

THE ROBONAUTS

2023 PIT WRITEUP

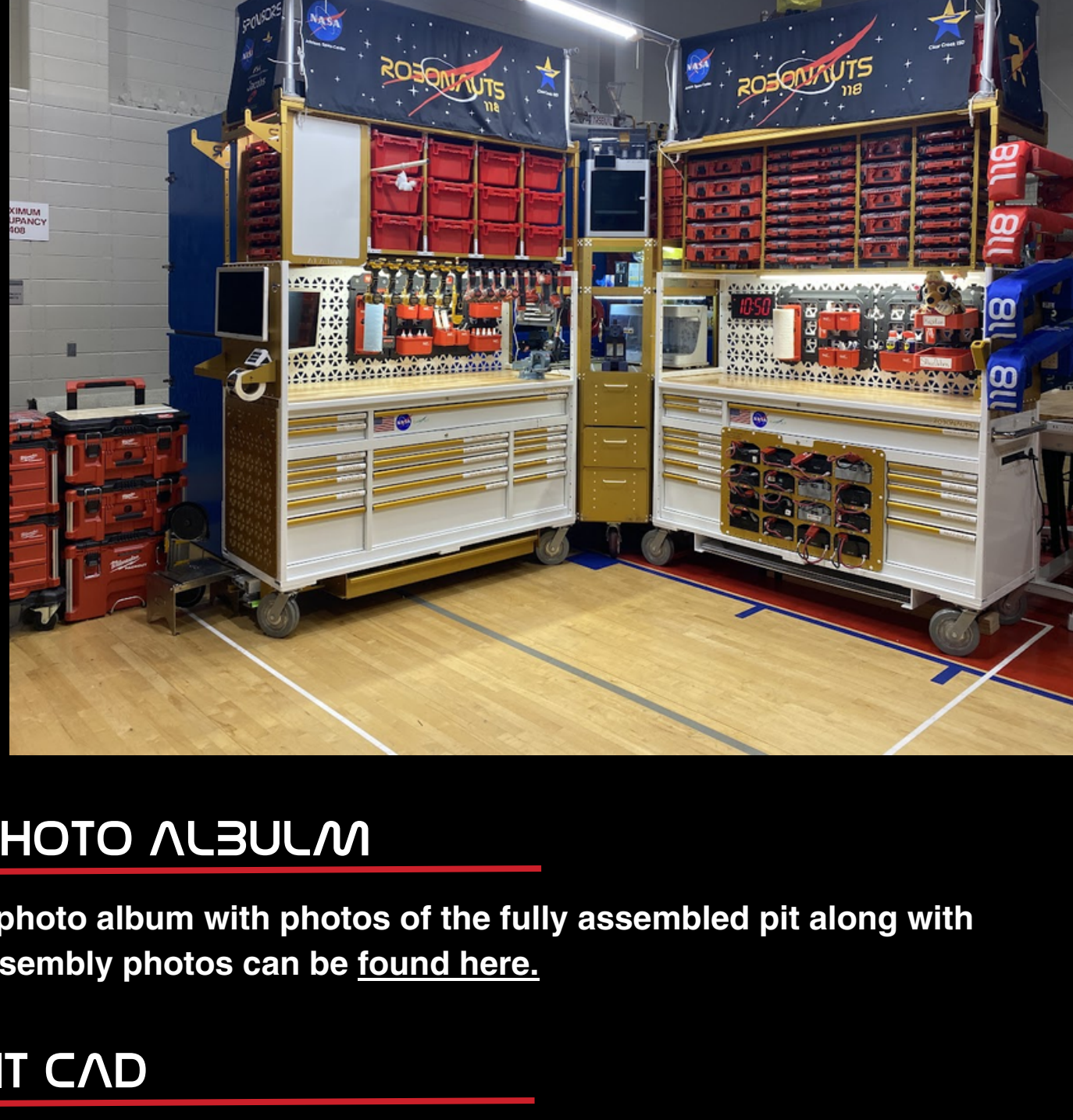


PHOTO ALBUM

A photo album with photos of the fully assembled pit along with assembly photos can be [found here](#).

PIT CAD

The CAD of the 2023 Robonauts Pit and Robot Cart can be [found here](#).

