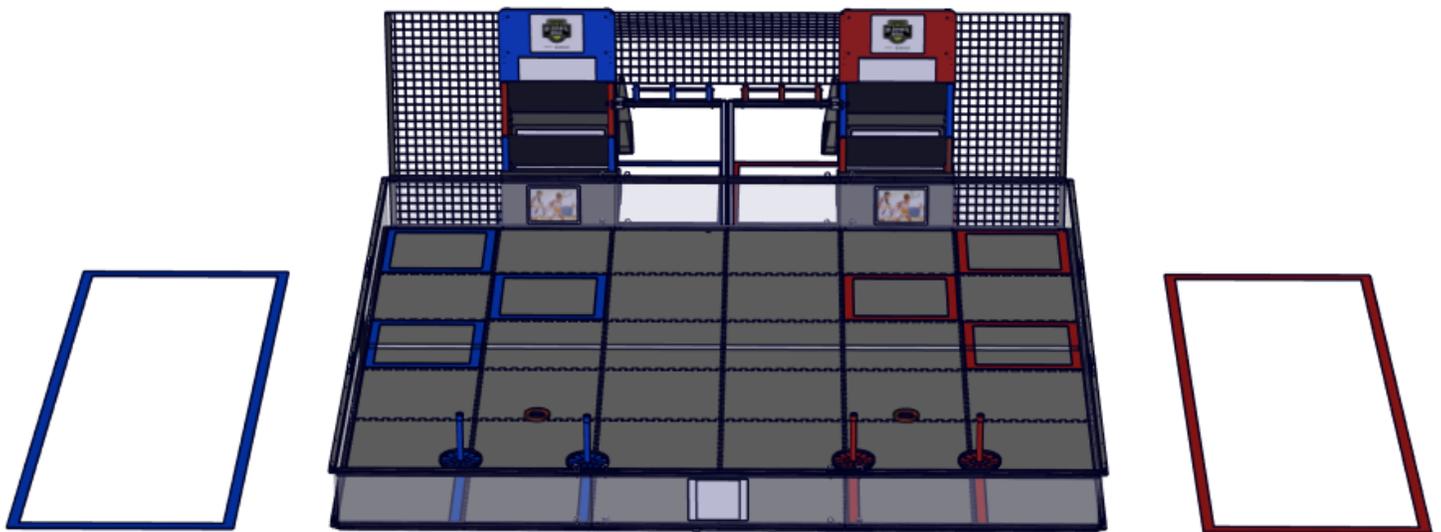




PRESENTED BY **Qualcomm**



## 2020-2021 **FIRST**<sup>®</sup> Tech Challenge Field Assembly Guide

Rev 1.2

**AndyMark**<sup>®</sup> Field Components for 2020-2021 **FIRST**<sup>®</sup> Tech Challenge

This guide contains instructions for assembling the Field Elements for the 2020-2021 *FIRST*® Tech Challenge Game

ULTIMATE GOAL<sup>SM</sup> Presented by Qualcomm®

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

## REVISION HISTORY

Rev.	Date	Description
1.0	8/25/20	Initial Release
1.1	8/28/20	Added net details, minor text changes.
1.2	9/10/20	Added folding details, and net details.

ASSEMBLY VIDEOS CAN BE FOUND ON OUR WEBSITE:  
[AndyMark.com/FTC](http://AndyMark.com/FTC)



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

## TOOLS NEEDED

Component	QTY	Part Photo
Safety Equipment		
Drill	1	
Ratchet (Optional)	1	
3/8" Nut Driver or Socket	1	
Cable Tie Cutters	1	
3/8" Combination Wrench	1	
7/16" Combination Wrench	1	
1/8" Hex Driver	1	
File	1	
Utility Knife	1	
25' Tape Measure	1	
Mallet	1	
Straight Edge (~24" long)	1	
Scissors	1	
ADDITIONAL REQUIRED ITEMS		
2" RED Gaffers Tape	1	
2" BLUE Gaffers Tape	1	

2" WHITE Gaffers Tape	1	
White 8.5x11" or A4 (international) Cardstock for Navigation Target (Printed from <a href="#">FIRST Resource Library</a> )	12	
Velcro® Dots	1-pack	
Clear Page Protection Sleeves (Similar to Staples P/N 40713)	7	

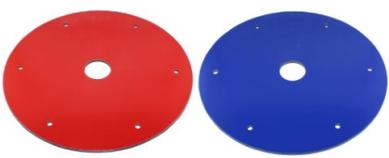
Tools and tape can be purchased as a set from AndyMark

## GAME PIECES and ELEMENTS

Component	Part #	QTY	Part Photo
Ring	am-4300	20 per field	

See Field Setup Guide for placement information.

## WOBBLE GOAL-QTY per Goal

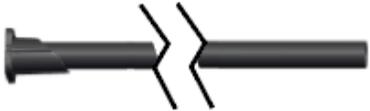
Component	Part #	QTY	Part Photo
Base	am-4217	1	
Shelf	am-4336_red/blue	1 Red/Blue	

Pipe	am-4293_red/blue	1 Red/Blue	
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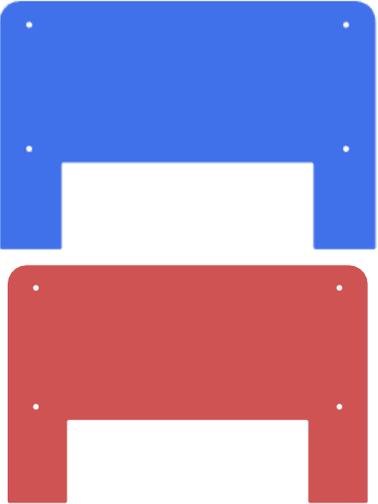
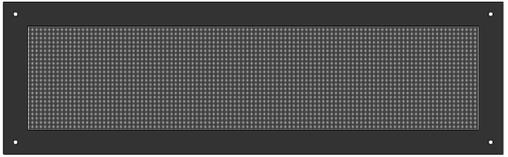
### WOBBLE GOAL HARDWARE

Component	Part #	QTY	Part Photo
End Cap	4297_Red/Blue	1 Red/Blue	
Plastic Rivet	am-1488	6	

### TOWER GOAL QTY per goal

Component	Part #	QTY	Part Photo
Tower Floor	am-4277	1	
Vertical Pipe with Foot	am-4278 +am-4274	4	
Left/Right Pipe	am-4279	3	
Front/Back Pipe	am-4280	4	
90 Elbow	am-4281_2_black	2	

3-way Elbow	am-4281_3_black	2	
4-way Elbow	am-4281_4_black	2	
Front Base Sleeve	am-4282_Blue/Red	2	
Low Goal Riser Sleeve	am-4283_Blue/Red	4	
Mid Goal Riser Sleeve	am-4284_Red/Blue	4	
Upper Goal Rear Sleeve	am-4285_Blue/Red	2	
Upper Goal Front Sleeve	am-4286_Blue/Red	2	
Goal Floor	am-4287	2	

Backboard	am-4288_ Blue/Red	1	
Goal Net (In 3 Sections)	am-4239	1 Upper	
		1 Lower	
		1 Top/Sides	

Trough	am-4289	1	
Return Rack	am-4303	1	
Corral	am-4290	1	

### TOWER GOAL HARDWARE

Plastic Rivet	am-1488	20	
Drill Bit	am-4273	1	
10-32 x 1.000 Screw	am-1475	12	
10-32 Nylock Nut	am-1042	12	

### POWER SHOT QTY Per Each

Component	Part #	QTY	Part Photo
Cross Bar	am-4295	1	

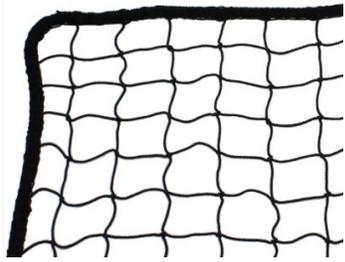
Vertical Bar	am-4296	1	
Hinge Pin	am-4302	1	
Target	am-4294_Red/Blue	3	
Hose Clamp	am-1574	1	
Side Mount	am-4304	1	
Churro	am-4307	1	
Cable Tie	am-1522	50	

**POWER SHOT HARDWARE**

Reset Strut	am-4276	2	
1/4-20 x 1.75" Screw	am-1372	2	

1/4-20x0.75" Screw	am-1310	6	
Peanut Cap	am-4305	1	

## SIDE NET

Side/Center Net	am-4292	3	
Side Net Pipe	am-4337	2	
Side Net Lower Clip	am-4275	2	
Side Net Cable Ties	am-1552	20	

## **Part Preparation**

The playing field is custom manufactured out of aluminum and plastic parts. The edges of some of these parts may be sharp. Be careful when handling and use a file to smooth any rough edges as needed prior to assembly.

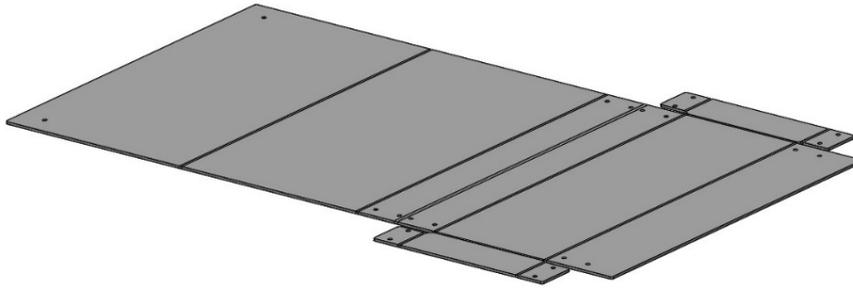
Some of the flat sheets have a protective plastic film on one or both sides to protect to surface from scratches during manufacturing and transportation. These protective covers can be peeled off and discarded.



## Fold the Corral

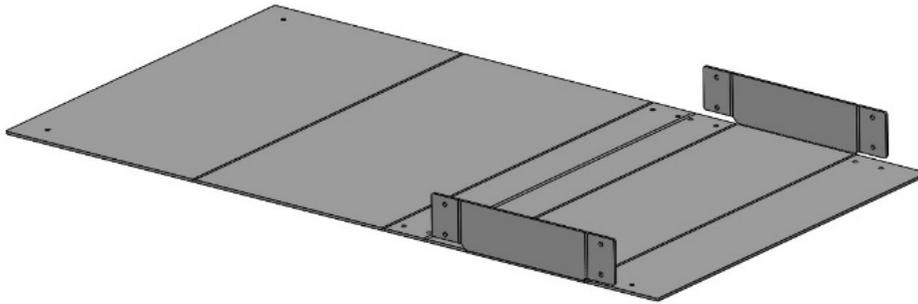
Take the Corral and place it on a flat surface. Use a straight edge to bend along each edge as shown.

1.



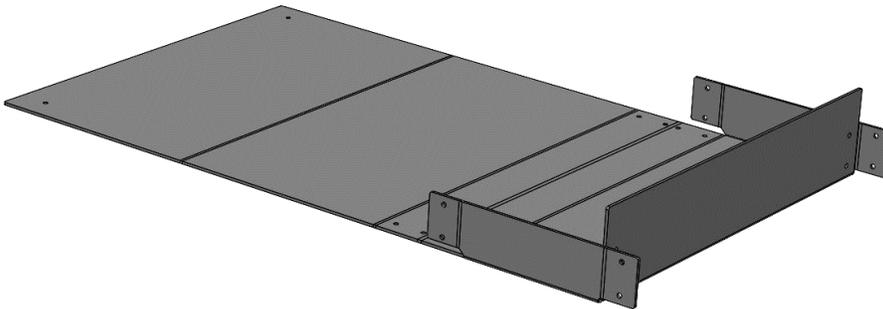
Start with the Corral unfolded and flat.

