Technical Project

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Fillet Tool

Intro

The fillet tool is meant to aid in creating clean, consistent, calculated epoxy fillets. With a good fillet, the parts and bonds are stronger, they behave more ideally, cleanup and postprocessing is simpler, and the aerodynamic properties are more consistent. From a mechanics point of view, fillets are important since they increase the radius of corners, avoiding stress concentrations; rounded corners are good!

Task

Design fillet tools for fin fillets and mount fillets with radii of:

- 1.0in
- 0.5in
- 0.375in
- 0.25in
- 0.125in

Notes

- Design them to have a sharp edge
- There should be a decent amount of material to be able to grab one to and hold
- For certain fillets, a lot of force is applied; don't let them break
- Keep in mind what kind of manufacturing process you want to use from the start

Fin Jig

Intro

Well-aligned fins keep a rocket with a steady heading and optimal trajectory. Even the most slightly misaligned fins can lead to catastrophic failure; uncontrollable spinning, unaccounted-for windcocking, and rapid disassembly. Therefore, it is crucial that our fins are aligned during the manufacturing process. This is where fin jigs come into play; they hold the fins at the perfect angle while they are being epoxied to the airframe.

Task

Design fin jigs for the ALULA rocket

- Airframe Outer Diameter: 6.17in
- Number of Fins: 3
- Fin Thickness: 0.25in
- Fin Root Chord: 4in
- Fin Sweep Length: 4in
- Fin Height: 6in
- Fin Length: 12in
- Fillet Radius: 1in

Notes

- Think about how the fin jig will be slid onto the airframe during manufacturing
- What considerations need to be made to ensure that there is enough clearance to fillet the edges
- The fiberglass sheets for the fins aren't actually .25 — the stock sheets are thicker
    - Go measure it from the source
- What are the tolerances for the manufacturing process that you want to use
    - Where do dimensions need to be oversized?
    - What dimensions are less important?
- Keep in mind what kind of manufacturing process you want to use from the start

Spacing Jig

Intro

Within the rocket, there are many different bulkheads and plates that are epoxied at varying distances. In an ideal world, where we place the bulkhead last is where it remains. Unfortunately, gravity exists, so if the bulkhead is left unsupported, it will slide down the tube and possibly even fall out. For this, we need to make a support structure that keeps it in place — a spacing jig!

Task

Create a spacing jig to fit within a 6 inch airframe

- 3in
- 12in
- 24in
- Bulkhead design
    - Flat solid bulkhead
        - 6in OD
    - Centering ring style
        - 6in OD
        - 5in ID

Notes

- Typically for these, laser cutting plywood is used since there can be very long lengths. For shorter lengths, 3D printing can be viable
- Different bulkhead designs have different things to account for
- These distances are arbitrary for now, but make sure that this jig isn't ultra-specialized
    - Changing a few parameters on Solidworks should be enough to get a new jig for different lengths

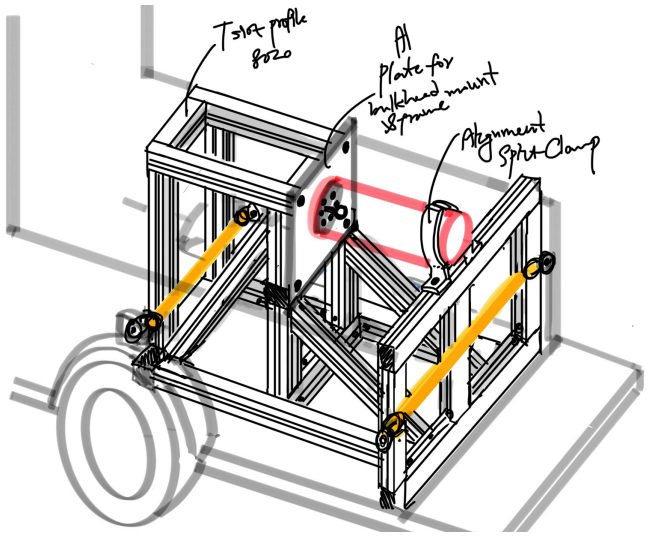
Recovery Test Stand

Intro

For bulkhead and shock load testing, Recovery needs to create a test stand that is placed in the back of a pickup truck. The truck drives at a calculated speed, where weights are dropped. Through this speed and impulse, rocket recovery conditions can be recreated. From this we can test multiple things: verify parachute design, assess shock loads, and evaluate shock load reduction methods.

Task

Complete the design Recovery has set in place:



Talk to Jisoo for more details

Notes

ACTUALLY NVM WERE DOING SOMETHING ELSE JUST WAIT A LIL BIT

Rocket Stand

Intro

While working on the rocket we typically just leave it on the table or whatever surface. However, this isn't always the most ideal, especially if there are external features on the rocket or we're trying to keep the paint pristine. Also, during integration and showcasing, it is highly beneficial to have the rocket on a horizontal stand, which looks cleaner and allows us to pick it up easily

Task

Create a rocket stand for our rockets

- Airframe diameter: 6in
- Airframe length: 11 - 16ft

Notes

- Think about bending within the rocket: just 2 points of contact is probably not enough
    - The stand should be comprised of multiple modular pieces
- What can we do to avoid scratching on the paint
- Are there ways to make the rocket easily turnable when already on the stand
- The stand is one of the most interesting technical projects because of the different ways to achieve the same thing
    - For example, it can be made entirely from PVC pipes

Hole Jig

Intro

When drilling holes into the airframe, we require high precision and tolerances. These holes interface with precisely machined mounts, so to ensure seamless integration between everything, these holes must be cut perfectly. This is not possible with just a template and a hand drill. We need hole jigs to make sure our drill bits go where we intend.

Task

Make a hole jig that goes on the outside of the rocket

- Number of Holes: 6
- Hole sizing: For 8-32 fasteners

Notes

- We do not drill holes for the full size straight off the getgo; you need pilot holes
    - This may facilitate the need for multiple jigs that step up in hole size
- Think about the tolerances: our mounts have high tolerances and these holes need them as well

Tube Right Edge

Intro

When cutting the tubes, from a structural standpoint and an aesthetic standpoint, it is important to to make sure they are right edges. While cutting the tubes over time, they can start to become slanted. Despite our attempts to make templates through tape and other alternatives, these methods rely on the tube edge itself being datumed properly. If the datum itself is not perfect, the guide won't be either. By the end of cutting, there can be up to 15-degree slants; no good. For this, we need a solution to ensure that our cuts are truly right angles.

Task

Design a tool that helps us cut perfect right angles on our tubes

- Airframe Outer Diameter: 6.17in
- Airframe Inner Diameter: 6in

Notes

- It can be helpful to use the length of the tube as datum for this tool
- How can we mark the outside of the tube so that we can come back and cut along the line