DESIGN GOALS

- Use as much vertical space as possible for storage to leave as much floor space as possible for robot testing in the pit.
- Carry spare parts and tools for repairing anything on our robot.
- Carry FRC COTS components and tools needed to fix almost any robot at an event.
- Have manufacturing tools to be able to make parts for our robot or any other team's robot at an event.
- Minimize clutter.
- Reflect the Robonauts Brand

LOWER STRUCTURE



In the 2022 season we used 2 of these [72" Husky tool boxes](#), an issue we had several times throughout the season was breaking casters off so one of the biggest goals for the new toolbox structure was to use the most robust casters we could find. We used [4, 8" Diameter dual roller Kingston Casters](#). Each caster is rated for 2,000 pounds and they are bolted into [locking Helicoil inserts](#) and properly torqued to ensure they do not come loose over the years.

The bottom of the mechanical toolbox has a 72" long tray underneath that holds longstock and the bottom of the avionics toolbox has a tray built from $\frac{1}{4}$ " wall C-channel that holds 24" X 48" sheets of material.

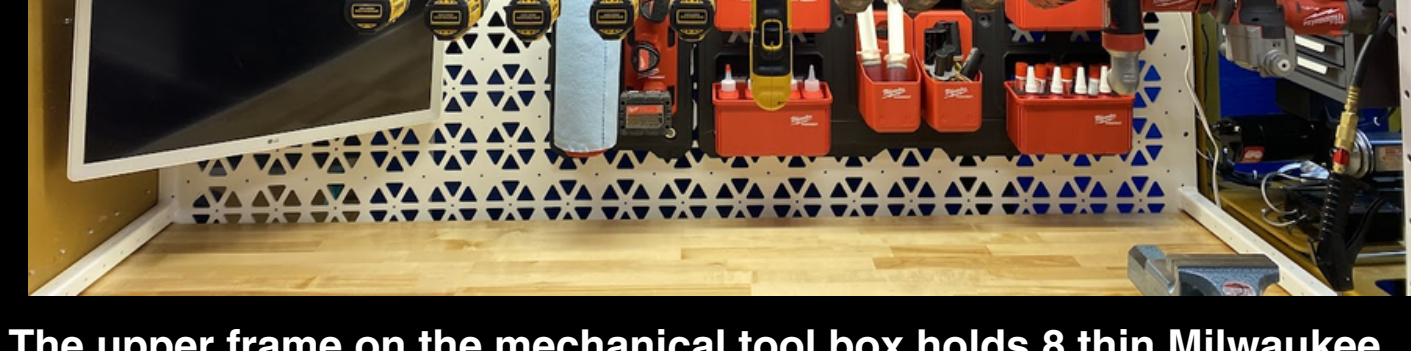
The back walls of each lower frame have Milwaukee Packout walls mounted to them with various consumables in bins that clip in. One upgrade we will be doing is replacing the Packout wall with a custom Packout interface for better packaging.

The frame around the toolboxes is built from welded, [1.25" square, pre-drilled Alcobra telescoping tubing](#) that is welded to a 1"x3" aluminum box tube frame underneath the toolboxes. The tubing comes pre-drilled on one side and we match drilled it through the other side and reamed to fit [3/8" Pip-pins](#).

UPPER STRUCTURE

The upper structures on each toolbox are slightly different but are both made with 1" and 1.25" welded Alcobra tubing and $\frac{1}{8}$ " sheetmetal.

The upper structures do not actually telescope up. When we get to an event we install 4 individual 1" square "sticks" in the corners that insert into the 1.25" "receiver" on the upper shelf. This made assembly and fabrication far easier as it would have been extremely difficult to ensure the frames were welded 118% square to prevent binding of the tubing during extension.



The upper frame on the mechanical tool box holds 8 thin [Milwaukee Packouts](#) that contain fasteners. These Packouts face outside our pit so that they can be grabbed by someone standing outside the pit since most of the time we pull these out we are giving fasteners to other teams. The mechanical upper frame also holds 12 small totes that carry spares specific to the year's robot. Each subsystem gets at least one tote and a couple are reserved for consumables like tape, zip ties and Everybot components. On top of the frame there are two [Packout cabinets](#), one with extension cords used when setting up the pit and one with cleaning supplies. We also store boxes of new safety glasses up high.



The upper frame on the avionics toolbox holds 28 Milwaukee Packouts of various sizes. Most of these are stocked with COTS components intended to be used to help fix other robots at events. The top shelf of the avionics upper frame contains totes that aren't regularly needed such as plastic repair supplies, excess stock of rivets and fasteners, pool noodles.

