Trevor Tuck
Mechanical Engineer

Hi, I'm a mechanical engineer with an interest in manufacturing and structural design.

Telephone: (562) 673-4551
Email: trevortuck00@gmail.com
LinkedIn

1 GE Aerospace
Manufacturing Engineer

2 UCI Rocket Project
Structures & Manufacturing Engineer

3 Gluebi: Additively Manufactured Bike
Chief Engineer

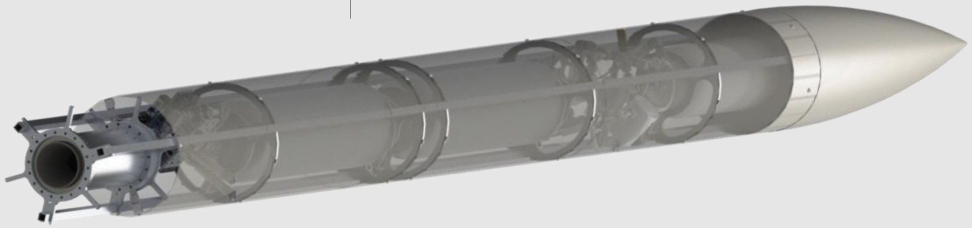
Education

B.S. Mechanical Engineering
University of California, Irvine
Class of 2023

Skills

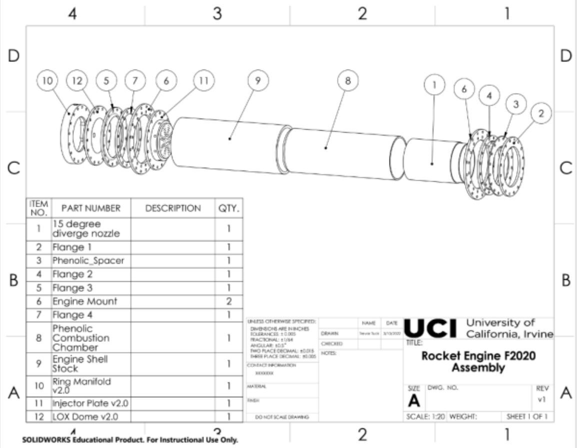
Siemens NX
SolidWorks
Python
Abaqus

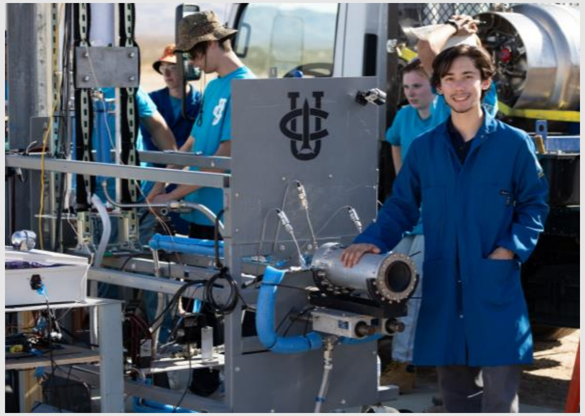
Root Cause Analysis
Fixture Design
3D Printing
Bolted Joints
Machining
FEA