2.



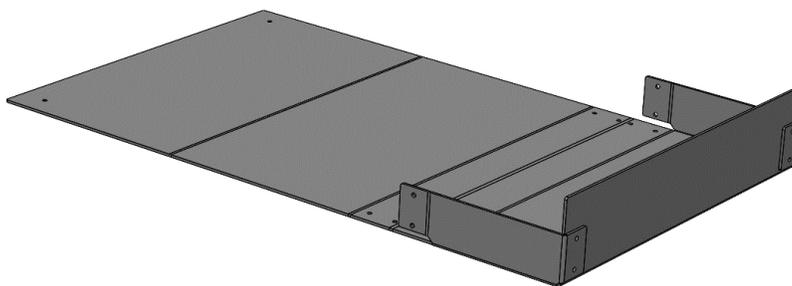
Fold the side flaps up.

3.



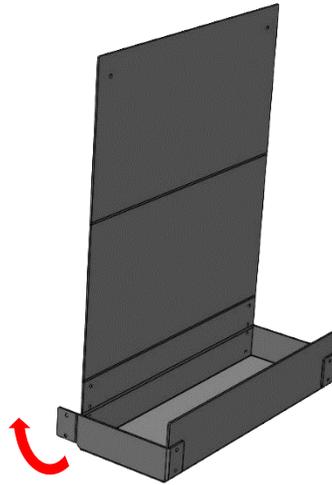
Fold the front flap up.

4.



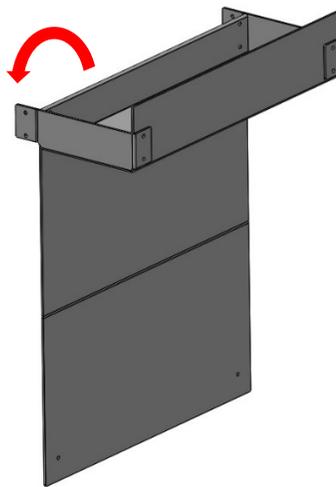
Fold the small front flaps in towards the center. Secure the front flap to the side flaps using cable ties. The small front flaps sit on the outside.

5.



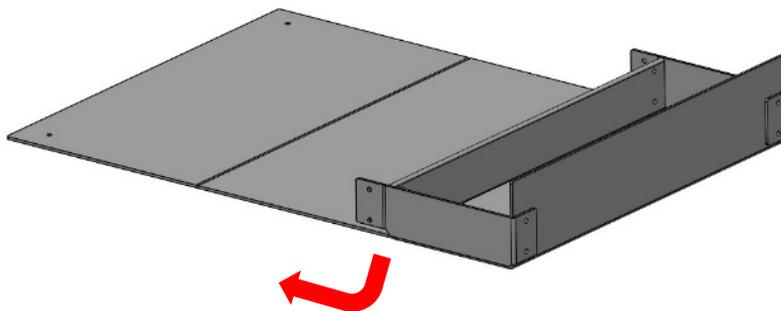
Fold the back flap up.

6.



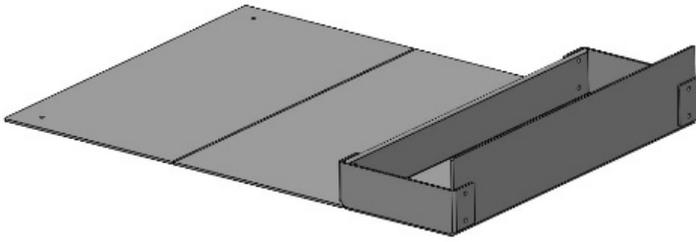
Fold the back flap down on the adjacent bend line to create the back wall of the corral. At this step, the back flap will extend past the bottom of the corral.

7



Fold the back flap straight back on the adjacent bend line.

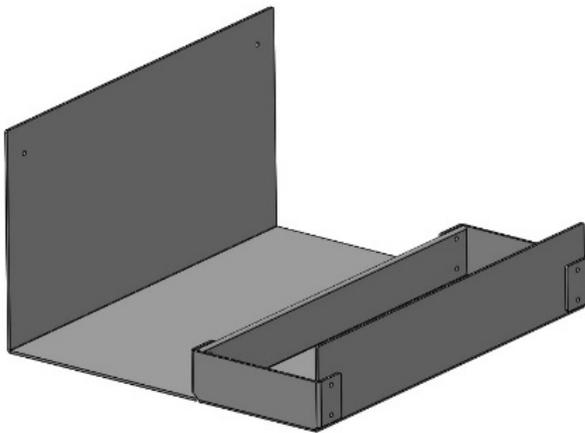
8



Wrap the small rear flaps around the back wall of the corral.

Secure back flap and rear flaps by running cable ties through the two holes.

9



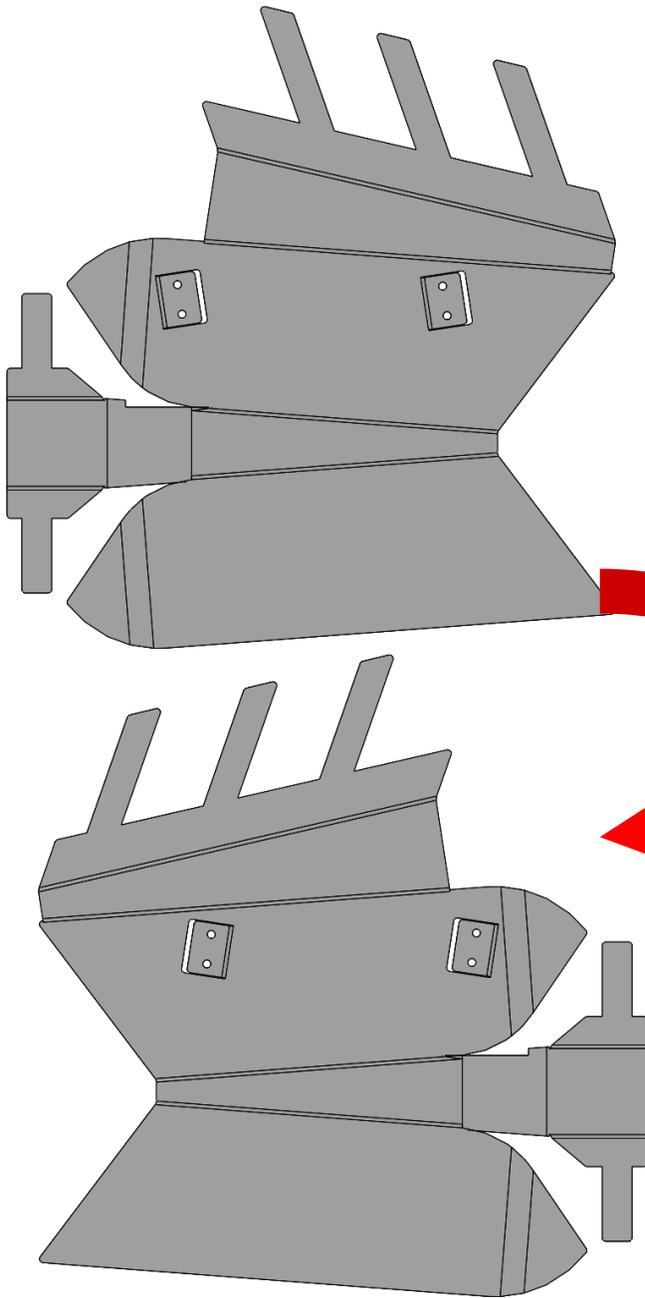
Fold the back flap up at the next bend line.

The Corral is complete!

## **Fold the Return Rack**

Take the Return Rack and place it on a flat surface. Use a straight edge to bend along each edge as shown.

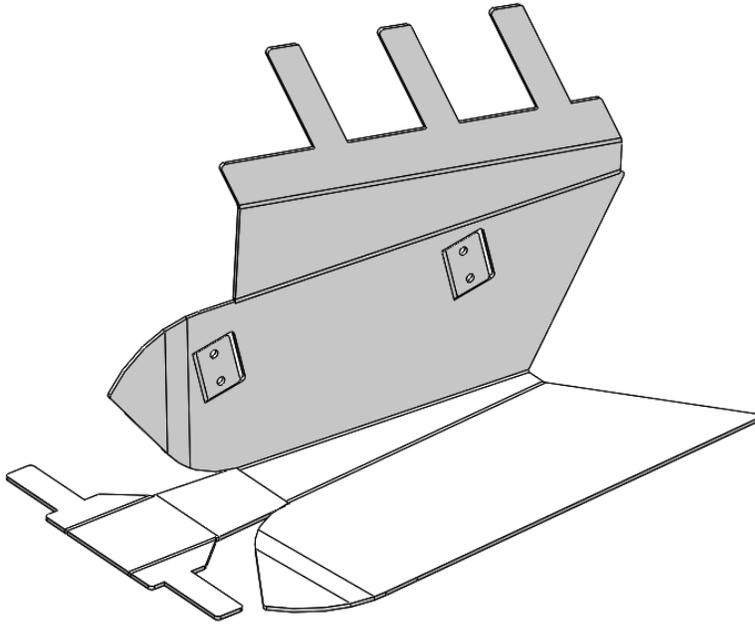
1.



Start with the Return Rack unfolded and flat.

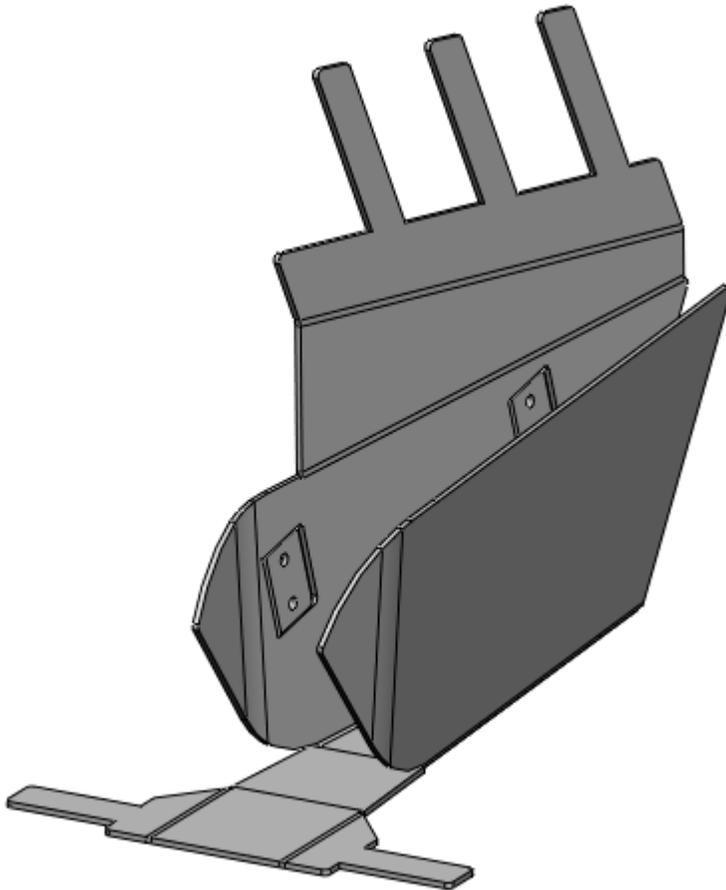
**Note:** The following instructions are for a **blue** Return Rack. For the **red** Return Rack, the instructions are the same, but a mirror image. Ensure that one of each Rack is made by flipping over the flat panel before constructing the red Return Rack.

