

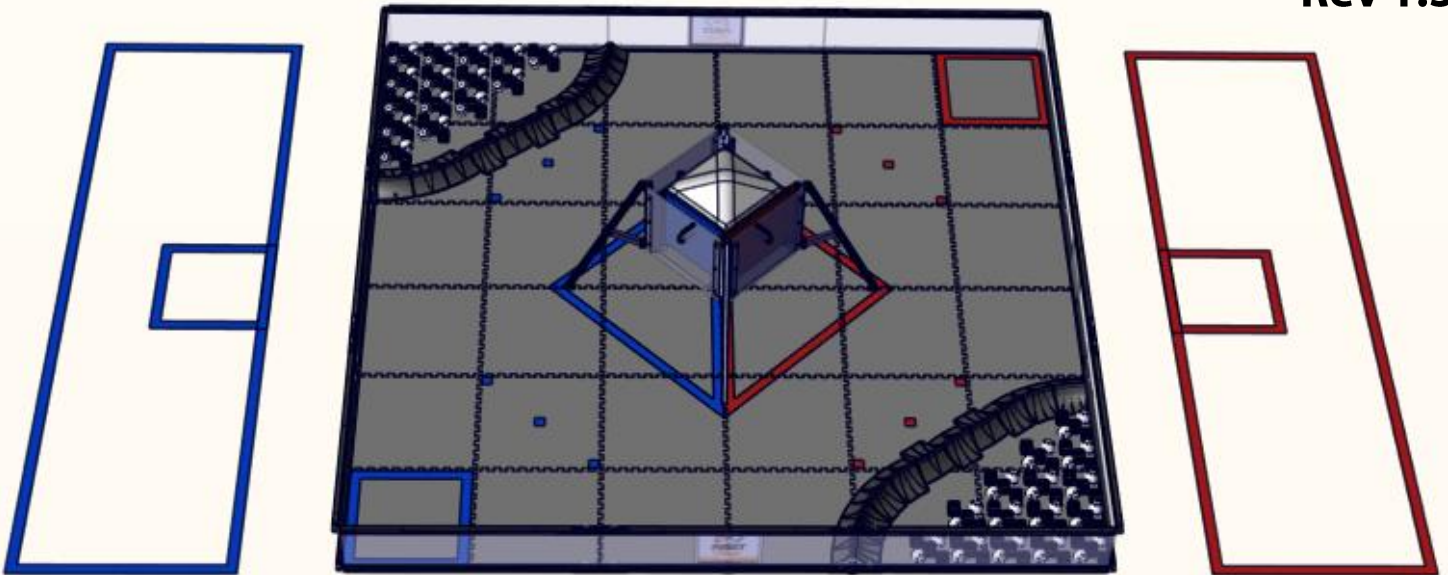
# ROVER RUCKUS



Presented By **Qualcomm**

## 2018-2019 *FIRST*<sup>®</sup> Tech Challenge Field Assembly Guide

Rev 1.3



**AndyMark<sup>®</sup> Field Components for 2018-2019 *FIRST*<sup>®</sup> Tech Challenge**

***Read through all the instructions and take inventory before you begin to assemble the game elements!***

## REVISION HISTORY

Rev.	Date	Description
1.0	8/24/2018	Initial Public Release
1.1	9/6/2018	Added Sticker Placement info, Minor Text Changes
1.2	9/13/2018	Added note about stuck game pieces.
1.3	9/28/2018	Corrected images of Lander in step 1-29
















### **CAUTION!**

**Edges of field parts may be sharp. File or deburr sharp corners or edges as needed.**



**ASSEMBLY VIDEOS CAN BE FOUND ON OUR WEBSITE:**

**[AndyMark.com/FTC](http://AndyMark.com/FTC)**

## TOOLS NEEDED



Component	QTY	Part Photo
Safety Equipment		
Ratchet (Optional)	1	
Drill (Optional)	1	
3/8" Nut Driver or Socket	1	
Zip Tie Cutters	1	
5/16" Wrench	1	
3/8" Combination Wrench	1	
7/16" Combination Wrench	1	
1/2" Wrench		
File	1	
Utility Knife	1	
25' Tape Measure	1	
Rubber Mallet	1	

## ADDITIONAL REQUIRED ITEMS

2" RED Gaffers Tape	1	
2" BLUE Gaffers Tape	1	



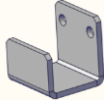
Tools and tape can be purchased as a set from AndyMark

## GAME PIECES and ELEMENTS

Component	Part #	QTY	Part Photo
Gold Scoring Element	ftc-2013	90	
Silver Scoring Element	am-2850	60	

See Field Setup Guide for placement information.

# CRATER





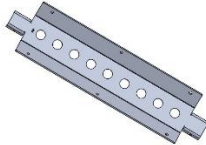
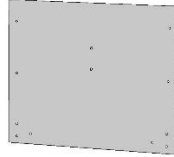
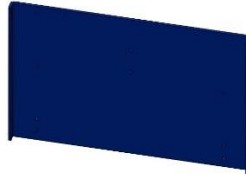
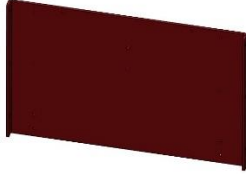

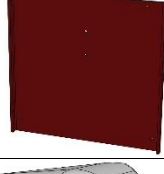
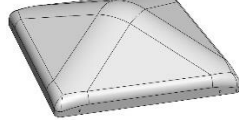



Component	Part #	QTY	Part Photo
Crater Segment	am-3862	20	
<b>Hardware Pack</b>			
11" Cable Tie (extras included, additional will be needed for future setups)	am-1067	22	
Lower Clip	am-3875	4	


















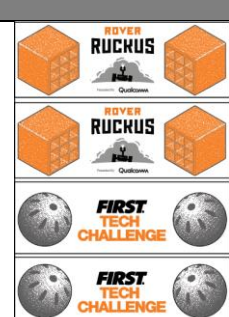
# ADDITIONAL ITEMS – NOT INCLUDED

Component	Part #	QTY	Part Photo
Cardstock for Navigation Target  (Printed from <a href="#">FIRST Resource Library</a> )		8	
Command Mini Hooks P/N: 17006-VP  For use with AndyMark, IFI and Logo Loc Perimeters	P/N: 17006-VP	8	
Velcro® Dots  For use with early generation AndyMark Perimeters	Roughly $\frac{3}{4}$ " diameter or larger	1 pack	
Clear Page Protection Sleeves	Similar to Staples P/N 40713	4	

See Field Setup Guide for placement information.



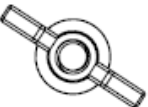
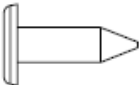
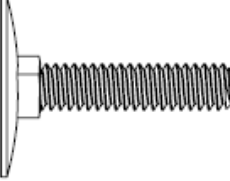
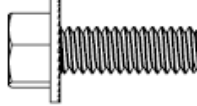



# LANDER

Component	Part #	QTY	Part Photo
Leg	am-3872a	4	
Foot Cap Bracket	am-3874	4	
Under Tile Disk	am-3881	4	
Leg Strut	am-3879	8	
Corner Bracket	am-3885	4	
Side Panel - Unified	am-3884	4	
Internal Long Wall - BLUE	am-3887_Blue	1	
Internal Long Wall - RED	am-3887_Red	1	
Internal Short Wall - BLUE	am-3888_Blue	1	
Internal Short Wall - RED	am-3888_Red	1	
Top Dome	am-3878	1	
Ball Floor	am-3882	2	
Cube Floor	am-3883	2	
3in Churro	am-3873	12	

Release Pin	am-1489	4	
32" Large Cable Tie (175lb Tensile Strength)	am-1497	4	
<b>Hardware Pack 1</b>			
Elevator Bolt	am-1482	4	
1/4-20 Hex Nut	am-1487	4	
Lower Strut Spacer	am-3876	4	
1/4-20 x 0.75" Self Tapping Screws	am-1310	8	
10-32 x 1.75" Hex Screw	am-1491	12	
10-32 Wing Nut	am-1483	12	
<b>Hardware Pack 2 – Lander Body Hardware</b>			
1/4-20 x 0.75" Self Tapping Screws	am-1310	24	
10-32 x 0.75" Hex Screw	am-1157	28	
10-32 Nylock Jam nut	am-1063	28	
3/16" Push In Rivet	am-1488	8	
Lander Support Bracket	am-3886	8	
<b>Hardware Pack 3</b>			
Hinge Bracket	am-3880	8	
3/16" Push In Rivet	am-1488	16	
10-32 x 4.000 Hex Head Cap Screw	am-1484	4	
10-32 Nylock Jam nut	am-1063	4	
Field Sticker Sheet (Packaged with AndyMark Flyer)			

# Hardware Sizing Chart

Print at 100% scale to use as a sizing chart.

1/4-20 Nut	am-1487	
10-32 Nylock Jam nut	am-1063	
10-32 Wing Nut	am-1483	
3/16" Push In Rivet	am-1488	
Elevator Bolt	am-1482	
1/4-20 x 0.75" Self Tapping Screws	am-1310	
10-32 x 0.75" Hex Screw	am-1157	
10-32 x 1.75" Hex Screw	am-1491	
10-32 x 4.000 Hex Head Cap Screw	am-1484	

## Churro Tapping Preparation

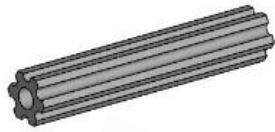


**NOTE: Complete this section first to prepare parts for the Lander**

The Lander includes parts called “Churro” standoffs. The Churro is a profile with a through hole in the center. The Churro is designed to be held with a 1/2” wrench. The center hole is designed to fit 1/4-20” Self Threading Screws.

The Churros included in the kit do not have center hole threads. These threads will be cut into the center hole with the Self Threading Screws as shown below. More information can be found in the “Churro Tapping Video” available on [AndyMark.com/FTC](http://AndyMark.com/FTC).

### **Parts Required:**



12 - 3in Churro,



24 – 1/4-20 Self Tapping Screws

### **Method 1: Drill and Bench Vise**

**Tools required:** Drill, 3/8” driver, bench vise.

Add a 3/8” driver to a drill on a high-torque, low speed setting. Hold the Churro with a vise. Align the screw to be as straight as possible and drive the screw into the hole.

