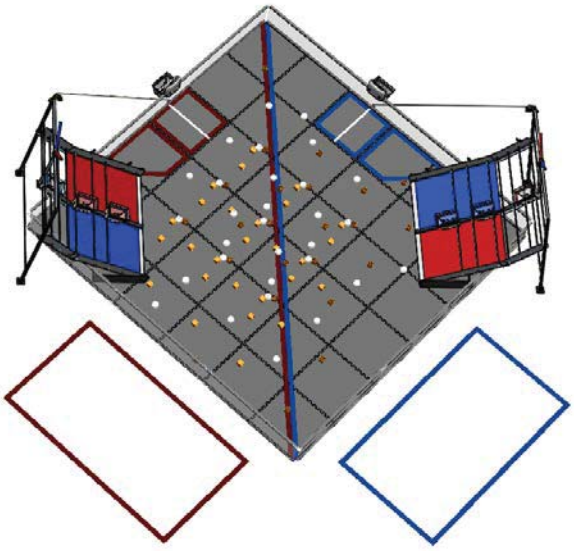
FTC
FIRST® Tech Challenge

AndyMark

FIRST RES-Q℠

Field Assembly Guide

Rev 1.0



AndyMark Field Components for 2015-2016 FIRST® Tech Challenge

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

This guide contains instructions for assembling the Field Elements for the 2015-2016 *FIRST*® Tech Challenge Game *FIRST*® *RES-Q*℠.

REVISION HISTORY		
Rev.	**Date**	**Description**
1.0	8-20-15	Initial Release

ASSEMBLY VIDEOS CAN BE FOUND ON OUR WEBSITE: AndyMark.com/FTCVideo

Videos can also be found on the *How to/Pictures* tab on each AndyMark.com product page.

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

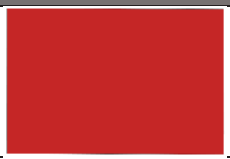
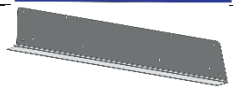
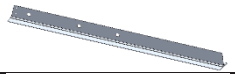
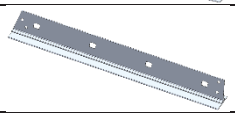
TOOLS NEEDED

Component	QTY	Part Photo
Safety Equipment		
9/16" or 14mm Wrench or Ratchet*	1	
1/2" Wrench or Ratchet*	1	
7/16" Wrench or Ratchet*	1	
3/8" Wrench or Ratchet*	1	
3/16 Hex Key Driver*	1	
#0 Small Philips Screwdriver*	1	
#1 Philips Screwdriver*	1	
File	1	
25' Tape Measure	1	
Rubber Mallet	1	

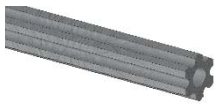
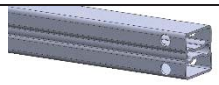
***Tools can be purchased as a tool set from AndyMark part number am-3146: AndyMark.com/am-3146**

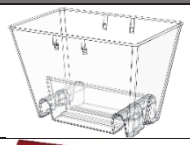
Mountain Parts List (per *Mountain*)

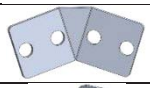
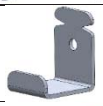
Panel Box

Component	Part #	QTY	Part Photo
Red Panel	am-3095R	1	
Blue Panel	am-3095B	1	
Lower Mountain Side	am-3088_01	2	
Upper Mountain Side	am-3088_02	2	
Lower Mountain Center	am-3089_01	1	
Upper Mountain Center	am-3089_02	1	
Arch Center Divider	am-3094_zone	1	
Fence	am-3096	2	

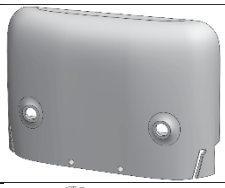
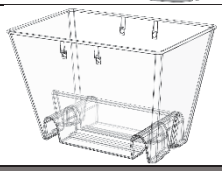
Extrusion Box

Component	Part #	QTY	Part Photo
Churro	am-3022	10	
Arch Support Leg	am-3090_01	2	
Pull-up Bar	am-3090_02	1	

All Clear Signal and Basket Parts			
Component	**Part #**	**QTY**	**Part Photo**
Goal Basket	am-3015	3	
Flagpole RED	am-3120	1	
Flagpole BLUE	am-3121	1	
90 Degree 3/4" PVC Elbow Connector	am-1375	1	
Main Body	am-3130	2	
Outside Connector Plate	am-3094_outside	2	
Inside Connector Plate	am-3094_center	1	
Arch Foot	am-3063	2	
Cable Tie (white or black)	am-1067	10	
¼-20 x 1.25" Eye Bolt	am-1373	2	
Mountain Hardware			
NOTE: TFS = Thread Forming Screws SHCS=Socket Head Cap Screw			
Component	**Part #**	**QTY**	**Part Photo**
1/4-20 x 1.75" TFS	am-1372	10	
1/4-20 x 0.750" TFS	am-1310	14	
1/4-20 x 0.50" SHCS	am-1370	14	
1/4-20 x 1.50" SHCS	am-1131	3	
1/4-20 x 1.25" Eye Bolt	am-1373	1	
1/4-20 Nylock Nut	am-1102	24	
1/4-20 x 1.00" SHCS	am-1374	6	
¼" Washer	am-1027	6	
1/4-20 x 2.00" SHCS	am-1012	3	
NOTE: TFS = Thread Forming Screws SHCS=Socket Head Cap Screw			