2.



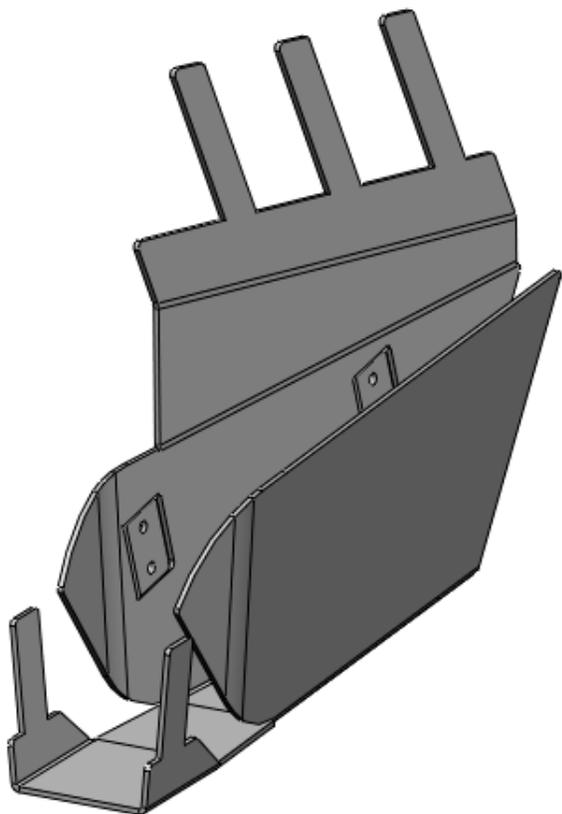
Fold up side flap with the long tabs up.

3.



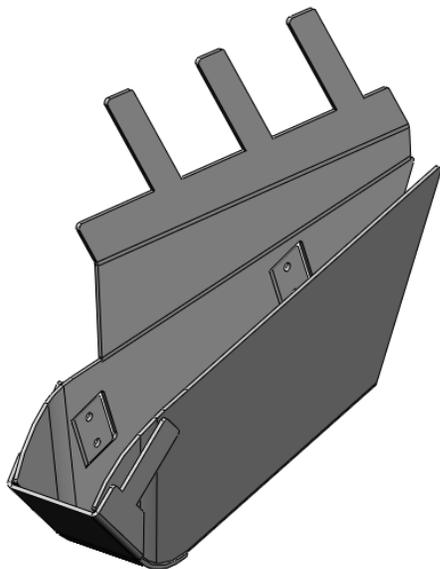
Fold the opposite flap up.

4.



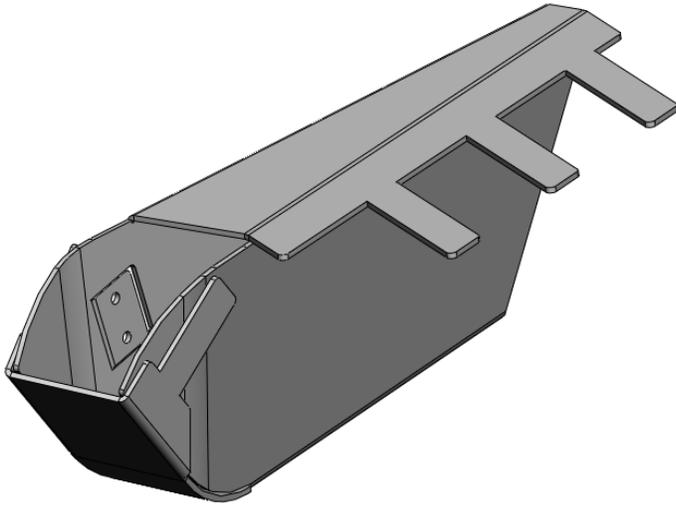
Fold the small front flaps up.

5.



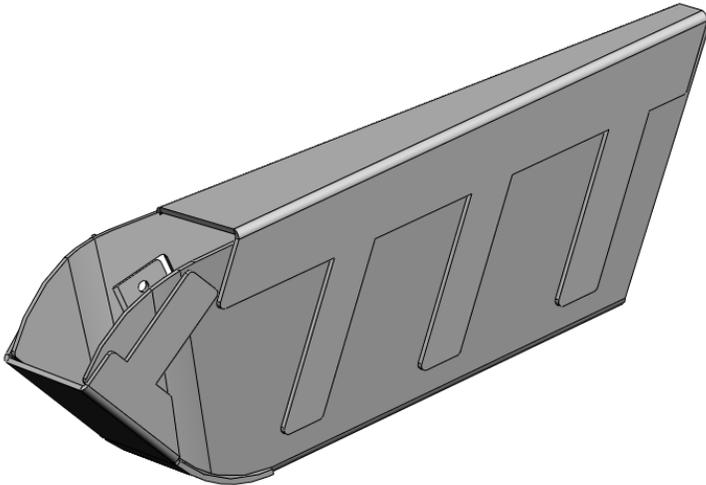
Fold the front flap up following the contour radius of the side flaps.

6.



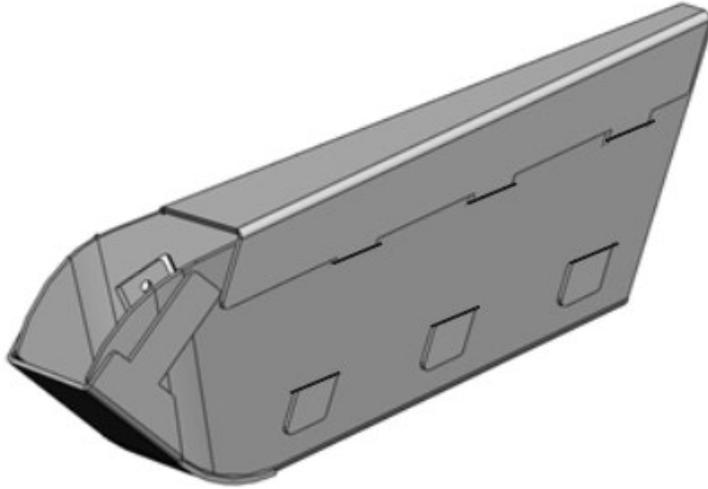
Fold the side flap with the long tabs across the top .

7.



Fold the side flap with the long tabs down along the other side flap.

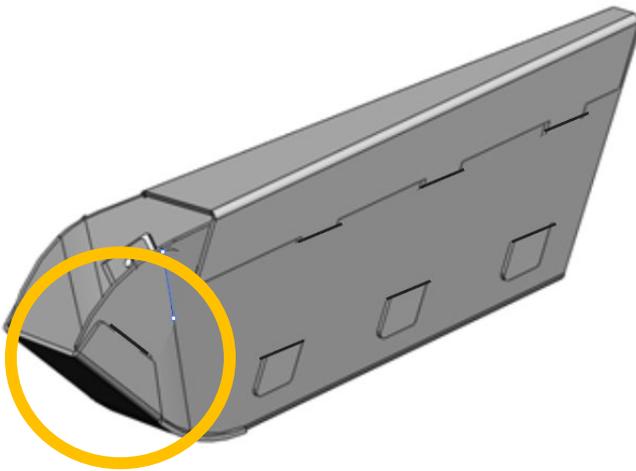
8.



Tuck the long tabs into the top slots and back out the bottom slots.

This is the most challenging part of the build. You may need to bend the tabs to insert and/or spend some time opening up the slots with your fingers or a screwdriver.

9.



Tuck both front flaps into the front slots.

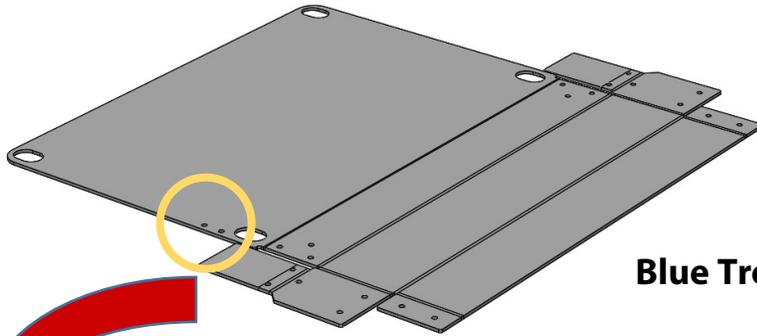
The Return Rack is complete!

**Note:** The front flaps are designed to sit flat. If they stick out too far, they may affect the path of the ring and keep it from exiting the Return Rack. If the flaps stick out too far, try to bend them out of the way or use a piece of tape to secure.

## Fold the Trough

Take the Trough and place it on a flat surface. Use a straight edge to bend along each edge as shown.

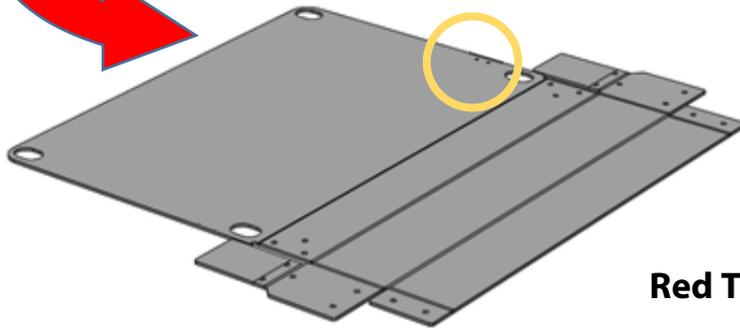
1.



Blue Trough

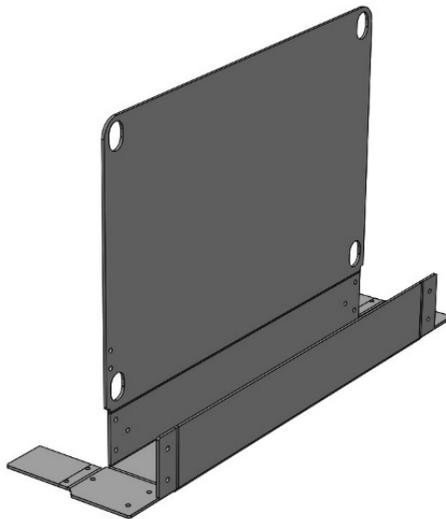
Start with the Trough unfolded and flat.

**Note:** On the **blue** goal ensure the mounting holes are as shown above. On the **red** goal, ensure the mounting holes are on the opposite side by flipping over the flat panel.