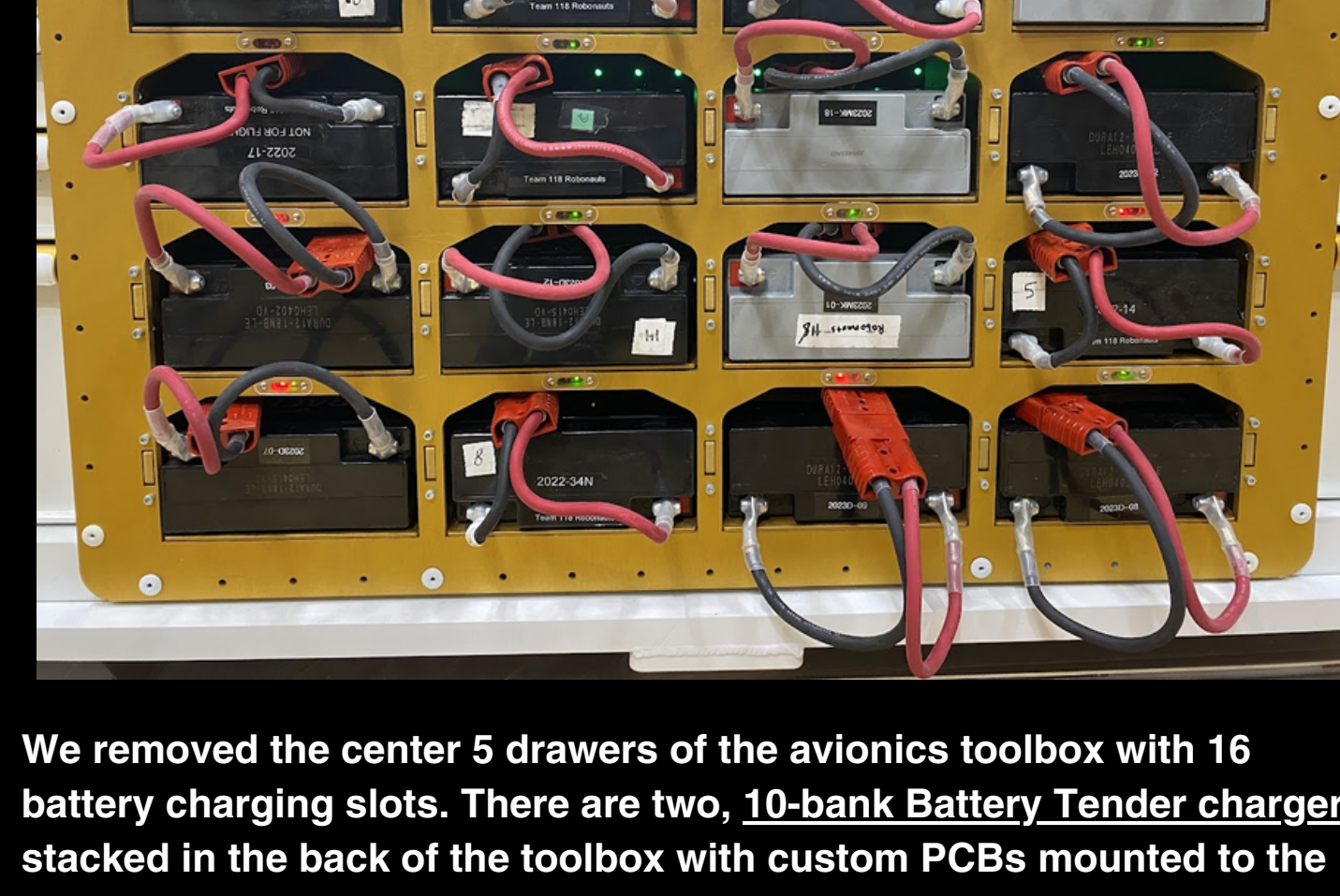
CORNER TOOL BOX

The corner tool box is what brings the pit together. In the past the corner of our pit would end up being a pile of backpacks, cases of water, and random totes of robot components.

The corner toolbox is built from $\frac{1}{8}$ " thick 6061 aluminum riveted together. The bottom section has 3 drawers that are 34" deep. The top one holds our 4 spare swerve modules and bottles of cleaning supplies and adhesives. The middle drawer holds our Milwaukee and DeWalt battery chargers along with a hot glue gun kit and staple gun kit. The bottom drawer holds heavy items such as our vise-mounted sheet metal brake. The "wings" on the sides of the drawers hold things we don't expect to need to access during an event weekend. The left side has a custom triangular shaped trashcan and the right side houses a DeWalt 60V compressor connected to an air hose reel along with a 5 gallon water bottle with a dispenser. In an effort to have less half full plastic water bottles laying around we now just have team members bring their reusable team water bottle and fill it up at this dispenser and swap the large bottle after each event.