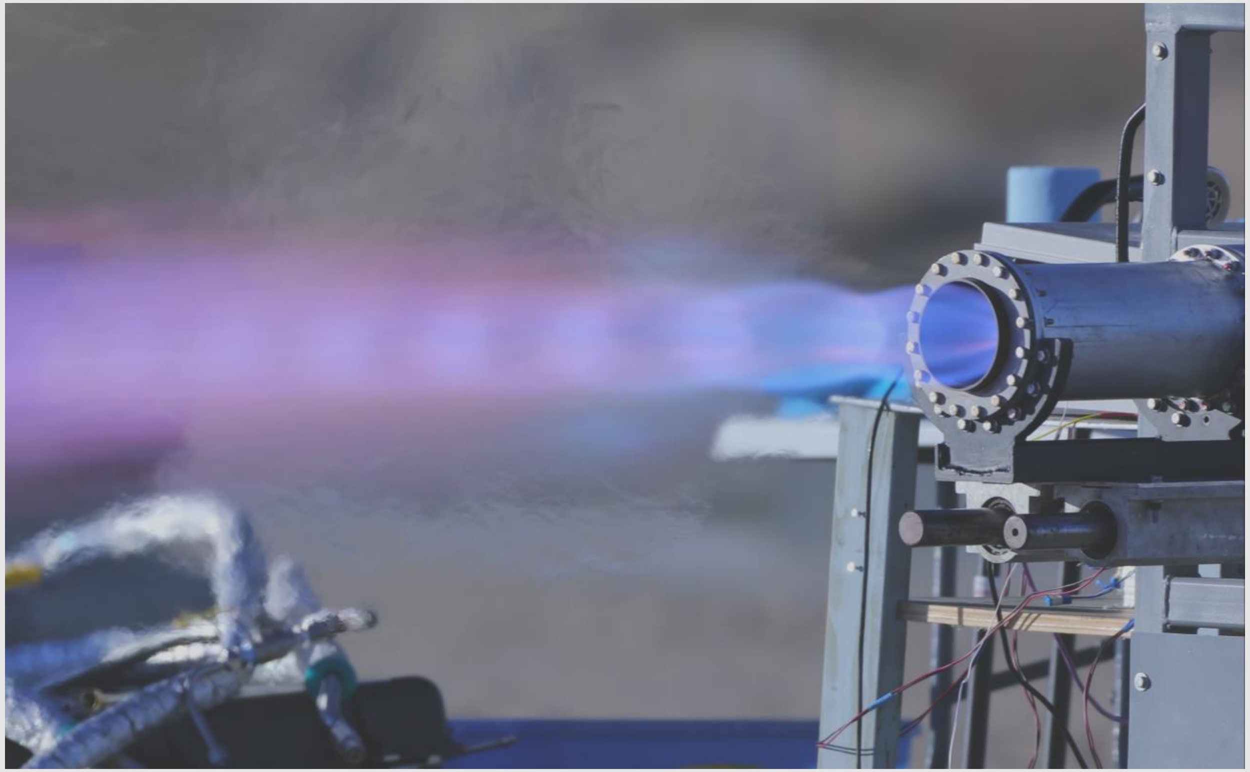



PTR, the rocket

Methalox Rocket Engine Manufacturing





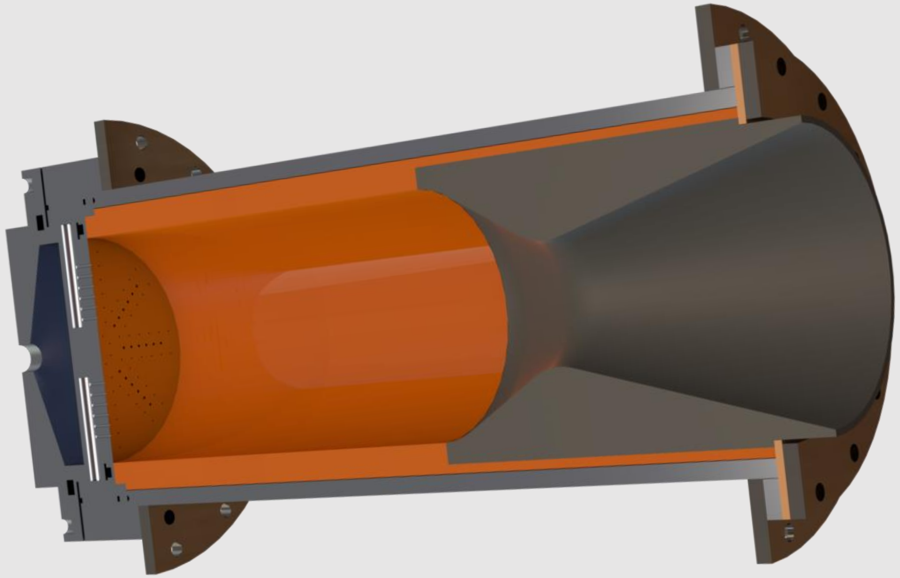


I manufactured “Engine IPA” by creating my own set of drawings considering thermal and structural loads, as well as a stack-up analysis based on practical machine tolerances and operation order. The engine was successfully test-fired and launched thanks to aerospace-grade precision and careful re-assembly.

