



**REEFSCAPE**

PRESENTED BY Gene Haas Foundation

**FIRST® DIVE<sup>SM</sup>**  
presented by Qualcomm

[firstinspires.org/robotics/frc](http://firstinspires.org/robotics/frc)

2025 *FIRST*® Robotics Competition

# Field Manual

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## 1 General Notes

This section contains step-by-step guidance on building the 2025 playing field. Also included are some cautions and general reminders about FTA tasks and the Competition components. Before you begin, you are urged to review these instructions completely and get comfortable with the tasks at hand.

Safety and other important notes are highlighted in red.

### 1.1 Field Build Volunteers

Depending on the venue, you may receive help from either contract or union labor and/or from a dedicated field build volunteer group. Some will have experience from prior competitions; others will be seeing the equipment for the first time.

Due to the nature of the job, the builders should be physically able individuals capable of lifting up to 50 lbs. above shoulder height and should be aware of general safety. The FTA and Field Supervisor will probably want to set up “build teams” to each major section of the field, as detailed in Section 1.4 Assembly Teams.

### 1.2 Field Build Assembly

*FIRST* strives to deliver playing Fields that are identical at all events. These Fields travel, are unpacked, used, and repacked repeatedly. While the Field is in your care, it is your responsibility to ensure that it is treated in a manner consistent with the demands of multiple uses; protect it, keep it organized, and keep it complete.

*FIRST* requires the cooperation of all to not modify Field components without first contacting *FIRST* Engineering for approval. This includes adding stickers, writing, tape, cable tie mounts, hook and loop strips, etc.

Unless specifically instructed by *FIRST*:

- Do not remove any button head bolts or rivets from any Field structure.
- Do not drill, bend, straighten, shim, or cut Field components.
- Unless you are SURE that hook, loop, or cable tie points are missing, do not add any.

Hex head and Phillips head bolts are intended to be removed during tear down for shipping purposes, but any bolt that requires a hex key is intended to stay together. Once a field has been built once, it is likely that everything will fit nicely. If it does not fit, it is likely in the wrong position, location, or orientation. Do not force anything together unless permission is given by *FIRST* staff.

## 1.3 Hand Tools

A minimum number of tools are needed to assemble the 2025 field. All the necessary tools are provided in the Tools Road Case – Case 8. You can expect to use 100' tape measures, knives, scissors, wire cutters, mallets, shears, wrenches, screwdrivers and a chalk line. You will also use cable ties to attach cables and plastic sheets to the Field framework.

**IMPORTANT:** There are three different kinds of cable ties – high, medium, and low strength. High strength cable ties are used to hold plastic sheets to the Guardrail. High and medium strength cable ties are used for assembling field components. Low-strength cable ties are used to dress Field wiring and cables.

## 1.4 Assembly Teams

Setting up volunteer teams to manage the various tasks required to build the Field can increase efficiency, leading to quicker, more effective build times. The FTA and the Field Supervisor should discuss the teams needed, the tasks involved, and the ideal number of people per team.

## 1.5 Electronics: General Reminders & Notes

- The Field Electronics installation happens in the following categories:
  - The Scoring Table
  - Field ends also known as Alliance Stations
  - Referee Panels
  - Game specifics – Processor
  - Game Specifics - Barge

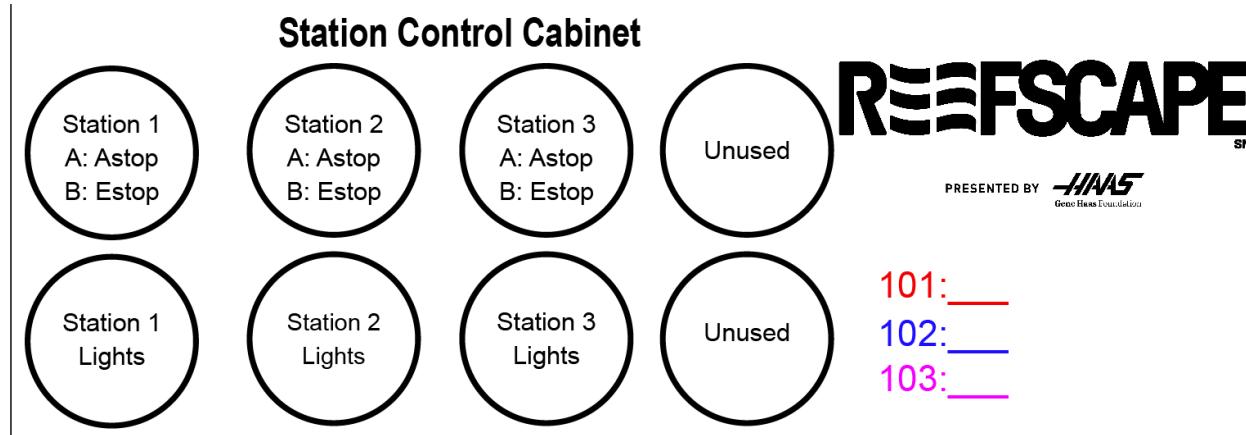
*FIRST Engineering asks that you do NOT add or remove any markings (sharpie, label with gaff tape, etc.) on items (including cables!!) without expressed permission from FIRST Engineering. Please discuss any actions with your Support staff member beforehand.*
- Testing has been extensive to ensure quick response through the industrial network of the FMS. Allowing access to these connections could have detrimental effects on field performance. The only people permitted to connect to the FMS network are:
  - FTA
  - Announcers
  - Official FIRST webcasts using Case 35
  - If Internet access is requested at the Scoring Table for webcasting the event, judges, DJ's, etc. contact FMS Support for assistance.
- Be alert for additional power or camera cabling running along the field border supporting the A/V crew and confirm that the cable will not interfere with the gates and is safely stowed along the side of the field.

- Avoid network loops. Ensure to not cross connect (i.e. loop) any network cables (e.g. venue Ethernet, SCCs, etc.) into the Ethernet switch, as you may cause a network error.
- The SCCs and Field AP Ethernet must plug into their specified ports on Case 33.

Most of the connectors are made of plastic and will break if stepped on. When installing or removing, hang the cable connectors on the field end or other places where they are not prone to damage

- Electronics case information:
  - Case 6 - Field End Electronics: includes Station Control Cabinets (SCCs), LED Display units, Team Lights, E-Stops, A-Stops, and field electrical cables.
  - Case 7 - Scoring System: includes power strips, printer, monitors, keyboards, mice, Field Access Point (AP), Pit Display laptop, Audience Display laptop, WPA/Radio Kiosk laptop, FTA laptop, other game specific hardware, and miscellaneous cables.
  - Case 19 – spares, FTA Toolbox (outlet tester, multimeter, USB-to-Ethernet adapter, etc.), consumable Driver Station Ethernet cables, Light strings
  - Case 33 - Scorpion: Includes primary server, backup server, field router, UPS, Arena Signal Light, and Arena E-stop.
  - Case 34: touchscreens, stands, and associated cabling
  - Case 35: Webcast (See Webcast instructions for help with the Webcast unit) - Regional Trucks only
- Equipment decals:

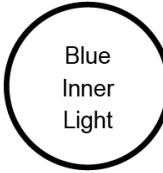
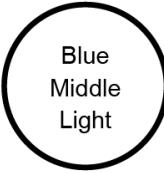
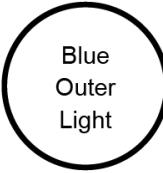
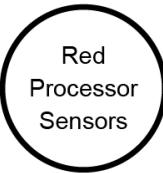
SCC: (6.5" x 2.25")



Red Smart IO (6.5" x 1.5")

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**Red Smart IO**

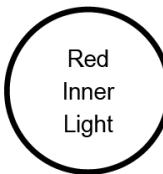
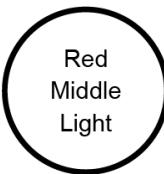
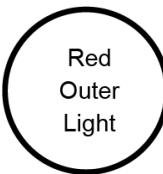
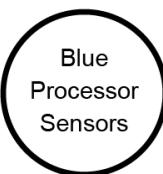


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Blue Smart IO (6.5" x 1.5")

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**Blue Smart IO**

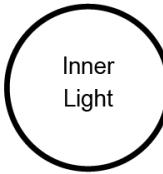
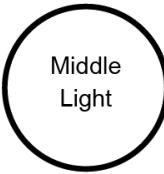
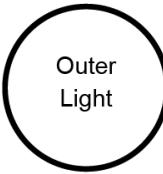
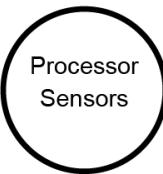


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Aux Smart IO (6.5" x 1.5")

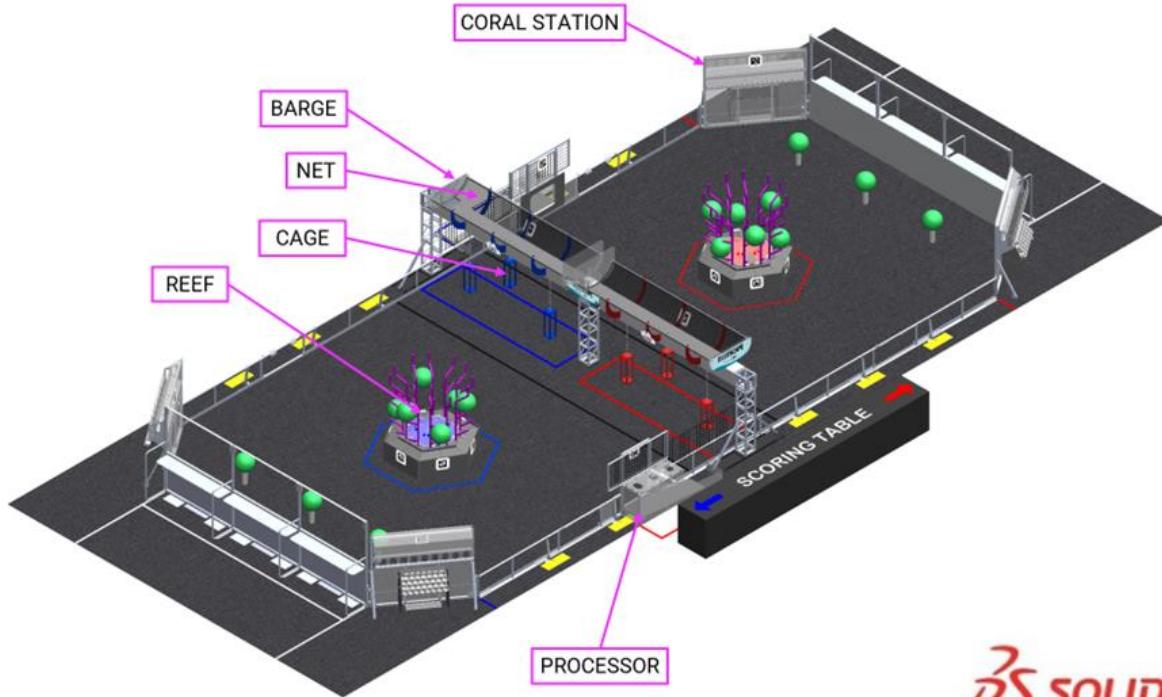
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**Aux Smart IO**



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## 2 Field Components by Name

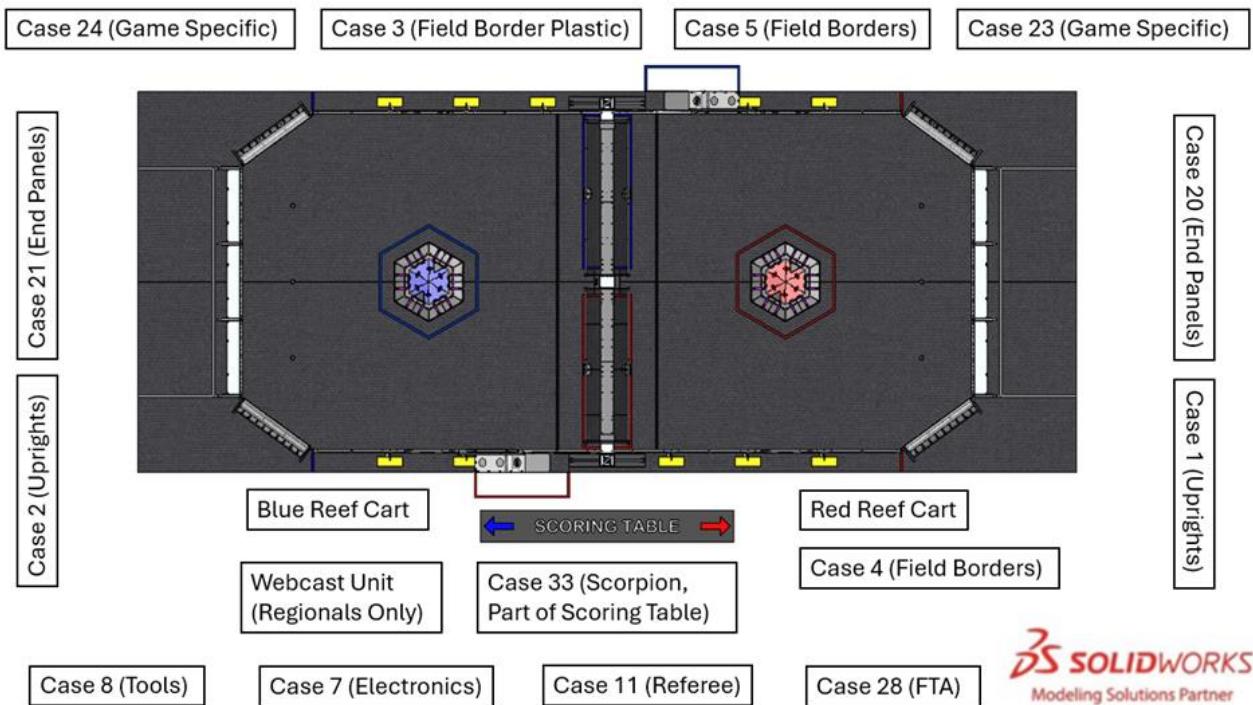


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## 3 Competition Field

### 3.1 Road Case Layout

The first step in building the Field is proper case location. Properly locating the cases saves time and unnecessary carrying and lifting. The diagram below provides a suggested initial position of the road cases. Space may be limited at some venues, requiring road cases to be brought into the Field area in stages.



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Cases 23 and 24 are game specific cases for the Coral Stations, Processors and Barges. Reefs have their own custom carts. Case 31 will have a few items that need to be placed near the field, while the rest of the case goes to the Practice Field. It is recommended to bring all the cases and carts onto the carpet to unpack and sort items into spaces near their final location.

## 3.2 Carpet Installation

- The playing field carpet is 74' x 30'.
- Carpet should be centered under AV equipment (where applicable).
- Minimize bumps and ripples as much as possible.
- Accurate chalking and taping is paramount to correctly build the field.
- Gaff tape should be used for carpet marking, not for queuing.

### 3.2.1 Laying Carpet

#### 3.2.1.1 Tools & Equipment Required

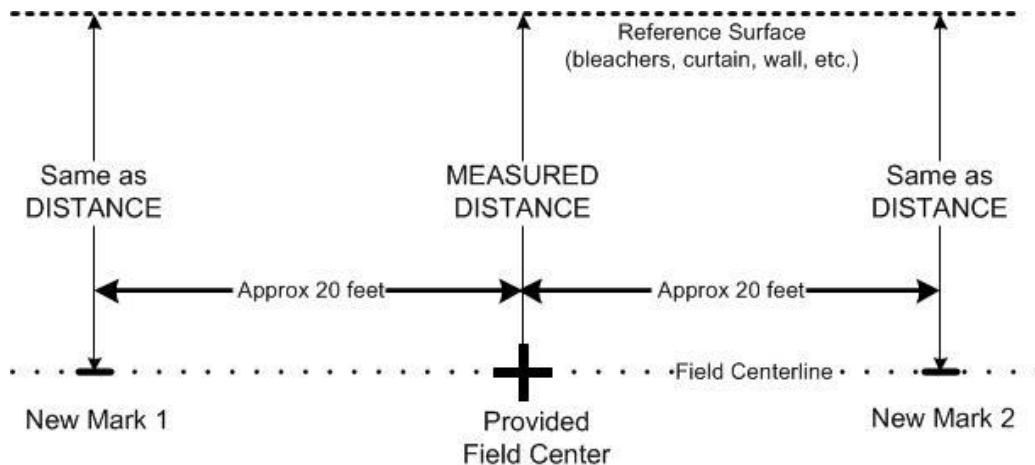
- Two Gray Carpet Rolls – 74' long
- Carpet Tape – 1 roll
- 3" Black Gaffer's Tape – 3 rolls
- Sharpie and/or White Paint Markers – 1 or more
- 100' Measuring Tape – 1
- 25' or 30' Measuring Tape – 1
- 100' Chalk Line – 1
- Utility Knife – 1
- Carpet Knife – 1 (pictured right)



#### 3.2.1.2 Steps

1. Work with AV crew and event management to decide when you can install the carpet.
2. Locate Field Center. Field center is the mark that is located on the centerline where the two carpet rolls meet and is equidistant from the ends of the rolls. This point may be supplied by the AV crew or event management. If not, it will be up to the FTA to locate. Consider any pedestrian or robot traffic lanes that may be needed. Also consider the locations of the processors, human players and referee stands when marking field center.
3. Establishing your Field Centerline. Find a nearby wall, set of bleachers, drapes, stands, etc. that will be parallel to the field center and measure the shortest distance to the field center (the "measured distance" in the diagram). Using small bits of Gaffer's tape, put two marks on the floor the same "DISTANCE" from the reference surface, but about 20' from the field center. These three points constitute your Field Centerline.

Note: If there is no obvious reference surface, align the Field by eye to the best of your ability.



- Position both carpet rolls 37' from the field center point such that the carpet will uncoil in the intended direction, parallel to the Field Centerline.
- Roll out the carpets, keeping the edge of the carpet approximately 3" from the Field Centerline, respectively. Eliminate any ridges and puckers in the carpet by stretching (walking out) carpet sides. Verify by measurement that the carpet is at least 74' in length.
- Trim the uncarpeted material from each roll. Try to trim the material in a long, clean, straight line along the edge of the carpet pile edge using a Carpet Knife. Working in tandem, one person cuts and the other keeps tension on the loose portion. Avoid cutting into the carpet weave.



- Measure and mark 37' from the end of one carpet down the centerline edge. Repeat the process for the second roll, measuring from the same end. Bring the carpets in line with the field center line. The mark should coincide with the field center mark on the floor. The seam should be smooth and straight with very little gap.



- Measure 74' from the end of each carpet along the outer edge. Mark using a Sharpie. Snap a chalk line across the carpet at this location. Cut excess carpet and discard.



9. Fold back the carpets along the Field Center width as shown. Begin affixing your roll of carpet tape to the edge of one carpet with half the width of the tape beyond the edge of the carpet. Extend this by about 6". As you continue to apply the tape, gradually unfold the carpet, returning it to the floor. As you do so, unfold the other carpet to lie on top of the newly exposed edge of the carpet tape. Continue along making a straight, smooth center seam as you go the width of the carpet. Ensure no overlapping of carpet occurs



along the seam.

10. When the Center seam has been fully joined, walk the seam to make sure the carpet is firmly bonded to the tape. Cut away any stray threads of carpet. Apply a layer of 3" Black Gaffer's tape over the center seam. Check by hand to verify the tape is fully bonded and wrinkle free.



11. Check that the carpet is lying flat without any ridges or puckers in the carpet. Stretch by walking out the carpet sides if necessary. Secure each outside edge of the carpet perimeter to the floor with 3" Black Gaffer's tape.

Locate and enlarge your previous carpet Center Mark onto the 3" Gaffer's tape to serve as a guide for future markings and measurements. You may find it useful to write the "P#"

designations on the carpet, particularly if you want to use them to aid in telling your crew to do things at specific locations. If so, add the "P0" notation here.

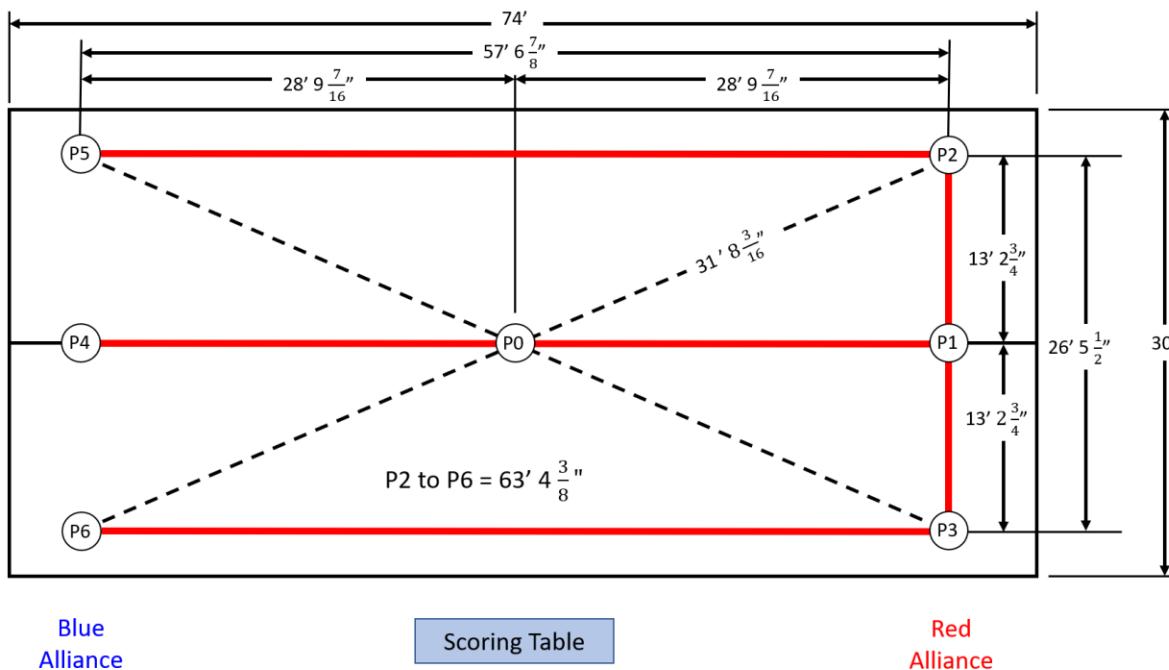
### **3.2.2 Initial Carpet Marking**

Note: There are different marking for AndyMark fields. See Section 3.2.2.3.

### 3.2.2.1 Tools Required

- 100' Measuring Tape – 1
  - 25' Measuring Tape – 1
  - Sharpie or White Paint Pen – 1
  - 100'+ Chalk Line – 1
  - Roll of 2" White Gaffer's Tape – 1

### 3.2.2.2 Markings

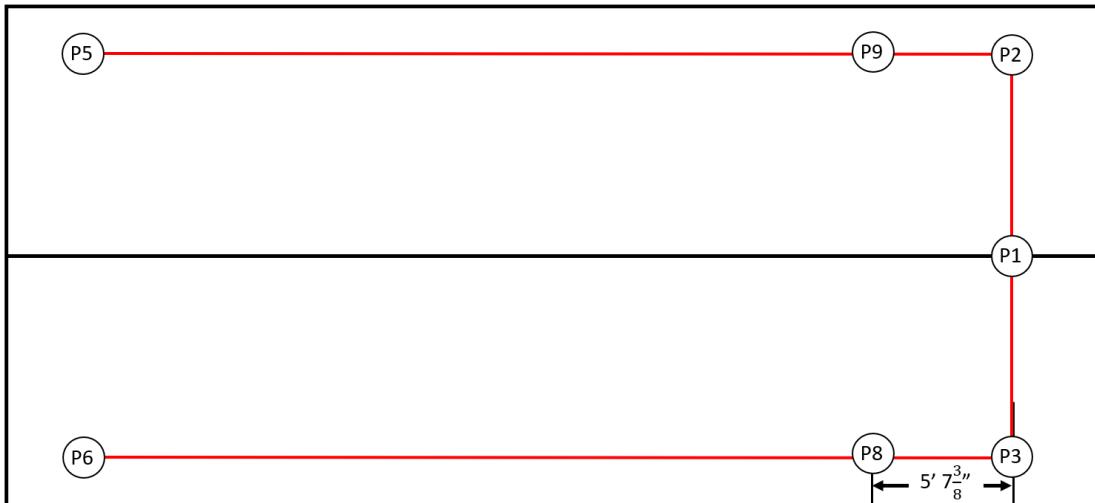
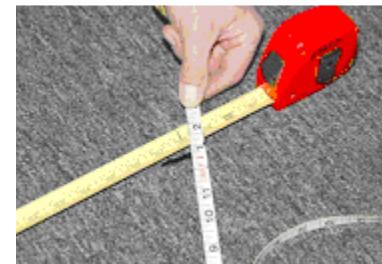


2025 Carpet Markings for Field Position and Layout - 1

See Chapter 3 for full instructions, Updated 10/28/2024 - Draft

Note - The "P" used on the Carpet Markings diagram above and the accompanying text means Point. The compass notations ("North", etc.) are provided to assist in locating items with the Field and are not meant to imply any particular orientation of the Field reference to geographic North.

- Snap the centerline of the field where the edges of the two carpets meet. The exact length does not matter provided it is longer than 5' 7" and is centered on the carpet. If P0 is no longer directly on the line, transfer the mark to the closest point of the snapped line.
- Locate the P2 Field Corner. Starting from P0, measure east along the center chalk line 28' 9-7/16", and mark P1. Starting again from P0, measure northeast 31' 8-3/16". At the same time, starting from P1, measure north 13' 3-3/4". Place a small piece of Gaffer's tape at the intersecting point to temporarily mark the intersection as the P2 Field Corner. After you remove the tape measures, make a bold "+" at this point with the Sharpie.
- Using the same technique as above, locate and mark the P3 Field Corner. Verify 26' 5-1/2" between P2 and P3.
- Using the same technique as above, locate and mark the P5 and P6 Field Corners. Verify 26' 5-1/2" between P5 and P6.
- Verify that the distance from P2 to P6 and from P3 to P5 is 63' 4-3/8".
- **Snap the following chalk lines:** P2 to P3, P2 to P5, & P3 to P6
- Measure 5' 7-3/8" from P3 along the chalk line that connects P3 and P6. Mark this location P8. Measure 5' 7-3/8" from P2 along the chalk line that connects P2 and P5. Mark this location P9.



Blue  
Alliance

Scoring Table

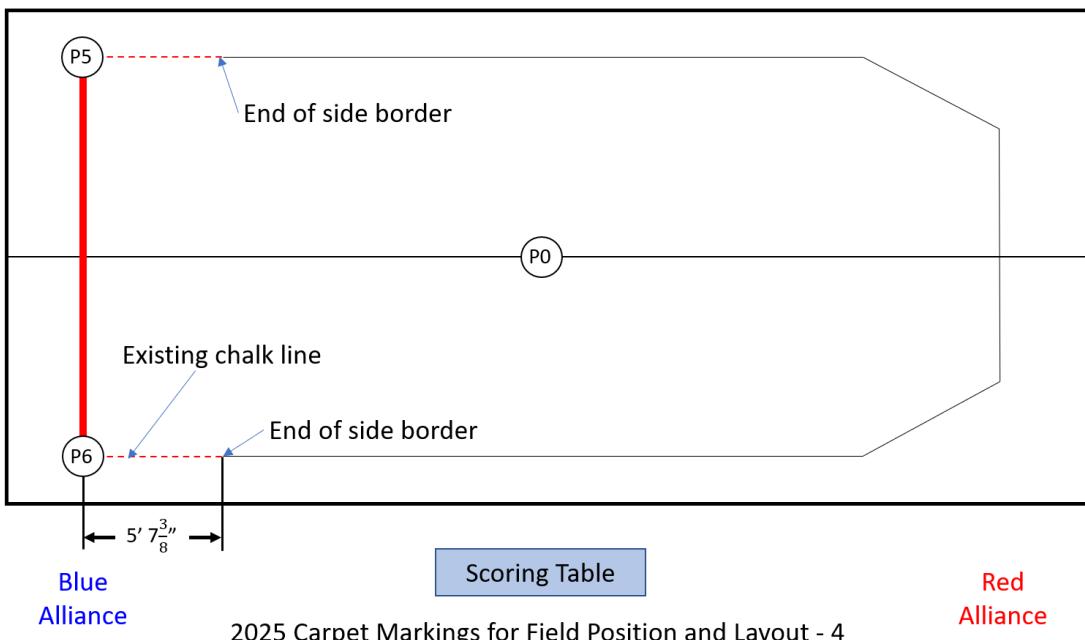
Red  
Alliance

#### 2025 Carpet Markings for Field Position and Layout - 2

See Chapter 3 for full instructions, Updated 10/28/2024 - Draft

Suggestions for snapping chalk lines:

- Be sure there is a sufficient level of chalk in the chalk marker container. If you need to add chalk, do so away from the carpet and over a trash can.
- Extend the chalk line while standing off the carpet to the necessary distance. Then move onto the carpet to lay the marks. This helps avoid dumping chalk onto the carpet. It is also a good idea to use a surplus cardboard box, or trash can under the line spool while the line is pulled out to catch the spillage.
- Prior to snapping the line, hold and stretch the line taut so the chalk line will move straight up and down. This helps to make a straight line.
- When winding the chalk line up, stand off the carpet to prevent the chalk from spilling onto the carpet.
- Follow instructions to place the red alliance wall, Coral Station frame, and side borders



2025 Carpet Markings for Field Position and Layout - 4

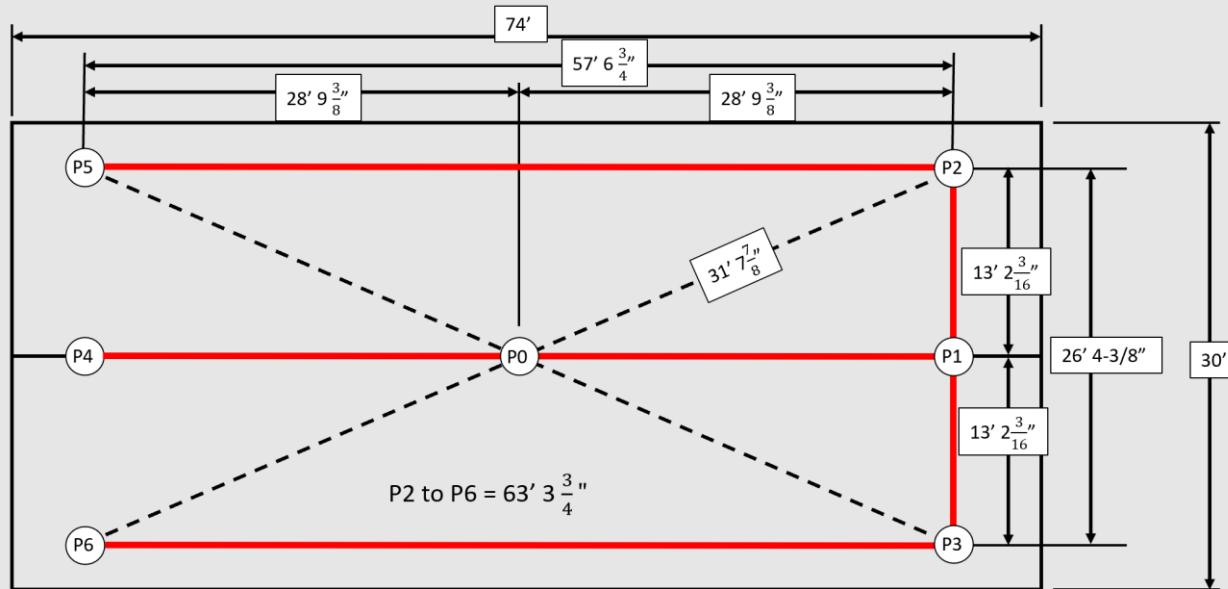
See Chapter 3 for full instructions, Updated 10/29/2024 - Draft

- Verify that P5 aligns with the end of the side border. Measure 5' 7-3/8" from the end of the both side borders to verify the locations of P5 and P6. Measure from the surface highlighted in 3.3.2 - Step 5. If necessary, remark P5 and P6. Snap a chalk line from P5 to P6.
- Follow instructions to place blue alliance wall and Coral Station frame

### 3.2.2.3 AndyMark Field Markings

#### FOR ANDYMARK FIELD ONLY

For the AndyMark Field, use the following carpet markings and measurements instead. The same general procedure as above should be followed.

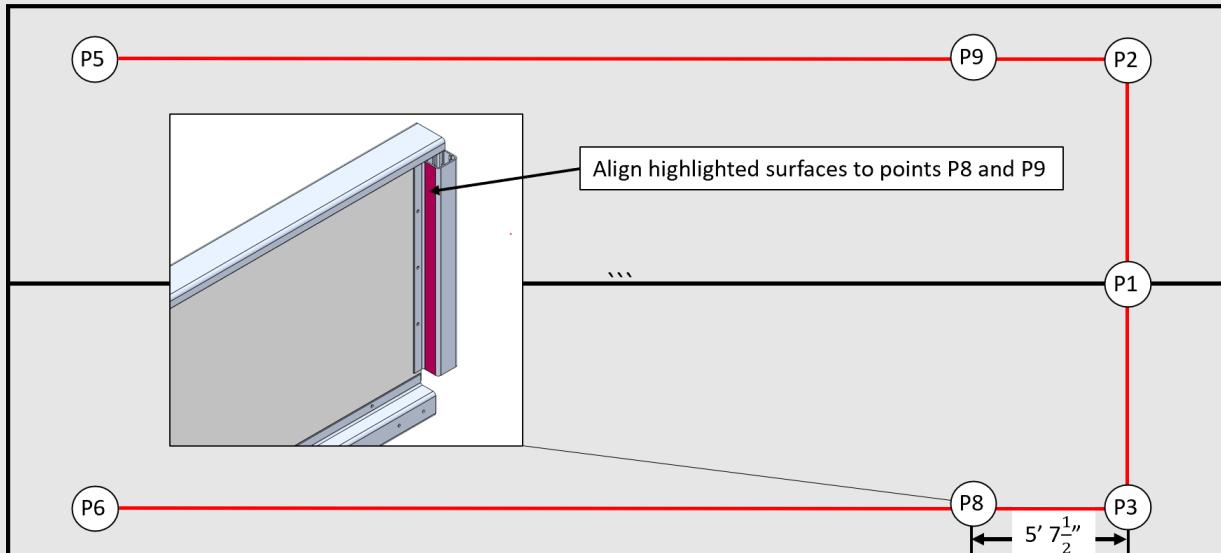


Blue  
Alliance

Scoring Table

Red  
Alliance

2025 Carpet Markings for Field Position and Layout – 1 – AndyMark



Blue  
Alliance

Scoring Table

Red  
Alliance

2025 Carpet Markings for Field Position and Layout – 2 – AndyMark

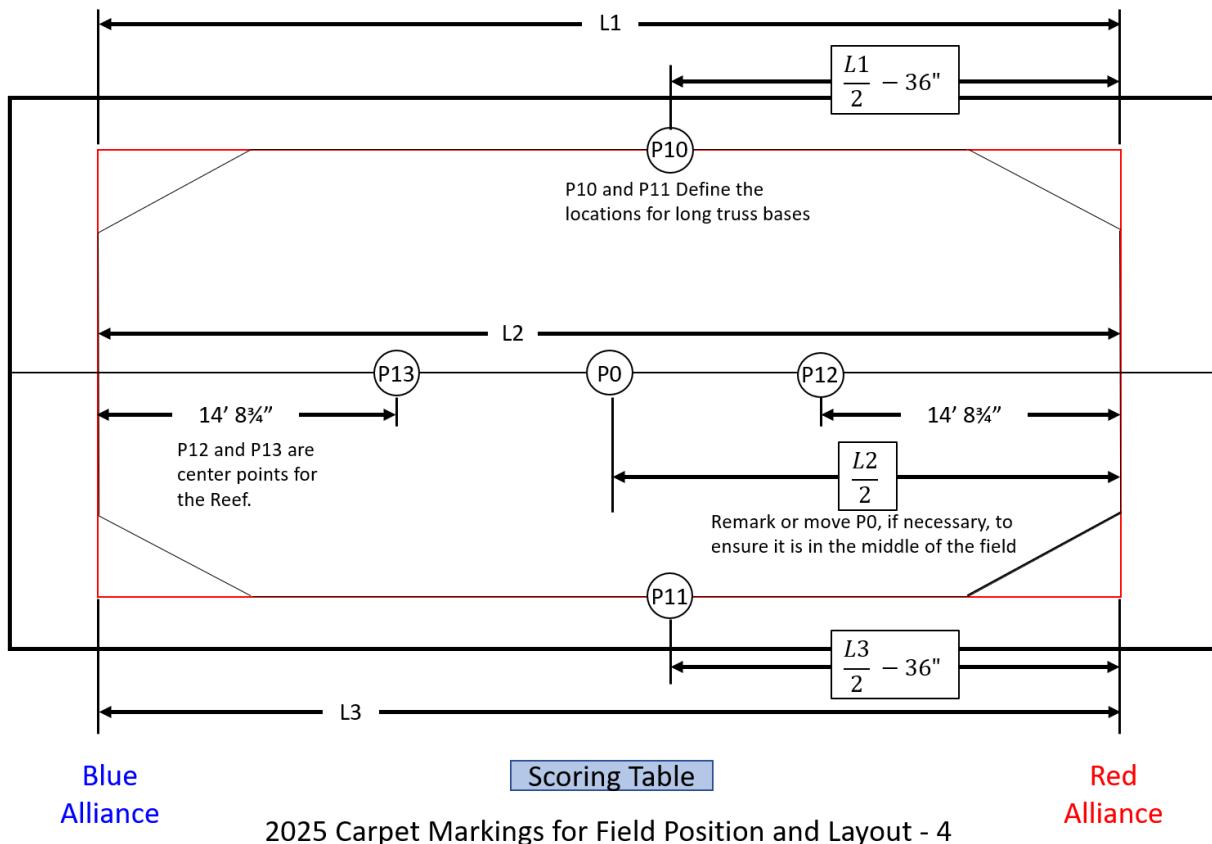
### 3.2.3 Marking BARGE and REEF locations

Note: Alliance Walls and Side Borders must be complete before this process.

#### 3.2.3.1 Tools Required

- 100' Measuring Tape – 1
- Sharpie or White Paint Pen – 1
- 100'+ Chalk Line – 1
- Roll of 2" White Gaffer's Tape – 1

#### 3.2.3.2 Markings



- Measure the length of the field along the centerline. Take half of this measurement and reposition P0, if necessary.
- Measure/mark P12 and P13. Each are 14' 8-3/4" from both alliance walls along the center line.
- On each side of the field, measure the distance between alliance wall chalk lines. Take half of this measurement, subtract 36" and mark P10 and P11 just outside the field next to the side border angle.

### 3.3 Side Borders and Gates

In this step you will build two complete Side Borders with their respective Gates. The two sides can be built simultaneously.

Note: When unloading and handling border segments containing Gates, make sure they are in the closed and locked position.

#### 3.3.1 Tools & Equipment

- Side Border Cases (Cases 03, 04, and 05)

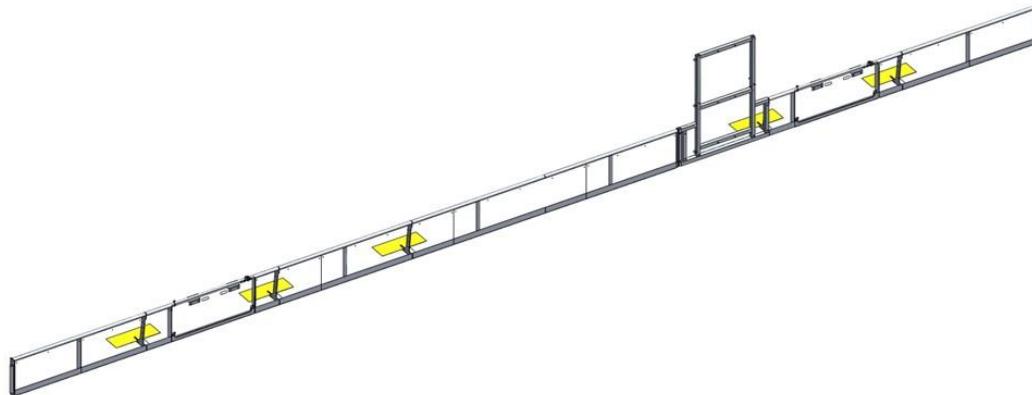
#### 3.3.2 Assembly

1.



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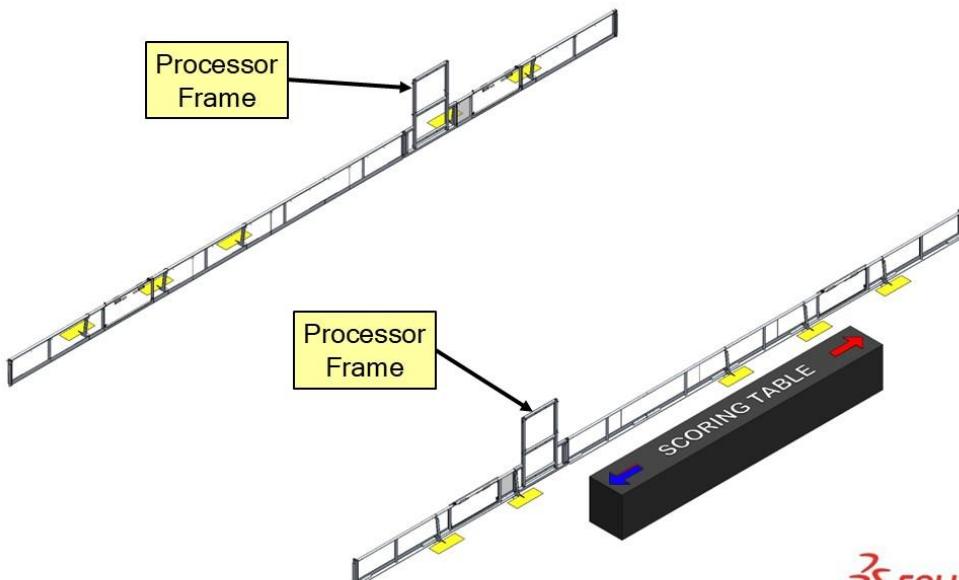
#### Side Border Assembly



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2.

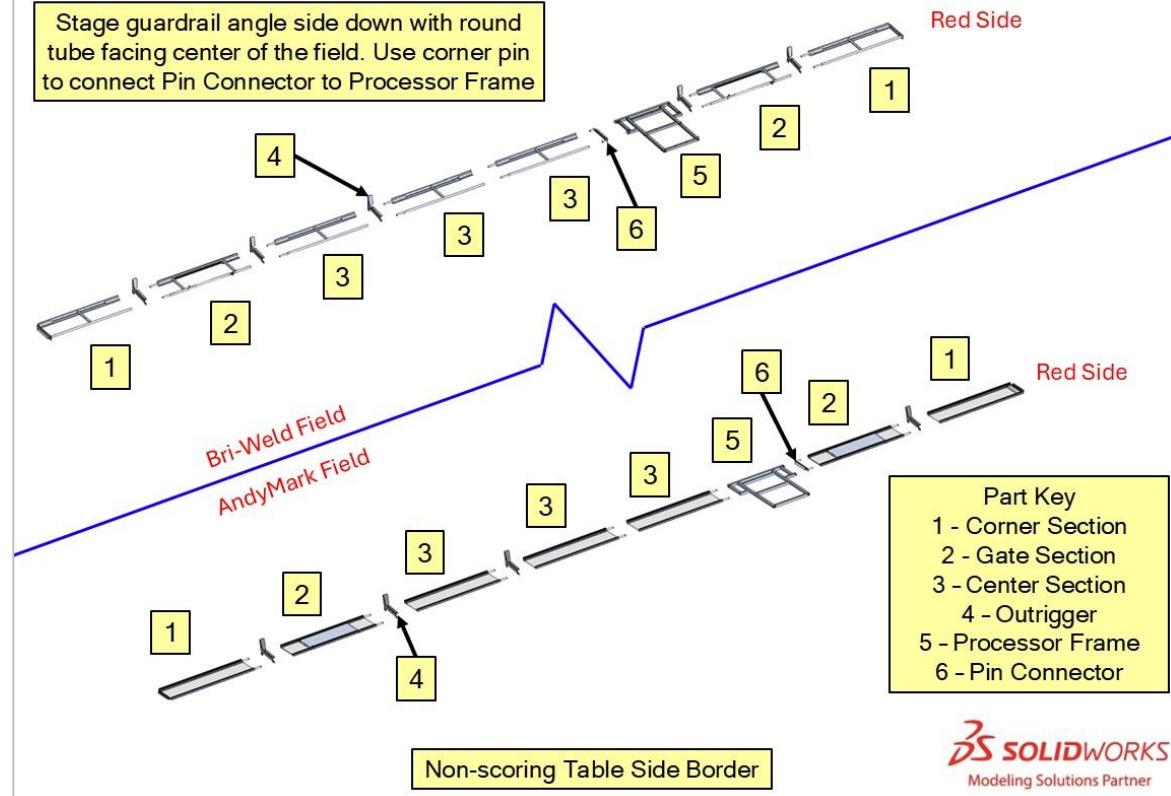
Processor Frames in relation to scoring table.  
Carpet hidden for clarity.



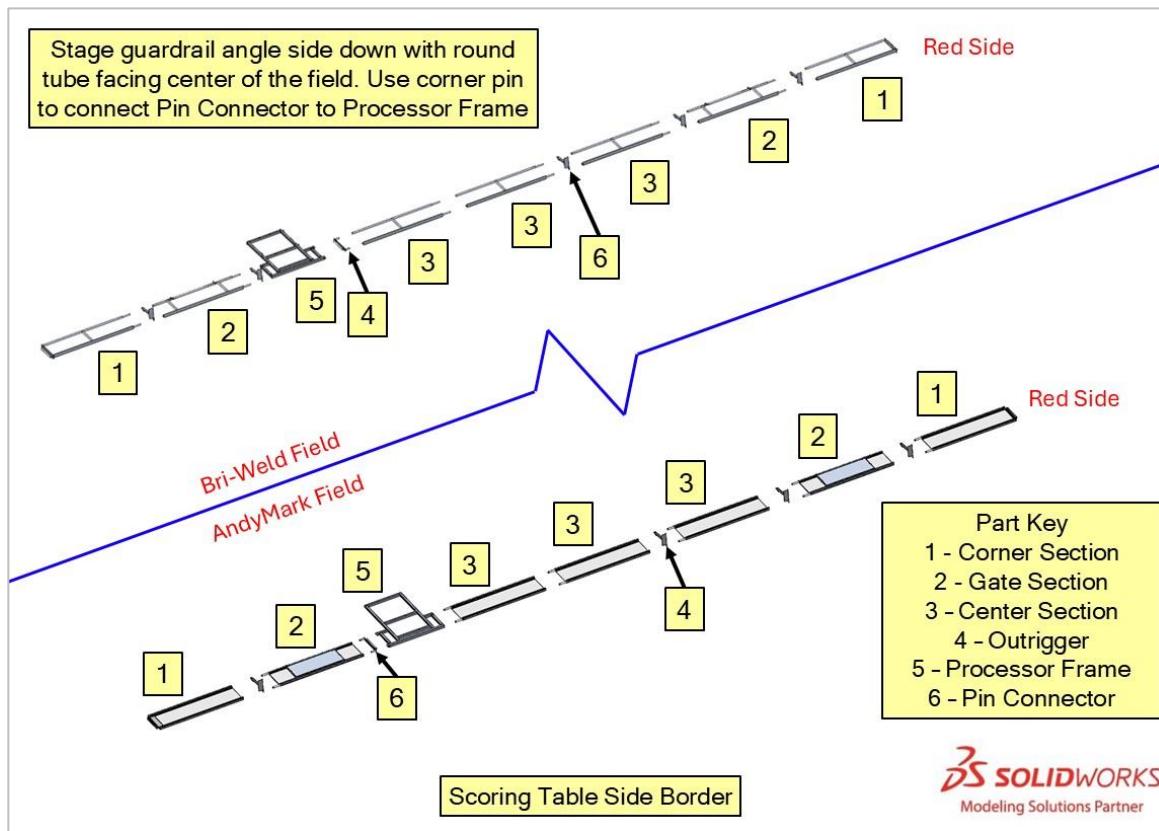
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3.

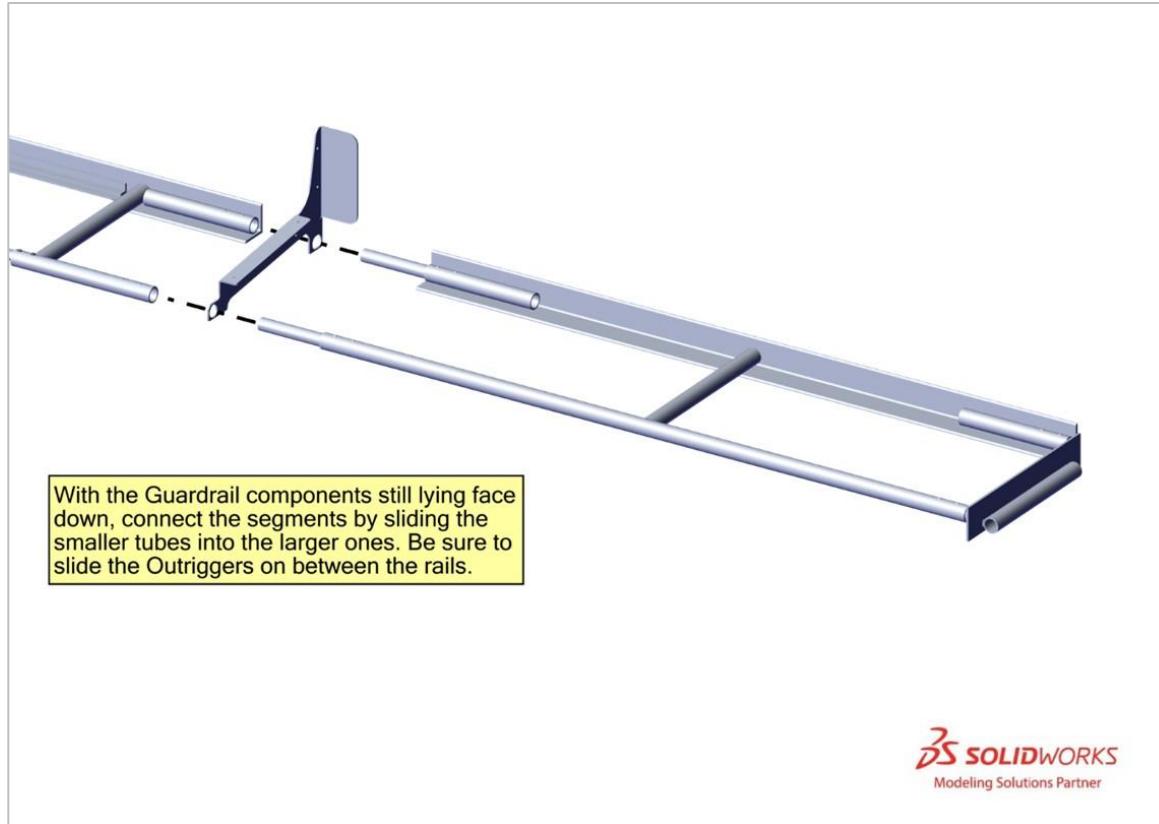
Stage guardrail angle side down with round tube facing center of the field. Use corner pin to connect Pin Connector to Processor Frame



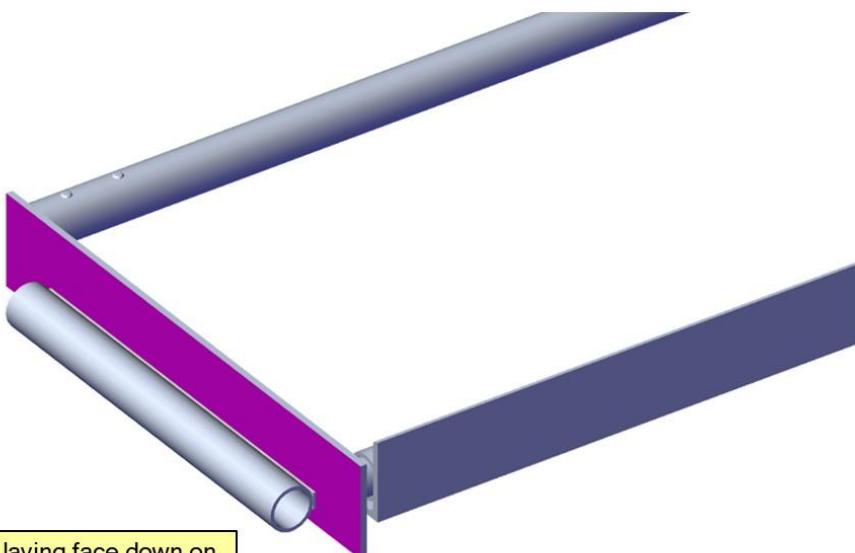
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4.



5.

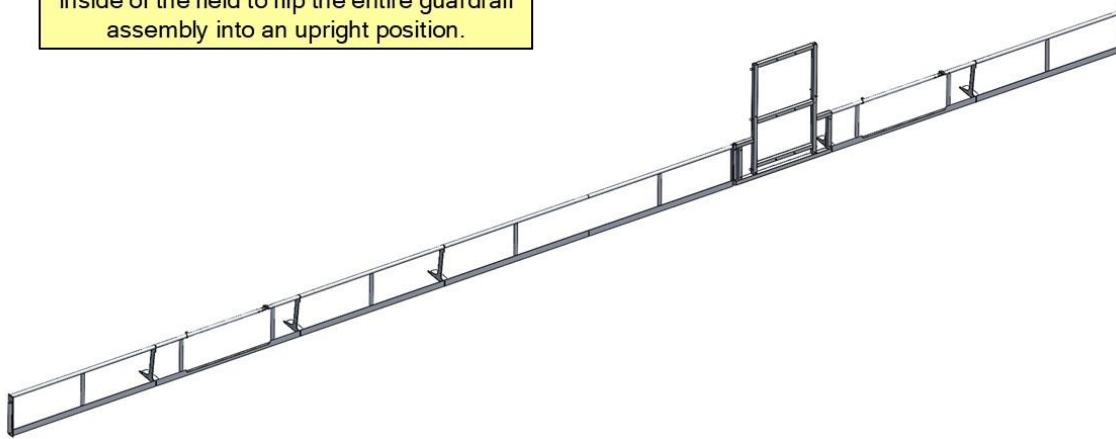


With the guardrail still laying face down on the carpet, align the highlighted surface to P8 or P9 (depending on which side of the field is being assembled)

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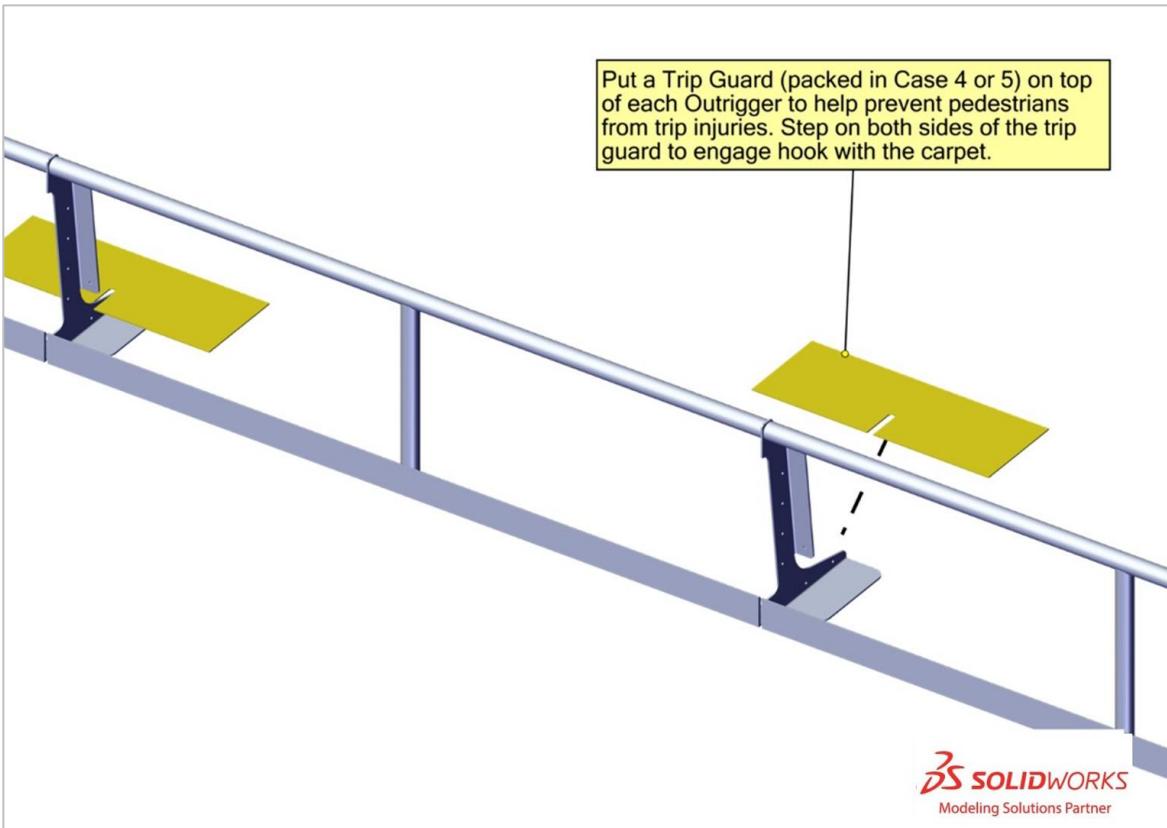
6.

Once all segments are attached and the guardrail has been lined up with chalk lines, use four or more people positioned on the inside of the field to flip the entire guardrail assembly into an upright position.

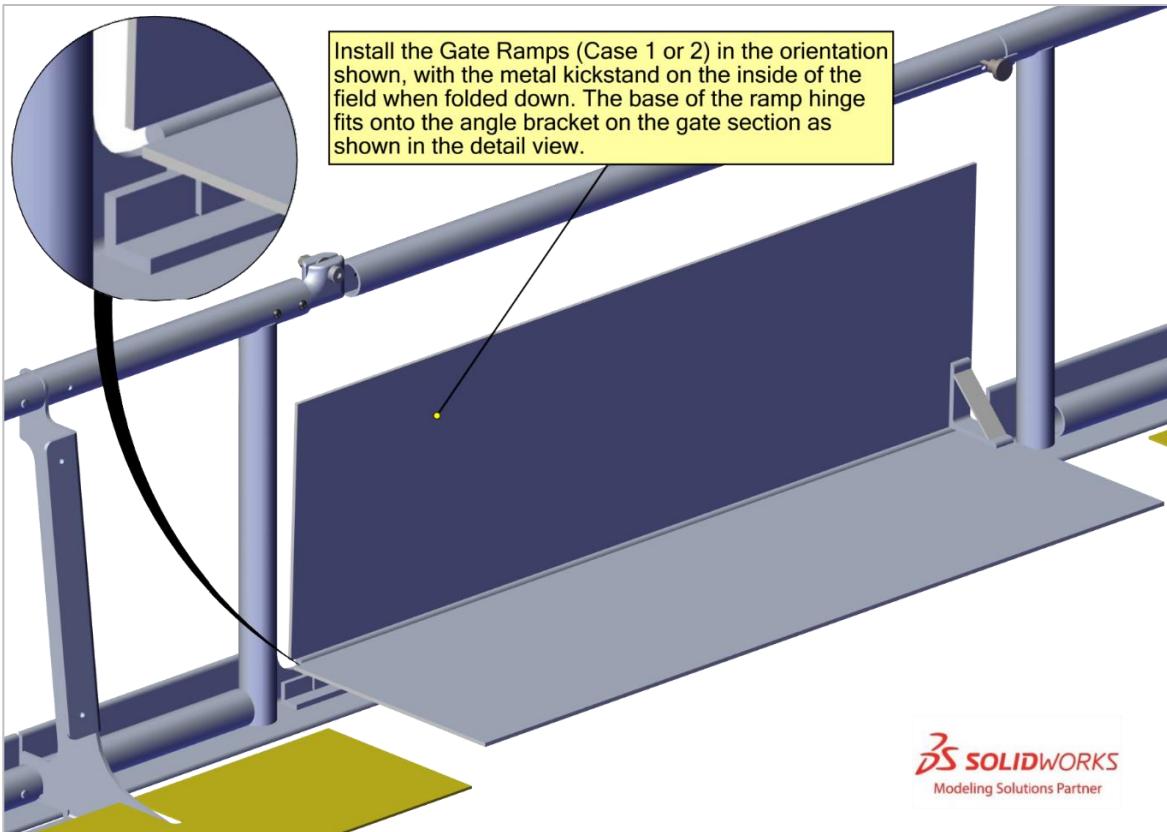


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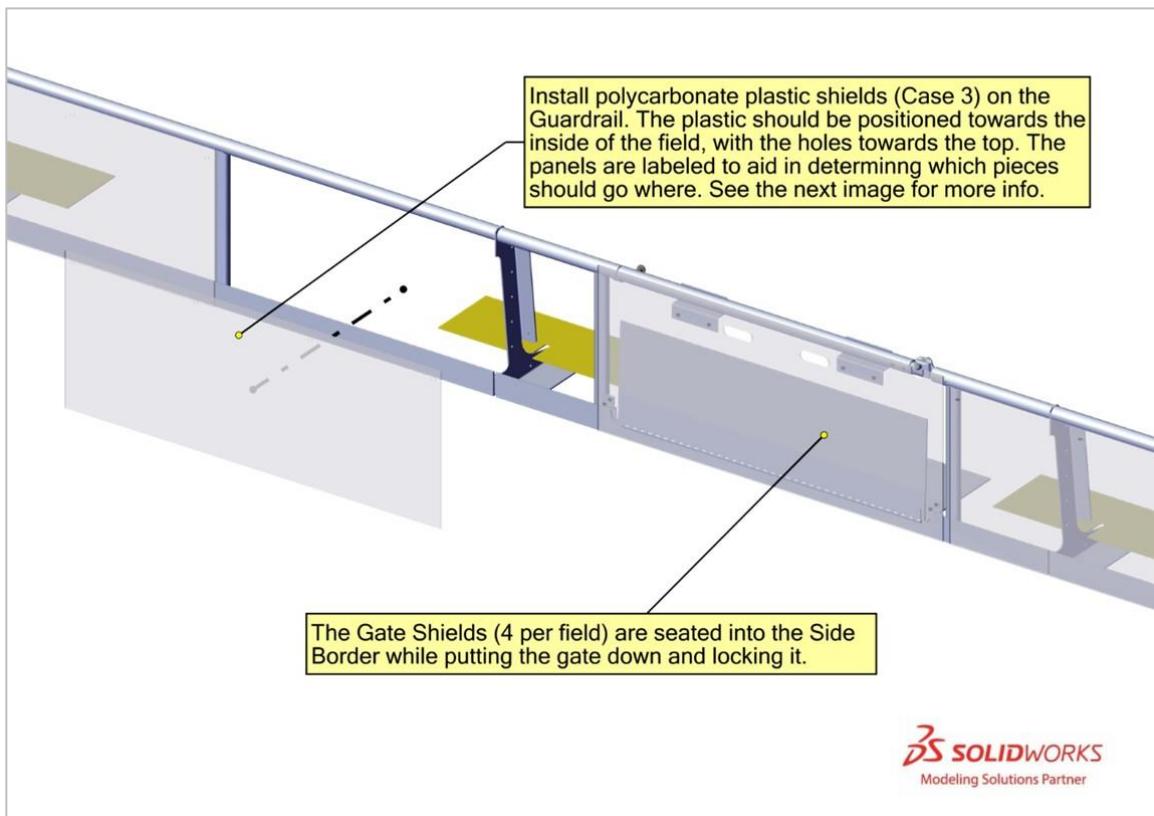
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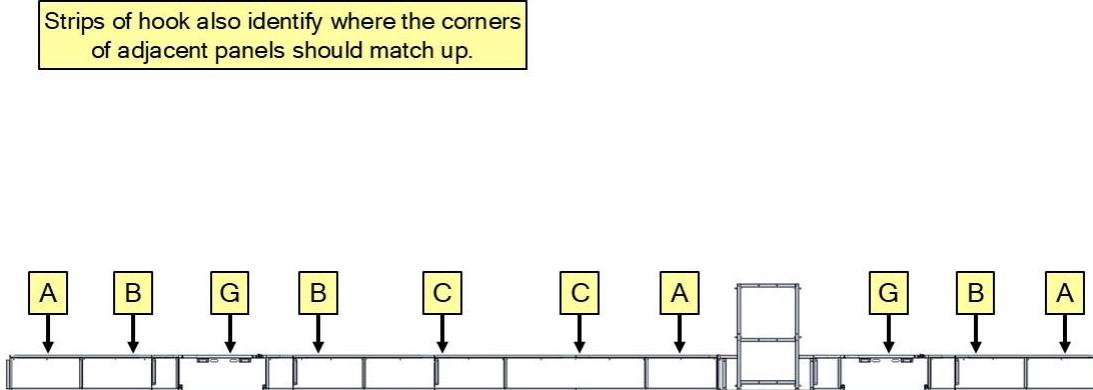


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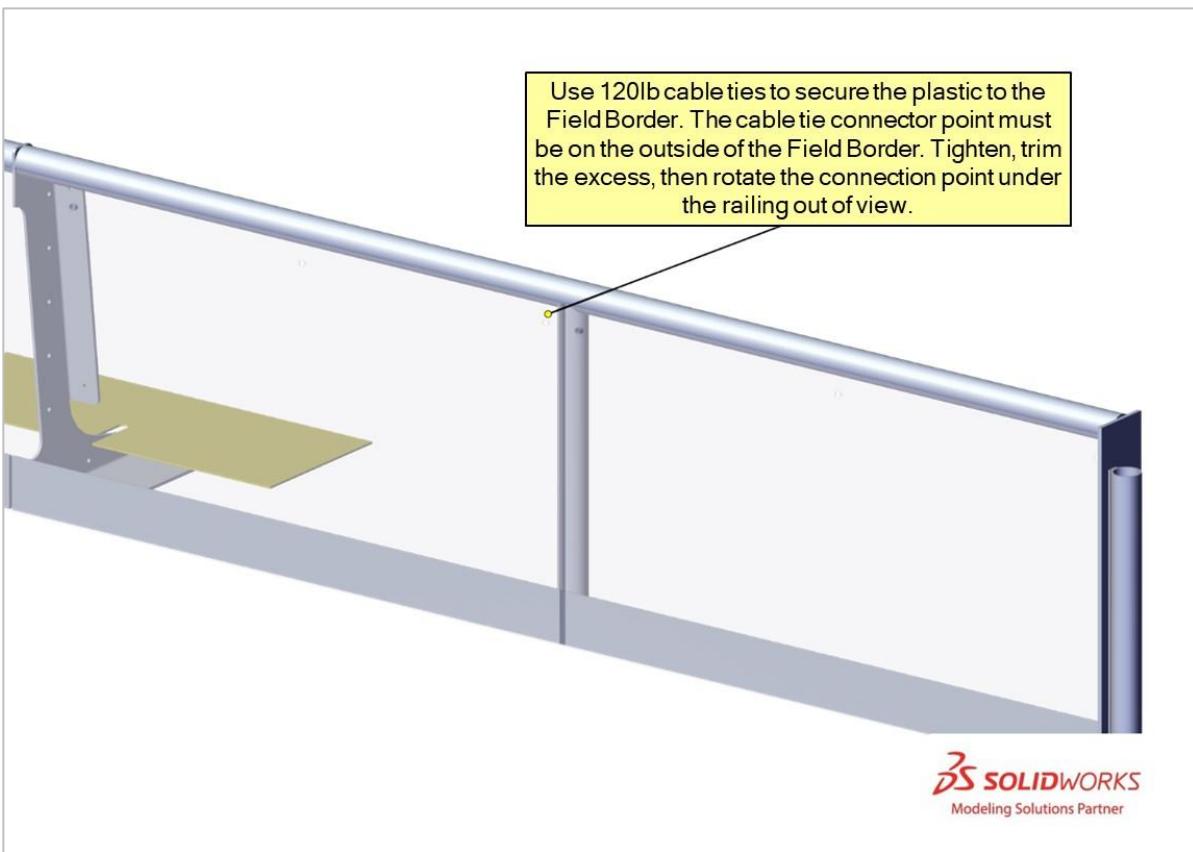
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11.