Zip Line Parts			
Component	**Part #**	**QTY**	**Part Photo**
Zip Line	am-3125_line	1	**approximately 96”**
Trigger 1 Line		1	**approximately 81”**
Trigger 2 Line		1	**approximately 63”**
Trigger 3 Line		1	**approximately 40”**
Line Runner	am-3125_runner	3	
Trigger	am-3036	3	
Release	am-3024	3	
Zip Line Main Release Mount (MRM)	am-3093_holder	2	
Zip Line Bracket	am-3093_bracket	1	
Zip Line Lower Anchor	am-3125_anchor	1	
Zip Line Figurine	am-3023	3	
Zip Line Hardware			
NOTE: TFS = Thread Forming Screws SHCS=Socket Head Cap Screw			
Component	**Part #**	**QTY**	**Part Photo**
Spring	am-3176	1	
#32 Rubber Band	am-3178	1	
Beam Clamp	am-3177	2	
1/4-20 x 1.250” Thumb Screw	am-1376	1	
1/4-20 x 1.75” TFS	am-1372	1	
1/4-20 x 0.50” SHCS	am-1370	2	
1/4-20 x 1.00” SHCS	am-1374	3	
1/4-20 x 3.00” SHCS	am-1030	1	
1/4-20 Nylock Nut	am-1102	7	
NOTE: TFS = Thread Forming Screws SHCS=Socket Head Cap Screw			

Rescue Beacon Parts

Component	Part #	QTY	Part Photo
Electronics Board	ip-3011_electronics	1	
Battery Holder	ip-3011_batt	1	
Button	am-3011_switch	3	
Wire	am-3011_wire	6	
Rescue Beacon Housing	am-3011_housing	2	
Shelter Basket	am-3015	1	

Rescue Beacon Hardware

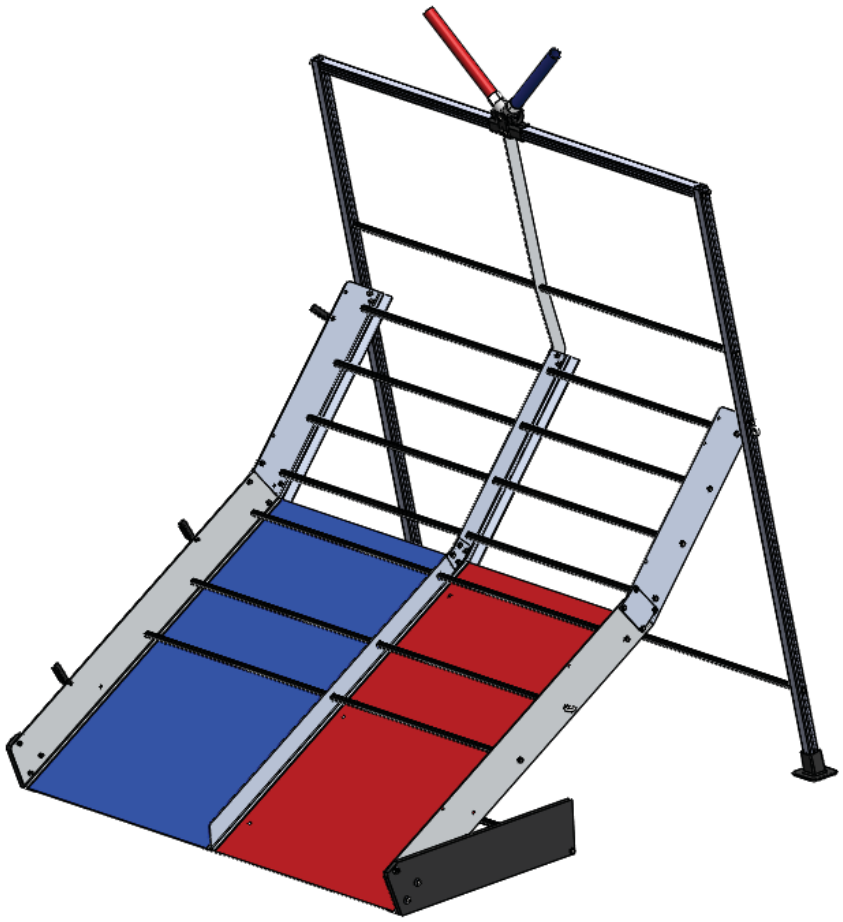
BHCS=Button Head Cap Screw SHCS=Socket Head Cap Screw

1/4-20 x 1.50" SHCS	am-1131	2	
10-32 X 0.375" BHCS Phillips	am-1028	2	
¼-20 Nylock Nut	am-1102	2	
¼-20 x 1.25 BHCS	am-1183	2	

BHCS=Button Head Cap Screw SHCS=Socket Head Cap Screw

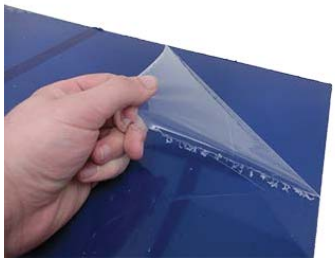
Mountain Assembly Instructions

The *Mountain* is made up of multiple parts that can be disassembled for transportation and storage. The base assembly instructions are for a *Mountain* located on the Blue Alliance Side. Differences in assembly instructions for *Mountain* located on the Red Alliance Side of the playing field are noted when appropriate.