Skins Jig

To attach the structural phenolic skin to the rocket's internal structure, I 3D printed a skins jig with holes to drill/tap into 3⁄8" 6061-T6 bulkheads. Each hole contains a slot with a corresponding drill and tap bushing. I completed this print on the BigRep with ProHT filament for $16.

UCIRP CAD Drive



I developed the UCI Rocket Project Google CAD drive and organized the rocket assembly. The first folder was my updated CAD of the engine, which included a set of drawings, photos, renders, and notes for new members to gain familiarity more quickly.

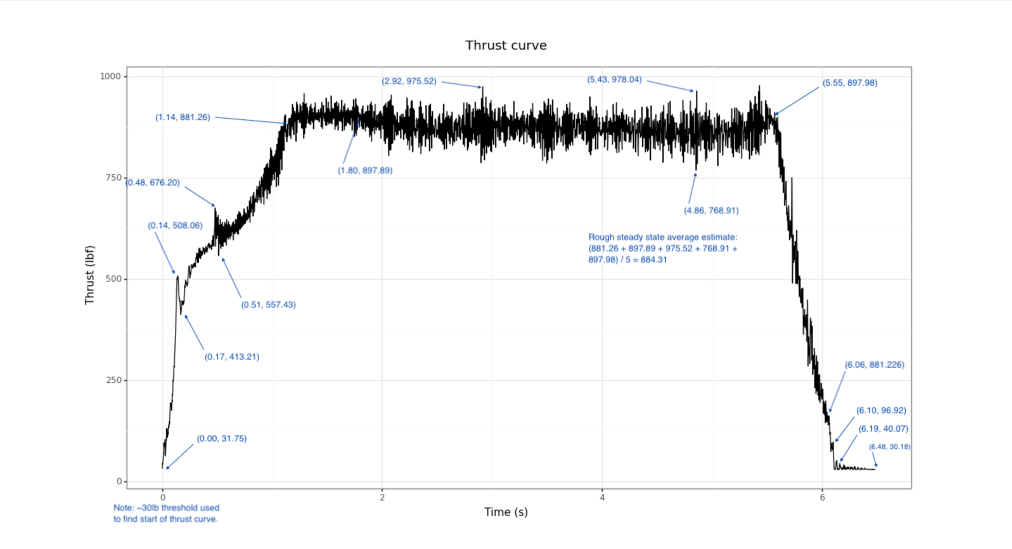
Bulkhead Isogrid

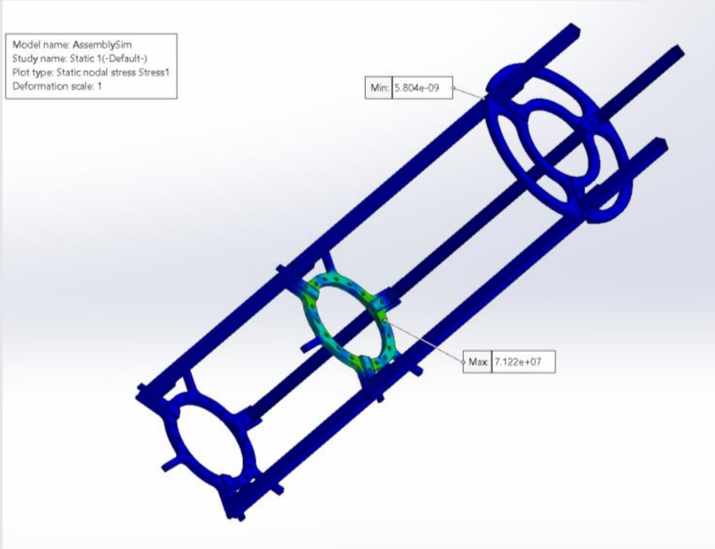
This is the recovery bulkhead, which transfers the shock force of the recovery parachute: axial loading to the internal struts and bending loading to the skins. I completed this task on the school HAAS CNC, and the bulkhead was successful during flight.