## 3.4 Alliance Wall

### 3.4.1 Tools & Equipment Required

- Case 20 or 21
- Case 1 or 2
- 25' tape measure
- Sharpie
- HDPE sheets (from Case 1 or 2, used as sliders in between hook and carpet)

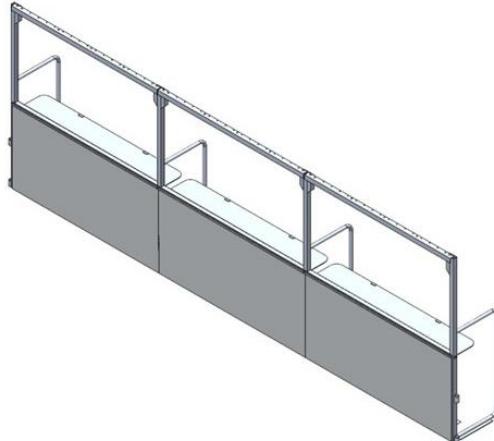
### 3.4.2 Assembly

1.



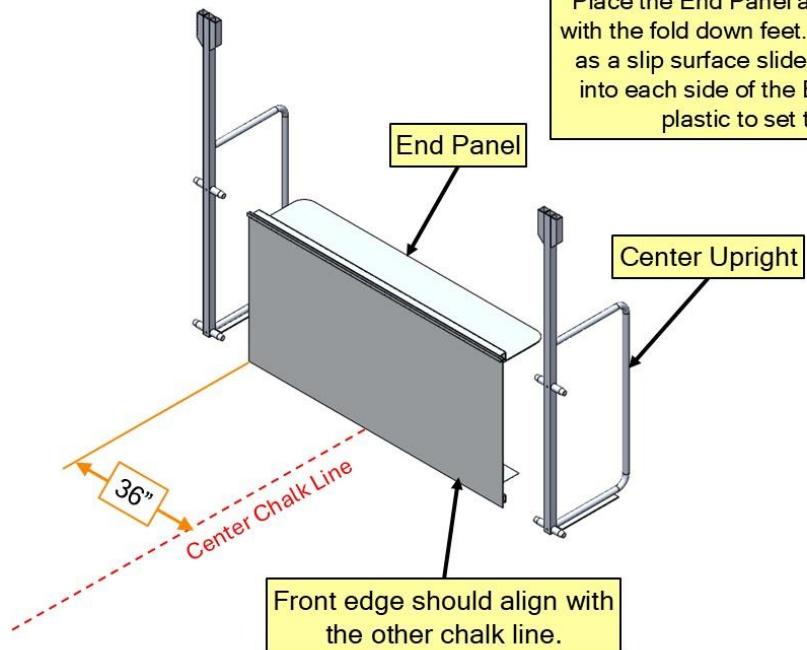
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Gene Haas Foundation

#### Building the Alliance Wall



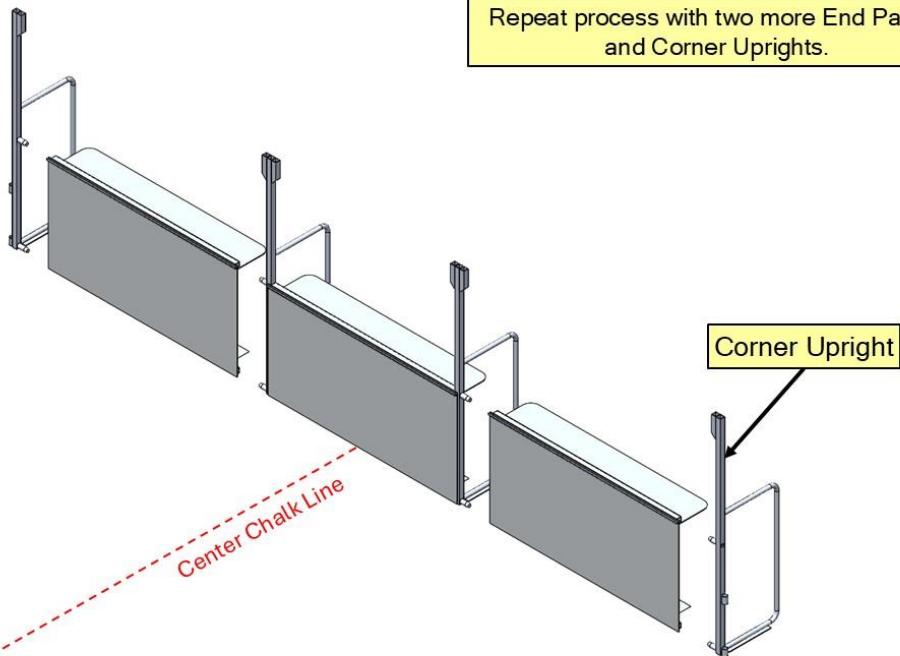
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2.



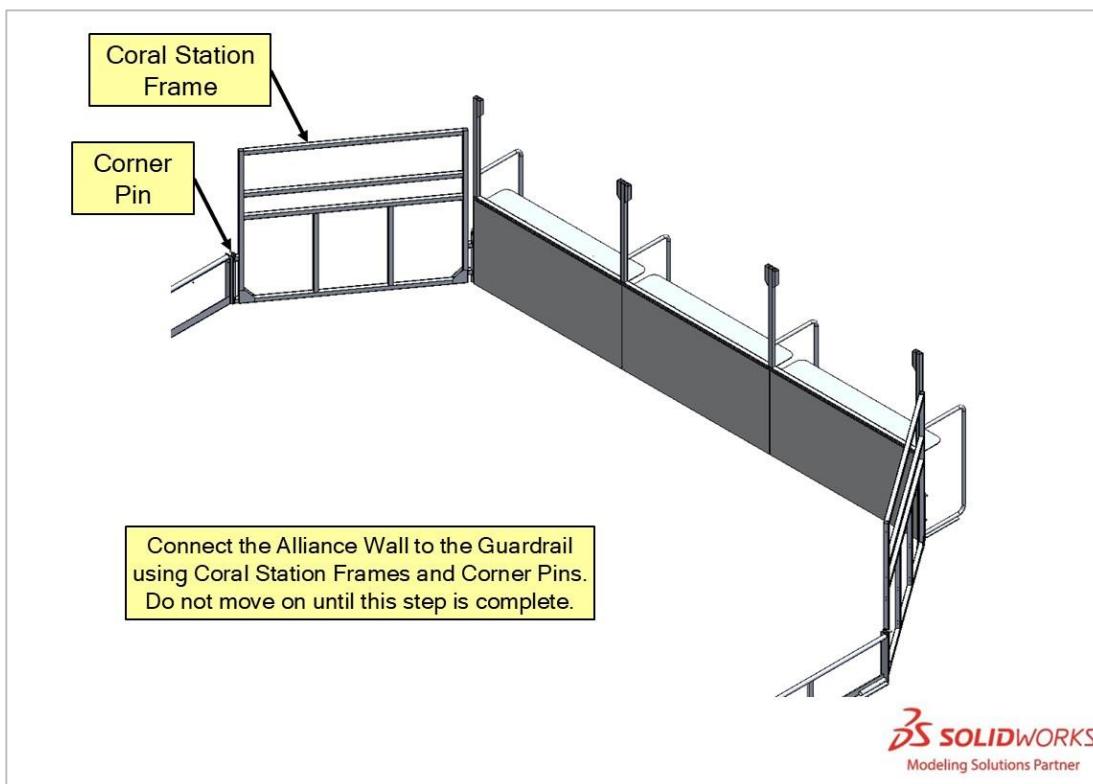
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3.



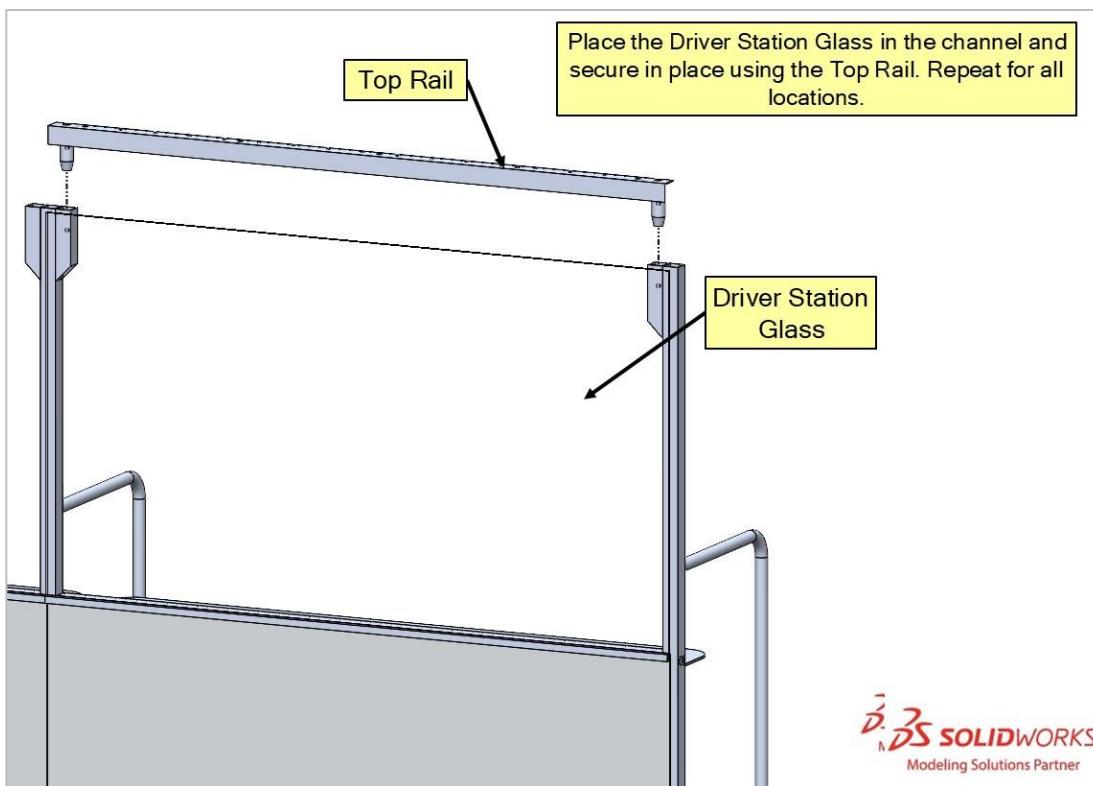
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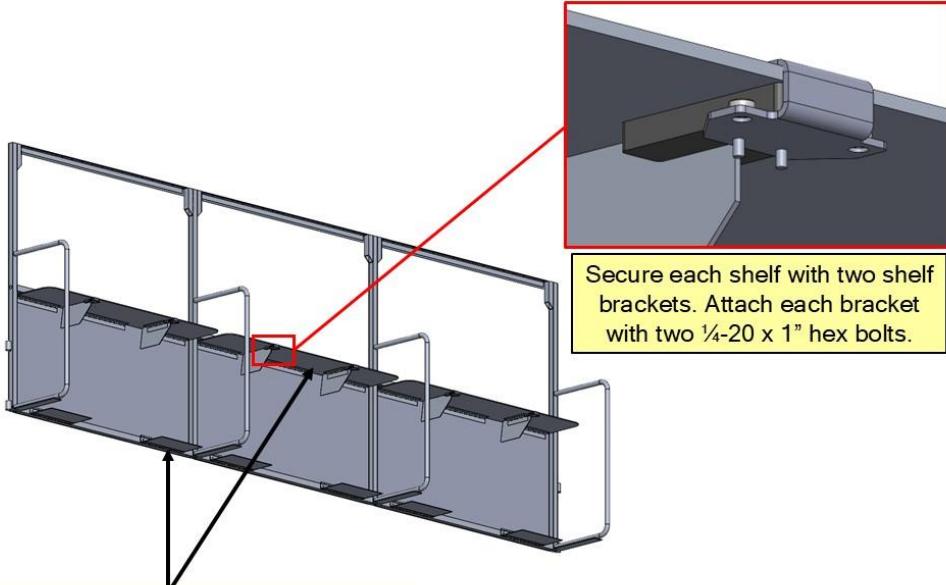
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6.



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### 3.4.3 Alliance Wall Electronics

#### 3.4.3.1 Equipment List

- Case 6
  - 2 (75-100') AC power cables
  - 2 20m Ethernet cables
  - 2 Station Control Cabinets (SCCs) (one red and one blue)
    - 2 power cable for SCCs
  - 8 Cypress Team signs. (4 red and 4 blue)
  - 6 Team Stack Lights (3 red and 3 blue)
  - 6 E-Stops
  - 6 A-Stops
  - Yellow AB Cables
    - 6 A/E-Stop Y-Cable
    - 2 A/E-Stop cable 5m
    - 4 A/E-Stop cable 10m

- 2 Team Light cable 5m
- 4 Team Light cable 10m
- Ethernet cables
  - SCC Ethernet - 20m (teal, Allen Bradley)
  - 4 Team Sign Ethernet cables 5m
  - 4 Team Sign Ethernet cables 10m
- 2 8-Outlet power strips (Tripp Lite or similar)
- 2 sets of Driver Station power outlets

### 3.4.3.2 Equipment Layout

- The Field should be run on at least 2 20-Amp electrical circuits to minimize the risk of tripping a breaker.

*Figure 3-1 Alliance Area - Electronics Layout (viewed from within Alliance Station)*

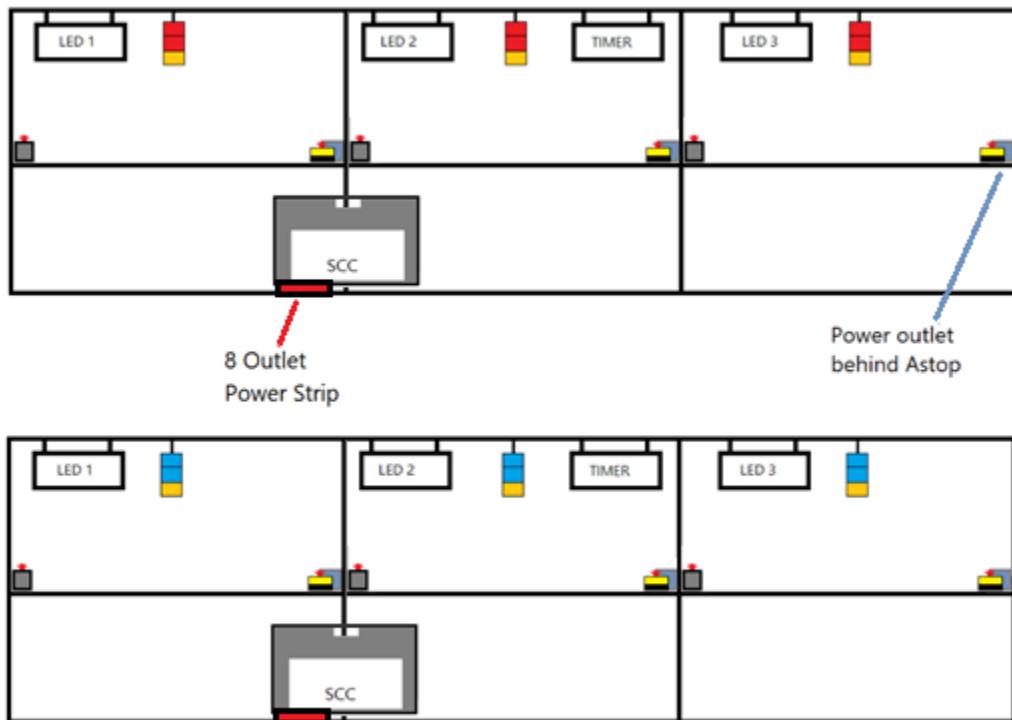
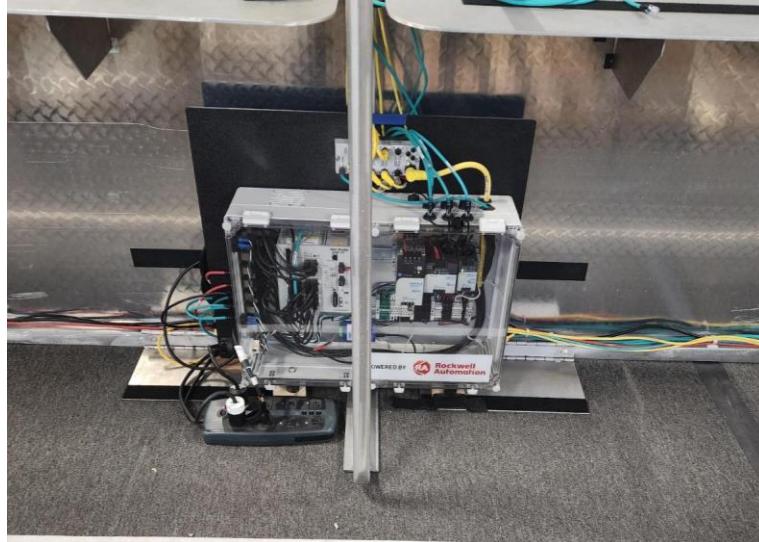


Figure 3-2 Alliance Area - SCC placement



**SCC:** Place one (1) Station Control Cabinet at each end of the Field between Driver Stations 1 and 2 as shown in the figures above. The SCC has tape on the handle to indicate the Field end at which it should be placed.

- The SCC with blue tape is placed at the blue alliance end of the Field (when powered some have blue LED's)
- The SCC with the red tape is placed at the red alliance end of the Field (when powered some have red LED's)
- The Spare SCC is stored in Case 19 and has black or white tape on its handle. It has no lights.

**Team Signs:** Team Signs units #1, #2, and #3 are mounted in each of the three Driver Stations. Team Signs are attached by hooking the "J" hooks into the left-most holes (when looking at the Driver Station from the Alliance Station side) pre-drilled in the rail of each Driver Station section. Spare Team Signs can be used by switching the team sign settings in FMS:

Timer units are mounted in each Alliance Station #2, on the opposite side of the station as the Team Sign. The Timer is attached by hooking the "J" hooks into the right-most holes (when looking at the Driver Station from the Alliance Station side) pre-drilled in the rail of Driver Station #2 as shown in Figure .

**Team Stack Lights:** Mount one Team Stack Light onto each of the three Driver Stations by sliding the light hanger over the middle hole of the rail. Secure the light by inserting the locking pin through the light plate and hole in the top rail. Each light is centered in its Driver Station, the 8th hole from either side.

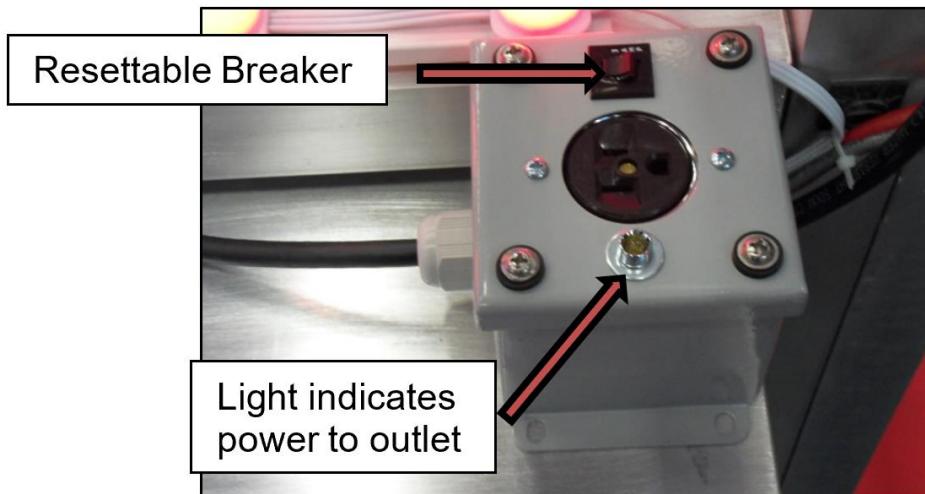
**E-stops:** Place one E-Stop on the left edge of the Driver Station shelf. Confirm that the cable connector faces inward for cable routing.

**A-Stops:** Place one A-Stop on the right edge of the Driver station. Confirm that the cable connector faces inward for cable routing.

The E-Stop and A-Stop both connect to the E/A-Stop Y-cable with the A-Stop connected to the end labeled "A" and the E-Stop connected to the end labeled "B". An extension cable may be required to reach the SCC from the base of the Y-cable. If FMS indicates that both buttons are pressed when both buttons are in their reset position (i.e. up) they may be plugged into the wrong ends of the Y-cable.



**Team Power Outlets:** Place one power outlet on the right edge of the driver station shelf. Behind the A-Stop



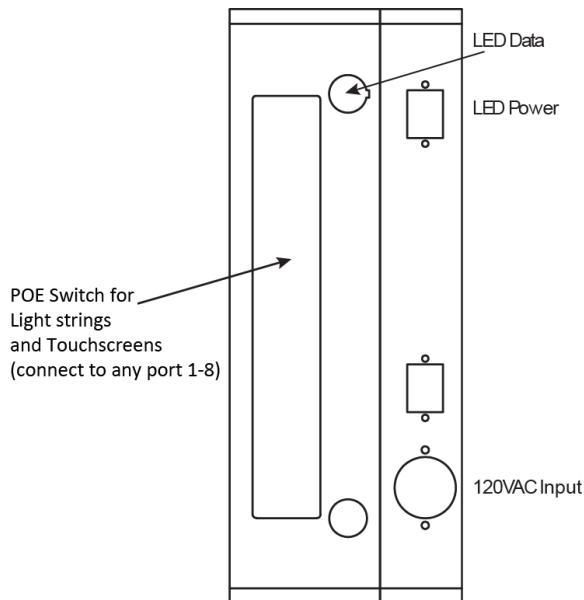
**8-outlet Power Strip:** Place one power strip under on the floor to the left of the SCC

### 3.4.3.3 Wiring

Looping 11" or 14" cable ties through the holes of the end frame top rails initially helps to form the harness support required for finishing the cable installation.

**Station Control Cabinets (SCC)** The SCC has connections located on the top and left side. They are for connecting the E-Stops, Ethernet, Team Lights, AC Power, Team Sign AC power, Team Sign data cables, and Touchscreens. The 120 VAC input is located on the left side of the SCC.

Figure 3-3 SCC (V1) Side Connections



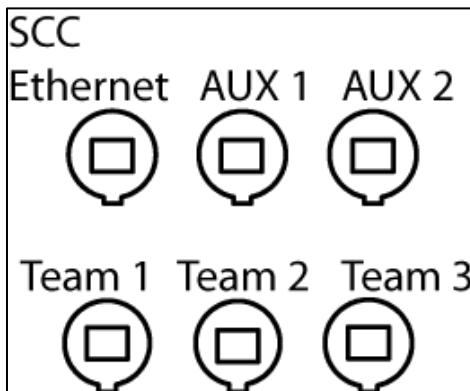
**AC Power cable:** from Scoring Table (75-100') – There is an AC power cable to feed each end of the field. The 3-pin male plug connects to the power strip at the Scoring Table and the female end connects to the power strip next to the SCC. A short power cable (SCC pigtail) connects from the power strip to the AC inlet on the SCC.

**Ethernet Cable:** from Scoring Table (20 meter) - Connects from the designated RJ-45 input, labeled SCCE, on the top of the SCC to the corresponding field end input on Case 33 at the Scoring Table.

**Driver Station Ethernet Cables:** The Driver Station Ethernet cables are used by teams to connect their Driver Stations into the field run from the top of the SCC to the corresponding Driver Station shelf.

Make sure to leave ample slack so teams can connect to their laptops anywhere along the shelf.

Figure 3-4 SCC Top Connections

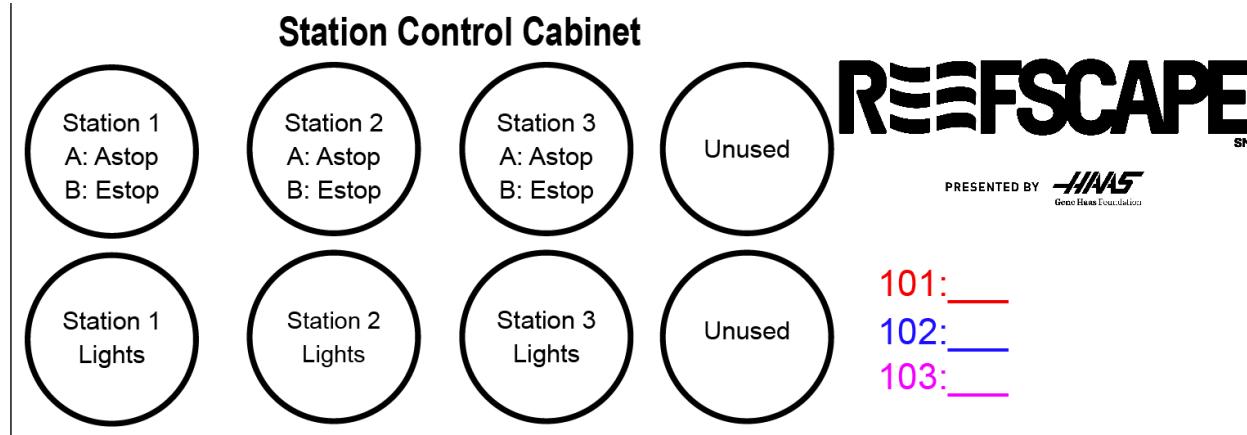


AUX1 and AUX2 are spare connections to be used only under FMS Support guidance.

**Team Signs:** Team signs are connected via a single Ethernet cable. Connect all 4 team signs to the POE switch ports on the left side of the SCC. 5m cable is used for the stations nearest the SCC while the 10m cable should be used for the farther stations.

**Team Stack Lights:** Team Stack Light cabling all runs directly from the Station Cabinet to each light. Attach the yellow Allen Bradley cables to the corresponding ports on the I/O module mounted at the top of SCC back panel as shown in Figure 3-5.

Figure 3-5 SCC Armor block Label-



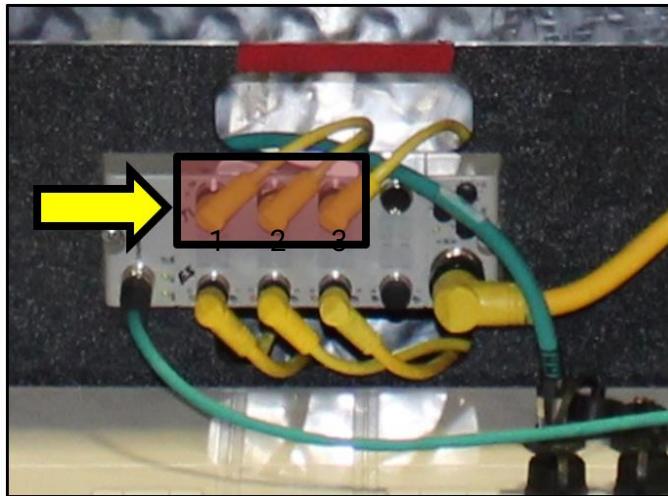
Wire routing:

- Team Lights #1 and #2 from the Station Control Cabinet up to the top of the upright between stations #1 and #2, and then over to the light assembly.
- Team Light #3: From the Station Control Cabinet across the floor to the uprights between stations #2 and #3, up to the top of the Alliance wall and then Over to the #3 light assemblies.

**E/A-Stops:** E/A-stop cabling all runs directly from the Station Cabinet through a Y-cable to each E-stop and A-Stop. Extensions may be needed for the Y-cable to reach the SCC. Attach the

yellow Allen Bradley cables to the corresponding ports on the I/O module mounted above the SCC (i.e. STOPS ON TOP!) (see Figure 3).

Figure 3-8 Highlight of E/A-Stop Ports on SCC Armorblock



Wire routing:

- E/A-stop #1: From the Station Control Cabinet along the base of the diamond plate, up to the E-Stop via the left Driver Station 1 upright on the left side of Driver Station 1 shelf.
- E/A-stop #2: From the Station Control Cabinet up the left Upright of Driver Station #2 to the Driver Station shelf.
- E/A-stop #3: From the Station Control Cabinet along the base of the diamond plate across to Driver Station #3, up the left Upright of Driver Station #3, to the Driver Station shelf.

## 3.5 Referee Panels

### 3.5.1 Equipment – Found in Case 34

- Referee Panel touchscreens
- Referee Panel Bases
- Lower Mounting Pole
- Upper Mounting Pole
- 5 red 15m Ethernet cables
- Mounting Pins (3 per Referee Panel)

Figure 3-6 Case 34 - Regionals



Figure 3-7 Case 34 - Districts



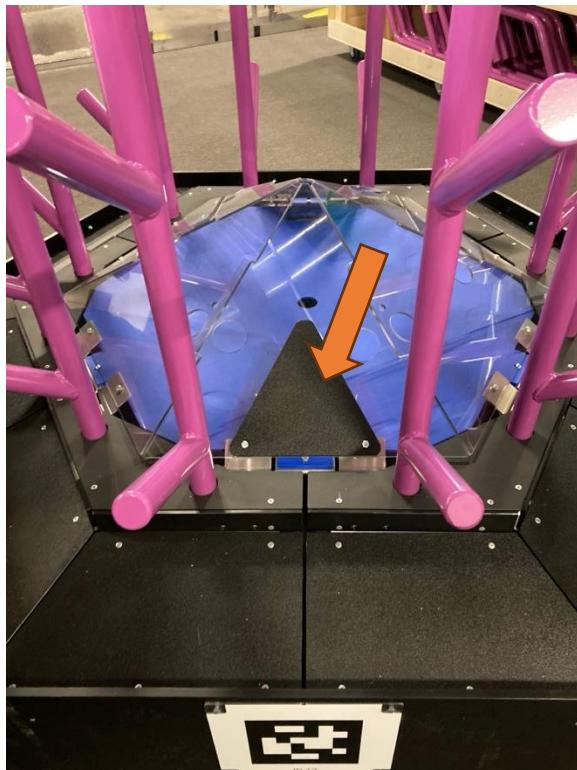
Districts receive a modified version of the previous style Case 34. Be cautious unloading this case and unload the poles and single Panel base from the compartments at the back of the case to help prevent the case from being unbalanced and potentially tipping over.

### 3.5.2 Location

Each ref location on the field uses 1 of each item in the list. The locations are shown below in Figure 3-9.

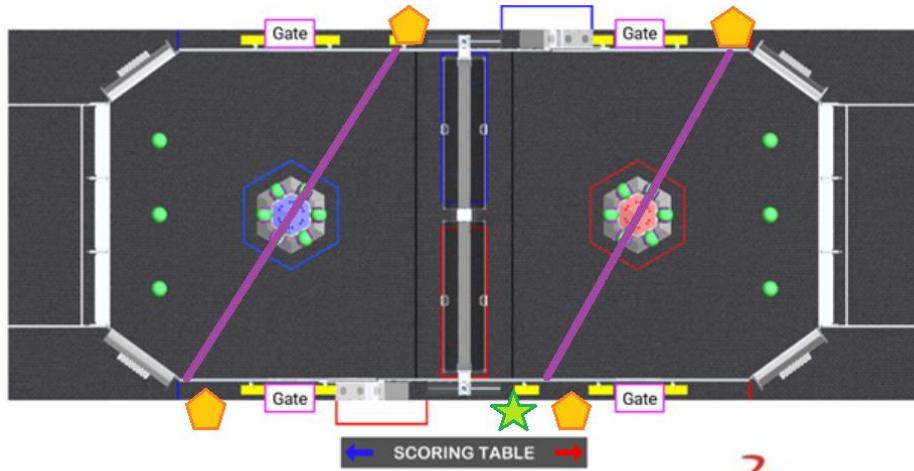
Note the Official Scorer site line requirements (purple lines in Figure 3-9) when positioning the Ref Panels. Official Scorer Triangles on the Reef define the center of each Official Scorer's designated scoring area.

Figure 3-8 Official Scorer fiducial



The Head Referee panel (star in Figure 3-9) is offset towards the red alliance side of the field to leave room between the truss and the Scoring Table for people to walk by.

Figure 3-9 Referee Panel Locations



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### 3.5.3 Wiring

Power for the Referee Panels is over Ethernet, make sure all Referee Panels are plugged into POE capable ports.

The Head Ref (HR) panel is the only panel to receive its Ethernet connection from the Scoring Table.

- The RN and RF panels connect to the Red SCC using the red Ethernet cables.
- The BN and BF panels connect to the Blue SCC using the red Ethernet cables.

### 3.6 Coral Station

A total of 4 Coral Station Stations need to be built. The large weldment should be attached to the field during the construction of the field border.

#### 3.6.1 Tools & Equipment (for 1x Coral Station)

- 2x 7/16" wrenches
- 10x 1/4-20 x 1" hex head bolts
- 6x 1/4-20 x 2.5" hex head bolts
- 8x 2-5/16" quick release pin
- 8x 1/4-20 Nylock nuts
- 40x 50lb cable ties
- 22x 120lb cable ties

#### 3.6.2 Assembly

1.



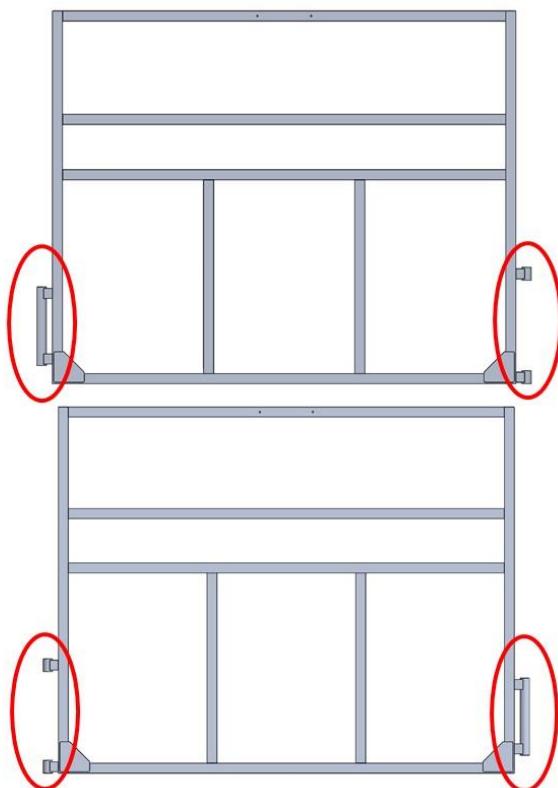
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#### Building the Coral Station



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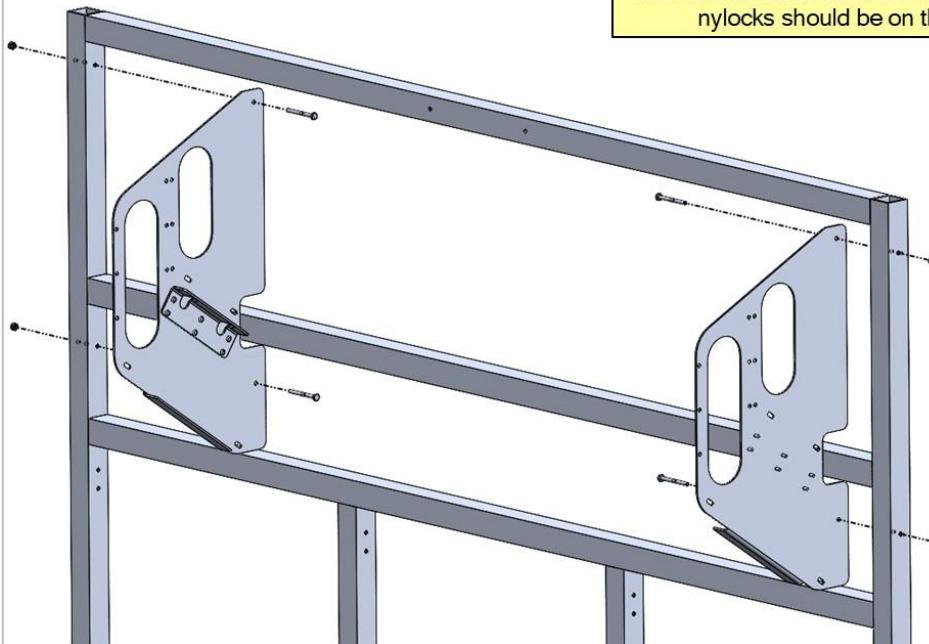


The Coral Station weldment is a part of the field perimeter that will be needed as the start of the build process. The remaining components of the Coral Station can be attached to this frame any time during the Field build.

Each of the four frames can be mounted to any of the four corners of the field by rotating the weldment around to use the corresponding set of tubes, circled here.

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3.

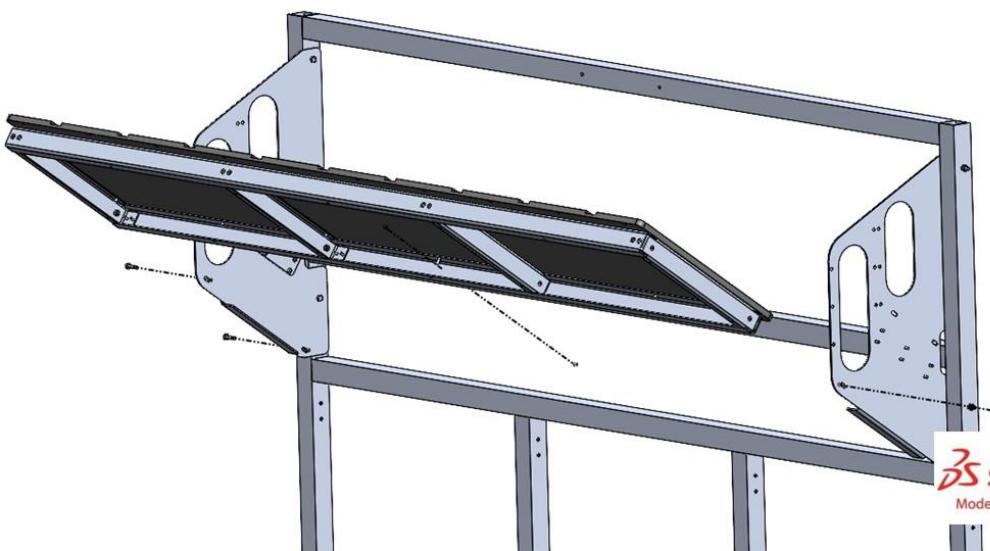


Attach the two side panel assemblies to the inside of the weldment with 2.5" long 1/4-20 hex head bolts and nylocks. The flanges on the side panels should face the inside of the weldment. The bolt heads should face the inside, and the nylocks should be on the outside.

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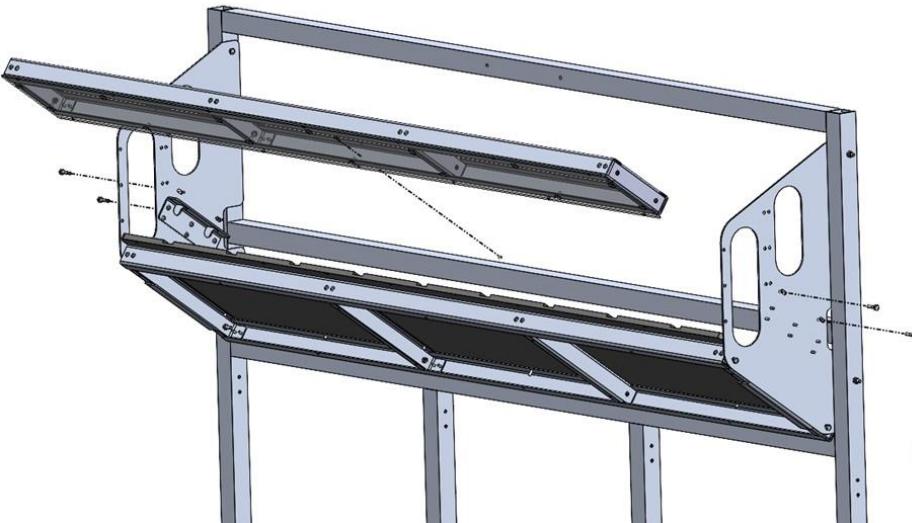
4.

Slide the Chute Ramp Assembly onto the bottom set of flanges until it hits the weldment. Pin this in place with 1" long 1/4-20 hex head bolts into the PEM nuts in the Chute Ramp.

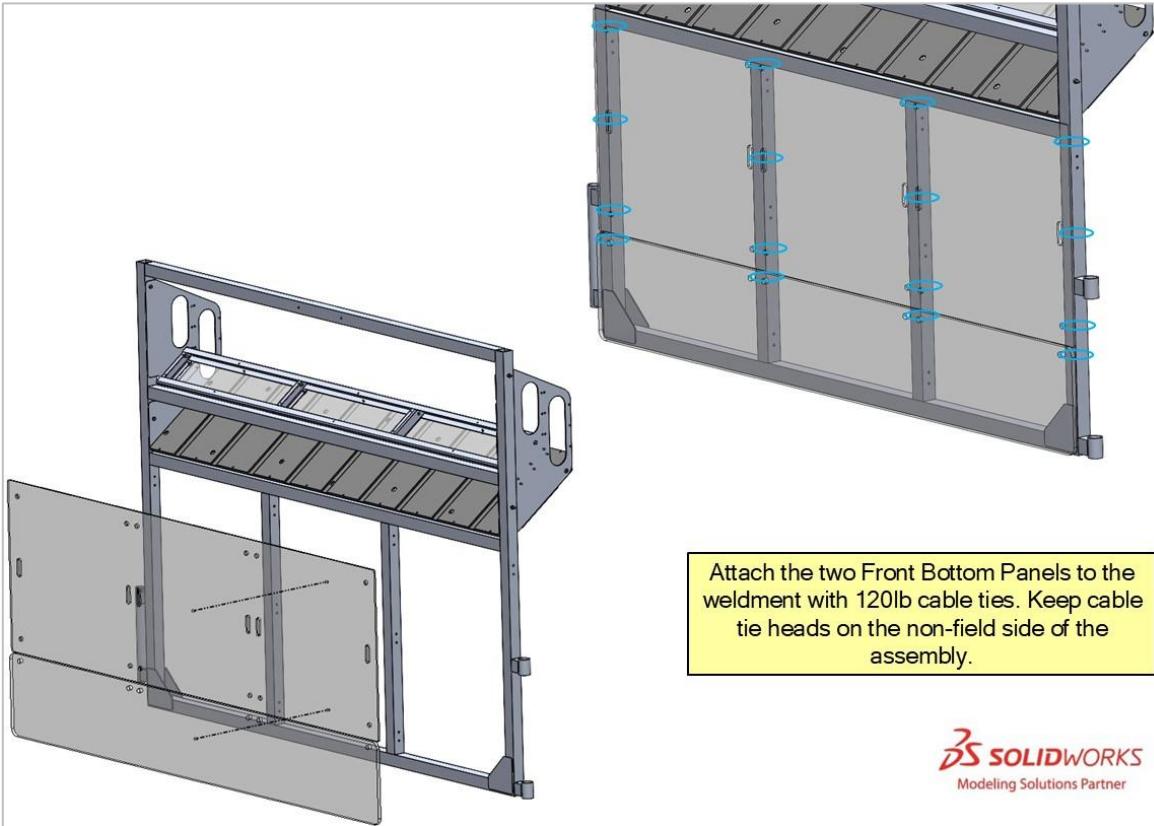


5.

Slide the Chute Roof Assembly onto the top set of flanges until it hits the weldment. Pin this in place with 1" long 1/4-20 hex head bolts into the PEM nuts in the Chute Roof. The plastic on the Chute Roof should face down.



6.



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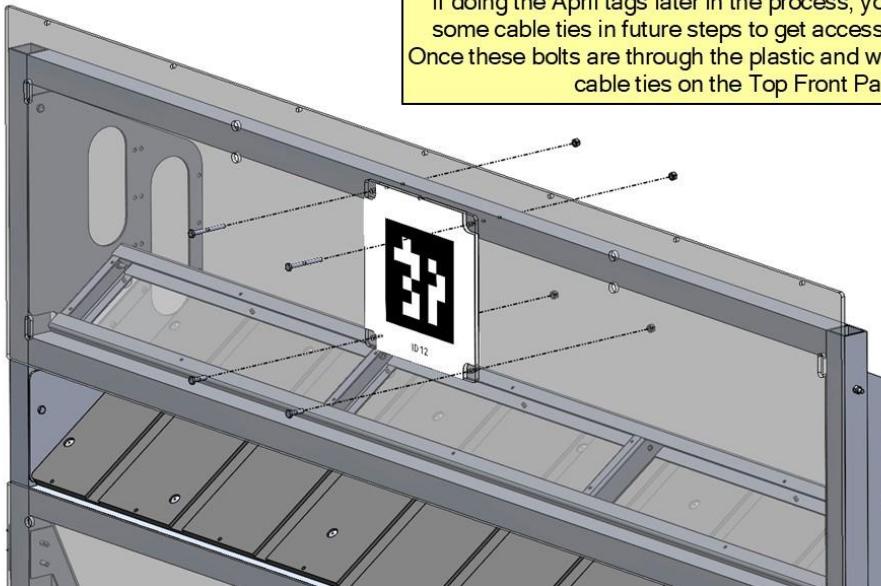


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8.

Attach the correct April Tag on to the structure. The top two holes are lined up with both the Top Front plastic and the holes in the weldment and attach with 2.5" long 1/4-20 hex head bolts. The bottom two holes just go through the plastic and attach with 1" long 1/4-20 hex head bolts. Both sets of bolts are finished with nylocks on the back side.

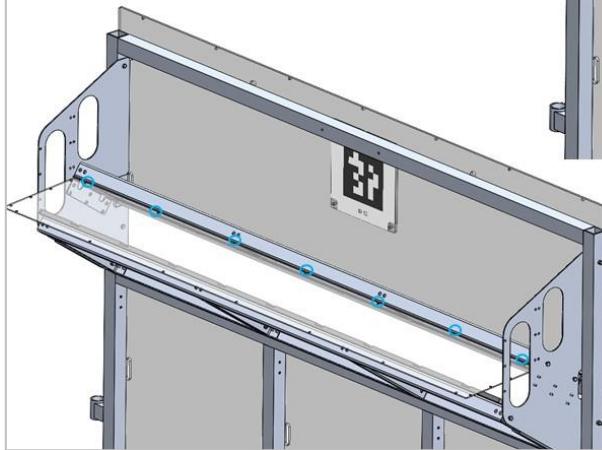
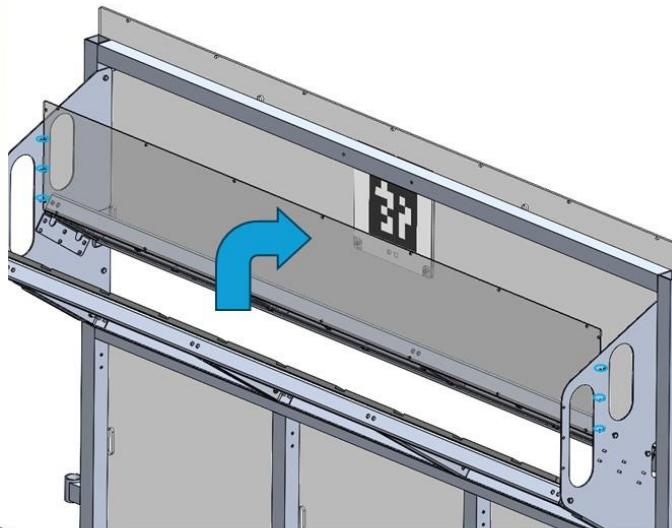
If doing the April tags later in the process, you may need to cut some cable ties in future steps to get access to these nylocks. Once these bolts are through the plastic and weldment, tighten the cable ties on the Top Front Panel.



9.

Attach one of the Top Panels to the end of the Chute Roof plastic with 50lb cable ties.

Leave these ties mostly tight, but loose enough that the Top Panel can rotate. Cable tie heads should be on the top side, so that they will end up on the inside of the structure. Snip the tails off these cable ties now.



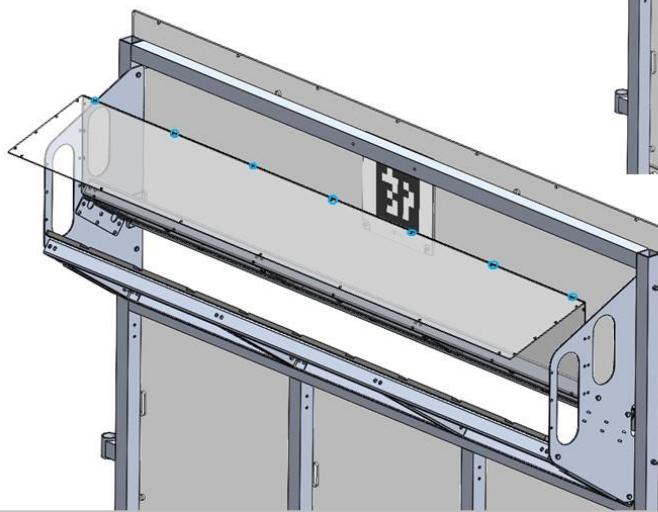
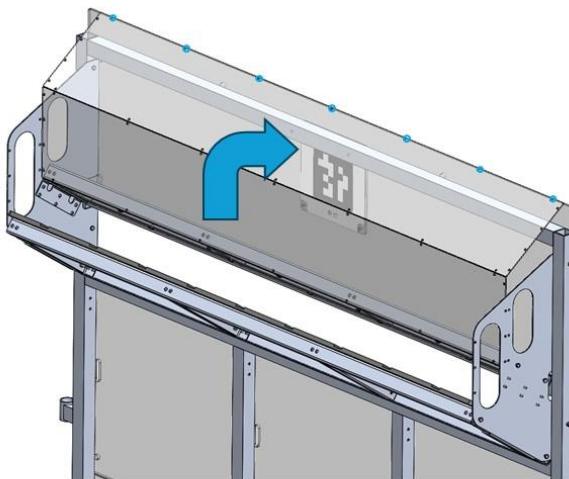
Rotate the top panel so that it is vertical and attach it to the Side Plates with 50lb cable ties. Keep the cable tie heads away from the area where Human Players will have their hands during gameplay.



10.

Attach one of the Top Panels to the top of the vertical Top Panel with 50lb cable ties.

Leave these ties mostly tight, but loose enough that the Top Panel can rotate. Cable tie heads should be on the top side, so that they will end up on the inside of the structure. Snip the tails off these cable ties now.

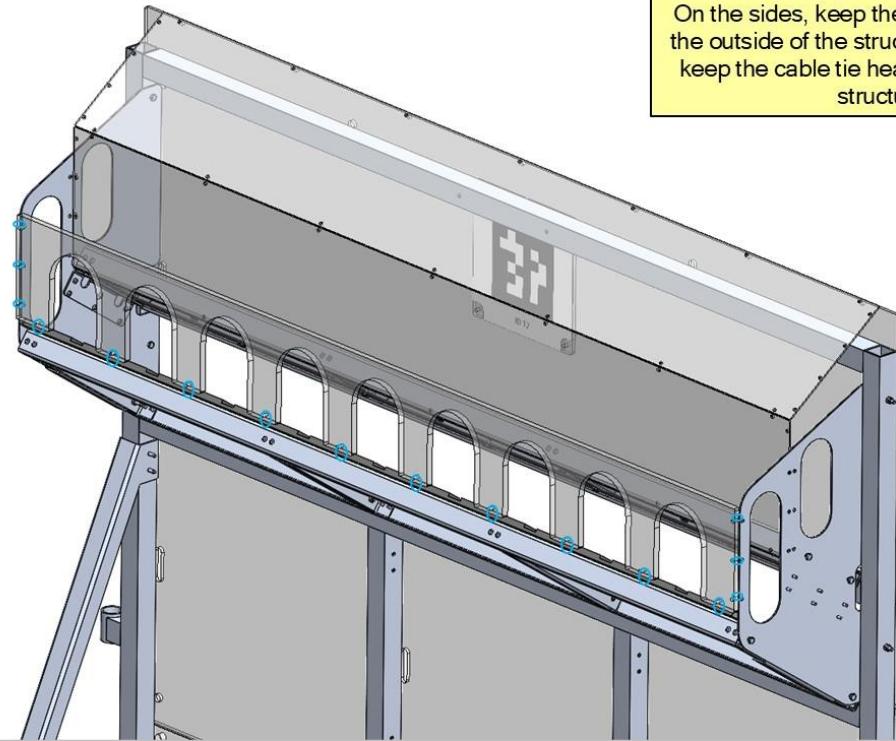


Rotate the top panel so that it is diagonal and attach it to the Top Front Panel with 50lb cable ties. Keep the cable tie heads on the non-field side of the structure.

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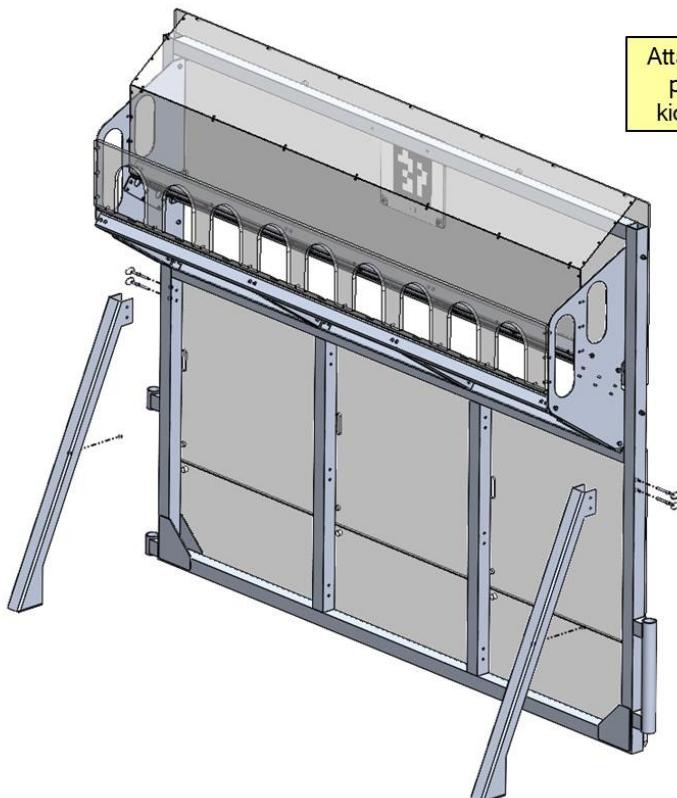
11.

Attach the Back Divider to the Side Plates and Chute Ramp plastic with 50lb cable ties. On the sides, keep the cable tie heads on the outside of the structure. On the Ramp, keep the cable tie heads underneath the structure.



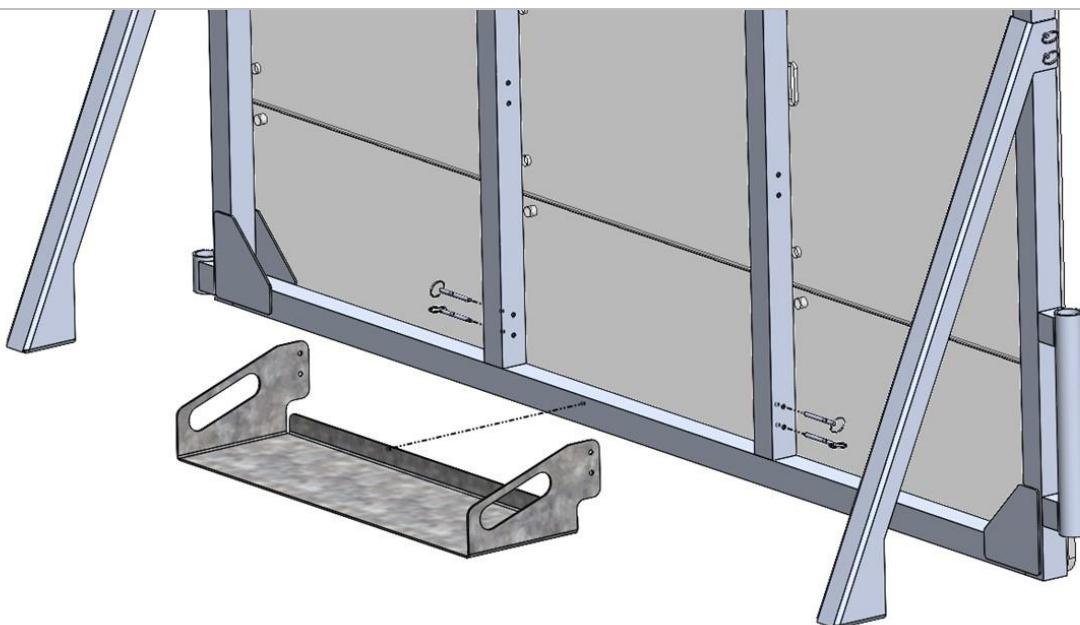
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13.



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## 3.7 Processor

A total of 2 Processor Stations need to be built. The large weldment and side border adapter should be installed during assembly of the Field border. Most of the assembly work can be done away from the Field if convenient.

### 3.7.1 Tools & Equipment (For 1x Processor)

- 2x 7/16" wrenches
- 1x Phillips head (#3) screwdriver
- 39x 1/4-20 x 1" hex head bolts
- 2x 1/4-20 x 2.5" hex head bolts
- 12x 1/4-20 x 2.5" counter sunk Phillips bolts
- 14x 1/4-20 Nylock nuts
- 6x 2-5/16" quick release pins
- 45x 50lb cable ties
- 4x 120lb cable ties
- White Gaffers tape

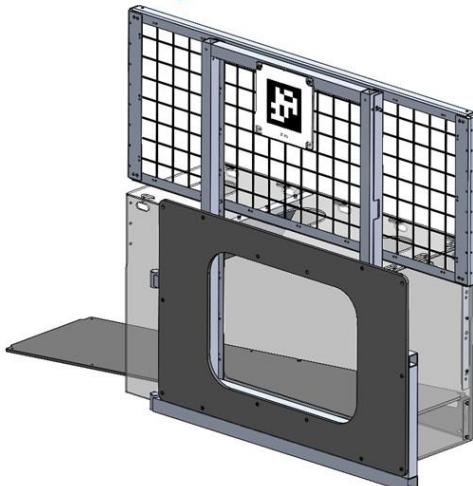
### 3.7.2 Assembly

1.



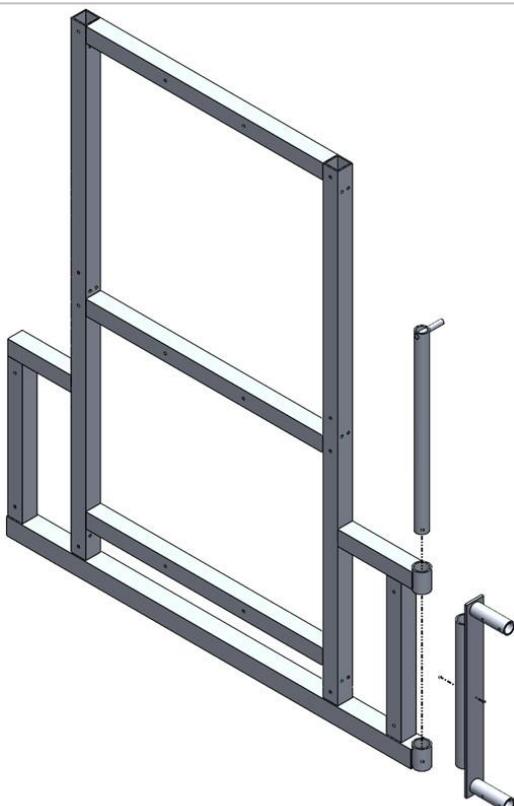
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### Building the Processor



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2.

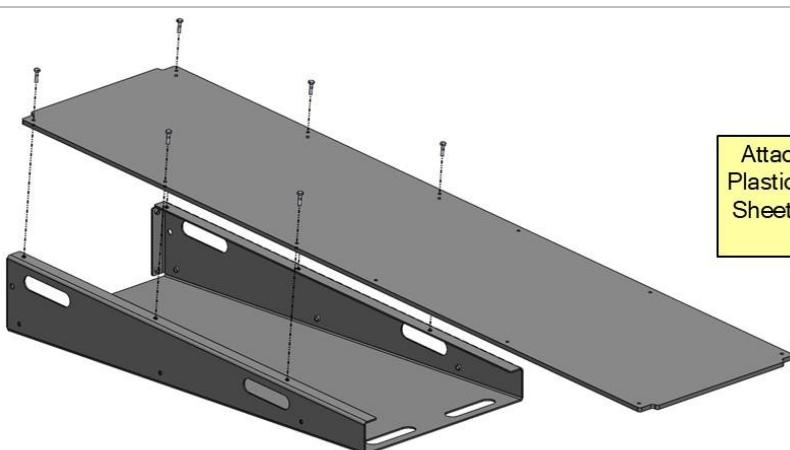


The Processor weldment and Wall Adapter are a part of the Field perimeter that will be needed as the start of the build process. The remaining components of the Processor can be attached to this frame any time during the Field build.

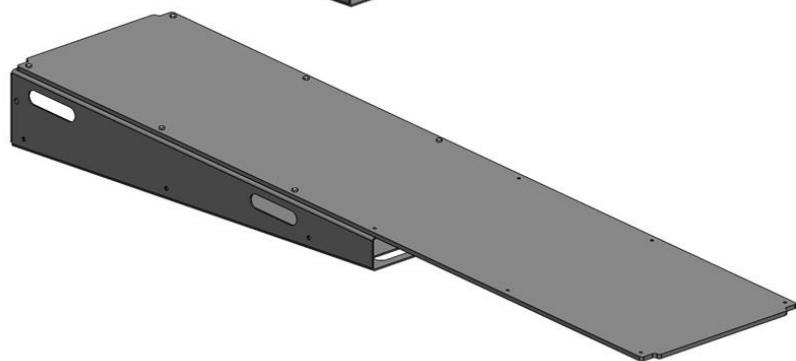
Each of the two frames can be mounted to either of the field. The weldment will need to be flipped around from how it is shown in this document if building the Field with an AndyMark Field Border.

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3.