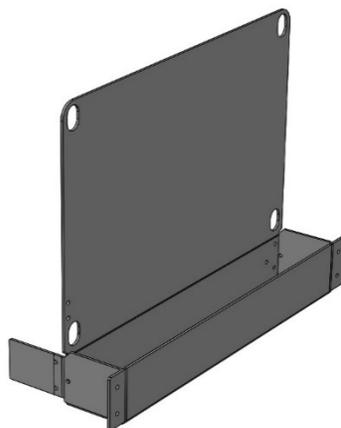
Red Trough

2.



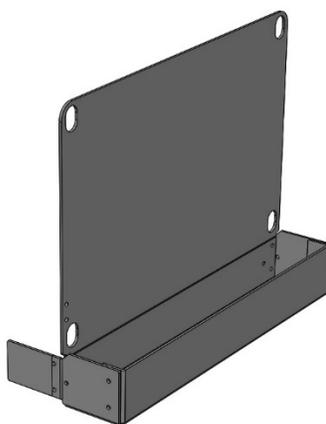
Fold the front and back flaps up.

3.



Fold the side flaps up.

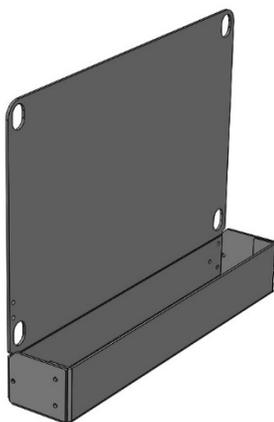
4.



Fold the small front flaps in towards the center.

Secure the front flap and side flap by running cable ties through the two holes.

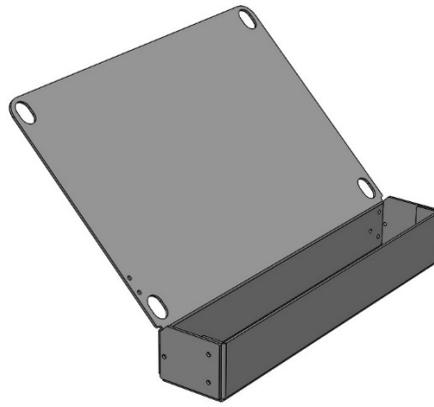
5.



Fold the back flaps towards the center.

Secure the back flap and the center flap by running cable ties through the two holes.

6.



Fold the back flap at approximately a 45 degree angle.

The Trough is complete!

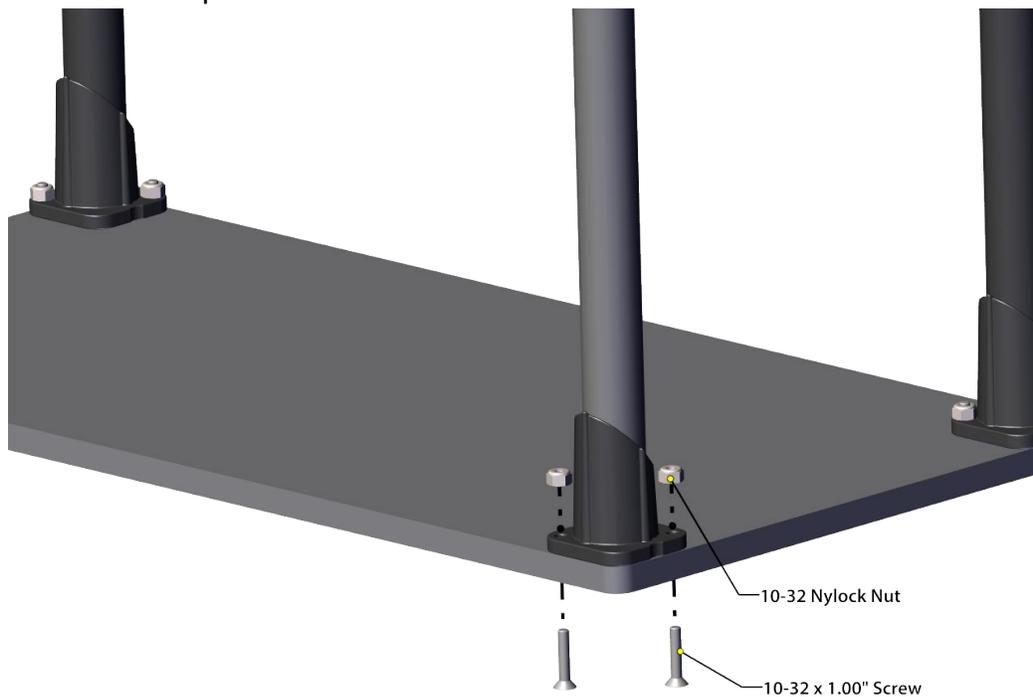
## **Tower Goal Assembly Instructions**

Each playing field has one red and one blue Tower Goal. Assembly steps are *almost* the same for both colors. The red and blue goals have alternating color schemes, and are mirror images of each other. Pay close attention to the notes highlighting the differences between the red and blue goals. The instructions below show a blue Tower Goal.

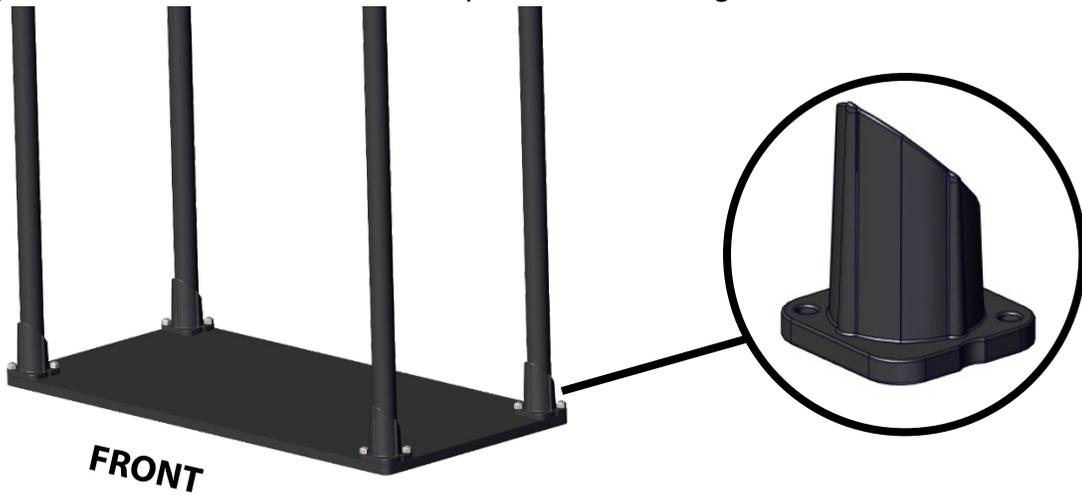
1. Locate the Tower Floor. On one side, the holes have a countersink. The side with the countersink is the bottom.
2. The foot and vertical pipe should ship pre-assembled. Align all 3 holes in the foot with the holes in the tower floor.



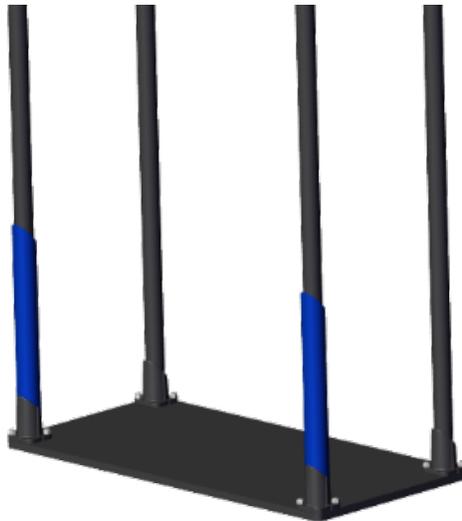
3. Using 10-32 x 1.00" screws and nuts attach each foot to the base. Each foot should be secured with 3 screw and nut pairs. Ensure the screw head sits in the countersink hole in the Floor Plate.



4. Identify the "front" of the structure. The top of the feet are angled towards the back of the goal.

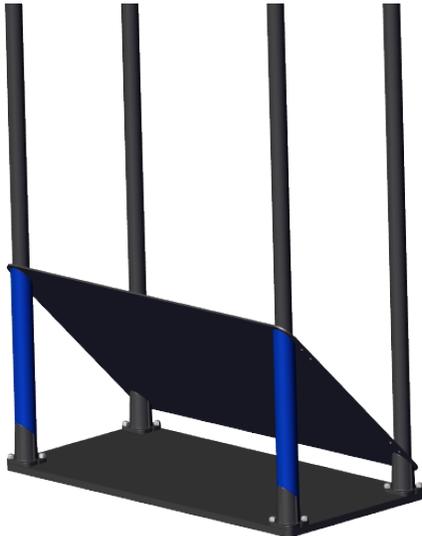


5. Slide a Front Base Riser Sleeve onto the two front vertical pipes. The Front Base Riser Sleeve has an angled cut on each end.

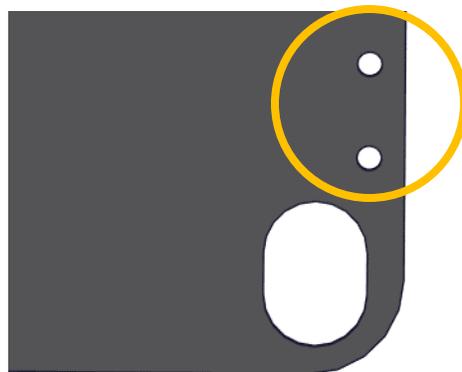


**Note:** On the **blue** goal, these sleeves should be blue.  
On the **red** goal, these sleeves should be red.

6. Slide one of the Goal Floors onto the vertical pipes.



**Note:** When viewed from the front.  
On the **blue** goal, the two holes on the Goal Floor should be on the right side.  
On the **red** goal, these holes should be on the left side.

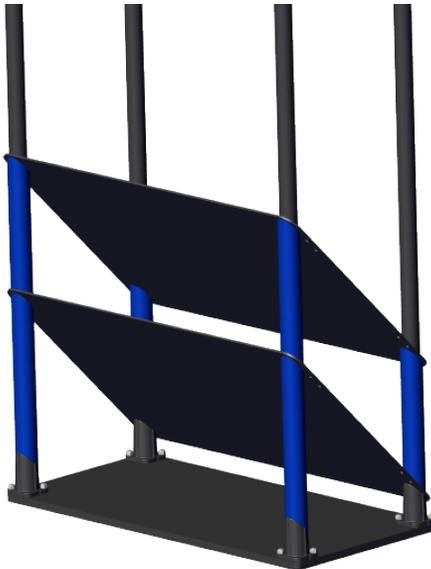


7. Slide a Low Goal Riser onto each of the four vertical pipes. The Low Goal Riser Sleeve has an angled cut on each end and is approximately 7 7/8" in length.

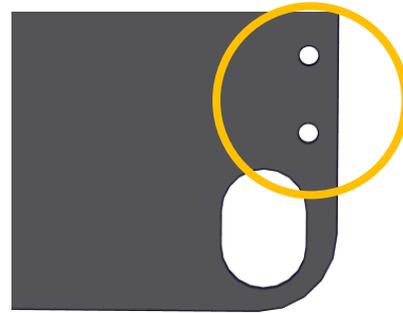


**Note:** On the **blue** goal, these sleeves should be blue.  
On the **red** goal, these sleeves should be red.

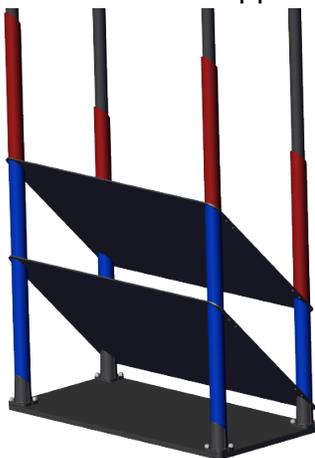
8. Slide the second Goal Floor onto the vertical pipes.



