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Field Construction guide.

Lessons learned in the development of the FAcToId field and game components.

Rev History (abridged)

Rev 0.4: Added images for NN tube installation

Rev 0.5: Updated to 1" foamboard for NN connector tiles

Rev 0.6: Added details on colors for gate latches

Rev 0.7: Example painted latch added; note on 1-1/4" PVC

Rev 0.8: Added details on stringing TT release

Rev 0.9: Clarified NN tile drawing and text; update on TT misplaced piece

Rev 1.0: Added velcro recommendations

Rev 1.1: Specified where the "X" for dumping failbook factoids is located; added details on spotter storage bin

Factoid Construction

Failbook and Tweeter Factoid construction:

True Factoids

- Drill 9/32" hole in practice golf ball
- Fill 25 Grams salt (approx 1 Tablespoon)
- Fill 10g shot blasting media (shy 1/2 teaspoon)
- Shake
- Fill rest with salt
- Plug with hot glue

Make 10 of each primary color, and 5 each of tweeter colors (recommend white, white with stripe, orange, orange with stripe for tweeters)

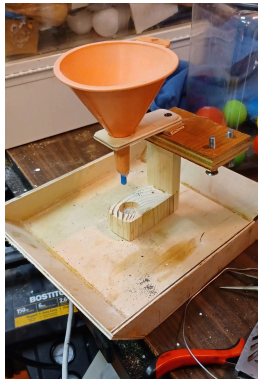
False Factoids

- Drill 9/32" hole in practice golf ball
- Fill with 6 and 1/2 teaspoons of glass microspheres
- Plug with hot glue

Make 15 of each primary color, and 20 of each tweeter color (see above)

Testing each false factoid is a good idea; not all balls have perfectly sealed seams. A dot of cyanoacrylate glue can be used to seal any holes found.

NOTE: Glass microspheres are very fine and can easily float in the air. Please wear appropriate respiratory protection.



Example of ball filling jig. Plastic straw glued in bottom of larger funnel. May need to tap funnel to get spheres to load into ball.

Wall Street Dispatch Factoid Construction:

Note: Some builders have come across 1-1/4" pipe that has a smaller ID than the spec pipe. It is recommended to obtain the caps first and then test them when buying the pipe.

True Factoids:

- Cut 1-1/4" PVC to 4.5" in length
- Cut 2 pieces of 1/2" Electrical conduit 3.5" long.
- Slightly compress each piece lengthwise in a vise so that together they both fit inside the 1-1/4" PVC (squish the conduit to an oval cross-section). Insert the 2 pieces together into 4.5" length of 1 1/4" PVC.
- Hot Glue in pieces at one end, also circling glue around inside lip of PVC tube, then quickly insert one endcap
- Repeat on other end with more glue and a second endcap

- Using 1/4" drill guide, or another template with 1/4" hole, using a fine-point sharpie or other permanent marker, make a circle at center of each endcap. Write a "T" inside the circle

False Factoids:

- Cut 1 1/4" PVC to 4.5" in length
- Hot Glue a circle around inside lip of PVC tube, then quickly insert one endcap
- Repeat on other side
- Using 1/4" drill guide, or another template with 1/4" hole, make a circle at center of each endcap. Write a "F" inside the circle

Details and Notes

Drilling

Drilling of golf balls works best if you can use a 1/4" Forstner bit, as a regular drill bit may press and collapse a golf ball. The Forstner will cut the circle as it goes without too much pressure



Fill Media - Shot Blasting Media

TABLE - Shot Used in True factoids for entire course

	Num True Factoids	Grams each	Total
Golf Balls	60	10	600g

Fill Media - Salt

TABLE - Salt Used in True factoids for entire course

	Num True Factoids	Grams each	Total
Golf Balls	60	40	2400g

Critical Final Steps

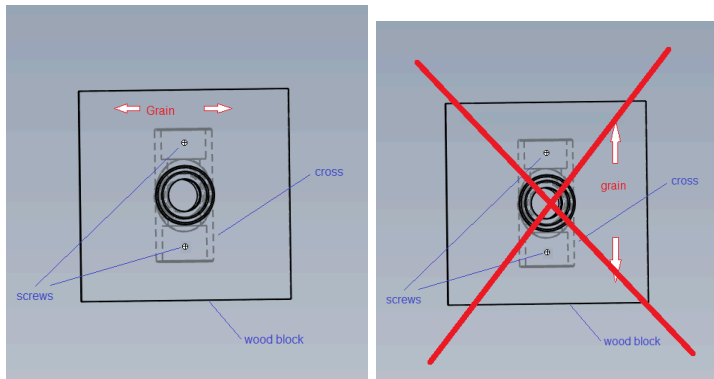
- Shaking is an important step. Without the blast media spread, it may not show magnetism evenly. Shaking should also be considered to be re-done from time to time
- color will also help the field reset team get factoids back where they belong to keep the ratio of true/false correct per area. Be sure to follow the color guide for factoids in the rules