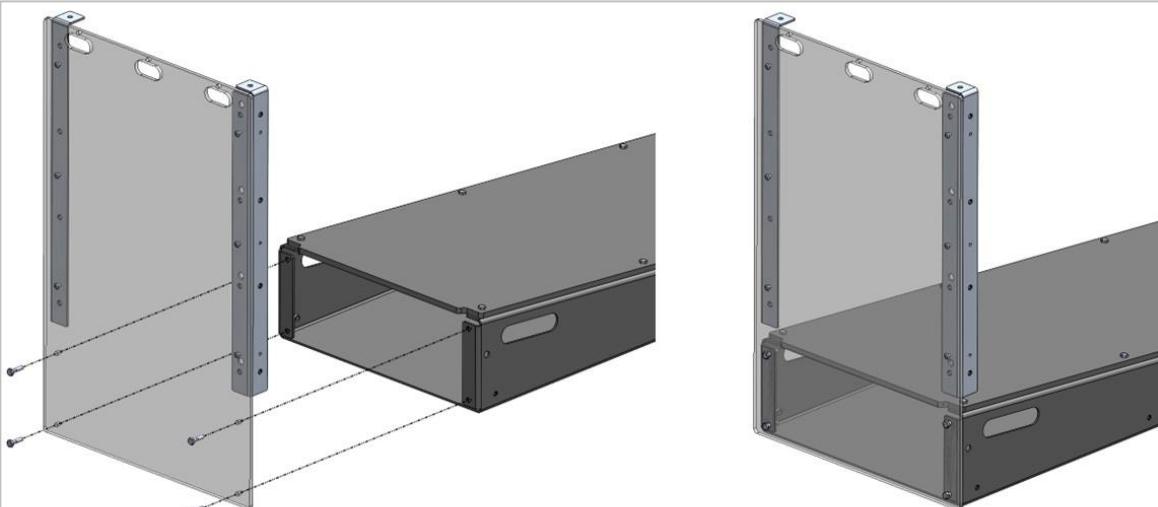


Attach the Processor Ramp Plastic to the Processor Ramp Sheetmetal with 1" long 1/4-20 hex head bolts.



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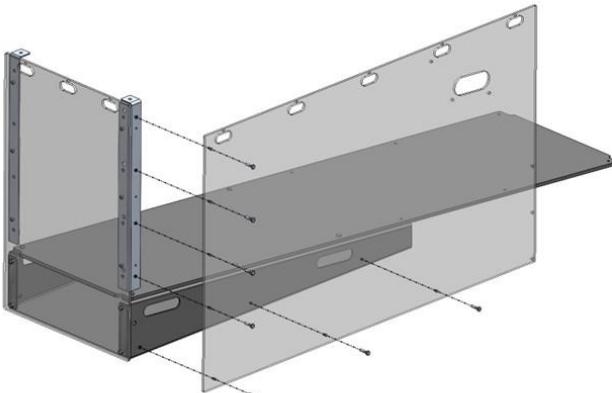
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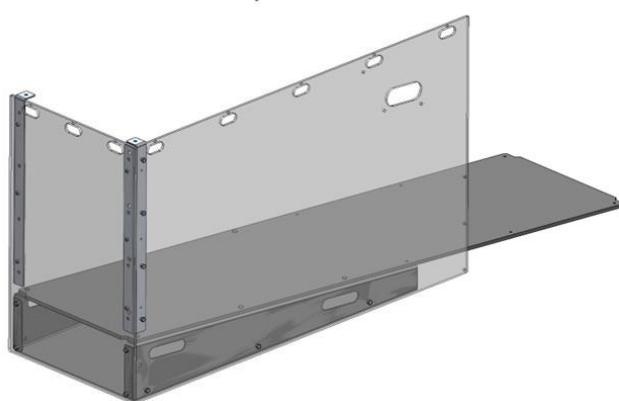
Attach the Ramp Back Assembly to the structure with 1" long 1/4-20 hex head bolts.

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5.

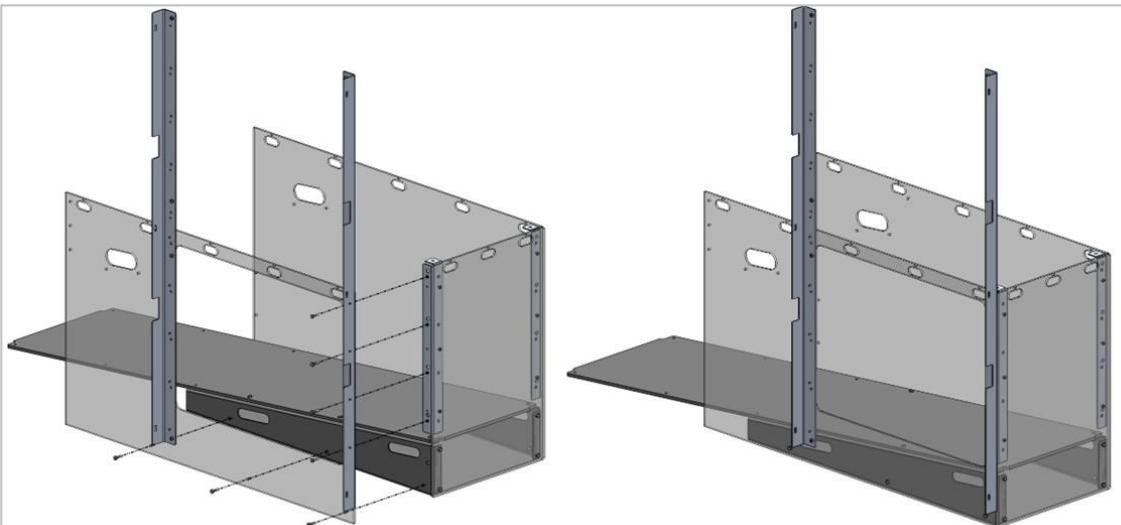


Attach the Processor Humanside Panel to the assembly with 1" long 1/4-20 hex head bolts.



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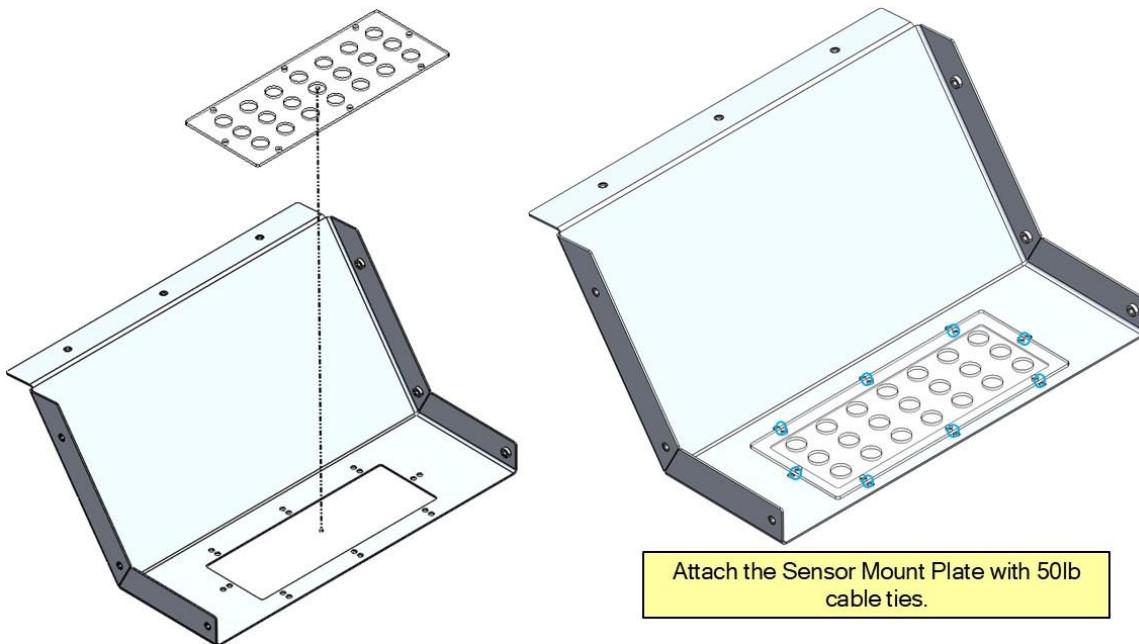
6.



Attach the Fieldside subassembly to the structure using 1" long 1/4-20 hex head bolts.

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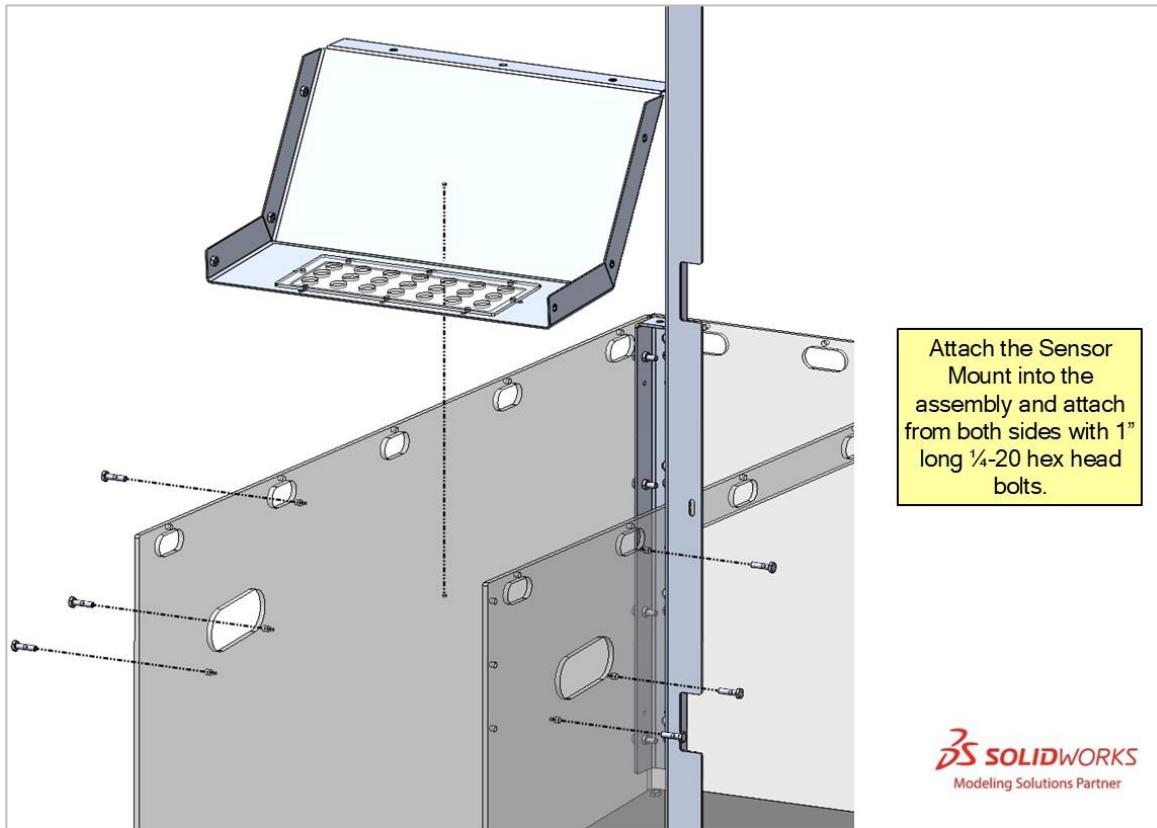
7.



Attach the Sensor Mount Plate with 50lb cable ties.

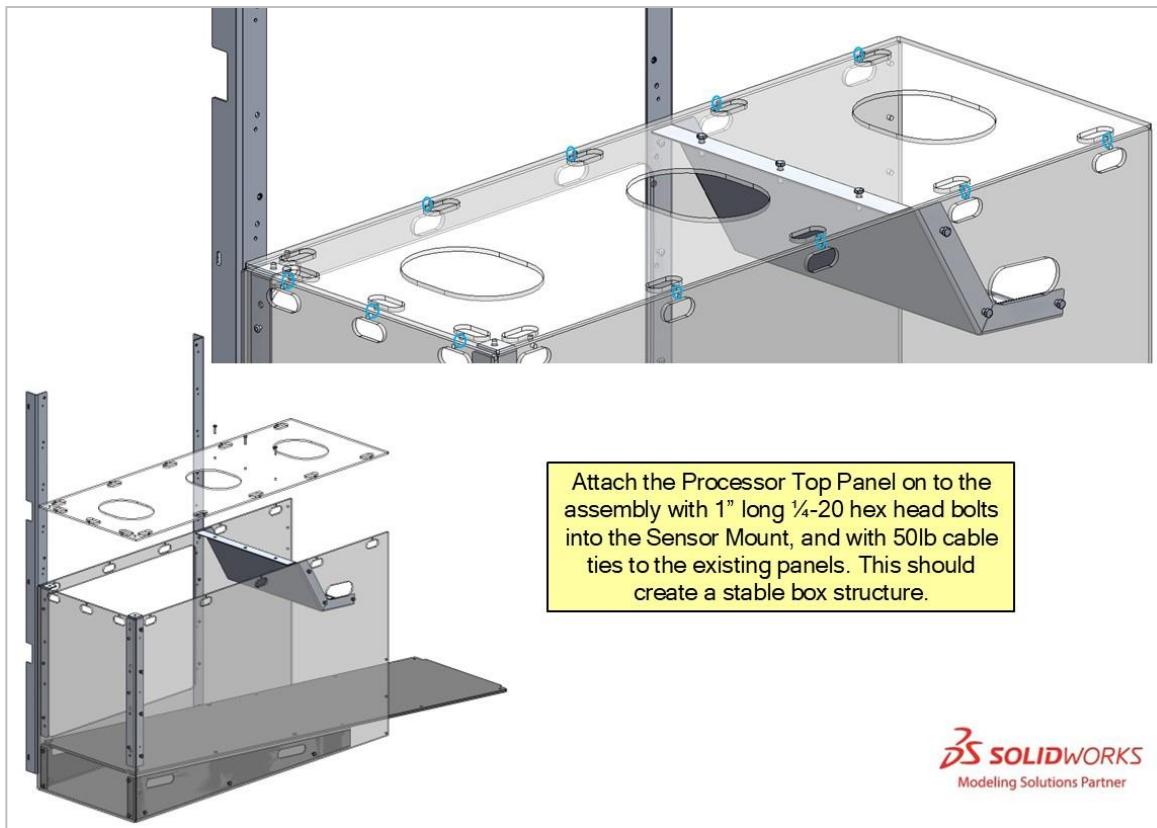
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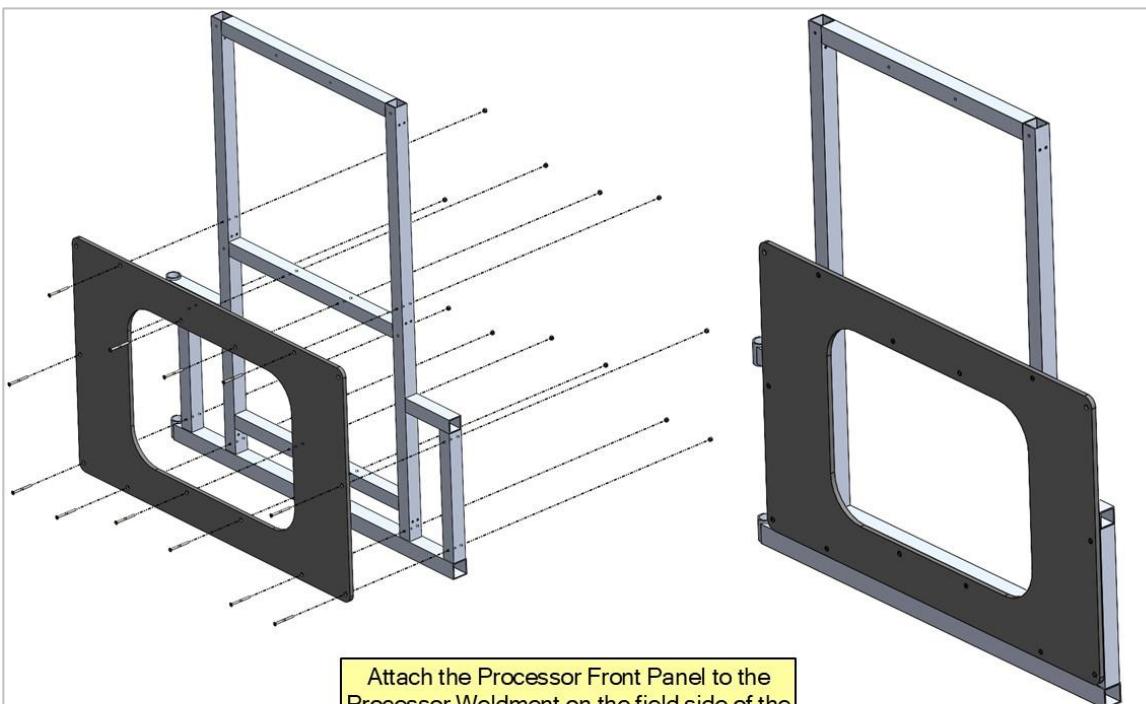
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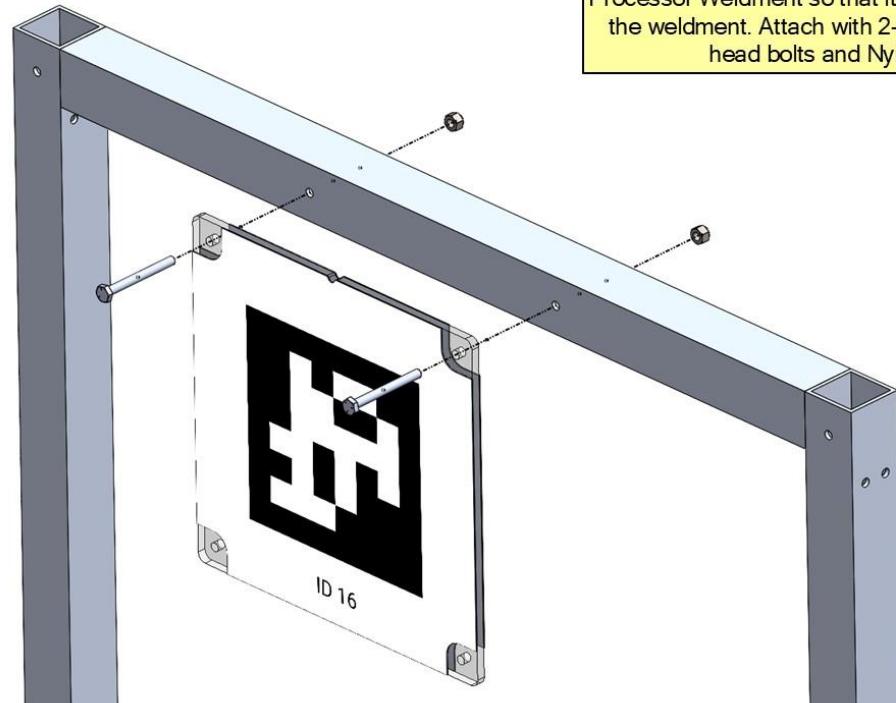
10.



Attach the Processor Front Panel to the Processor Weldment on the field side of the weldment with 2-3/4" long 1/4-20 countersink bolts and Nylock nuts.

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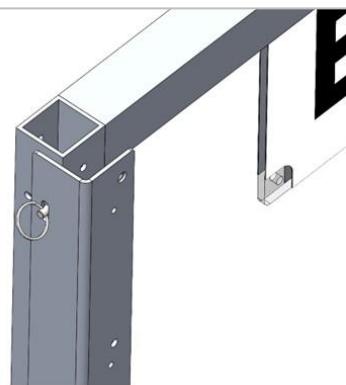
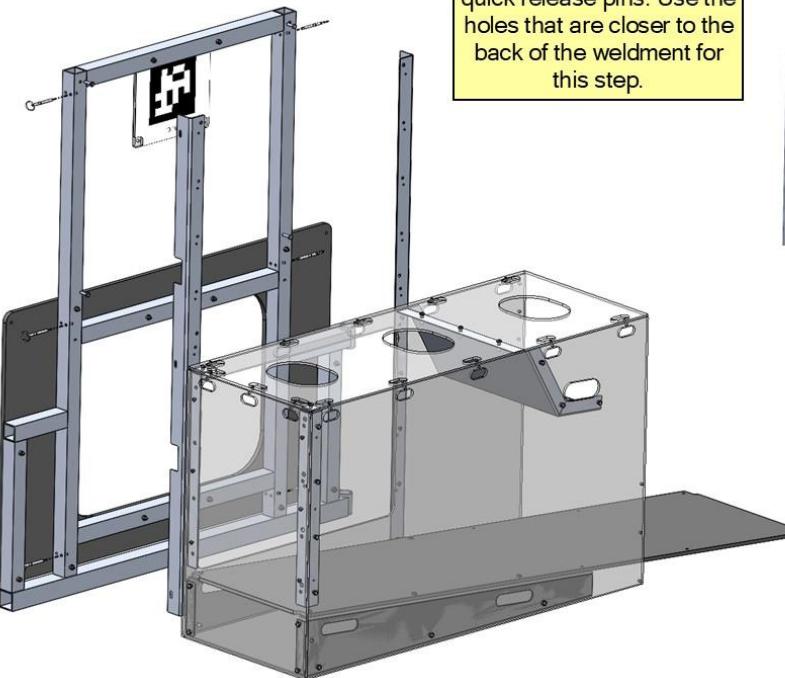
11.



Attach the appropriate ID April Tag to the top of the Processor Weldment so that it is on the field side of the weldment. Attach with 2-1/2" long 1/4-20 hex head bolts and Nylock nuts.

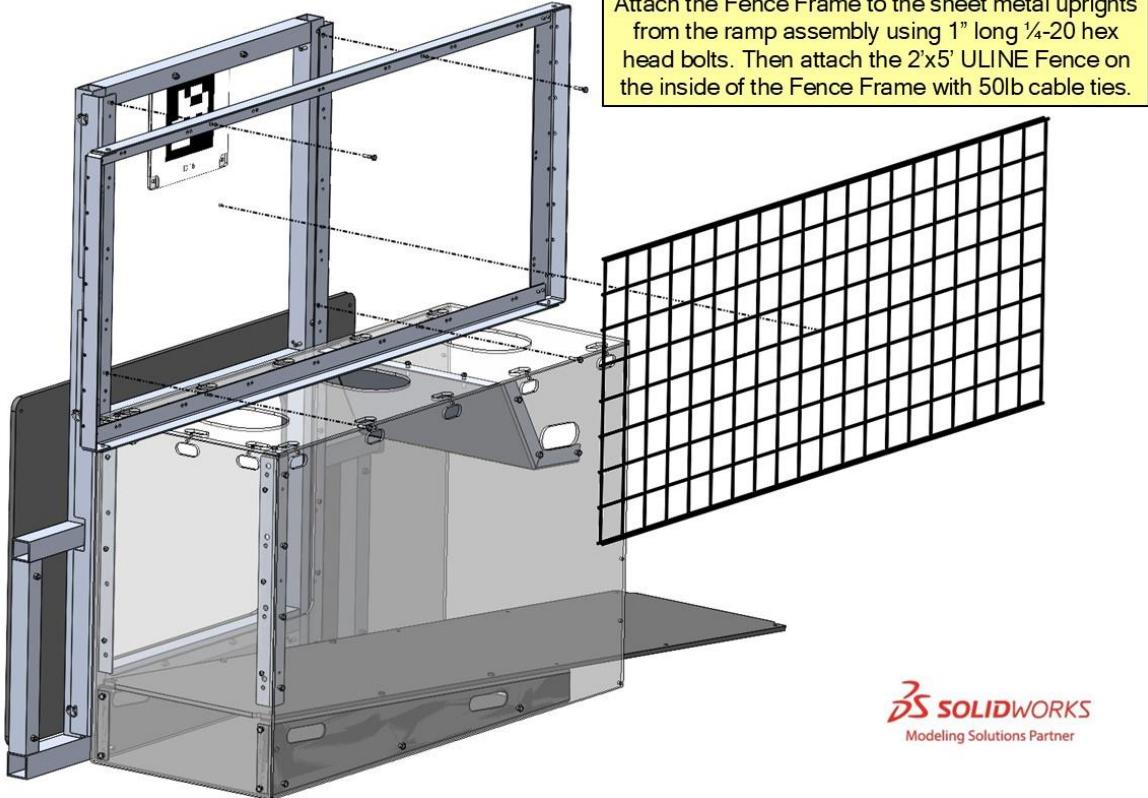
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12.



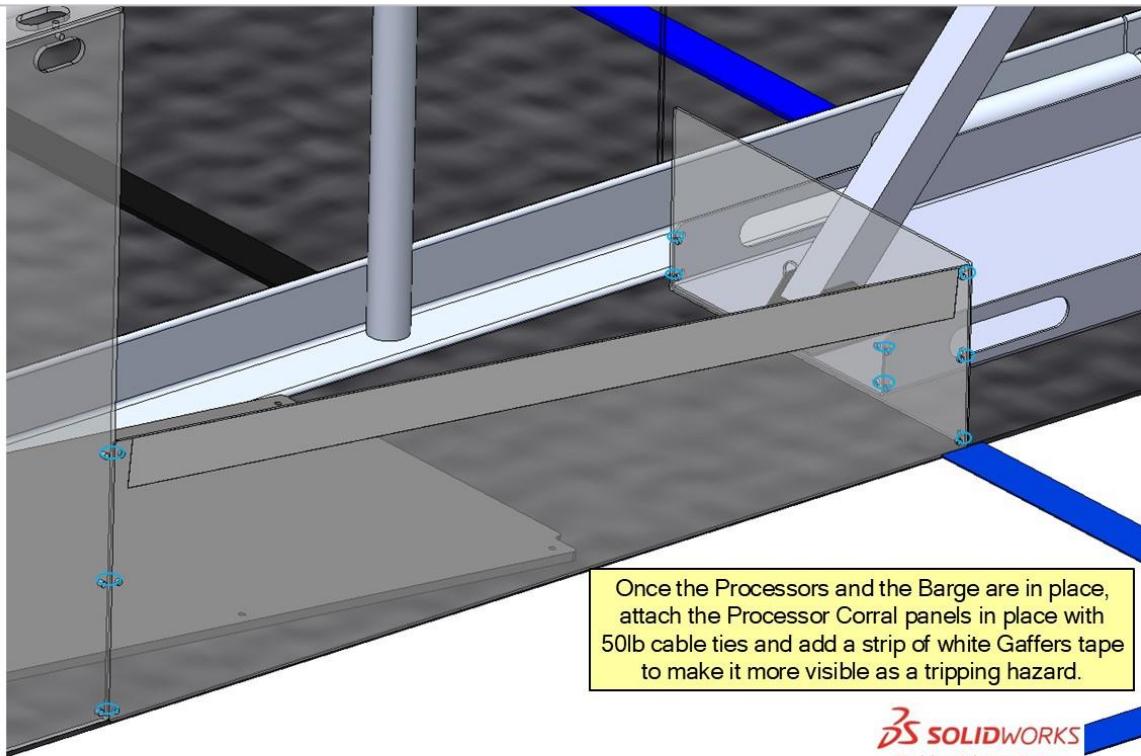
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13.



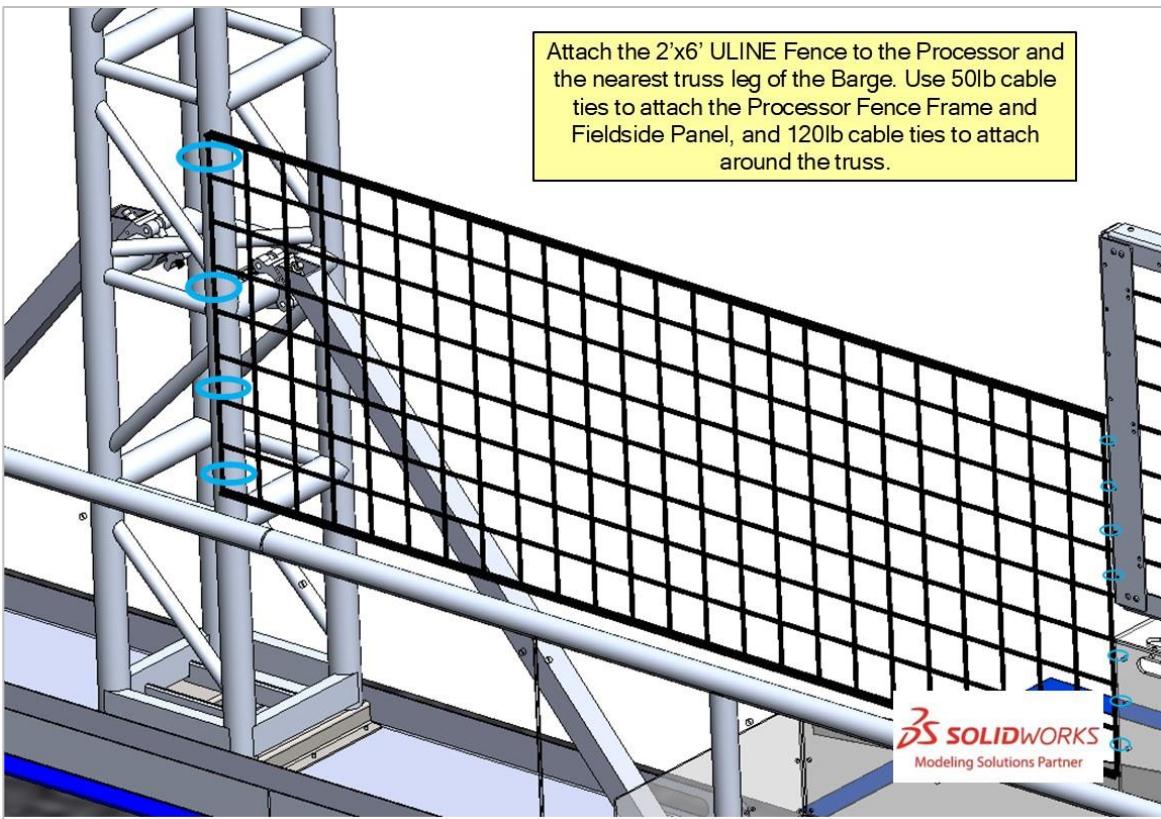
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14.



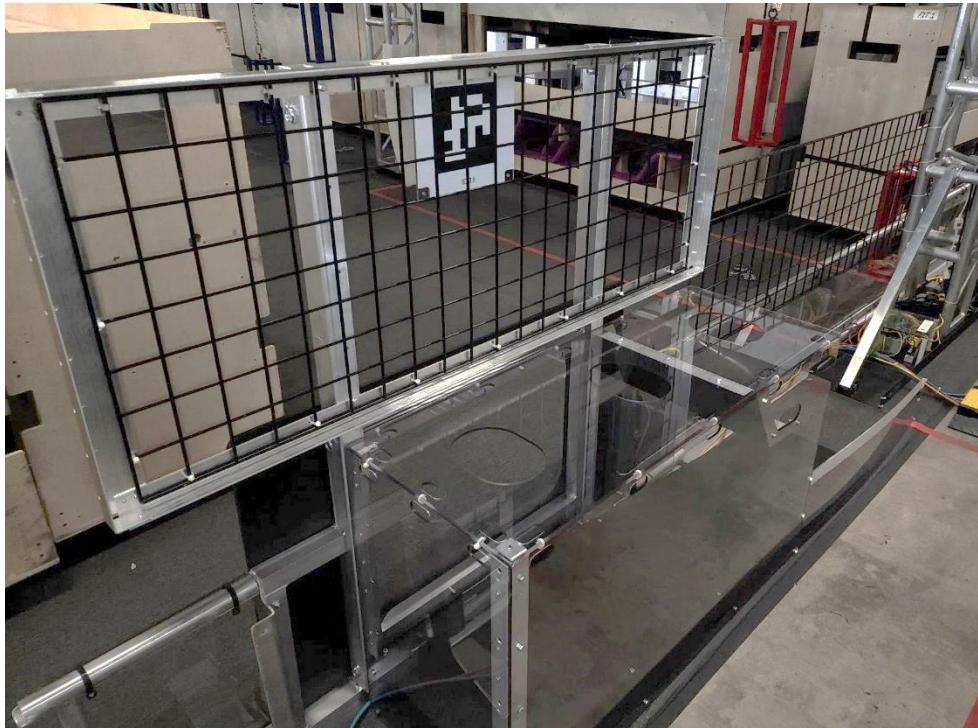
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15.



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### 3.7.3 Electronics



#### 3.7.3.1 Equipment

##### Sensor Wiring

- Case 7 - 2025 Game Specific – Both Processors
  - 2 - Smart IO boxes w/IEC power cable
  - 2 - GFCI power adapters
  - 6 - Barge Light relay box
  - 2 – 8 outlet power strips
  - 2 - Main power extension cord (5' for Red, 25' for Blue)
  - 2 - A-B Y Cables
  - 8 - 5m A-B cables
  - 2 - 30m black Ethernet
  - 2 - Processor Station Sensor units

#### 3.7.3.2 Processor wiring

- The Smart IO, 8-outlet power strips, and relay boxes go in the Long Truss Base.
- The Processor extension cord plugs into the GFCI adapter, and then to the power strip, then the SmartIO and all 3 relay boxes plug into the power strip.
  - Blue processor power connect to the Scoring Table.
  - Red processor power connects to the red alliance wall.

- The 30m ethernet cable gets plugged into the Smart IO and the closest SCC to that processor.
- Take the processor station sensor units and attach them to the processor such that the sensors are in the farthest positions from the processor opening. (Shown below)

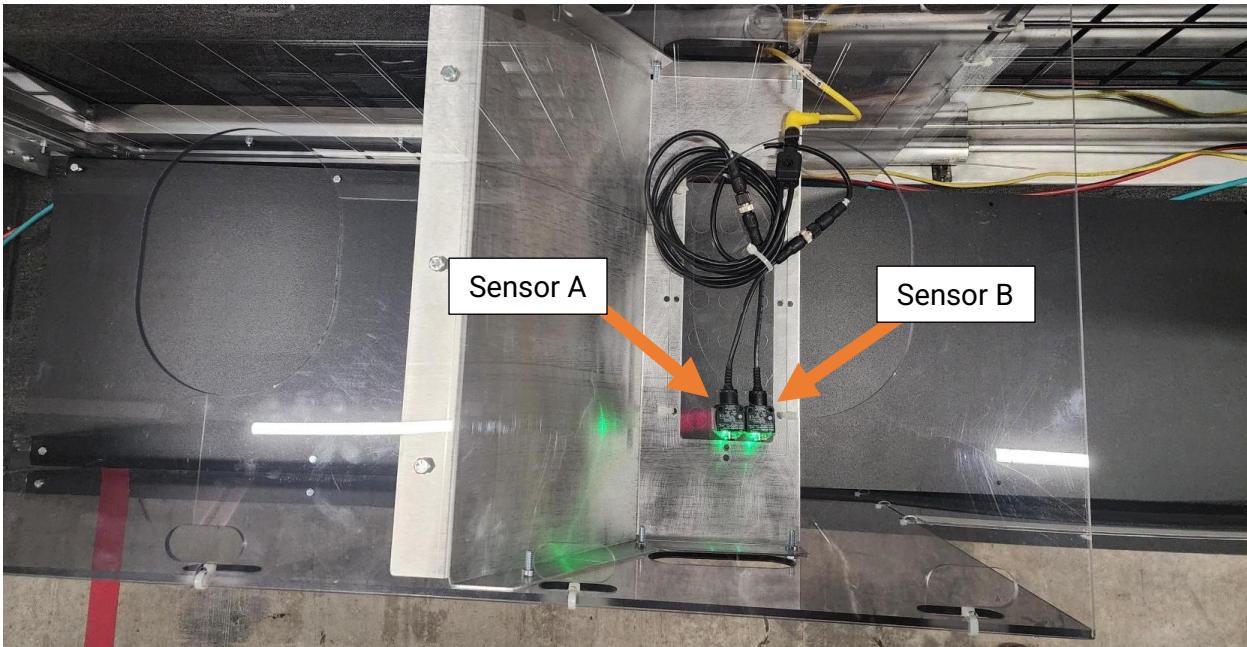


Figure 3-11 Sensor Assembly

- The sensors plug into the A-B Y-Cable with the sensor closest to the opening getting attached the lead marked as "A" and the other getting "B"
- The Y-cable then plugs into one of the 5m A-B cables routed similarly to the figure below. Then plugging into the 0/1 port of the Smart IO, labeled Processor Sensors
- The other 3 5m A-B cables plug into the remaining 3 Smart IO ports each labeled for the Inner, Middle, and Outer lights.

The "Inner light" is closest to the middle of the field and "Outer light" is on the field border.

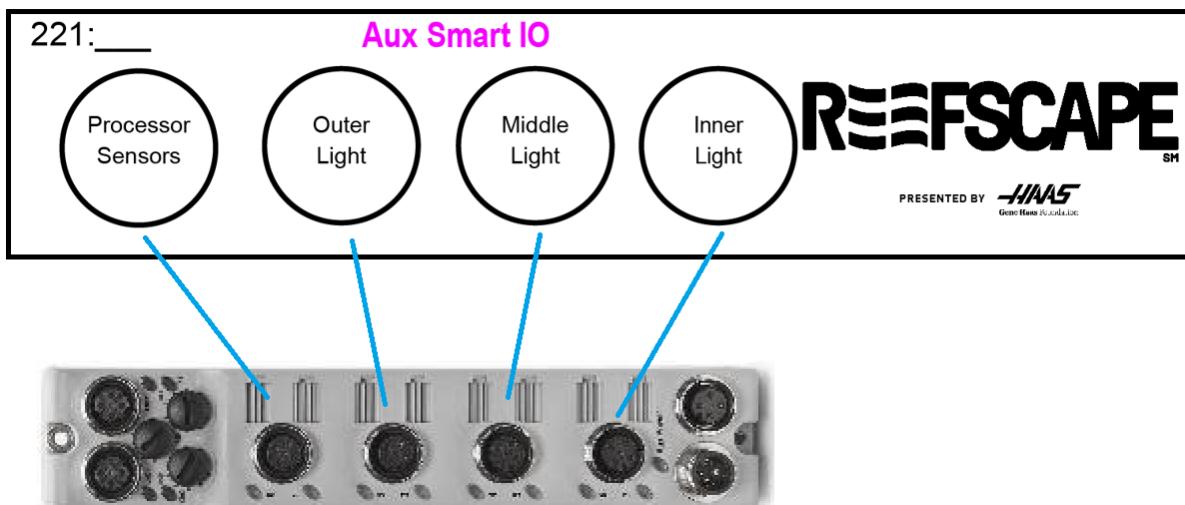
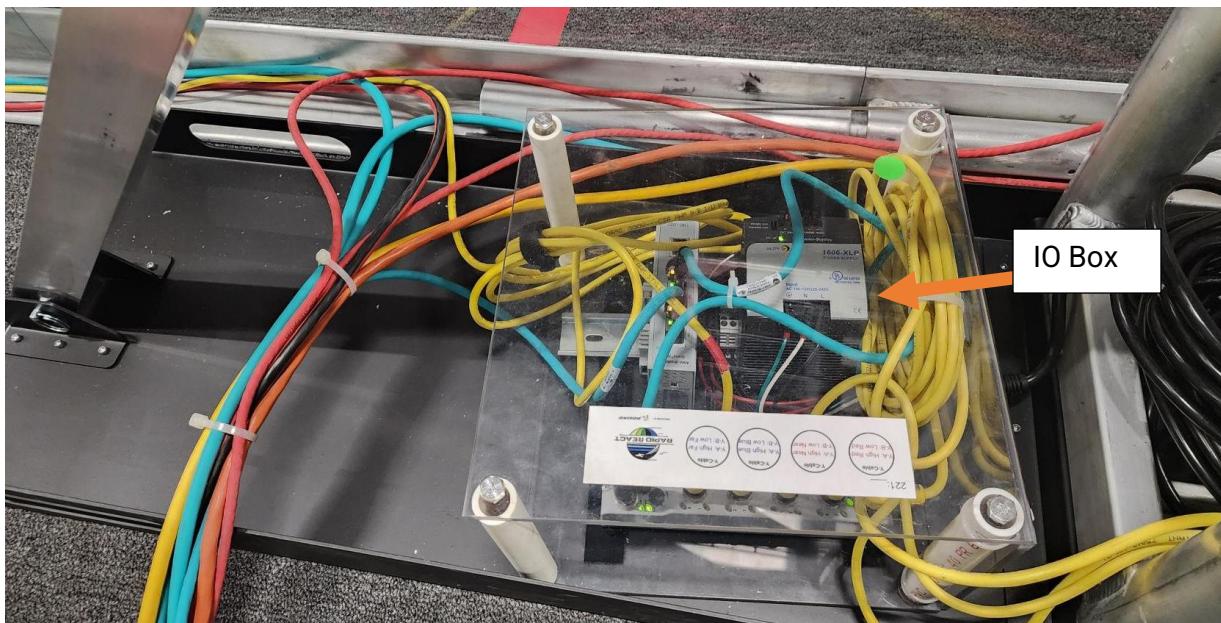


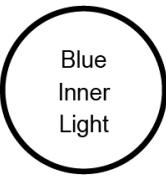
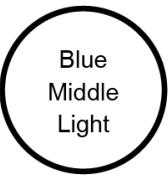
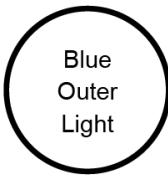
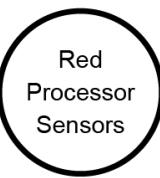
Figure 3-12 Truss Base Wiring (Blue Processor)

- The relay boxes plug into the extension leads coming from the Barge lights. See 3.8 for more details on installing Barge lighting.

Red Smart IO

241: \_\_\_\_\_

**Red Smart IO**



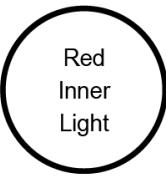
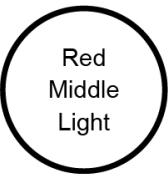
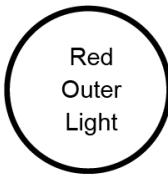
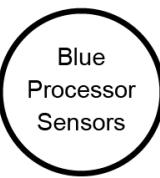
**REEFSCAPE**<sup>SM</sup>

PRESENTED BY 

Blue Smart IO

240: \_\_\_\_\_

**Blue Smart IO**



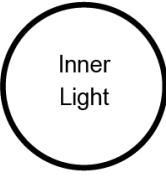
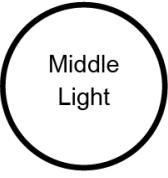
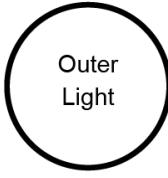
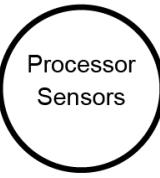
**REEFSCAPE**<sup>SM</sup>

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Aux Smart IO

221: \_\_\_\_\_

**Aux Smart IO**



**REEFSCAPE**<sup>SM</sup>

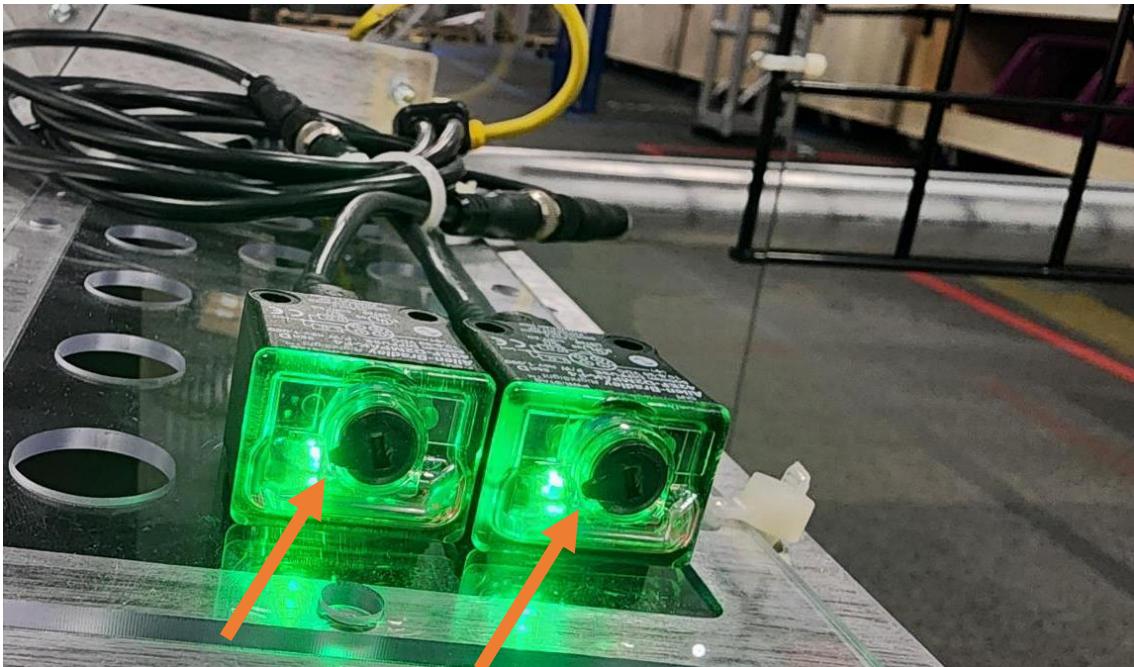
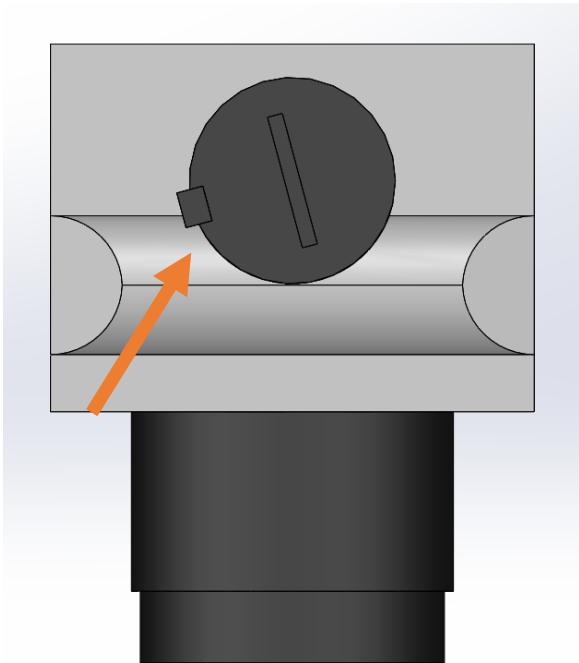
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### 3.7.3.3 Wire Management

All wires should be kept as clean and neat as possible. In the Long Truss Base excess wires can be stored in the Truss as this is out of the way of people walking by. Behind the Alliance Station, excess wiring can be stored behind the SCC.

### 3.7.3.4 Processor Sensor Calibration and Adjustment

Both Sensors should be set at their absolute minimum. As shown below



### 3.8 Barge

One Barge needs to be built. Tools & Equipment (for 1x Barge)

- 7/16" wrenches/sockets
- ¾" wrenches /sockets
- 15/16" wrenches/sockets
- 50 lb. cable ties, white
- 50 lb. cable ties, black (ONLY USE ON REEFSCAPE LOGO PLASTIC)
- 120 lb. cable ties
- 6x ½-13 eye nuts
- 6x ½-13 shoulder eye bolts
- 8x ¼-20 x 1" hex head bolts
- 10x 1/2-13 x 1.25" hex bolts
- 10x ½-13" nylock nuts
- 12x ½" flat washers
- Tackle box of truss hardware
- 24x ¼" x 2-5/16" pins

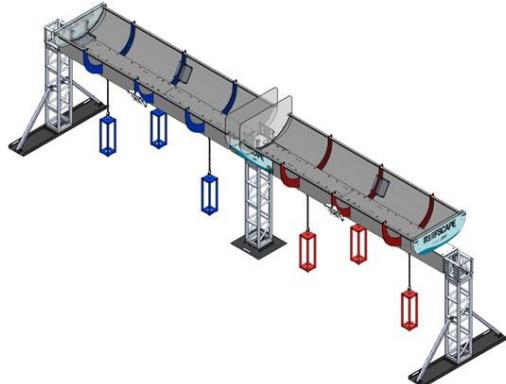
### 3.8.4 Assembly

1.



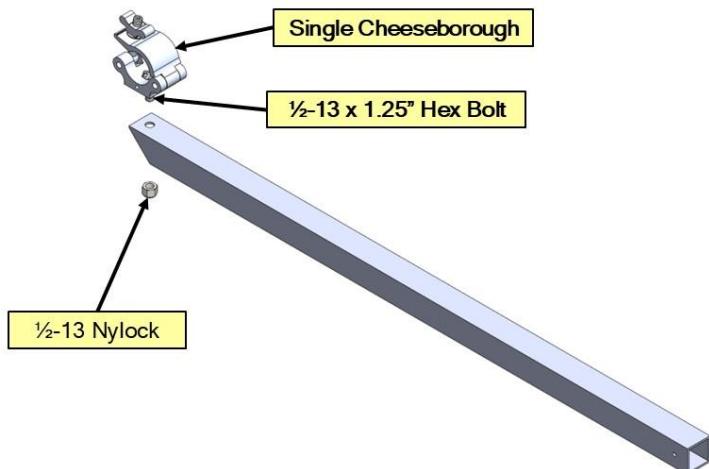
PRESENTED BY **HAIAS**  
Gene Haas Foundation

#### Building the Barge



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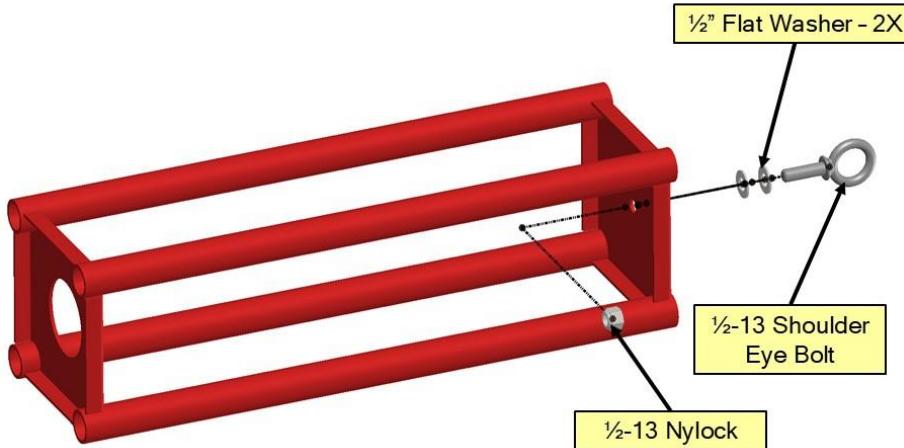
2.



Truss Brace Assemblies - 4 units needed

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3.

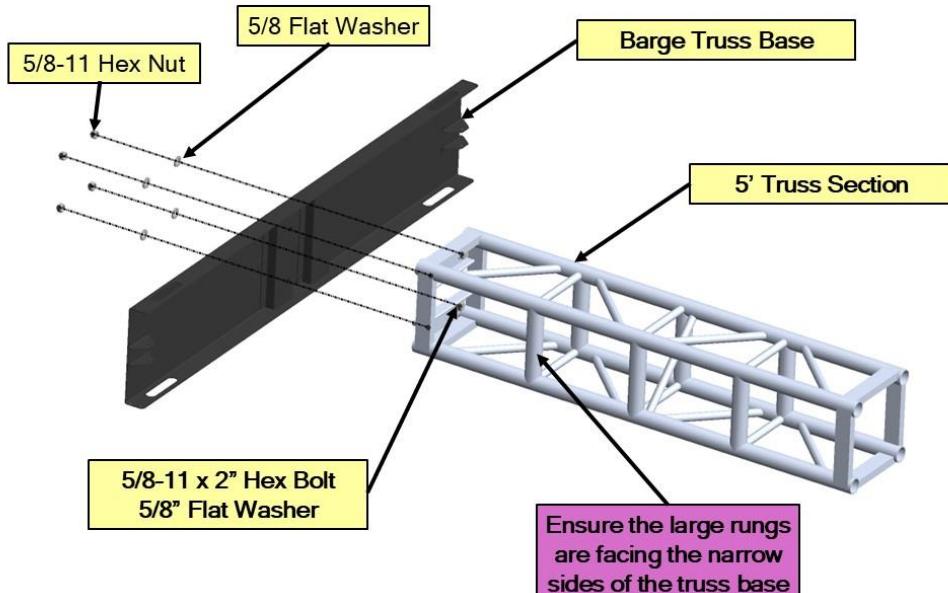


Attach shoulder eye bolts to the cages using hardware shown. Tighten so that the cages do not spin freely, but can still rotate by hand with some difficulty.

**Units Needed: 3 Red, 3 Blue**

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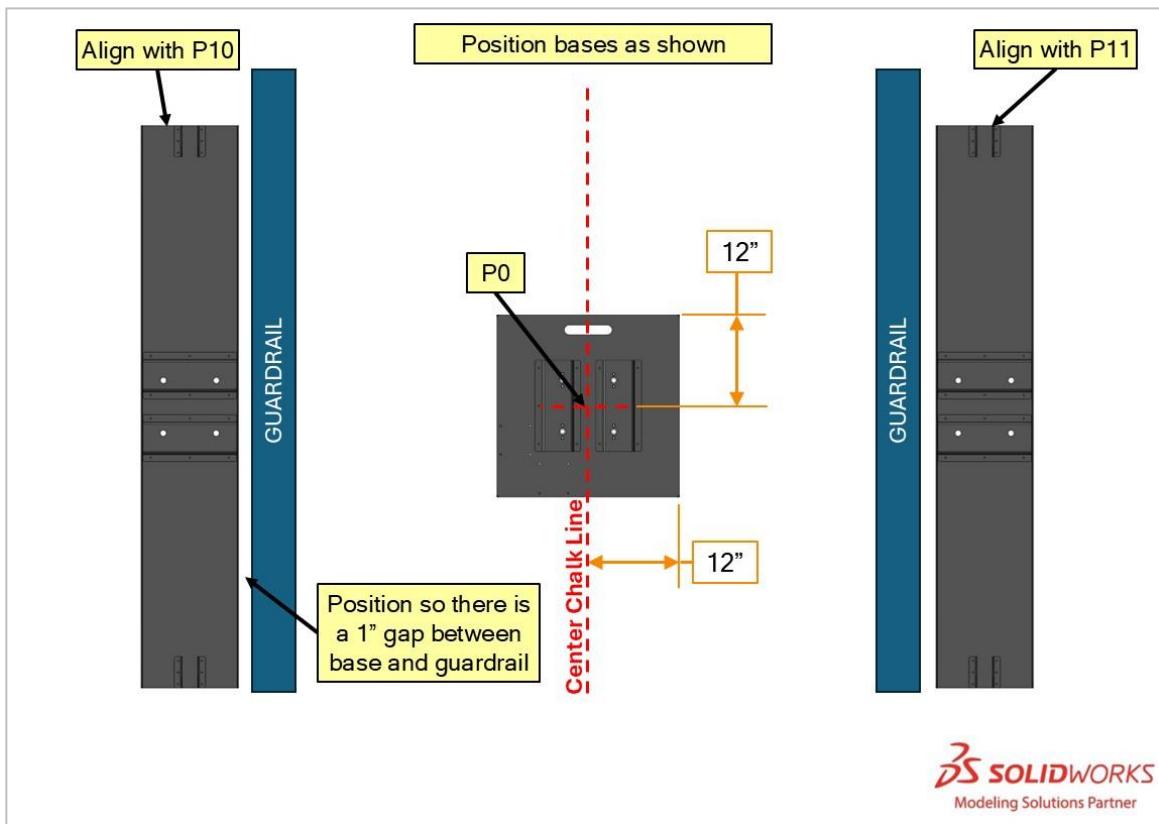
4.



**Units Needed: 2**

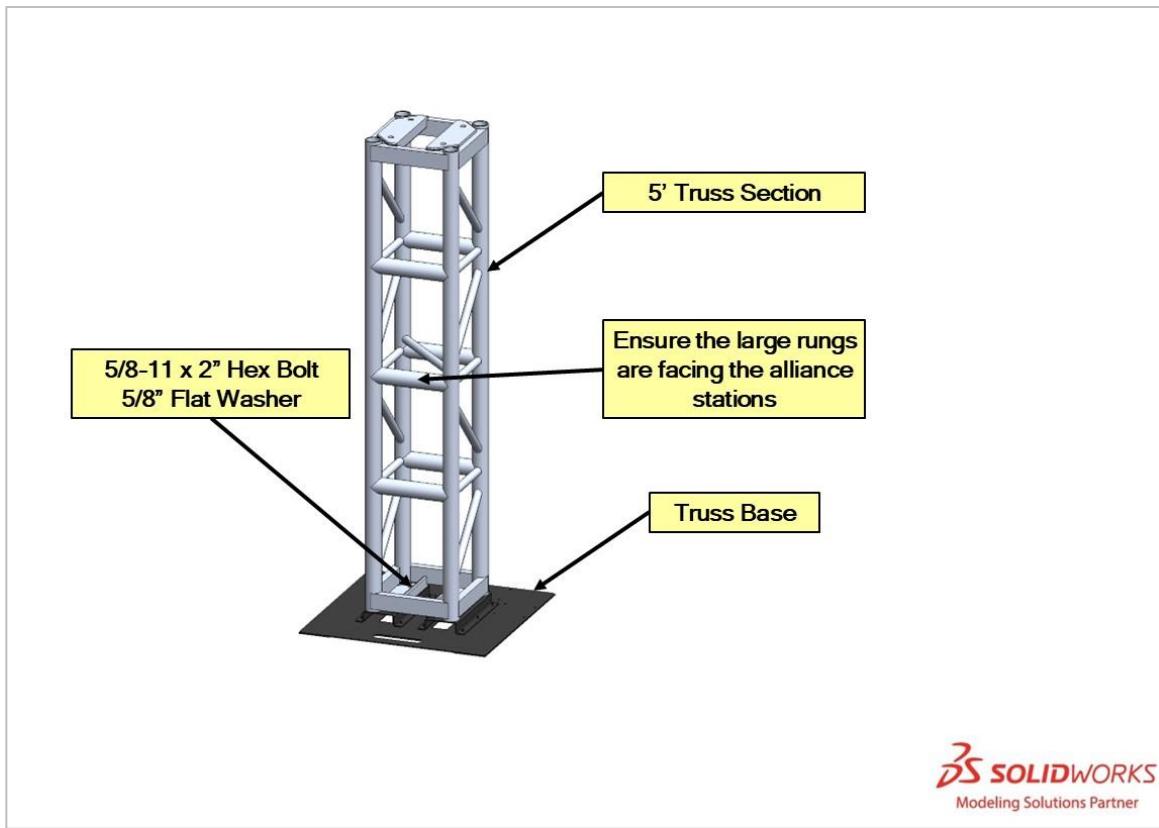
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5.



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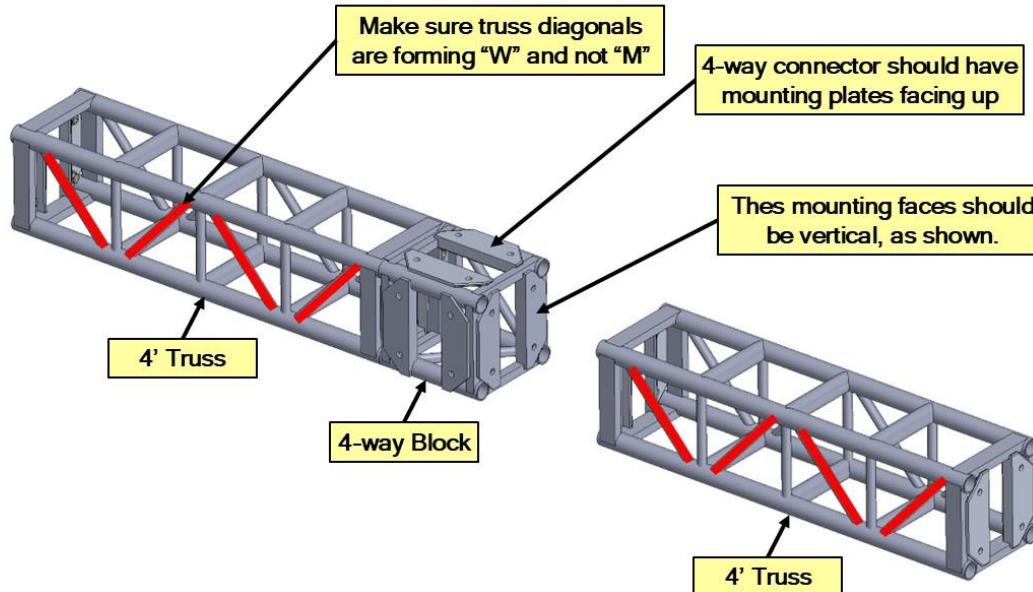
6.



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Modeling Solutions Partner

7.

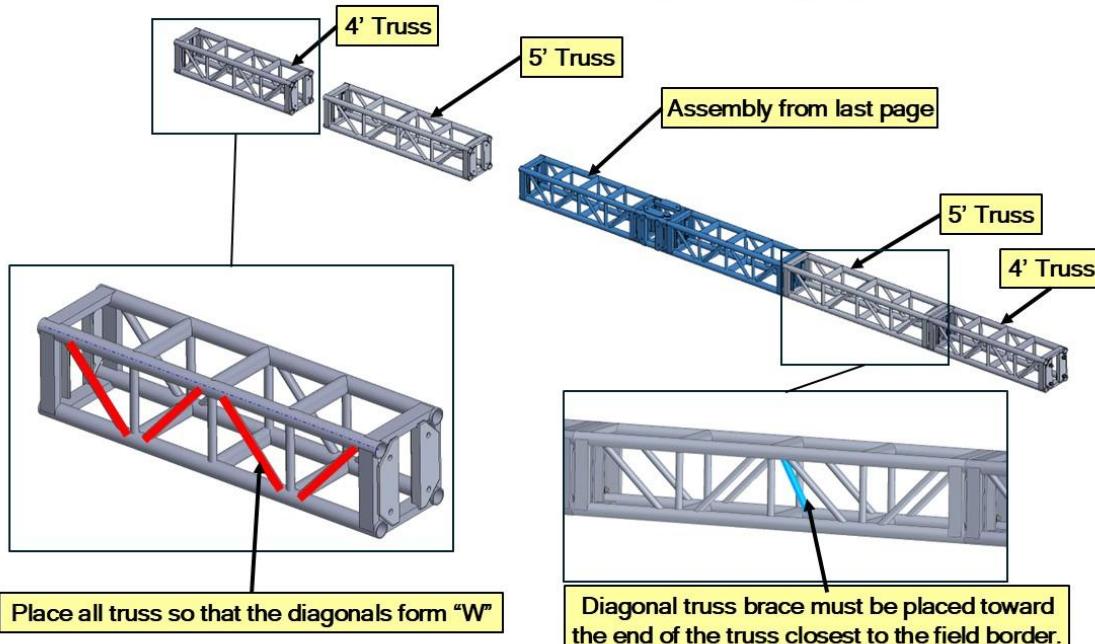
**IMPORTANT:** Incorrect truss orientation will cause significant delays in your build time.



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8.

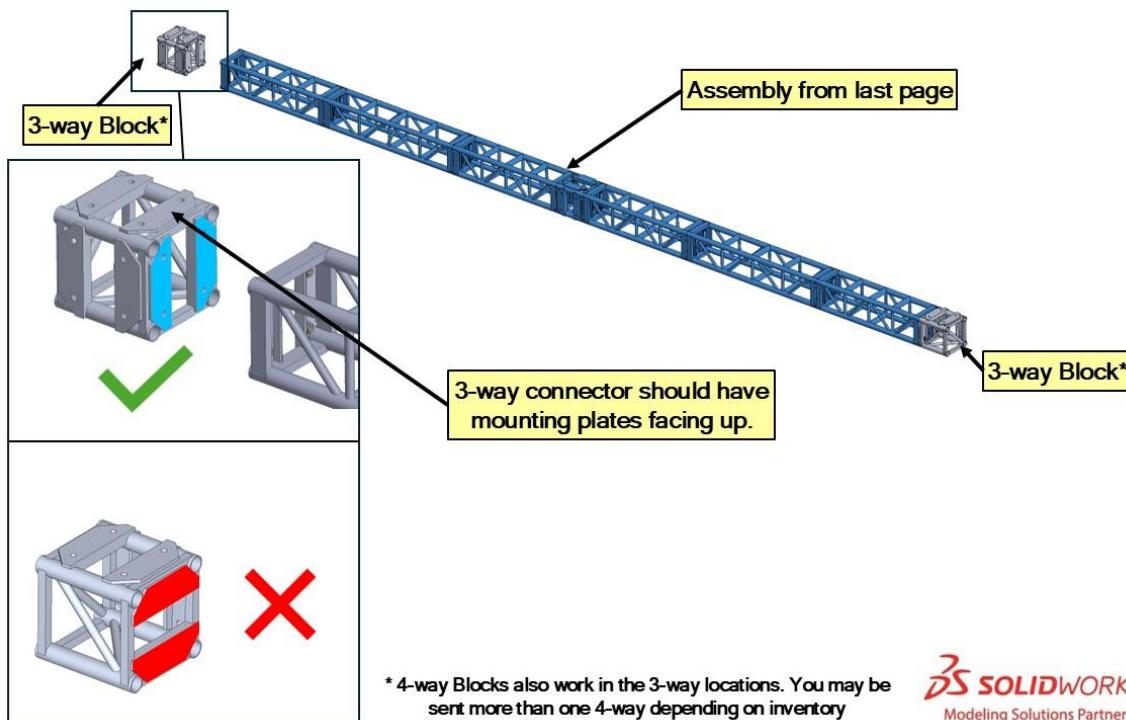
**IMPORTANT:** Incorrect truss orientation will cause significant delays in your build time.