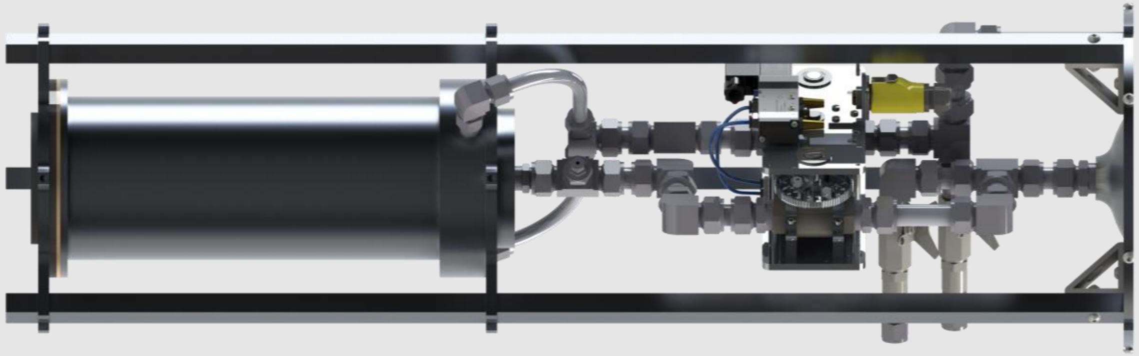
Rocket Erector

This is my design for hoisting the 14ft, 300+ lb. rocket for rapid storage and vertical testing outside the rocket lab. A drill with a 5/8” socket drives a winch that safely hoists the system in under a minute. I manufactured the system with teammate assistance.

