



Challenge 2: Mr. Fix It Robot

Important: For World Robotics League®, the constitution and Manifesto which describes the acceptable behavior of help from Parents, Coaches and Mentors is present [here](#).

Challenge

Maximum robot run time: 2 minutes.

This challenge is geared towards you understanding that sometimes your robot needs to solve complex problems in a constrained space. You need some out of the box thinking and may need to solve a problem in multiple parts.

In this challenge, as the Chief Robot Engineer on Mars, you are in charge of creating, programming and maintaining all Robots. A huge dust storm is approaching your colony in the next 24 hours and you are so glad that the new shelter that was built by the building engineers is ready. With the new shelter and its amazing roof, you will not even feel the fierce winds of the storm as you think about Earth and play Minecraft on your phone.



Unfortunately, just as you are about to turn in for the night, the CEO of the colony comes running to your home and tells you that the engineers made a huge blunder and installed the roof of the shelter incorrectly. The incorrectly installed roof cannot be sealed and is likely going to be blown away in the storm. This poses a grave threat to the colony since they were supposed to gather under the shelter to weather through the storm. Although the CEO would love to make the engineers go out and fix the issue, the wind has already picked up a bit and it is not safe for humans to go out. Your latest Robot, Mach-X, Series III is however, very well suited to operate in slightly hostile environments and the CEO is pleading for you to save the day.

You grumble, but are ready to save the day anyways. `A new hero is born!



Figure 1 - A Martian dust storm with its incredible destructive power

Challenge Description

In this Challenge, you must pick the roof that is made of two separate panels and reinstall it such a manner so that the arrows will be pointing towards each other as shown. At the beginning of the challenge, the



roof will be placed as shown in Figure 2 and when your robot is done, the roof must look as in Figure 3. Please note that the roof panels are supported on two C-channels and not attached with hardware.