Other construction notes:

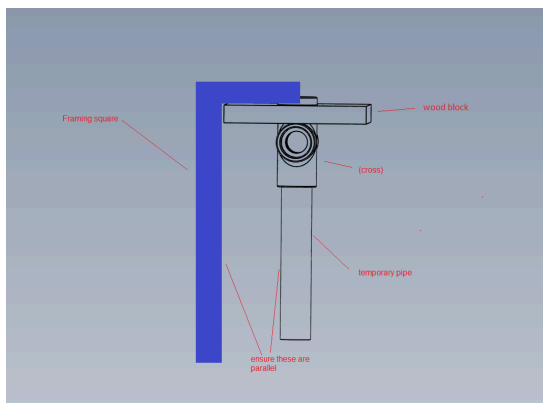
Net Selector

Mounting the square “ratchet block” to the PVC tee in the Net Selector:

1. Be sure to orient the grain of the wood so that you are screwing into the unbroken grain from edge to edge, not into the portion where the grain is broken by the hole:



2. It is important to get the block and tee in the same plane so the ratchet runs true. An easy way to do this is to dry fit a length of PVC into the tee, opposite the side where the block is being attached. Then with the pipe pointing downward and the block facing up, place a framing square on the block across the face not supported by the cross arms, and verify the edge of the framing square and pipe are parallel:

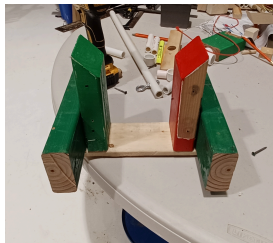


(note position of cross arm)

Once parallel is established, pilot drill through block and cross and assemble with screws.

NS interior cross members should be match drilled to make sure the hole alignment is consistent.

The guts of the NS can be assembled outside the box; attach the long PVC nipple to the wood block side of the cross, string a crossmember on, and add the indicator cross. Drill through the 1x2 of the indicator and into the PVC, and lock it in place with a screw. Do not glue or screw the nipple to the cross at this time. Insert the short nipple in the cross, add the other crossmember, and add the tee. Tighten so there is only about 1/8" of play between the cross, crossmember, and tee. A jig is useful for holding the crossmembers in place so they can be attached to the box sides. Ensure the tee is centered in the access hole before assembly. Example jig:



In this jig, sides of the NS are against the outsides of the green 2x4s; front and back panels of the NS are against the ends of the same. Crossmembers sit on edge on top of the same 2x4s, spaced by the pointy 2x4s (points are from the scrap and serve no purpose here).

Carefully drill the ratchet 30 degree hole for the 4" bolt. Starting with a smaller size drill might help. After installing the bolt, add a 1/4" nut to hold it in place, then loosely string the six 1/2" hex nuts on the bolt, and top off with another 1/4" nut to hold the stack on (weight can be added after the ratchet is installed in the box). Any suitable weight can be used for the ratchet (instead of the 1/2" nuts). Weight should be 4 oz total. After assembly, spritz a bit of WD-40 on the underside of PVC so it slides as smoothly as possible over the block. The completed assembly should offer very little resistance to rotating, and should self-center on a selection if +/- ~15 degrees of any selection.