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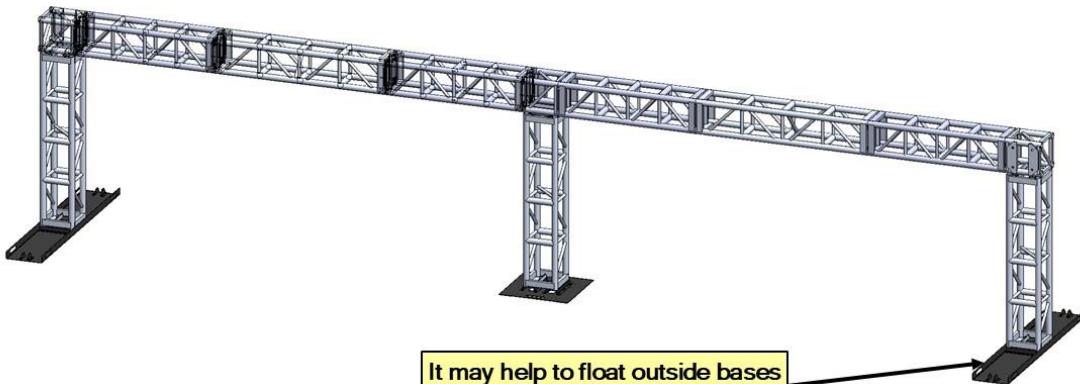
9.

**IMPORTANT:** Incorrect truss orientation will cause significant delays in your build time.



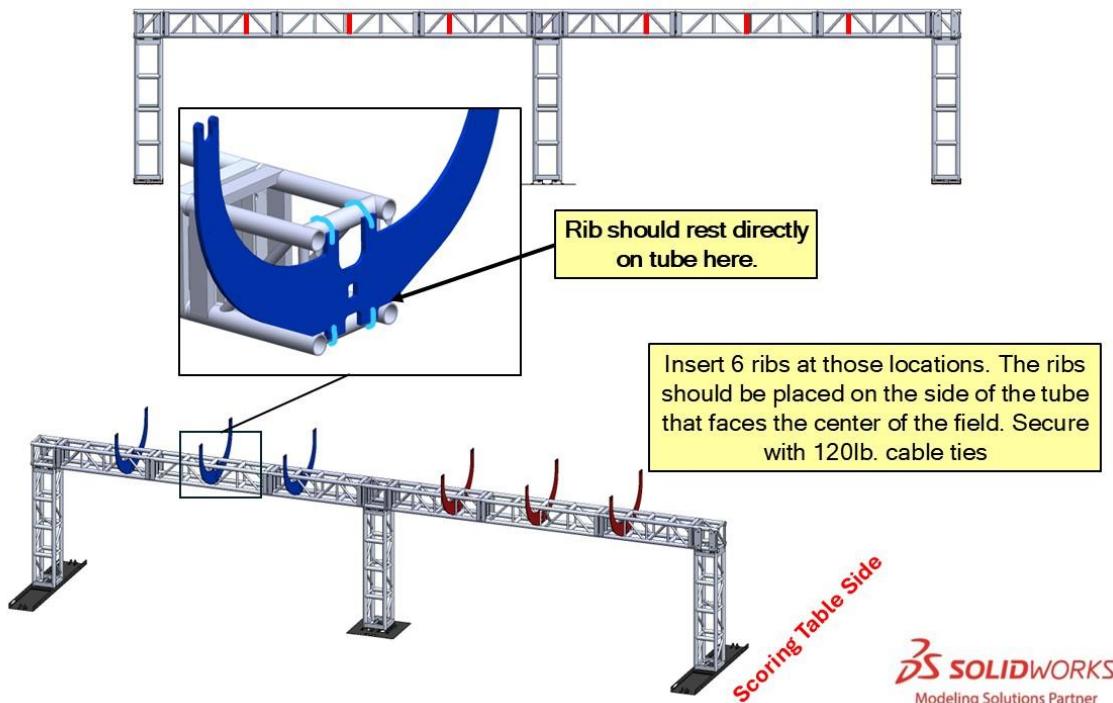
10.

1. Gather a crew of 5-6 people.
2. Flip the long section of truss over so that the mounting plates are facing downward.
3. Lift the long assembly and place it on the upright 5' sections.
4. Secure using truss hardware.



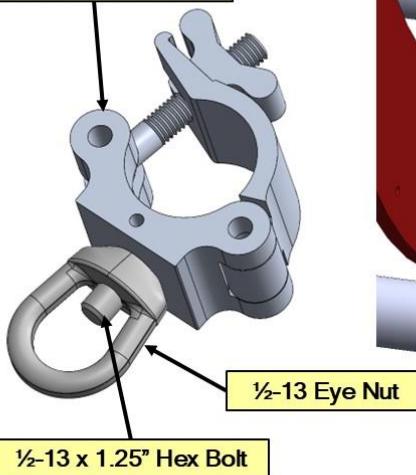
11.

Identify the vertical truss supports highlighted below



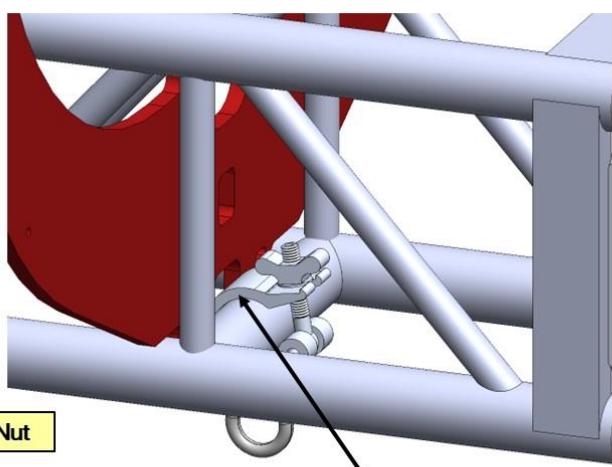
12.

Single Cheeseborough



$\frac{1}{2}$ -13 x 1.25" Hex Bolt

6 units needed

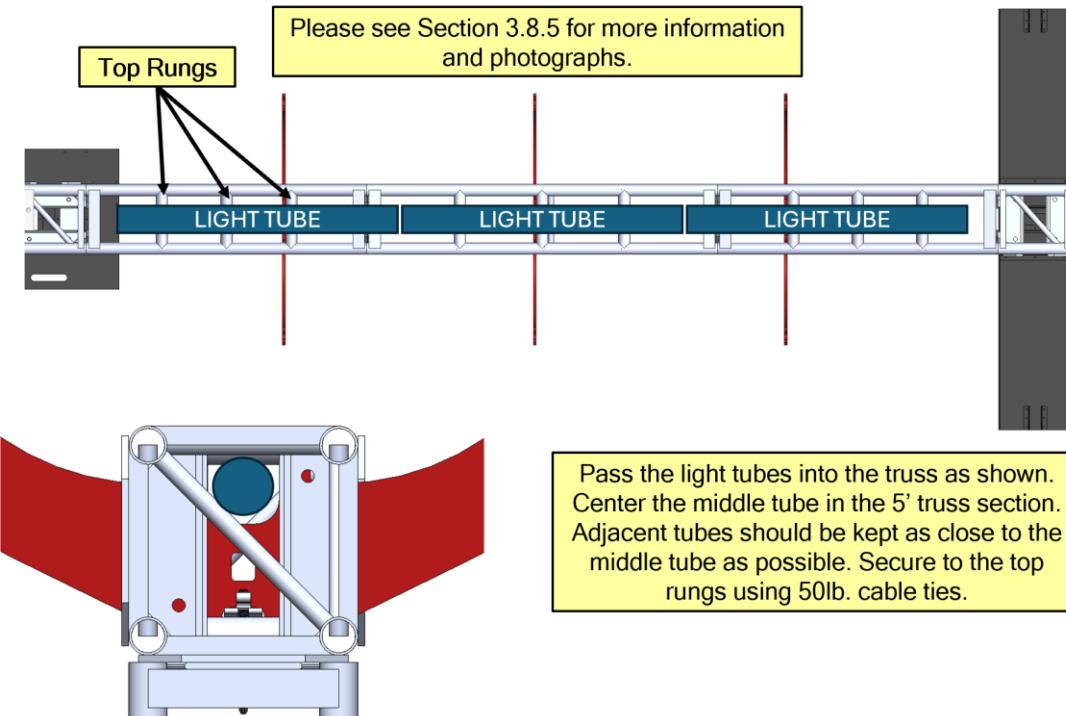


Position cheeseborough assembly as shown. The bolt should be vertical and centered in the cut out of the rib.

Units Needed: 6

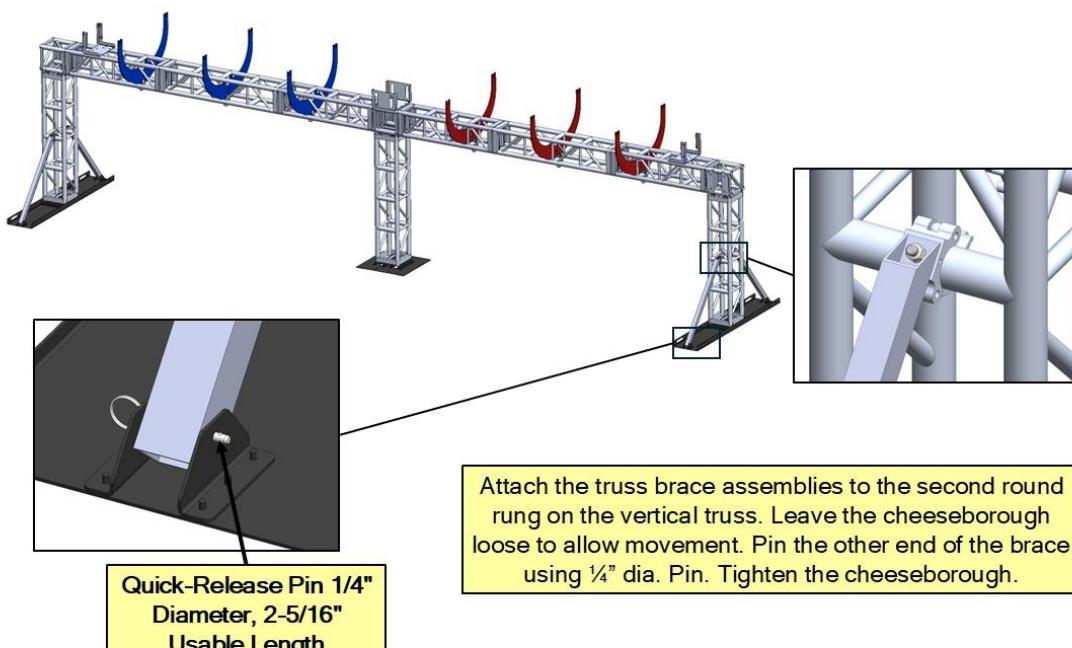
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13.



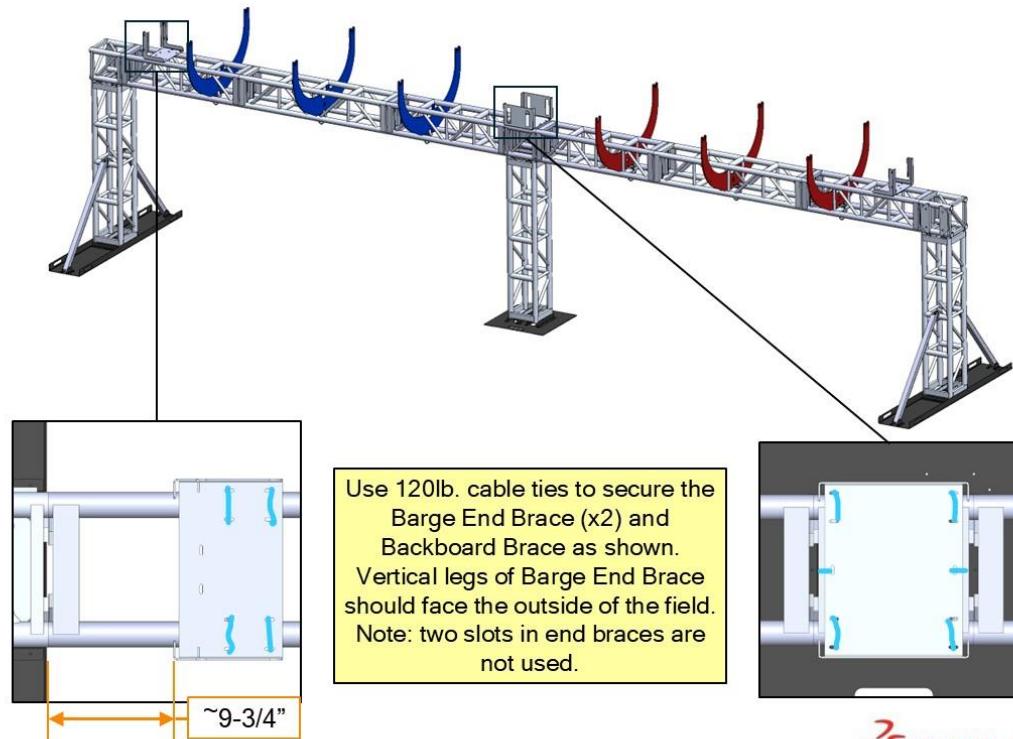
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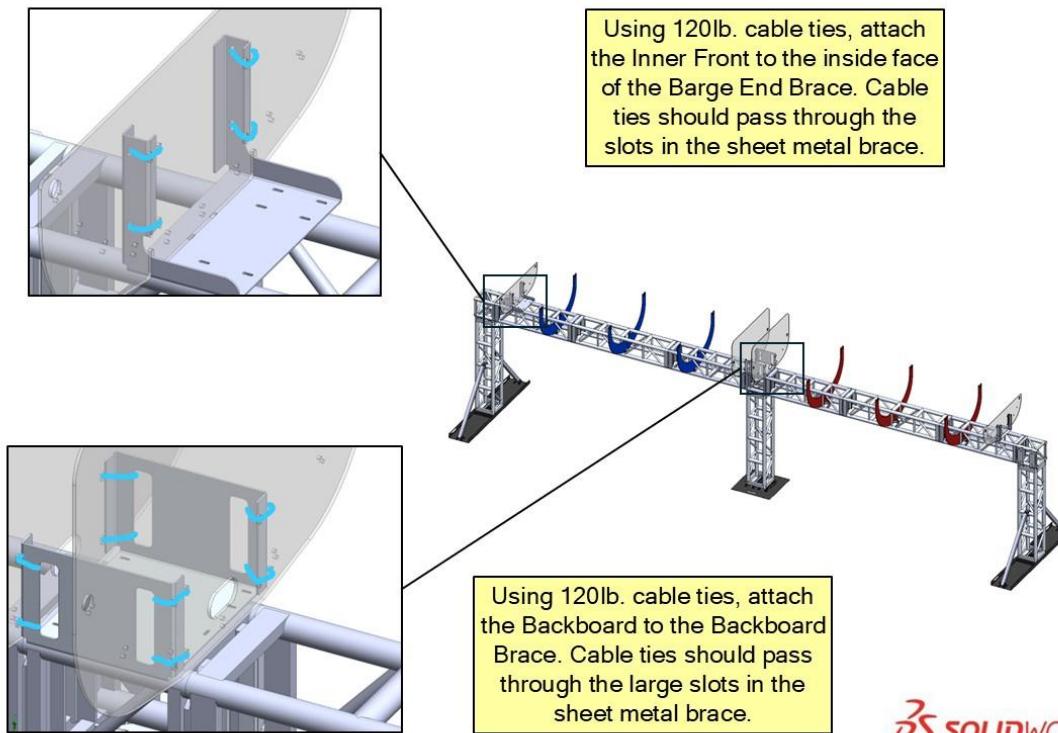
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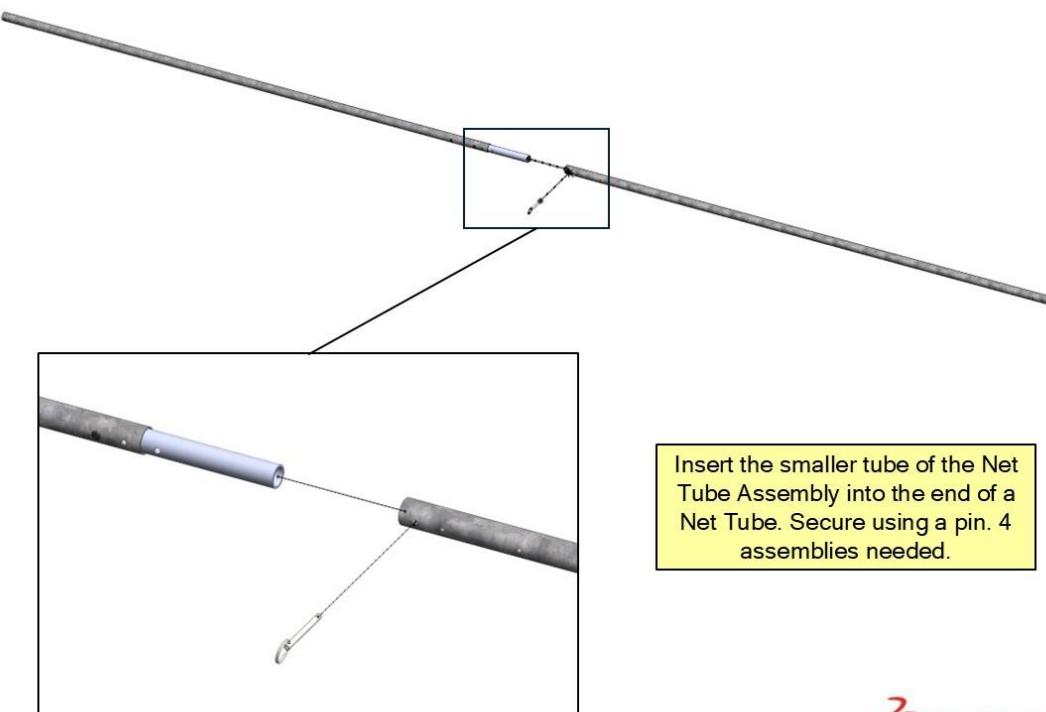
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16.



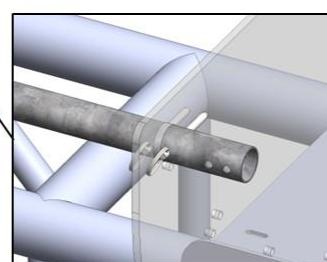
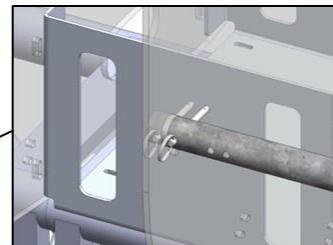
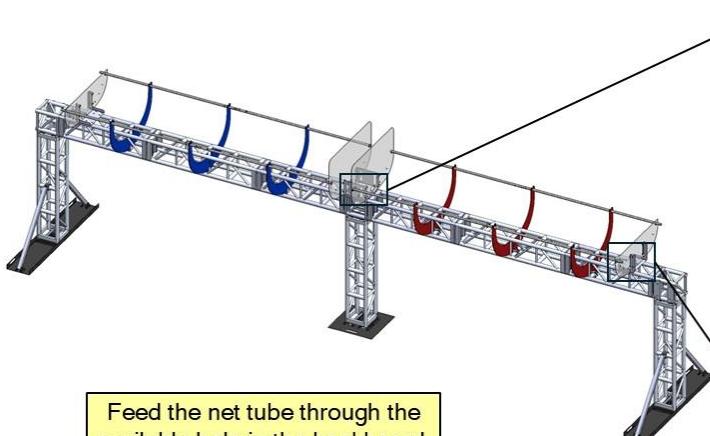
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17.



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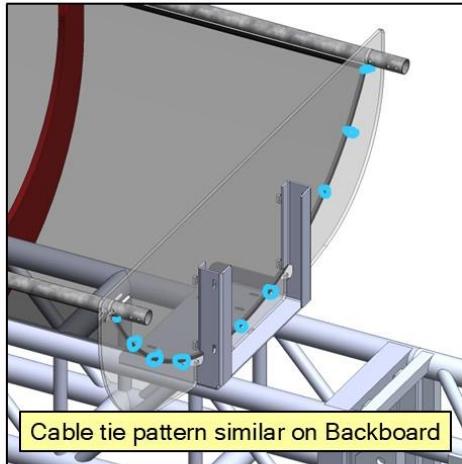
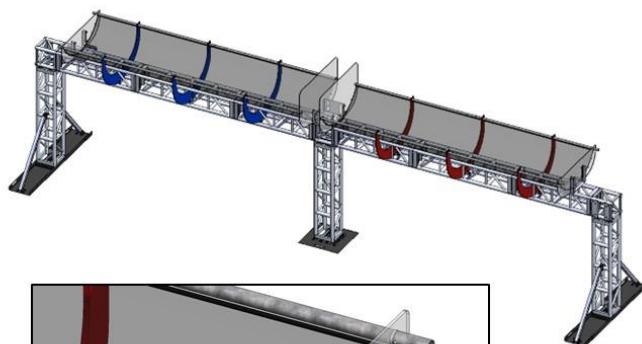
18.



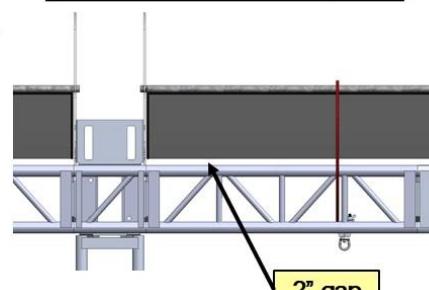
Feed the net tube through the available hole in the backboard. Set the tube into the slots in the ribs. Push the tube into the hole in the Inner Front. Secure with pins. Repeat for all net tubes.

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19.



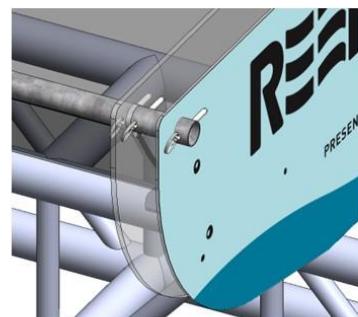
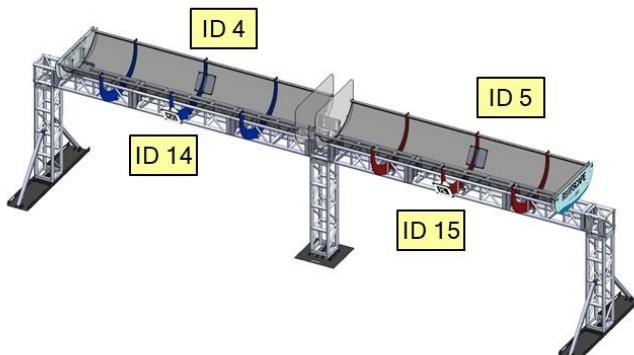
Using 50lb cable ties, attach the long side of the nets to the net tubes. Make sure the ties are loose enough to slide on the tube. Attach the net to the backboard, these cable ties can be tight. Attach the net to the Inner End. Do not over tighten.



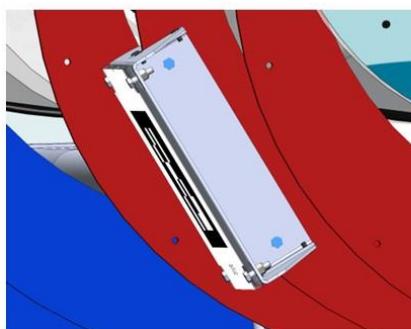
Using 50lb. cable ties, cinch the net up until there is an approximately 2" gap between the net and truss.

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20.



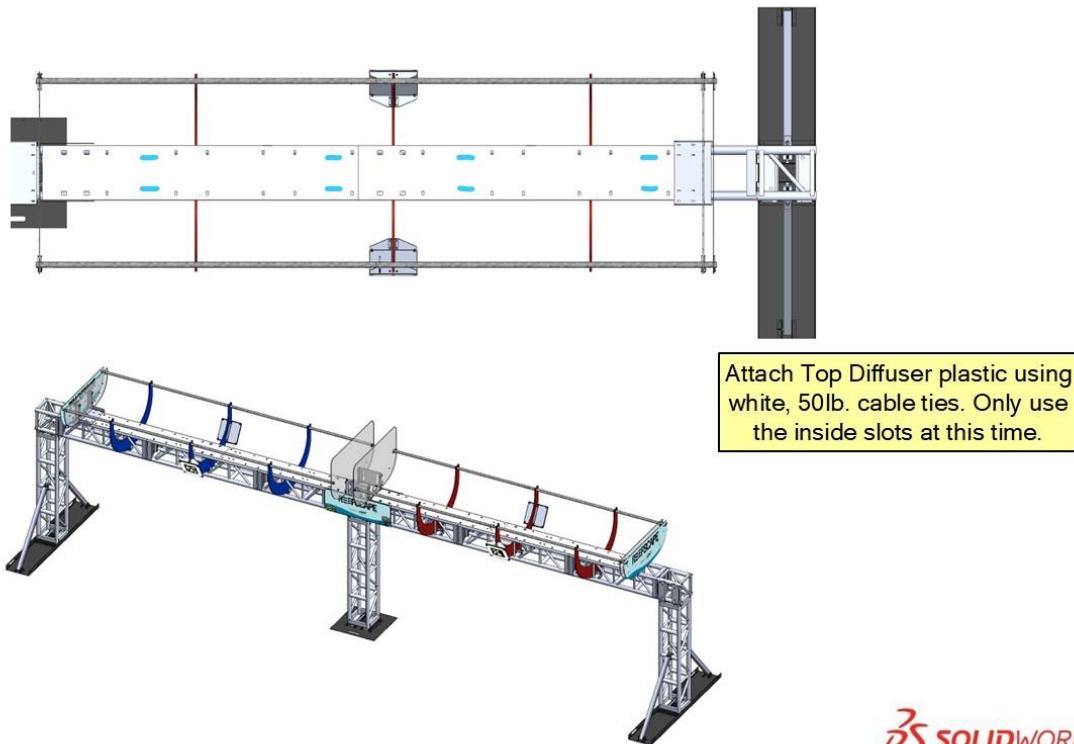
Insert the two net tubes into the Outer End (vinyl). Secure with pins.



Attach April Tags to the middle ribs on both sides. Secure with 1" Hex Bolts

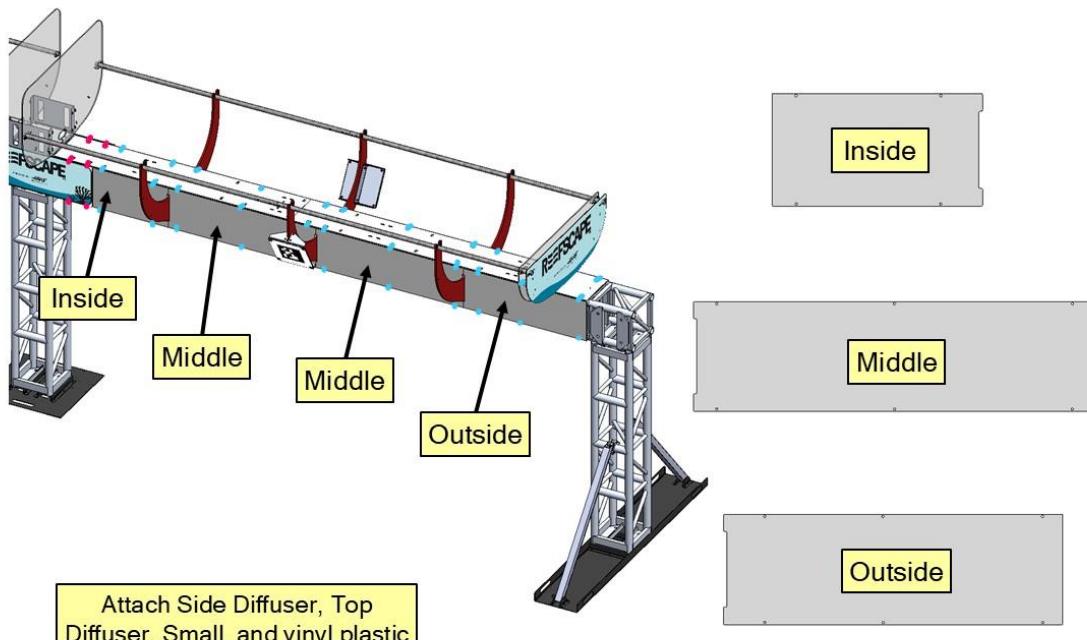
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21.



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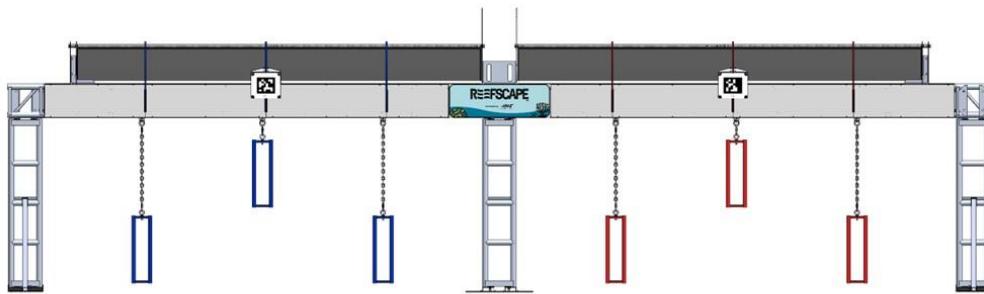
22.



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23.

Hang the cages using two carabiners and chain.  
Please note, cages should be in the low position  
to start each day.



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### 3.8.5 Electronics

#### 3.8.5.1 Equipment

- 6 5' extensions
- 6 Alliance Colored Lights wrapped around an acrylic tube. (3 Red and 3 Blue)

#### 3.8.5.2 Barge Wiring

- The Alliance colored lighting is installed in the Barge during the construction phase (Step 13). If the extension cords were not installed with the lights, it should be done now. An example of cable tying the lights in is shown below.



- All cords should be cable tied to ensure they do not hang below the truss and no robot gets snagged on one. Example shown below.



- Run the cables down the inside of truss leg to the base. See Section 3.7.3 for more details about how this lighting cables connect to their associated relay box.



## 3.9 Reef

A total of 2 Reefs need to be built. The beginning portion of this assembly (placing the uprights and base frames) is part of the ALLIANCE WALL assembly and should already be completed. Note these images show a build on a traditional field border. Building with an AndyMark border will look slightly different than the pictures, but the process is the same except where otherwise noted.

### 3.9.1 Tools & Equipment (for 1x Reef)

- 2x 7/16" wrenches
- 66x 1/4-20 x 1" hex head bolts
- 36x 1/4-20 x 1" counter sunk Phillips (#3) bolts
- 24x 1/4" x 2.3125" quick pull pins
- 12x 1/4"-20 Nylock nuts

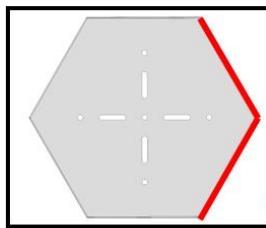
### 3.9.2 Assembly

1.

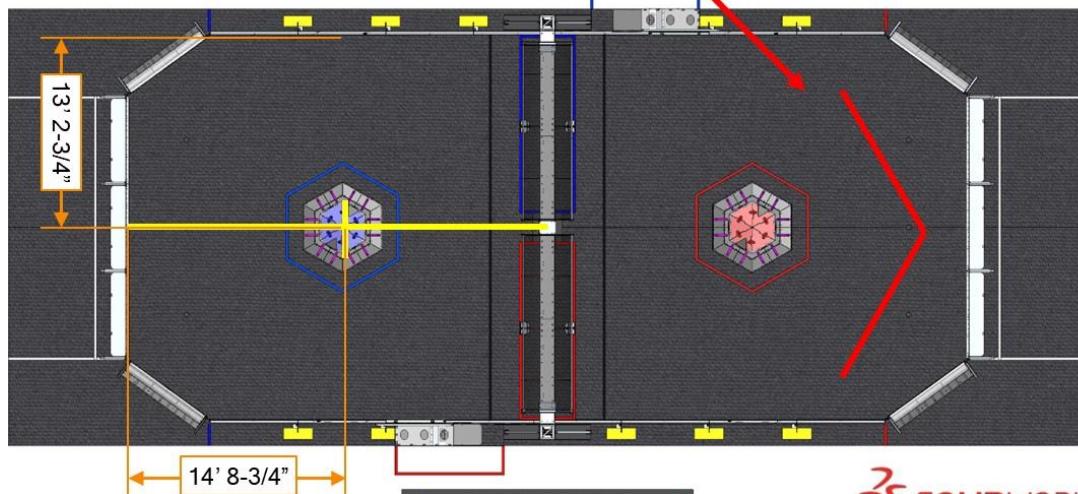


2.

Place the two hexagon bases on the intersection on the chalk line shown below. If this has not been marked yet, dimensions are shown here.



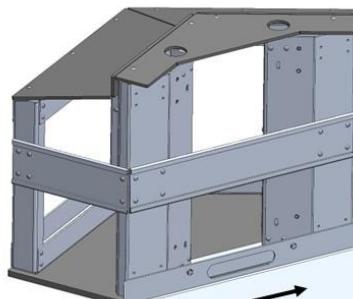
This part must be oriented such that it points toward the alliance wall.



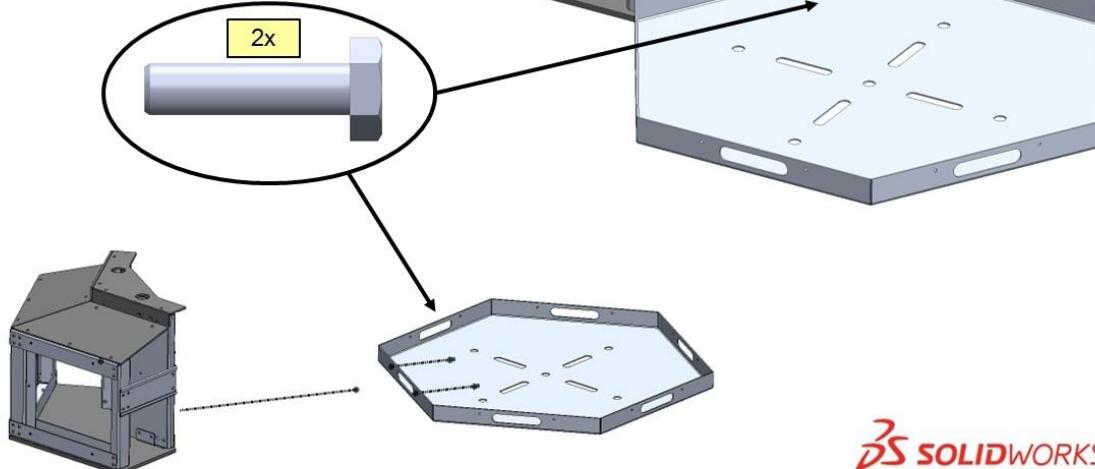
**DS SOLIDWORKS**  
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3.

Starting on any side, fasten one section of the reef to the base plate with two 1" 1/4-20 hex head bolts.



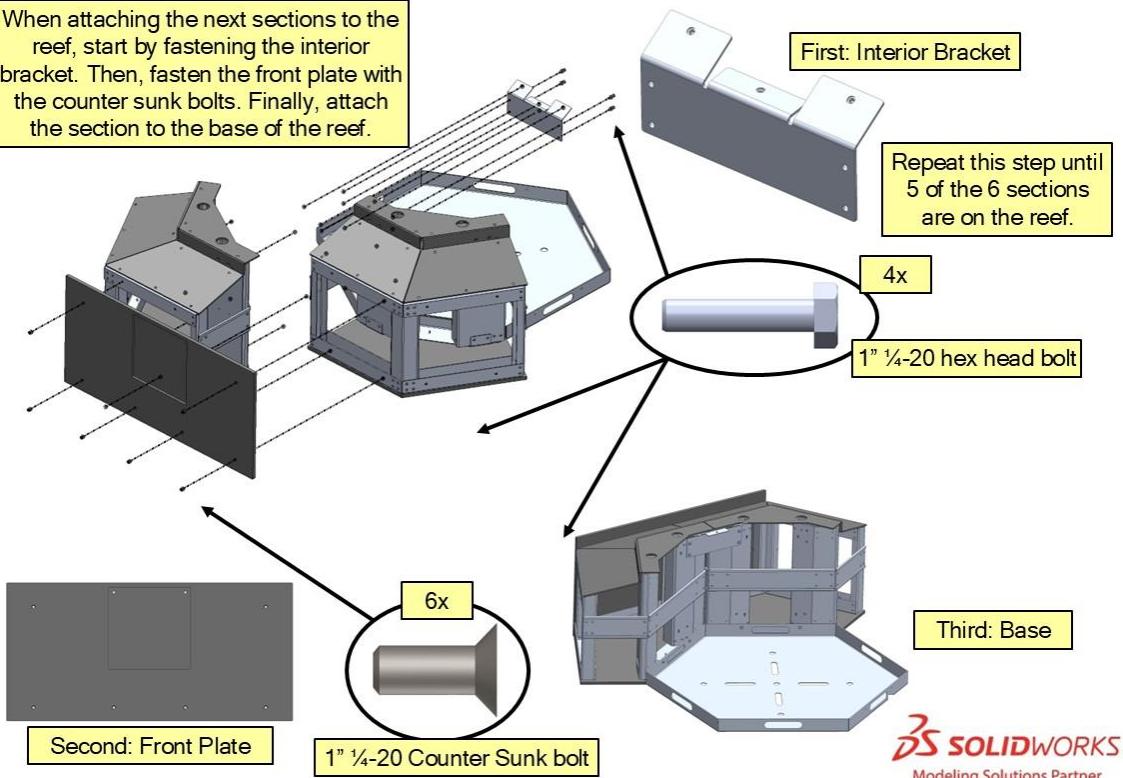
It is recommended to use a sheet of HDPE beneath the hook tape of the reef slice for each section as you fasten it to the base.



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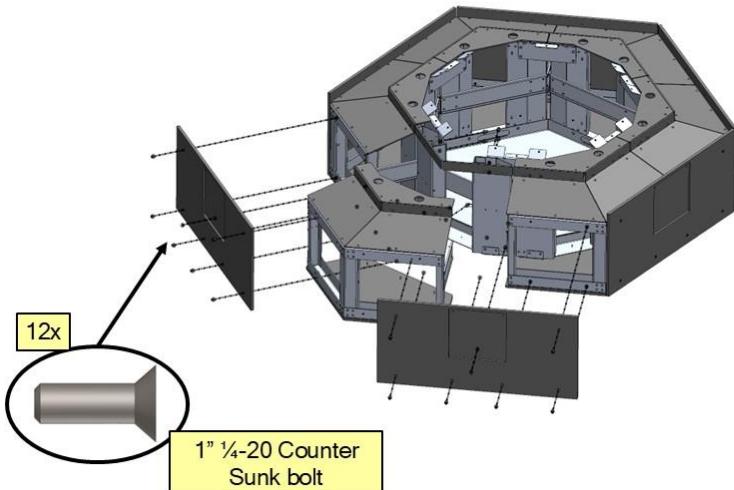
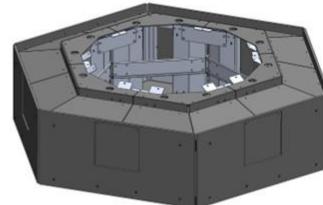
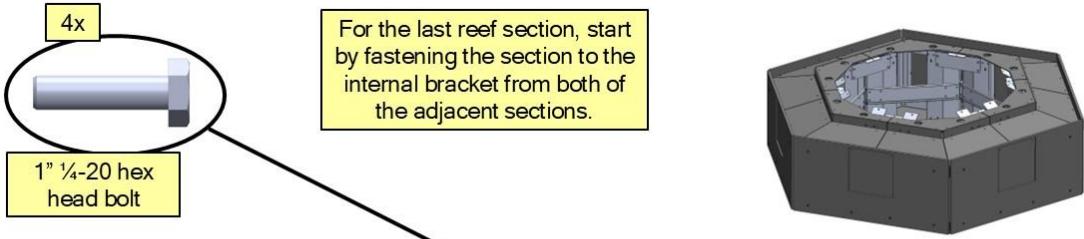
4.

When attaching the next sections to the reef, start by fastening the interior bracket. Then, fasten the front plate with the counter sunk bolts. Finally, attach the section to the base of the reef.



5.

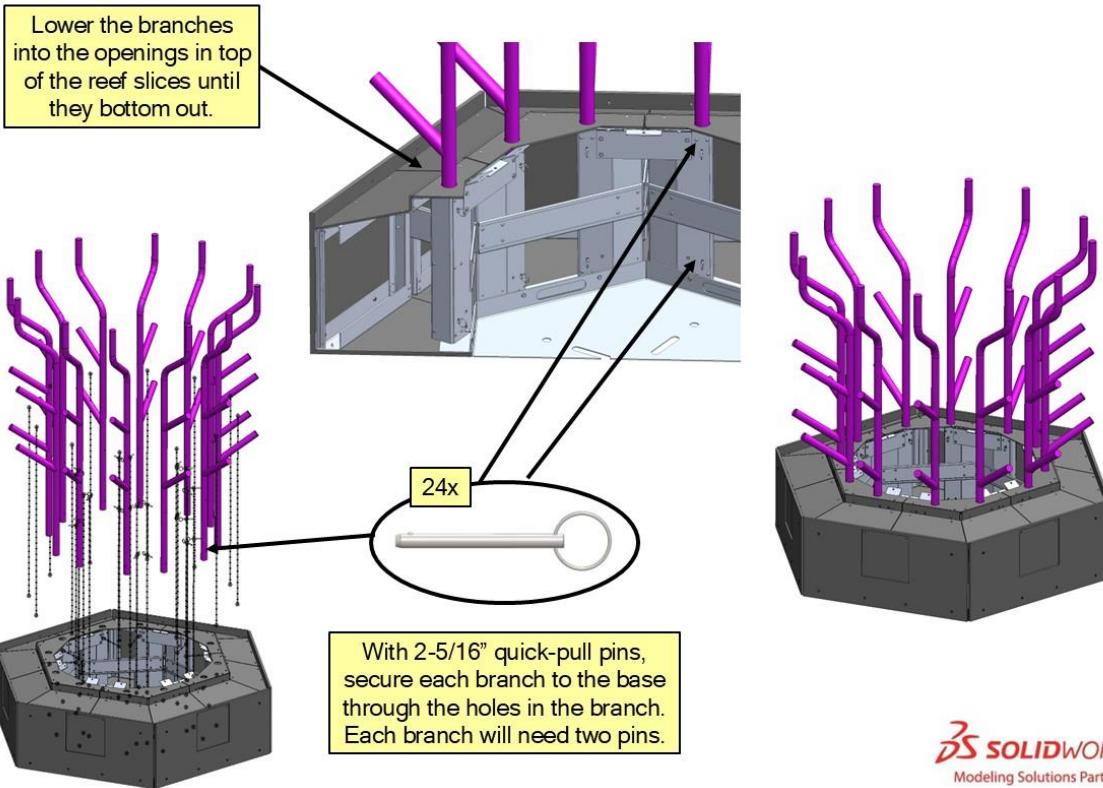
For the last reef section, start by fastening the section to the internal bracket from both of the adjacent sections.



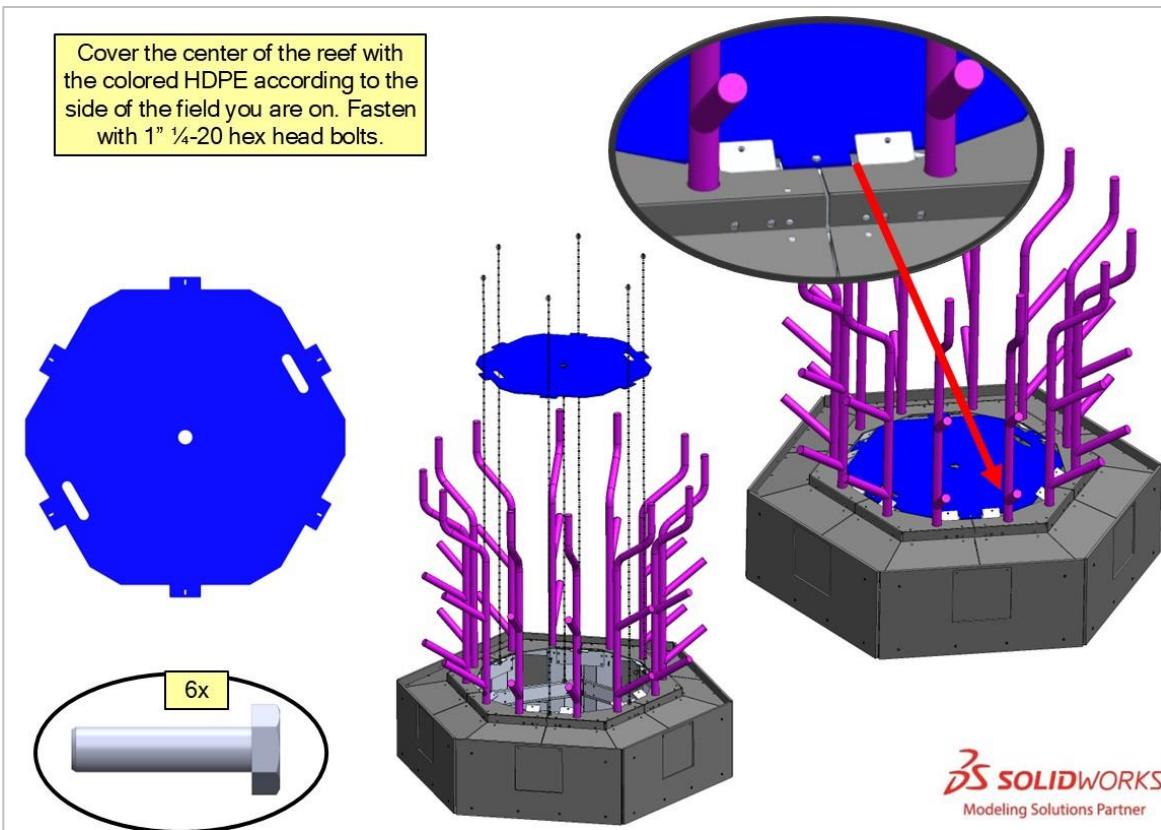
Then, attach the front HDPE to the front of the last section and its neighboring portions of the reef. Remove any HDPE sheets underneath the reef and make sure the hook is well engaged to the carpet.

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6.

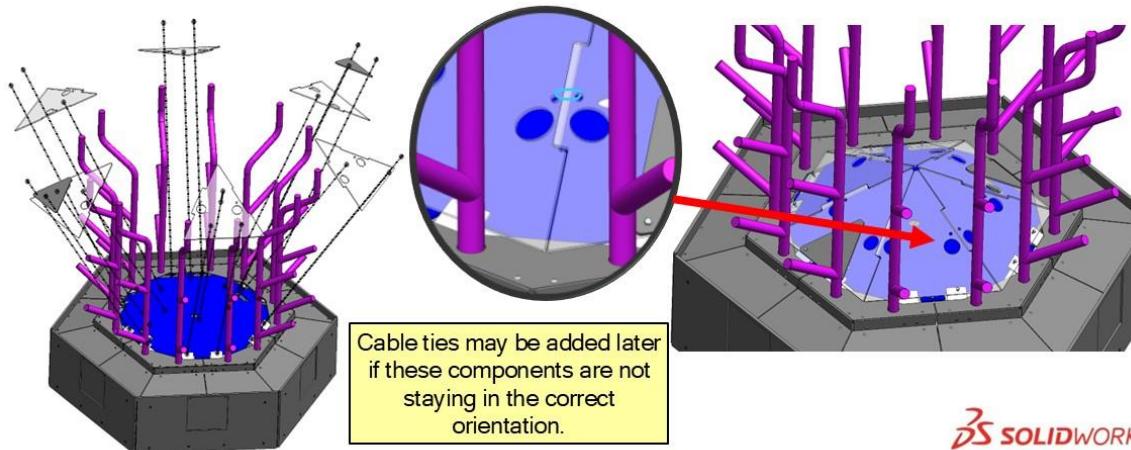
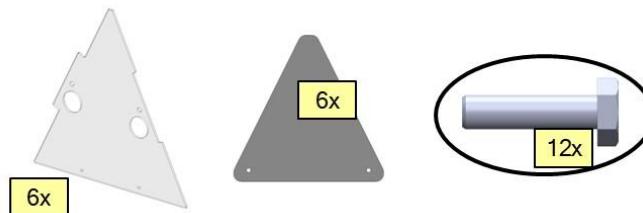


7.



8.

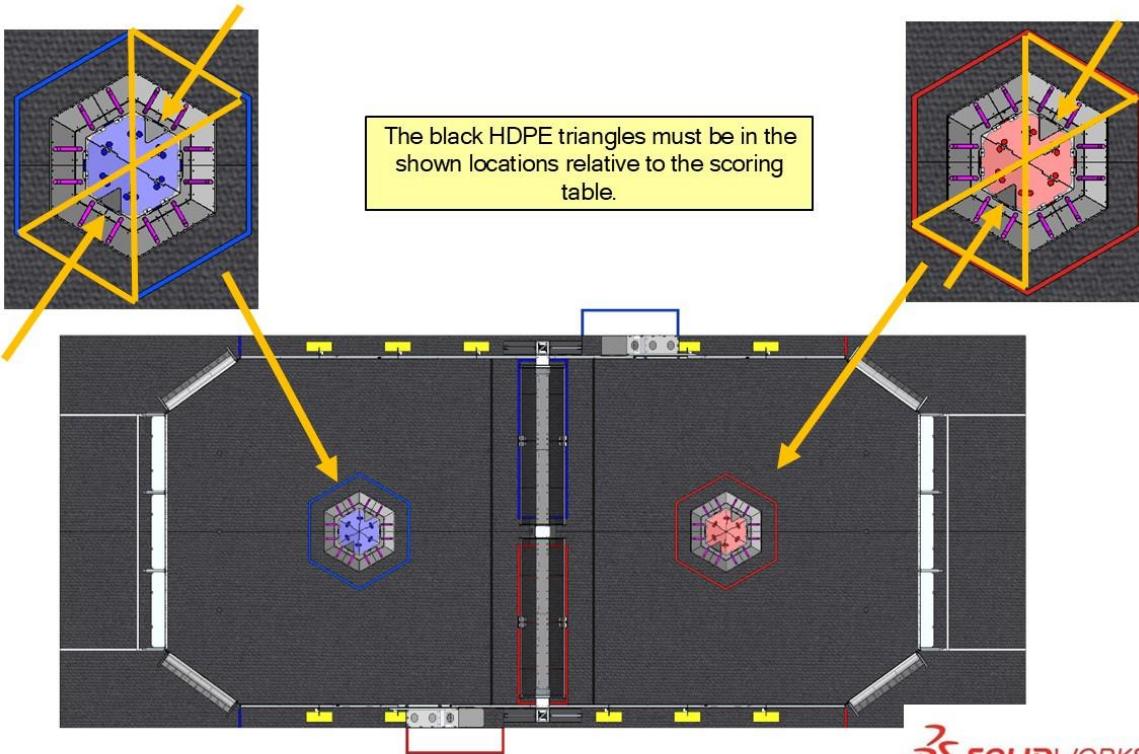
Attach the center plastic components to the reef such that the tabs on each piece interlock with one another. Use 1" 14-20 hex head bolts to fasten into the interior brackets. Two faces will also have extra triangles that cover some of their polycarbonate. Refer to the next step to locate which faces need these.



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9.

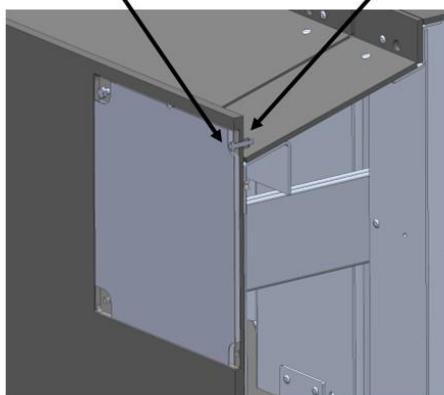
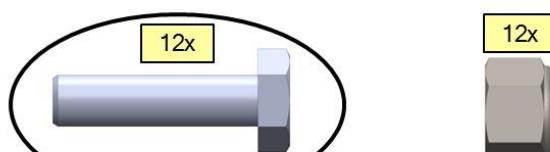
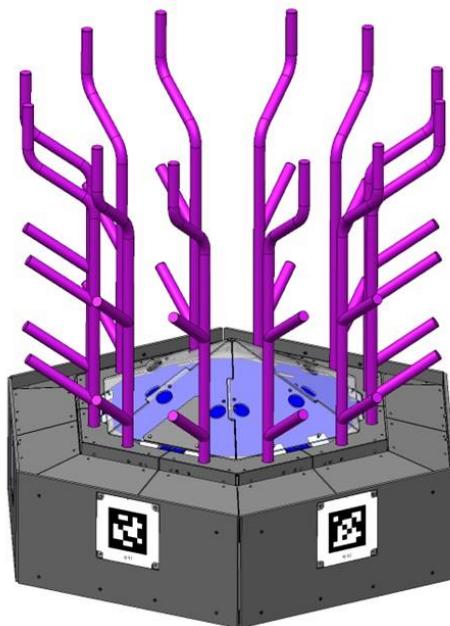
The black HDPE triangles must be in the shown locations relative to the scoring table.



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10.

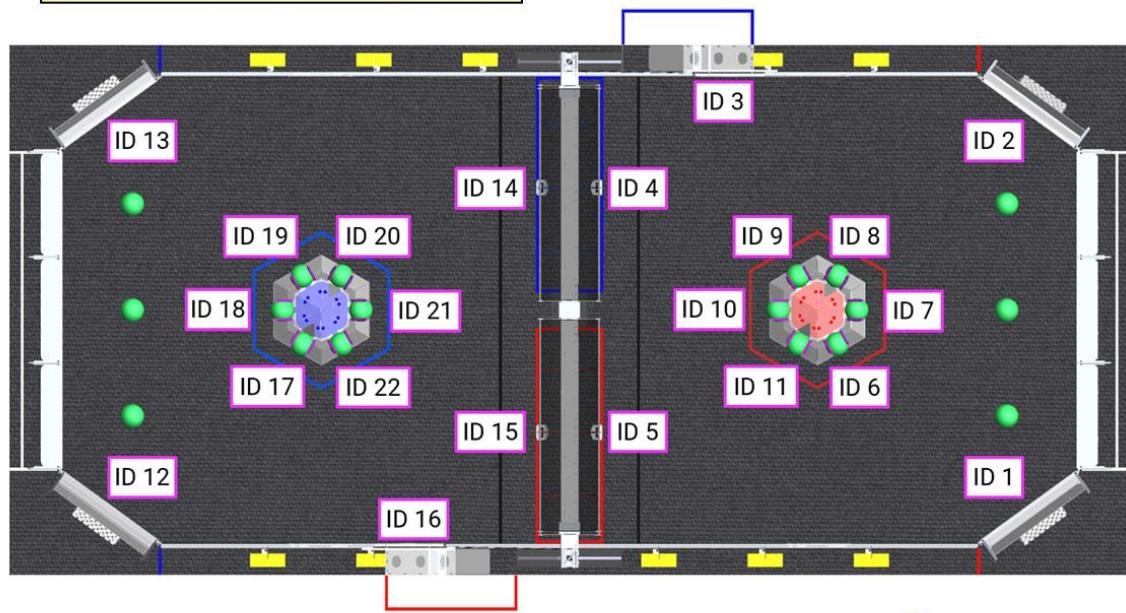
Fasten the April tags to the faces of the reefs with 1" 1/4-20 hex head bolts and 1/4-20 nyloc nuts. April tag placement can be found on the next page.



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11.

Tags 6-11 and 17-22 will attach to the reefs.  
April tags can be found in an electronics case,  
talk to the FTA at the event to get these,



SCORING TABLE

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## 3.10 Coral Holder

A total of 4 Coral Holders need to be built. 1 will be located in each of the Coral Stations positioned under the ramp used to introduce Coral onto the field.

### 3.10.1 Tools & Equipment

- 120lb Cable Ties
- Wire Cutters (for the cable ties)

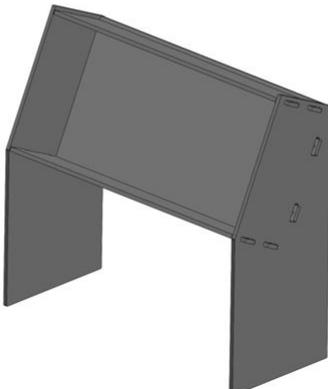
### 3.10.2 Assembly

1.



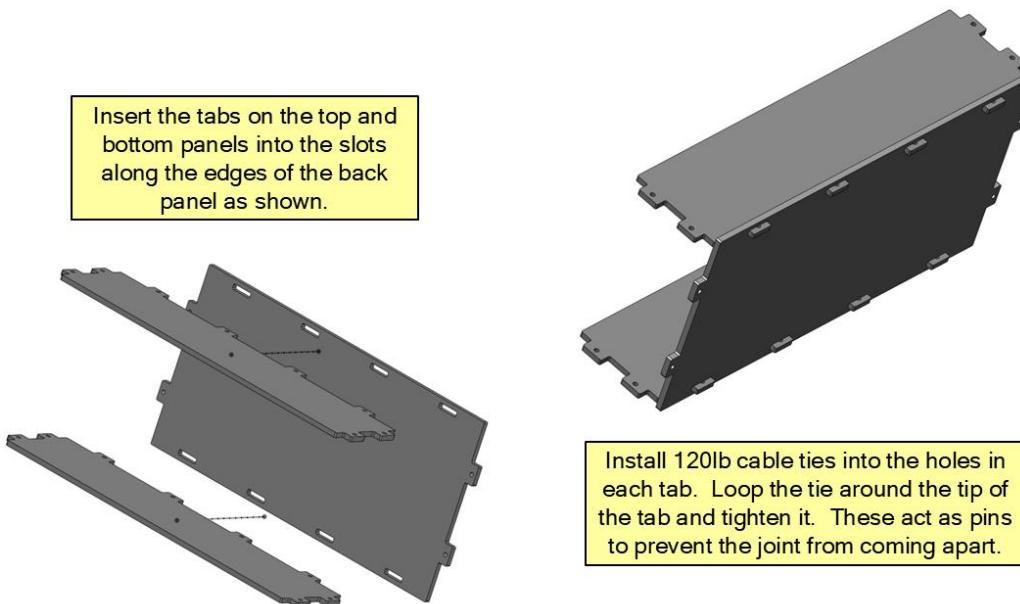
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#### Building the Coral Holder



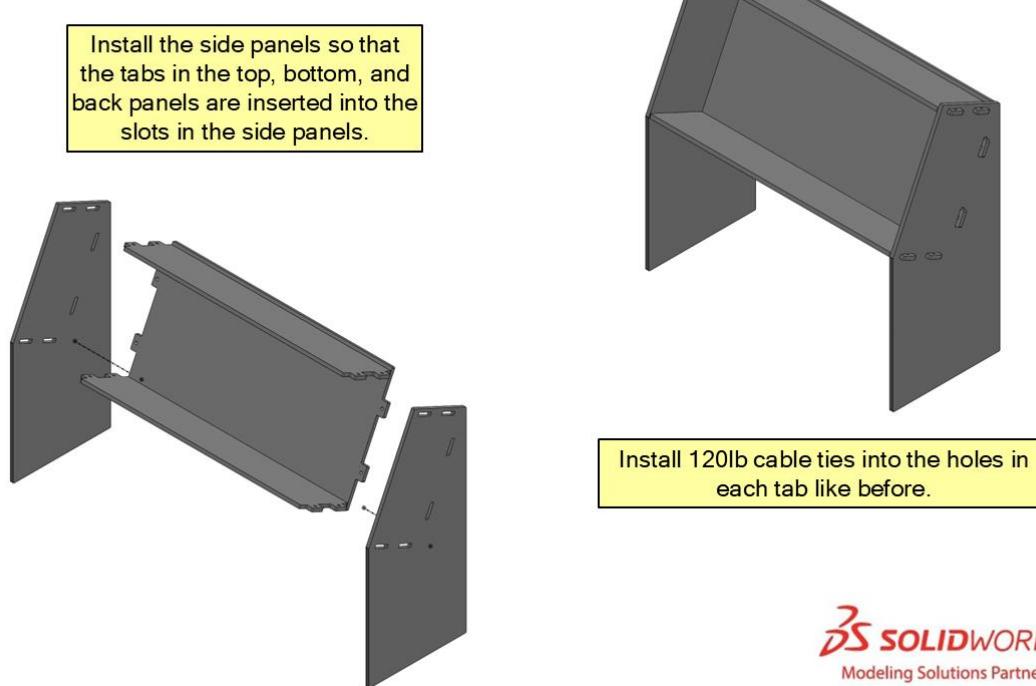
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2.



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3.

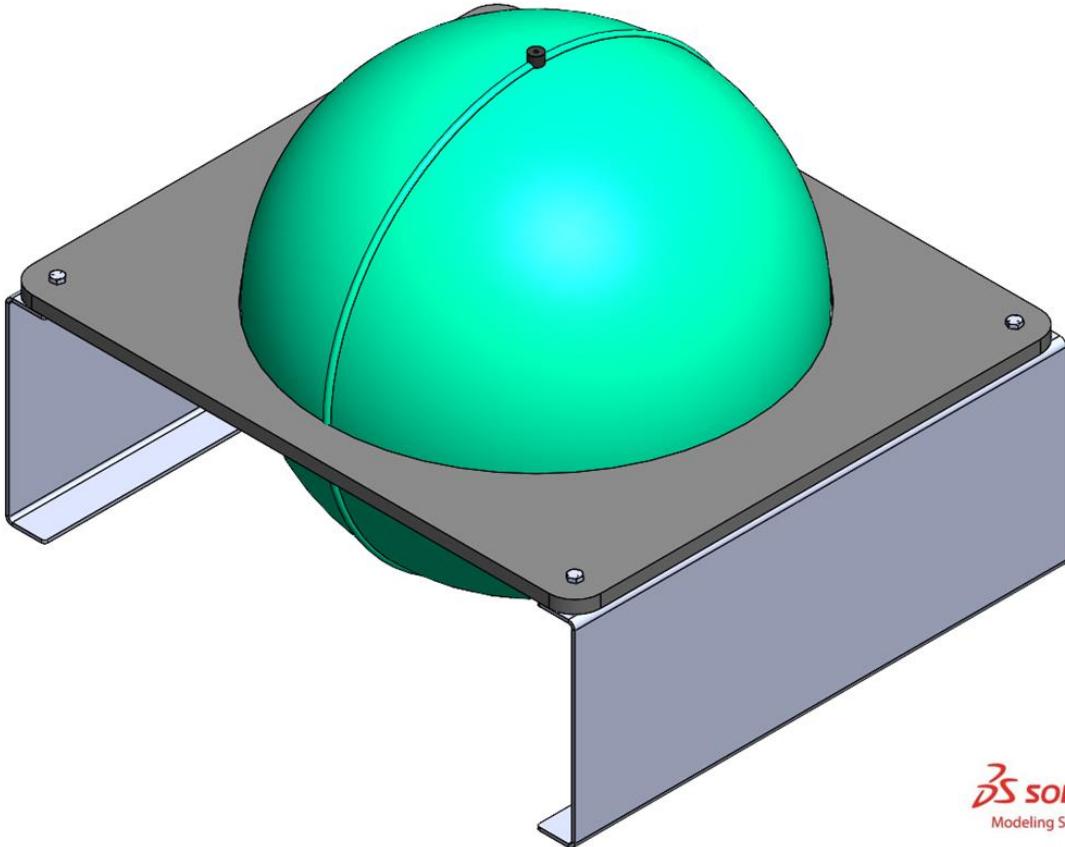


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### 3.11 Game Pieces

Coral should be inspected upon initial Field setup and throughout the event for sharp edges. A deburring tool has been supplied in the hardware bin for this purpose.

Algae has a size specification of 16-1/4" +/- 1/4". The inflation jig is designed to inflate the Algae as close to the nominal 16-1/4" as possible. This measurement is based on the seam of the Algae, as the Algae are not always perfectly round. The Algae Measurement Jig can be seen below, where the valve of the Algae should be facing up during inflation, and it should be inflated until the seam of the ball touches the edges of the jig on both sides. Anecdotally, this should cause the Algae to feel "like a ball", and not overly saggy.



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The Algae should be placed into the Reef as lightly as possible during Field Reset. It is important that the Algae are not squeezed in between Branches of the Reef as it becomes more difficult for Robots to remove them from the Reef.