Some pressure will need to be applied to the drill as the screw will be cutting away metal to form threads. Thread the screw all the way into the Churro. Repeat for both ends of the Churro and then remove the screws to use later in the Lander assembly.





## **Churro Tapping Preparation cont.**

### **Method 2: Ratchet and Bench Vise**

**Tools required:** Ratchet, 3/8" driver, bench vise.

Add a 3/8" driver to a ratchet. Hold the Churro with a vise. Align the screw to be as straight as possible and drive the screw into the hole using the ratchet and driver.

Pressure will need to be applied as the screw will be cutting away metal to form threads. Thread the screw all the way into the Churro. Repeat for both ends of the Churro and then remove the screws to use later in the assembly.



### **Method 3: Ratchet and Wrench**

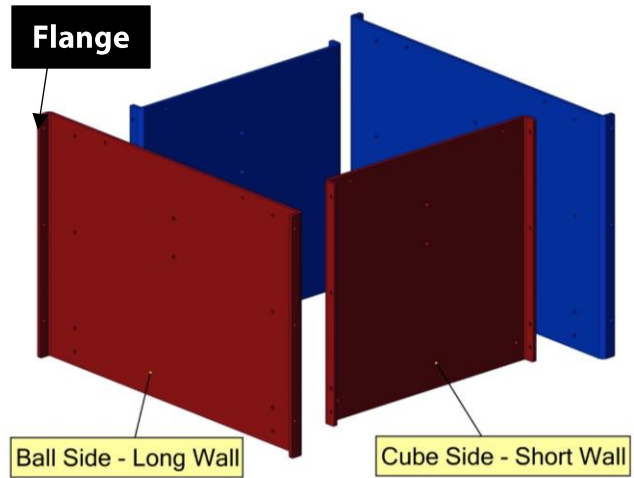
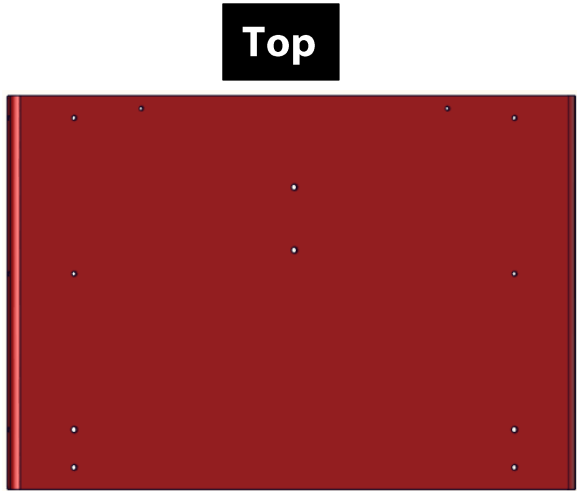
**Tools required:** Ratchet, 3/8" driver, 1/2" open ended or combination wrench.

Hold the Churro with the open ended wrench in one hand. Hold the ratchet with screw in the other hand. Align the screw so that is as straight as possible and drive the screw into the hole. Coordination is needed to hold the parts straight and pressure will need to be applied as the screw will be cutting away metal to form threads. Thread the screw all the way into the Churro. Repeat for both ends of the Churro and then remove the screws to use later in the assembly.



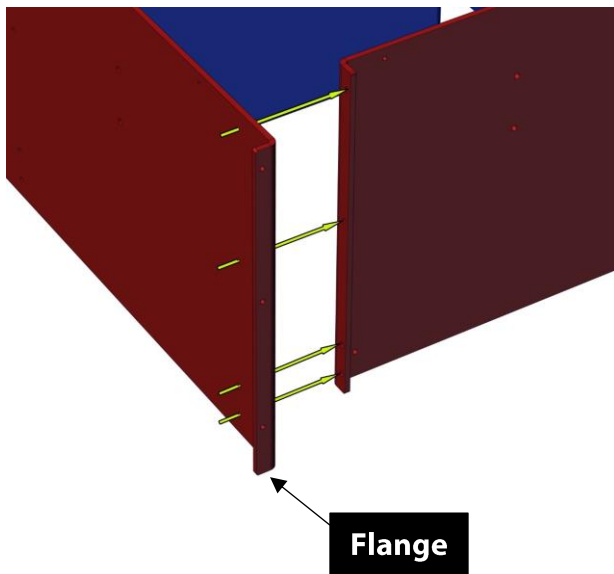
# Lander Assembly Instructions

**Step 1-1:** Locate the 4 wall panels needed to form the inner Lander frame and arrange in the pattern shown below. Note the top and bottom of the panel are different. The long panel forms the "ball" side cargo hold. The short panel forms the "cube" side cargo hold. Make sure to put the panels in the correct order.



**NOTE:** The Lander can be built the wrong way. Make sure the panels are in the correct location prior to moving to the next step. The long panel should always be to the left of the short panel of the same color.

**Step 1-2:** Ensure the bolt holes line up on all four panels. The flanges on all the panels should face outwards.

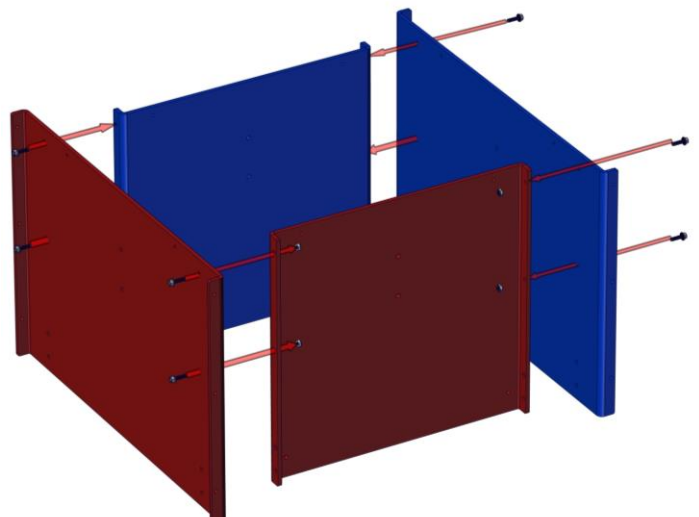


**Step 1-3:** Tools Needed: 3/8" Wrench; 5/16" Wrench

Hardware Needed: 8 - 10-32 x 0.75" Hex Screw; 8- 10-32 Nylock Nut

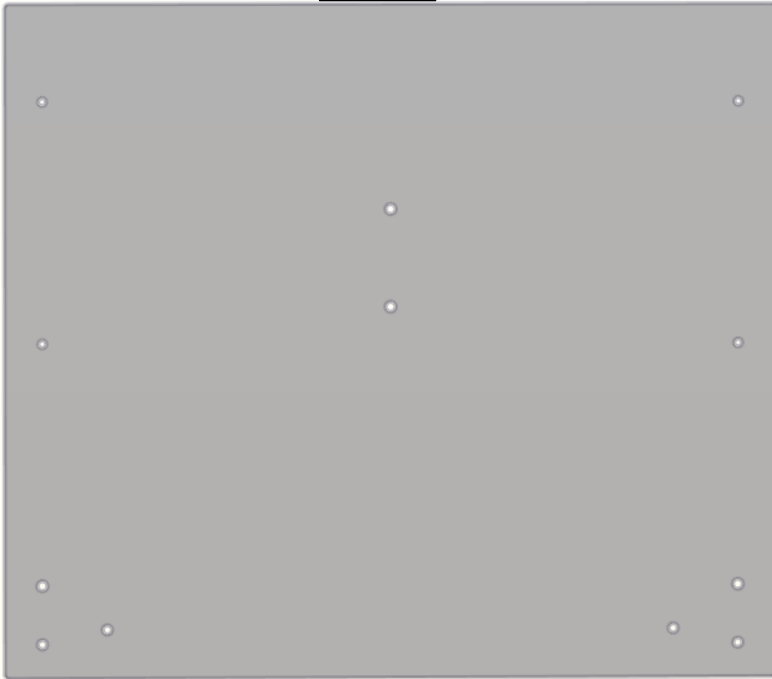


Bolt the 4 panels together using 10-32 x 0.75" Hex Screw and nuts through the upper two holes as shown ensuring that the two long panels are opposite each other. The nut should be on the inside of the assembly. 8 screw and nut pairs total will be used to attach all 4 panels. BE CAREFUL NOT TO OVERTIGHTEN! There should be no gaps between the panels, but the screw and nut should not press into the panel. Overtightening can permanently dent and damage the panels.



**Step 1-4:** Locate the polycarbonate Side Panels and remove the protective plastic from both sides. With the plastic removed, this panel is transparent. Take note that the two center holes are closer to the top of the panel.

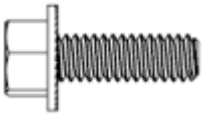
**Top**



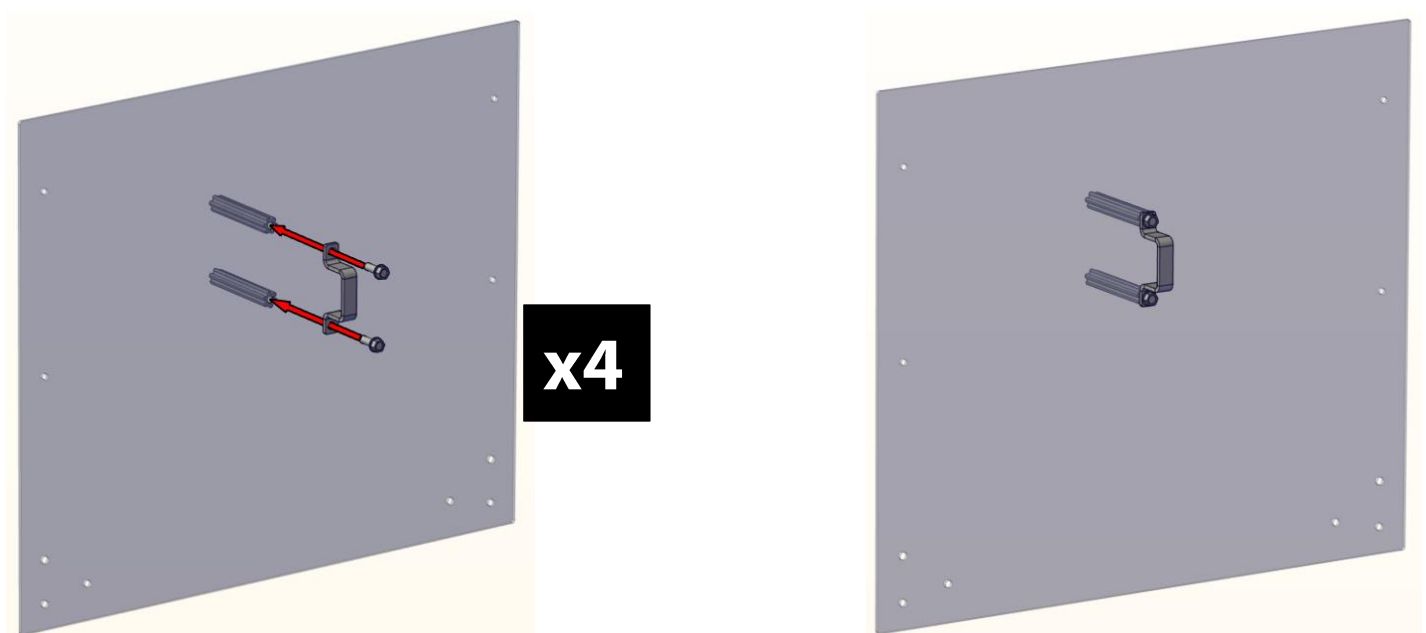
**NOTE:** The next steps use 3in Churros. Reference the "Churro Tapping Preparation" section in this assembly guide and the "Churro Tapping" video on [AndyMark.com/FTC](http://AndyMark.com/FTC) to prepare the churro pieces for the next steps.

