fender is located in between each of the LOWER EXITS.

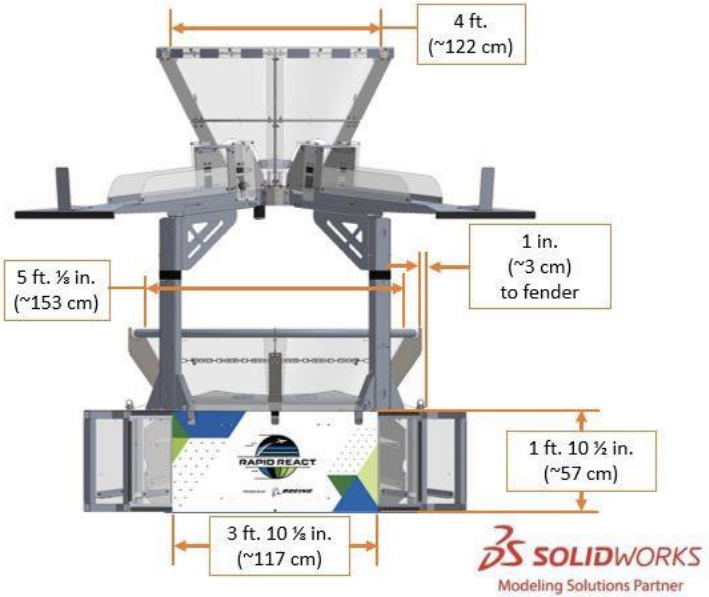


Field


8 ft. 8 in.
(~264 cm)
5 ft. 7 ⅜ in.
(~171 cm)
3 ft. 5 in.
(~104 cm)
1 ft. 1 ¼ in.
(~34 cm)
8 ft. 11 in.
(~272 cm)
SOLIDWORKS
Modeling Solutions Partner

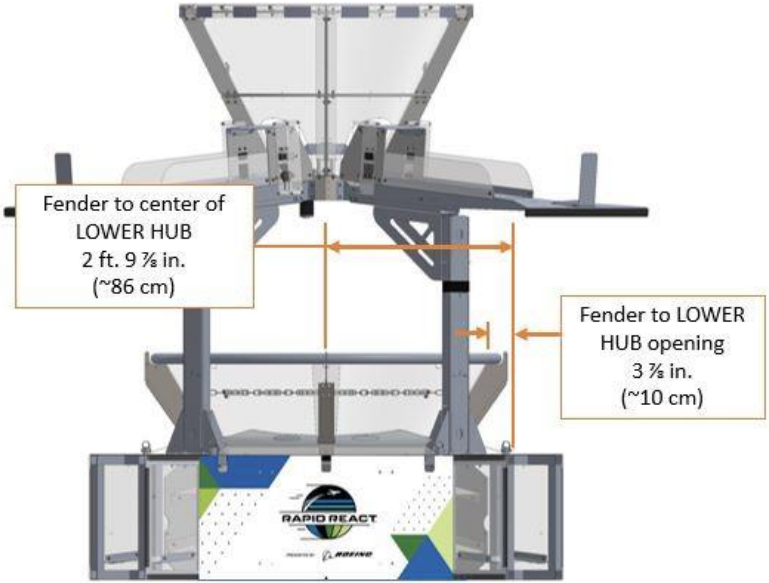
Field

- The opening of the lower hub is 3 ft. 5 in. above the field
- The opening of the upper hub is 8 ft. 8 in. above the field
- The upper hub opening has 4 4-ft. diameter
- The lower hub opening has a 5 ft. 1/8 in. diameter