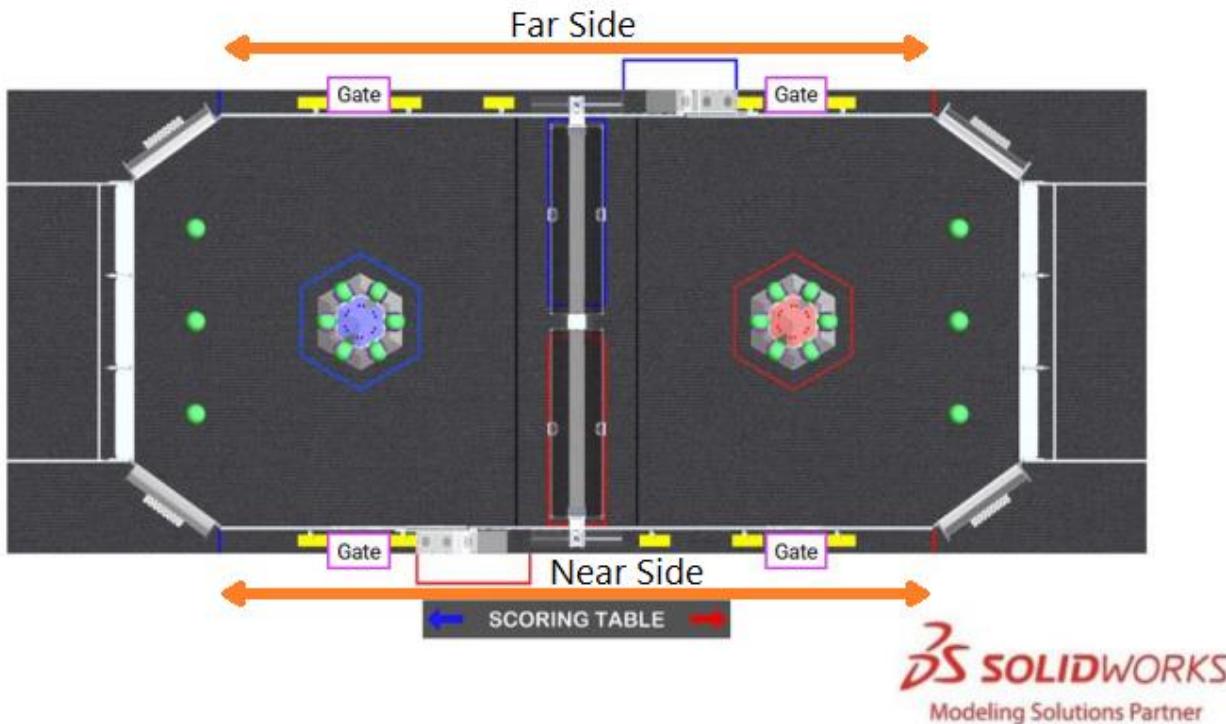
### 3.12 Scoring Table

The Scoring Table is the headquarters of the field. The field ends and the game specific scoring structure all communicate with the Scoring Table in some form. Placement around the field is relative to the Scoring Table. “Near” is the long side closest to the Scoring Table, “Far” is the opposite side. The blue alliance is to the left of the Scoring Table and the red alliance to the right.

#### 3.12.1 Scoring Table Location

The Scoring Table is located at mid-field and ~5-6 feet from the field side border. The blue alliance and blue field equipment is located to the left-hand end of the field when observed from the Scoring Table.

Figure 3-10 Field layout



#### 3.12.2 Location of Equipment

Having determined the location of the Scoring Table, crew can unload the contents of Case 7 and move Case 33 into position at the Scoring Table.

There are two versions of Case 33. Version 2 has a drawer that slides out that contains the Arena Stack Light, Arena Estop and power cable for the case.

The equipment is placed on top of the Scoring Table per Figure 3-11:

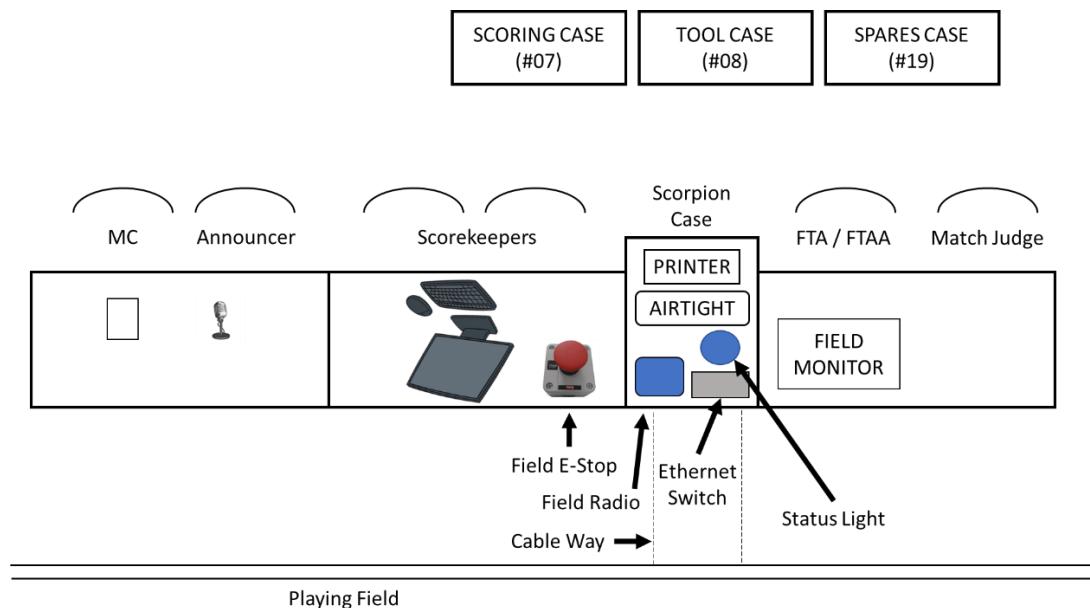
- keyboard and mouse for scorekeeper

- monitor for scorekeeper
- Field Access Point
  - AP Tray (found in case 7)
  - POE adapter (found in case 7)
  - AP Stand (found in case 34)
- FTA Access Point (optional)
- Arena E-stop
- Ethernet switch (not needed with version 2)
- FTA Toughbook w/secondary monitor
- Arena Status Light

Equipment placed under the Scoring Table:

- 2 8-outlet power strips

Figure 3-11 Scoring Table Layout



Each Case 33 has a Field side and a Scorekeeper side. The arena side faces the field and is easily distinguished by the Ethernet ports for the blue and red SCCs. Figure 3-12 and Figure 3-13 show version 1 of Case 33.

Figure 3-12 Case 33 - version 1 - Field side

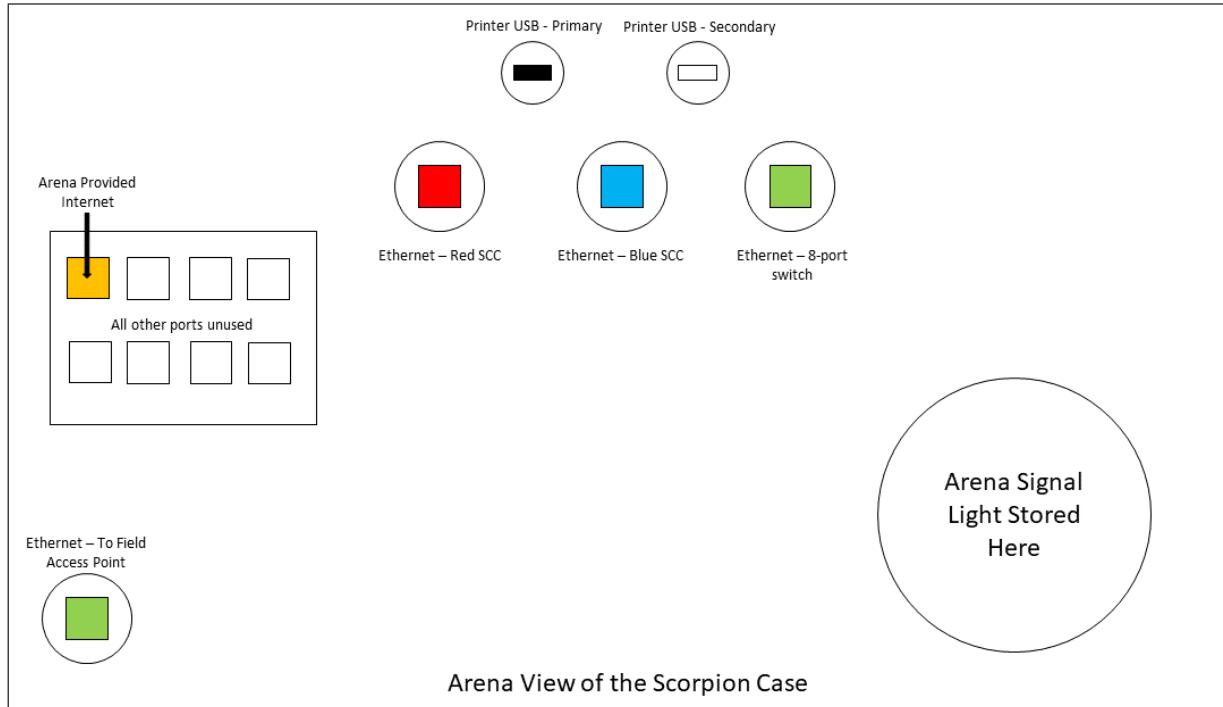


Figure 3-13 Case 33 - version 1 - Scorekeeper side

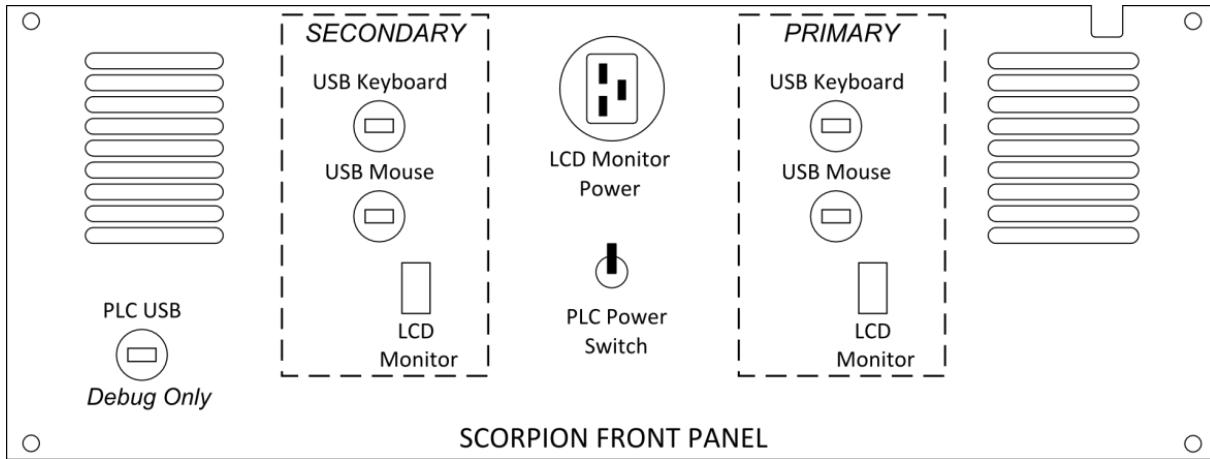


Figure 3-14 Case 33- version 2 - Field side



Figure 3-15 Case 33 - version 2 - Scorekeeper side



### 3.12.3 Primary Server indication

All primary servers are Lenovo machines and indicated by a green dot, see images below for reference.

Figure 3-16 Primary server (with green dot) on bottom



Figure 3-17 Primary server (with green dot) on top



### 3.12.4 Wiring The Scoring Table

**Connections from Venue:** Verify with the Event office and/or Facility services that the following are installed and available at the Scoring Table:

1. Two dedicated and independent 120VAC/15A drops (one for Scoring Table/Blue Side, and the other for the Red Side)
2. At least one Ethernet (CAT5e or CAT6) for Internet, and the Ethernet cable routed to the Pit in the spot designated for the Pit Toughbook.

Cableways (2 of them) are not included with the fields but are strongly recommended to protect cables crossing to/from the Scoring Table to the field. Consult with the Event Manager or A/V crew to obtain them.

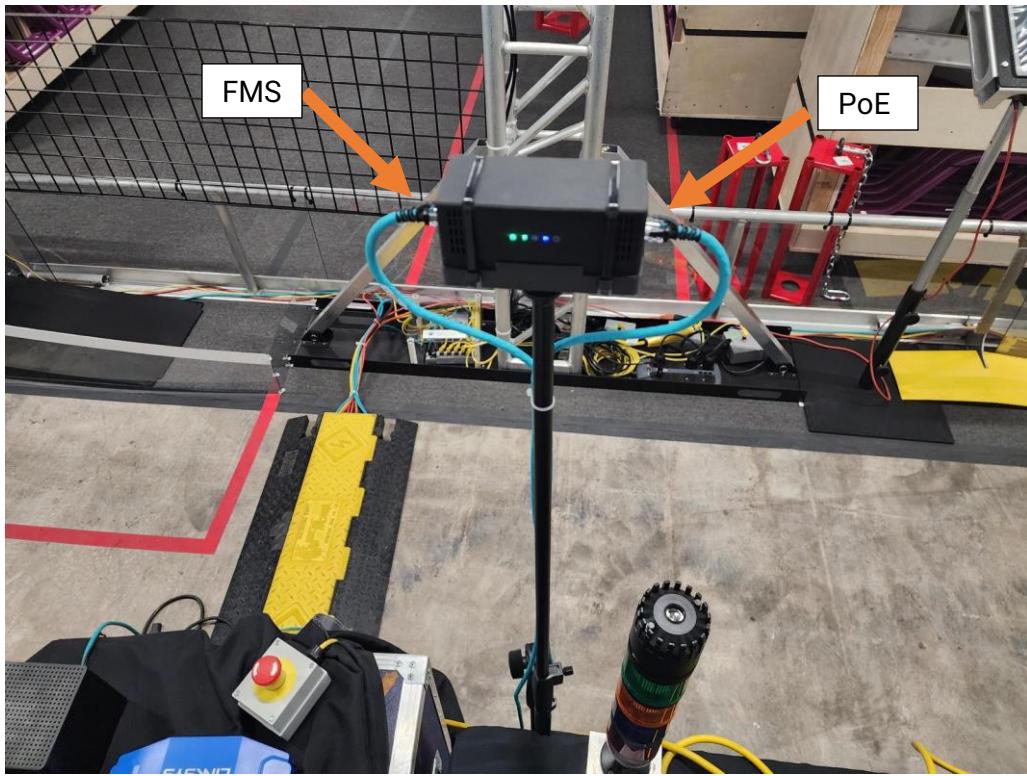
**8-outlet power strips:** Each power strip is connected to a separate power drop. One is used to power the blue side of the field and the Scoring Table, the other the red side of the field.

**The Field Access Point (AP):** A Vivid Hosting VH-113 radio

1. Orient radio as shown in Figure 3-18, indicator lights face the Scoring Table
2. Ethernet cable from *FMS* port on the AP to the *Field AP* port on Case 33
3. Ethernet cable from the *PoE* port on the wall adapter to the *PoE* port on the AP

These need to be 2 separate cables to ensure gigabit capability. No cable goes into the LAN port on the wall adapter.

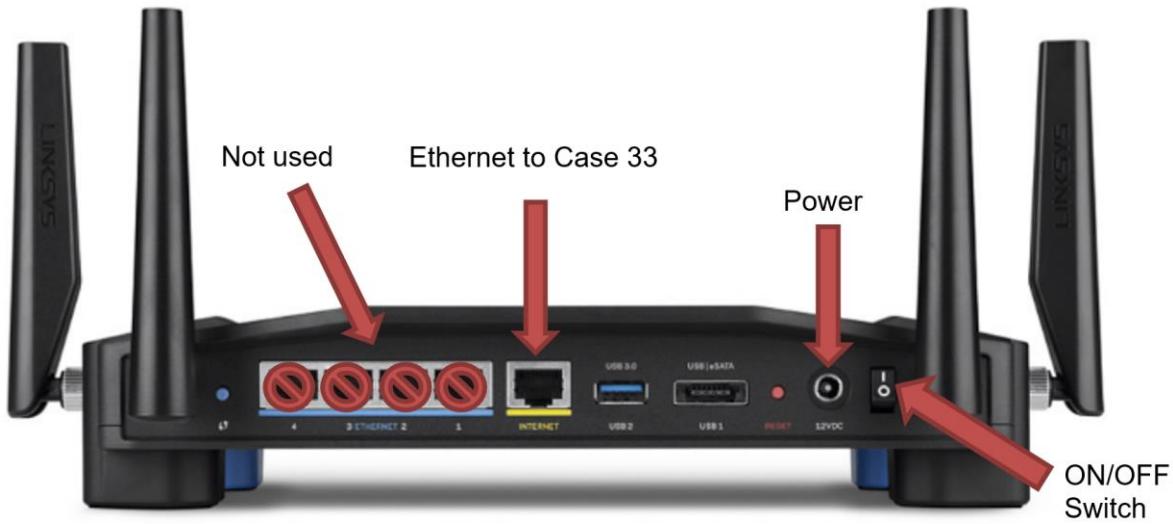
Figure 3-18 Field Access Point



**The default FTA Access Point:** A Linksys radio with the following connections:

1. Ethernet to POE switch at Scoring Table
2. Power Supply to the power strips
3. 4 Radio antennas

Figure 3-19 FTA Access Point



**Keyboard and Mouse:** connect into USB ports on the scorekeeper's side of Case 33.

**Monitor for scorekeeper:** The monitor has two cables, the power cable plugs into the monitor power plug on Case 33.

Utilizing the monitor power outlets in Case 33 ensure that safe shutdown of case can be performed in the event of extended power loss to the field.

**Ethernet Switch:** Connect to the FCUI/PIT port (version 1 only)

For Case 33 version 2, the external Ethernet switch is not required.

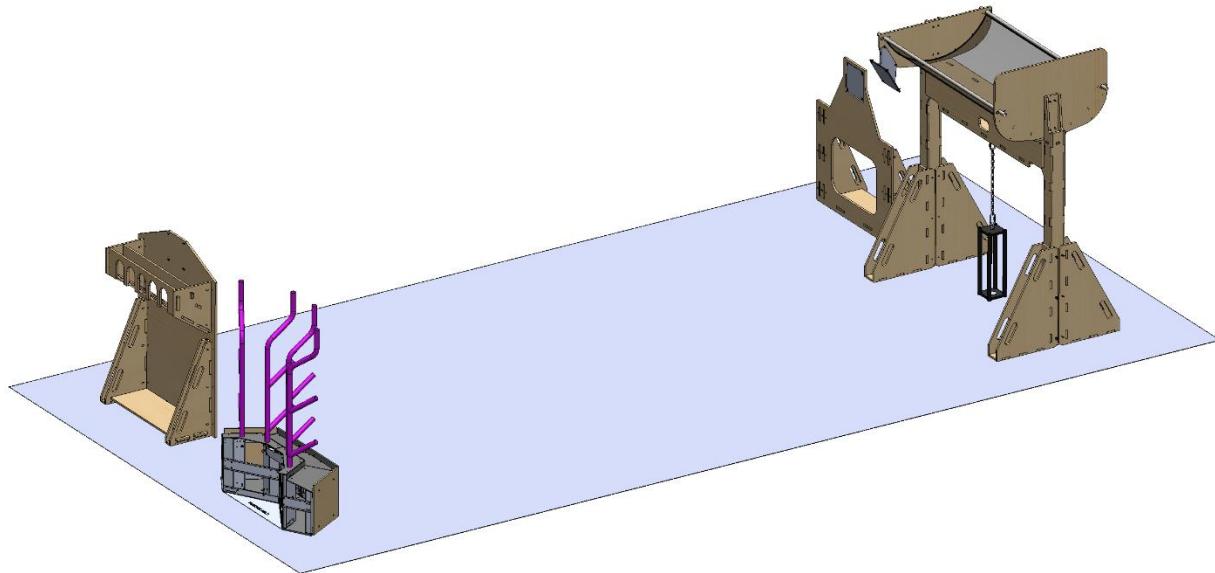
**FTA Toughbook:** The FTA Toughbook receives power from a power strip and connects to the field through the Ethernet switch.

**Field Monitor:** This external monitor is connected into the FTA Toughbook and faces the field to display the Field Monitor display webpage to the FTA. Power is connected to the power strip.

**Arena Status Light:** Connected to Case 33 and placed on top of the road case beside the Arena E-stop.

**Arena E-stop:** Connects to the yellow Allen-Bradley cable attached to Case 33 and is interchangeable with the E-stops used in each Driver Station.

## 4 Practice Field



This is the recommended layout for the Practice Field, spacing the Reef, Processor, Coral Station and Barge apart to deter teams from testing multiple game piece autonomous routines. This layout intentionally does not space field elements apart in a representative orientation to the playing field. See the [Practice Field Attendant Instructions](#) for more information about running the practice field.



## 4.1 Practice Field Coral Station

A total of 1 Practice Field Single Coral Station needs to be built.

### 4.1.1 Tools & Equipment

- 7/16" Wrenches/Sockets
- 4x 1.5" 1/4-20 Hex Head Bolts
- 4x 1/4-20 Wingnuts
- 30x 120lb Cable Ties

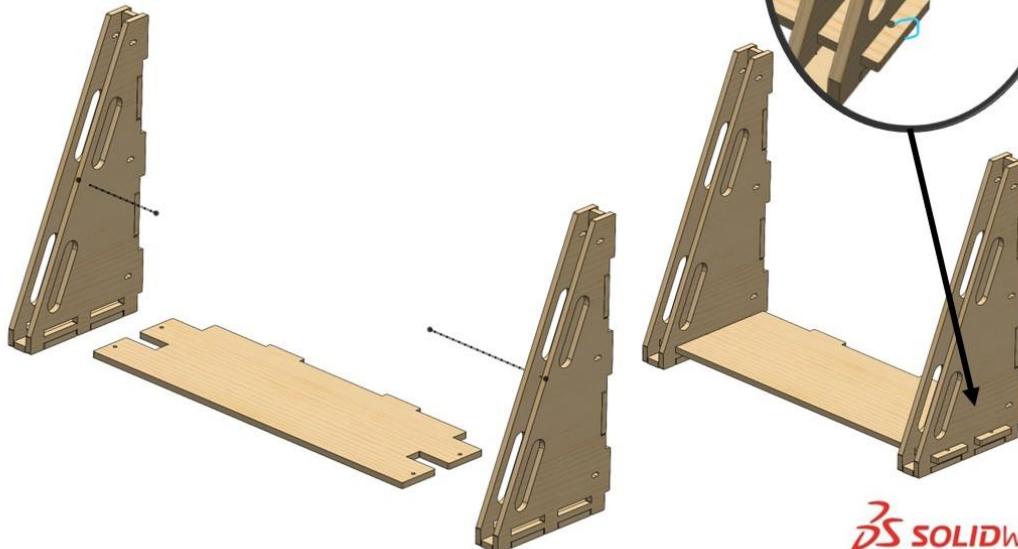
### 4.1.2 Assembly

1.



2.

Start by sliding the brace into the support triangles in the shown orientation. To prevent the connection from pulling apart, fasten 120lb cable ties through the shown holes and trim tails.



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3.

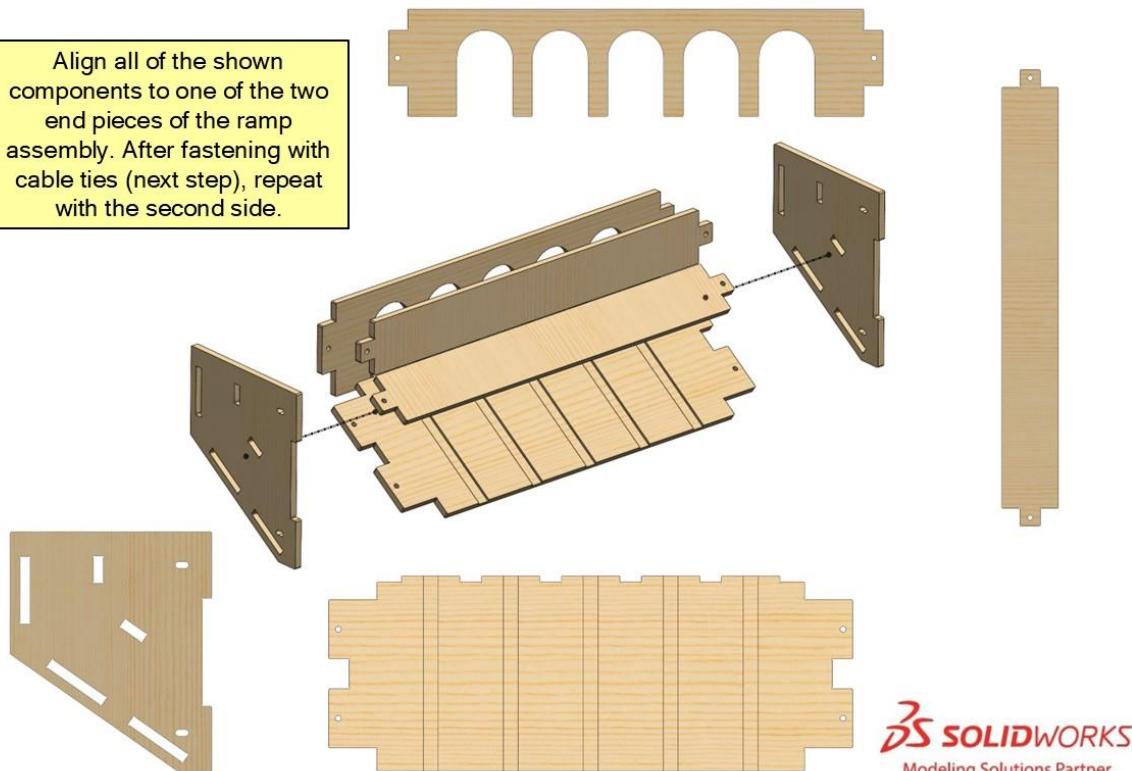
Using 12x 120lb cable ties, fasten the front panel to the assembly. Be sure to align all tabs before tightening cable ties.



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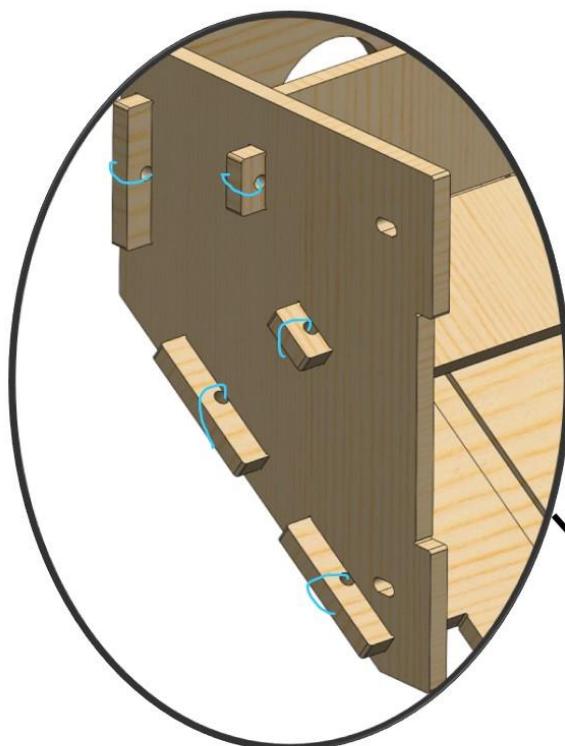
4.

Align all of the shown components to one of the two end pieces of the ramp assembly. After fastening with cable ties (next step), repeat with the second side.



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5.



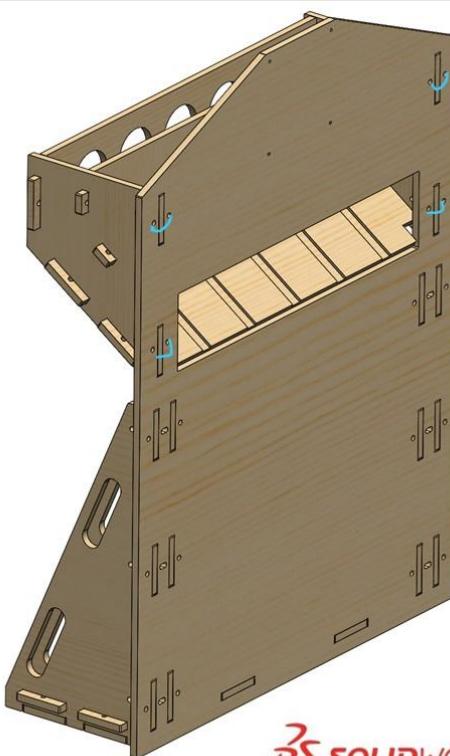
Using 120lb cable ties, tighten one to each tab to prevent the parts from being pulled apart in use.



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6.

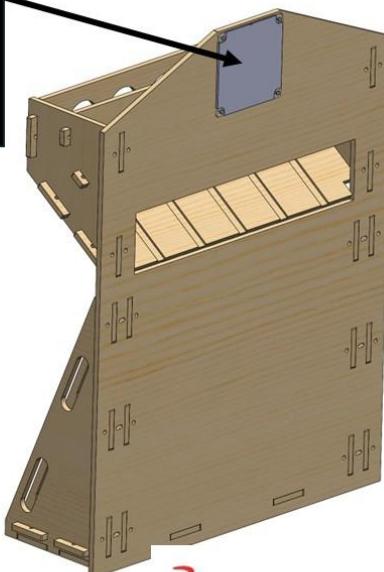
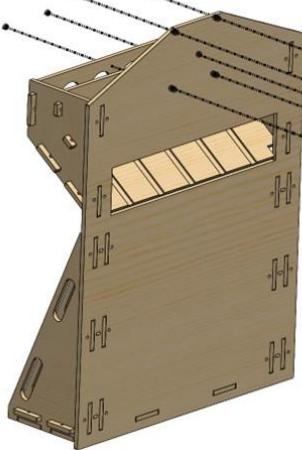
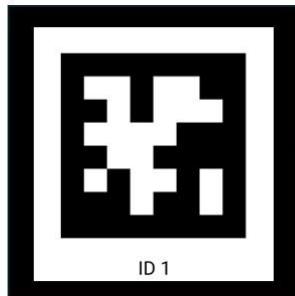
Combine the two assemblies with 120lb cable ties and aligning the tabs of the shelf into the front panel.



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7.

With 1.5" 1/4-20 hex head bolts and 1/4-20 wingnuts, attach AprilTag ID 1 to the front plate.



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## 4.2 Practice Field Processor

A total of 1 Practice Field Processor needs to be built.

### 4.2.1 Tools & Equipment

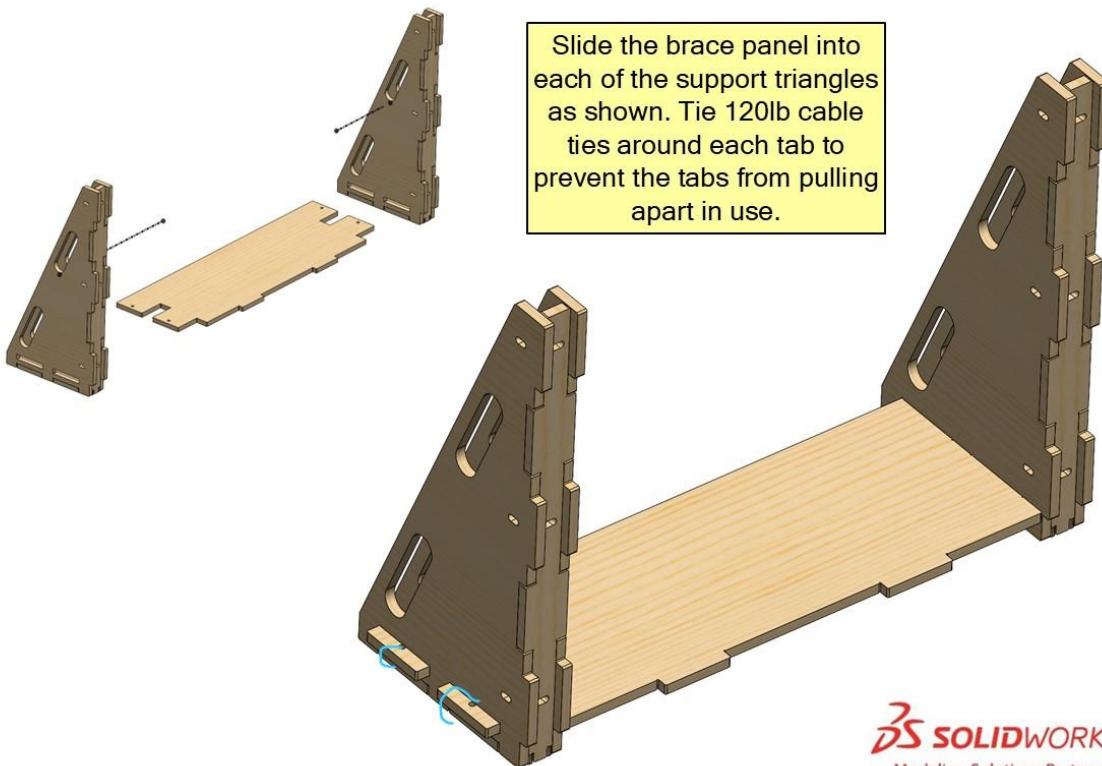
- 7/16" Wrenches/Sockets
- 4x 1" 1/4-20 Hex Head Bolts
- 4x 1/4-20 Wingnuts
- 16x 120lb Cable Ties

### 4.2.2 Assembly

1.

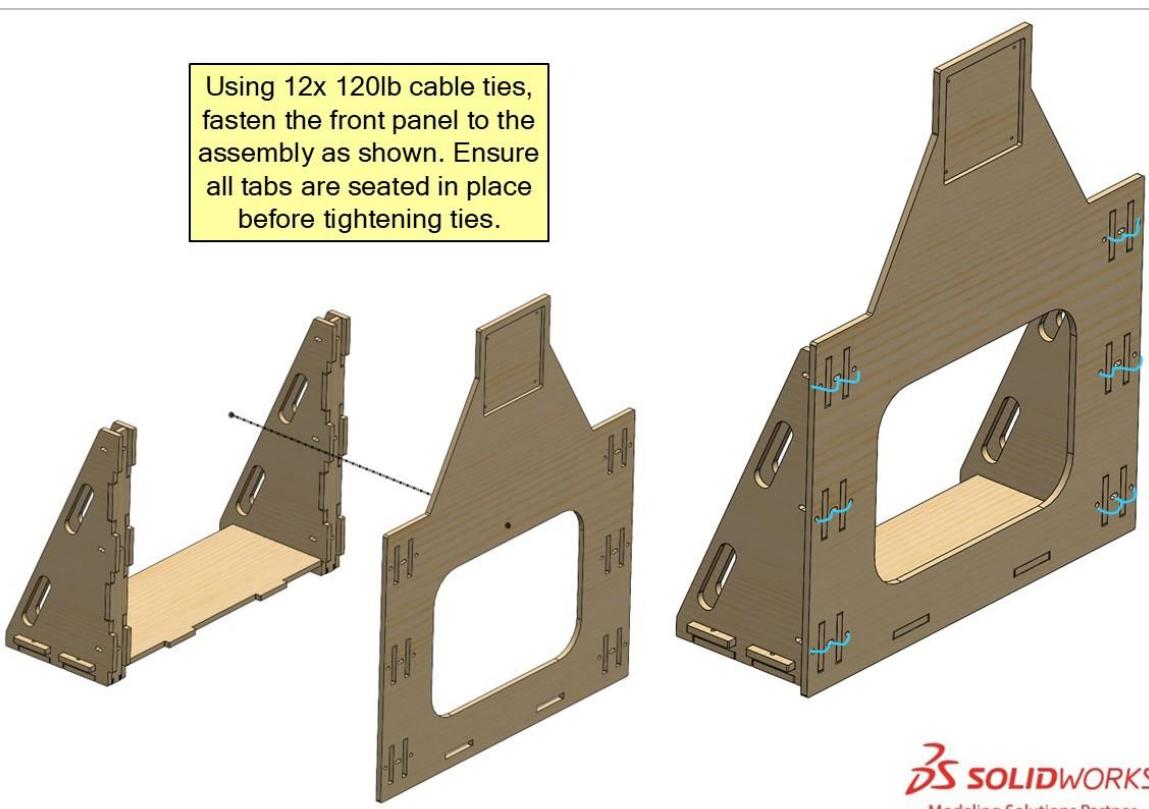


2.



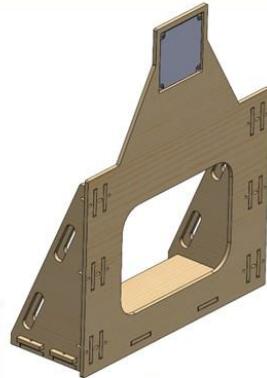
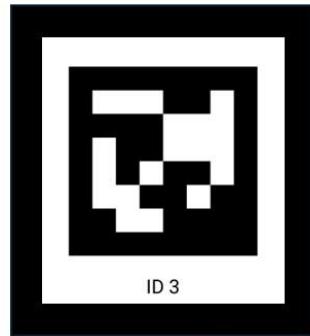
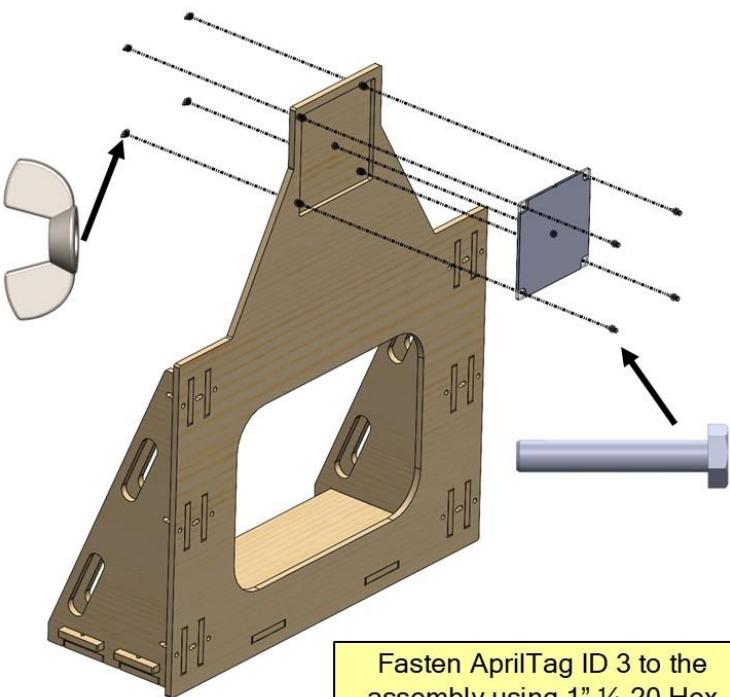
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3.



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4.



Fasten AprilTag ID 3 to the assembly using 1" 1/4-20 Hex Head bolts and 1/4-20 wingnuts.

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## 4.3 Practice Field Barge

A total of 1 Practice Field Barge needs to be built.

### 4.3.1 Tools & Equipment

- 50lb cable ties
- 3/4" wrenches/sockets
- 7/16" wrench/sockets
- 4x 1/4-20 x 2" hex head bolts
- 4x 1/4-20 x 1.5" hex head bolts
- 4x 1/4-20 x 1" hex head bolts
- 4x 1/4-20 wing nuts
- 1x 1/2-13 x 1.25" hex head bolt
- 2x 1/2" washers
- 1x 1/2" nylock nut

### 4.3.2 Assembly

1.



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#### Building the PF Barge



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2.

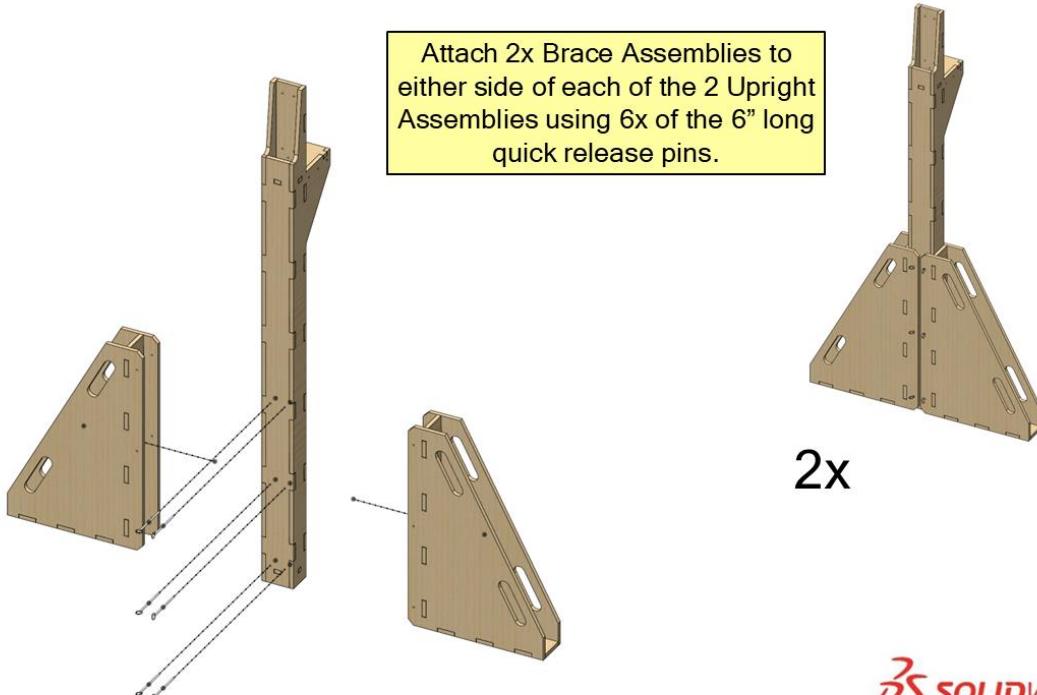
Apply 2x strips of hook tape to the bottom of each of the 4 brace assemblies.



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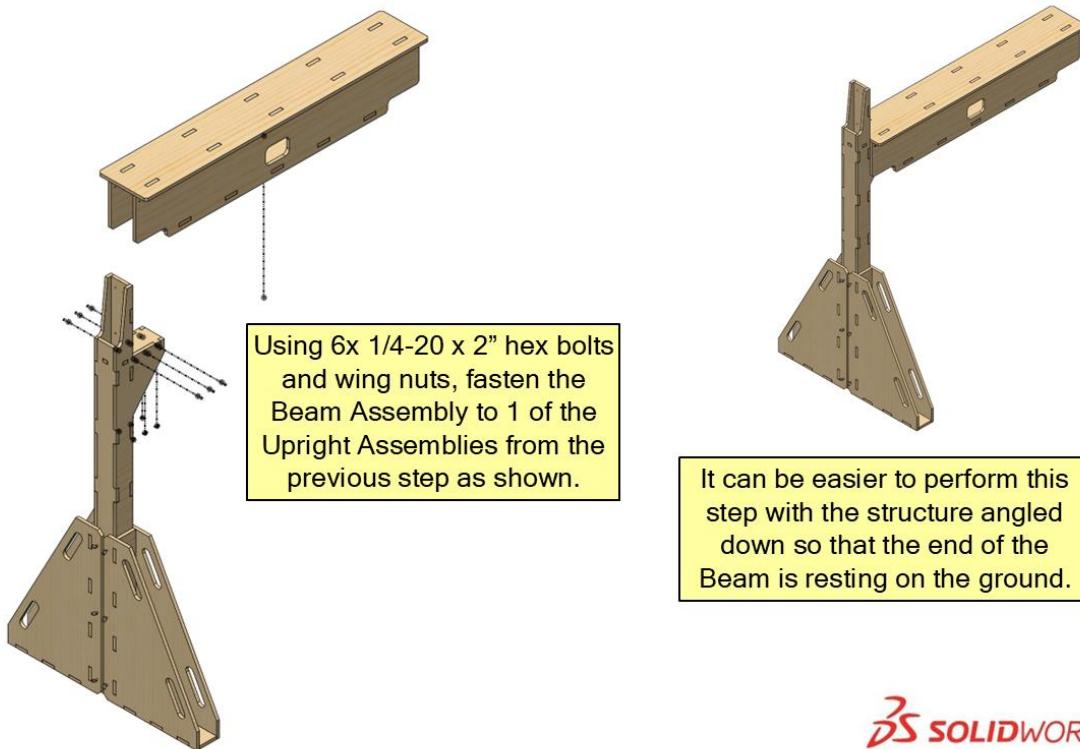
3.

Attach 2x Brace Assemblies to either side of each of the 2 Upright Assemblies using 6x of the 6" long quick release pins.

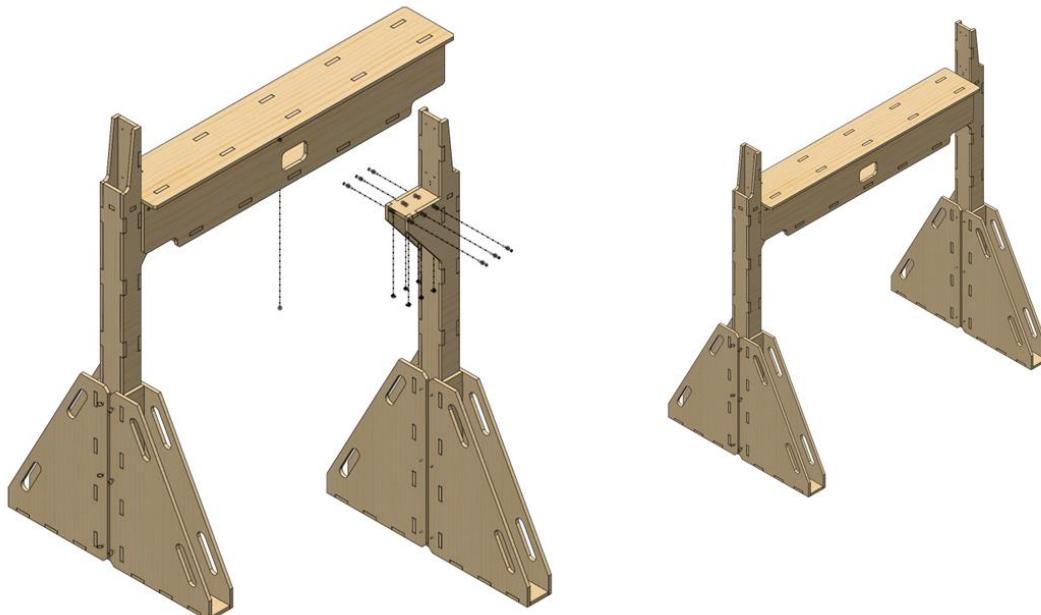


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4.



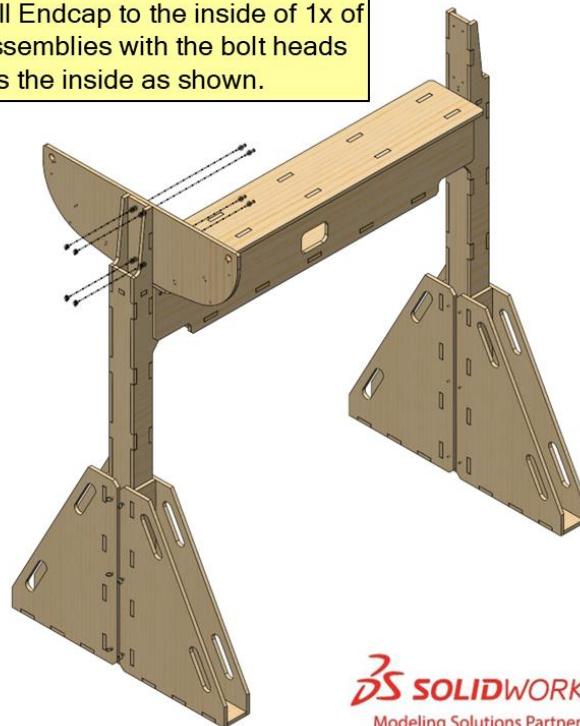
5.



6.

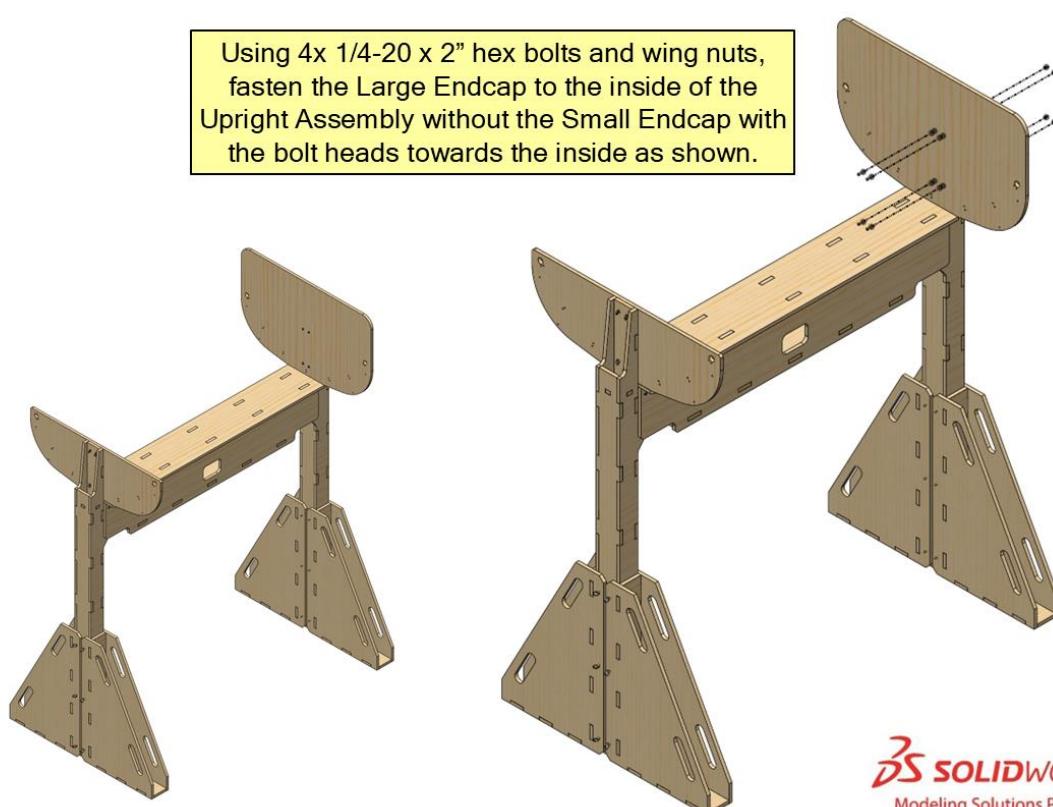


Using 4x 1/4-20 x 2" hex bolts and wing nuts, fasten the Small Endcap to the inside of 1x of the Upright Assemblies with the bolt heads towards the inside as shown.



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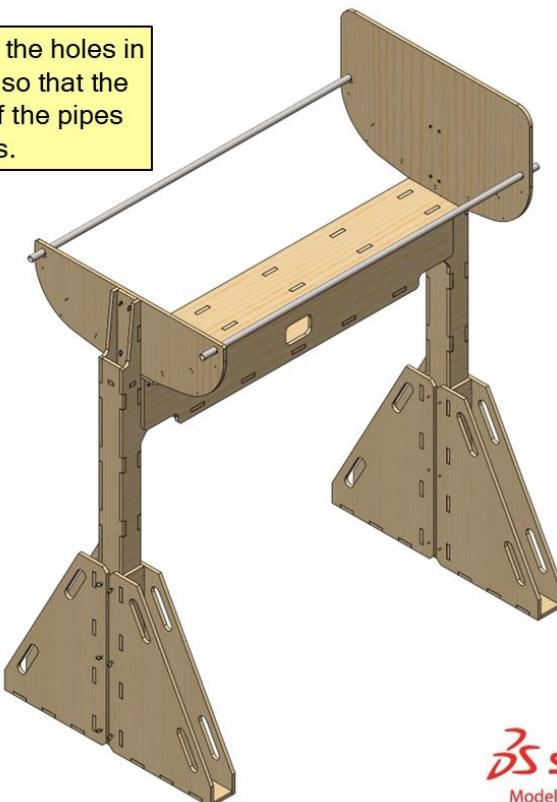
7.



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8.

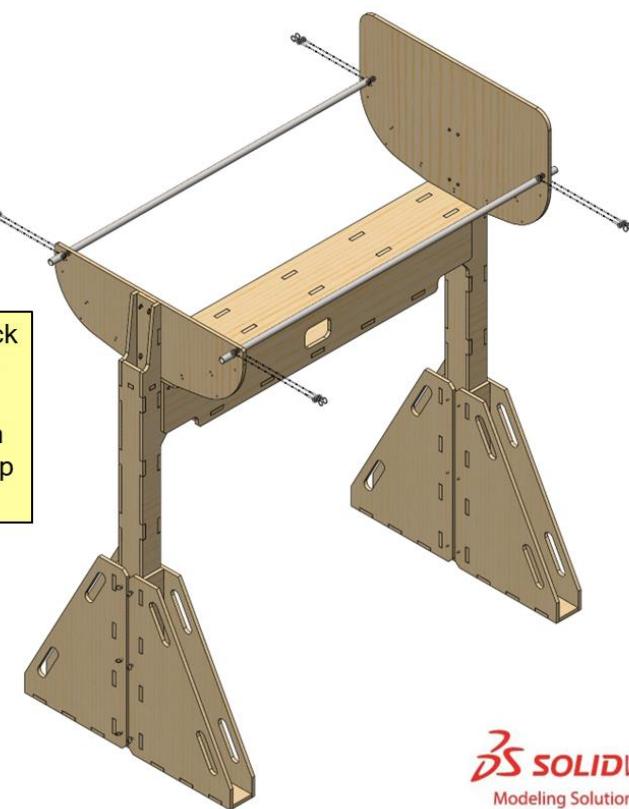
Insert the 2x Net Pipes through the holes in both Endcaps. Position them so that the pairs of holes on either end of the pipes straddle the Endcaps.



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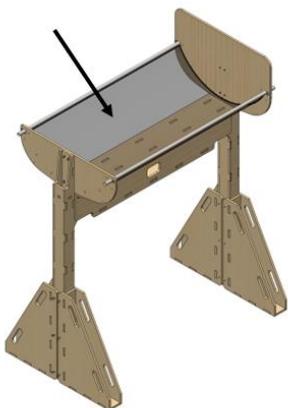
9.

Insert 8x 2-5/16" long quick release pins through the holes in the Net Pipes. There should be a pin on either side of each Endcap for each pipe.

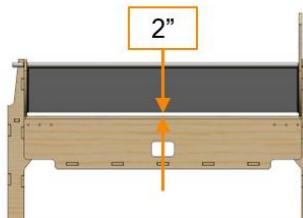


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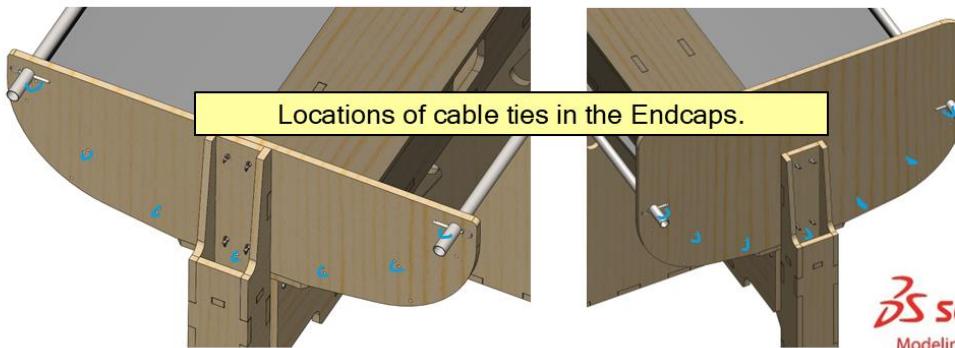
10



Using 50lb cable ties, install the Net on the top of the assembly. The cable ties should fasten to the Net Pipes and the pairs of holes in the Endcaps.

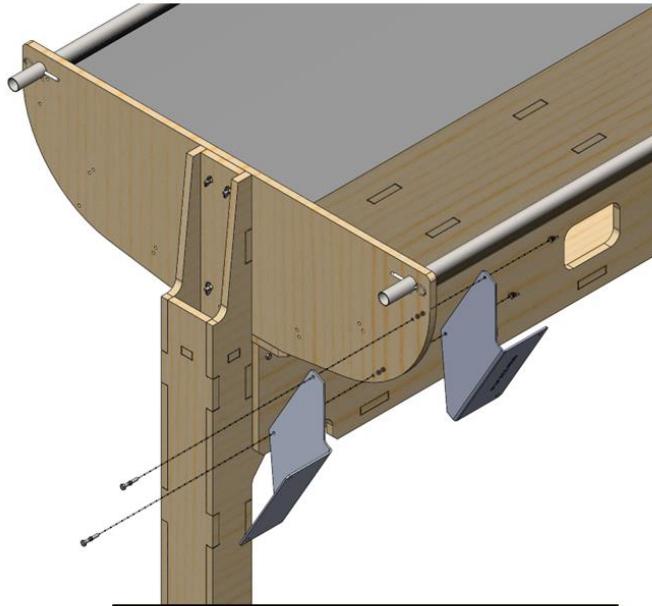


During the installation process, tension the net to maintain the gap between the bottom of the net and the top of the Beam to 2" as shown above. Tension can be adjusted by installing more cable ties or using openings in the net further from the edge to "gather" the net.

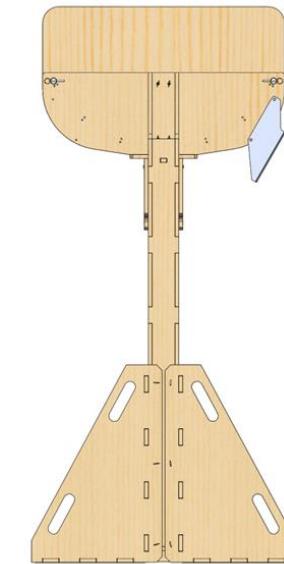


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11



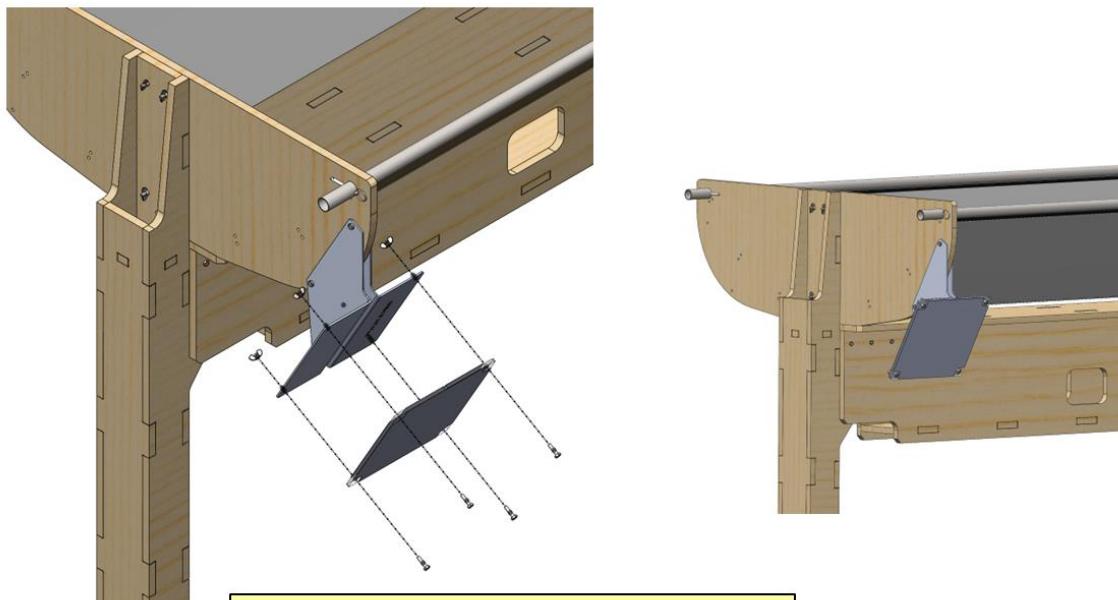
Using 2x 1/4-20 x 1-1/2" hex bolts and 2x wing nuts, install the LH & RH AprilTag Brackets onto either side of one of the Endcaps as shown.



Ensure the orientation of the brackets matches this image.

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12

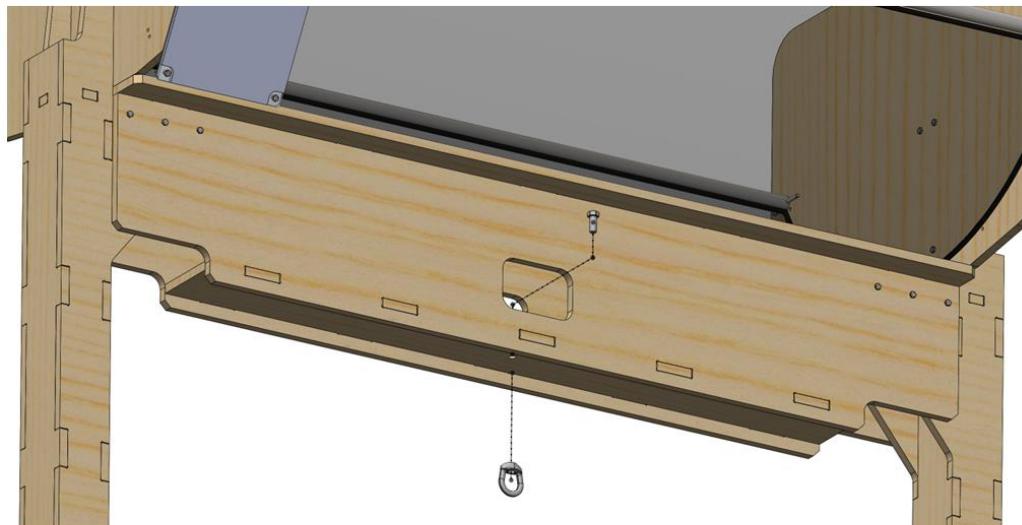


Using 2x 1/4-20 x 1" hex bolts and 2x wing nuts, install the AprilTag panel with ID 5 onto the brackets. Ensure that the tag is upright using the text printed on it.

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13

Install the Eye Nut on the bottom of the Beam using 1x 1/2-13 x 1-1/4" hex bolt. Use the access window in the side of the Beam to install the bolt.

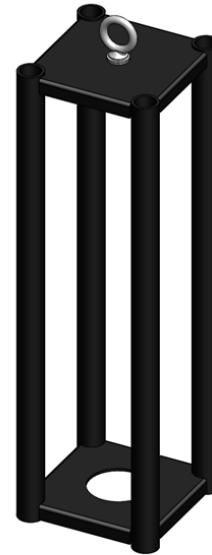


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14



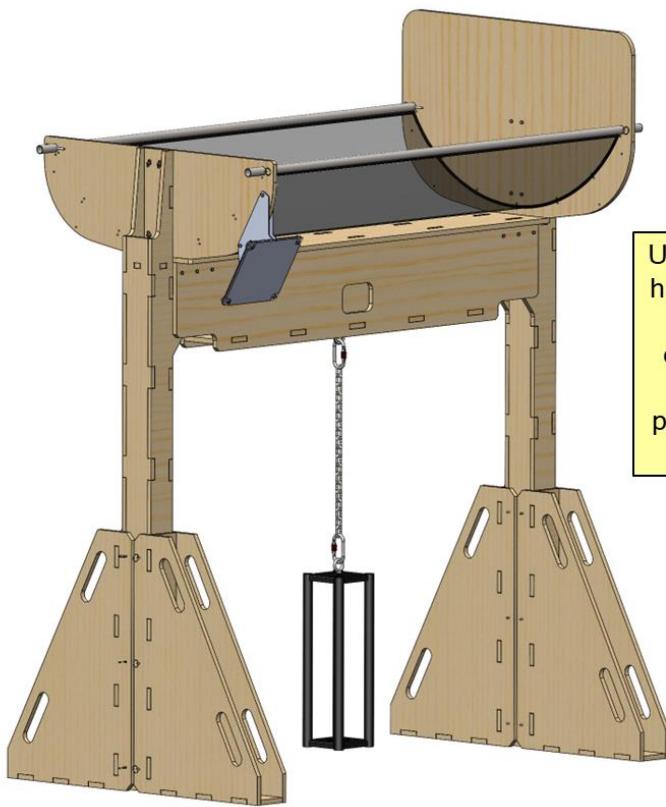
Using 1x 1/2-13 nylock nut and 2x 1/2" washers, install the Eye Bolt on the top of the Cage.



The number of washers can be adjusted to calibrate the height of the Cage from the floor if needed later.

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Using the Chain and 2x Carabiners, hang the Cage from the Eye Nut on the Beam. The Cage can be changed between the “deep” and “shallow” configurations during practice by removing the chain and 1x carabiner.

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## 4.4 Practice Field Reef

### 4.4.1 Tools & Equipment

- 2x 7/16" wrenches
- 10x ¼-20 x 1" hex head bolts
- 14x ¼-20 x 1" counter sunk Phillips (#3) bolts
- 8x ¼" x 2.3125" quick pull pins
- 2x ¼"-20 Wingnuts

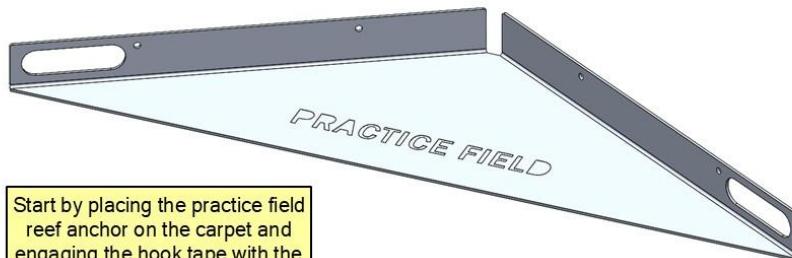
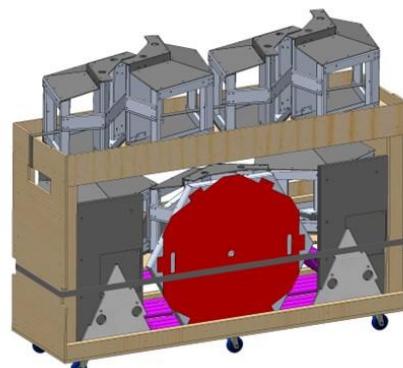
### 4.4.2 Assembly

1.



2.

Unlike the other practice field items, the practice field reef components are packed with on the reef carts with items from the playing field.