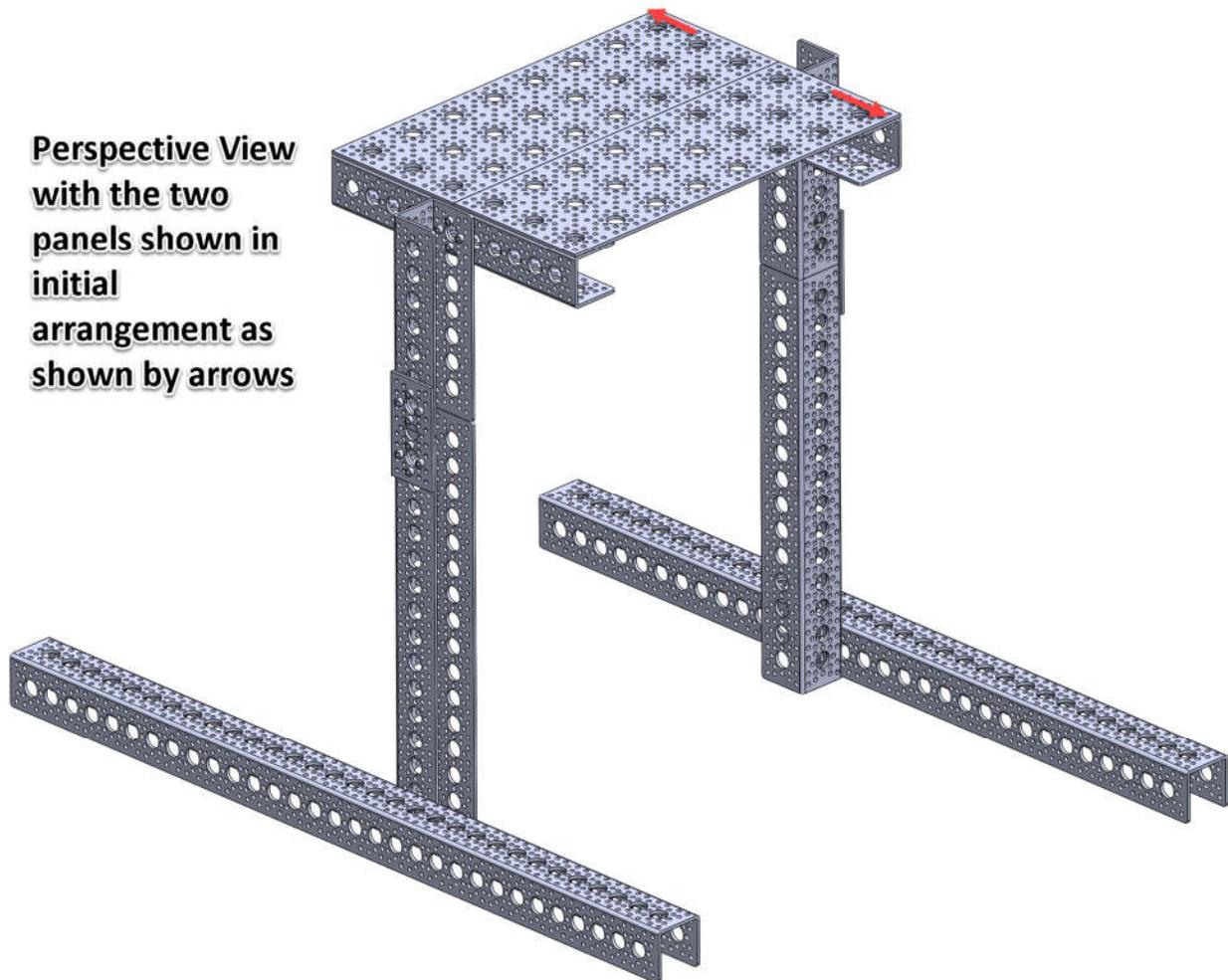


Figure 2 : The initial structure that was put wrong and need to be corrected by the autonomous robot. The arrows should have been pointing towards each other as shown in Figure 3, but unfortunately were installed incorrectly facing away from each other.