PART 1: Lower Mountain Assembly

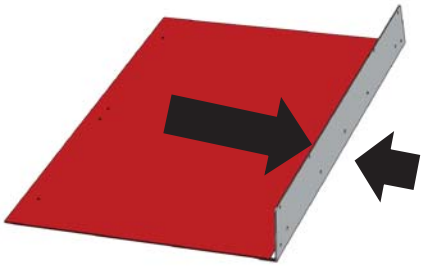
Step 1-1: Remove the white or clear protective film from both sides of both the red and blue panels.



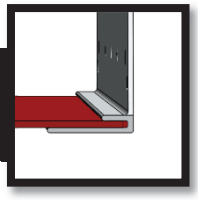
Use caution when using a rubber mallet not to damage the edges or corners.

Always place the panel edges on the floor and hit the extrusion with the mallet.

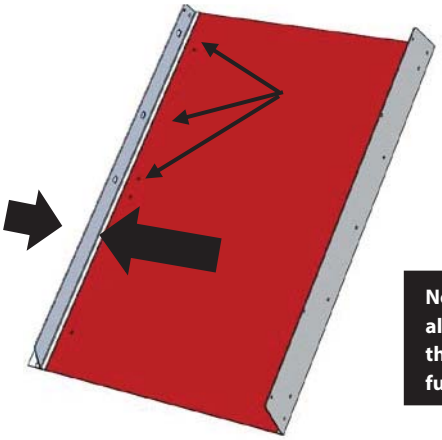
Step 1-2: Align the bottom of the *Red Panel* with the bottom of the L-shaped *Lower Mountain Side*. Press the long edge **without holes** of the *Red Panel* into the *Lower Mountain Side* using a rubber mallet. Do not use a traditional hammer, it will damage the panel!



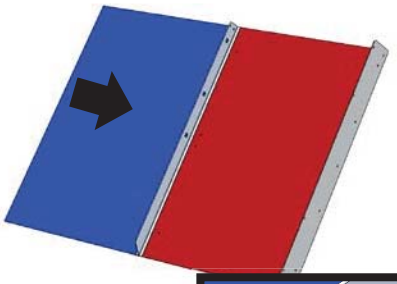
Note: Be sure the panel is fully seated within the slot.



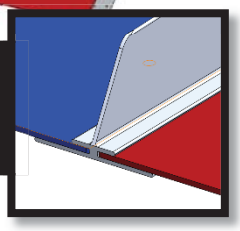
Step 1-3: Add the T-shaped *Lower Mountain Center* onto the opposite side of the *Red Panel*. Be sure the **square holes** on the *Lower Mountain Center* are located on the upper left corner and the bottom of the panel lines up with the *Lower Mountain Center*.



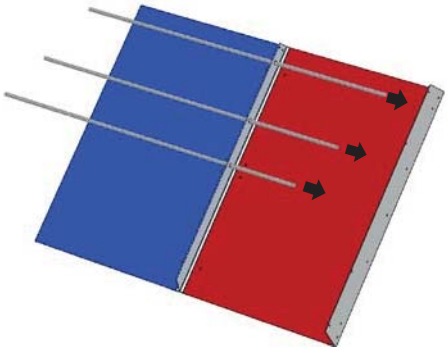
Step 1-4: Add the *Blue Panel* to the other side of the *Lower Mountain Center*. The side with the holes should be adjacent to the *Lower Mountain Center*.



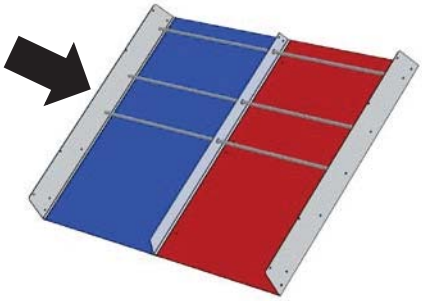
Note: Be sure the panels are aligned with the bottom of the center and the panel is fully seated in the slot.



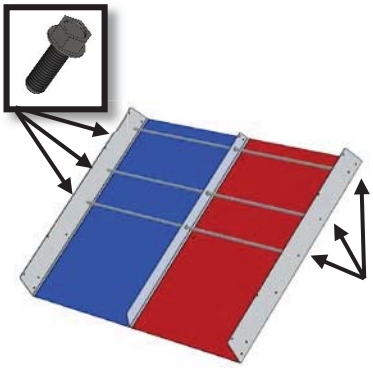
Step 1-5: Slide three *Churros* through the square holes in the *Lower Mountain Center*.