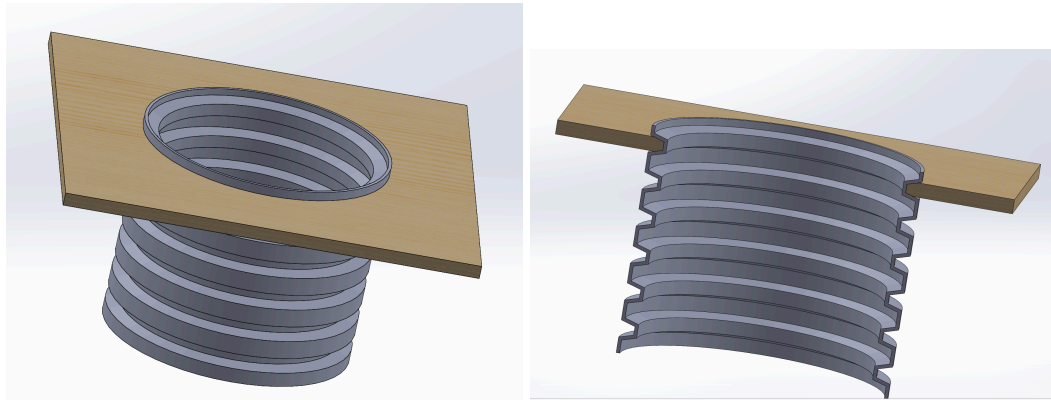
Aligning the selector: Rotate the nipples so that one of the indicator crosspieces is straight up, the tee handle is horizontal, and the PVC ratchet is flat against the wood block (wood block will be at an angle). Screw or glue the nipples to the cross and tee. Turn the tee handle clockwise (viewed from the access hole) 90 degrees and place an "A" on the indicator facing up (tee handle should be vertical). Turn the handle another 90 degrees CW (handle horizontal), and place a "B" on the indicator. One more CW 90 degree turn (handle vertical) and place a "C" on the indicator.

Ensure that with the top cover on no selection is visible when the shaft is stuck between two stops.

Neural Network

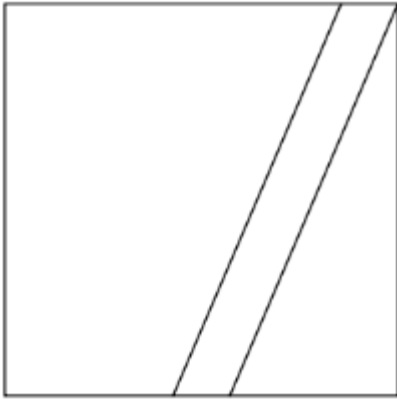
Neural net tubes

Cutting the 4" tubing: Measure from the non-coupling end 4" and then shorten the piece to the closest "outdent" of the pipe. Make a plunge cut with a Stanley knife, centered on the outdent flat, and then insert a pair of scissors in the plunge to cut around the diameter. Scissors are easier to control than a knife, and the material cuts easily. Repeat 35 times. The indent next to this now half-outdent is where the holes cut in the NN face board will be positioned. The half outdent is bent or pushed through from the backside before the panel is installed (first mark tangents as indicated below). This will give a consistent lip for all NN nodes. If the pipe is not up against the very bottom of the NN when installed, this is not a concern as the gap will not be large enough to affect gameplay. See images below on how the pipe fits in the hole.

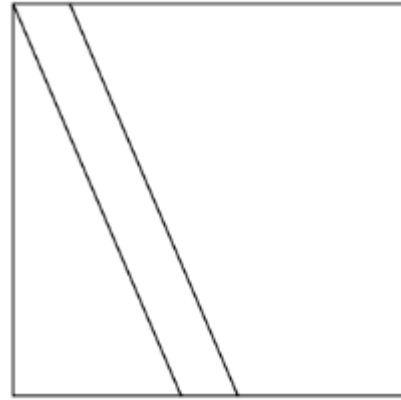


Neural Net Connection Tiles

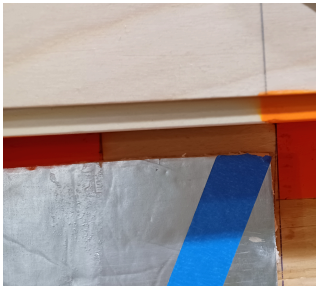
The 1" foamboard can be cut with a utility knife or on a table saw (change from $\frac{3}{4}$ " to 1" foamboard was made late in the design process). Each tile is 7- $\frac{1}{2}$ " on a side. To make the tiles look consistent on each side, remove the logos and instructions on the "back" side of each of the tiles. Safest way is with 91 or 99% Isopropyl Alcohol (70% will not work). 99% IPA is available at any pharmacy. Cut 1" wide strips of gaff (or other) quadrant-color tape and place the tape from the center of one side of the tile (center of tape at center of tile) to the corner of the opposite side of the tile, the corner of the tape matching the corner of the tile, excess tape can fold on the "top" of the tile. Turn the tile over and place the tape along the same path (center of same edge to same corner). This will give a mirror image as the tile is flipped over if the side with the centered tape is considered the "bottom"