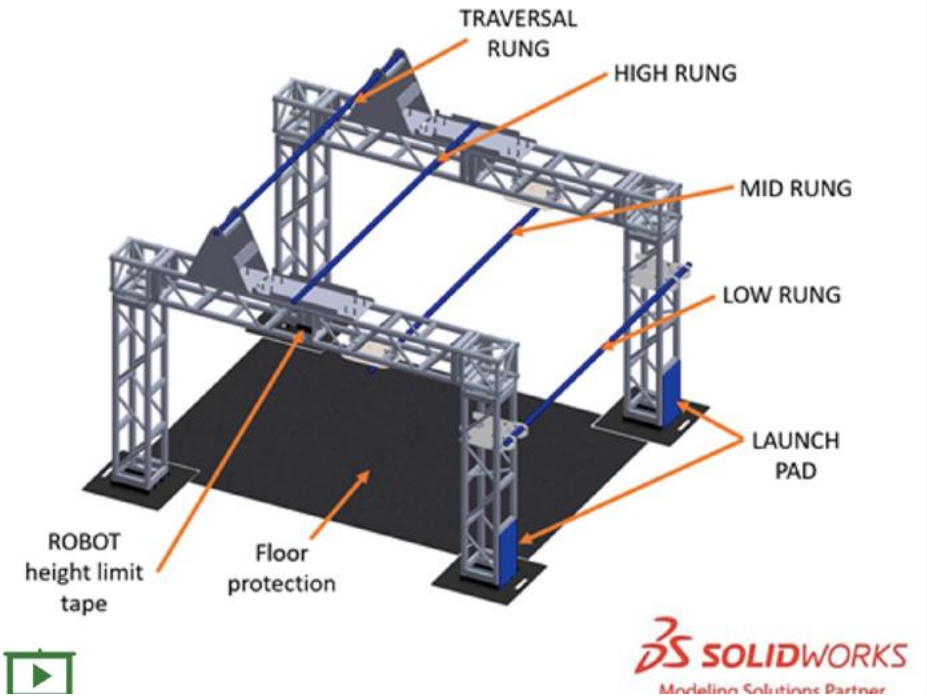
Field

- Fenders are 3 ft. 10 1/8 in. wide by 1 ft. 10 ½ in tall and positioned between each lower exit



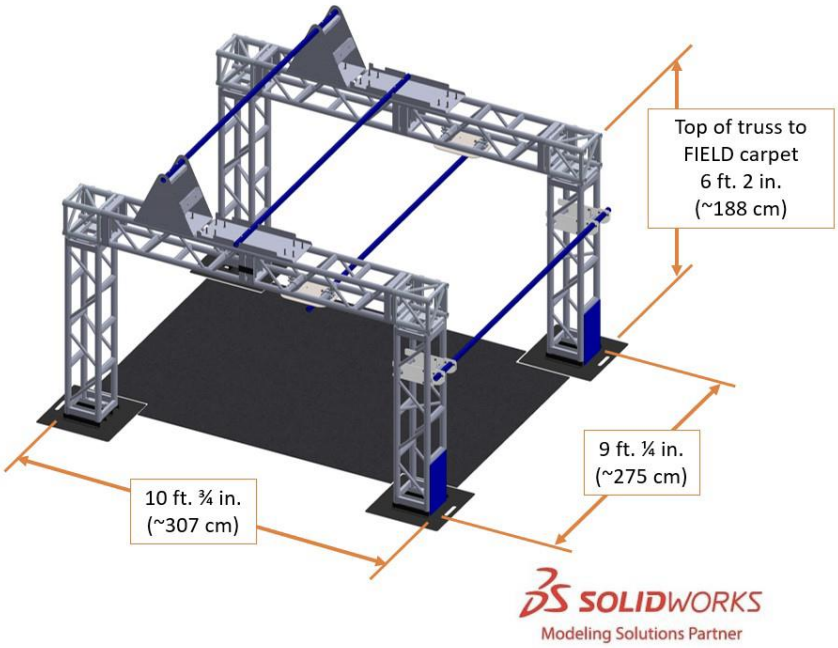
Field

A HANGAR assembly consists of truss structure, bases, 4 RUNGS, RUNG mounting brackets, floor protection, and 2 LAUNCH PADS. The maximum ROBOT height limit described in G106 is marked on the center of each horizontal truss assembly in black tape (i.e. the bottom edge of the tape is 5 ft. 6 in. above FIELD carpet).



Field

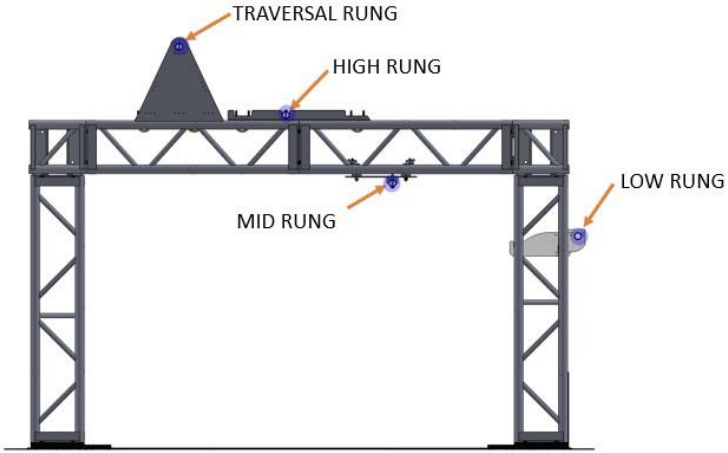
HANGAR truss is 1 ft. x 1 ft. square. The structure is 9 ft ¼ in. wide, 10 ft. 2/4 in. deep, and 6 ft. 2 in tall when measured from the field carpet.