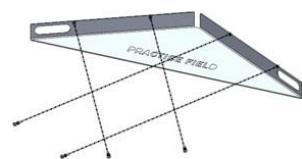
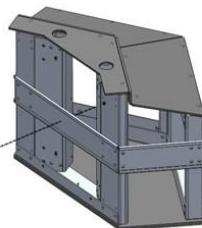
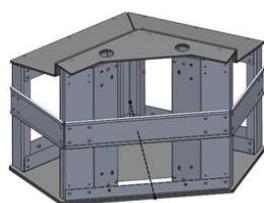
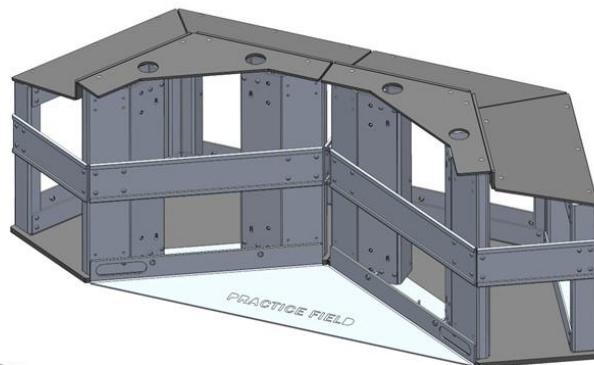


Start by placing the practice field reef anchor on the carpet and engaging the hook tape with the carpet.

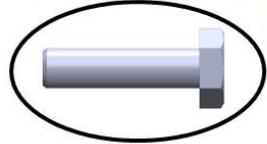
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3.

Fasten two sections of the reef to the anchor plate with bolts. It is recommended to set these reef sections on a sheet of HDPE while fastening them to prevent the hook tape from engaging with the carpet until they are fixed.



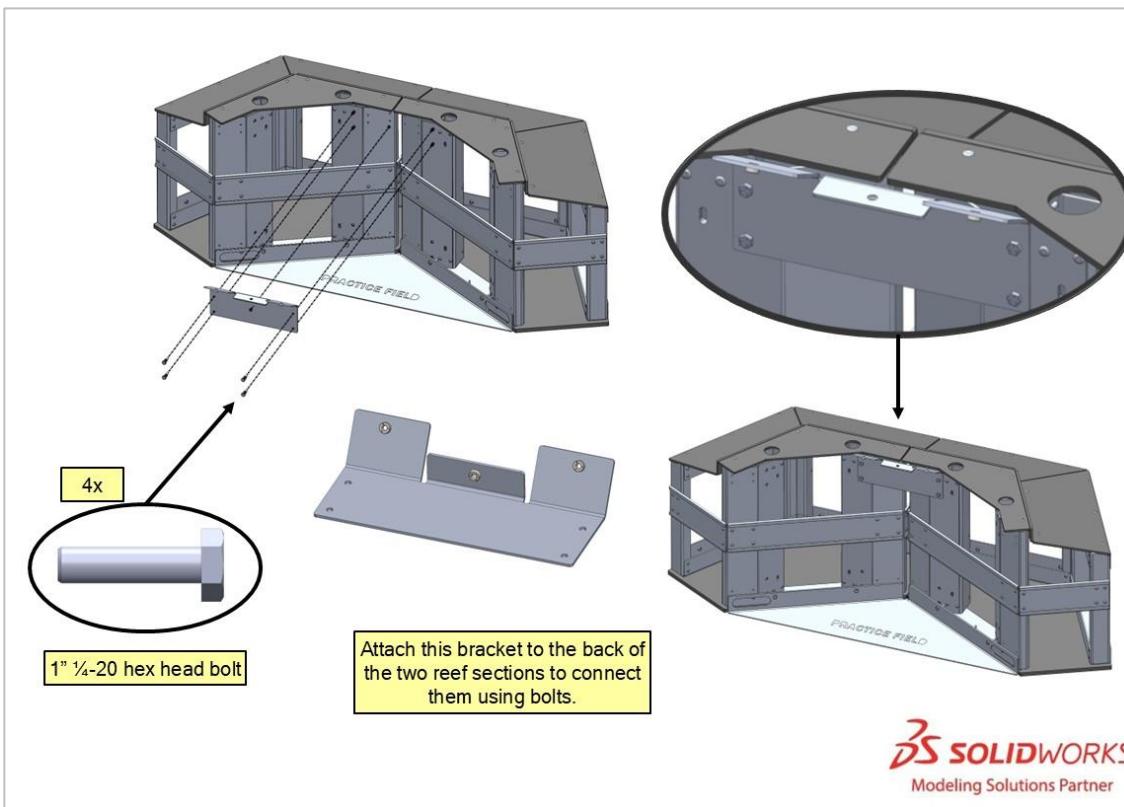
1" 1/4-20 hex head bolt



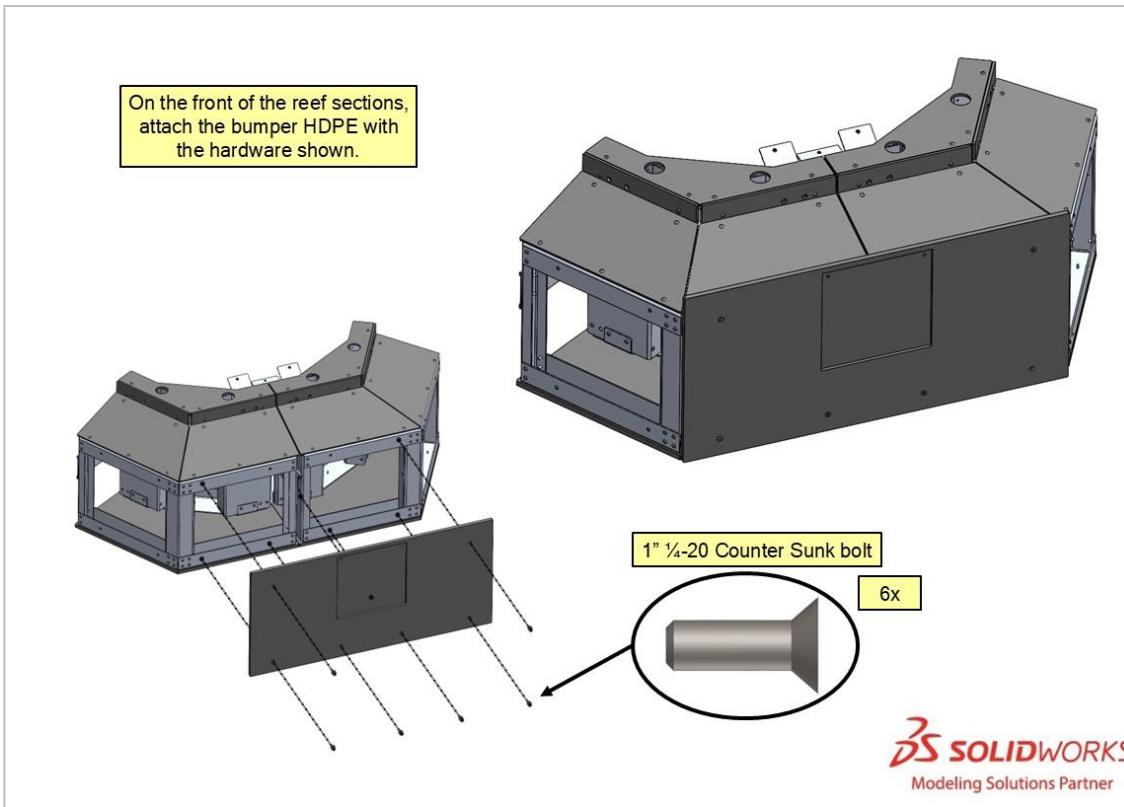
4x

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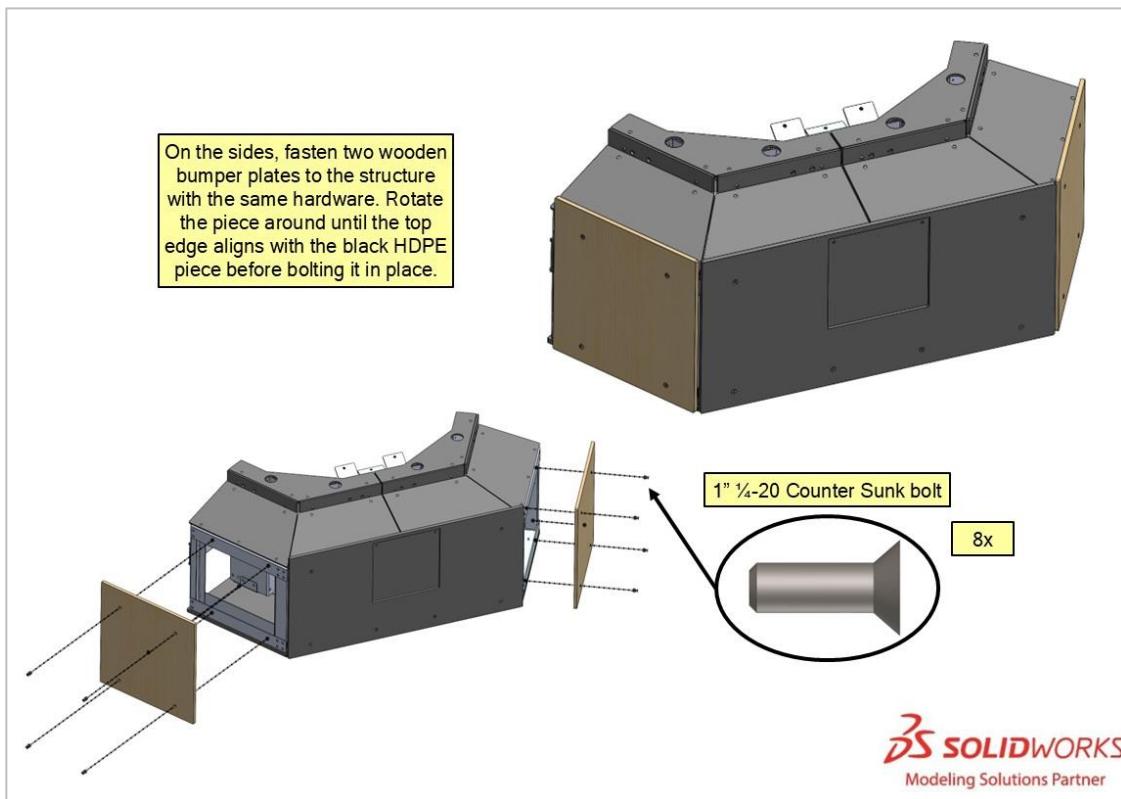
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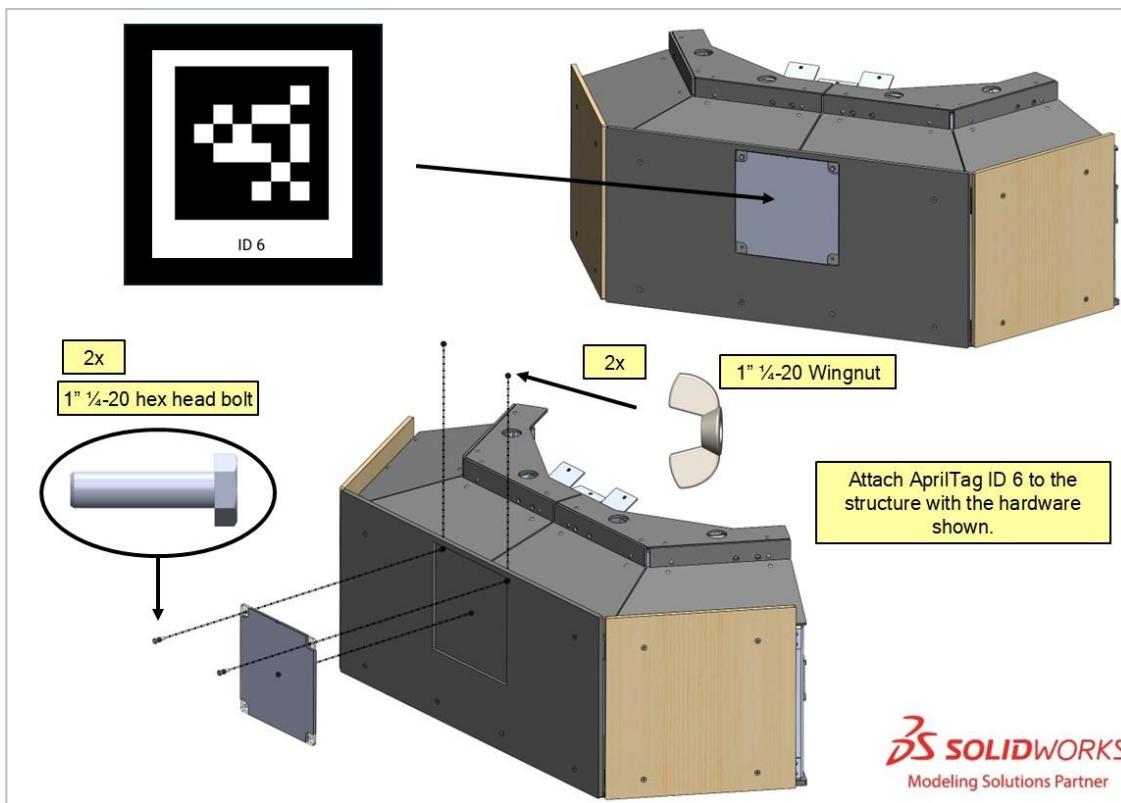
5.



6.

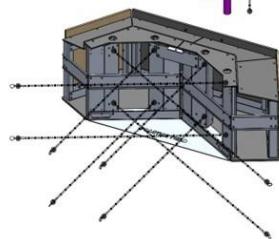
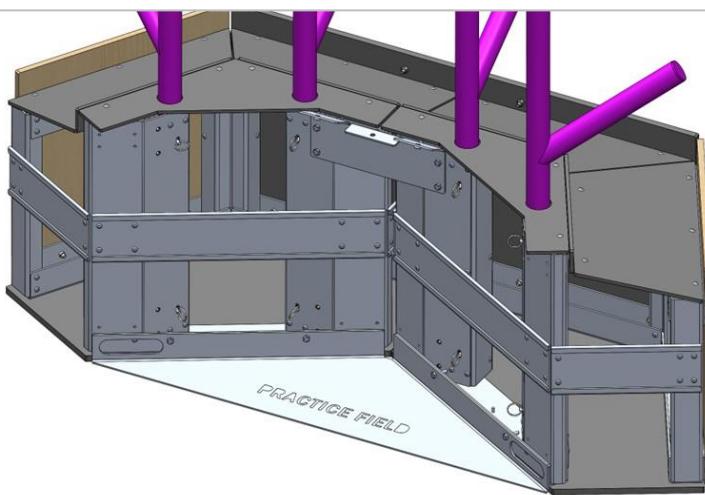
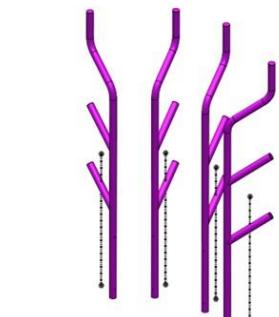


7.



8.

Lower the purple pipes into the opening in the reef until they reach the bottom. Secure each of them into the structure with two pins from behind.



2-5/16" Quick Pull Pins

8x

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## 5 Tearing Down & Packing the Field

### 5.1 Before the Awards Ceremony

The general preference is that you should not begin disassembly of any field cabling or components prior to or during the Awards Ceremony. Please be aware of noises generated and any physical distractions that could adversely affect the program. Ordinarily the Scoring Table remains intact while the Award winners are posted and updated to the web. You could retrieve the Pit computer but be aware that teams may still be assembled at the monitor viewing the Final Rankings display.

If you begin breakdown early and volunteers start removing devices and distracting the audience (or disassembly noise is distractive), cease disassembly until the ceremony has ended.

Teams, particularly the winners, will want to take pictures on the field after the event is over. That is okay but be sure that teams do not damage the field or stand on the driver's station shelves for a photo.

You can still get started with parts of the packing process even while they are on the field. Cutting cable ties, disconnecting cabling, and starting to pack E-stops, SCC units, LED's and electronics can all be accomplished while photos are being taken on the field. You should also gather up all game pieces and other specific items such as the fire extinguisher, miscellaneous tapes and tools from the Scoring Table, etc.

### 5.2 Field Disassembly Organization

During the disassembly of the Field at the end of the event, take time to monitor the repacking of the Field components. All parts to the Field and FMS have specific locations in the road cases, and they must be packed according to the photographs and diagrams provided in each road case and in this document.

Missing or damaged components must be reported to *FIRST* as soon as possible to ensure repair or replacement for the next event. FTAs should utilize their event reports to communicate this information and contact Engineering Support directly with major issues.

The best defense against loss or confusion is to observe where things come from in the first place, and how they are packed. When in doubt refer to the many photos that are provided here, in Chapter 3, and inside or on the road cases.

Also please refer to the Truck Packing Diagram for information on the proper location of the cases once reloaded onto the truck. All regional trucks should be the same size and will utilize the truck packing diagram, but some district and international events may have their own transportation systems with different packing plans.

Seek to gain solid control of the field breakdown process in advance. As early as possible on the final competition day, the Field Supervisor should find and organize the 10+ volunteers that

will assist in field disassembly and packing. Recall that Unionized Venues may specify “who will help” before you completely populate your crew. You may need to factor in their help.

The Field Supervisor should organize them so that 10+ people are designated for the dismantling and packing team. Other workers should standby to retrieve the empty cases and carts for distribution around the field. They also can push full carts and cases to the designated staging area or loading dock.

Here are a couple of General Rules and Guidelines to work by:

- Field disassembly is not necessarily the reverse of assembly. It is important to read this section thoroughly to understand case and cart packing requirements to prepare. To ensure success at the next event, please pack everything properly.
- Nothing should be left over after the packing is complete. Coordinate with everyone to verify that *FIRST* will leave the event with everything that *FIRST* brought. Once again, make sure your people know what is going to happen ahead of time. As cases and carts are filled, they should be systematically Barged and prepped to go to the loading dock. Items that are easy to miss during packing are ladders, handicap ramps, carpet dollies, vacuum cleaners, fire extinguishers, game pieces, etc.

### 5.3 Field Tear Down

Following the conclusion of the competition the event manager, the event assistant, pit admin, and others will dismantle their own areas and pack their cases and carts. They will then either move their packed containers toward the field or to the loading dock. One exception to this may be the re-packing of the Inspection cart in the Pit, which includes the sizing box, scale, calibration weights, Inspection documents, and supplies. The packing responsibility ultimately falls on the FTA and field crew to ensure packing of the Inspection case is completed.

Be careful when selecting a staging area some venues have limited dock space and share access with A/V. Also, carefully follow the truck-packing plan. Anticipating the proper order of things needing to go to the loading dock to be loaded on the truck is very important.

*Figure 5-1 Road case locations for field build & tear down*

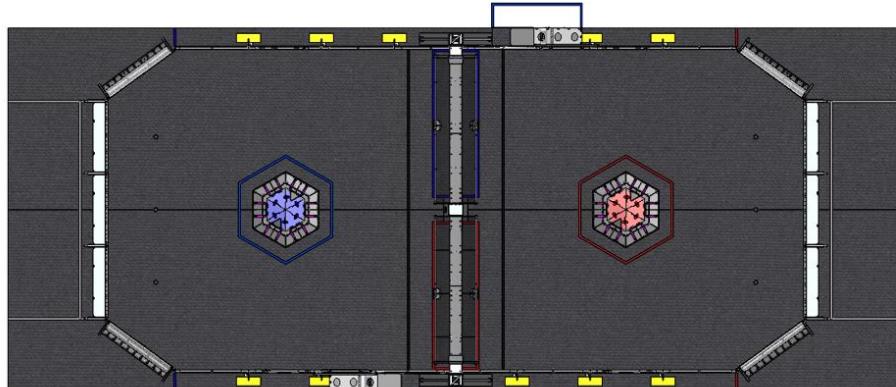
Case 24 (Game Specific)

Case 3 (Field Border Plastic)

Case 5 (Field Borders)

Case 23 (Game Specific)

Case 21 (End Panels)



Case 20 (End Panels)

Case 1 (Uprights)

Case 2 (Uprights)

Case 8 (Tools)

Case 7 (Electronics)

Case 11 (Referee)

Case 28 (FTA)

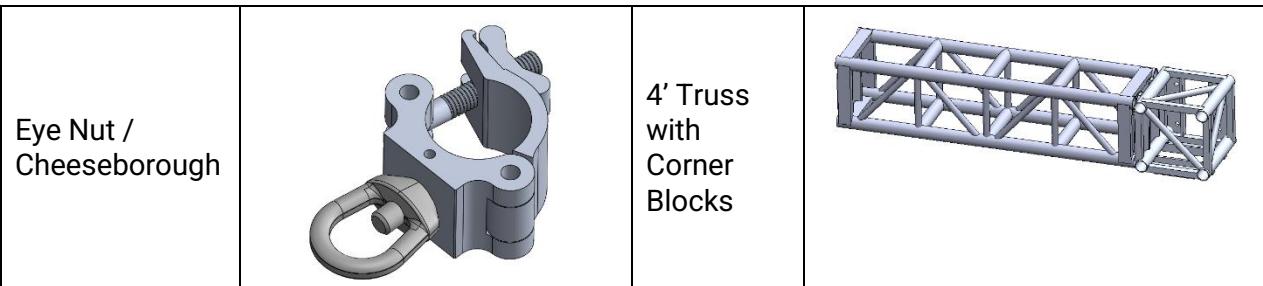

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The cases are numbered and labeled according to type of field components. It is critical to load the proper contents into the proper cases to avoid possible injury to people and damage to field components. For example, field support items, such as the fire extinguisher, scissors, tape, etc. must be collected and repacked into Case 8.

Fasteners that are not meant to be removed by volunteers generally require hex keys. Additionally, there are parts assembled on Week 1 that will not need to be disassembled for subsequent events. For these parts, use a marker to color the fasteners that should not be removed by volunteers. Don't forget to remind your volunteers that marked fasteners and most fasteners using hex keys should remain in place. Plan on having someone be in charge of collecting and organizing hardware as it is removed from the field elements.

### 5.3.1 Items That Should Not Be Disassembled

Cages with hardware		Truss braces with hardware	
---------------------	--	----------------------------	--



## 5.4 Electronics

The Scoring electronics packing includes all the electronics components contained in Cases 6, 7, 19, 33, 34 and 35. It is recommended to coordinate with the Key Volunteers working with this equipment during the event to see if they can remain to assist with the packing process. All field cable ties (with the exception of those holding the light strips to their light tubes) can be cut in preparation for the removal, coiling, and packaging of cables in the proper cases.

During disassembly, it's easy for the extension cords and 20M Ethernet cables used to connect the Scoring Table to the field ends to mistakenly end up with the A/V equipment. Keep track of these cables to ensure they end up back in Case 6 to avoid expensive replacement costs.

The Pit Display, WPA Kiosk, and Audience Display laptops should be shut down, accessories gathered and returned to the Scoring Table for packing in Case 7.

Move Case 6 to one end of the field for packing of all the associated components from the Alliance Station, then move the case to the other Field end and repeat the process.

1. E-Stops
2. A-Stops
3. Team Sign and Timers
4. Team Lights
5. SCCs
6. All associated cabling

*Figure 5-2 SCC packed in Field Electronics Case*



## 5.5 Side Border Disassembly

- Remove all clear plastic Side Rail Shields from the Side Borders by cutting and removing the cable ties. Place them into Case 3 as you progress.
- Remove the pins from the corners of each field end.
- Once the corners have been disassembled, lay the side railings face down on the carpet towards the field center.
- Bring Case 4 (Side Borders) to one side of the field, Case 5 to the other.
- Disassemble Side Border Elements, including Outriggers, at one end and work towards the opposite end.

The sequence of photos below illustrates the packing portion of this procedure:

- Load sequential sections into the Side Border case, alternating top and bottom with the rail of one section sitting on the flat base of the next. Always have the flat side facing up. Don't mix sections between two sides/cases.
- Insert the Outriggers down between the rail sections. Yellow Trip Guards go into same case together with four short pins.

When all rails are stowed, close the case(s) and verify proper fit.



## 5.6 Field Ends

It takes a crew of four to dismantle and pack one Field end. Another crew of four should be assigned to dismantle and pack the other end. Before you can do the mechanical disassembly, the electronics and cables must already be removed.

Cut all cable ties and remove any remaining Scoring and Field Electronics cabling between the Scoring Table and field ends and from electronic modules on the field ends. Stow the cables in the appropriate cases.

If not already done, remove all electronic modules from the field end panels including the LED modules, E-stops, Team Lights, and the Station Control Consoles and re-pack the components into the designated locations in Case 6.

You are now ready to disassemble the Field Ends.

- One person removes the Top Rail Lexan holders one at a time and places them in case 1 or 2; as the rail is removed, a team of two people carry and pack the Station Lexan panels and corner Lexan into Case 20 or 21
- Lower the player station shelves and then lift/rotate/lock the Velcro footpads on all of the Player Station panels.
- Place the end panels into Case 20 or 21 as shown.

As you progress, put the uprights aside, ready to go into Case 1 or 2.

- As the end panels are disassembled, take any game specific wall weldments to their respective game specific cases.
- As Station End panels are removed, people need to carry them and insert them in the case as shown. Repeat until it's done.



You are now ready to load the uprights into the Uprights case. Do not mix pieces from the two ends; all of one end's uprights go in Case 1, the other end's uprights go into Case 2.

On the next page, the photo sequence depicts loading the components into the Uprights case.





## 5.7 Carpet

The Practice Field Carpet must be rolled up and sent to the next event. No exceptions.

The Competition Carpet handling varies from event to event. Most competitions give their carpet away to teams or other local *FIRST* participants (such as folks who run off-season events). The notable exceptions to this rule are the fields that get sent to Championship.

If you are uncertain about any of the above, please check with *FIRST* to confirm.

If your field is one of those designated “Dispose of” the Regional or Volunteer Coordinator may arrange with a local team to take the used carpet for their own use at local events. If the carpet remains unclaimed, notify the venue that the carpet should be trashed.

Two full-sized carpet rolls will be traveling on the truck for the next event. The carpet will be delivered to your venue on Wednesday or Thursday. Please contact Mechanical Support immediately on Friday morning if the carpet has not arrived at your event. Each FTA will be responsible for loading the carpet on to the truck during load out.

### Carpet Rolling

- Remove the gaffer’s tape from the perimeter of the carpet; use a carpet knife to cut the carpet down the middle so that you cut through the gaffer’s tape and the under-carpet seaming tape. Be careful of the floor underneath.
- Separate the 2 pieces of carpet a little to simplify rolling; with 15’ wide carpet, 5 people should do the rolling

- Roll the carpet by starting with a very tight roll and maintain good alignment; otherwise, it may end up looking like a sharpened pencil.
- After rolling, tape the carpet in 4 spots to keep it bound together; this will require the tape to totally encircle the roll plus a little.
- If available use carpet dollies to roll the carpet off to the side or to a location from which the team can take it out, or the venue will let you dispose of it. Ensure you take back the carpet dollies!

If the carpet is unclaimed, move the carpet to a wall edge (out of the way) and notify the venue maintenance of its location and disposition.

Note: As indicated in the chart, some regionals need to load their complete, uncut carpets onto the truck for the Championship.

## 5.8 Game Pieces

Please plan on packing new and used game pieces to carry to the next event. Algae can be deflated or left inflated and shipped in trash bags.

**Unless you are given permission by FIRST management, do not give away game pieces.**

## 5.9 Case Packing

### 5.9.1 Reef Cart Packing



#### 5.9.1.1 Contents

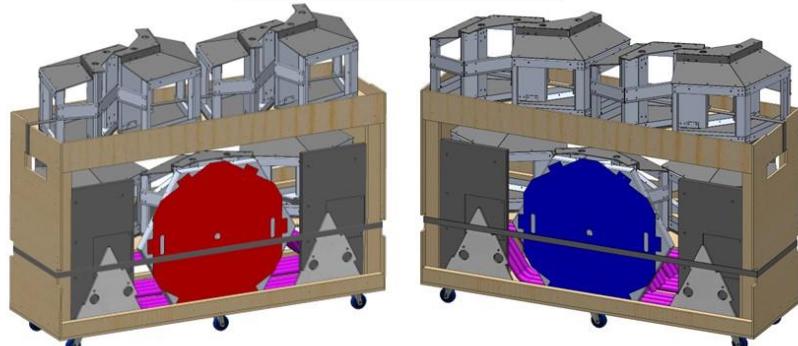
Item Name/Description	Qty in red cart	Qty in blue cart
Reef Slice	7	7
Scoring Pipe/Branch	14	14
Hexagon Base Plate	1	1
Red Reef Cover	1	0
Blue Reef Cover	0	1
Bumper Plastic	7	6
Coral Catcher Polycarbonate	6	6
Scorekeeper Triangle	2	2
Coral Catcher Bracket	7	6
Practice Field Reef Anchor	1	0
Ratchet Strap	2	2

### 5.9.1.2 Packing Steps

These two cases are packed in very similar fashion. This set of instructions will be used for both carts and will highlight any differences as they come.

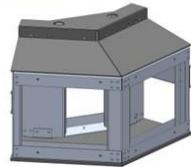
Elements Packed:

- Red Reef
- Blue Reef
- Non-wooden components of practice field Reef

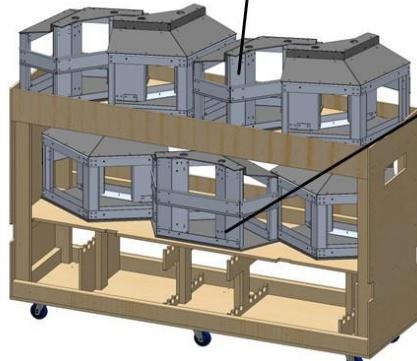
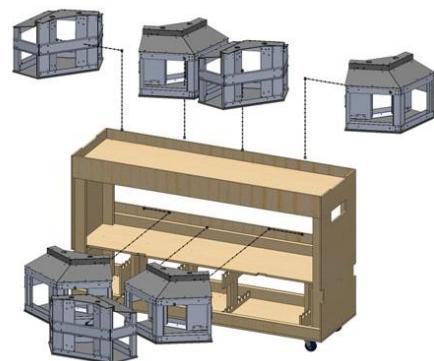
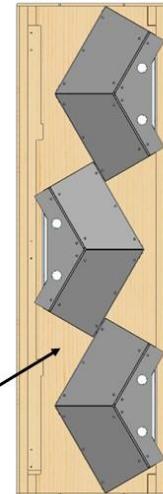
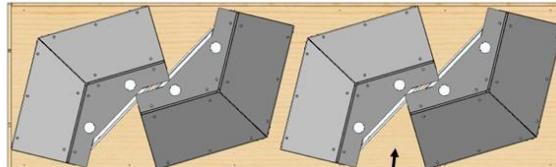


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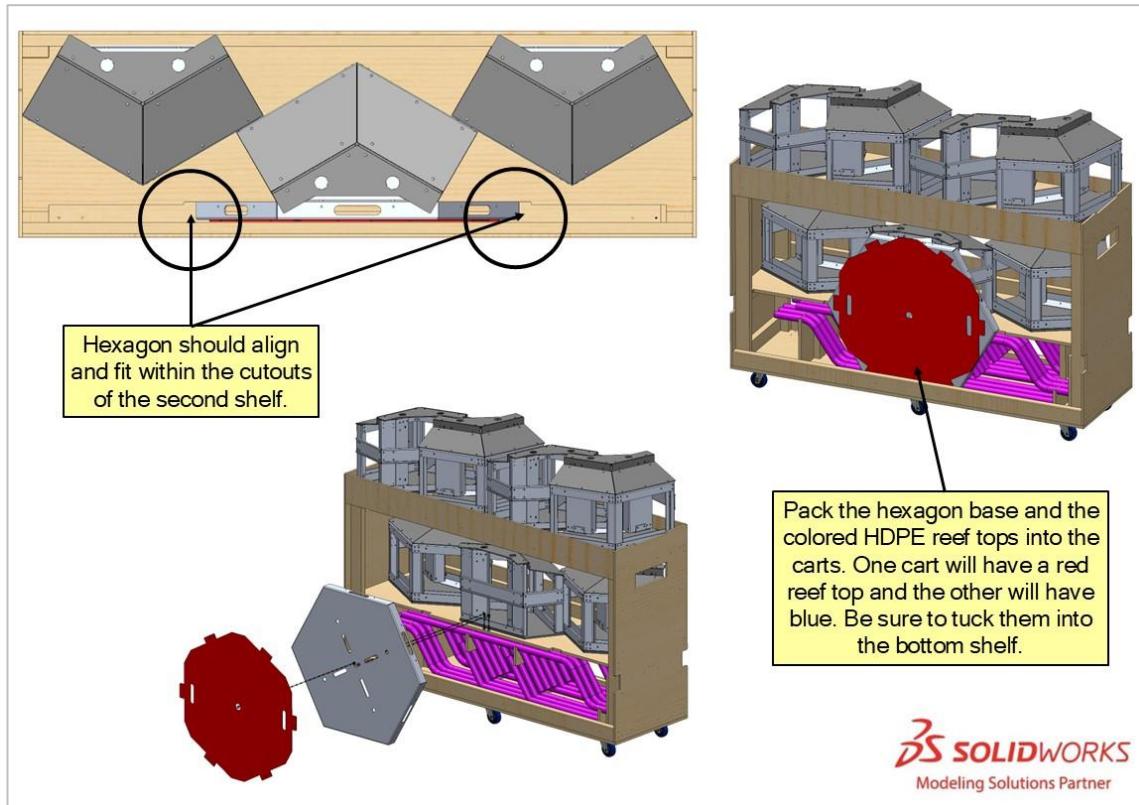
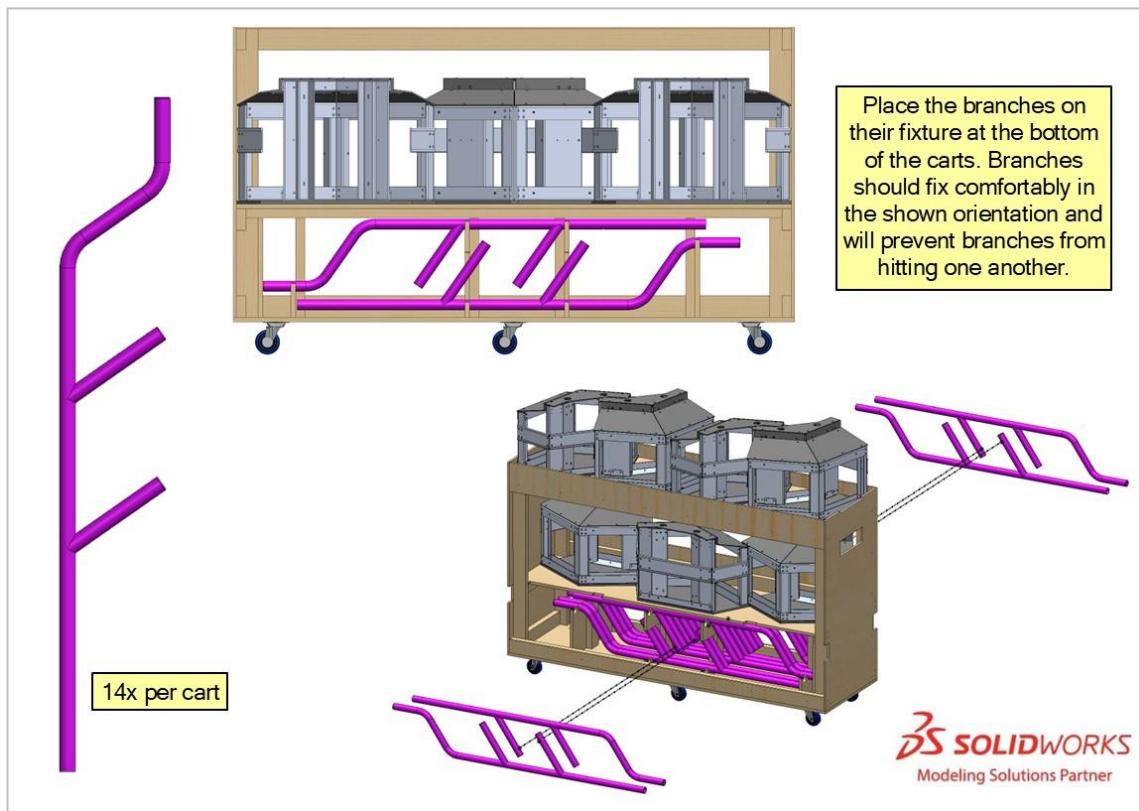
Put the Reef slices on the carts for both Reefs and the practice field



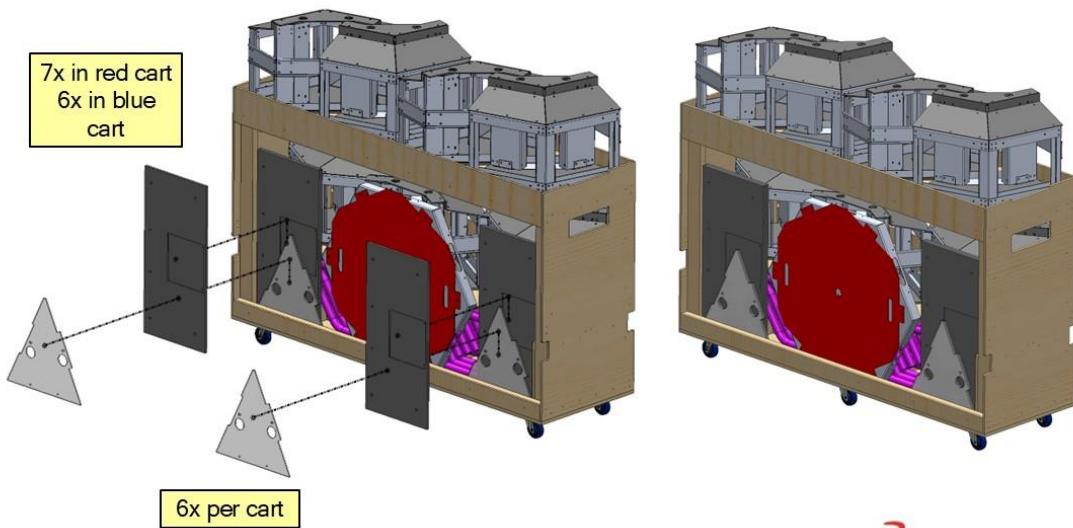
7x per cart



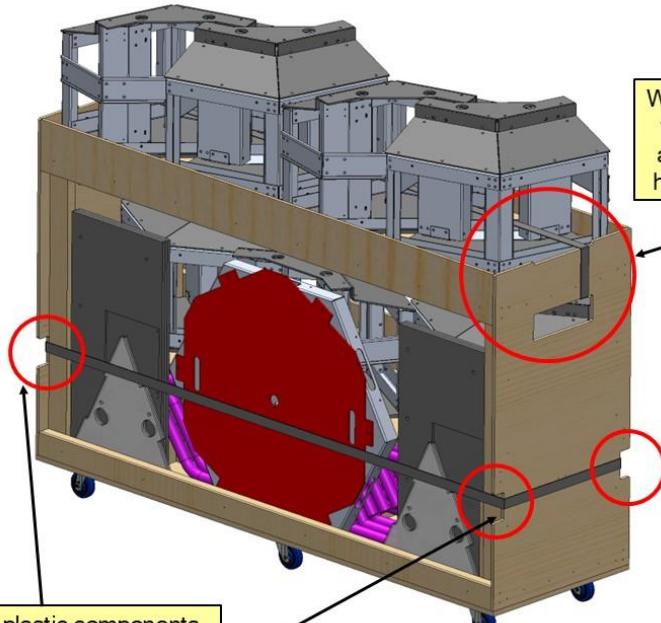
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Pack the Reef bumpers and coral catcher plastic into each cart. There will be an extra coral catcher plastic from the practice field, this belongs in the red cart.

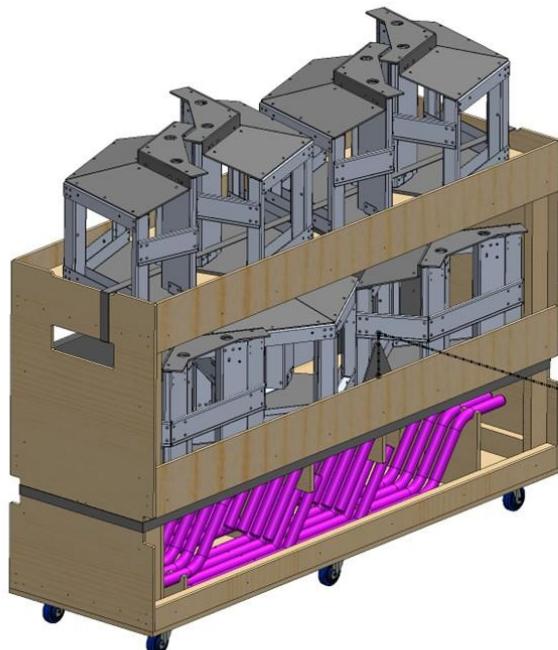


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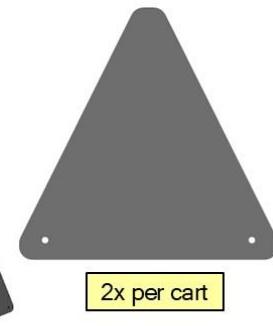


Weave one ratchet strap through the reef slices on the top shelf and strap them down using the handles on the ends of the cart.

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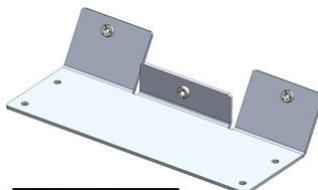
Pack the scorekeeper triangles onto the middle shelf wherever they fit and will not fall off.



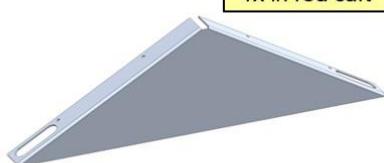
2x per cart

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Coral catcher brackets can be packed in any remaining open spaces on the second shelf.

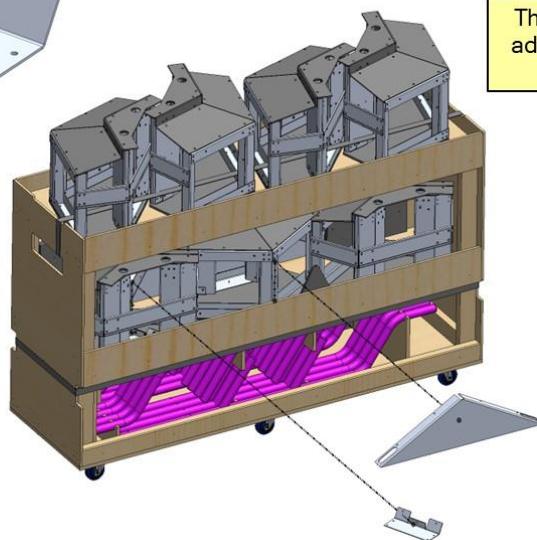


6x in red cart  
7x in blue cart



1x in red cart

The practice field reef has this additional bracket. Pack this in the red cart.



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### 5.9.2 Case 23



#### 5.9.2.1 Contents

Item Name/Description	Qty
Field Border Frame	2
Ramp Sheetmetal	1
5ft Truss	2
4ft Truss	2
4-way Corners	1
Floor Support	4
Cage Weldment - Blue	3
Processor Weldment	1
Truss Base Long	1
Lower Front Plastic	2
Upper Front Plastic	2
Ramp	2
Bumper Plastic	2
Back Divider Plastic	2
Game Piece Holder Side	4
Game Piece Holder Top/Bot	4
Game Piece Holder Back	2

<b>Frame Support Leg</b>	4
<b>Backboard</b>	2
<b>Side Panel w/Vinyl</b>	2
<b>Top Panel</b>	2
<b>Humanside Panel</b>	2
<b>Rib, Blue</b>	3
<b>Rib, Red</b>	3
<b>Holder, April Tag</b>	4
<b>Left Side Assembly</b>	2
<b>Right Side Assembly</b>	2
<b>Truss Base Normal</b>	1
<b>Brace, Barge End</b>	2
<b>Extra Wall Panel Briweld</b>	2
<b>Pin Connector - Briweld</b>	2
<b>Pin Connector - AM</b>	2
<b>Net Tube, Outer</b>	4
<b>Net Tube (Assembly)</b>	4
<b>2x6 Gridwall</b>	2
<b>Carabiners</b>	14

### 5.9.2.3 Packing Steps

1.



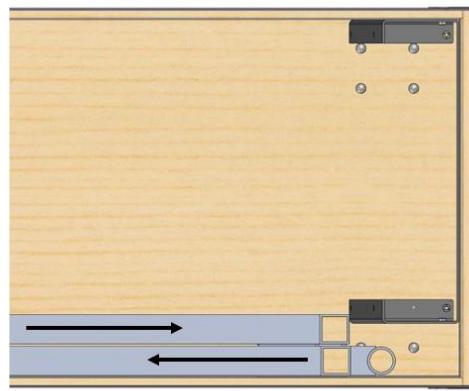
Start by packing two Coral Station weldments into the case. The weldment closer to the middle of the case should be placed upside down.

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2.



Position the Processor ramp vertically at the end of the case. The two weldments should be slid into the position shown.



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3.

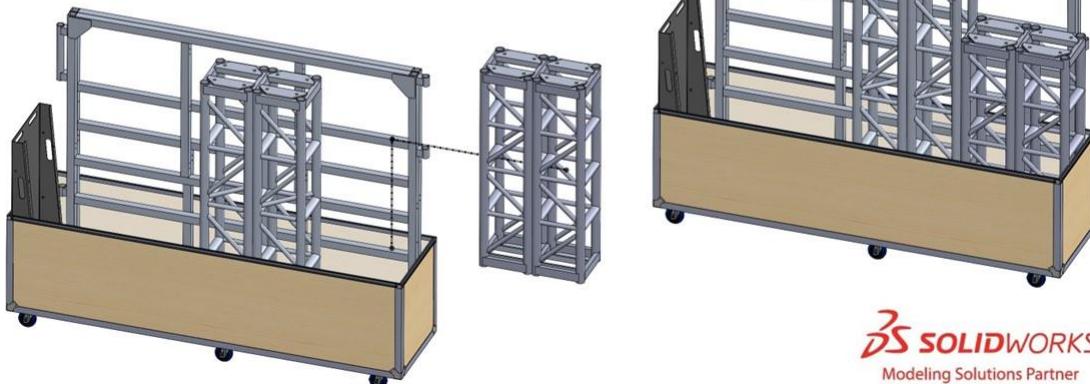
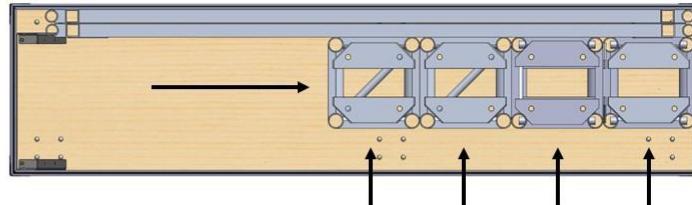
Pack 2x 5ft truss near the center of the case.



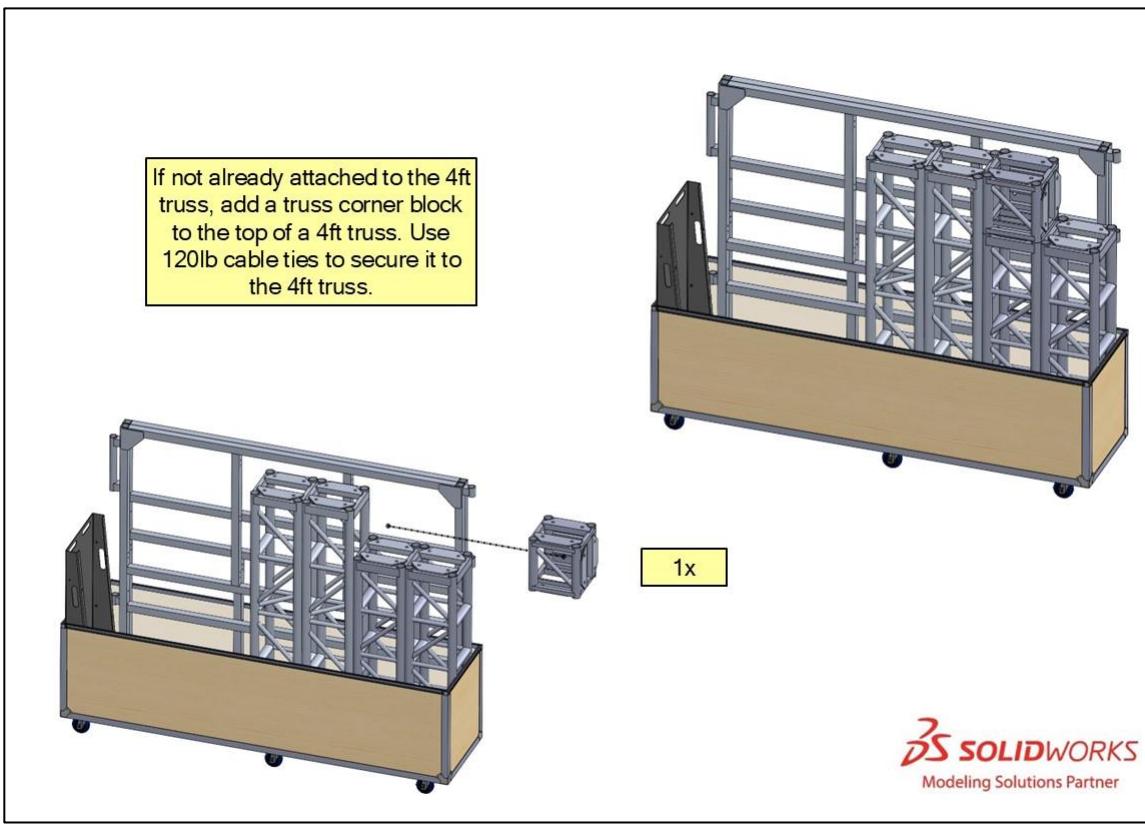
4.

Add 2x 4ft truss to the case inline with the 5ft truss. Slide the group to the end of the case opposite of the Processor ramp and push them back into the Coral Station Weldments.

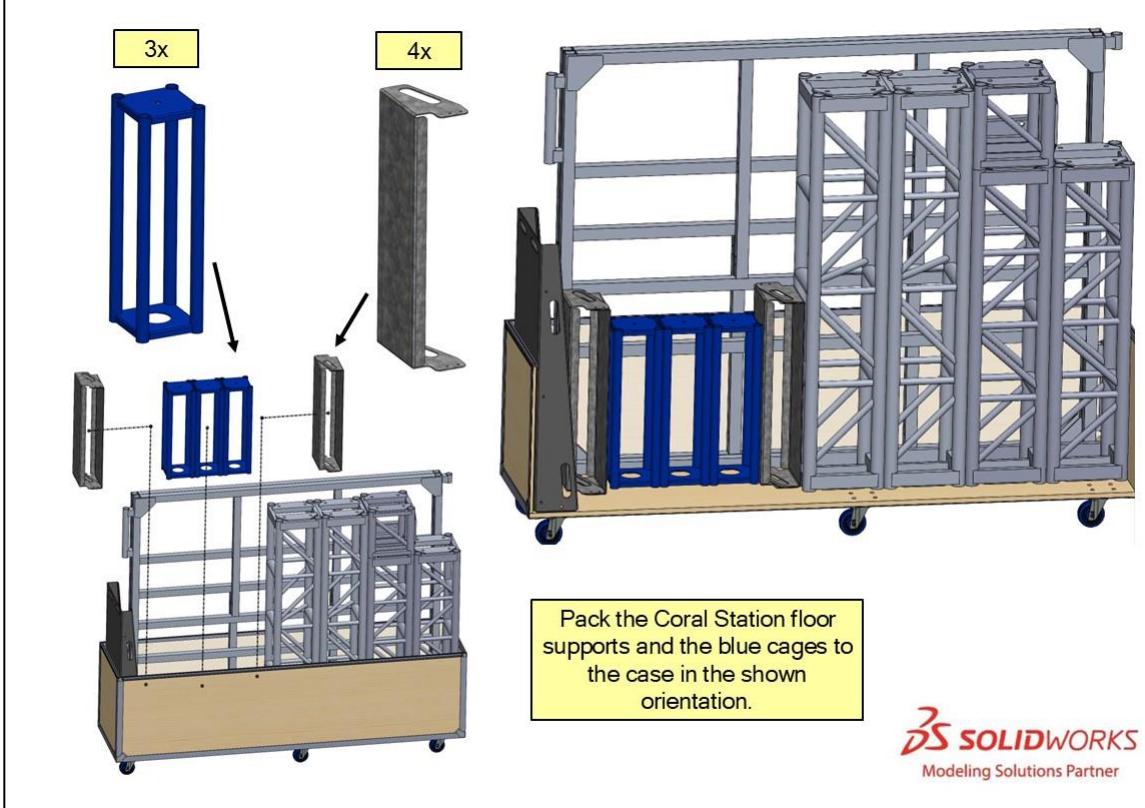
If you have a corner block attached to the 4ft sections of truss you can leave that attached.



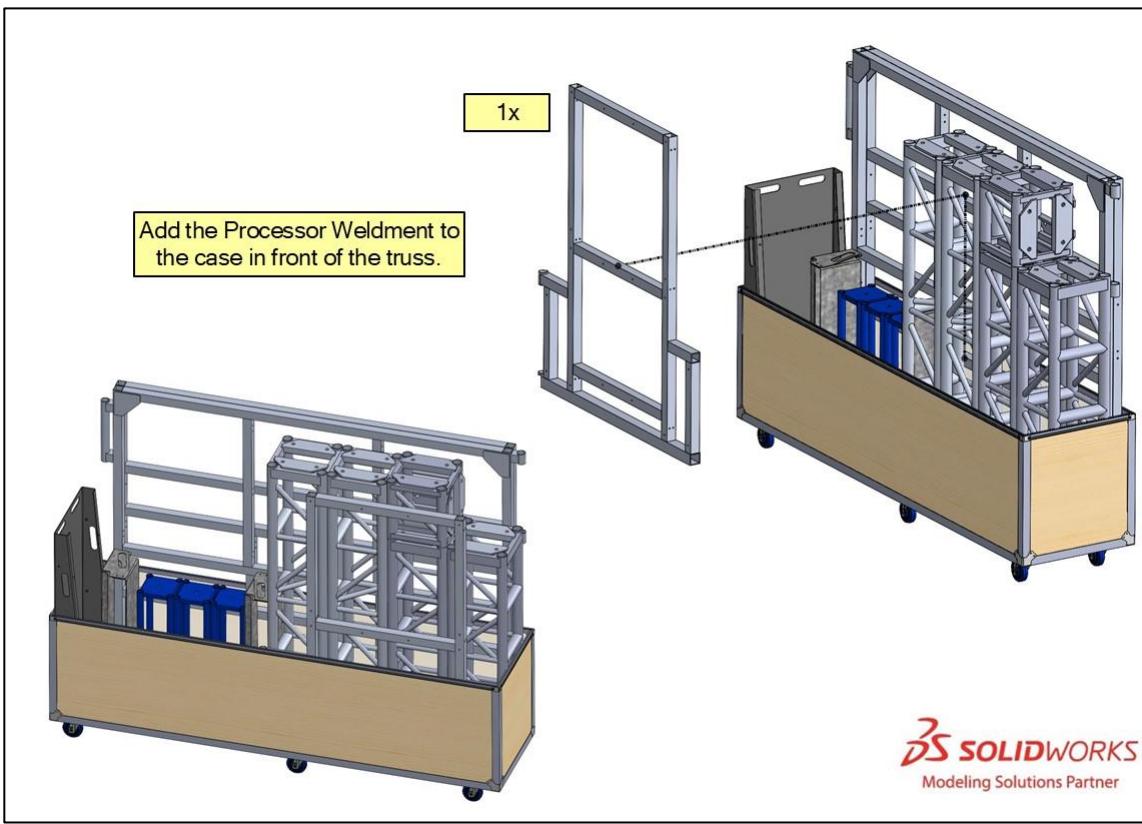
5.



6.



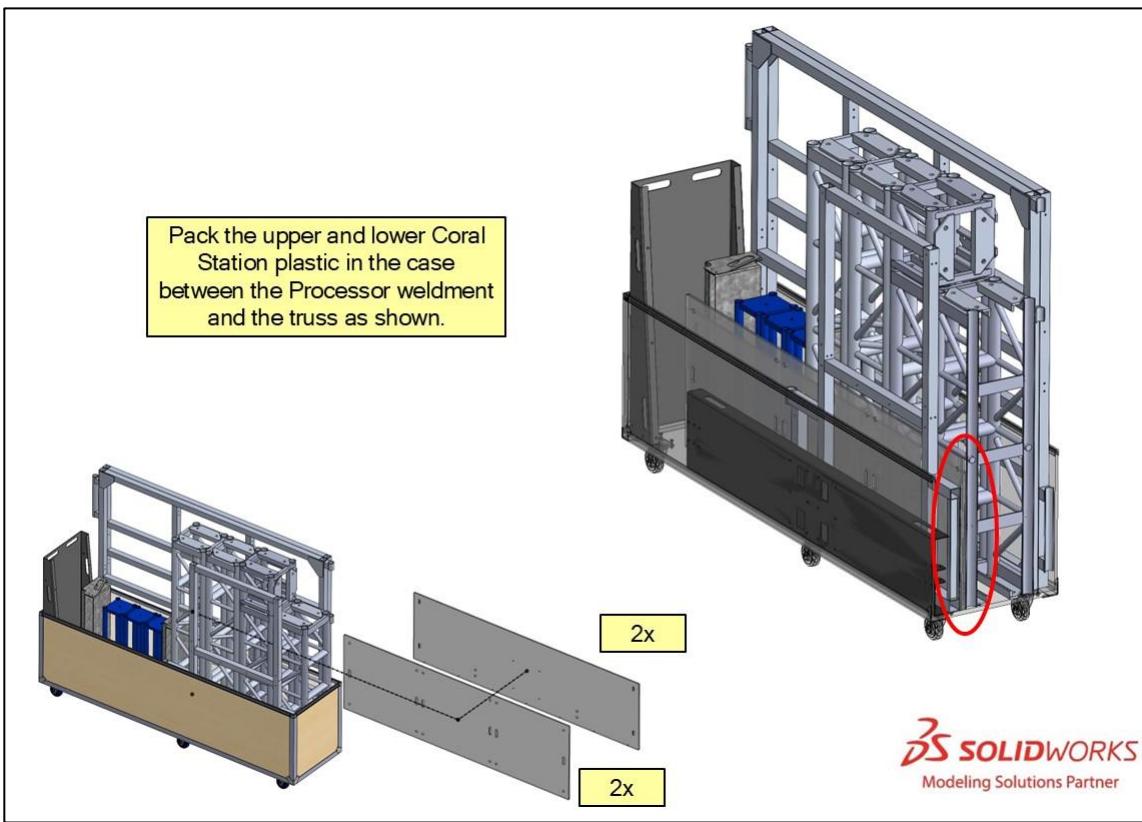
7.



8.



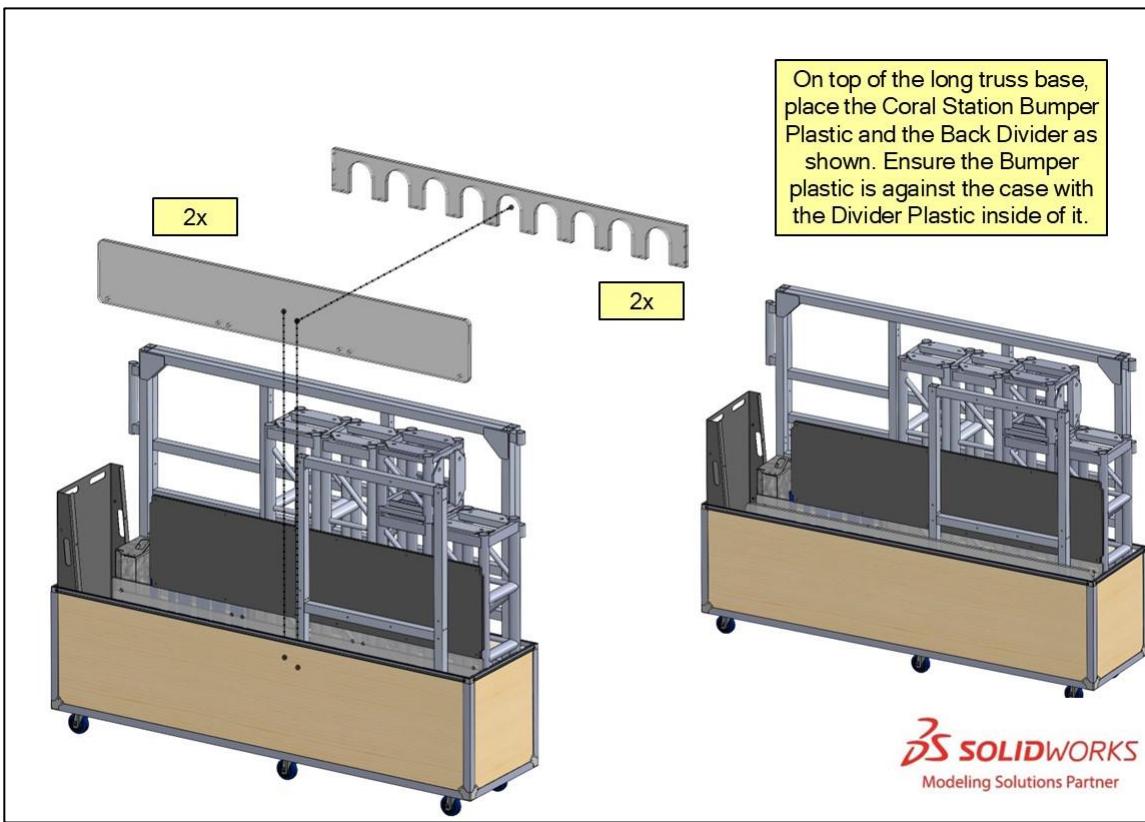
9.



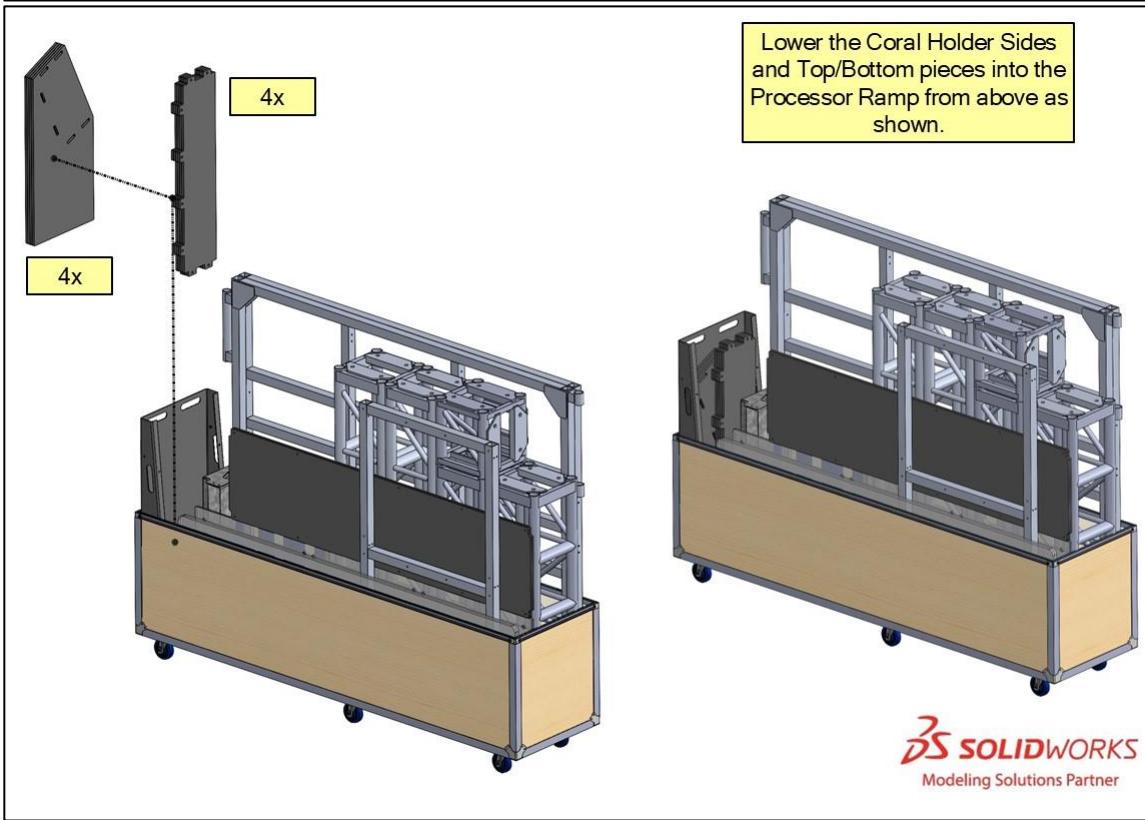
10.