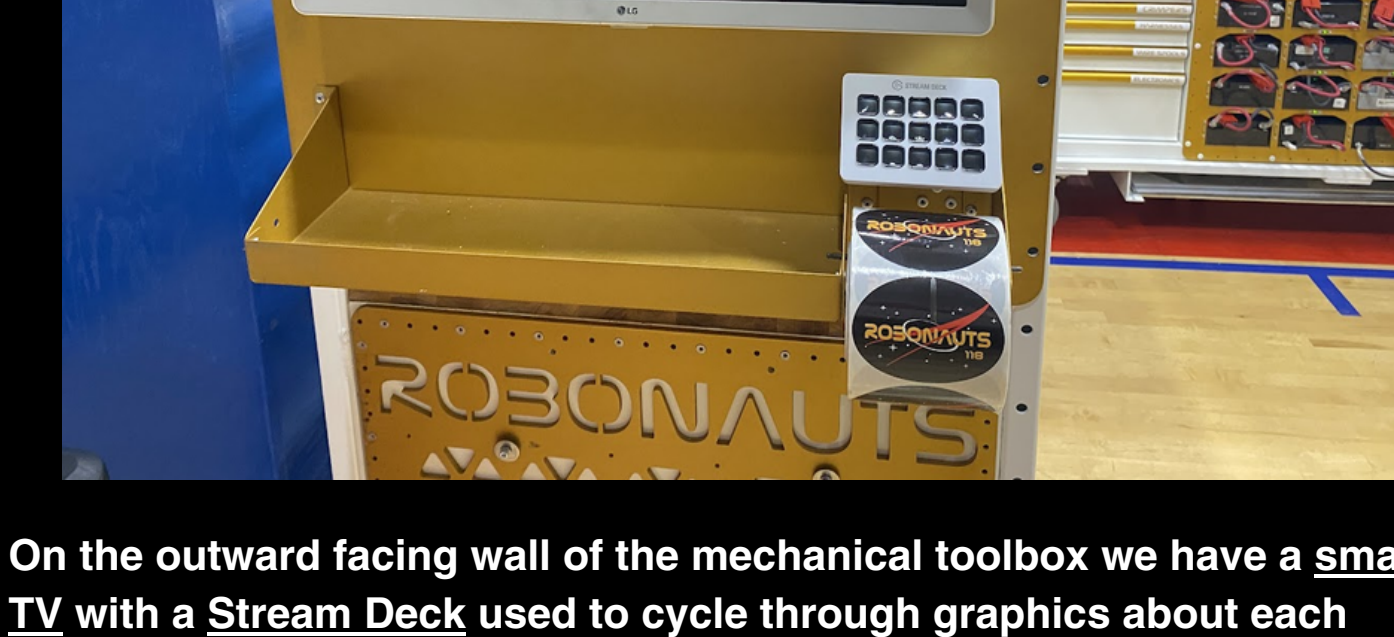
For the 2023 season we had a small [Sherline lathe](#) on drawer slides that slides out over the mechanical toolbox and a [Markforged printer](#) that slid out over the avionics toolbox. The lathe was a pretty big hit and was used by multiple teams at each event to make parts for their robot. With the new event rules the Markforged long printing time made it less useful so we have replaced it with a [Bambu Labs X1 Carbon](#).

BATTERY CHARGER



We removed the center 5 drawers of the avionics toolbox with 16 battery charging slots. There are two, 10-bank Battery Tender chargers stacked in the back of the toolbox with custom PCBs mounted to the outside of the charger structure to show the charging status of each battery. We generally charge 12 batteries for our robot and the other 4 slots are used to charge batteries for partners, our scouting inverters, and the inverter on the robot cart used to power the drivers station.

MEDIA



On the outward facing wall of the mechanical toolbox we have a small TV with a [Stream Deck](#) used to cycle through graphics about each subsystem of our robot and our outreach initiatives. There is also a tray for holding giveaways such as pins and stickers. This display is run off of a [Lenovo IdeaCentre Mini](#).

Inside the pit there is an identical TV that is connected to both an [Apple TV](#) that we cast the event stream to using Airplay. The PC that is connected to the outreach display is also connected to this TV and can be used to pull up the CAD of the robot or slice 3D prints for the [Bambu Labs printer](#).