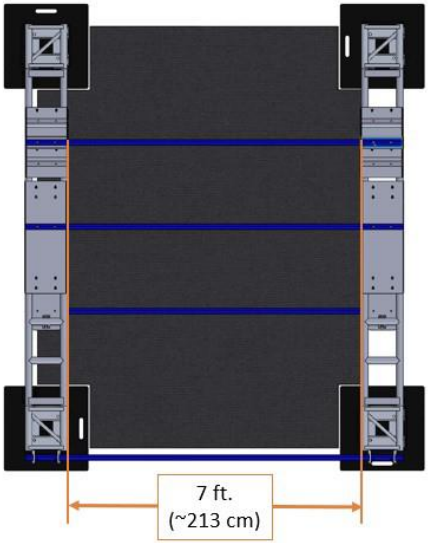


Field

HANGAR has 4 RUNGS

- Low
- Mid
- High
- Traversal





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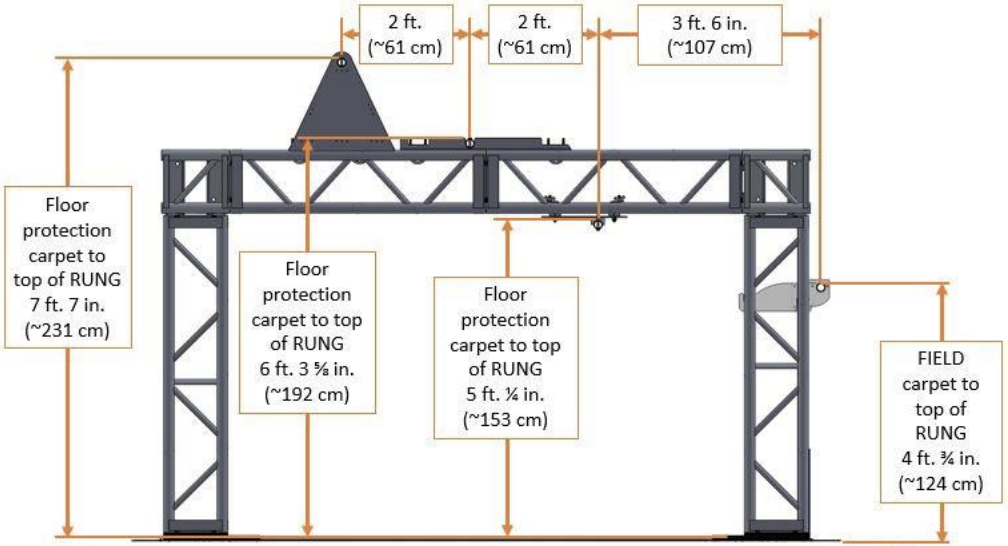
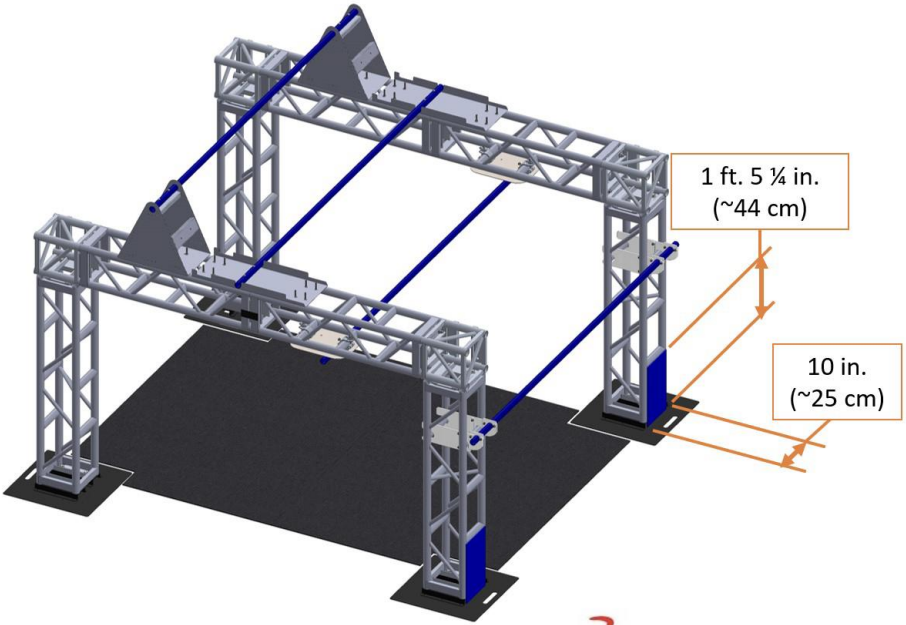