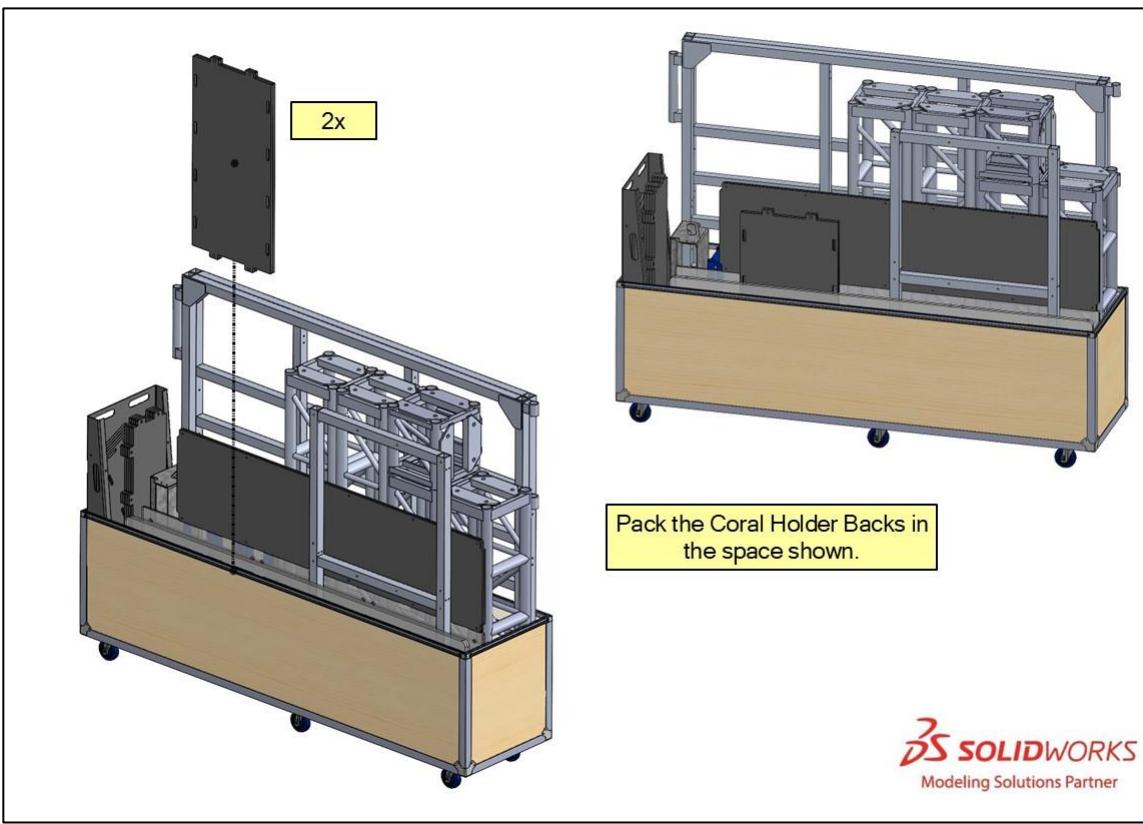
11.



12.

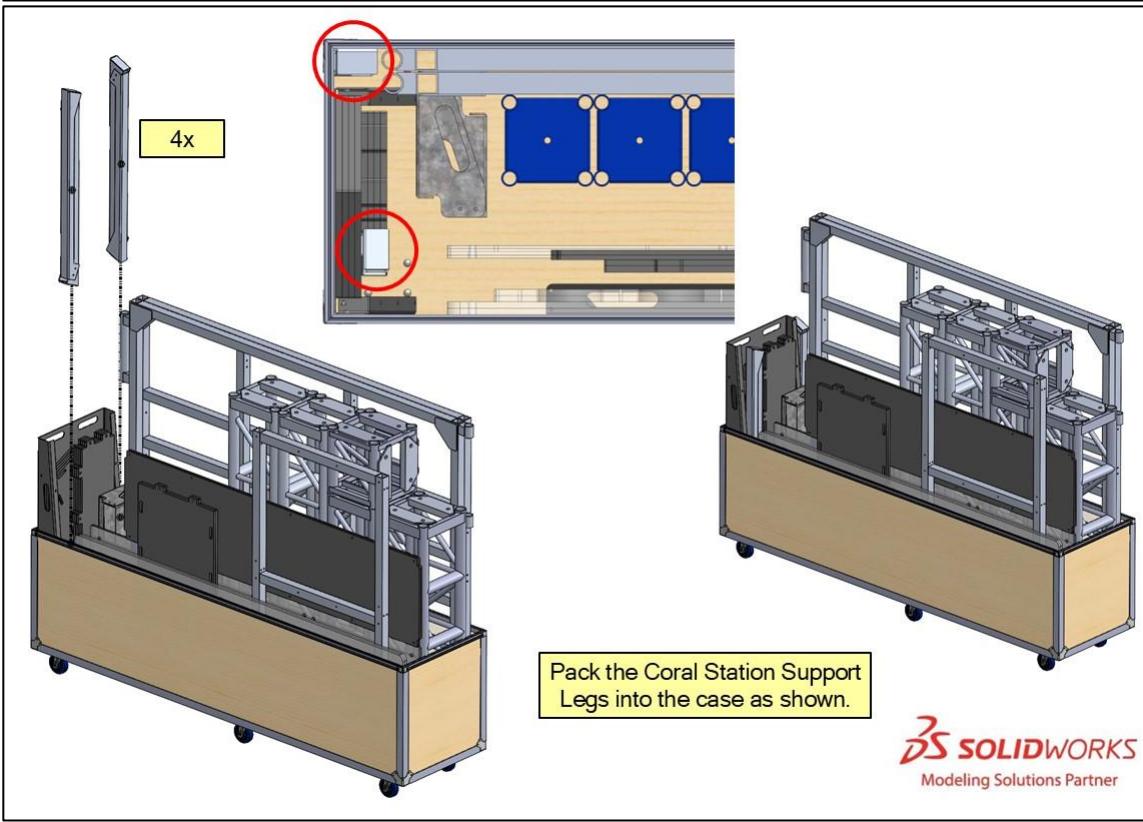


13.



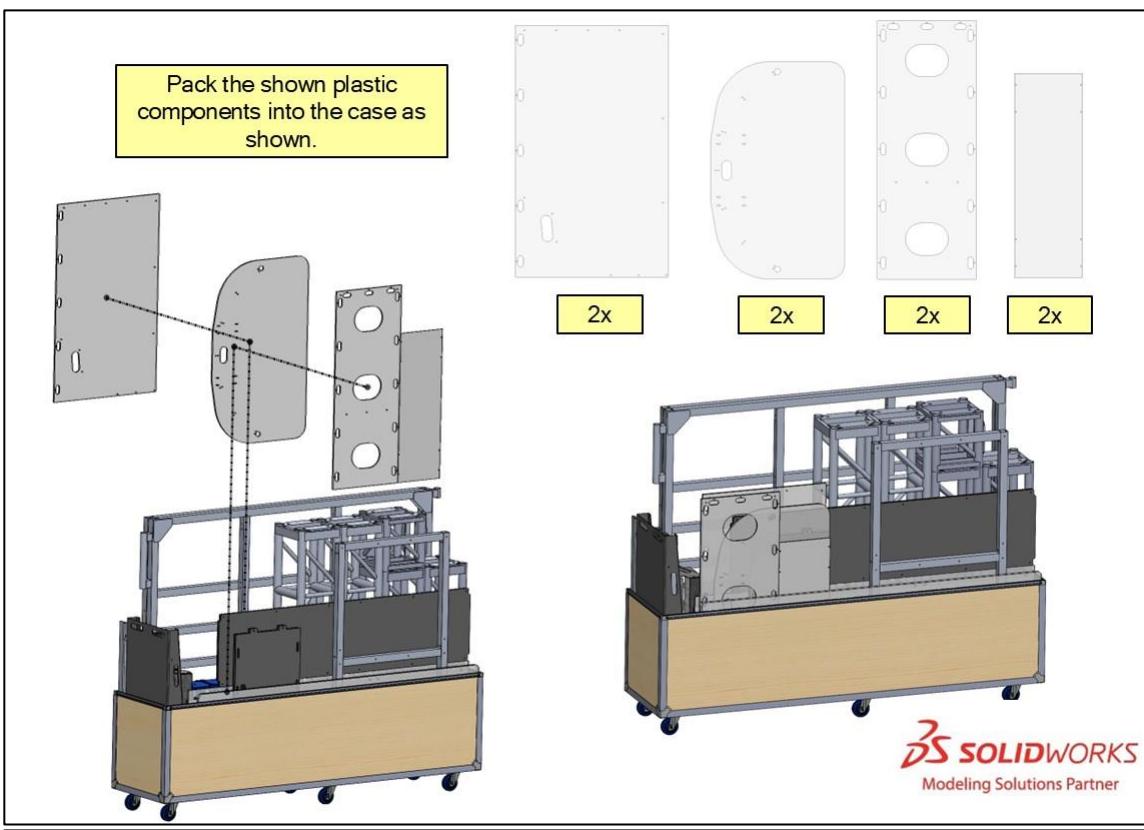
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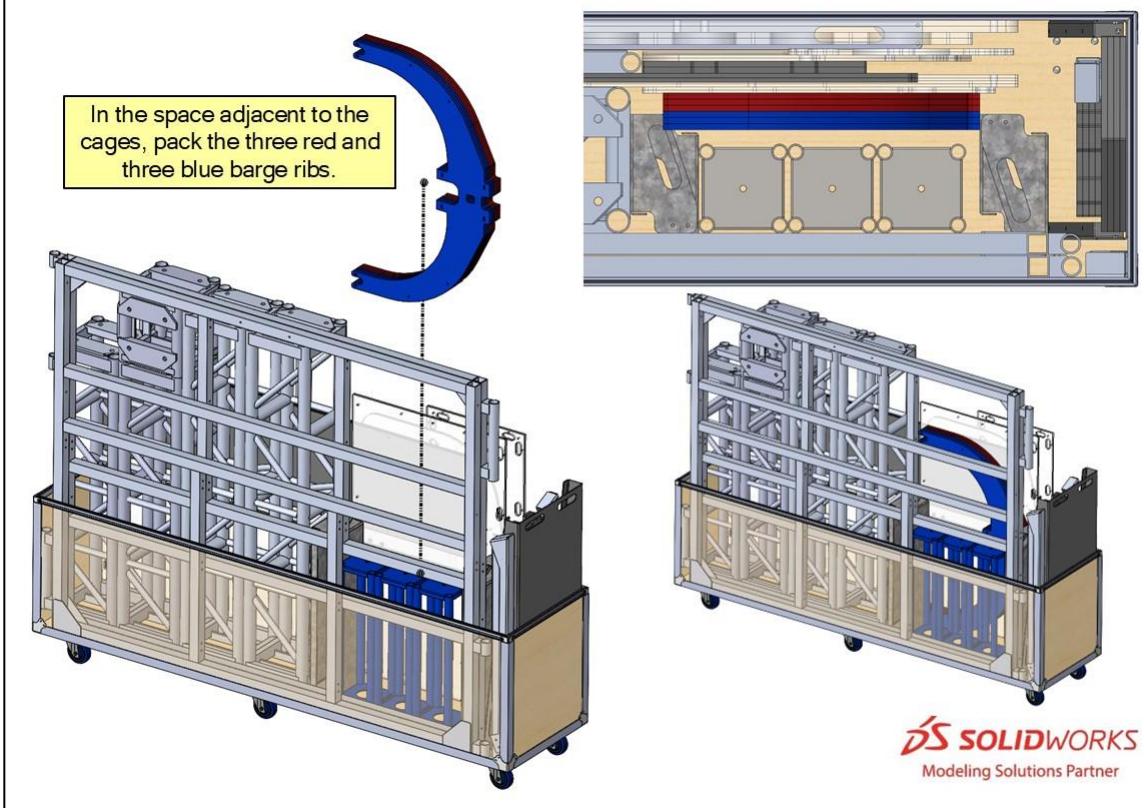


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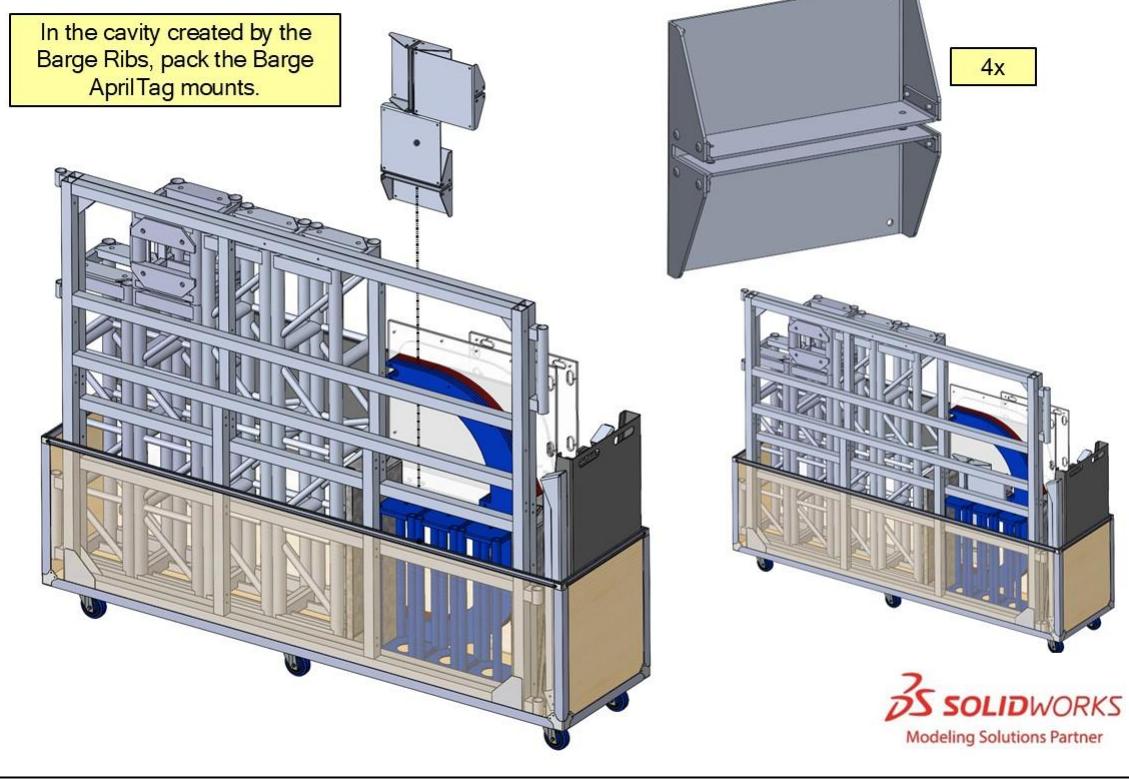
15.



16.

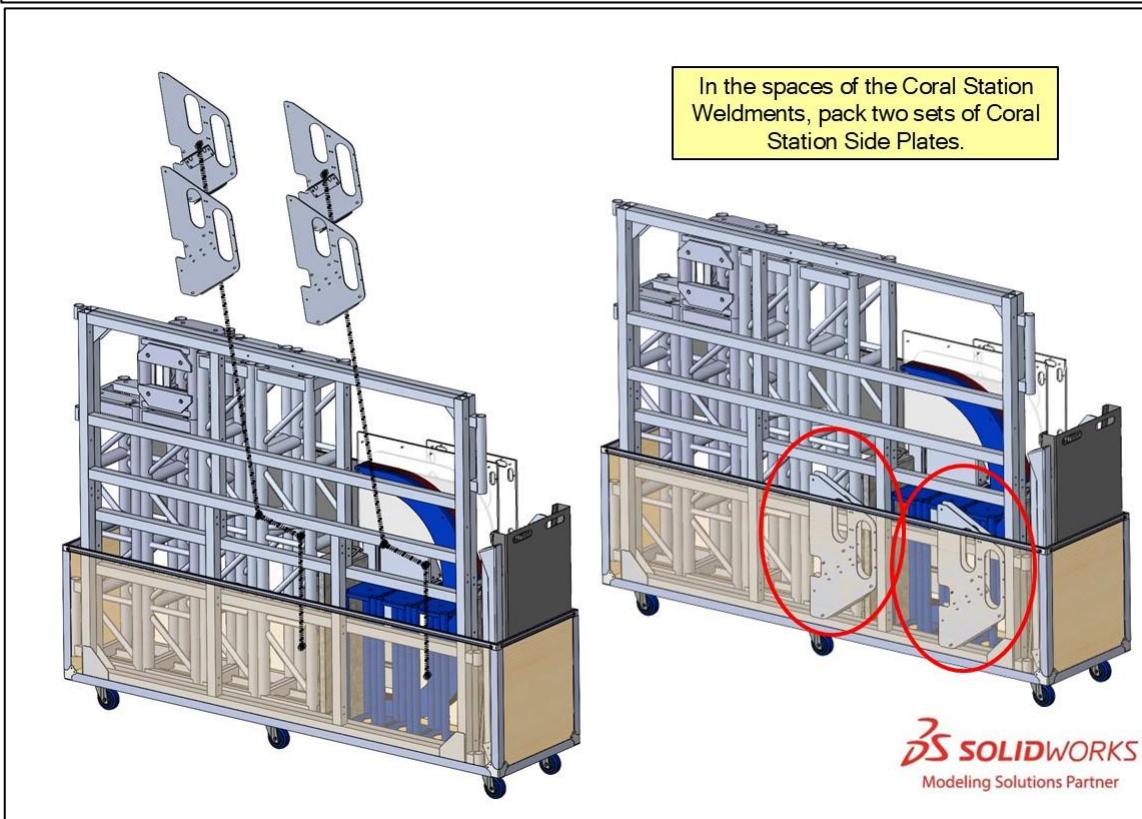


17.



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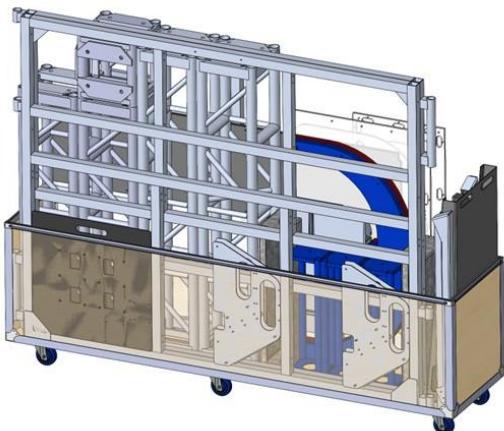
18.



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19.

Stow the smaller truss base in the remaining gap in Coral Station Weldments.

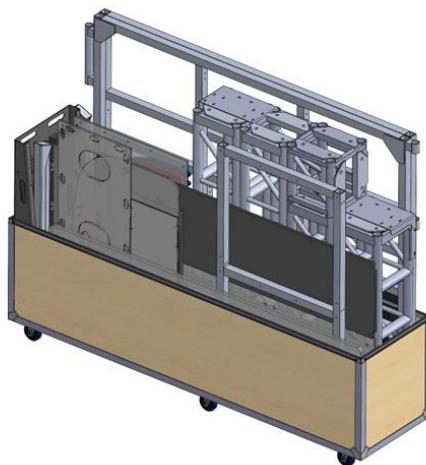
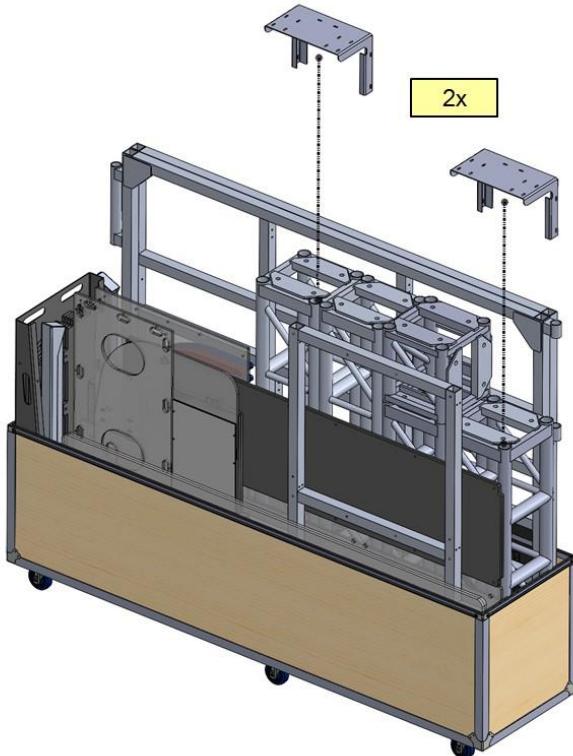


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20.

2x

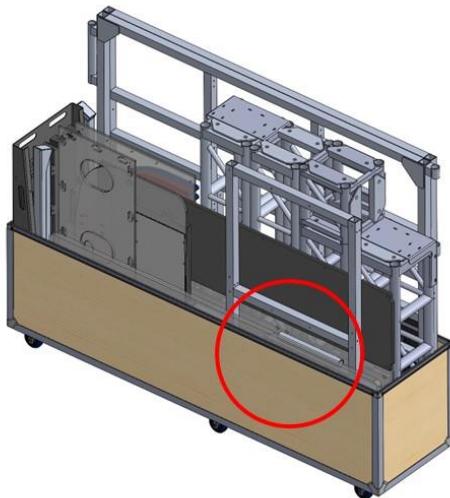
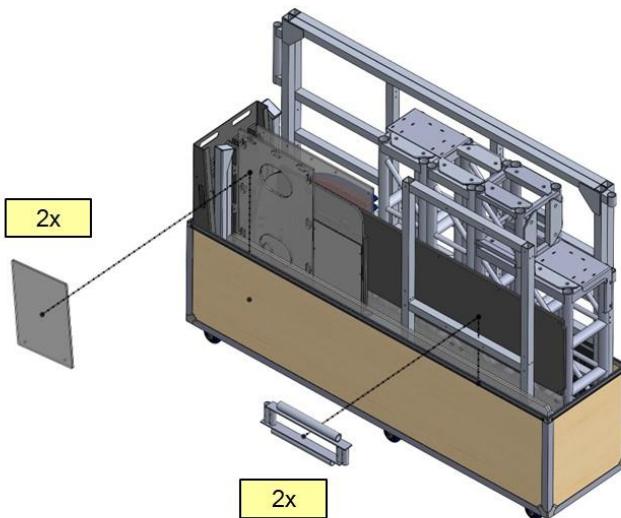
By sliding them onto the tops of truss, pack the Barge End Brace



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21.

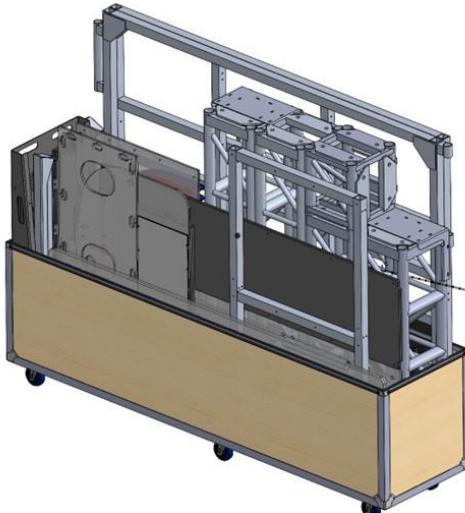
Pack the Processor Weldment Pin Connectors into the space inside the Processor Weldment. If you are packing a field with a Briweld Field Perimeter, also pack the Extra Processor Plastic



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Modeling Solutions Partner

22.

By sliding them into the end of the truss, pack the Barge Net Tube Outer and Net Tube Assemblies.

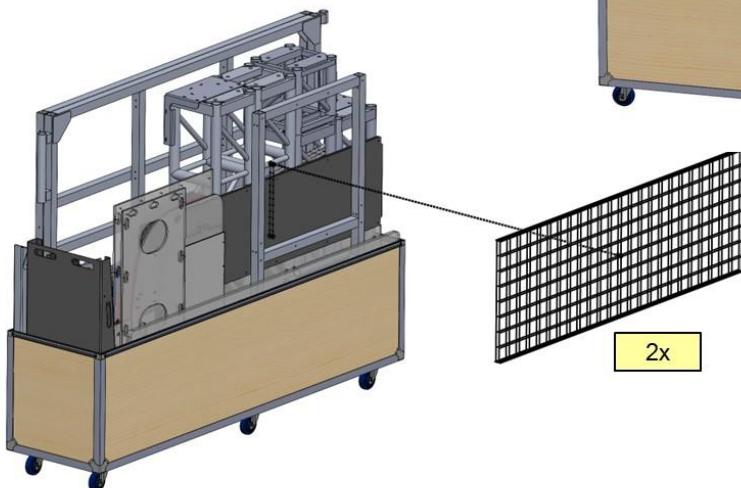


4x Each

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23.

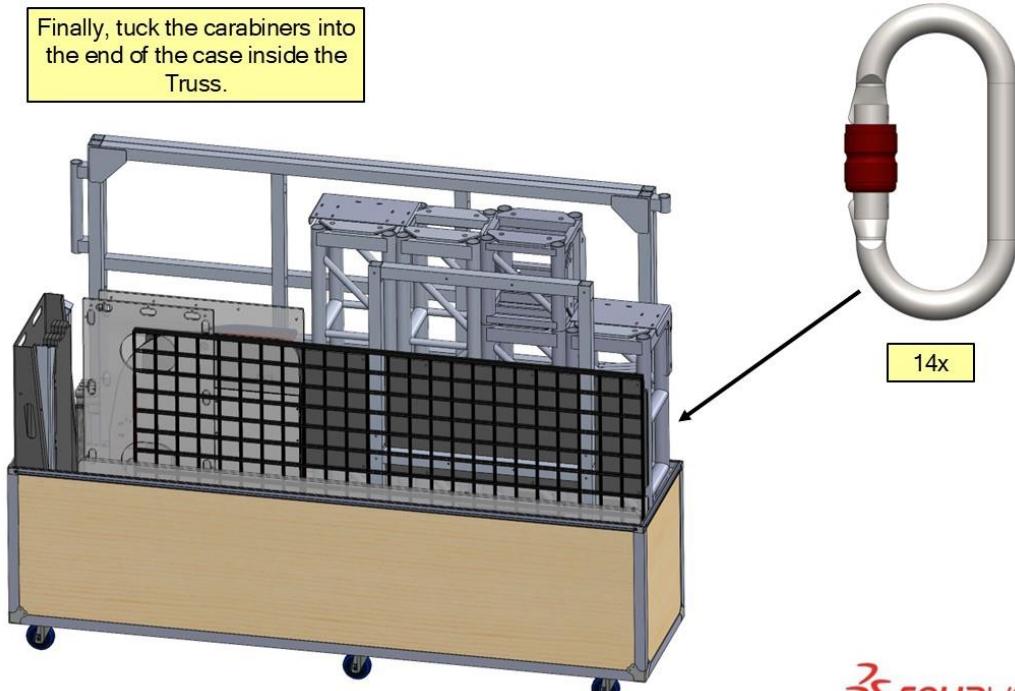
Pack the 2'x6' fence structures in the case as shown. Cable tie to the Processor Weldment for stability.



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24.

Finally, tuck the carabiners into the end of the case inside the Truss.



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### 5.9.3 Case 24



#### 5.9.3.1 Contents

Item Name/Description	Qty
Field Border Frame	2
Ramp Sheetmetal	1
4ft Truss	2
5ft Truss	3
3-way Corners	2
Cage Weldment - Red	3
Processor Weldment	1
Truss Base Long	1
Lower Front Plastic	2
Upper Front Plastic	2
Top Cover Plastic	8
Bumper Plastic	2
Back Divider Plastic	2
Top Diffuser	4
Side Diffuser 1	4
Top Diffuser, Small	2
Game Piece Holder Side	4

<b>Game Piece Holder Top/Bot</b>	4
<b>Side Diffuser 3</b>	4
<b>Frame Supprt Leg</b>	4
<b>Extra Processor Pins</b>	2
<b>Processor Opening</b>	2
<b>Game Piece Holder Back</b>	2
<b>Side Diffuser 2</b>	8
<b>Ramp Back Assembly</b>	2
<b>Outer Front w/Vinyl</b>	2
<b>Corral Side</b>	2
<b>Corral Back</b>	2
<b>Inner Front</b>	2
<b>Sensor Plate</b>	2
<b>Steel Hook Foot</b>	6
<b>Truss Brace</b>	4
<b>Sensor Mount</b>	2
<b>Left Side Assembly</b>	2
<b>Right Side Assembly</b>	2
<b>Cheeseborough</b>	10
<b>Backboard Brace</b>	1
<b>2x5 Gridwall</b>	2
<b>Nets</b>	3
<b>Chain</b>	7

### 5.9.3.3 Packing Steps

1.



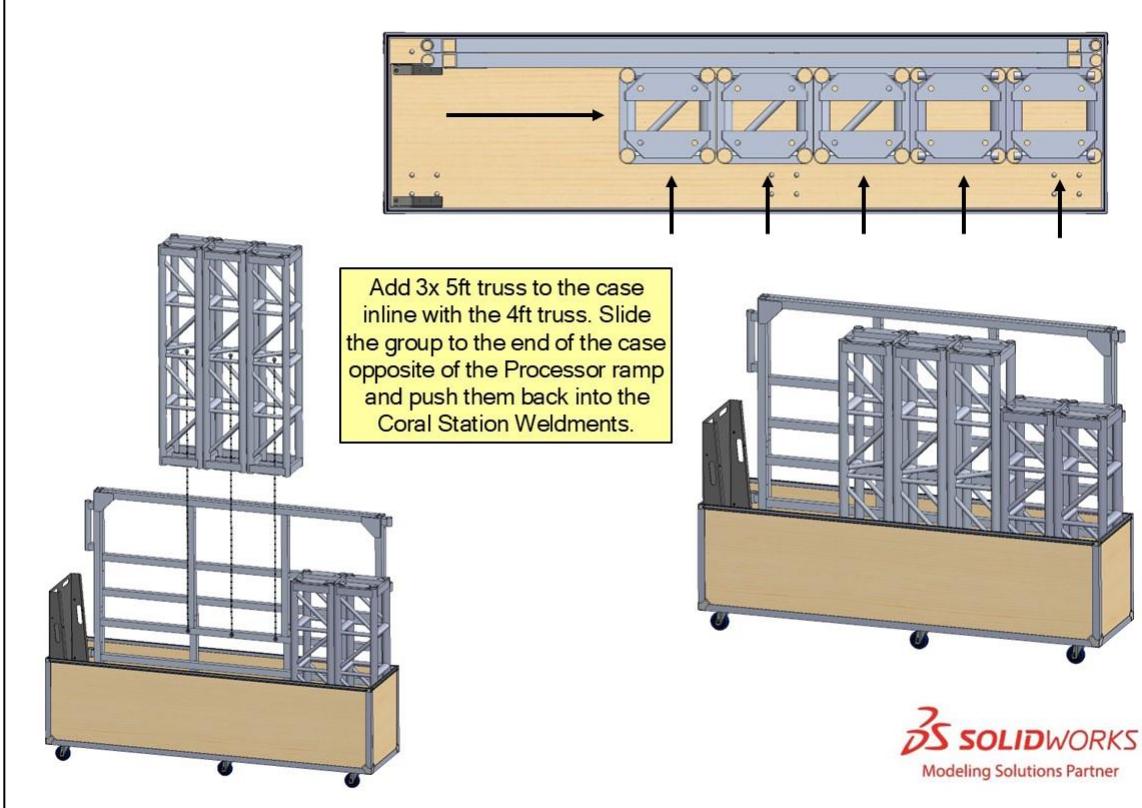
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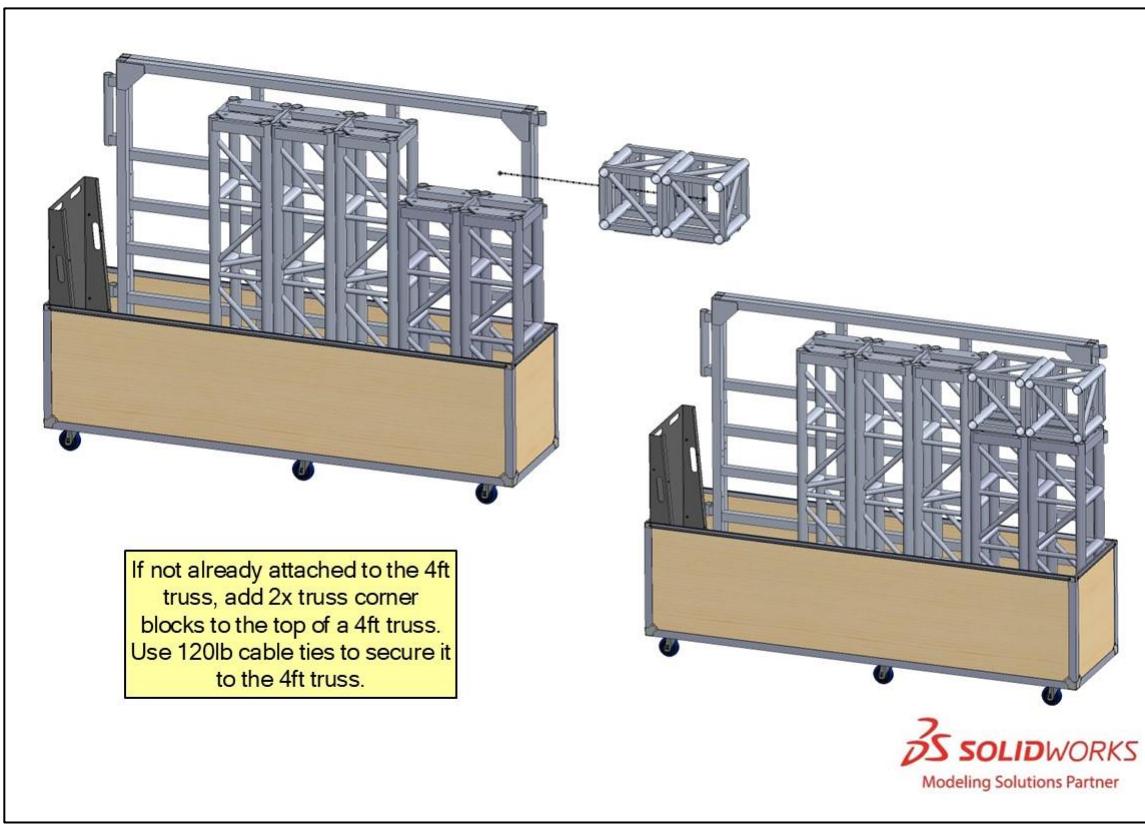
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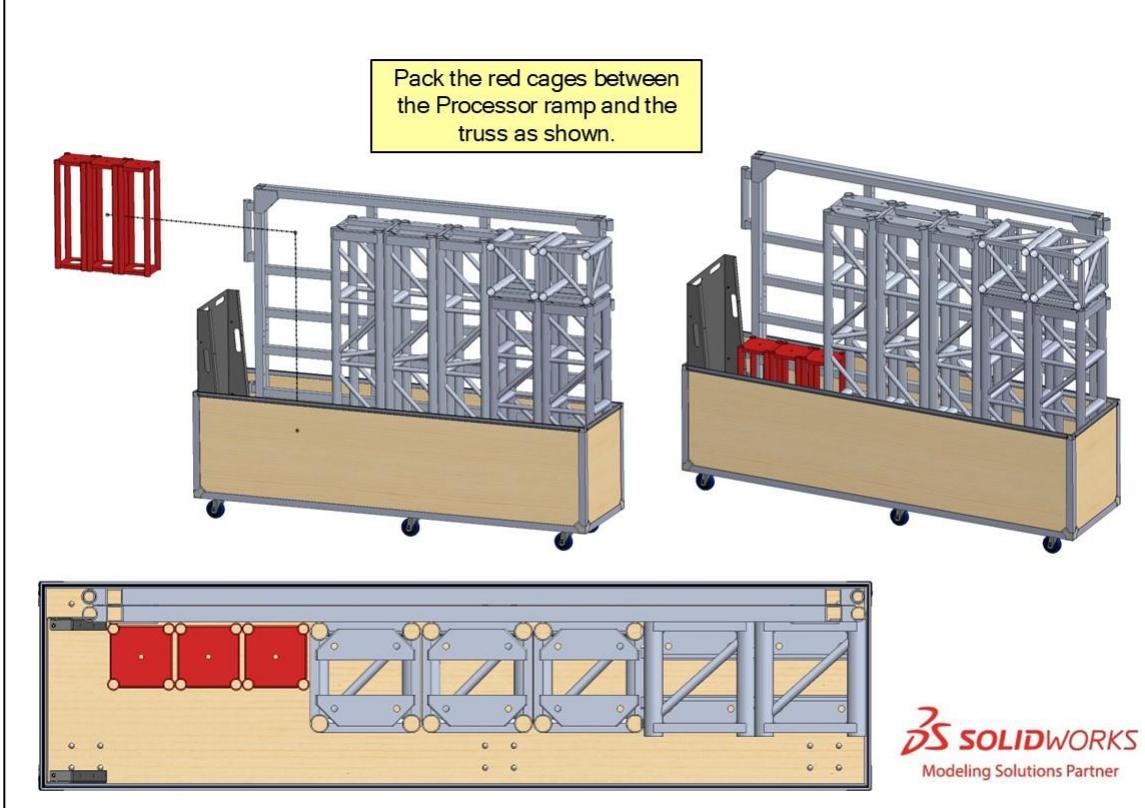
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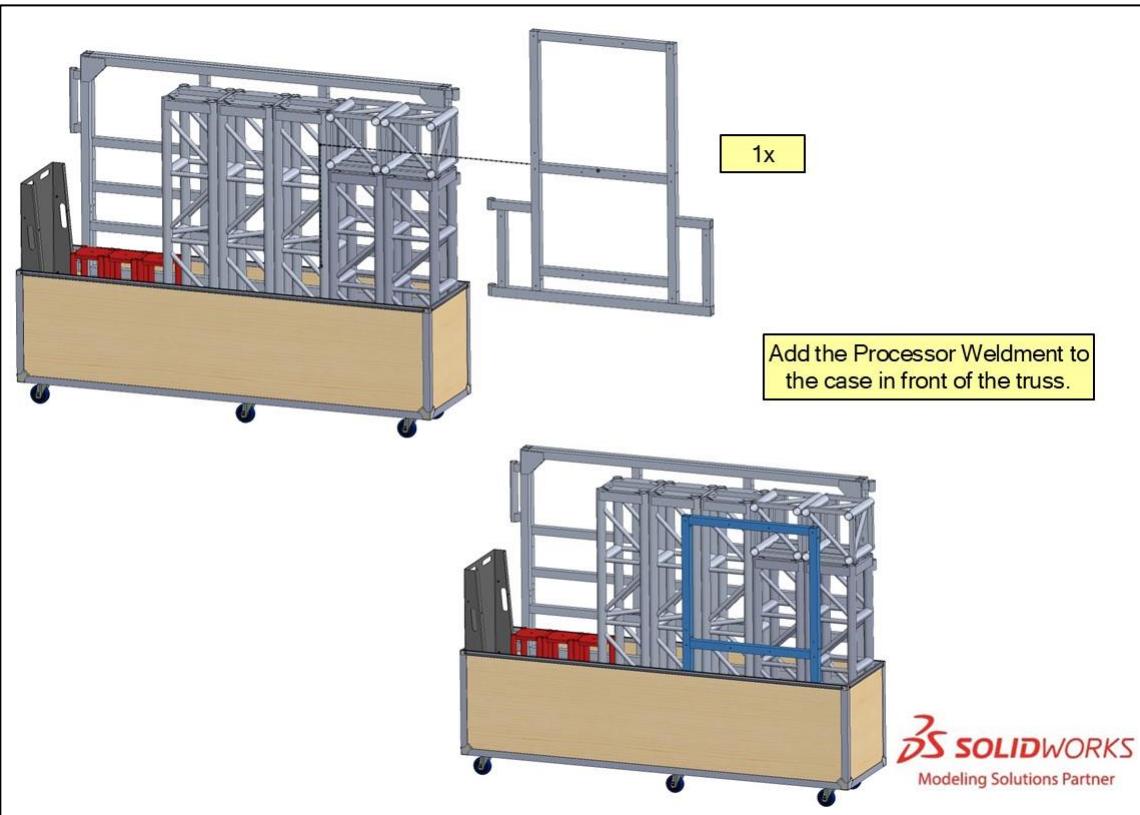
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6.



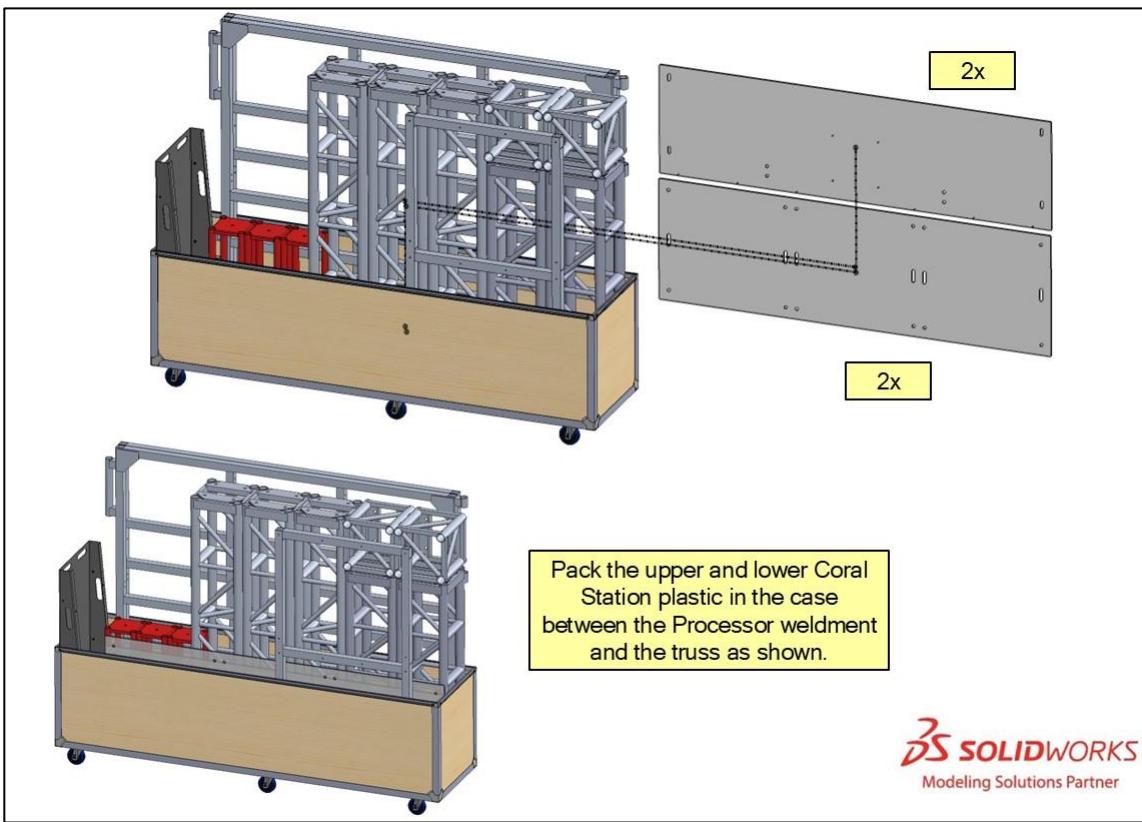
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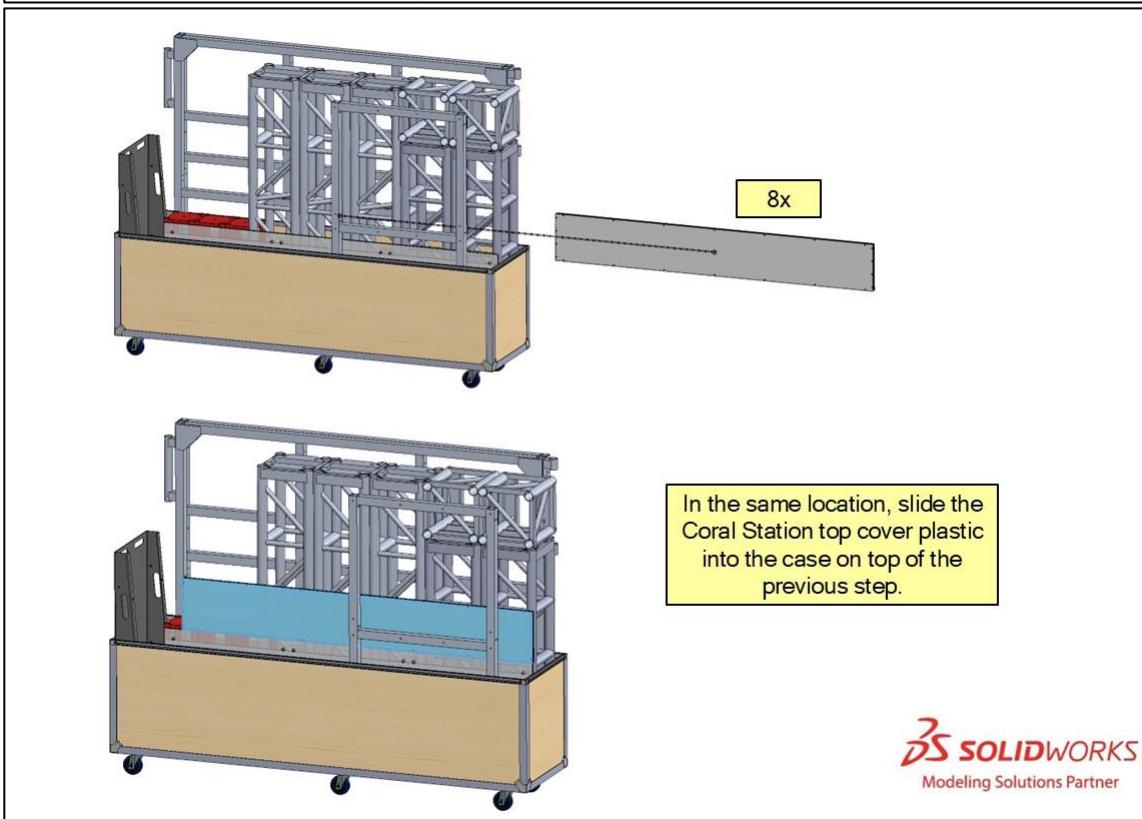
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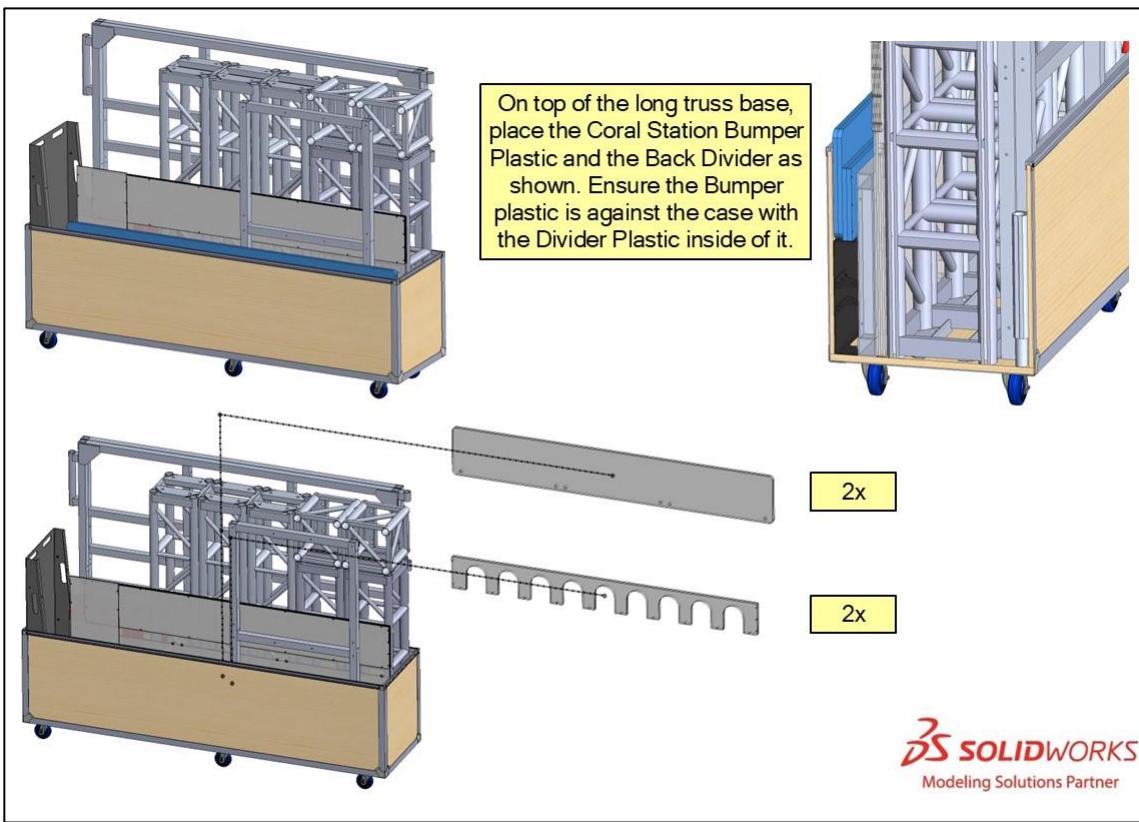
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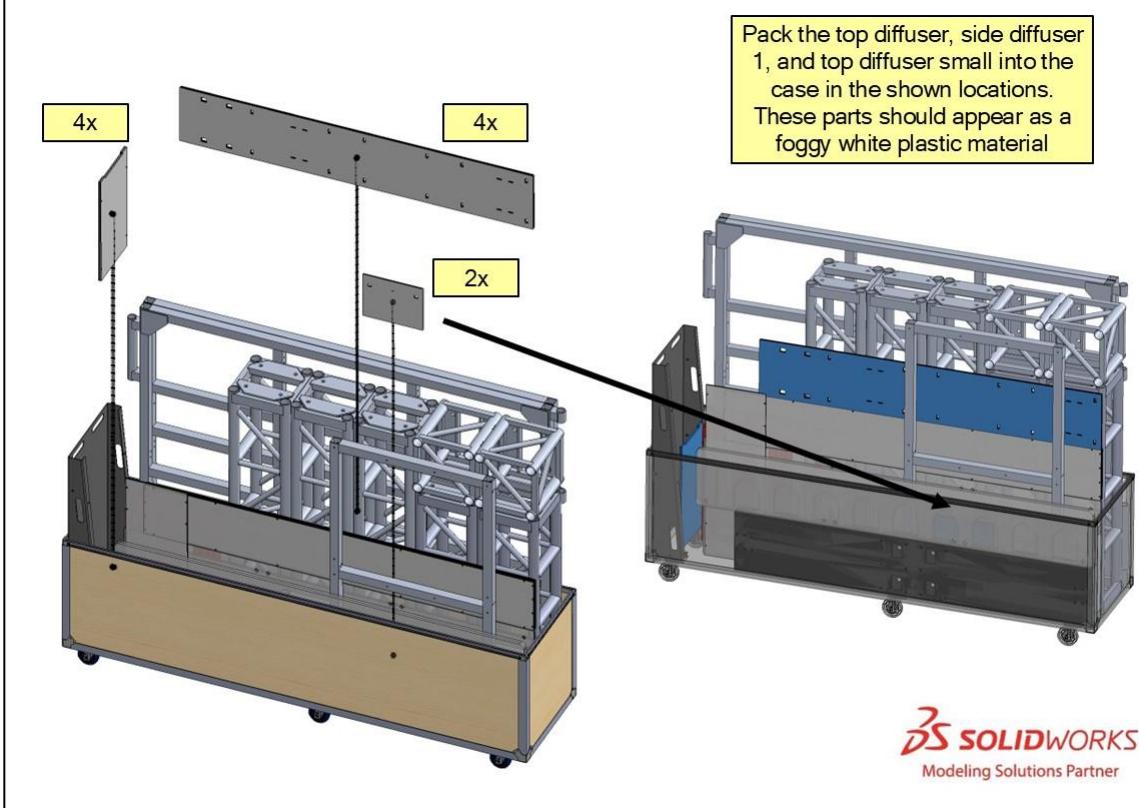
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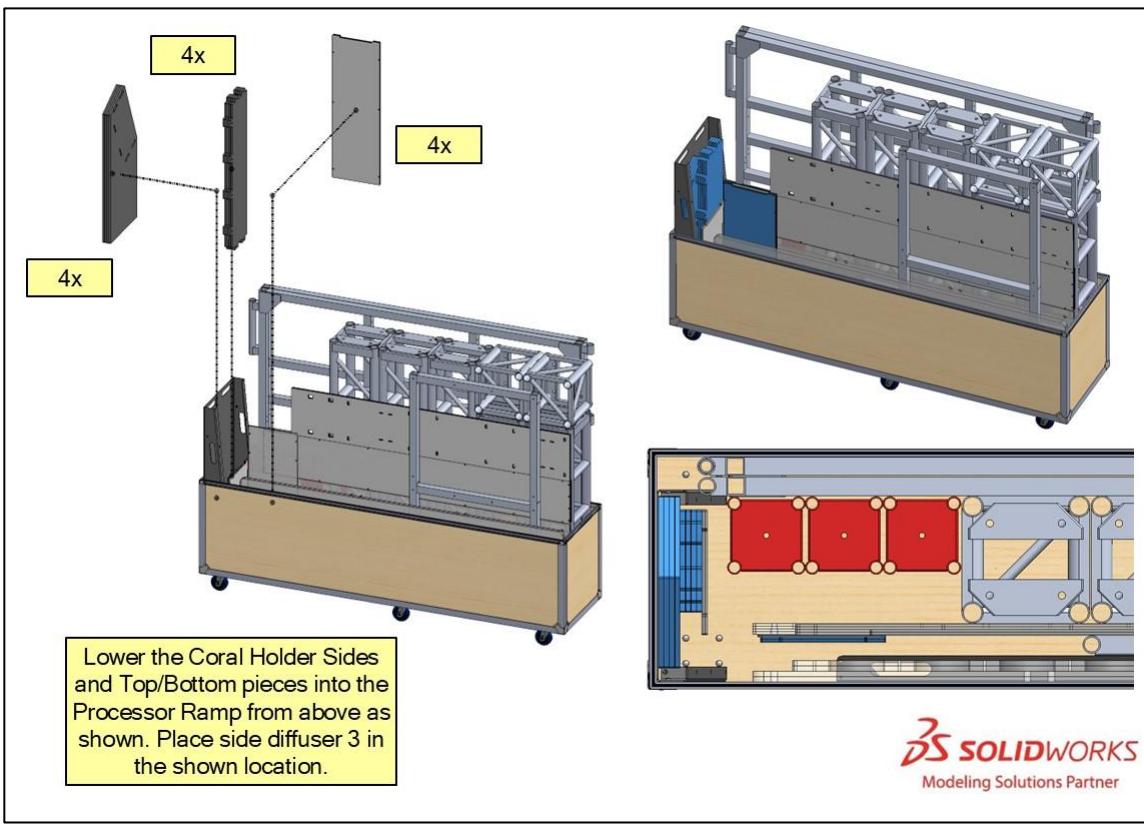
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12.

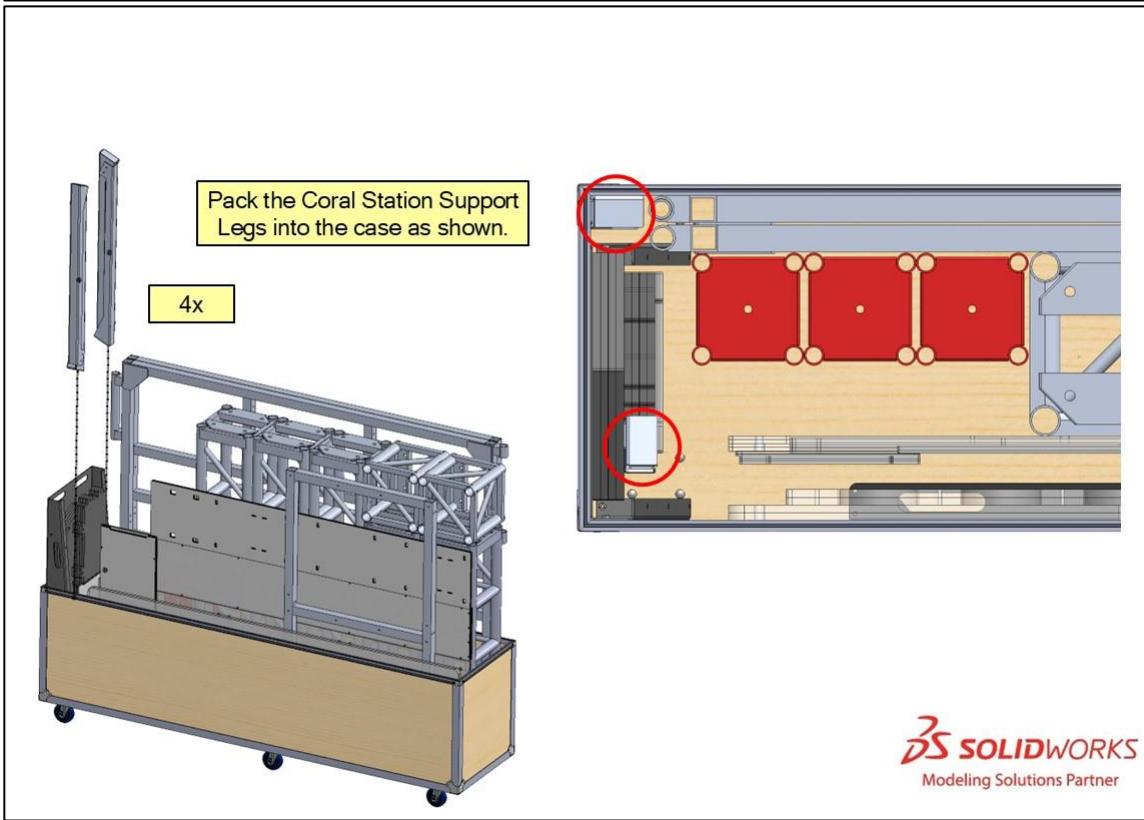


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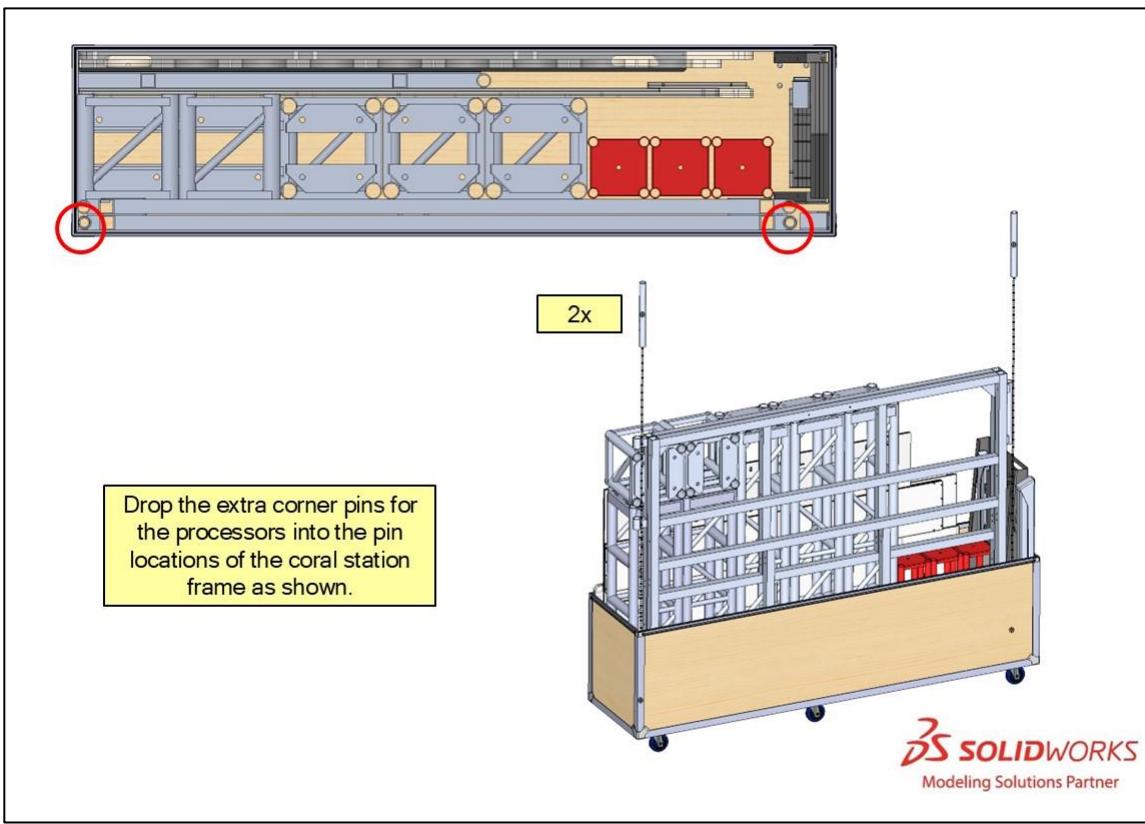
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Modeling Solutions Partner

14.