**Note:** When viewed from the front.  
On the **blue** goal, the two holes on the Goal Floor should be on the right side.  
On the **red** goal, these holes should be on the left side.

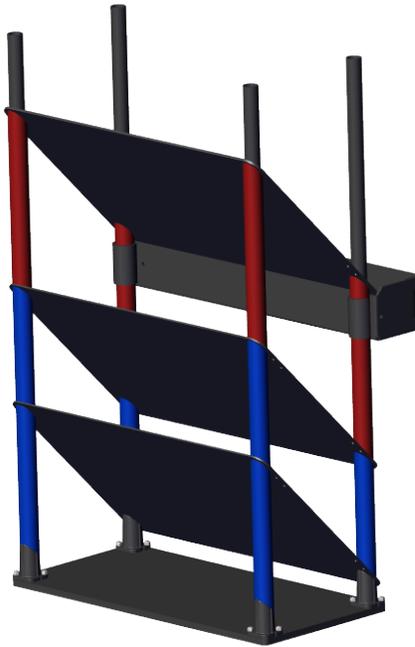


9. Slide a Mid Goal Riser onto each of the four vertical pipes. The Mid Goal Riser Sleeve has an angled cut on each end and is approximately 11 7/8" in length.

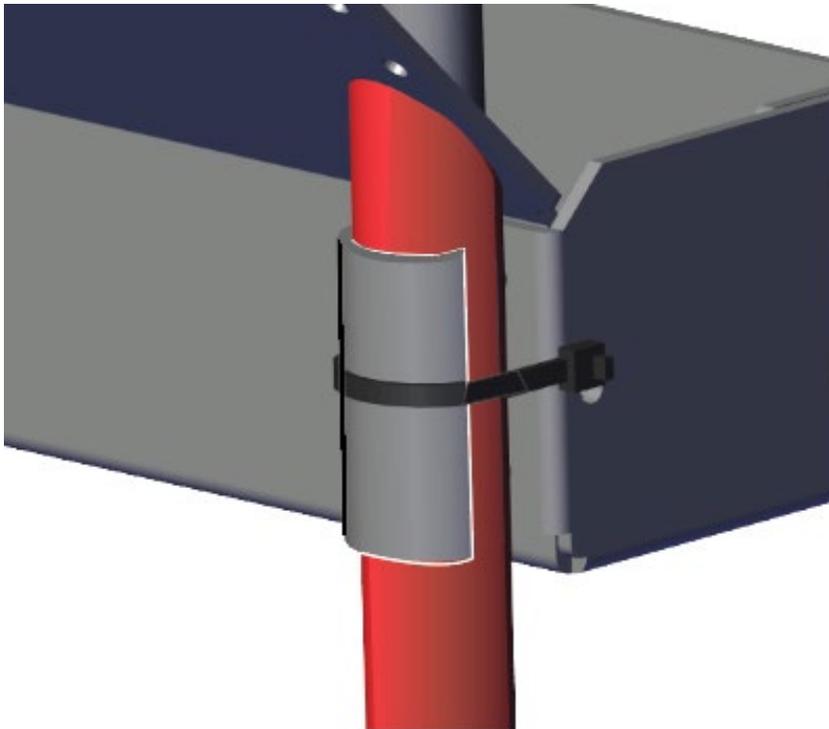


**Note:** On the **blue** goal, these sleeves should be red.  
On the **red** goal, these sleeves should be blue.

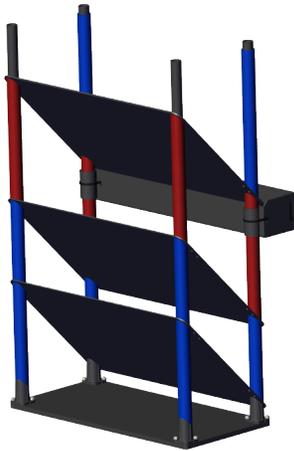
10. Slide the pre-folded Trough onto the vertical pipes. This will be the upper goal floor. The tray should sit open side up on the rear of the Tower Goal. For instructions on how to fold see the “Part Preparation” section above.



11. Wrap the loose flap on the Trough around the pipe and sleeve. Secure to the vertical pipes using a cable tie on each side. The cable tie will go through the holes in the Trough and around the outside of the flap around the pipe.

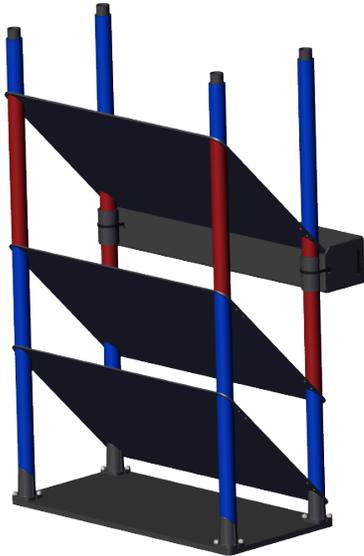


12. Slide a Rear Upper Goal Sleeve onto the two rear vertical pipes. The straight cut should face up.



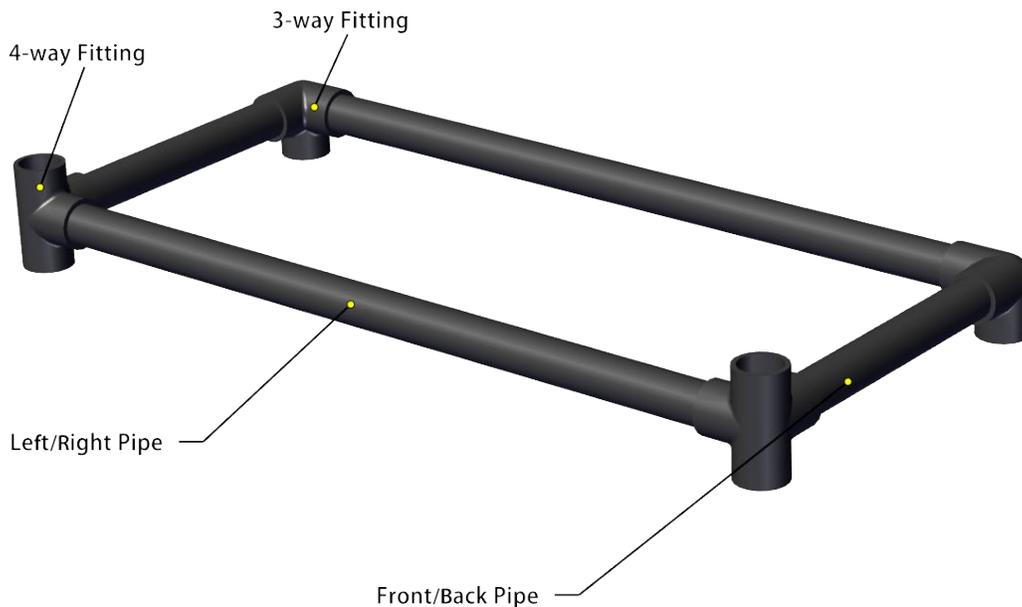
**Note:** On the **blue** goal, these sleeves should be blue.  
On the **red** goal, these sleeves should be red.

13. Slide a Front Upper Goal Sleeve onto the two front vertical pipes. The straight cut should face up.

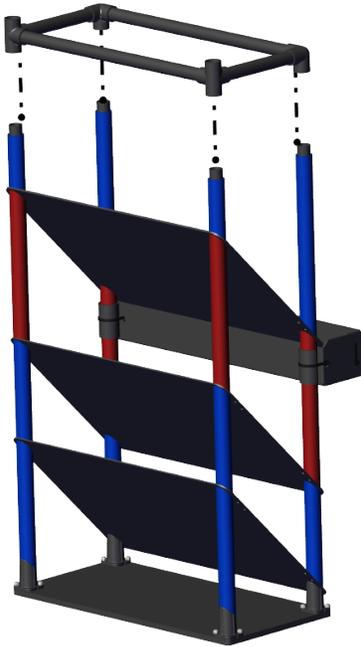


**Note:** On the **blue** goal, these sleeves should be blue.  
On the **red** goal, these sleeves should be red.

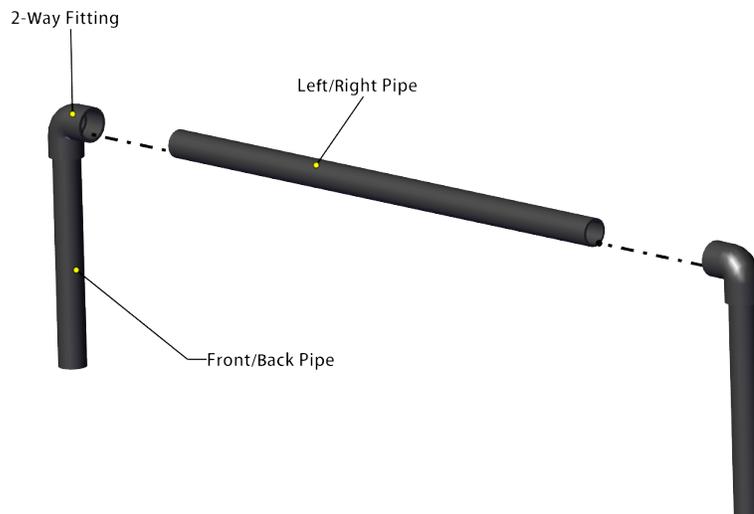
14. Assemble the top cap as shown. The 4-way fittings will be at the front and the 3-way fittings will be at the rear. Ensure each pipe is firmly seated in each fitting.



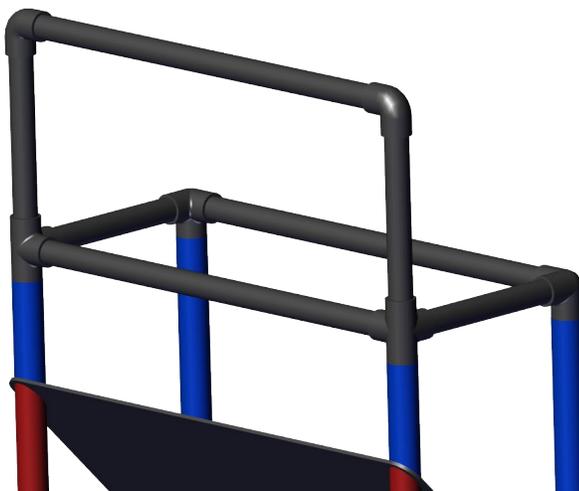
15. Add the top cap assembly to the top of the goal.