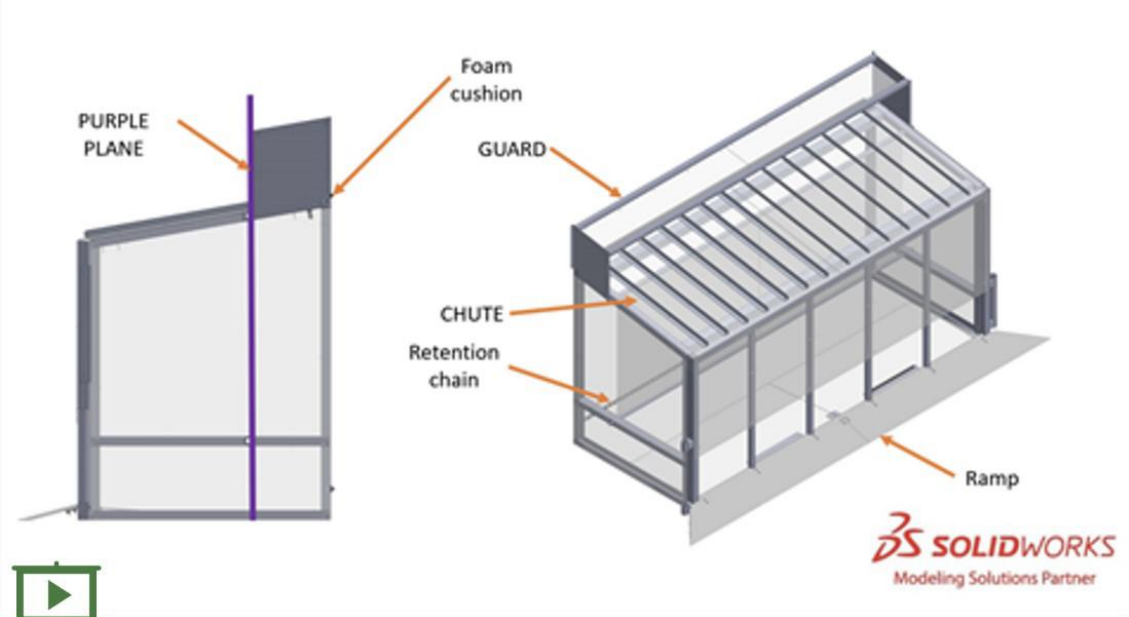
Field

LAUNCH PADS are mounted to the 2 truss legs closest to the HUB corresponding to the alliance color



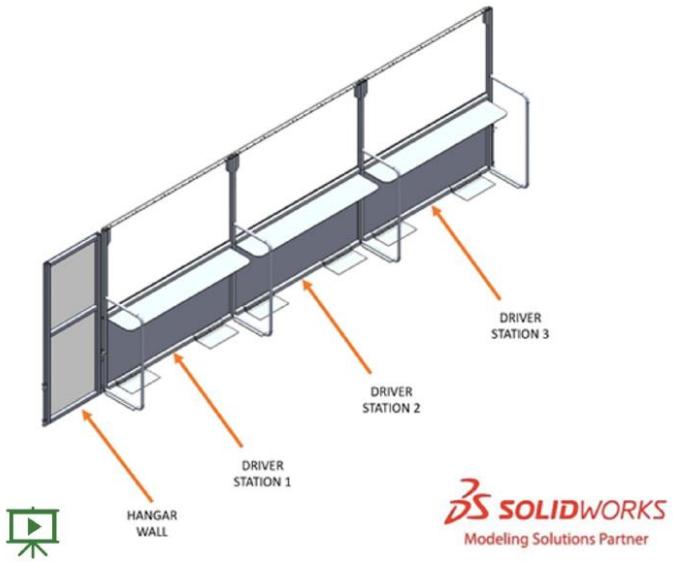
Field

Each TERMINAL is shared between alliances and consists of 1 ramp, 1 guard, 1 purple plane, and 1 chute.
Each TERMINAL has 5 cargo delivery openings through which robots may transfer cargo.



Field

An alliance wall consists of 3 driver stations and a hangar wall

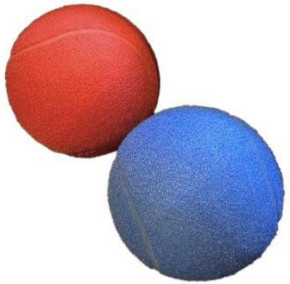


Field

A string of LED nodes in mounted to the bottom of each driver station window frame. The colors change during the match and will not be discussed here. The drive team needs to understand them when we get to competition.