**Step 1-5:** Tools Needed: 1/2" Wrench; 3/8" Driver

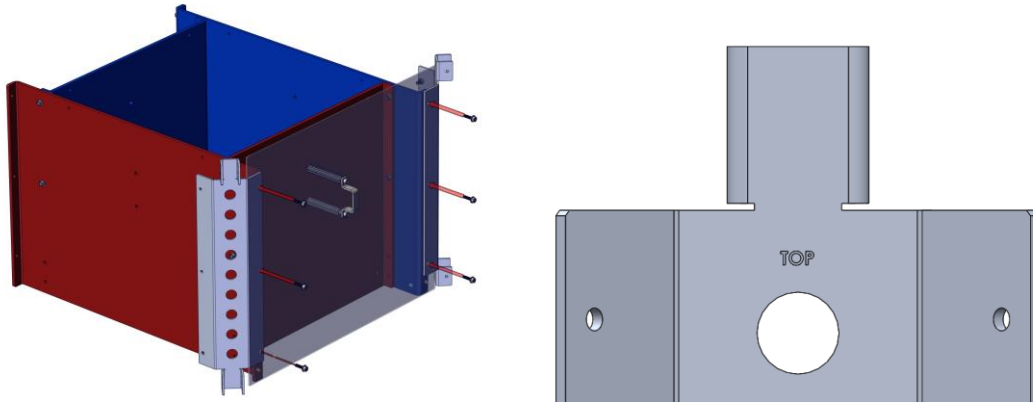
Hardware Needed: 8 - 1/4-20 x 0.75" Self Tapping Screws



Attach a Lander Support Bracket to the polycarbonate Side Panel as shown using 2 - 1/4-20 x 0.75" Self Tapping Screws. A 3" Churro will act as a nut on the back side. A 1/2" wrench can be used to hold the Churro. The screw should be tightened so there is no gap between the parts. Repeat for all 4 Side Panels.



**Step 1-6:** Align the polycarbonate Side Panels and 2 Corner Brackets on the flanges of the long walls. The Side Panels should sit between the flange and the Corner Bracket. The Corner Brackets are labeled with the word "TOP" to indicate which side should face up. The Lander Support Bracket should sit towards the top of the assembly.

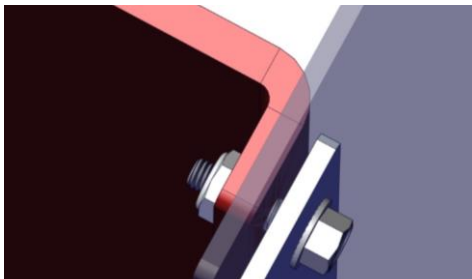


**Step 1-7:** Tools Needed: 3/8" Wrench; 5/16" Wrench

Hardware Needed: 12 - 10-32 x 0.75" Hex Screw; 12- 10-32 Nylock Nut

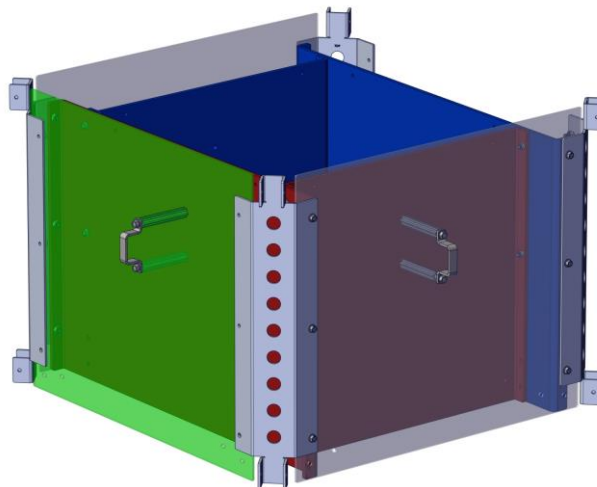


Use 10-32 x 0.75" Hex Screw and nuts to attach the panel and corners. 3 screw and nut pairs will be used on each side of the bracket. The screws should go through all materials including the colored panels. The nuts should sit inside of the assembly. Repeat on opposite side of the Lander.



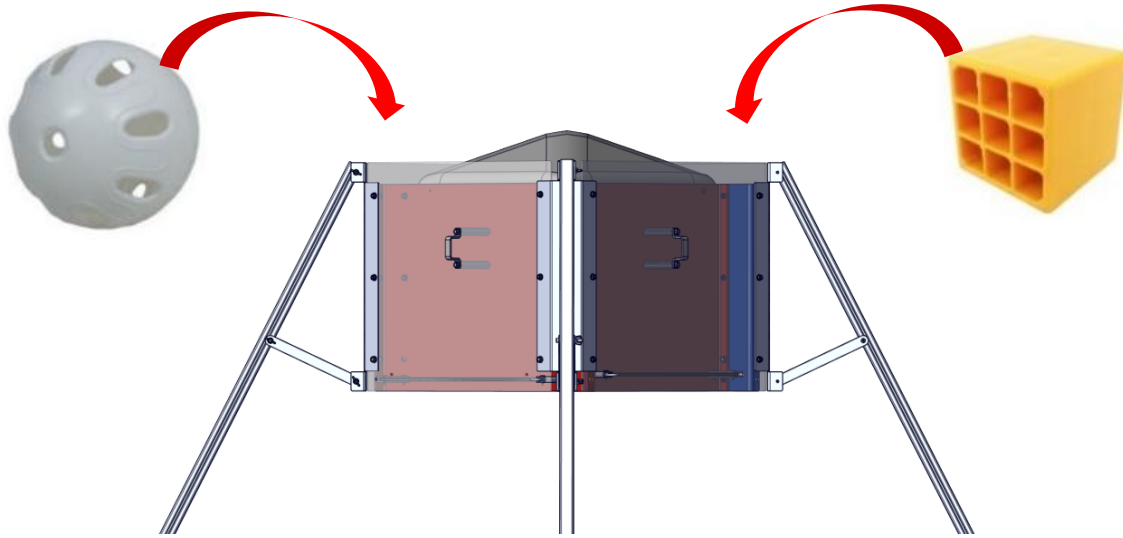
**NOTE:** Be cautious with tightening these bolts, as over tightening them can cause the goal opening to be too small. Check the size with a Silver Mineral (ball) and ensure that these can still drop through. The opening should be between 2.875 and 3 inches.

**Step 1-8:** Align remaining polycarbonate Side Panels with the open edge of the corner brackets. The panels should sit on the inside of the brackets.

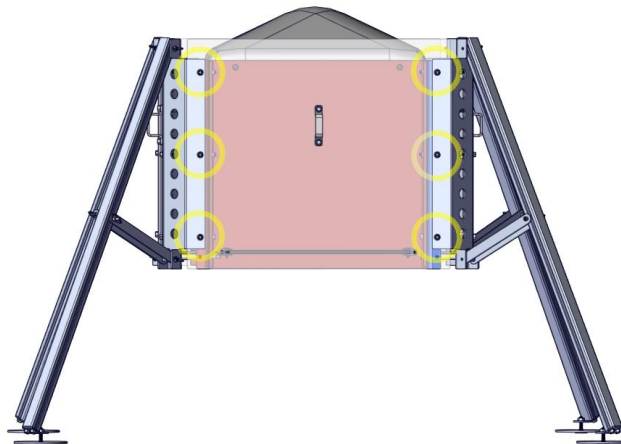


**Stop and Check:** For gameplay, ensure there is enough clearance for the game pieces. The Silver Scoring Mineral should easily slide between the Front Panels and the Internal Long Walls. All Cargo Holds should have an opening between 2.875 and 3 inches

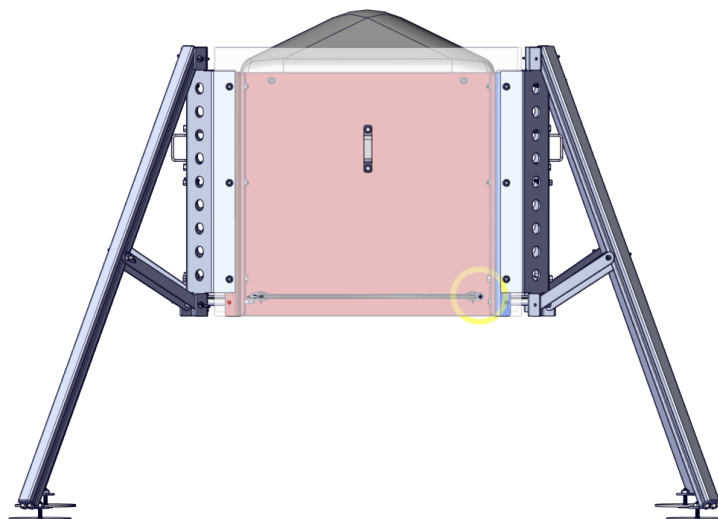
The Gold Scoring Mineral should easily slide between the Front Panels and the Internal Short Walls.