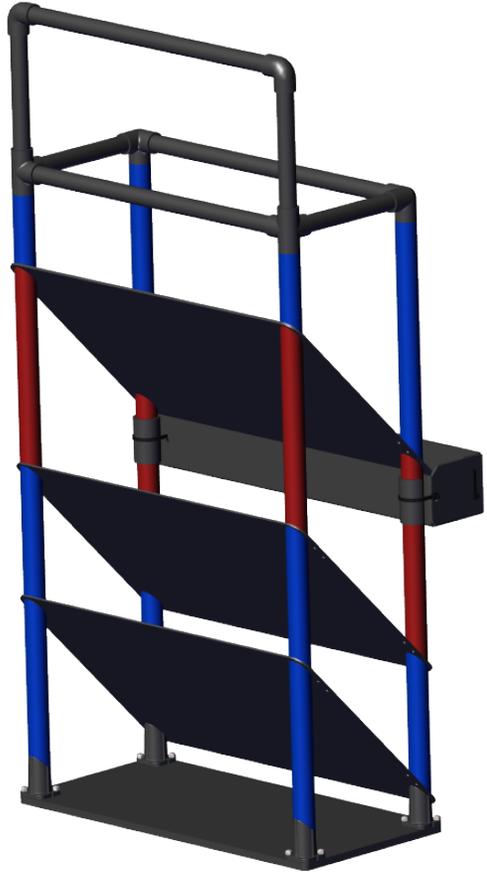
16. Assemble the backboard pipes as shown. Ensure each pipe is firmly inserted into each fitting.



17. Add the backboard pipes to the front of the Tower Goal Assembly.

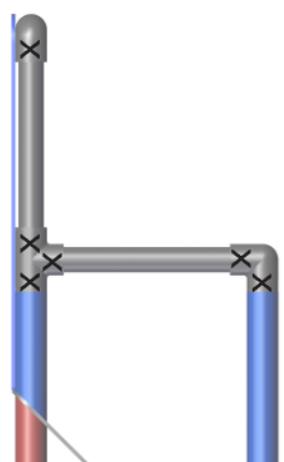


18. Ensure all connections are tight on the Tower Goal Assembly. The pipes should be firmly seated in each fitting.



**RED TOWER GOAL**

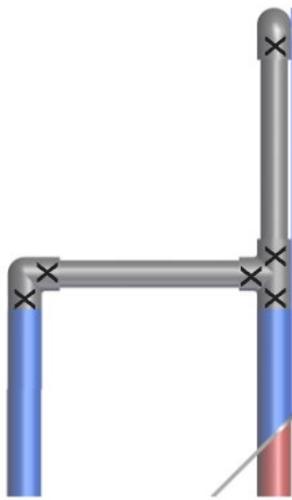
19. With a drill and the included drill bit, drill a hole in the following 18 locations. Only drill half way through each pipe, it's not necessary to drill all the way through to the other side.



**RIGHT VIEW**



**BACK VIEW**

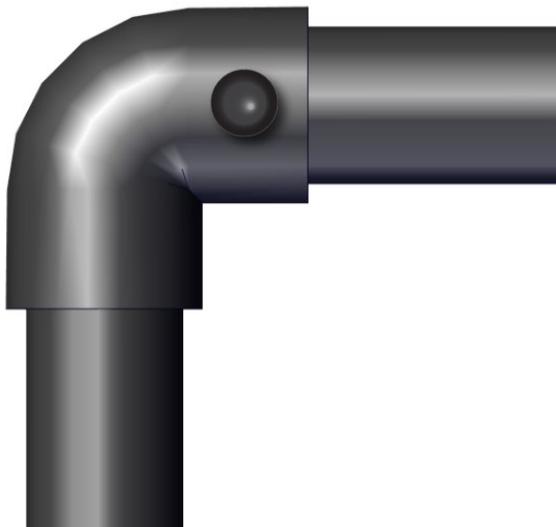


**LEFT VIEW**

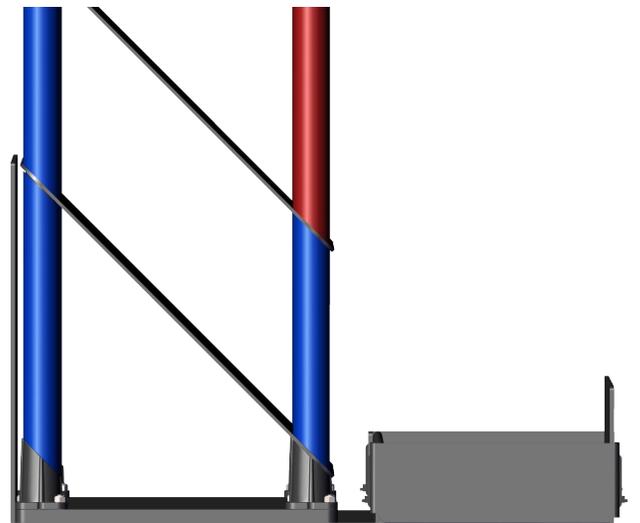
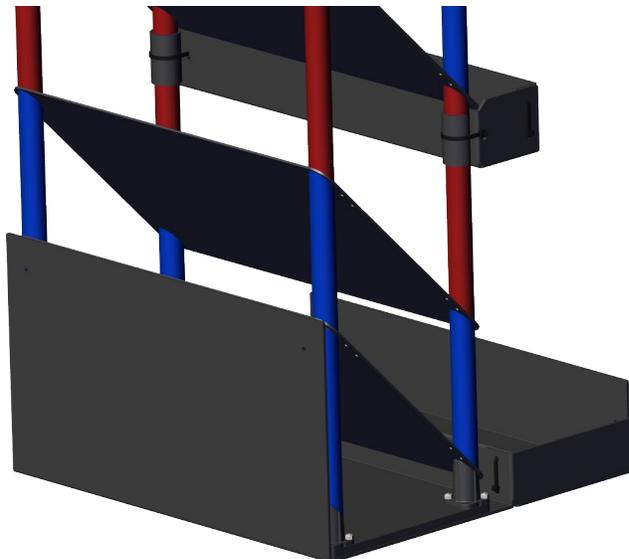


**FRONT VIEW**

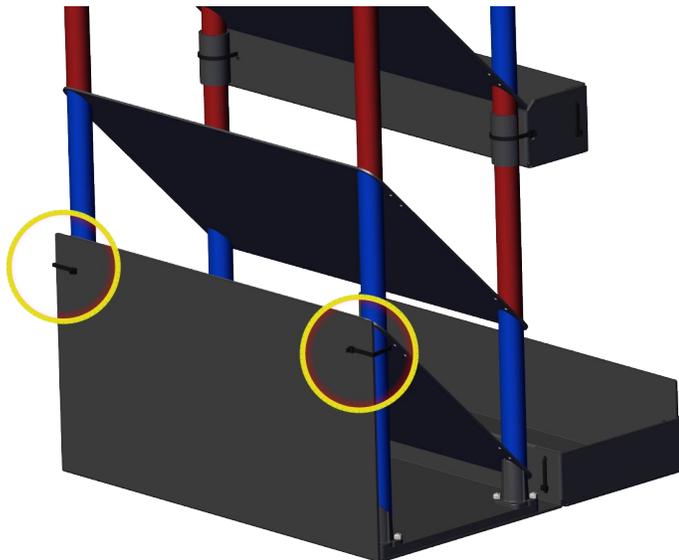
20. Use a plastic rivet to secure the pipes in the drilled locations as shown. These can be pressed in by hand or tapped in with a mallet.



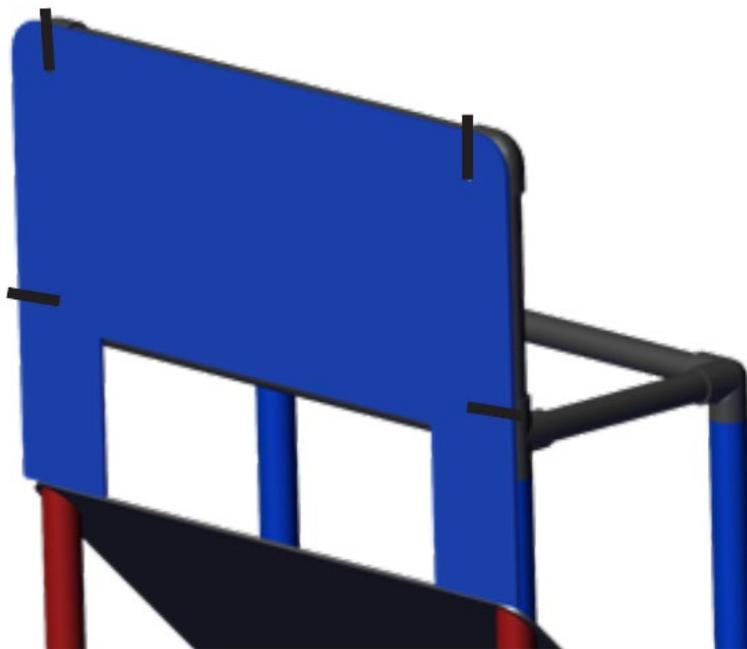
21. Place the Tower Goal on the assembled Corral.



22. Secure the front of the Corral to the front of the Tower Goal Assembly using cable ties.

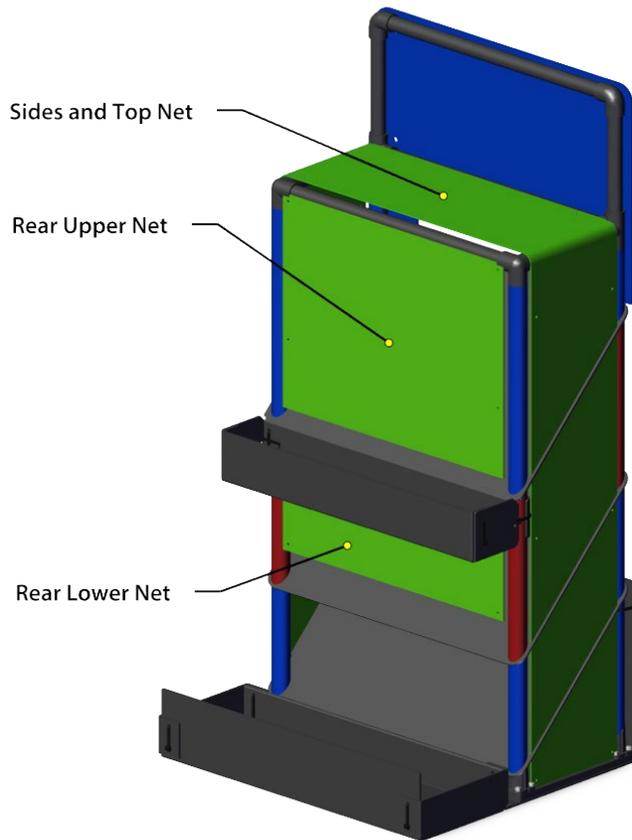


23. Add Backboard to the front top of the Tower Goal Assembly and secure using cable ties..



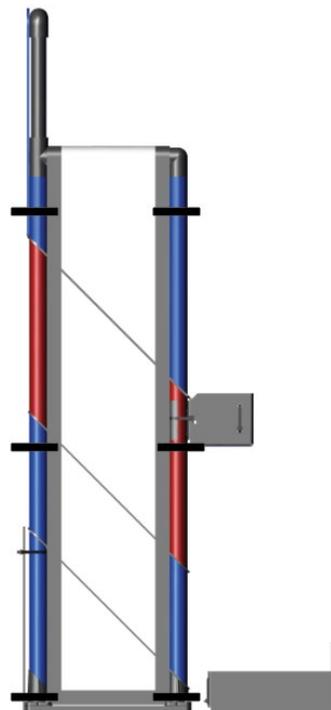
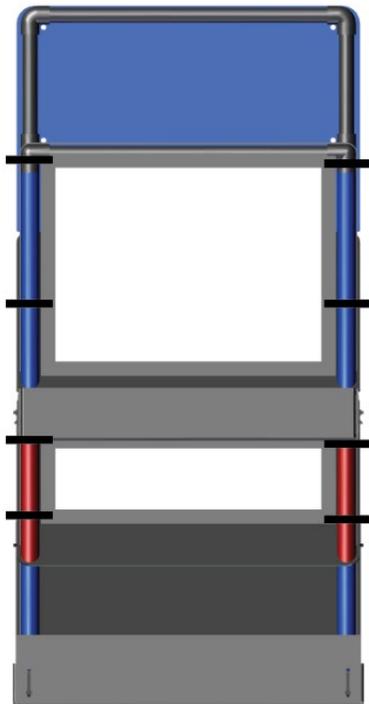
**Note:** On the **blue** goal, the backboard should be blue.  
On the **red** goal, the backboard should be red.