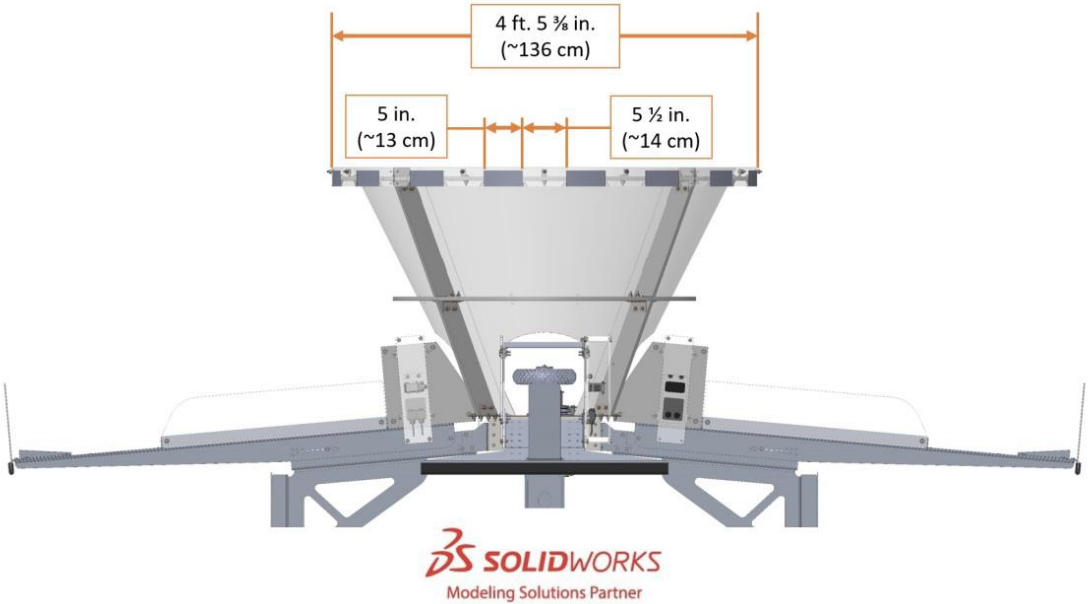
Field

RAPID REACT is played with oversized tennis balls called CARGO, custom modified for *FIRST* by Flaghouse. CARGO is 9½ in. in diameter, weighs 9½ oz., and has a fuzz surface. CARGO is inflated to 3½ psi. Typically, if a CARGO is dropped on FIELD carpet from a height of 3 ft., it bounces back to a height between 2 ft. 1 in. and 2 ft. 6 in. (as measured from the bottom of the ball). CARGO is available for purchase at AndyMark, part numbers am-4600_blue and am-4600_red. The oversized tennis balls used as CARGO are not manufactured with any tight tolerance. Wall thickness, surface pilling, and shedding may vary. An off-the-shelf ball may perform differently from the official CARGO.



Field

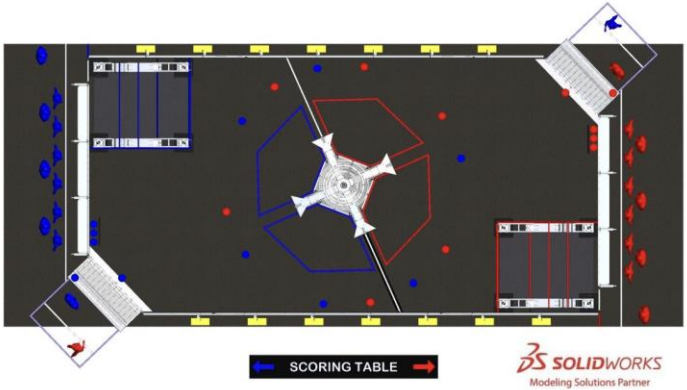
The upper hub is marked with a single 360 degree vision target consisting of 5 in. long strips of 2 in. wide reflective tape.



Match Play – Setup

22 CARGO, 11 red and 11 blue, are staged for each MATCH as follows:

- Each DRIVE TEAM may pre-load 1 of their CARGO in their ROBOT such that the CARGO is fully supported by their ROBOT. a. Any of the 3 CARGO not pre-loaded in the ALLIANCE'S ROBOTS are staged between the opponent's ALLIANCE WALL and the adjacent CARGO LINE.
- 1 ALLIANCE colored CARGO is staged in the TERMINAL closest to its ALLIANCE AREA.
- 1 ALLIANCE colored CARGO is centered in front of the TERMINAL closest to its ALLIANCE AREA
- 12 CARGO, 6 red and 6 blue, are staged on CARGO RINGS beyond the TARMACS as shown in Figure 6-2.



Match Play – Setup

Each drive team stages their robot such that its bumpers are fully contained within 1 of its tarmacs.

Humans stage for the match as follows:

A. Exactly 1 human player per alliance stages in each terminal area
    - The human player in the terminal area furthest from their alliance area stages behind the terminal starting line
B. Drivers, coaches, and any additional human players stage inside their alliance area and behind the staring line
C. Technicians stage in the event-designated area near the field

Match Play – Autonomous Period

Autonomous (auto) period is the first 15 seconds of the match.

During auto, robots operate without any drive team control and attempt to taxi from the tarmac, score cargo in the hub, and retrieve additional cargo.

Human players attempt to score their cargo in the hub.

Match Play – Teleoperated Period

The second phase of the match is called teleoperated period (teleop) and consists of the remaining 2 minutes and 15 seconds with drivers remotely operating the robots to retrieve and score their cargo in the hub and engage with their hangar.

Match Play – Scoring

Alliances are rewarded for accomplishing various actions including:

- Taxiing
- Scoring cargo in the hub,
- Engaging with their hangar, and winning or tying matches

Scores are assessed and updated throughout the match, except as follows:

A. assessment of CARGO scored in the HUB continues for up to 5 seconds after the ARENA timer displays 0 following AUTO.
B. assessment of CARGO scored in the HUB continues for up to 10 seconds after the ARENA timer displays 0 following TELEOP.
C. assessment of HANGAR points is made 5 seconds after the ARENA timer displays 0, or when all ROBOTS have come to rest following the conclusion of the MATCH, whichever happens first.