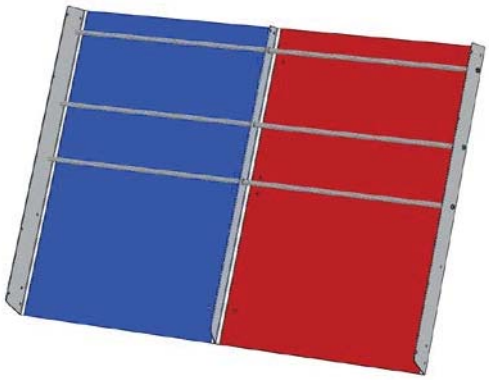
Step 1-6: Press the other *Lower Mountain Side* onto the *Blue Panel.* Ensure the holes align with the *Churros*.



Step 1-7: Using six *¼-20 x 0.750" TFS* attach the three *Churros* at both ends. The screws will form the thread in the end of the *Churro*.

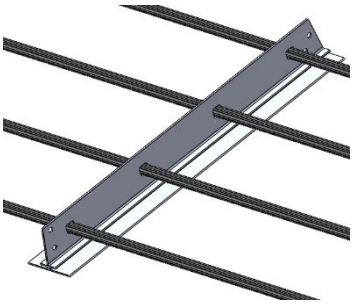


Step 1-8: The *Lower Mountain* is now complete! Build this structure for a *Mountain* on either side of the field.

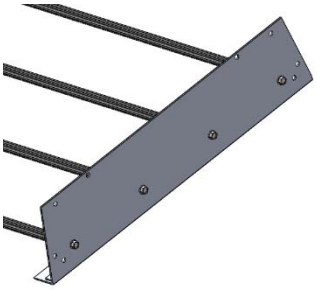


PART 2: Upper Mountain Assembly

Step 2-1: Insert four *Churros* into the square holes on the *Upper Mountain Center*.

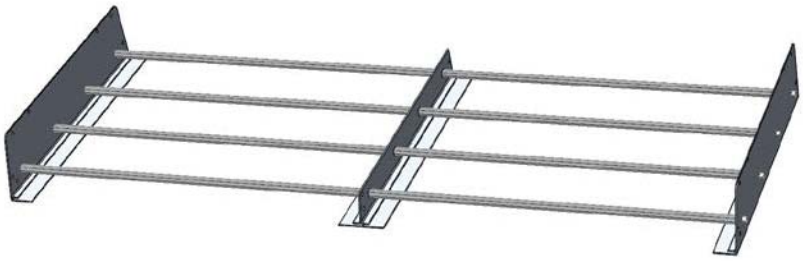


Step 2-2: Add the *Upper Mountain Sides* with four *¼-20 x 0.750" TFS* each. Keep the screws loose for now. See the next diagram for the orientation of these parts.



Step 2-3: Match the orientation of each part with the diagram below. Use a ½" wrench to keep each *Churro* from twisting while tightening the screws. Be careful not to overtighten the screws and twist the entire assembly, when finished the *Upper Mountain* should lie flat.

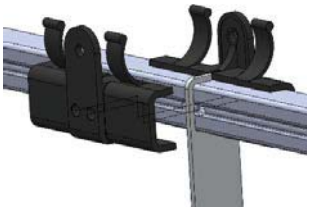
Step 2-4: Tighten all the screws in the assembly. The *Upper Mountain* is now complete! Build this structure for a *Mountain* on either side of the field.



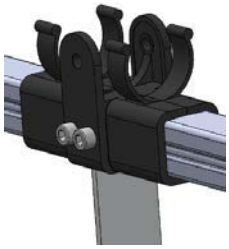
PART 3: Mountain Arch Assembly

Step 3-1: Slide the *Arch Center Divider* to the center of the *Pull-up Bar*. The kickout at the bottom will point towards the *Upper Mountain*.

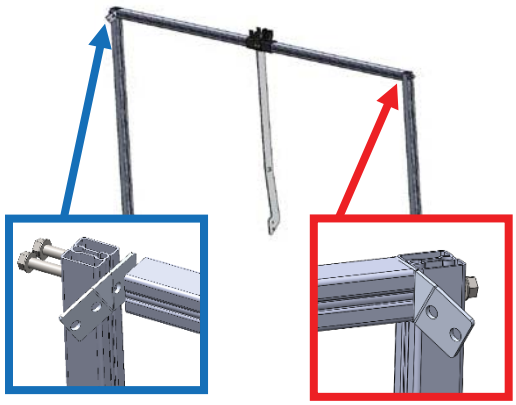
Step 3-2: Add the two *Main Body* halves. Be sure to line up the holes with those in the center of the *Pull-up Bar*.



Step 3-3: Secure the *Main Body* with two *¼-20 x 2.00" SHCS* and *¼-20 Nylock Nuts*.

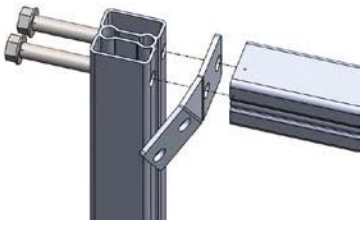


Step 3-4: Each *Mountain* has **ONE** *Zip Line Bracket*. The *Blue Mountain* has the bracket on the blue panel side. The *Red Mountain* has the bracket on the red ramp side.