**Perspective View
with the two
panels shown in
final
arrangement as
shown by arrows**

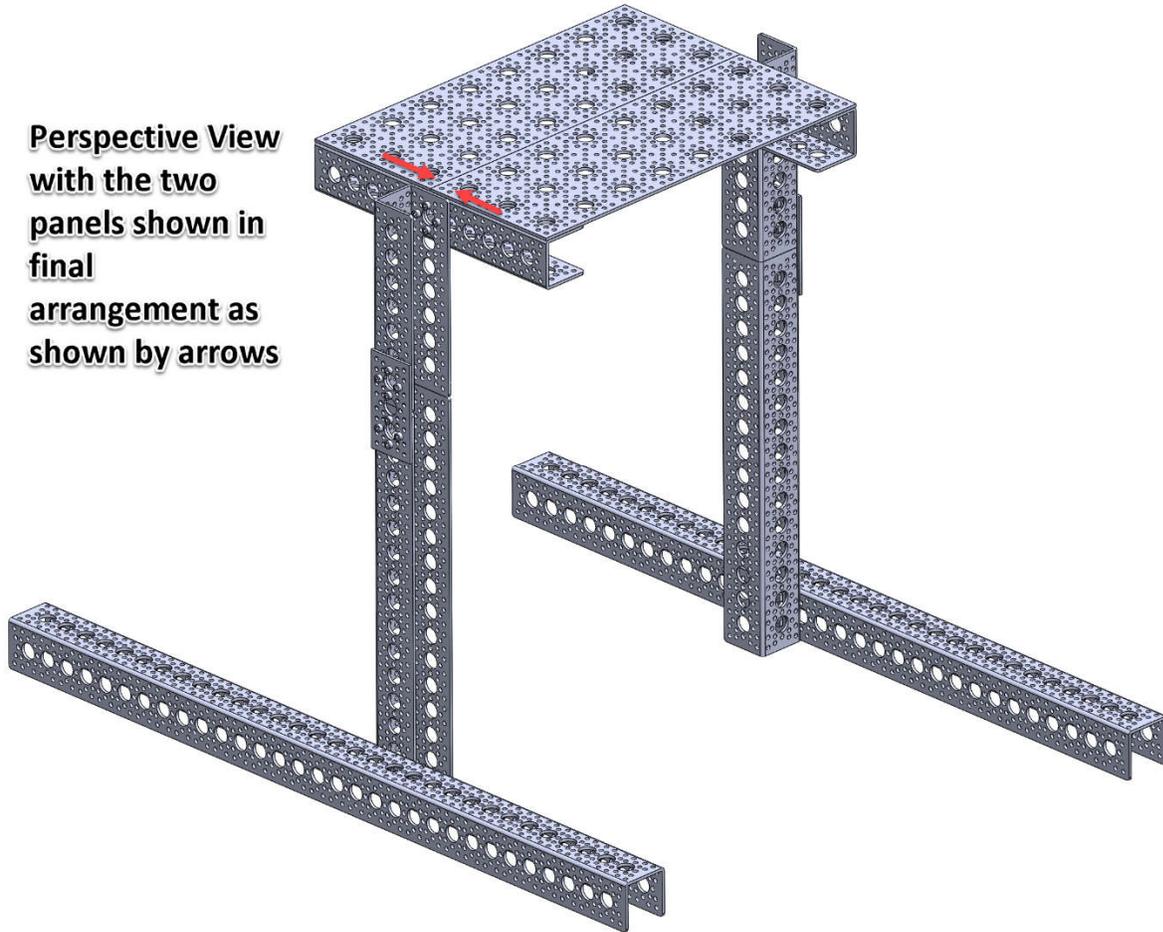


Figure 3 - The final position of the roof panels shown as correctly installed. Note that the arrows are pointing towards each other indicating that the roof is correctly installed.

In particular, your robot:

1. MUST start in the region marked *start and end* and then travel within the area described shelter area in Figure 4. There is a lot of equipment, rocks and other geographical constraints outside the box that make it impossible to work outside the box, so you MUST operate within this area.
2. MUST NOT drop any of the panels in an uncontrolled manner to get full points. The panels, when correctly combined are extremely strong. Unfortunately, when they are not connected to each other, they are fragile and may break.
3. The challenge may be attempted in Remote Control mode.
4. You MAY attempt to install only one panel at a time and may decide to come back to the start and end area for reconfiguration of the robot. You MUST NOT bring the panel back in the start and end area and they MUST remain within the confines of the shelter area at all points of time. If you DO come back to the start and end area for reconfiguration, you will not qualify for the mega bonus of 200 points.



Challenge Details

Refer to the detailed views to better understand the rest of the challenge.

- The challenge field is built using Servocity WRL field kit (<https://www.servocity.com/world-robotics-league-game-field-kit>). In case you do not have quick access to the Servocity parts, you may use other material such as extrusions, wooden posts, PVC pipe to create an equivalent structure per the dimensions provided in Figure 5 and Figure 6. The panels as described in Figure 5 are 4.5in X12 in.
- Note that the marking is done with red and green tapes that are .75 inch wide. You can use any tape within 0.5in to 1in wide). A standard electrical color tape or masking tape available in hardware stores or meets the required tape width