Match Play – Point Values

A cargo is scored in an upper or lower hub if it passes through the top horizontal opening and passes through the sensor array.

A robot may only earn points for a single rung. To qualify for hangar pints from a given rung, a robot may only be contacting:

- Rungs at that level or higher
- Truss structure,
- Launch pads,
- The alliance wall, guardrails, and/or
- Another robot qualified for any hangar points

Match Play – Point Values

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- The alliance wall, guardrails, and/or
- Another robot qualified for any hangar points

Match Play – Point Values

Award	Awarded for	Auto Points	Teleop Points	Ranking Points
Taxi	Bumpers have completely left the tarmac from which it started during auto	2		
Cargo	Alliance cargo scored in the lower hub	2	1	
	Alliance cargo scored in the upper hub	4	2	
Hangar (per robot)	Low rung		4	
	Mid rung		6	
	High rung		10	
	Traversal rung		15	
Cargo bonus	20 or more alliance cargo scored in the hub. If at least 5 scored in auto, then this threshold drops to 18			1
Hangar bonus	Alliance is credited with at least 16 hangar points			1
Tie				1
Win				2

Match Play – Point Values

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Taxi	Bumpers have completely left the tarmac from which it started during auto	2		
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	Traversal rung		15	
Cargo bonus	20 or more alliance cargo scored in the hub. If at least 5 scored in auto, then this threshold drops to 18			1
Hangar bonus	Alliance is credited with at least 16 hangar points			1
Tie				1
Win				2

Game Play – Rule Violations

Example Violation	Expanded Interpretation
FOUL	Upon violation, a FOUL is assessed against the violating ALLIANCE.
TECH FOUL and YELLOW CARD	Upon violation, a TECH FOUL is assessed against the violating ALLIANCE. After the MATCH, the Head REFEREE presents the violating team with a YELLOW CARD.
FOUL per additional CARGO. If egregious, YELLOW CARD	Upon violation, a number of FOULS are assessed against the violating ALLIANCE equal to the number of additional CARGO beyond the permitted quantity. Additionally, if the REFEREES determine that the action was egregious, the Head REFEREE presents the violating team with a YELLOW CARD after the MATCH.
TECH FOUL, plus an additional TECH FOUL for every 5 seconds in which the situation is not corrected	Upon violation, a TECH FOUL is assessed against the violating ALLIANCE and the REFEREE begins to count. Their count continues until the criteria to discontinue the count are met, and for each 5 seconds within that time, an additional TECH FOUL is assessed against the violating ALLIANCE. A ROBOT in violation of this type of rule for 15 seconds would receive a total of 4 TECH FOULS (assuming no other rules were simultaneously being violated).
RED CARD for the Alliance	After the match, the head referee presents the violating alliance with a red card: • In a playoff match, a single red card is assessed to the alliance • In all other scenarios, each team on the alliance is issued a red card

Game Play – Drive Team

Role	Description	Max/Drive Team	Criteria
Coach	A Guide or advisor	1	Student or adult mentor
Driver	An operator and controller of the robot	3	Student
Human Player	A cargo manager		
Technician	A resource for robot troubleshooting, setup, and removal from the field	1	Student or adult mentor

Game Rules - Robots

- Dangerous robots not allowed
- Robots must stay on the field
- Bumpers must be in the bumper zone
- Bumpers may not fail
- Robots may not intentionally detach or leave parts on the field
- Robot height, as measured when it's resting normally on the flat floor, may not exceed 4 ft. 4 in. unless any part of the robot's bumpers in in its hangar zone, in which case its height may not exceed 5 ft 6 in.
- Robots may not position itself such that any part of its bumpers is higher than the high rung
- Robots may never extend beyond the purple plane

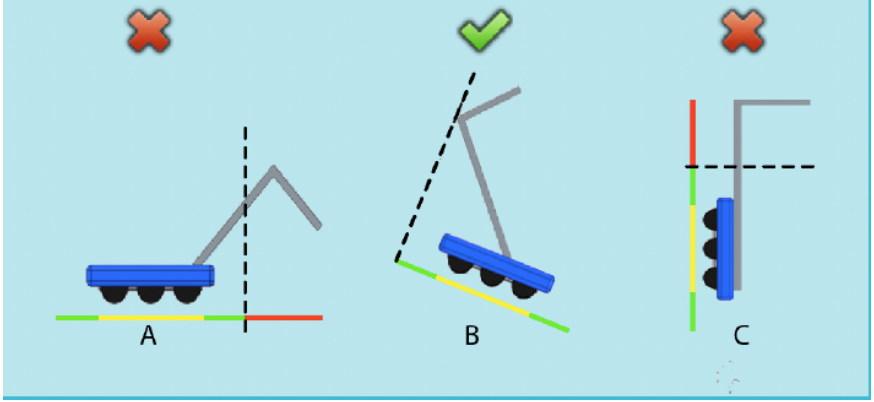
Game Rules - Robots

- Robots may not extend more than 16 in. beyond their frame perimeter

Examples of compliance and non-compliance of this rule are shown in Figure 7-2.