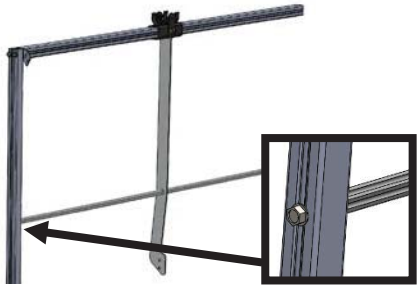


Blue Mountain Location **Red Mountain Location**

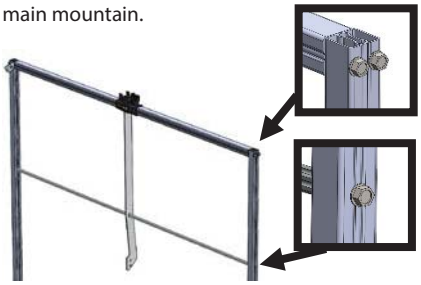
Step 3-5: With two *¼-20 x 1.75" TFS* add ONE of the *Arch Support Legs* and *Zip Line Bracket* to the end of the *Pull-up Bar*. The bracket should slope downward and away from the center of the *Pull-up Bar*.



Step 3-6: Slide a *Churro* through the hex hole in the *Arch Center Divider* and secure it to the *Arch Support Leg* with a *¼-20 x 1.75" TFS*. Use a ½" wrench to keep the *Churro* from twisting.

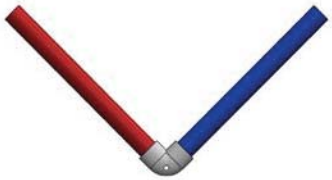


Step 3-7: Using three *¼-20 x 1.750" Thread Forming Screw* attach the second *Arch Support Leg* to the assembly. Keep these screws loose until you bolt the arch to the main mountain.



Step 3-8: Add a *Churro* to the bottom hole in the *Arch Support Legs* with two *¼-20 x 1.75" TFS*. Keep these screws loose until you bolt the arch to the main Mountain. Use a 1/2" wrench to keep the *Churro* from spinning while tightening the screws.

Step 3-9: Insert one *Flagpole RED* and one *Flagpole BLUE* into the 90° connector. This is standard 3/4" PVC pipe if you need to replace it at any time.

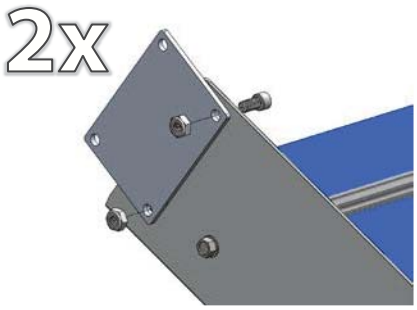


Step 3-10: Use a *¼-20 x 2.00" SHCS* and a *¼-20" Nylock Nut* to attach the *90 Degree Connector* to the *Main Body*. The *Flagpole RED* should be on the left side, as viewed from inside the field. Tighten the screw until there are no gaps and then turn an additional ½ turn.

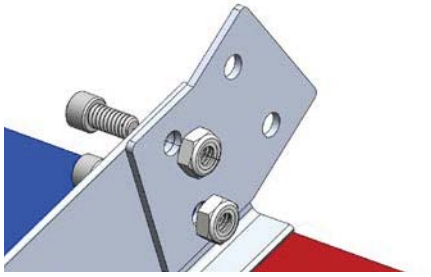
Step 3-11: The *Mountain Arch* is now complete!

PART 4: Mountain Assembly

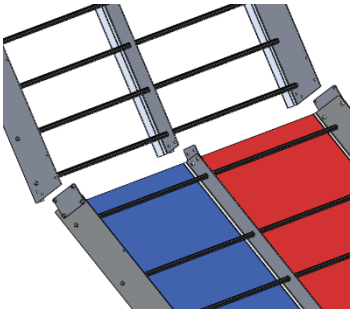
Step 4-1: Attach an *Outside Connector Plate* to the top of each *Lower Mountain Side* with two *¼-20 x 0.50"* screws and *¼-20 Nylock Nuts*. The plate should be on the outside of the *Mountain*.



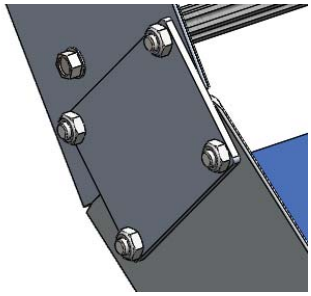
Step 4-2: Attach the *Inside Connector Plate* to the top of *the Lower Center Fence* with two *¼-20 x 0.500"* screws and *¼-20 Nylock Nuts*. The plate should sit on the red panel side of the *Lower Mountain Center*.



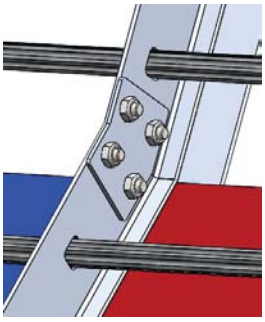
Step 4-3: Align the *Upper Mountain* with the *Connector Plates*. Verify that the *Upper Mountain Center* is on the correct side of the *Inside Connector Plate.*



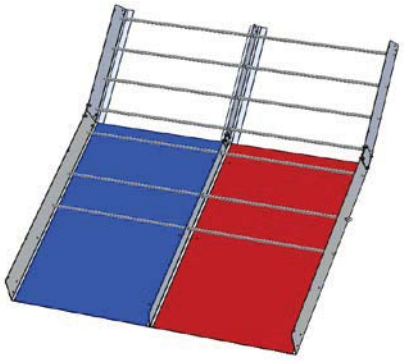
Step 4-4: Attach the *Outside Connector Plates* to the *Upper Mountain Side* using four *¼-20 x 0.50" screws* and *¼-20 Nylock Nuts*.