If the Minerals get stuck between the panels when they are dropped or placed in the lander, the bolts holding the panels together may be too tight. Loosen the bolts a quarter turn until the Minerals fall freely to the bottom of the lander.



Additionally, the screw and nut holding the Ball and Cube floor panels may need to be loosened as well.

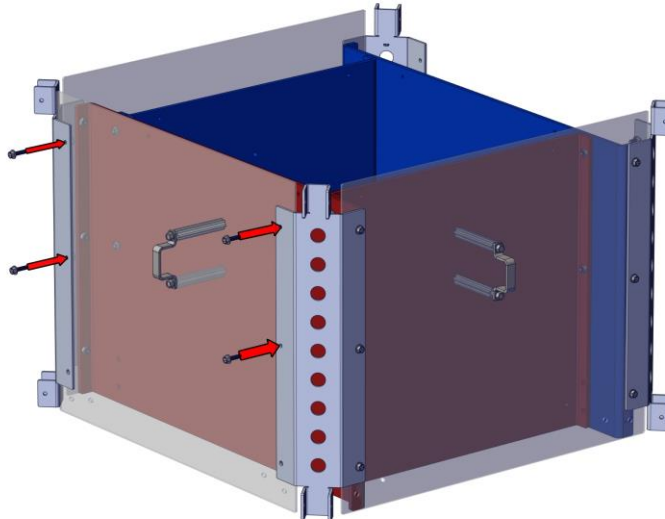


**Step 1-9:** Tools Needed: 3/8" Wrench; 5/16" Wrench

Hardware Needed: 8 - 10-32 x 0.75" Hex Screw; 8- 10-32 Nylock Nut

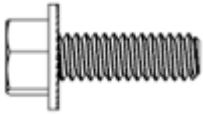


On the top two sets of holes use 10-32 x 0.75" Hex Screw and nuts to attach the Side Panel and Corner Brackets. Repeat on other side of the Lander. 8 total screw and nut pairs will be used overall.

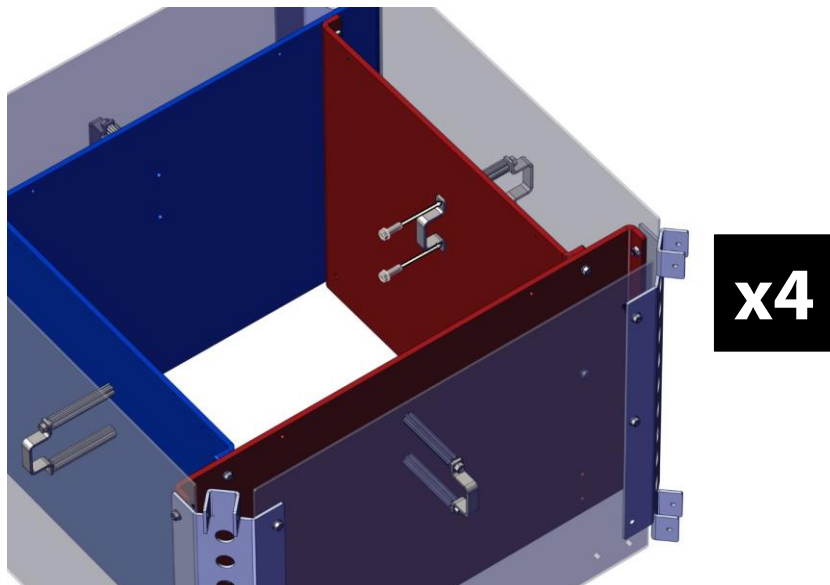


**Step 1-10:** Tools Needed: 1/2" Wrench; 3/8" Driver

Hardware Needed: 8 - 1/4-20 x 0.75" Self Tapping Screws

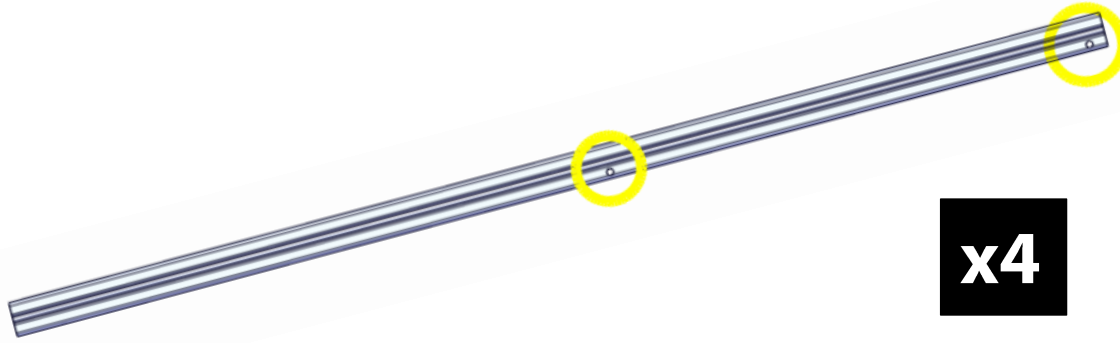


Inside the Lander, add 2 1/4-20 x 0.75" Self Tapping Screws through another Lander Support Bracket, Internal Wall and into the ends of the Churro. Use a 1/2" wrench to hold the Churro as you thread the screw into place. Repeat on all four Lander sides.



**NOTE:** For ease of accessibility, it may be easier to install the screw into the bottom Churro first.

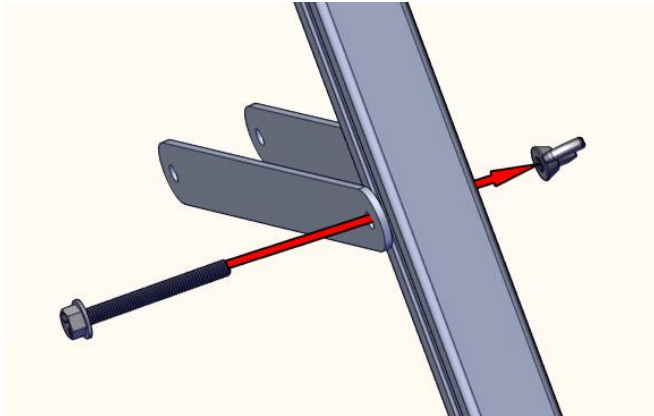
**Step 1-11:** Locate the 4 Lander Legs. There are two holes in the Lander Leg these holes face towards the top and the inside of the Lander.



**Step 1-12:** Hardware Needed: 4 - 10-32 x 1.750 Hex Screw; 4 - 10-32 Wing Nuts

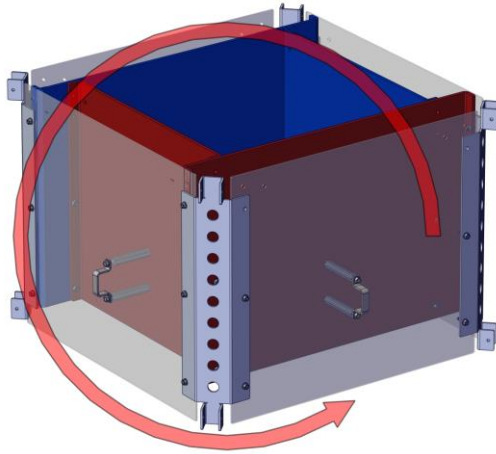


Attach a leg strut to either side of the leg as shown through the center hole using 10-32 x 1.750 Hex Screw and wing nuts. The leg struts face towards the side of the leg with the holes in it. Repeat for each of the four legs.



**x4**

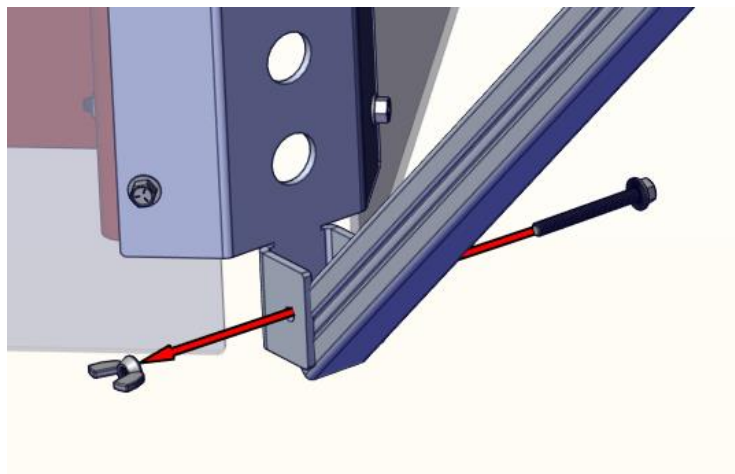
**Step 1-13:** Turn the Lander frame assembly upside down.



**Step 1-14:** Hardware Needed: 4 - 10-32 x 1.750 Hex Screw; 4 - 10-32 Wing Nuts

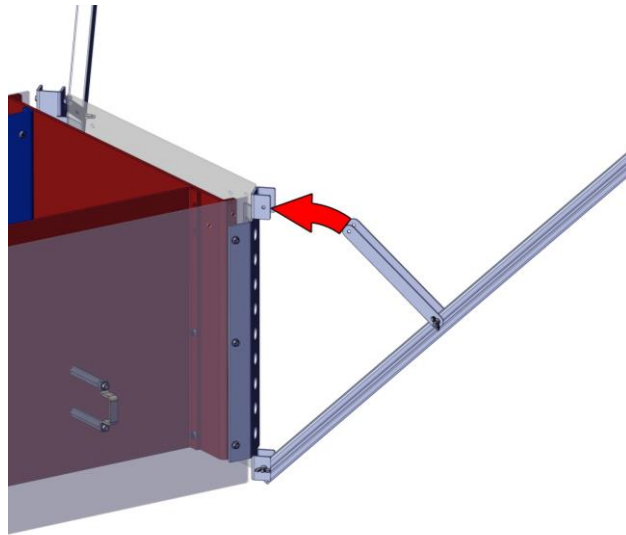


Attach the top of the Leg to the Corner Bracket near the mount labeled "TOP" using a 10-32 x 1.750" Hex Screw and Wingnut.