Yellow bars represent the limits of the FRAME PERIMETER and are drawn in the same orientation of the ROBOT'S FRAME PERIMETER. Green bars represent a measured extension from the FRAME PERIMETER that does not exceed the limit defined in this rule. Red bars represent a measured extension from the FRAME PERIMETER that exceeds the limit in this rule. ROBOTS A and C violate this rule, whereas ROBOT B does not.

Figure 7-2 Examples of compliance and non-compliance of this rule



Game Rules - Robots

- Strategies clearly aimed at forcing the opponent alliance to violate a rule is not in the spirit of FIRST
- Robots my not pin an opponent's robot for more than 5 seconds.
- Two or more robots that appear to a referee to be working together may not isolate or close off any major element of match play
- Robot may not use a component outside its frame perimeter to initiate contact with an opponent robot inside the vertical projection of that opponent robot's frame perimeter
- A robot may not damage or intentionally functionally impair an opponent robot

Game Rules - Robots

- A robot may not contact an opponent robot whose bumpers are contacting their launch pad
- A robot may not contact an opponent robot contacting their mid, high, and/or traversal rungs or an opponent robot whose bumpers are at least partially in their hanger zone during the final 30 seconds of the match
- A robot may not be fully support by a partner robot
- During auto, a robot with any part of its bumpers on the opposite side of the field may contact neither an opponent robot nor cargo still in its staged location on the opposite side of the field
- Robots may not reach into or straddle the lower exit.

Game Rules - Robots

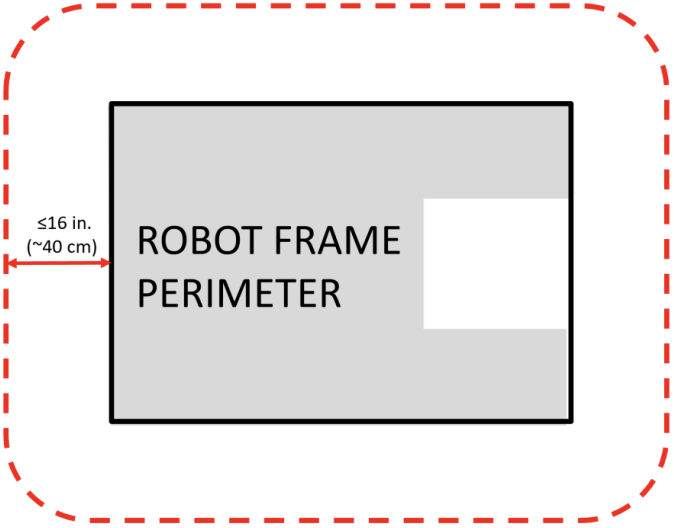
- Robots may not eject opponent cargo from the field other than through the terminal
- Robots may neither deliberately use cargo in an attempt to ease or amplify the challenge associated with the field elements
- A robot may not have greater than momentary control of more than 2 cargo at a time
- A robot may not restrict access to more than 3 opposing alliance cargo except during the final 30 second of the match
- A robot may not repeatedly gain greater than momentary control of cargo released by an upper exit until and unless that cargo contacts anything else beside that robot or cargo controlled by that robot

Robot Construction Rules

- There are many pages of rules around what is allowed in the construction of the robot and the engineering teams should look at them.
- A robot must have a fixed frame perimeter
- In the starting configuration, no part of the robot shall extend outside the vertical projection of the frame perimeter
- Robot weight must not exceed 125 lbs. (excludes bumpers, battery and its associated Anderson cable quick connect, tags used for location detection systems if provided by the event.

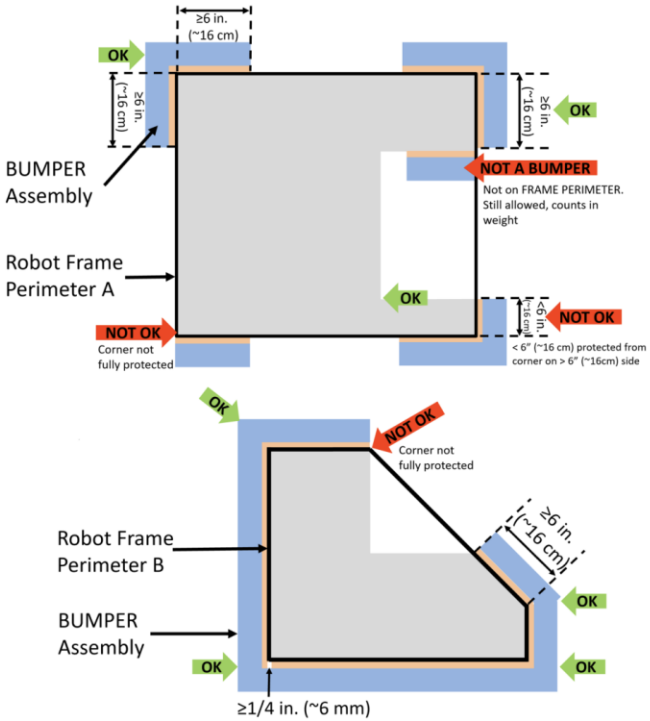
Robot Construction Rules

- A robot's starting configuration may not have a frame perimeter greater than 120 in. and may not be more than 4 ft. 4 in. tall.
- Robots may not extend more than 16 in. beyond their frame perimeter