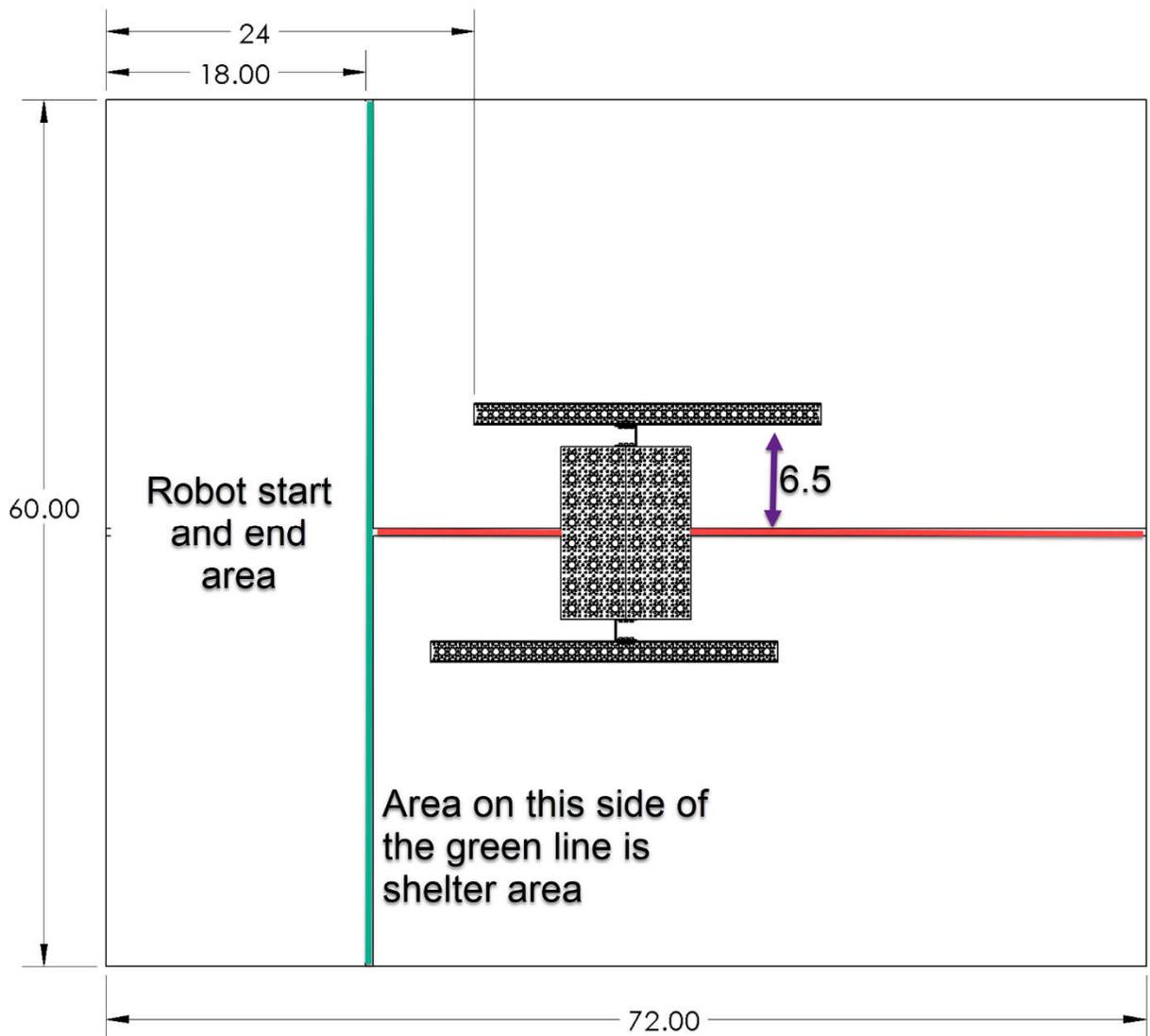


Figure 4- Drawing shown with the area that the robot must operate within. The robot **MUST** not ever go out of the total area encompassed by the Start and the End area plus the Shelter area. The red line runs through the middle of the shelter area, equal distances from the edges of the shelter area, including under the actual shelter.