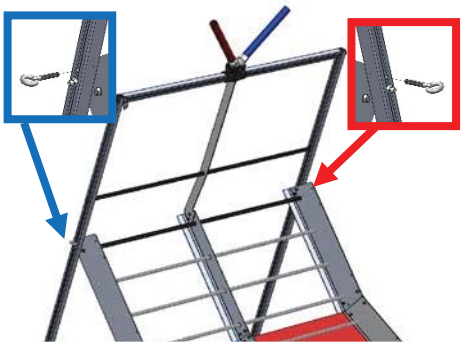
Step 4-5: Attach the *Inside Connector Plate* to the *Upper Mountain Center* using two *¼-20 x 0.50" screws* and *¼-20 Nylock Nuts*.



Step 4-6: The *Mountain Ramp* is complete and can now be added to the *Mountain Arch*.

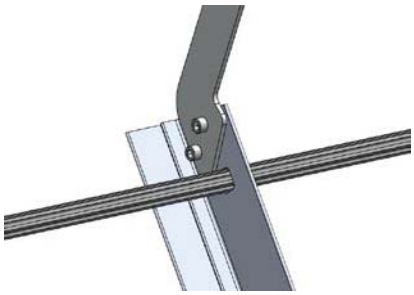


Step 4-7: Using three *¼-20 x 1.50"*, the *Eye Bolt*, and four *Nylock Nuts* join the *Pull-Up Bar* to the *Mountain Ramps*. The *Eye Bolt* goes in the upper hole near the *Blue Panel* on the *Blue Mountain* and the *Red Panel* on the *Red Mountain*.



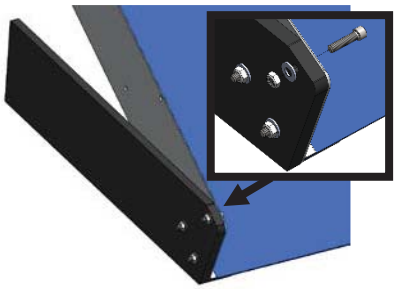
Step 4-8: Attach the *Arch Center Divider* to the *Upper Mountain Center* with two *¼-20 x 0.500"* screws and *¼-20 x Nylock Nuts*.

You can now tighten all the screws in the assembly.

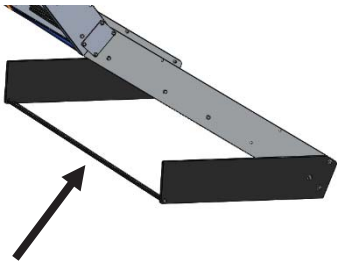


Step 4-9: Press the *Arch Feet* onto the bottoms of the *Arch Support Legs*. Be sure the bottoms of the feet sit flat against the floor.

Step 4-10: Add the two *Fences* with three *¼-20 x 1.00"* screws, *¼" washers* and *¼-20 Nylock Nuts* per *Fence*. Be sure to place the *washers* on the outside of the *Fences*.



Step 4-11: Add the last *Churro* to the bottom hole on the *Fences* with two *¼-20 x 1.75" TFS*. Use a ½" wrench to keep the *Churro* from twisting.

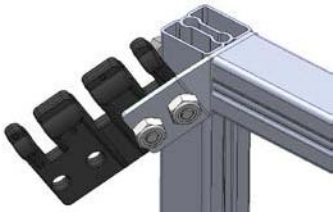


Step 4-12: The *Mountain Assembly* is now complete!

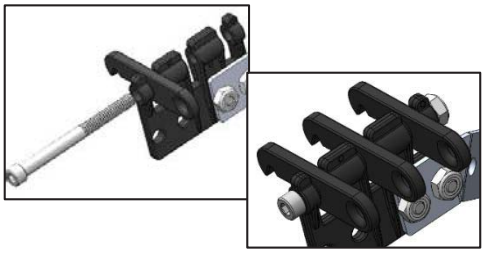
PART 5: Zip Line Trigger Assembly

Step 5-1: Press together two *Zip Line Main Release Mount (MRM)* halves.

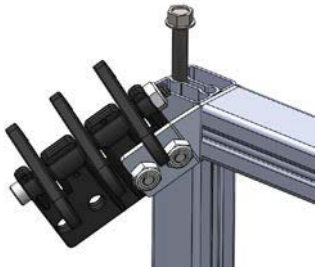
Step 5-2: Add the *MRM* halves to the *Bracket* on the *Pull-up Bar* and secure with two *¼-20 x 0.50"* screws and *¼-20 x Nylock Nuts*.



Step 5-3: Add the three *Releases*, one at a time using a *¼-20 x 3.00"* screw and *¼-20 Nylock Nut* as a pivot axle. The hole-side of the *Releases* should face towards the ramp. Tighten the screw until there is no gap between the parts and then turn the screw another 1/4 turn.