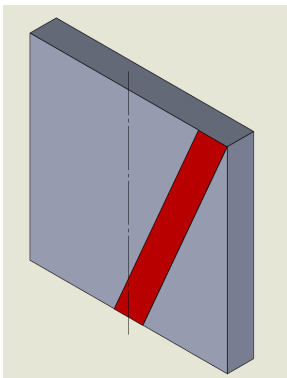
Tile side "A"



Tile side "B"



Sample of tape going to the "upper" corner of the tile



Tile showing centerline

Gaff tape being 50 mm instead of 50.8 mm is OK

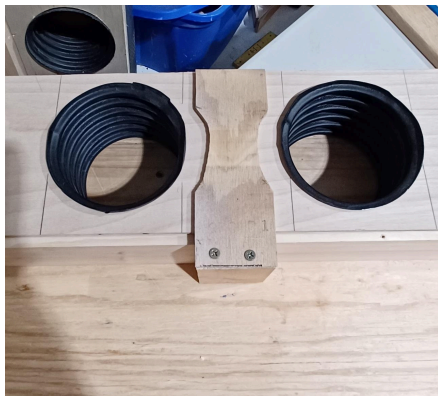
After taping both sides of the tile, take clear 2" packing tape and go around the edge of the tile. It is recommended that you tape all the way around initially only attaching to the edge, then cut all eight corners where the tape turns, and then fold each side down on each face of the tile. Simple tile marking jig, made of scrap foam and cardboard:

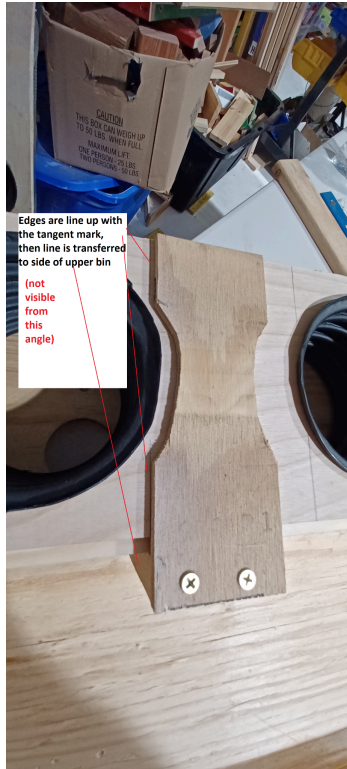


Tile in place to be marked. Red indicates center and corner to tape to.

Marking the Neural Network “valid connection” zones

Each NN connection tile needs to be connected on both ends to score any of the connection or connection bonus points. The valid zones for NN tiles to be considered connected are tangents of the drilled node holes, perpendicular to the long axis of the NN. The simplest way to identify these zones is to note the perpendicular tangents on the face of both the upper and lower NN section before assembly. After tube install and assembly, the tangents can be used with a jig to transfer the markings to the NN tile scoring area so the determination can be easily made. A jig like the one shown here can help transfer those tangents to the sidewall of the upper NN node section:



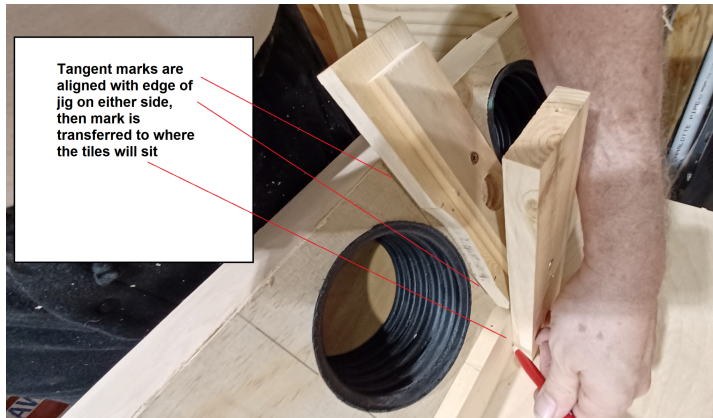


After this, a square block of wood can be used to take the line from the sidewall to the plywood backing where the tile will rest. Paint down 1-½" on the back of the NN to indicate the valid scoring area for the upper connection. Recommend fluorescent orange for contrast and visibility. Painting the entire back may make it harder to distinguish the upper scoring zone from the lower.