24. The net for the tower goal has 3 sections. Each net has holes along the edge. One cable tie per hole should be used to secure the net to the pipes. Each net should be tight and not have any gaps between the pipes and net.



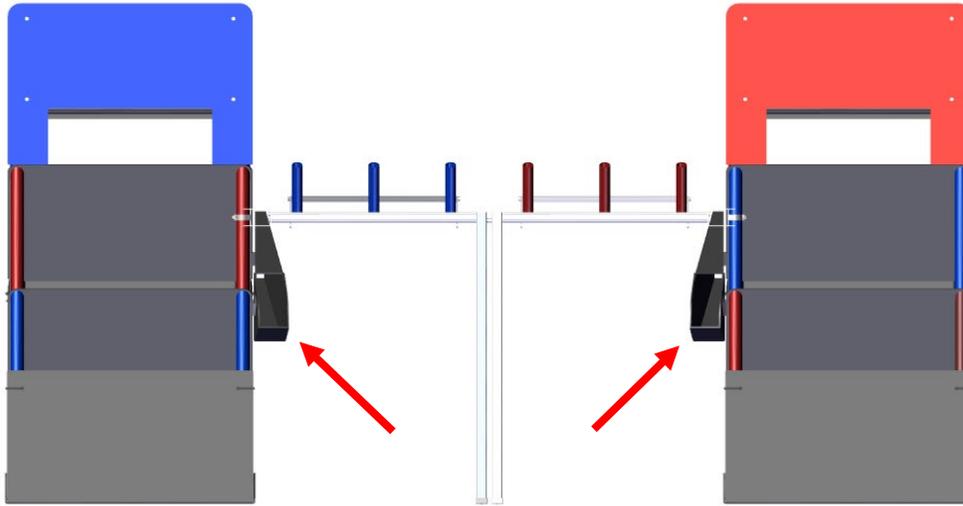
**NOTE:** It's helpful to leave all the cable ties loose, ensure the nets are evenly spaced and then tighten down the cable ties.

Overtightening the cable ties, may result in gaps between the net and the pipes.

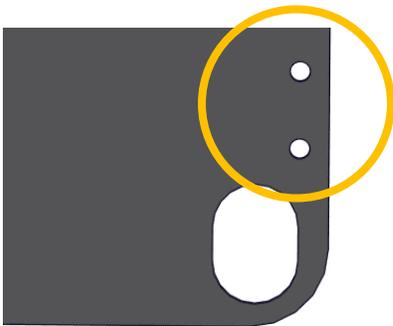


25. Locate the folded Return Rack. The blue Tower Goal will have the rack on the right side, and the Red Tower Goal will have the rack on the left side.

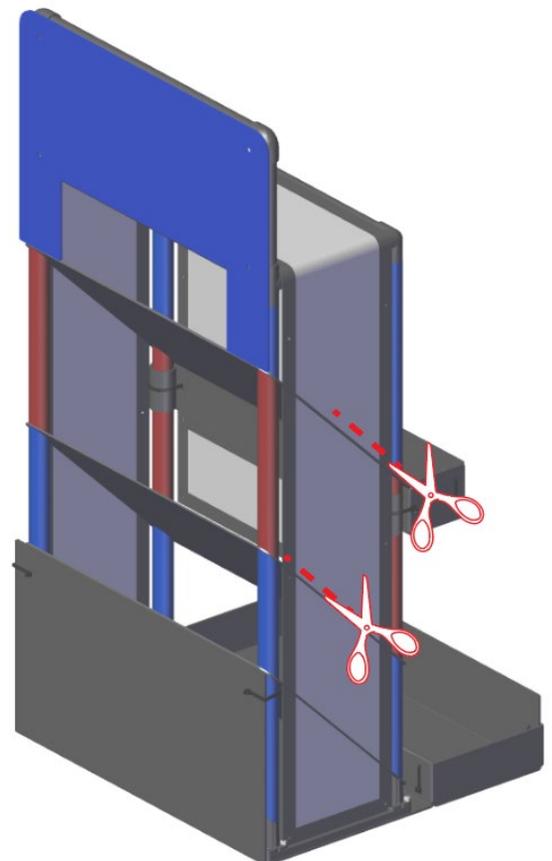
Note: The Power Shot will be assembled in the next section.



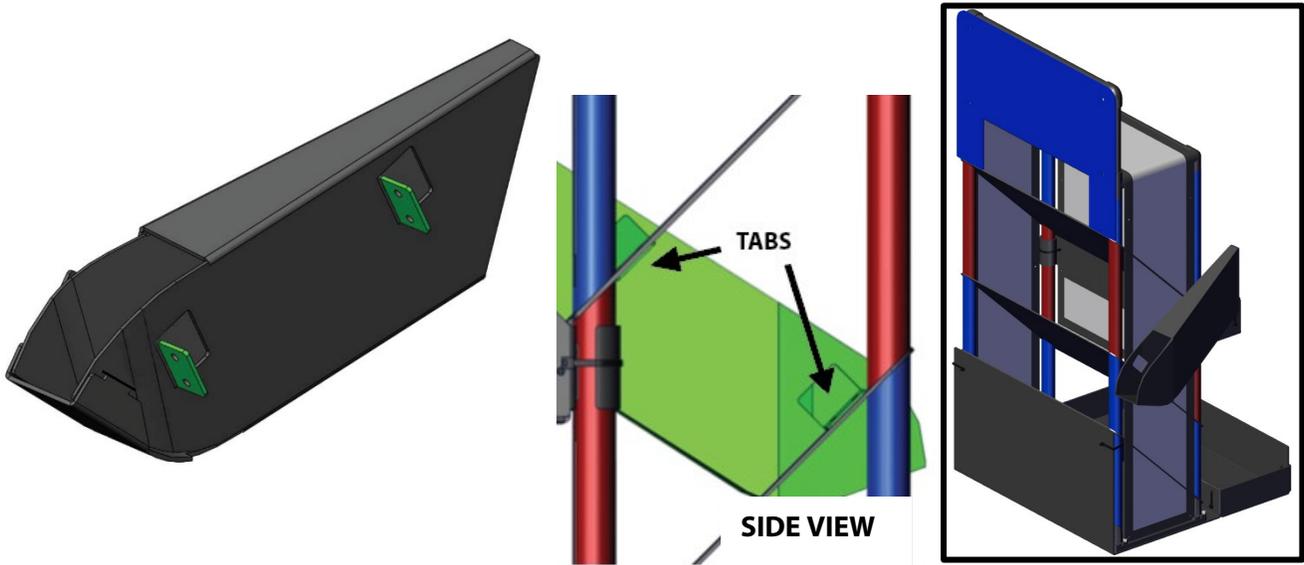
26. Locate the mounting holes in the Goal Floor and the Trough. Using scissors, carefully slice a small hole approximately 2" wide in the net near the mounting holes in the Goal Floor and Trough.



**Note:** On the **blue** goal, the Return Rack will be on the right side.  
On the **red** goal, the Return Rack will be on the left side.

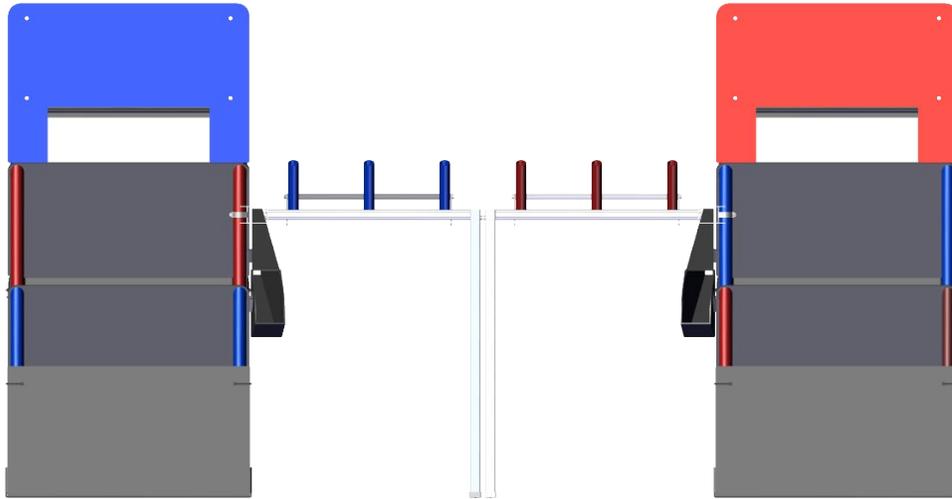


27. Fold out the tabs on the Return Rack. Cable tie through the tabs in the Return Rack and through the holes in the Goal Floor and Trough surfaces. The wide opening should be facing up and to the front. The Return Rack should be secured to the goal by placing the tabs UNDER the upper goal floor and OVER the middle goal floor.



## Power Shot Assembly Instructions

Between the Blue Tower Goal and the Red Tower Goal are the Power Shot Assemblies. The Blue Power Shot Assembly is located to the right of the Blue Goal. The Red Power Shot Assembly is located to the left of the Red Goal. These Assemblies are built as mirror images. Pay close attention to the notes highlighting the differences between the red and blue assemblies.