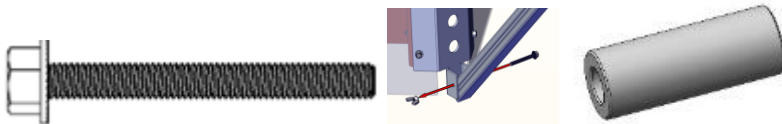




**Step 1-15:** Rotate the Leg up until the Leg Struts align with the Open Mount on the bottom of the Corner Bracket. The Leg Struts may need to be squeezed in order to fit within the two tabs of the Corner Bracket.



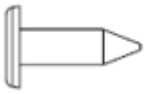
**Step 1-16:** Hardware Needed: 4 - 10-32 x 1.750 Hex Screw; 4 - 10-32 Wing Nuts, 4- Lower Strut Spacer



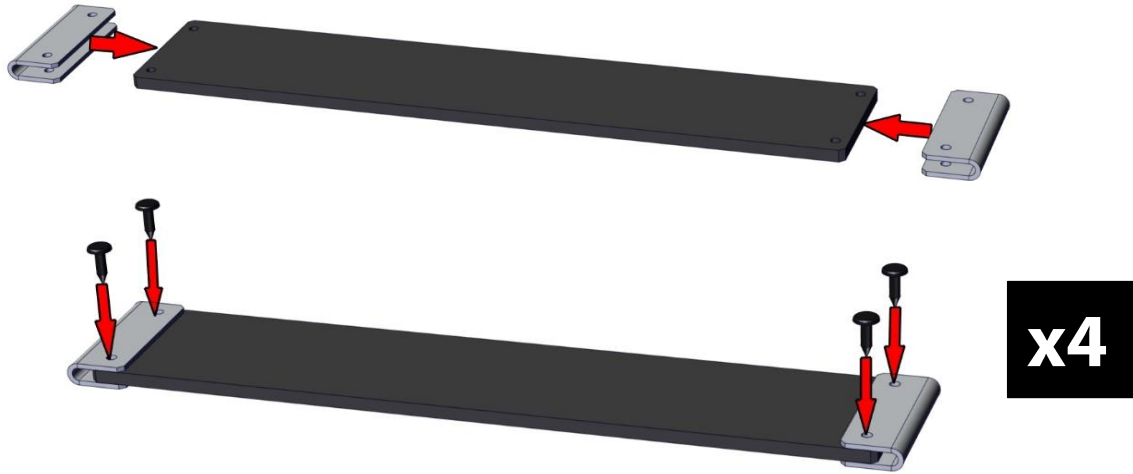
Attach the Leg Strut, Lower Strut Spacer, and Corner Bracket together with a 10-32 x 1.750" Hex Screw and 10-32 Wingnut. The spacer should sit in between the two Leg Struts and the screw will pass through it.



**Step 1-17:** Hardware Needed: 16 - 3/16" Push In Rivet

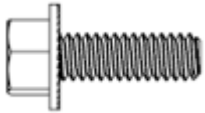


Attach hinge brackets to each end of both the long ramp and the short ramp using push-in rivets. There are 4 ramps total.

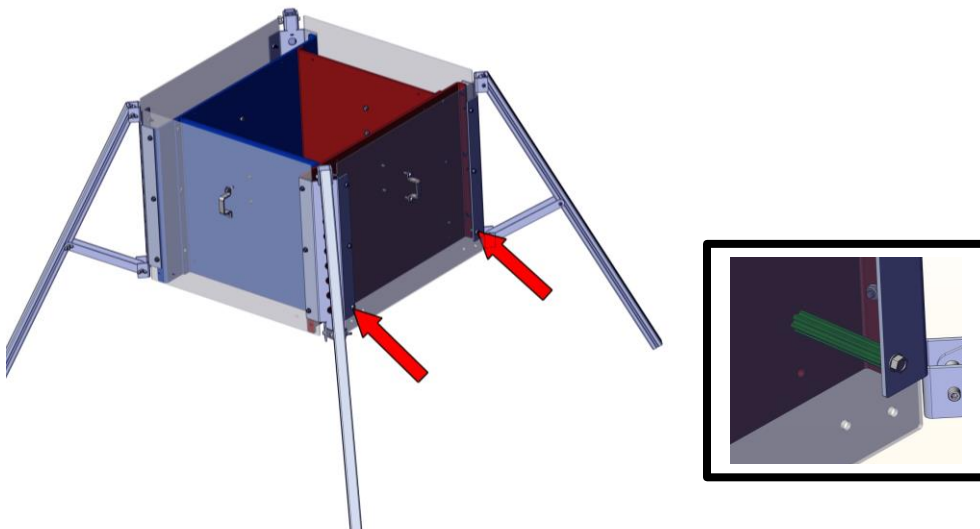


**Step 1-18:** Tools Needed: 1/2" Wrench; 3/8" Driver

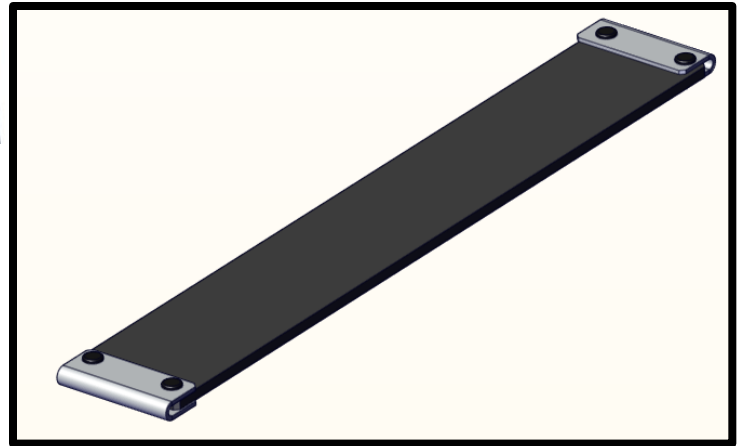
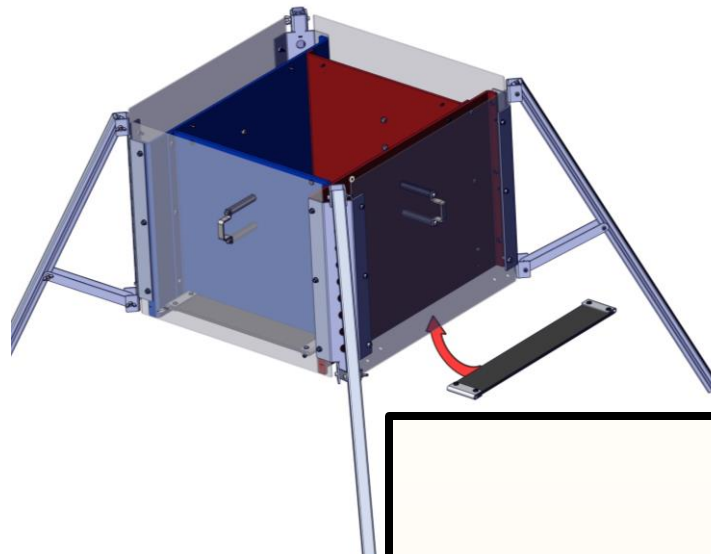
Hardware Needed: 8 - 1/4-20 Self Tapping Screw



Flip the Lander over. On the lower portions of the long side attach 2 Churros using a 1/4-20 Self Tapping Screw on each side. The Churro should sit between the polycarbonate panel and the colored panel. A 1/2" wrench can be used to hold the Churro.



**Step 1-19:** Place a long ramp in between the colored plate and the polycarbonate on the long side of the Lander.

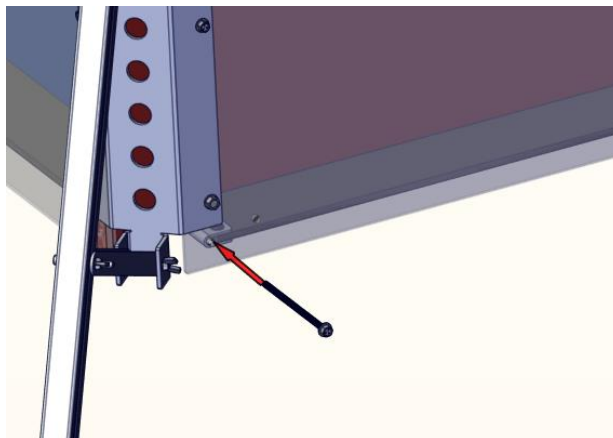


**Step 1-20:** Tools Needed: Tools Needed: 3/8" Wrench; 5/16" Wrench

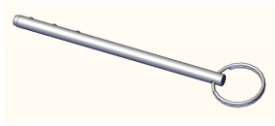
Hardware Needed: 4- 10-32 x 4.000" Hex Head Cap; 4 - 10-32 Nylock Nut



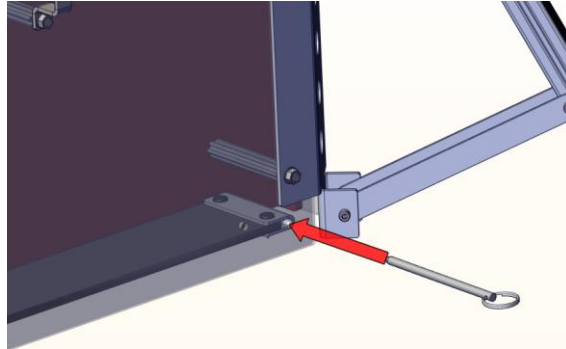
Use a 10-32 x 4.000" Hex Head Cap Screw as a hinge pin by inserting it through the Side Panel, Hinge, and Long Inside Wall. Add a 10-32 Nylock nut on the inside of the Lander and tighten one turn past when the nylon engages. The ramp should be able to pivot around the screw within the cargo hold and drop freely.