Robot Construction Rules

- Bumpers should protect the corners (similar to past years)



Tournaments

- Michigan Districts have qualification matches to determine seeding
  - Three team alliances play and each alliance member gets the ranking points for that match for their alliance (unless red card or they did not show up)
  - Teams ranked by ranking points with tie breakers

Order Sort	Criteria
1st	Ranking Score
2nd	Average MATCH points, not including FOULS
3rd	Average ALLIANCE HANGAR points
4th	Average ALLIANCE TAXI + AUTO CARGO points
5th	Random sorting by the FMS

Tournaments

- Michigan Districts
  - Following qualification matches, alliances are selected
  - No more ranking points - first alliance to win two matches advances to next round

  - Much more will be explained when we get to our first tournament in March, 2022

Tournaments

- Michigan Championship
  - 200 teams will qualify for the Michigan State Championship
  - 61 Michigan Teams may qualify for the World Championship

Considerations

What is important to do?

- For ranking points
- For auto scoring
- For teleop scoring
- For making it into the Playoff round
- 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 a 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

What is needed to win in week one might not win in week six or State Championship

The better the robot and drive team, the more we play and the more the robot is used

What about defense in this year's game

Can the same mechanism do more than one function with some modifications

- Example, same device turns control panel can also sense color

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

Hopefully, by next Saturday we will:

- Complete problem definition (what do we want to do)
- Review various design concepts we want to consider for each problem
- Eliminate things we do not want to do
- Decide how we are breaking up the mechanical teams
- Get started on programming concepts
- Determine any prototypes or CAD models we need to make to determine direction
- Develop a materials list of items we need now
- Decide what field elements we will need for future uses
- Start fabrication of items (chassis frame for example)

Robotics Collaboration Meetings on Saturdays

	FRC Collaboration Meetings 2022 Season						
	Team Number	Team Name	School	Name	email	Event 1	Event 2
	201	FEDS	Rochester HS, Rochester Hills, MI	Shishir Gupta	skgupta44120@gmail.com	FIM District Rochester March 10-12, 2022	
	245	Adambots	Rochester Adams HS, Rochester Hills, MI	Rick Drummer John Bueltel John Savage	rickdrumrs@aol.com bueltel.john@gmail.com jrsavage11@gmail.com	FIM District Rochester March 10-12, 2022	FIRM District Belleville March 24-26, 2022
	2224	Renaissance RoboPhoenix	Renaissance HS, Detroit, MI	Dominic Lanni	domLanni55@gmail.com	FIM District Detroit March 3-5, 2022	FIM District Troy March 31 - April 2, 2022
	3096	Village Bulldogs	East English Village Prep High School, Detroti, MI	Keith Buford	keith.buford@gm.com	FIM District Detroit March 3-5, 2022	
	4735	DEROF	Torreon, Mexico	Miguel Garcia Alex Martinez	miangaro@hotmail.com abraham.martinez@tecmilenio.mx	Regional Lagunaz March 23-26, 2022	Green County Regional April 6-9, 2022
	5436	Cyber Cats	Stoney Creek HS, Rochester Hills, MI				
	6121	RoboVikes	Grayling HS, Grayling, MI	Rick McBride Janet McBride	rickmcbride7@gmail.com janetmcbride3@gmail.com	FIM District Petoskey March 3-5, 2022	FIRM District Traverse City April 7-9, 2022
	6832	STEAMex	Santa Catarina, Nuevo Leon, Mexico	Jesus Betancourt Abraham Martinez Fernando Castro	jafbetancourt@gmail.com abraham.martinez@steamex.org fernando.castro@udem.edu	Hueneme Port Regional March 3-6, 2022	Regional Monterrey March 9-12, 2022

Key Dates

Snow Days or COVID Days - Unknown

FIM District – Rochester

March 10-12, 2022

FIM District – Belleville

March 24-26, 2022

Other award dates in February

Reminders

Strategy helps inform design (know what we want to do and why before we design it)

Form follows function – our design form should be based on the functions we want/need to perform

Quality and robustness – Robot will need to withstand lots of impacts, and maybe some falls, for at least two tournaments and hopefully more

Our team does not have all the experience we used to have, so we need each other and lots of communications, especially from student leads.