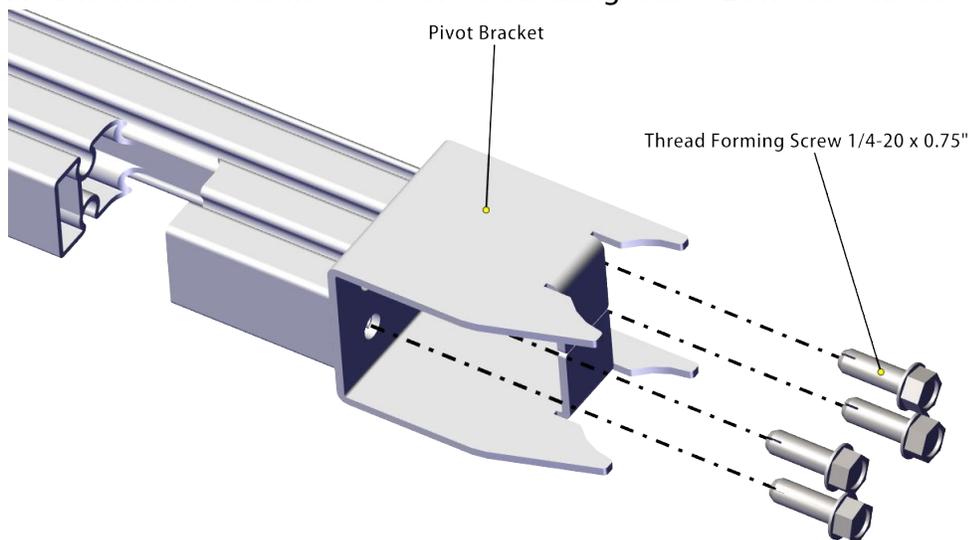


1. Using two Thread Forming Screws  $\frac{1}{4}$ -20 x 0.75", attach the two Reset Struts to the Churro to create the reset assembly. Ensure the two brackets are facing the same direction.



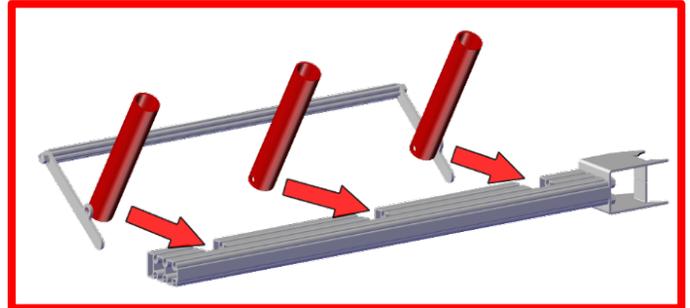
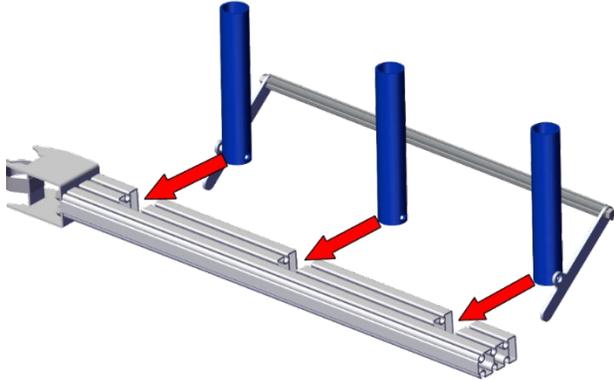
**Note:** These screws are designed to make their own threads in the churro metal. Use a driver to drive the screw and a wrench to hold the churro.

2. Attach the Pivot Bracket to the Cross Bar using four  $\frac{1}{4}$ -20 x 0.75" Thread Forming Screws.

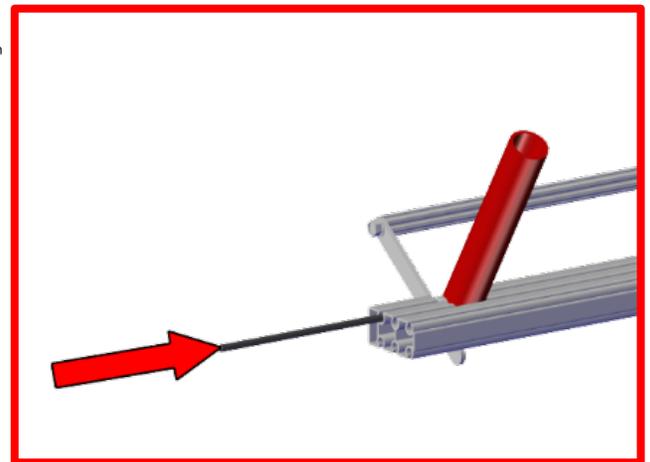
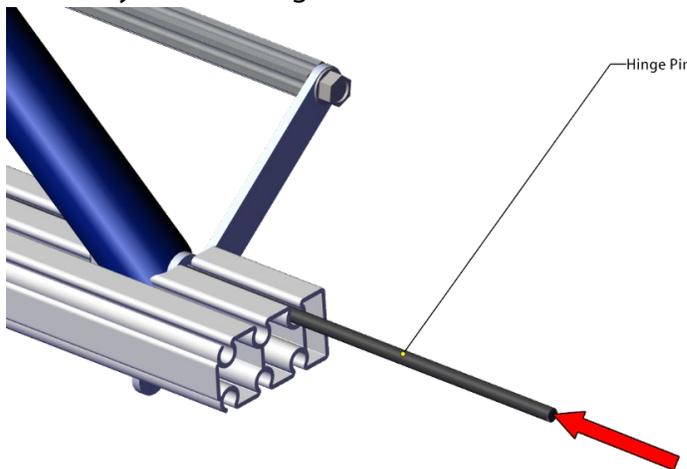


**Note:** These screws are designed to make their own threads in the Cross Bar metal. Use a long handled driver or socket to drive the screw.

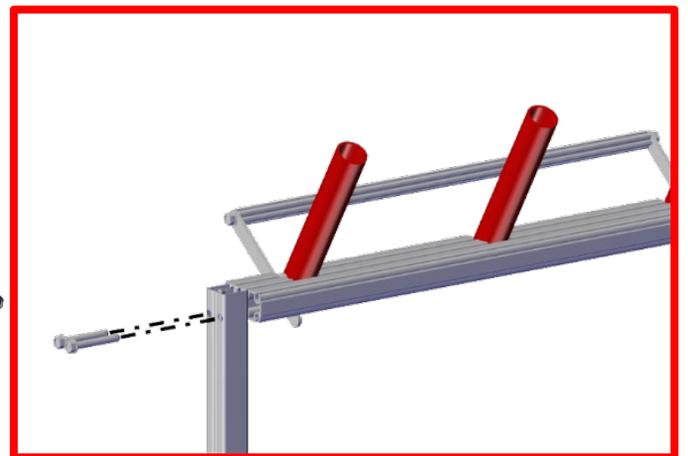
- For the Blue Power Shot Assembly place the Cross Bar so that the bracket is towards the left and the cutouts are towards the rear. For the Red Power Shot Assembly, flip the Cross Bar over so the bracket is on the right when the cutouts are towards the rear.
- The Red Power Shot and the Blue Power Shot are mirror images of each other. Slide the targets and Reset Assembly into the cutouts as shown. The Blue Power Shot has three blue Targets and the Red Power Shot has three Red Targets.



- Slide the Hinge Pin into the top extrusion hole closest to the cutouts and through the Reset Assembly and the Targets.

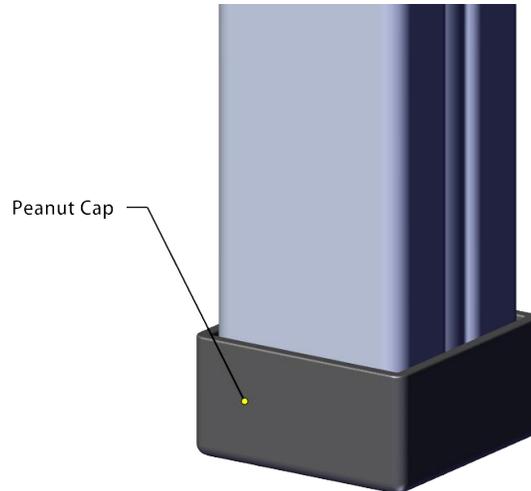


- Attach the Vertical Bar to the two rear most lower holes in the Cross Bar using  $\frac{1}{4}$ -20 x 1.75" Thread Forming Screws.

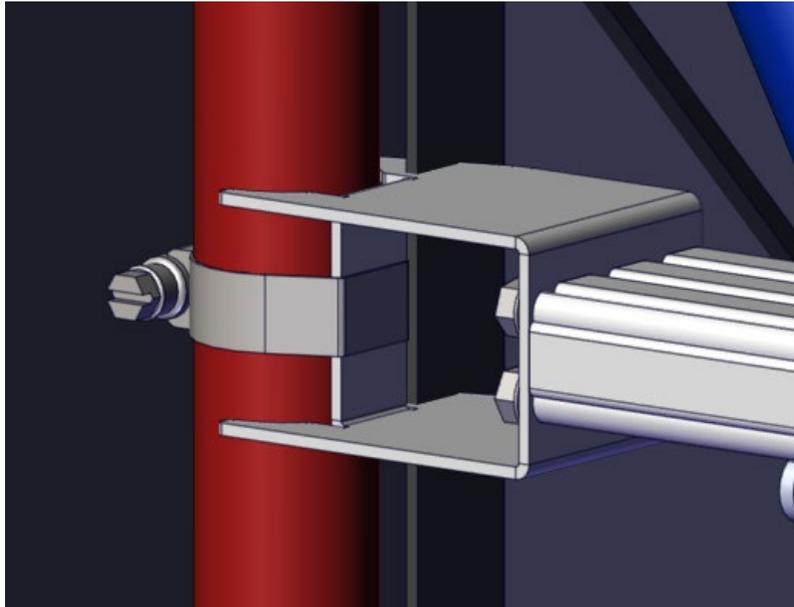


**Note:** These screws are designed to make their own threads in the Cross Bar metal.

7. Add the Peanut Cap to the bottom of the Vertical Bar.



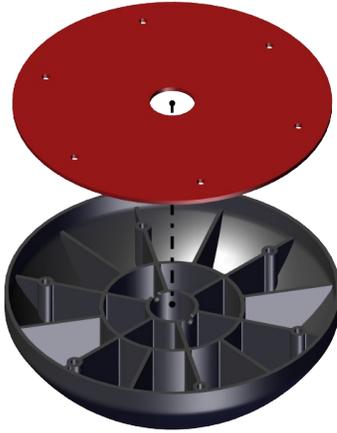
8. Secure the Power Shot Assembly to the Tower Goal using a hose clamp. When installed, the Power Shot Cross Bar should be parallel with the floor and the bottom of the Pivot Bracket should be approximately 27 inches off the floor.



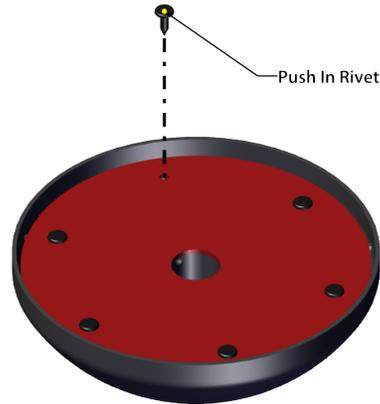
## **Wobble Goal Assembly Instructions**

Each playing field has two Red and two Blue Wobble Goals. Assembly steps are the same for both colors.

1. Align the holes in the shelf with the holes in the base.



2. Insert a plastic rivet into each shelf hole ensuring that the rivet passes through the shelf into the holes in the base. These rivets can be pushed in by hand or be tapped in with the use of a light-duty mallet.



3. Insert the pipe into the center hole in the shelf as far down as it will go. A fully-seated pipe extends approximately 9.5" from the top of the shelf to the top of the pipe.



4. Add an end cap to the end of the pipe.



5. Repeat steps 1-4 to create two red and two blue Wobble Goals per field.

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**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>