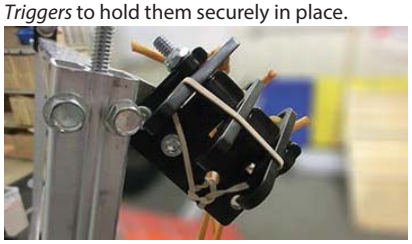


Step 5-4: Add a *¼-20 x 1.75" TFS* to the outside hole on the top of the *Arch Support Leg* as the top endpoint of the *Zip Line* cord. You should leave about an inch of the screw out of the square tube.

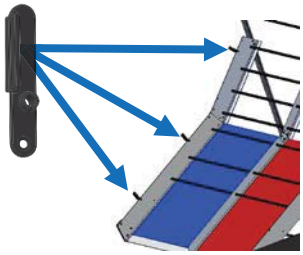


Step 5-5: Add the *Rubber Band* by looping through the bottom hole on the *MRM*.

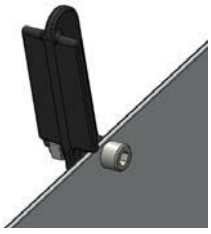
Step 5-6: The *Rubber Band* sits on top of the *Triggers* to hold them securely in place.



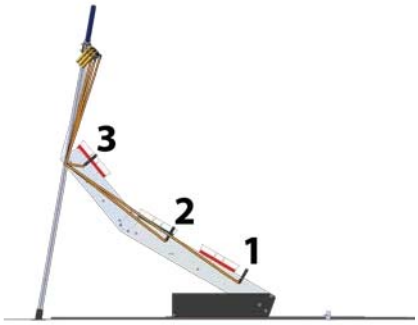
Step 5-7: Attach *Triggers* to the three holes closest to the edge on the *Mountain Side*. The *Blue Mountain* will have triggers on the blue side of the *Mountain*.



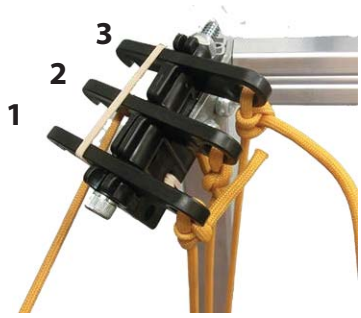
Step 5-8: Use a *¼-20 x 1.00" SHCS* and *¼-20 x Nylock Nut* as a pivot axle for the *Zip Line Triggers*. Bolt them on so that the large target pad faces the bottom of the *Mountain*. The screw should be tightened so that there is no gap between the parts. The *Triggers* should move freely



Step 5-9: The *Trigger Lines* are tied from each *Release* to each *Trigger*. Each cord is a different length. The longest cord is used for the *Zip Line*. The other 3 cords are used for the *Trigger Lines*.



Step 5-10: Tie each *Trigger Line* to each *Release*. The shortest cord goes on the *Release* closest to the *Bracket* (3).



Step 5-11: Run each of the *Trigger Lines* from *Releases* through the *Eye Bolt* on the *Arch Support Leg* to each of the *Triggers*.

Step 5-12: Run the end of a *Trigger Line* through a *Line Runner* as shown.

Step 5-13: Run the end of the *Line* through the hole on the *Trigger* as shown.

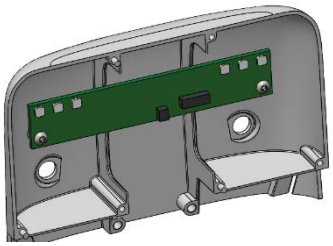
Step 5-14: Run the end of the *Line* between the cord and the *Line Runner* as shown.

Step 5-15: Wrap the *Line* around and underneath the *Trigger Line* as shown.

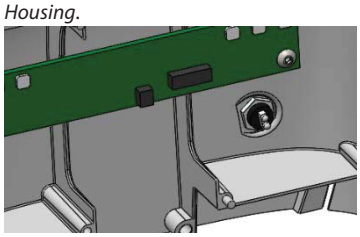
Step 5-16: Pull the *Line* tight to form a knot. Repeat steps 5-12 to 5-16 for the other *Triggers*.

PART 6: Rescue Beacon Assembly

Step 6-1: Mount the *Electronics Board* to the *Rescue Beacon Housing* with *2x 10-32 x 0.375" BHCS*.



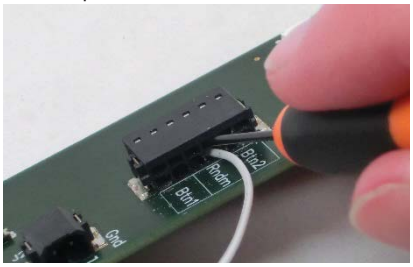
Step 6-2: Remove the nut off the *Button* using a 9/16" wrench (or 14mm wrench) and use it to securely attach one *Button* to the right hole in the *Housing* half. Be sure to securely tighten the nut on the inside of the *Housing*.



Step 6-3: The *Wires* should already have the ends scored. Ensure that the metal is fully exposed by pulling off any insulation left on the *Wire* ends.

Step 6-4: Using a small screwdriver secure one *Wire* to each of the terminals on the *Button*. Be sure the ends of the *Wires* don't touch each other.