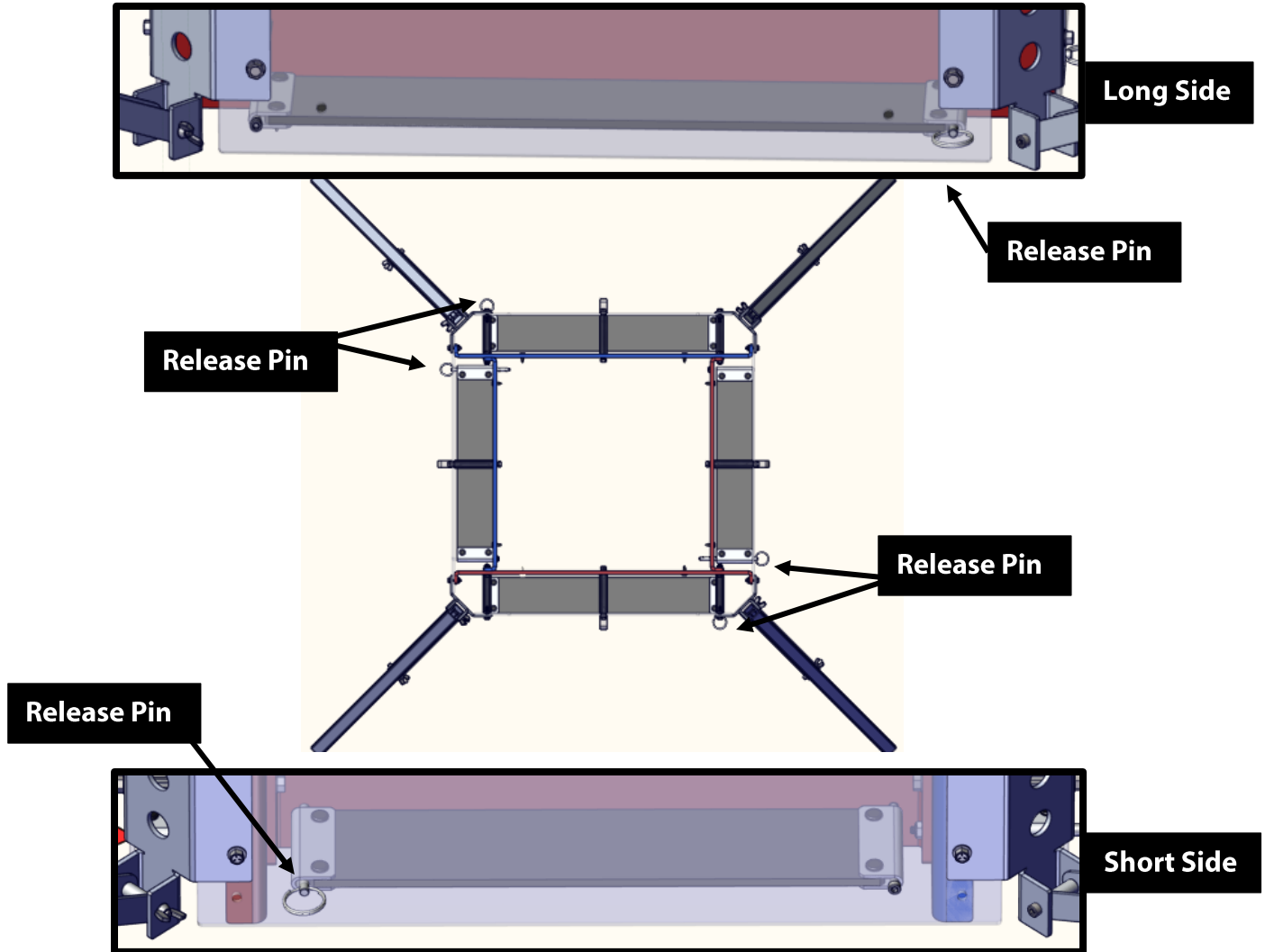
**Step 1-21:** Hardware Needed: 4 - Release Pin



On the opposite side of the floor, insert a release pin. These pins can be removed to allow the scoring elements to be reset.

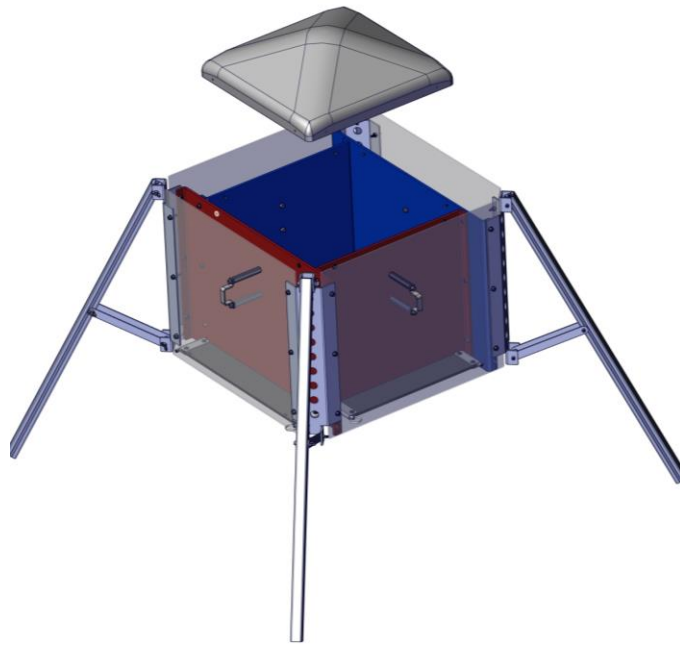


**Step 1-22:** Repeat steps 19-21 to install the other ramps in the assembly on all sides. The short ramps go on the short sides and the long ramps go on the long sides of the lander. On the short sides, the pin location is on the opposite side as shown below.

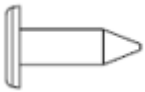


**NOTE:** Release pins are located to the right on the long side and to the left on the short side ramps.

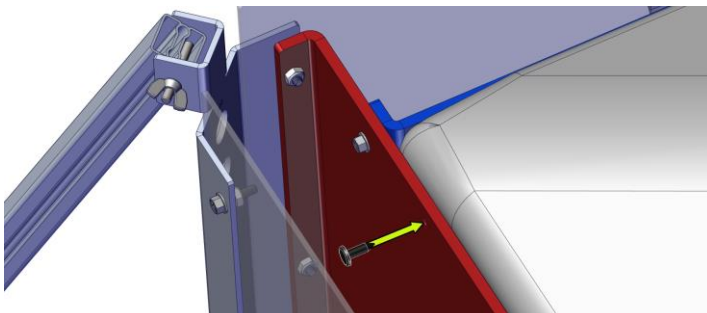
**Step 1-23:** Place the Top Dome on top of the Lander assembly.



**Step 1-24:** Hardware Needed: 8 - 3/16" Push In Rivet

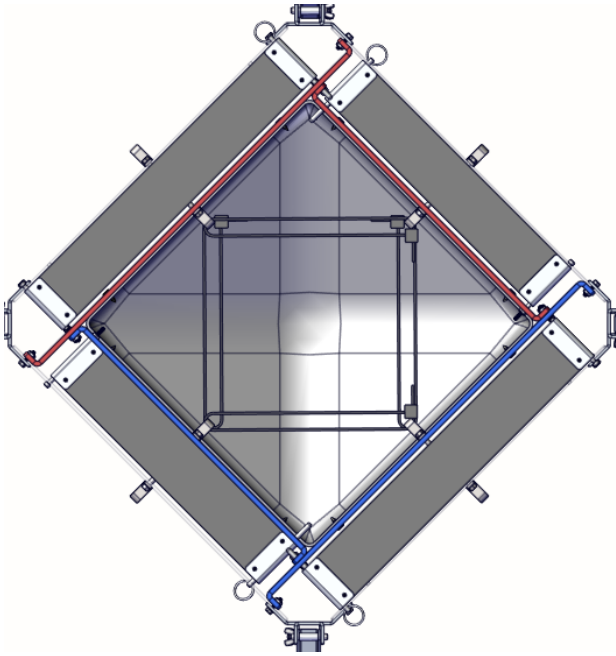


Use the push-in rivets to secure the top cap to the Lander. Two rivets are used on each Lander side.



**Step 1-25:**

The Lander needs to be braced to support the weight of hanging robots. Take 4 total large cable ties (am-1497) and attach one between each adjacent Lander Support Bracket. Tighten each cable tie enough so that it is tight, but not tight enough to make the Lander sides bow in. The tail of the cable tie should be approximately 10.5" long when tightened.

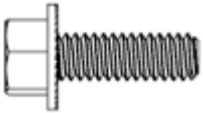


**NOTE:** After installation of the cable ties, the lander should be strong enough to hold the weight if 4 robots hanging.

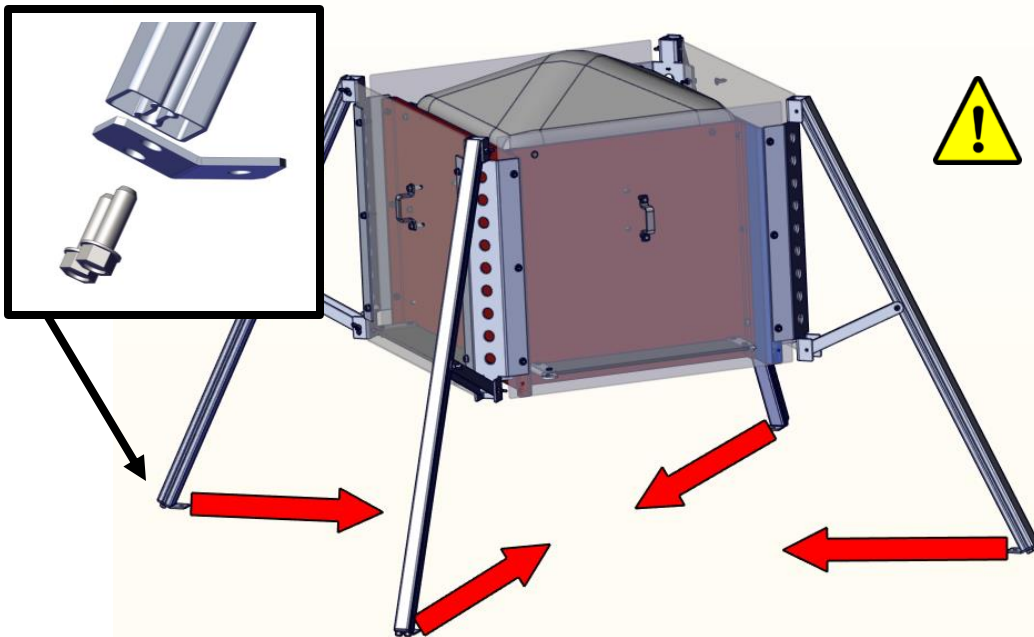
**NOTE:** With all the pieces in place, the game pieces should slide easily between the polycarbonate Front Panels and the Long and Short Internal Walls. If the Gold and Silver elements get stuck between panels, the screws and nuts holding the panels together may be too tight. Loosen them to ensure the game elements can be scored easily.