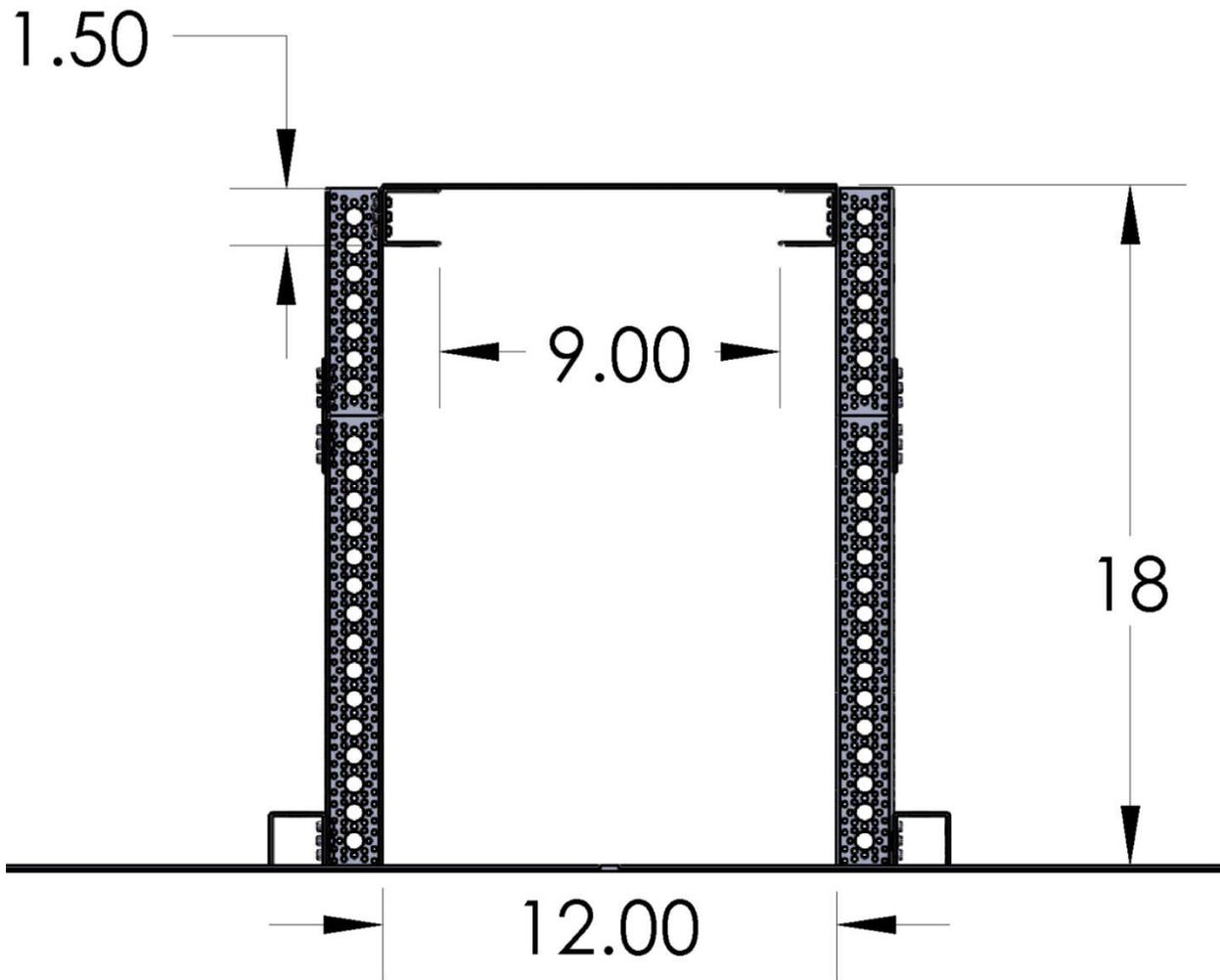


Figure 5 : Drawing showing the Front view of platform and panel height

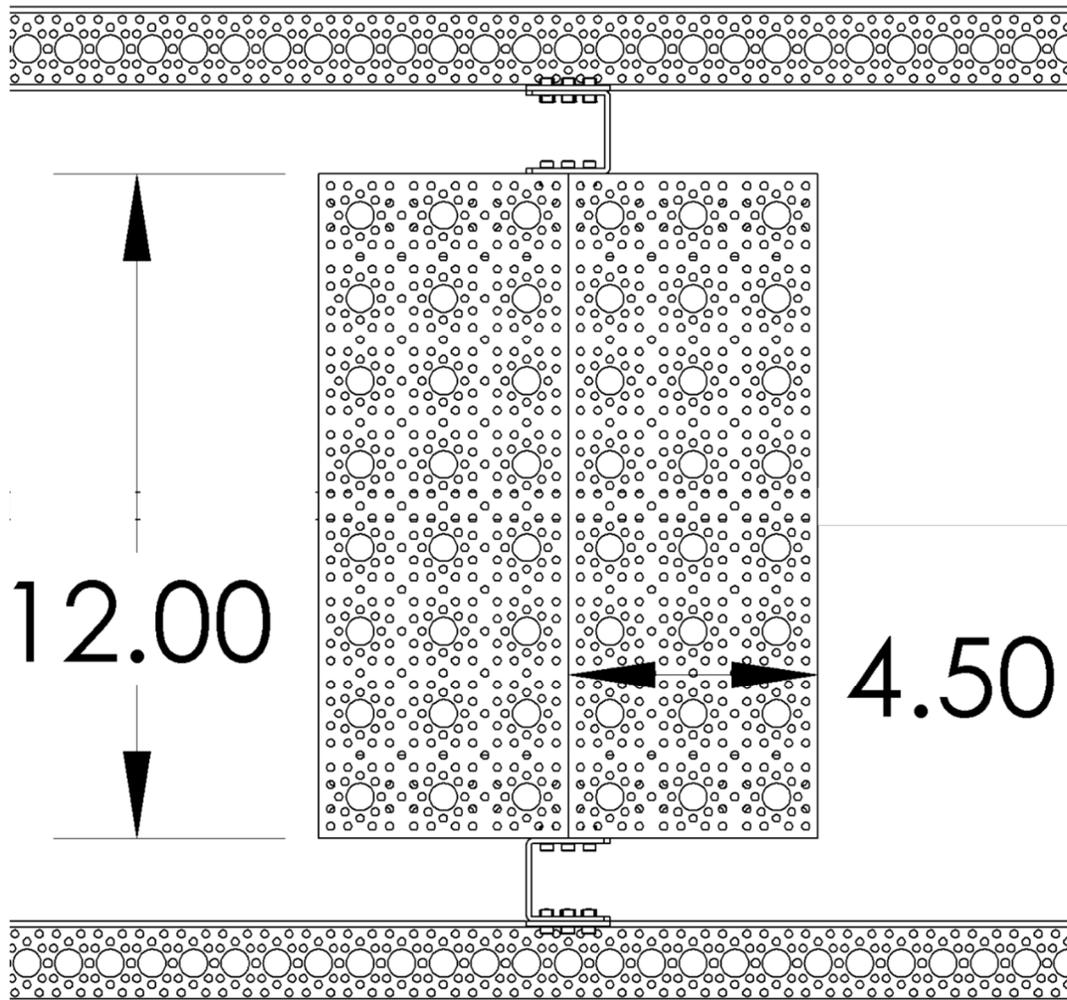


Figure 6 : Details of the Panel

We strongly recommend that you install free eDrawing and eAsm viewer provided by Dassult/solidworks, from following site:

http://www.solidworks.com/sw/support/edrawings/e2_downloadcheck.htm

eAsm files are provided along with the challenge. You can open the files to view the details of assembly.

Challenge Conditions and Rules

- All units (where applicable) are specified in Inches.
- For this challenge, if your robot misbehaves, you may pick up the robot and restart the robot. There is a 5 point penalty for picking up the robot.
- You may use up to 4 motors total on the mechanism of any kind. Both medium and large motors are allowed.
- You may use up to 4 sensors of any kind in this challenge.



Scoring

This challenge is suited for RoboNINJA™ Craftsman Silver skill level ONLY. For explanation of the levels, see the [Levels and Progression](#) page on the website.

RoboNINJA™ Silver Scoring Requirements

To understand the scoring, refer to the detailed design shown earlier.

- Exiting the *start and end area* and being able to touch at least one of the panels will give you 20 points.
- Being able to lift each of the panel will give you 50 points each even if you later end up dropping it.
- Being able to turn any of the panel so they are oriented correctly will give you 25 points per panel even if later you cannot install it correctly or if the panel falls down.
- Being able to correctly install any of the panels will give you 100 points. NOTE: If the panel is not completely seated but is still being able to hang onto the roof, even if in a flimsy way, you will qualify for 50 points only; for full credit, the panels MUST be completely seated correctly.
- If you manage to come back to the *start and end area* before the timer expires, you will get 20 bonus points one time.
- If your robot is able to install both the panels without any intervention from the robot operator without coming back to the *start and end area* for further modifications during the run, you will receive the “Star of Automation” Recognition and 200 mega-bonus points.
- There is a 5-point penalty if you have to abandon a run and pick up the robot in the middle of the run.