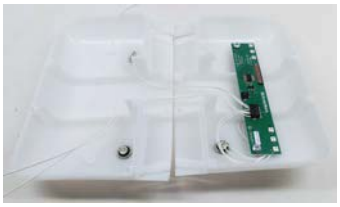
Step 6-5: Ensure there is no insulation on the end of the *Wire* and that the metal is exposed. Carefully insert each *Wire* into a lower hole in the zone labeled "Rndm". The orientation of the *Wires* does not matter. A small screwdriver may be needed in the top hole to open the bottom hole for the *Wire*.



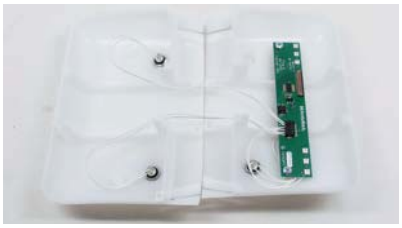
Step 6-6: Add two *Buttons* to the second *Housing* half, be sure to securely tighten the nut on the inside of the *Housing*.

Step 6-7: Using the small screwdriver add a *Wire* to each terminal on the two *Buttons*. Ensure the *Wire* ends do not touch each other.

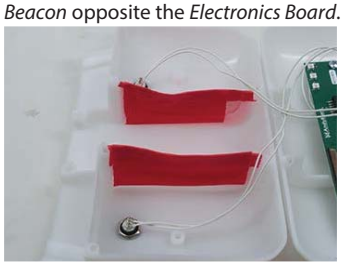
Step 6-8: Push the other ends of the *Wires* into the lower holes on the *Electronics Board* connector in the slots labeled "Btn 1" and "Btn 2". When in the orientation below, the upper *Button* should be wired to "Btn 1" and the lower *Button* should be wired to "Btn 2"



Step 6-9: With the wiring complete gently tug each *Wire* to verify they are all securely fastened. When wired, the assembly should look like this:

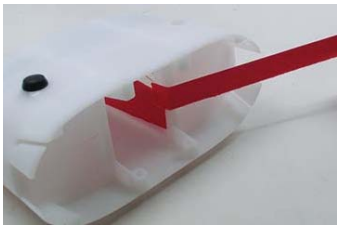


Step 6-10: To make the LEDs most visible add two strips of tape on each ridge on the side of the *Rescue Beacon* opposite the *Electronics Board*.



Step 6-11: Align the pins from the two *Housings* and press them together. Be careful not to pinch the *Wires*.

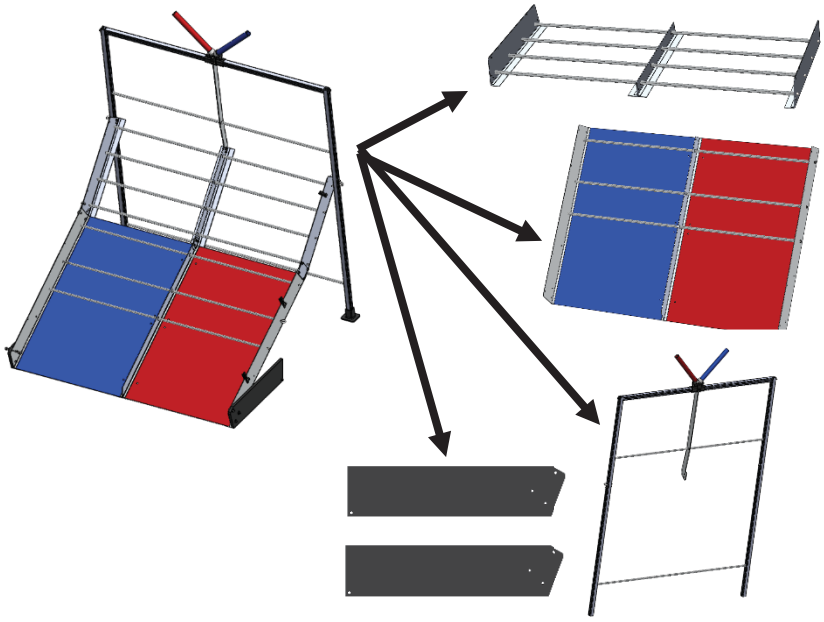
Step 6-12: To keep the halves together, add a 1" strip of gaffers tape or similar tape to the *Rescue Beacon*. Starting on the inside edge as shown, tape along the bottom seam. The *Rescue Beacon* on the Red Side of the field should have red tape. The *Rescue Beacon* on blue side should have blue tape.



Step 6-13: Add a 1" strip of tape to the top seam of the *Rescue Beacon*.

Step 6-14 Continue the tape line across the remaining bottom seam of the *Rescue Beacon*. The *Rescue Beacon* is now complete.

Note: The *Mountain* can be split into multiple assemblies for transport. We recommend removing the *Fences*, and splitting the *Lower Mountain, Upper Mountain*, and *Mountain Arch* for transport using the steps in "Part 4" of this guide.



Note: All leftover parts and hardware are used during full field setup. Make sure to keep all parts.

Additional instructions on the following can be found in the Field Setup Guide Available on AndyMark.com/FTC

- Setting up the Floor and Field Perimeter
- Instructions for Field Layout and Orientation
- Zip Line Installation
- Mountain Setup
- Taping Diagrams

More resources on this year's challenge can be found on **http://www.usfirst.org/roboticsprograms/ftc**