**Step 1-26:** Tools Needed: 3/8" Driver

Hardware Needed: 8 - 1/4-20 Self Tapping Screw



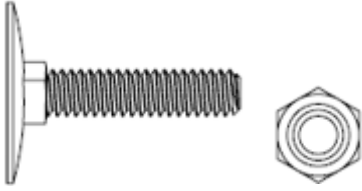
Locate the Foot Cap Bracket. Attach a Foot Cap Bracket on the bottom of the Lander Leg using 1/4-20 x 0.75" Self Tapping Screws. Repeat for each of the four legs. Ensure the screws align with the circular holes in the leg extrusion. The tab of the bracket that sticks out should point towards the inside of the lander.



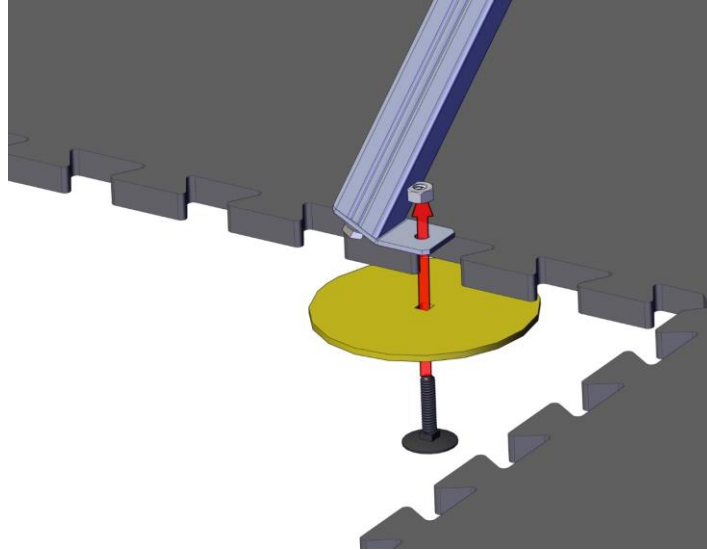
**NOTE:** The Lander Legs are not tapped and similar to the Churro, the threads of the screw will cut into the metal of the lander leg. It may take some force to turn the screw.

**Step 1-27:** Tools Needed:

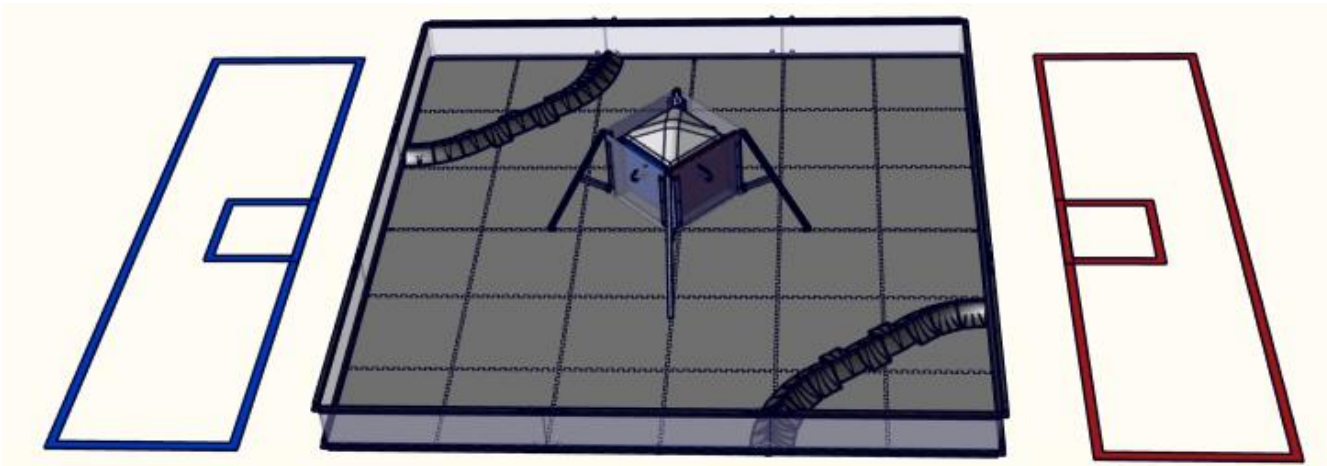
Hardware Needed: 4 – Elevator Bolt. 4 – 1/4-20 Hex Nut



If you're setting up the Lander on SoftTiles, use the Under Tile Disk with elevator bolt and 1/4-20 Nut to anchor it into place.

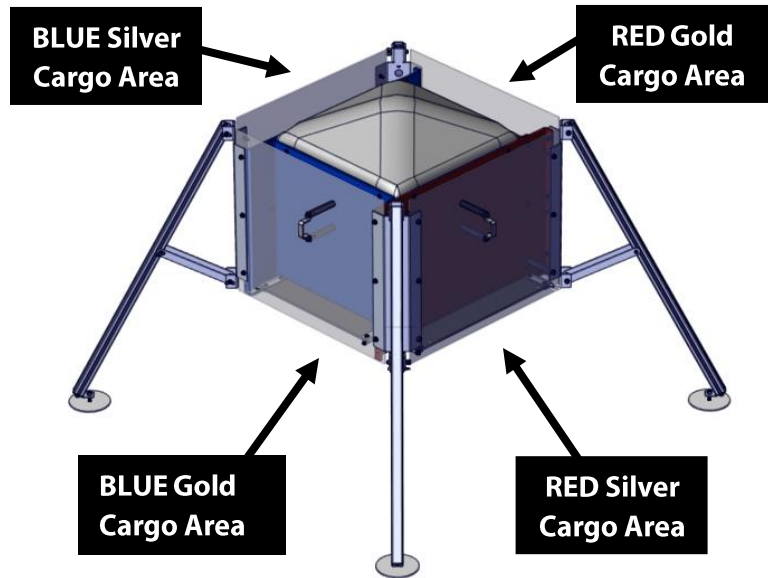
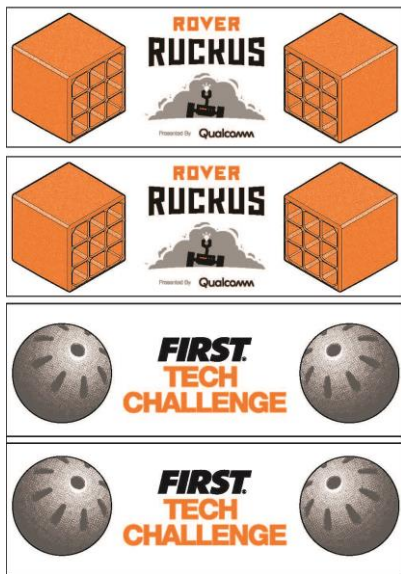


**Step 1-28:** The Lander sits in the center of the playing field with the red sides facing the Red Alliance Station and the blue sides facing the Blue Alliance Station. For more details on placement, please reference the Field Setup and Configuration Guide.



## Install Field Stickers

Each kit included one set of field stickers. These stickers are intended to be placed on the polycarbonate sides of the lander to help both the teams and volunteers quickly identify which cargo hold scoring area is designated for gold scoring elements (blocks) and silver scoring elements (whiffle ball). There are two stickers to identify the gold cargo hold scoring area, and two stickers to identify the silver cargo hold scoring area.

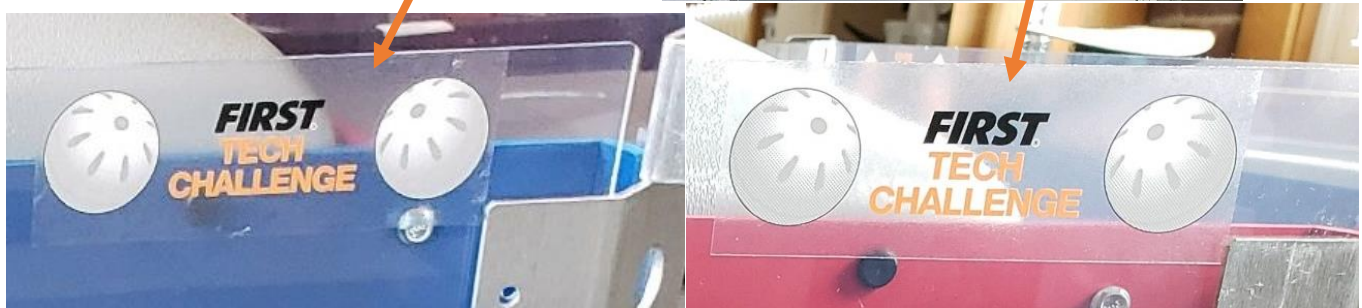


**Step 1-29:** Place each gold sticker on the upper right hand side of the clear polycarbonate Side Panel. For the gold cargo hold scoring area, make sure to place the sticker on the short sides. There should be one sticker placed on the short blue side, and one on the short red side.



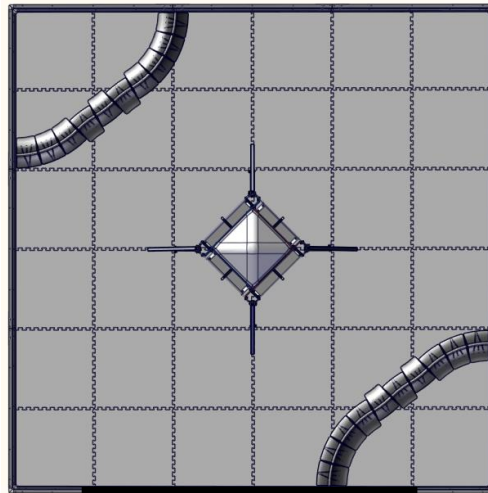


**Step 1-30:** Place each silver sticker on the upper right hand side of the clear polycarbonate. For the silver cargo hold scoring area, make sure to place the sticker on the long sides. There should be one sticker placed on the long blue side, and one on the long red side.