Special Note: Being able to place at least 1 of the panels in an autonomous fashion as described above will qualify you 1/6th of the way towards the RoboNINJA™ gold level.



Team Regulations

1. Teams must be at least 1 person and at most 4 people.
2. At most two of the team members may be at the table before starting the run; they will be designated as “Robot Drivers”.
3. Everyone else must stand back at least 12 inches from the table.
4. When multiple teams are competing at a common venue, each team will be given two opportunities and the Maximum of the two runs will be considered as the actual team score. For the submission by video, only one video per team is allowed.

Awards

- Highest score Award: 3 awards for the top three scores.
- Repeatability: The robot with most repeatable runs. We want to ensure that the skill of the kids is the largest part of the robot run. The robot that produces the highest scores in a consistent manner will get this award.
- Referees choice (flexible criteria): Referees will on the spot decide if some robot/program did something amazing/exceptional and hand these out.



- One team may win multiple awards.

Robot Run Rules

1. One team can use ONLY one robot during the entire challenge. They must finish with the exact same robot that they started with.
2. Size of the Robot shall not exceed 18in X 18in X 18 in. The robot starting edge is marked using color tape as described in Figure 4. If the team is submitting the challenge via video, the team shall include measurement from the top view of the robot in their videos using a ruler or other measuring device before the start of the challenge to confirm that no part of robot exceeds the specified boundary.
3. The clock for the run time for the robot will start as soon as the robot makes the first movement. The clock, once started, will not stop when the robot is modified or reoriented in the robot base.
4. Your robot MAY use multiple attachments to complete the task. However, your robot MUST come back to the base before you may modify the robot attachment or repair the robot. Handling the robot manually by the drivers and re-launching the robot is allowed under the challenge rules provided the challenge timer has not run out.
5. One team can use ONLY one robot during the entire challenge. They must finish with the exact same robot that they started with.
6. If you are submitting video entry:
 - a. Your video must describe the team name/number, Season (WRL Bronze 2020), Challenge Number on a A4 size paper.
 - b. At the start of the video, you must show a top view to ensure that the robot is within the specified size and no part of the robot is extending beyond the starting edge. Additionally, the height of the Robot shall be confirmed by placing a ruler next to the Robot. It is participants responsibility to submit the evidences for Robot size in a manner that ascertains robot size beyond doubt. Should there be any doubt, referee's decision will be final.
 - c. The video must be one continuous unedited video through the Robot run duration.
 - d. The angle of video recording must ensure beyond doubt that robot does not interfere with the walls. Should there be any doubt, referee's decision will be final.
7. If a robot or mechanism created by the participating team starts destroying any fragile mechanisms, the referees will ask the team to immediately stop the robot. The team may reattempt the challenge if the rules allow and if they are still within the allotted time.
8. The robot runs can be attempted indefinite number of times within the allotted time frame. The referee will stop the run if the robot is not finished by the end of the allotted time.
9. There will be two referees present during the judging on either sides of the field, and their combined decision will be final.
10. There will be 2 rounds for each team. Each team will get 1 run in each round. There will be at least 5-minute break between rounds for teams to tweak their programs or robots.
11. Adult help should be limited to non-competitive elements. Adults may help with video recording and time keeping, laying out team details on A4 page as specified in previous sections. We want teams to do the work themselves demonstrably.
12. Referees and Judges may ask the participants to explain their design before the run to ensure that they have done original work by themselves. Each member of the team must be able to answer questions about the design. If a team member cannot answer questions satisfactorily, that team will not be eligible for any awards no matter their score.



13. Should there be any doubt, referee's decision will be final.