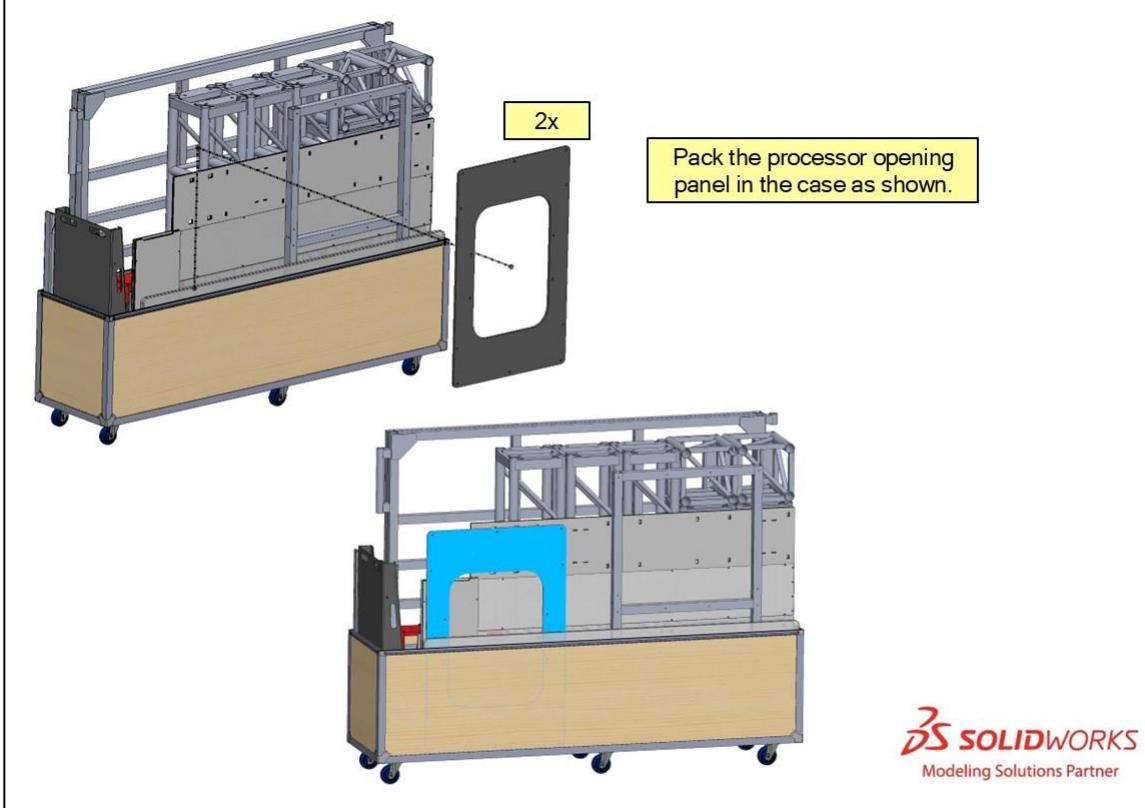


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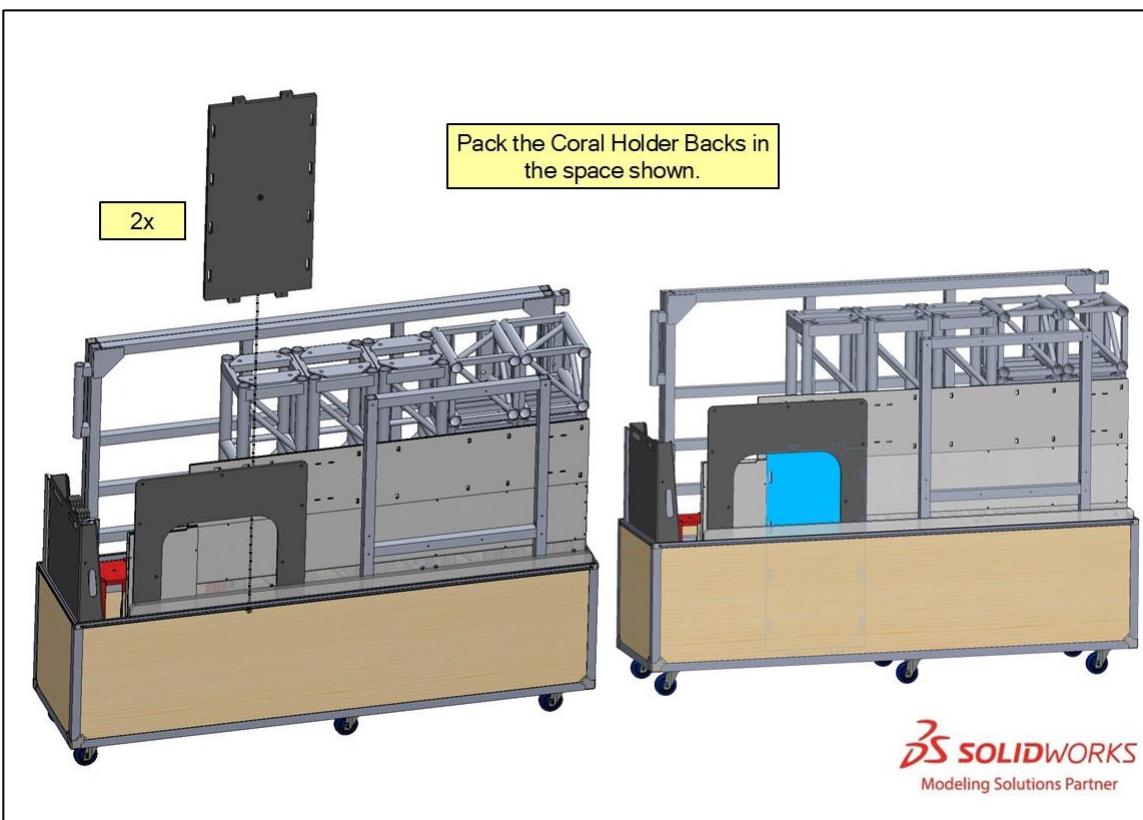
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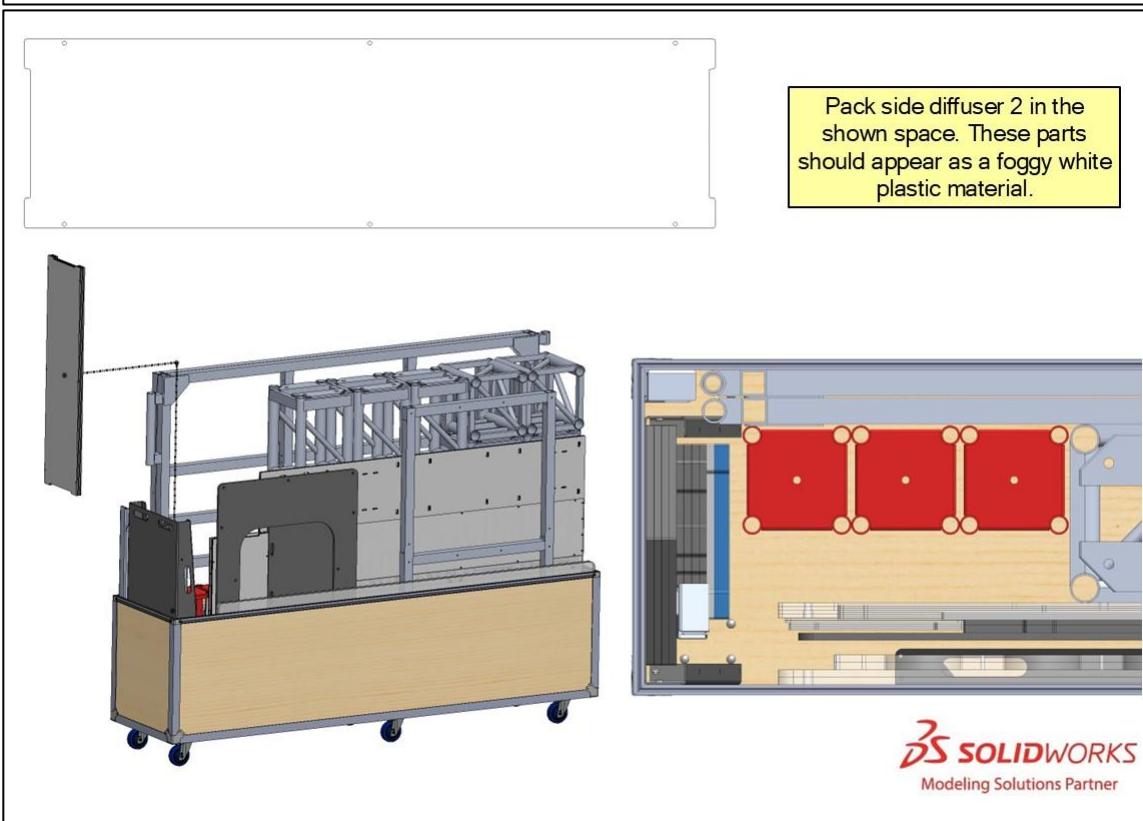
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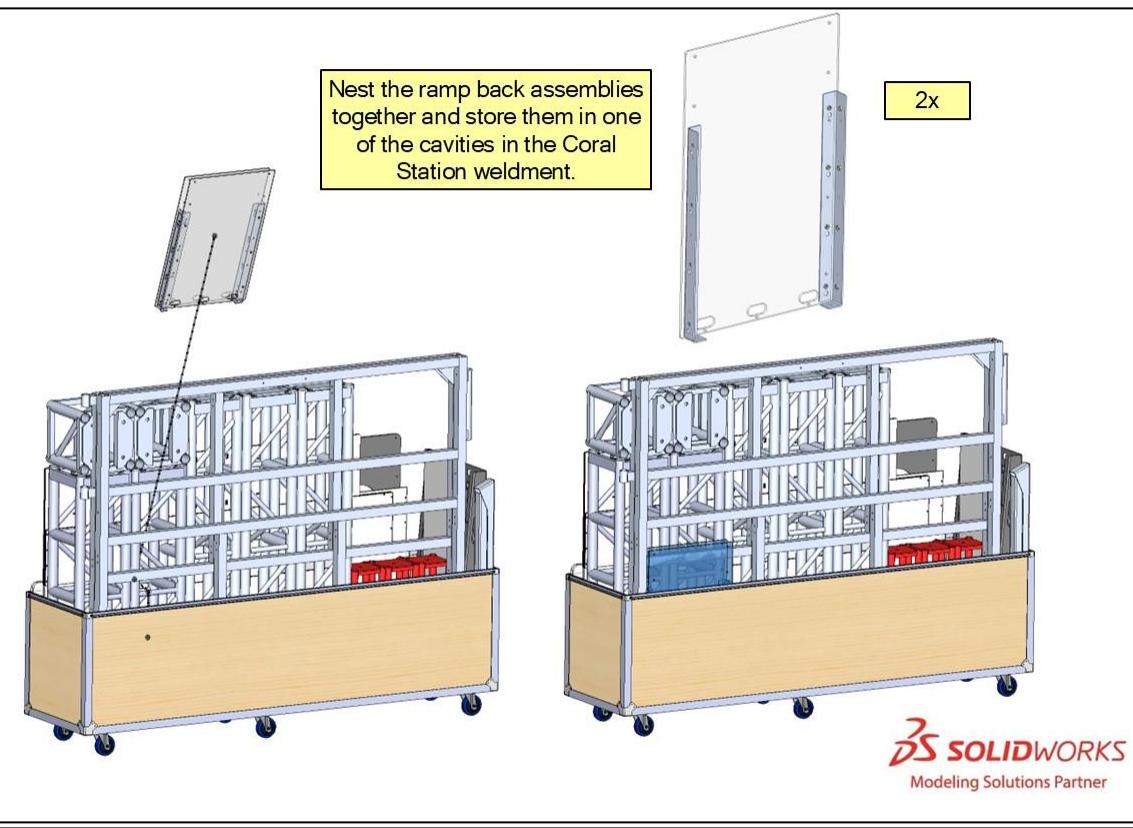
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18.

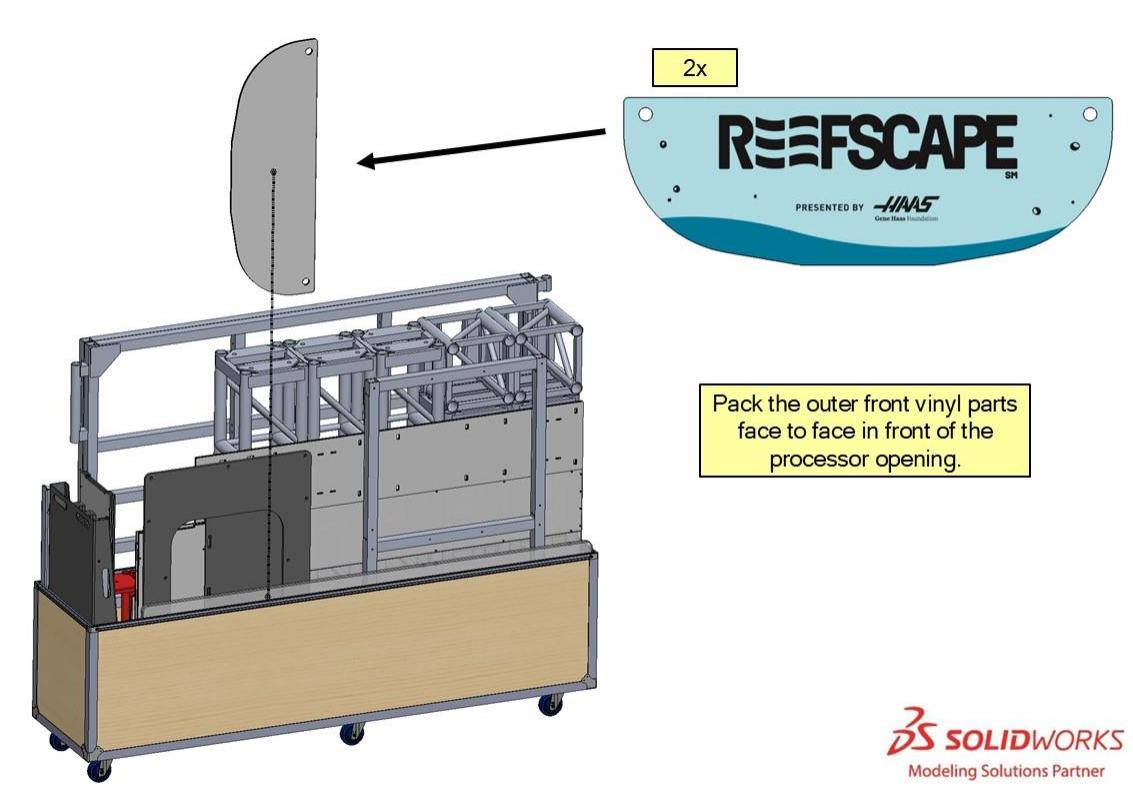


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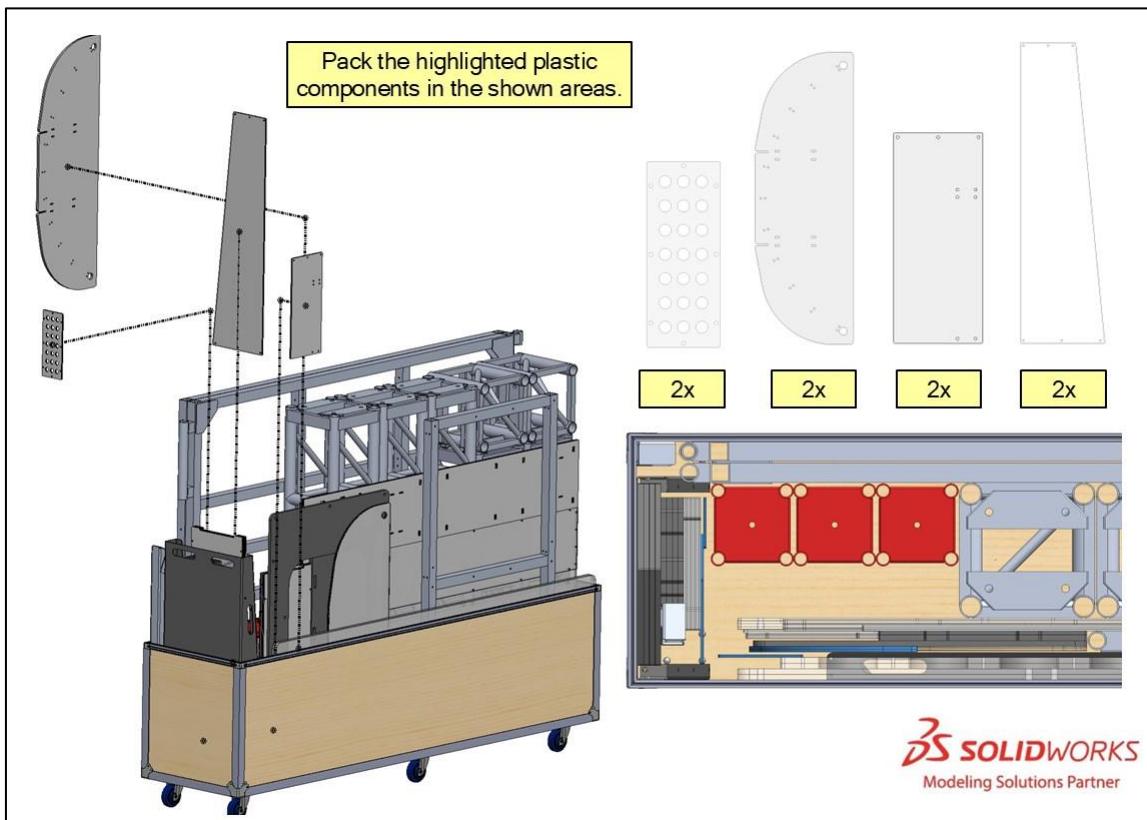
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Modeling Solutions Partner

20.

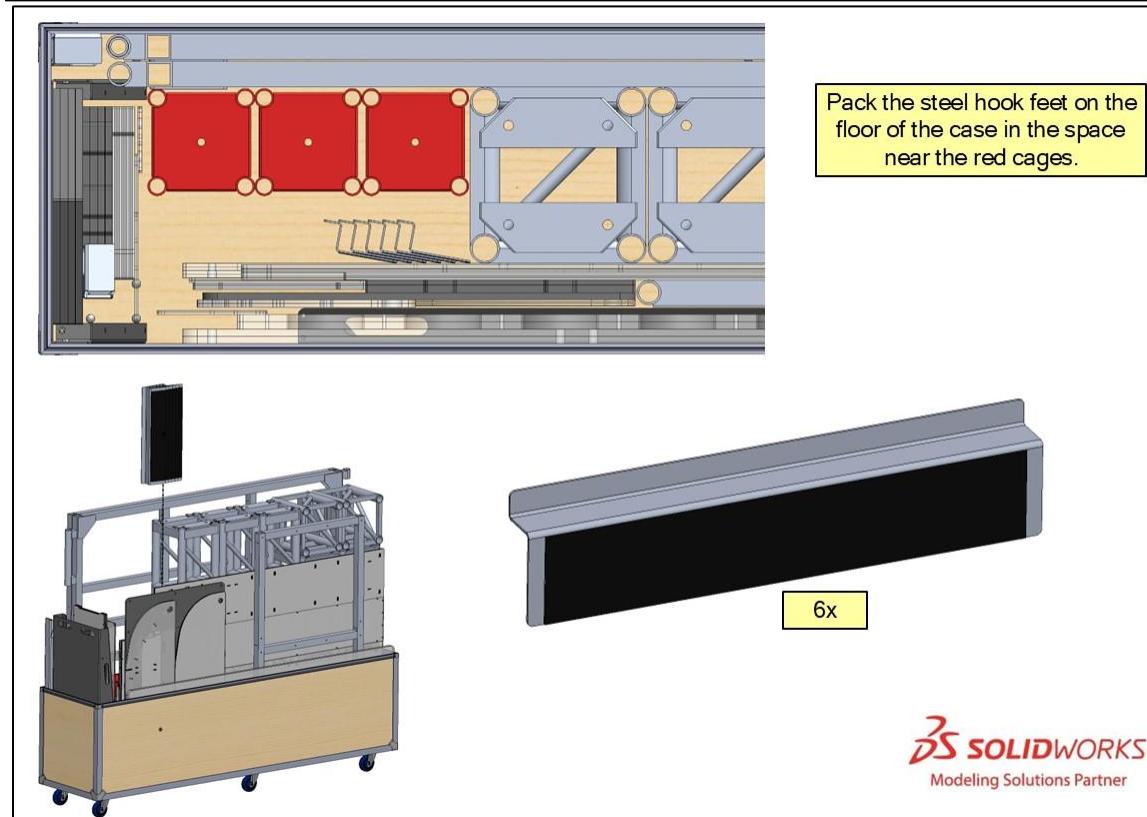


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Modeling Solutions Partner

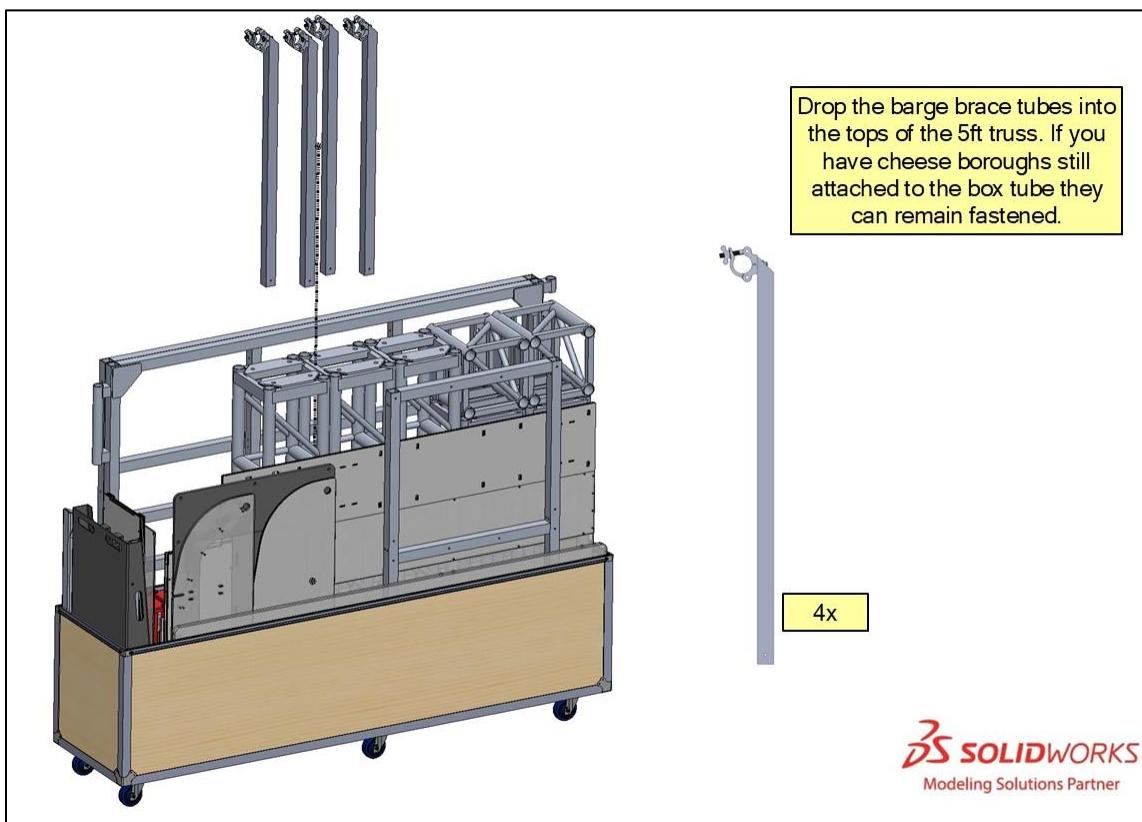
21.



22.

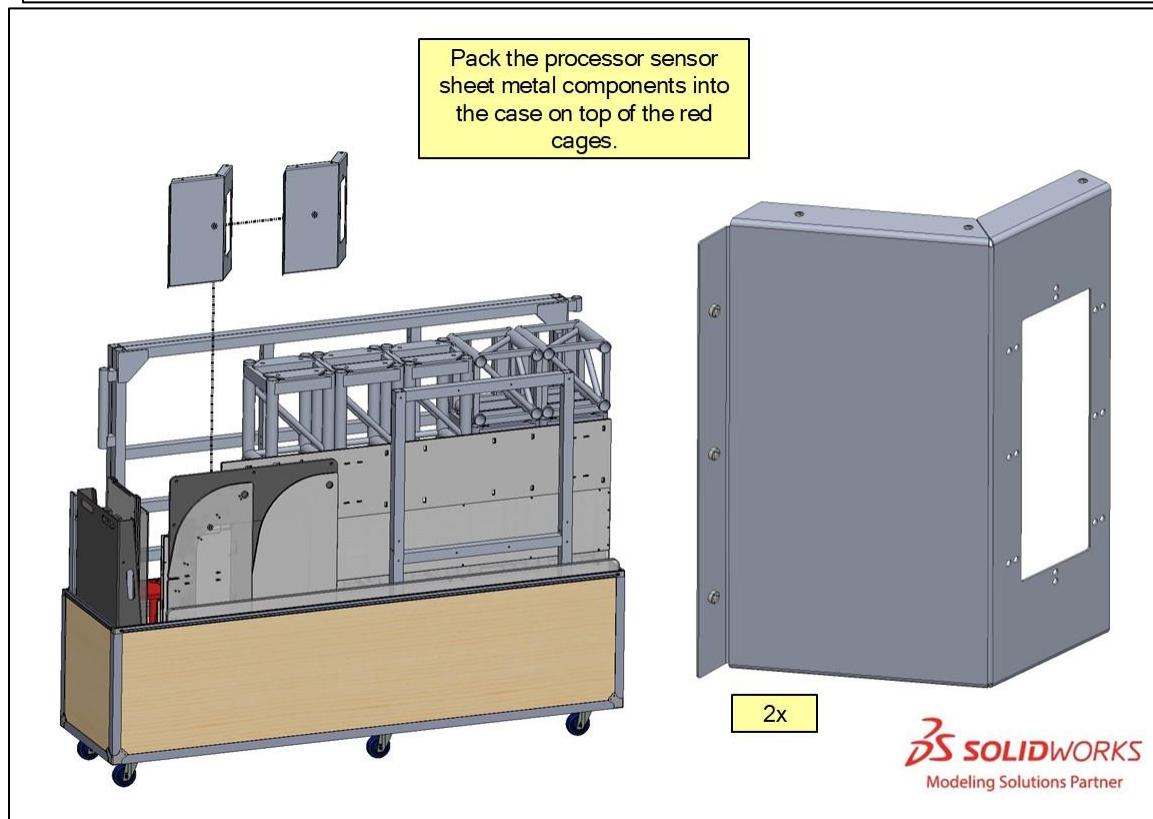


23.



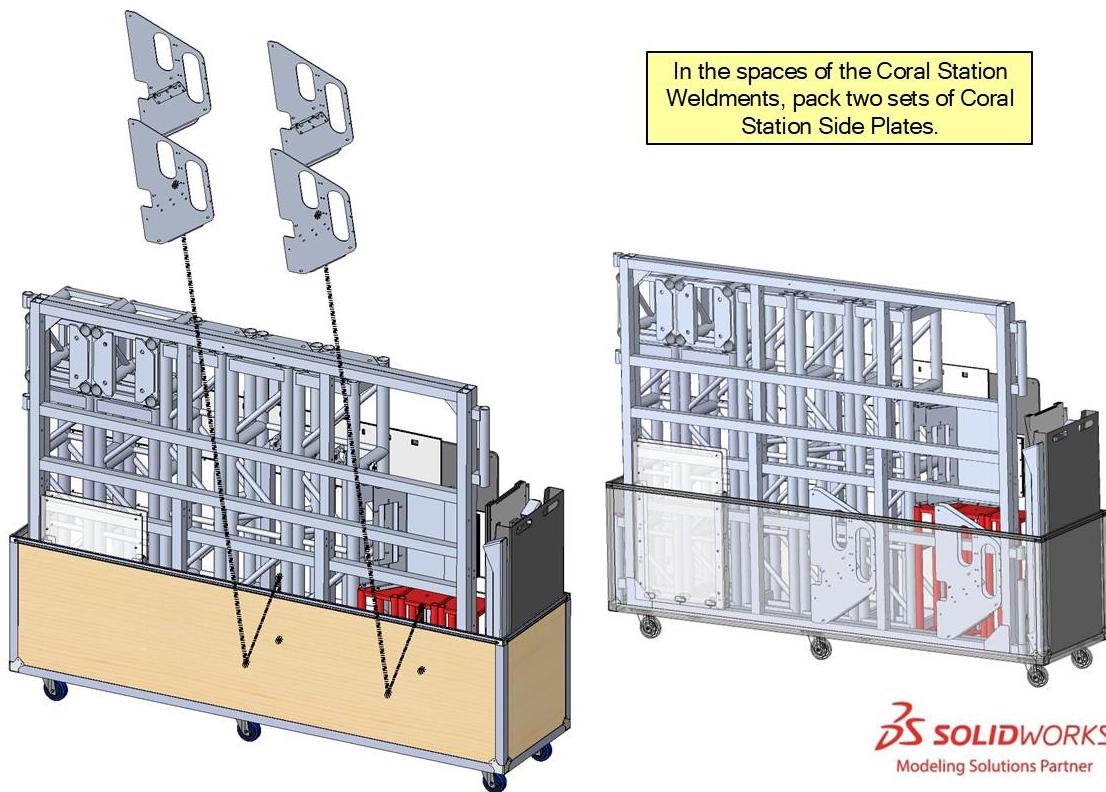
**SOLIDWORKS**  
Modeling Solutions Partner

24.



**SOLIDWORKS**  
Modeling Solutions Partner

25.



**SOLIDWORKS**  
Modeling Solutions Partner

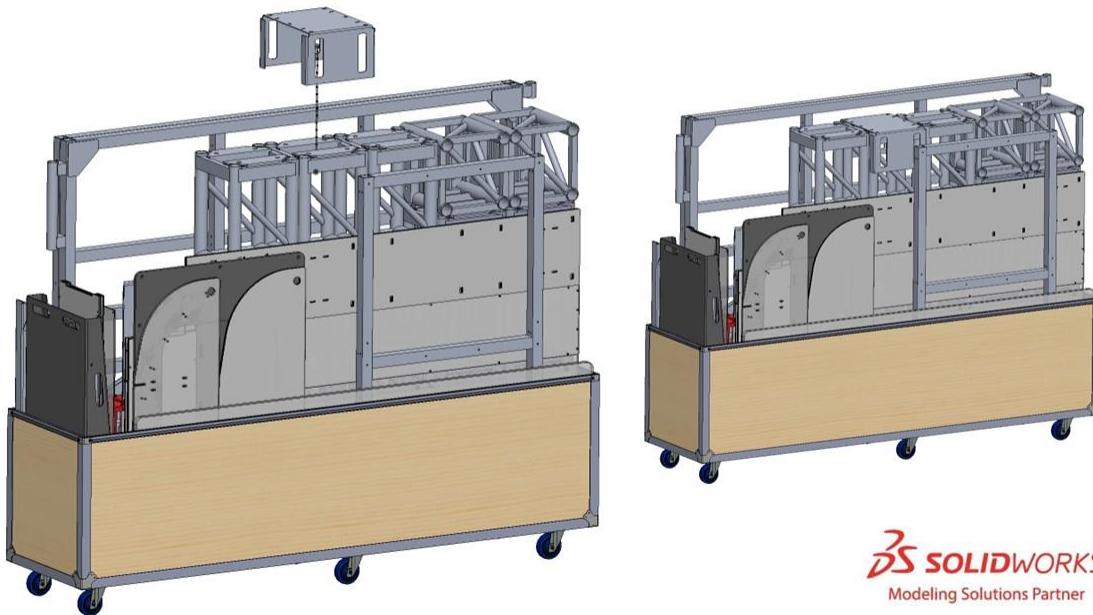
26.



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Modeling Solutions Partner

27.

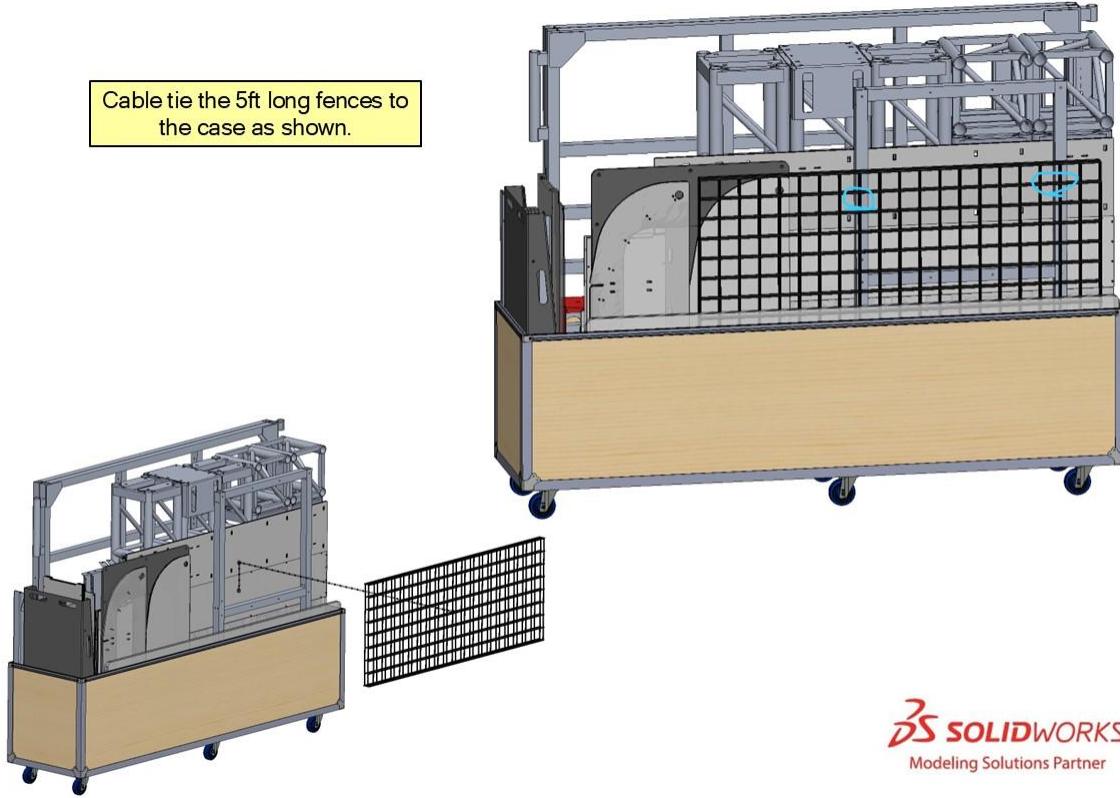
Cap a 5ft truss with the backboard brace sheet metal component as shown.



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Modeling Solutions Partner

28.

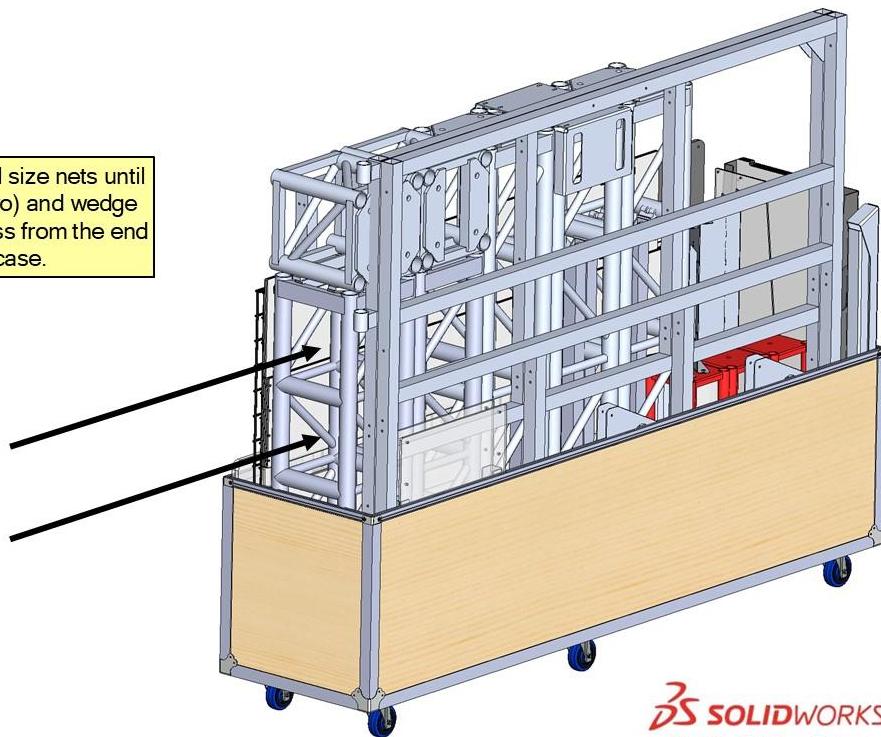
Cable tie the 5ft long fences to the case as shown.



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Modeling Solutions Partner

29.

Roll the three full size nets until a cylinder (or two) and wedge them into the truss from the end of the case.

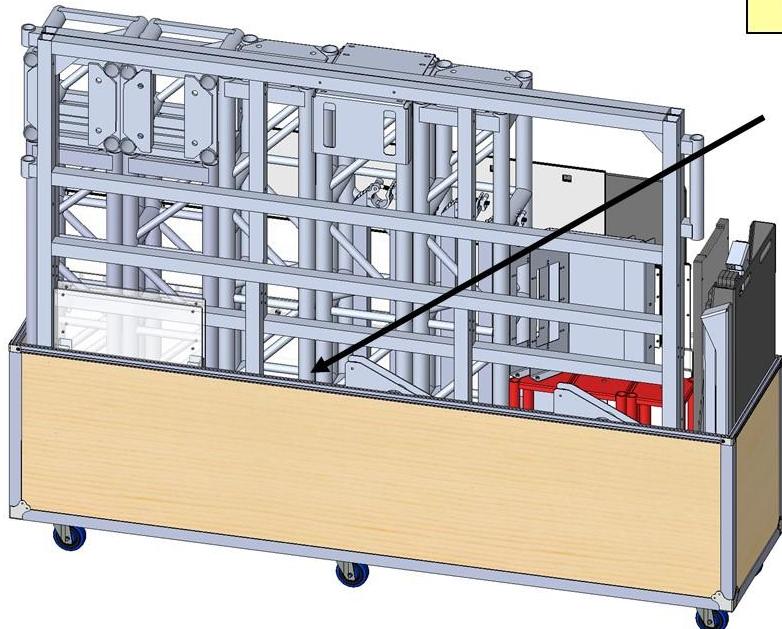


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30.

Finally, pack the chains into the case in the openings of the Coral Station Weldment

7x



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### 5.9.4 Case 31



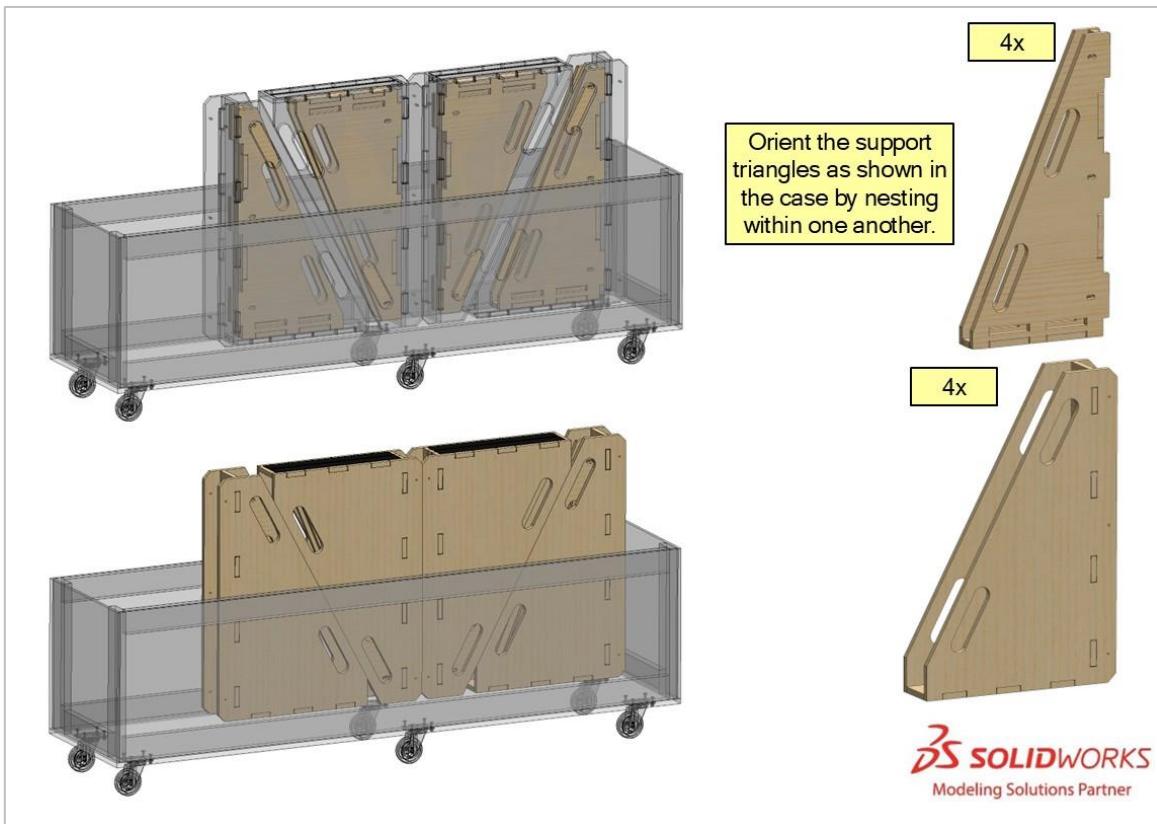
#### 5.9.4.1 Contents

Item Name/Description	Qty
PF Barge Brace Assembly	4
Support Triangle Assembly	4
Chute Ramp Assembly	4
Chute Cover Assembly	4
Bumper Plastic	1
Fieldside Assembly	2
Fence Frame	2
PF Coral Station Front Panel	1
PF Processor Front Panel	1
PF Coral Station Back Panel	1
PF Coral Station Hand Stopper	2
PF Coral Station Ramp	1
PF Processor Brace	2
PF Barge Large Endcap	1
PF Barge Small Endcap	1
PF Coral Station Side Panel	2
PF Bumper	2
PF Barge Beam Assembly	1

<b>PF Barge Upright Assembly</b>	2
<b>PF Barge AprilTag Bracket LH</b>	1
<b>PF Barge AprilTag Bracket RH</b>	1
<b>Cage Weldment, Black</b>	1
<b>Air Pump 1</b>	1
<b>Truss Hardware Kit</b>	1
<b>Hardware Kits</b>	2
<b>PF Barge Net Pipe</b>	2
<b>PF Barge Net</b>	1
<b>New Ball Jig Sheetmetal</b>	2
<b>New Ball Jig HDPE</b>	1

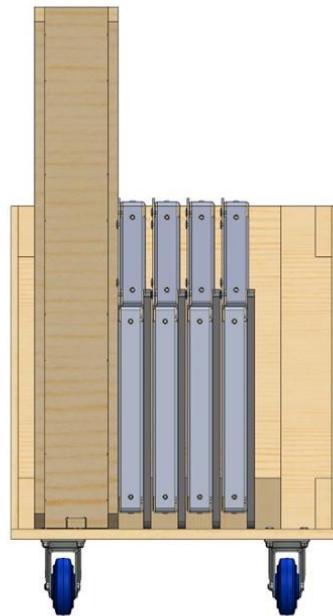
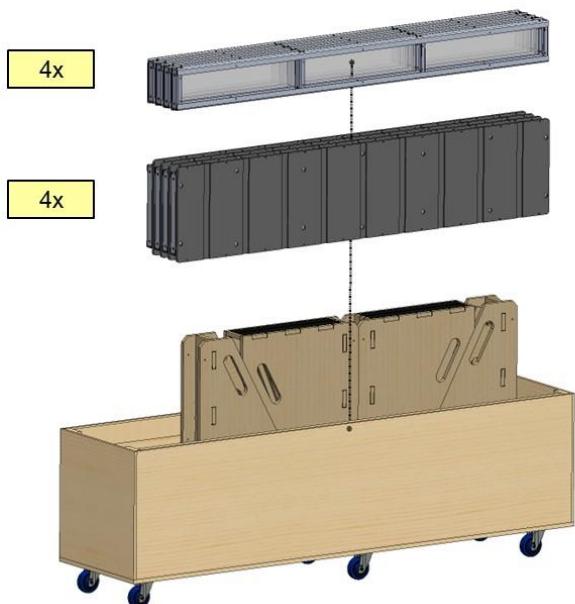
#### 5.9.4.2 Packing Steps

1.



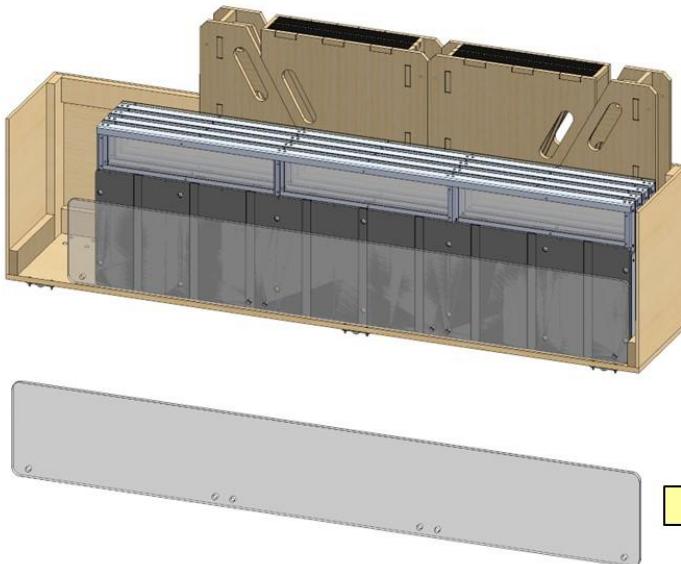
2.

Pack the Coral Station ramps and covers in the case as shown. Stack the covers on top of the ramps.

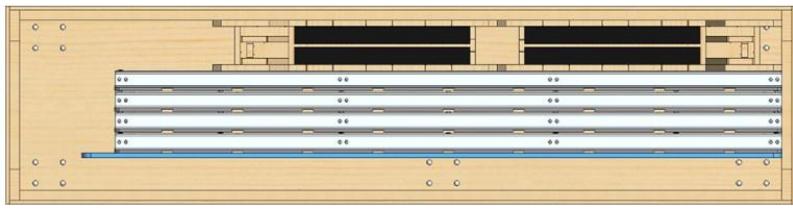


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3.

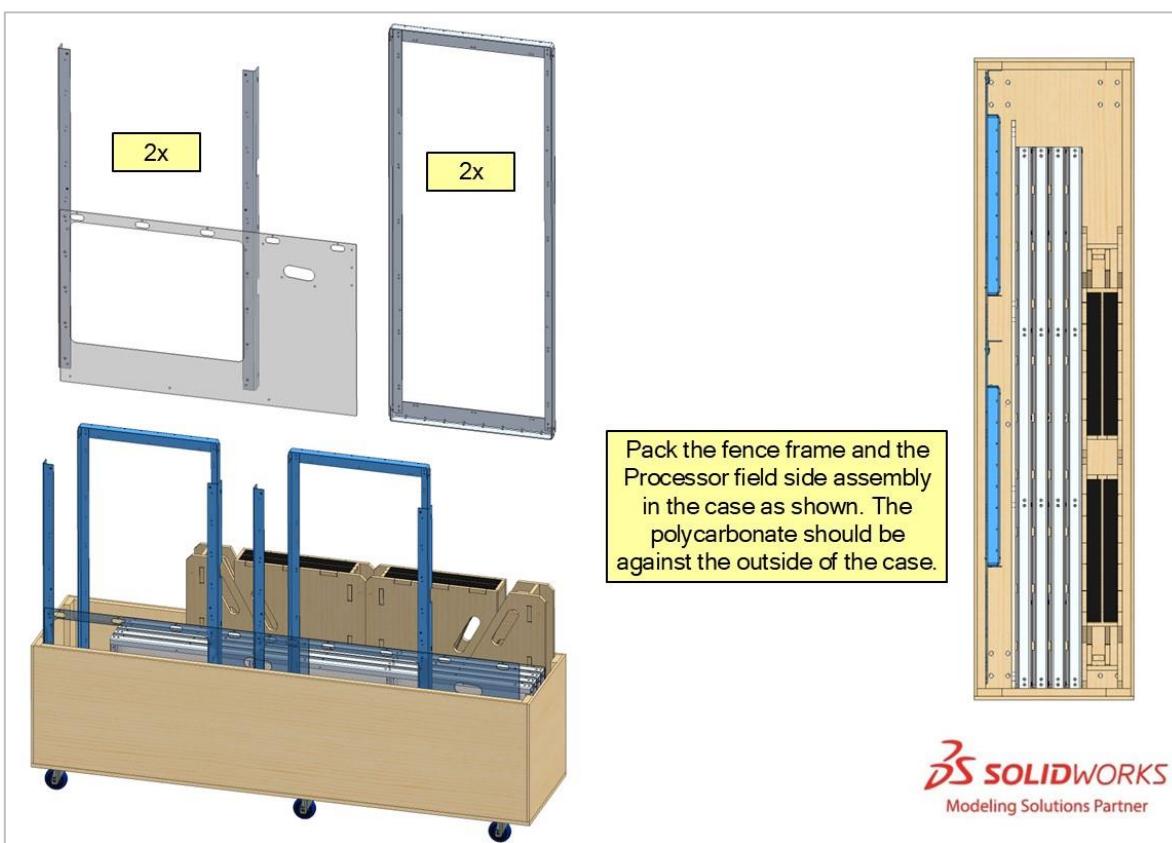


Pack the spare Coral Station bumper plastic in the case leaning up against the ramps from the previous step.

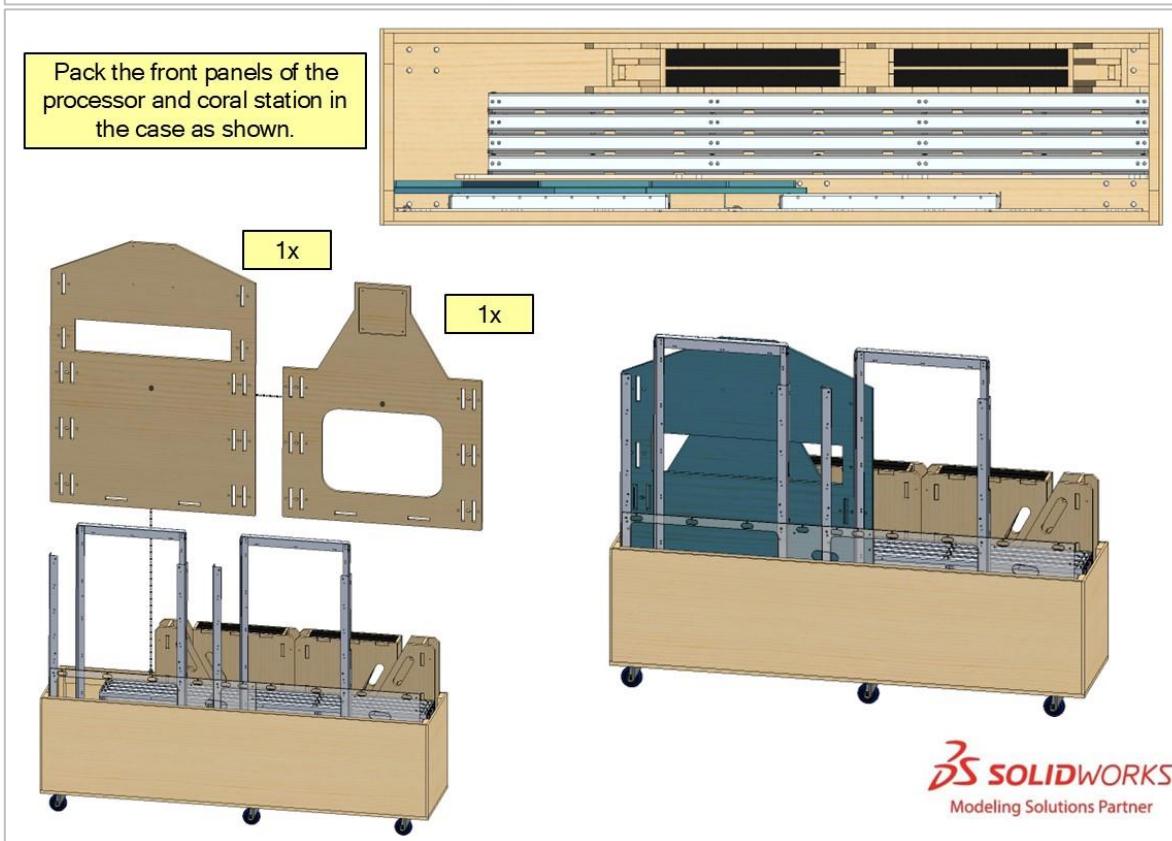


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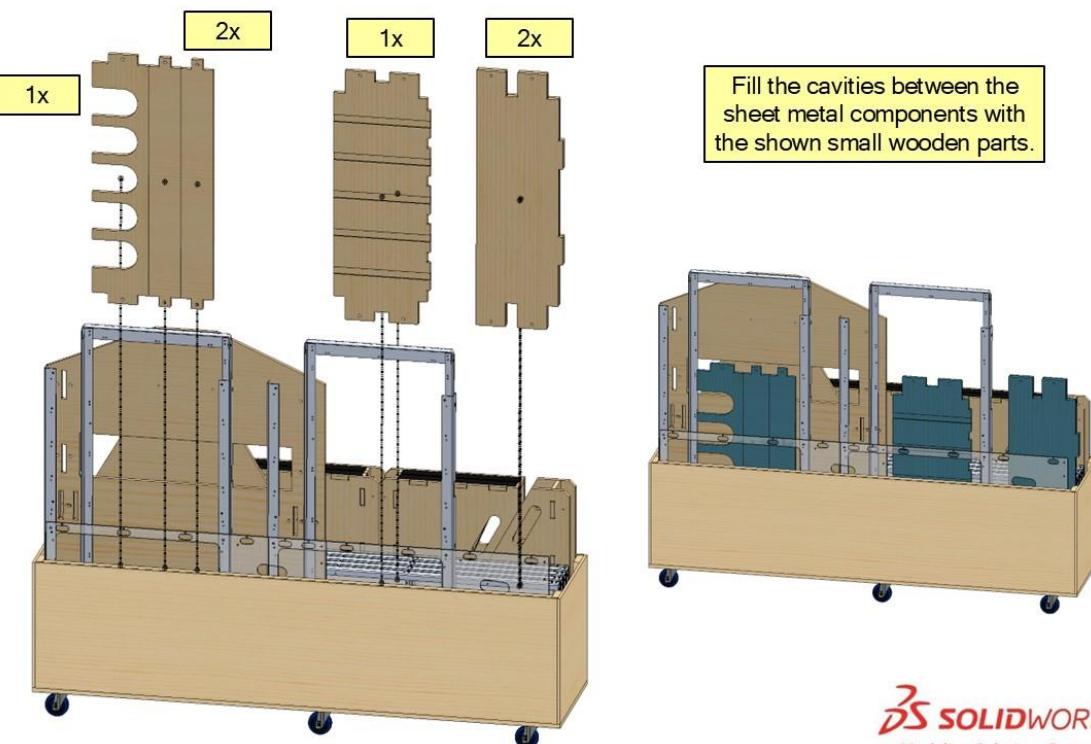
4.



5.

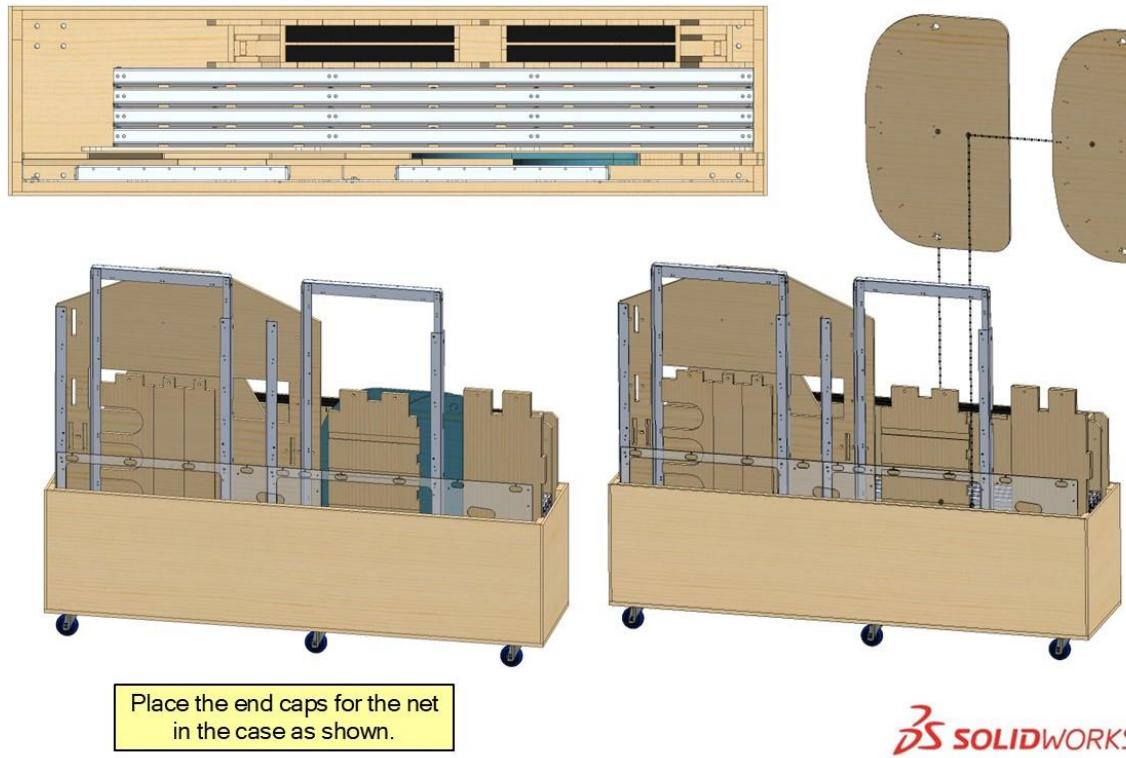


6.



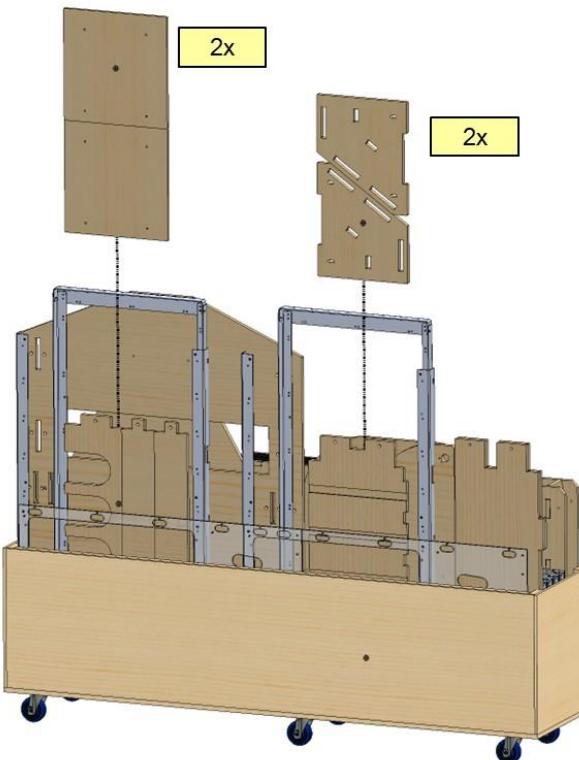
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7.



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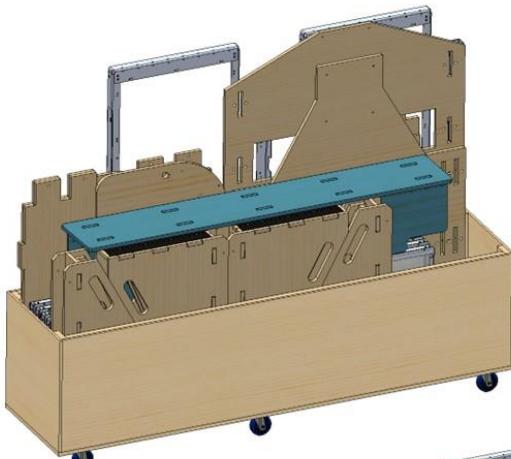
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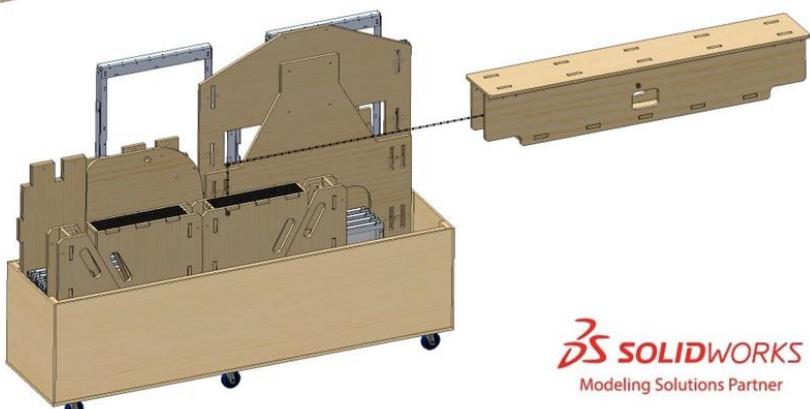
Pack the remaining small wooden components in any space available.

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9.



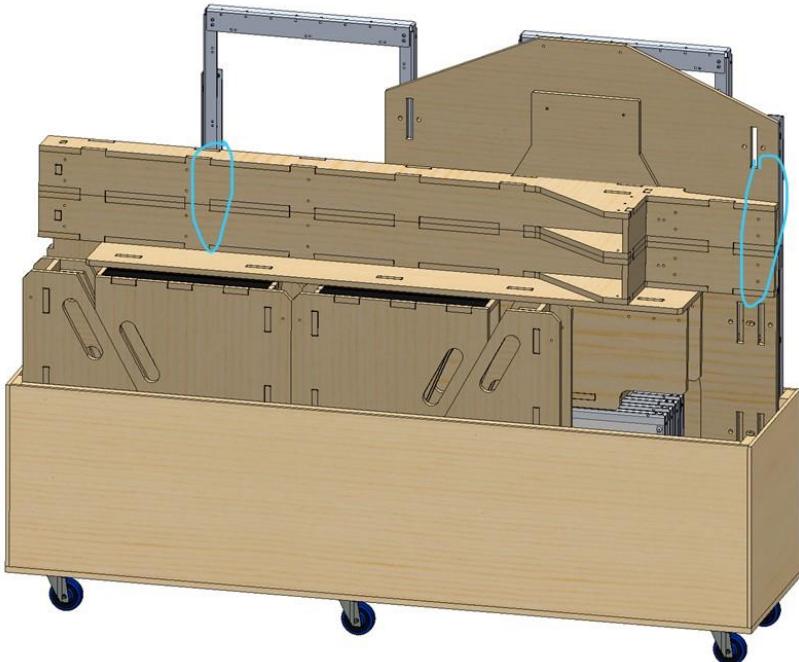
On top of the Coral Station ramps and covers, place the barge beam assembly in the case.



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10.

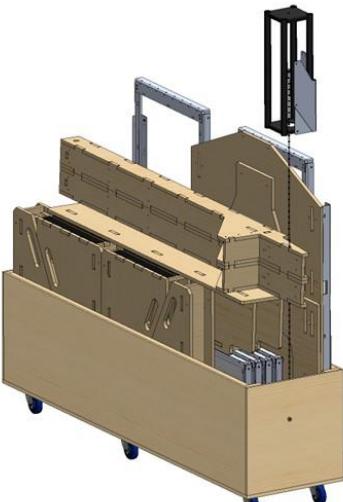
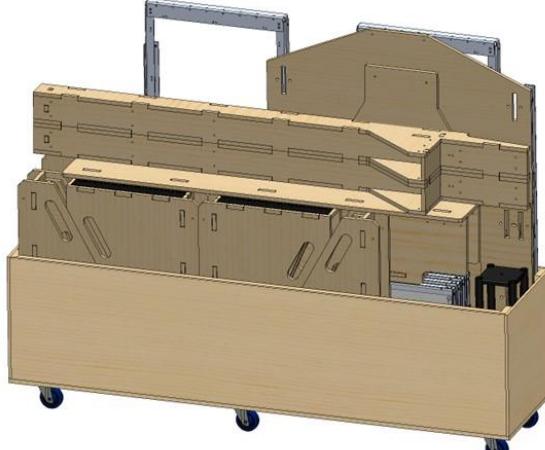
On top of the previous step,  
place the vertical posts as  
shown and cable tie them to the  
components behind them.



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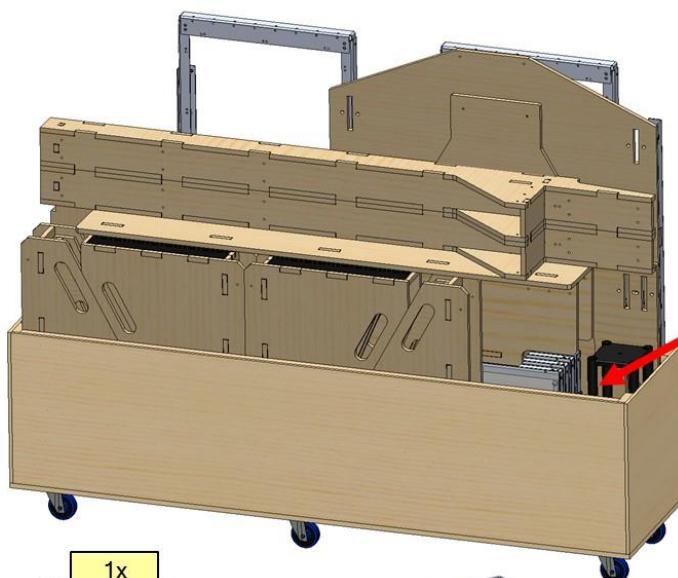
11.

In the remaining available  
corner of the case, place the  
spare cage and the two sheet  
metal April tag mounts for the  
barge labeled "Practice Field"

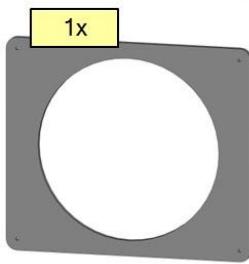


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12.



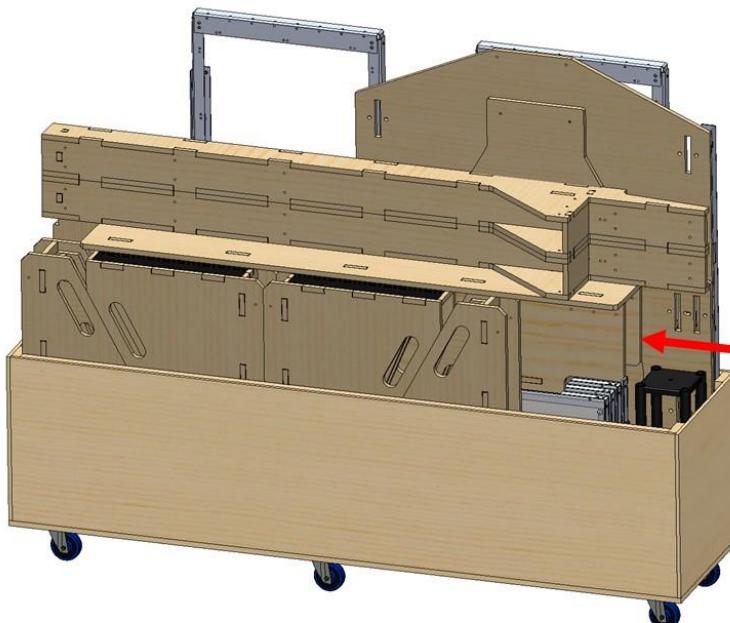
In the space remaining, pack the Algae air pump, the truss hardware kit, and the two field hardware kits.



Pack the Algae Inflation Jig components in the case where space allows.

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13.



Fill the internal space of the barge beam with the practice field net pipes and the practice field net.

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### 5.9.5 Game Specifics in Field Cases

	<b>Qty</b>
<b>Case 7 – Electronics</b>	
<b>Polycarbonate AprilTags (ID#1-22)</b>	22
<b>Polycarbonate AprilTags for Practice Field (ID#1,3,5,6)</b>	4
<b>Processor beam break sensors</b>	4
<b>Case 34 (Districts)</b>	
<b>Barge tube lights (red)</b>	3
<b>Barge tube lights (blue)</b>	3
<b>Case TBD (Regionals)</b>	
<b>Barge tube lights (red)</b>	3
<b>Barge tube lights (blue)</b>	3

### 5.9.6 Load Out

The truck-packing diagram is located on box.com. It is based on having a truck with a load area of 110" high, 98" wide and 53' long. Actually having a vehicle of that size is ideal, but it might not always be same as the vehicle now backing up to the ramp.

Remember that depending on where you are, the union will have varying degrees of involvement in the packing. Pay attention to the truck loading from the beginning. As much as possible, follow and defend the truck packing instructions.

Periodically use straps, load bars, and moving blankets as required to stabilize the truck's contents and prevent the load from shifting / tipping over.

As you near the end of all this process, you should have 1 or 2 people perform a quick walkthrough of the building to verify no *FIRST* material has been forgotten. If you do find something, obviously add it to the load on the truck, and then do one final walkthrough.

## 6 1<sup>st</sup> Event Modifications

Nothing Yet!

## 7 Field Maintenance

Nothing Yet!

## 8 Revision History

Version	Description of Changes	Date
1	<ul style="list-style-type: none"><li>Initial release – draft version for FTA training.</li></ul>	01/21/2025