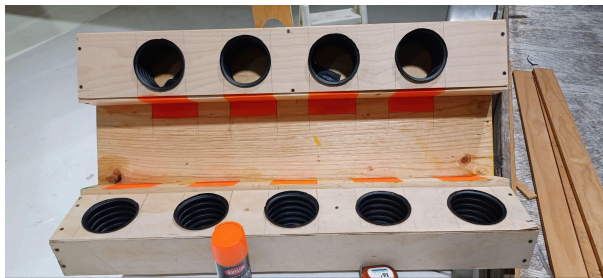
For the lower NN nodes, a somewhat more complex jig is needed:



In use:



Sample painted NN:



General note on counterweights: lumber density varies depending on age, treatment, and source of wood. Some adjustment in length or position may be needed to ensure consistent operation. **Tweeter flap test:** counterweight should be able to be opened with a single TRUE tweet remaining in the dispensing area, but may not be able to with only a FALSE tweet. Few teams will likely complain about this. The tweeter plunger counterweight should ensure that the plunger should naturally want to stay in the “unactivated” position without any tension from the tweet release string (string should be slack). Gate latch counterweights should enable bistable operation, allowing the latch to remain in either closed or fully open position.

Spotter Sorting Tray:

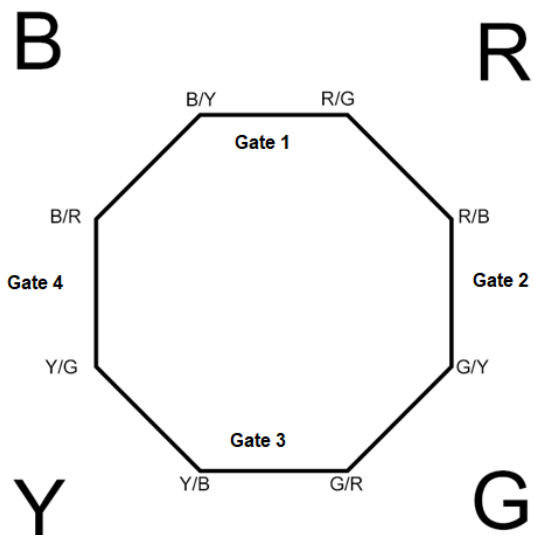
Sorting tray is specified with $\frac{1}{2}$ " plywood bottom only as there is excess $\frac{1}{2}$ " available on the cut sheets. If reusing existing lumber, any thickness bottom may be used from $\frac{1}{8}$ " masonite to $\frac{3}{4}$ " plywood with no effect on game play.

Field painting and unpainted areas:

The following should be left unpainted: Ramps, tweeter flap and flap latch block, LOC shelf faces, gate latch insides where it touches the ramp. Ensure that NN score zones are painted so that the connection tiles can quickly be evaluated. Leave the rest of the NN backside unpainted to not affect gameplay.

Gate Latch Painting:

The gate (or ramp) latches have a specific paint scheme on the “flag” counterweights (GA-25-115). Each of the left and right latches will have two colors, assigned such that any two teams can open at least one gate without penalty.



The left and right latches are defined by looking at the gate from outside the octagon.

Half of each counterweight is painted one color, half the other. Top/bottom or left/right, diagonal, stripes, etc. does not matter.

Left counterweights are painted:

Yellow and Blue (Gate 3)

Green and Yellow (Gate 2)

Red and Green (Gate 1)

Blue and Red (Gate 4)

Right counterweights are painted:

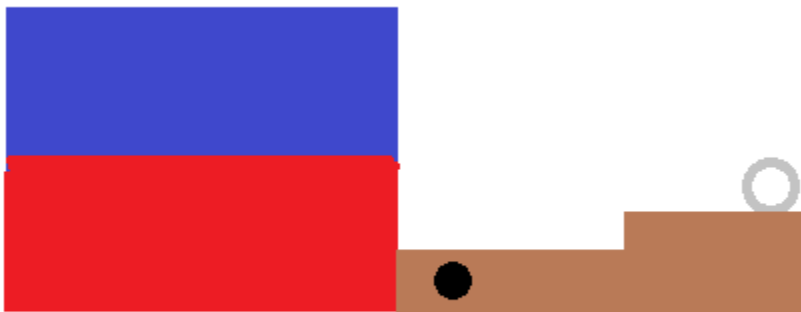
Green and Red (Gate 3)

Red and Blue (Gate 2)

Blue and Yellow (Gate 1)