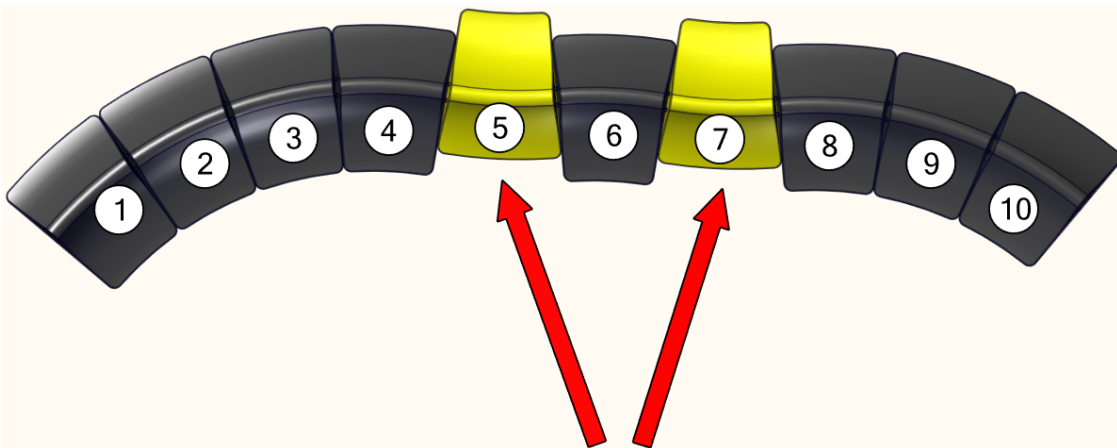
## Crater Assembly and Placement

*ROVER RUCKUS<sup>SM</sup>* is played with two Craters on opposing corners of the field. From the Audience perspective a Crater should sit in the upper left corner and a Crater should sit in the lower right corner. Each Crater Section is the same and assembly instructions are as shown below.

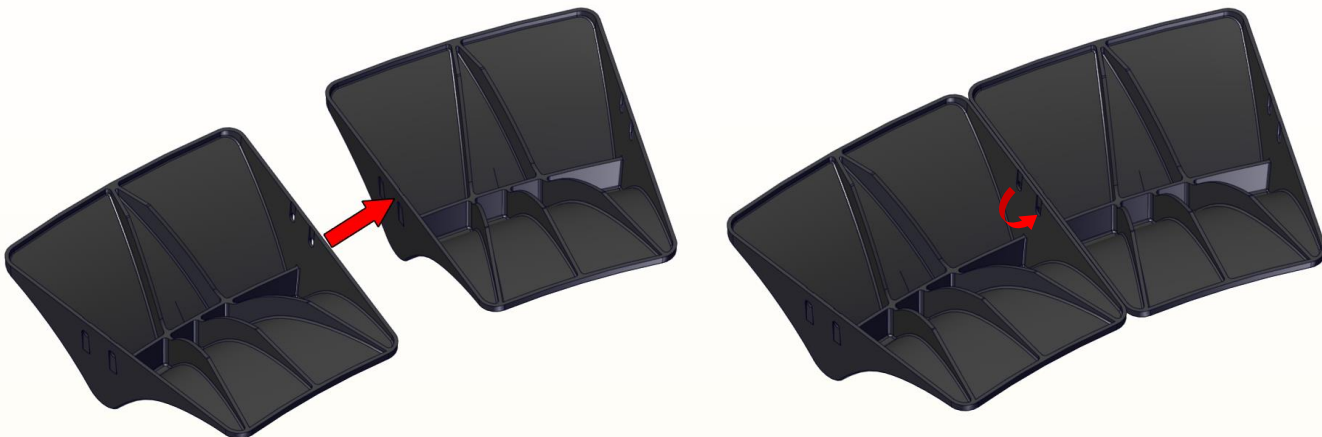


**AUDIENCE**

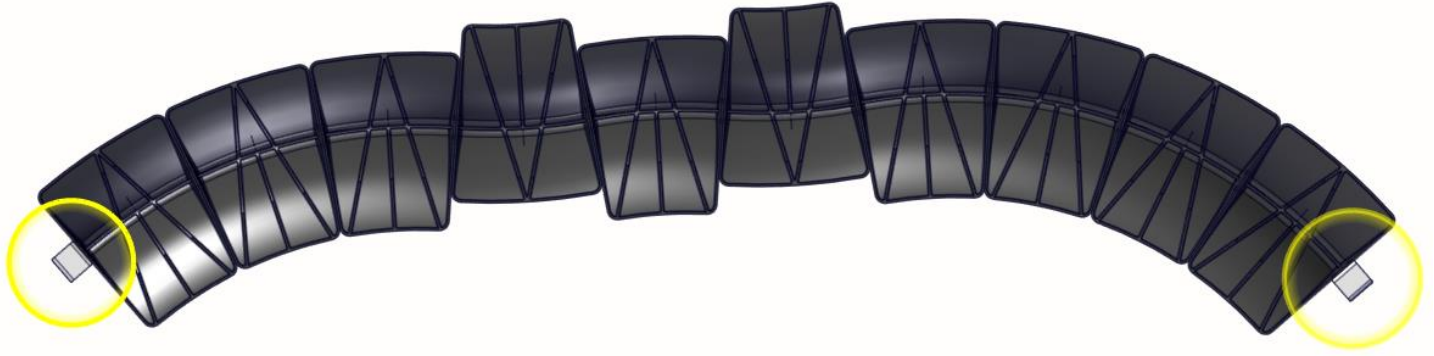
**Step 2-1:** Each Crater is made up of 10 Crater Segments. When counting from left to right, the 5<sup>th</sup> and 7<sup>th</sup> segments have their long side pointed outwards. The remaining segments have their long sides facing inwards.



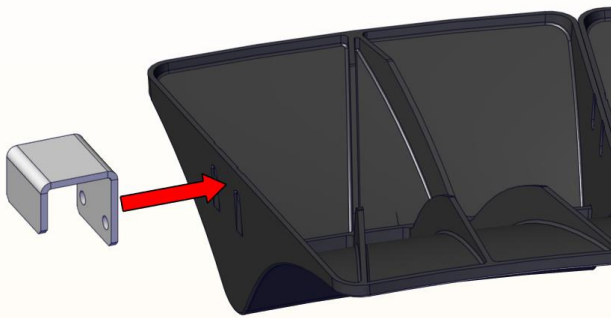
**Step 2-2:** To create a Crater, turn each segment upside down and place together. Use a cable tie to loop horizontally through the holes in each section to hold together. Tighten the cable tie so the sections don't separate. When flipped right side up, the Crater Segments should sit flat on the SoftTiles and not have any spaces between them.



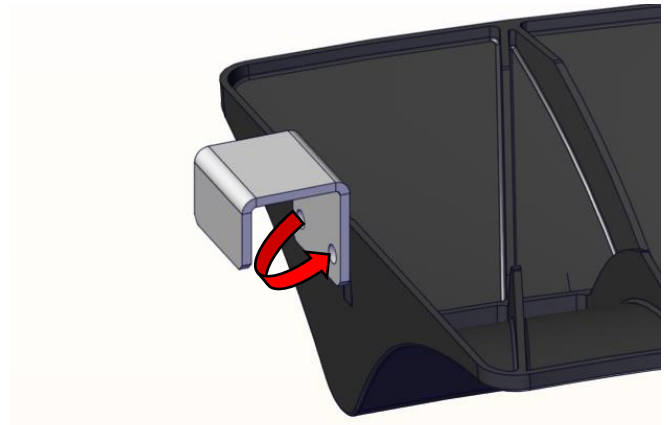
**Step 2-3:** Attach the 10 segments together. On both ends of the Crater, place a Lower Clip.



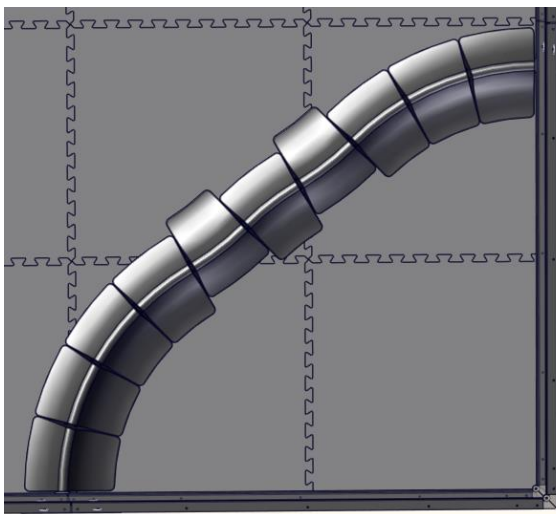
**Step 2-4:** The holes on the Lower Clip should line up with the holes in the Crater Segment. The clip should point up towards the top of the Crater.



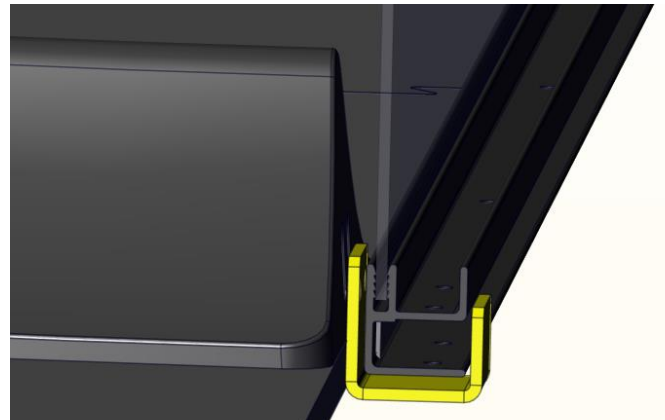
**Step 2-5:** Secure the clip to the Crater Section with a cable tie.



**Step 2-6:** Place each Crater into the corner of the field perimeter. From the Audience perspective a Crater should sit in the upper left corner and a Crater should sit in the lower right corner. The end Crater Segments should sit up against the field perimeter and there should be no gaps between the bottoms of the Crater Segments.



**Step 2-7:** The clip will sit underneath the field perimeter rail and secure the Crater to the perimeter.





**Additional hardware will be left over and used for attaching components to the field. Extra hardware should be kept and not discarded.**

**Additional instructions on the following can be found in the Field Setup and Configuration Guide Available on [AndyMark.com/FTC](http://AndyMark.com/FTC)**

- Setting up the Floor and Field Perimeter
- Instructions for Field Layout and Orientation
- Tournament Setup

More resources on this year's challenge can be found on <http://www.firstinspires.org/resource-library/ftc/game-and-season-info>