Yellow and Green (Gate 4)

Corresponding inner counterweights (GA-25-114) are also painted the same color pairs. This allows the opening of the correct gates from inside the octagon, given a sufficiently skilled driver and spotter. Example counterweight painting is shown here (right Gate 2 latch)



Tweeter Tower Release String:

Ensure that the TT-25-513 Tweeter tower counterweight has a $\frac{1}{4}$ " hole centered approx $\frac{3}{4}$ " from the end. Ensure when the tower is installed, the counterweight causes the Trip Arm (509) to remain in the unactivated position. Using any suitable string or rope, tie one end to 513, and the other end to TT-25-512 TT trip latch in the hole shown. Verify that there is some slack in the rope when unactivated, and that when the target is pushed in all the way that the latch releases the gate (flapper) so that the balls can be dispensed. Rope catenary should be 1" or less. Verify operation of flapper (gate) as indicated above "Tweeter flapper test".

Tweeter Tower Leg Brace:

There is an error in the drawing TT-25-500: Find 14 (leg brace, TT-25-514) should be fixed between the two upright legs of the tower (501), flush with the edge that forms an inverted "V" with the 2x4 support legs (511) and grounded with the bottom edge of the 511s. The lower rail of the gate assembly is then attached to 514 to help support the tower. See the green 1x4 in the image here:

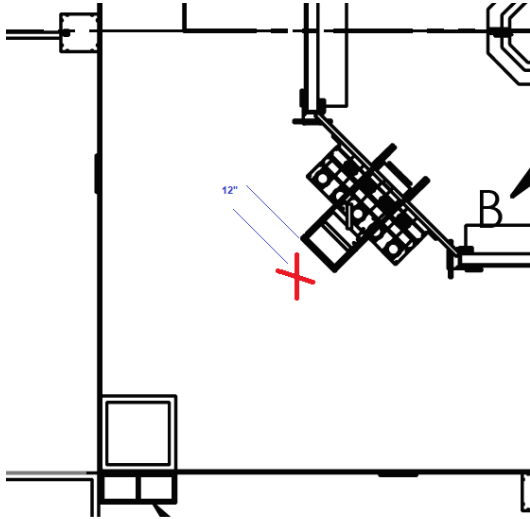


Keeping the Field in Place

It is recommended that hook-side velcro be applied to the bottoms of the gates (angled footer board), the Neural Nets, and the LOC tower. Two six-inch-long pieces attached to each of these units (except the LOC) should be adequate. LOC will likely need four pieces. Stapling the velcro in place is advised.

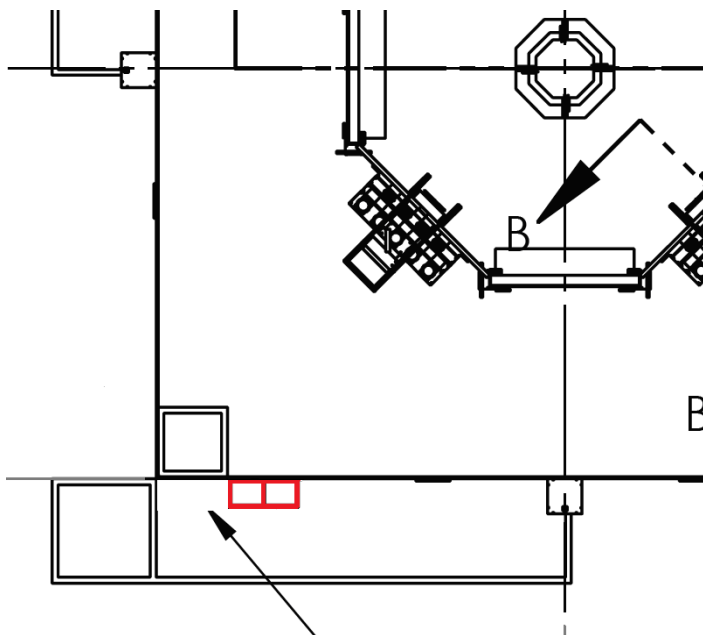
X Marks the Spot

The “X” location as seen in some drawings should be one foot in front of the tweeter tower arm. Field reset personnel should all use the same method of dumping failbook factoids on this mark before the match starts:



Spotter's factoid Storage Bins

The correct placement of the spotter storage bins are starting two feet from the corner of the field:



This allows the spotter unencumbered access to the RSA.