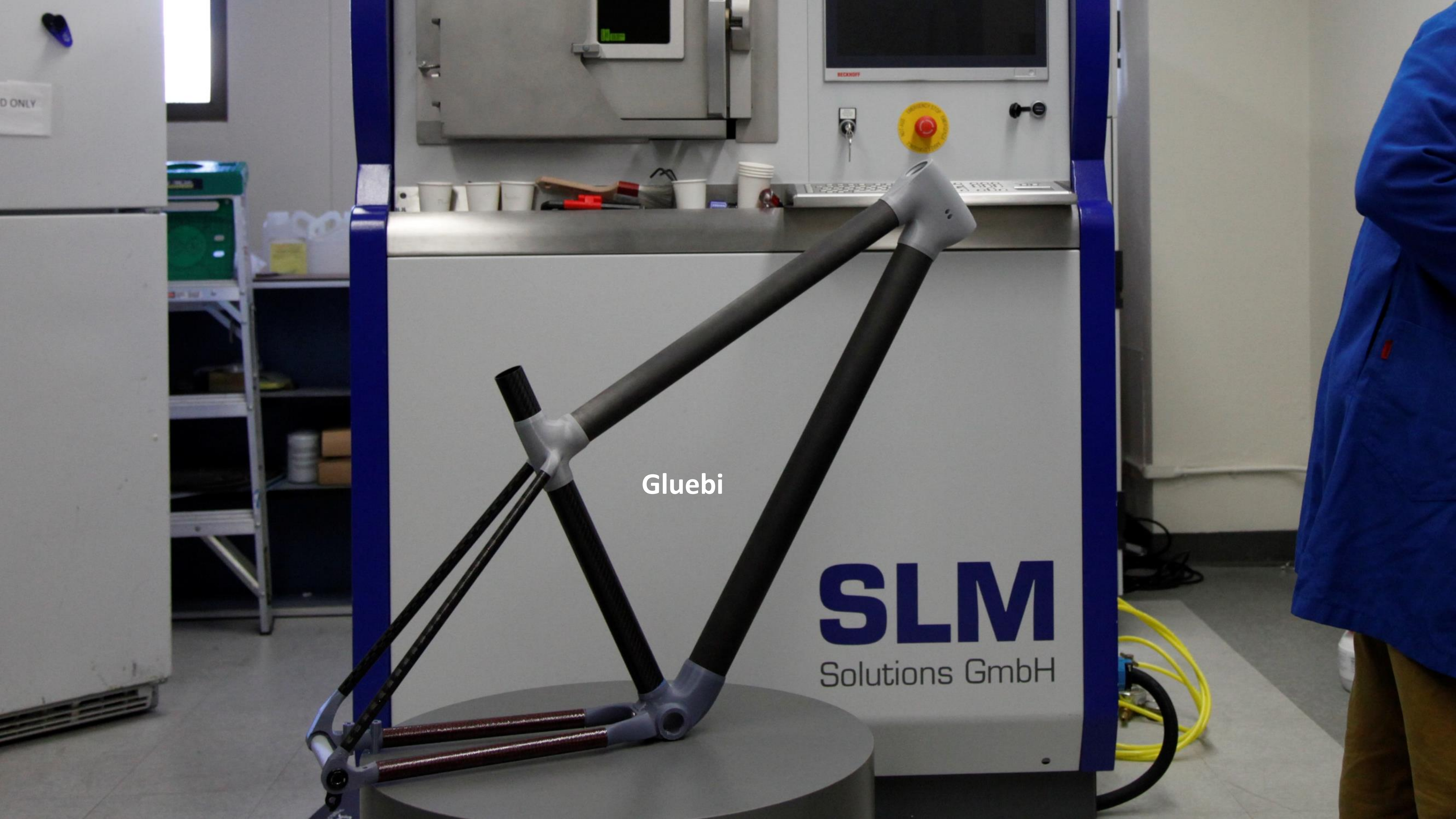
Structural Sim





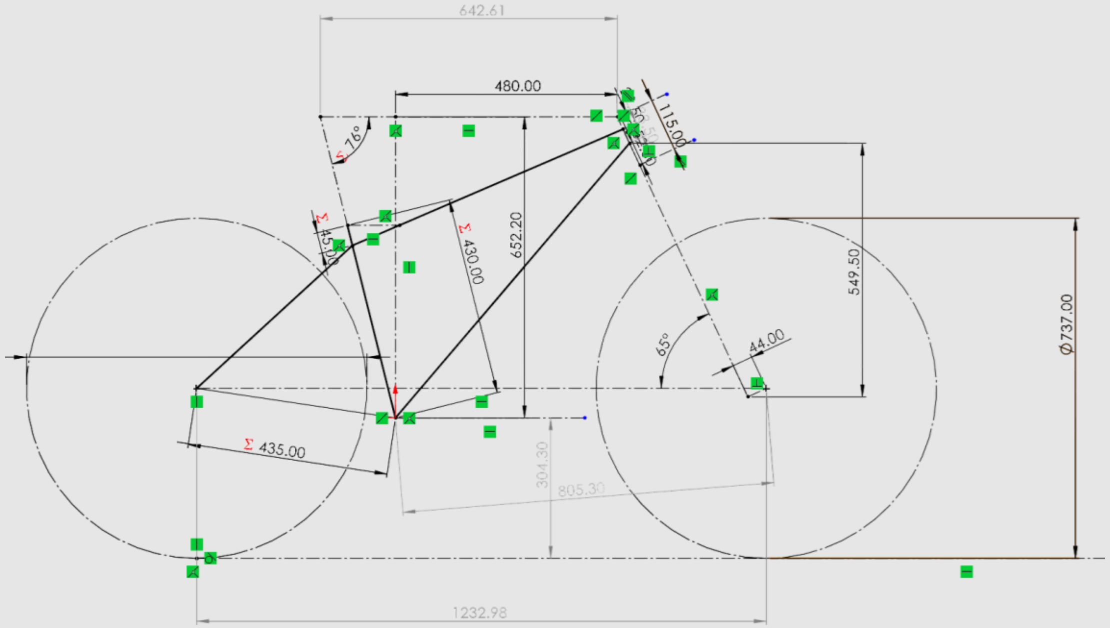


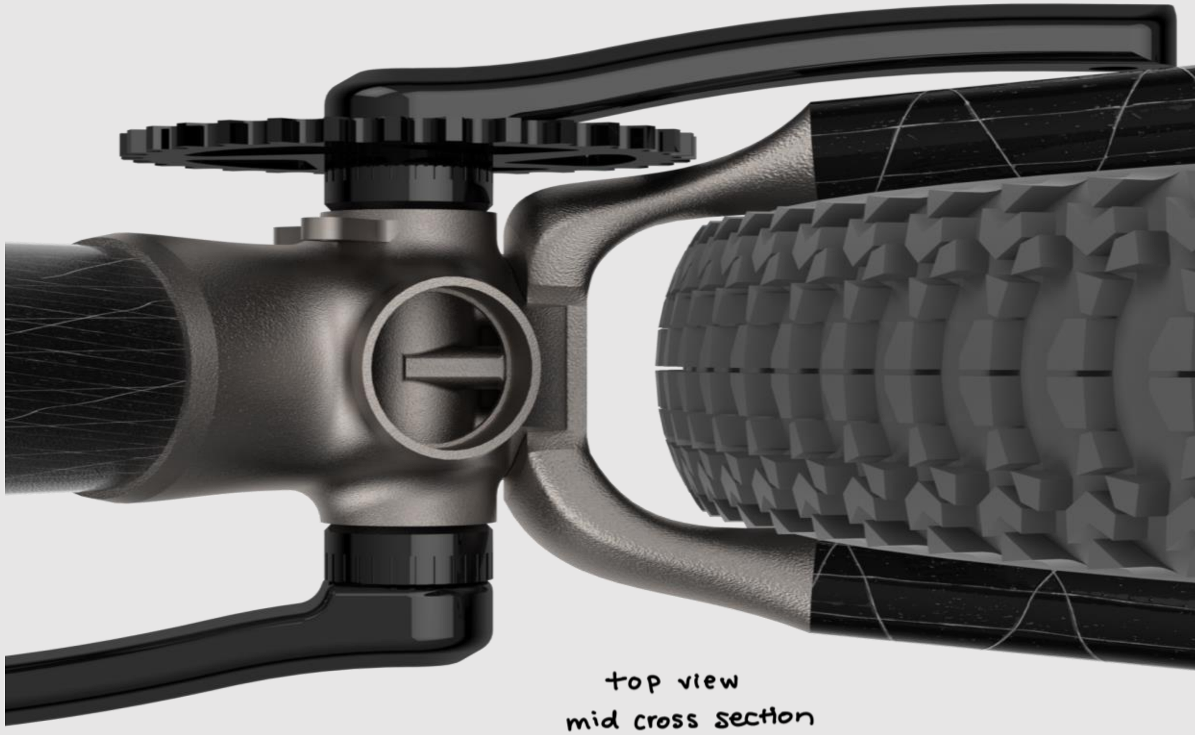
The internal structure simulation checked for buckling and tensile failure under engine and aerodynamic forces. This simulation included the entire rocket structure as well as smaller sections with higher mesh density. The simulation is validated by a rocket launch with no flutter or roll.

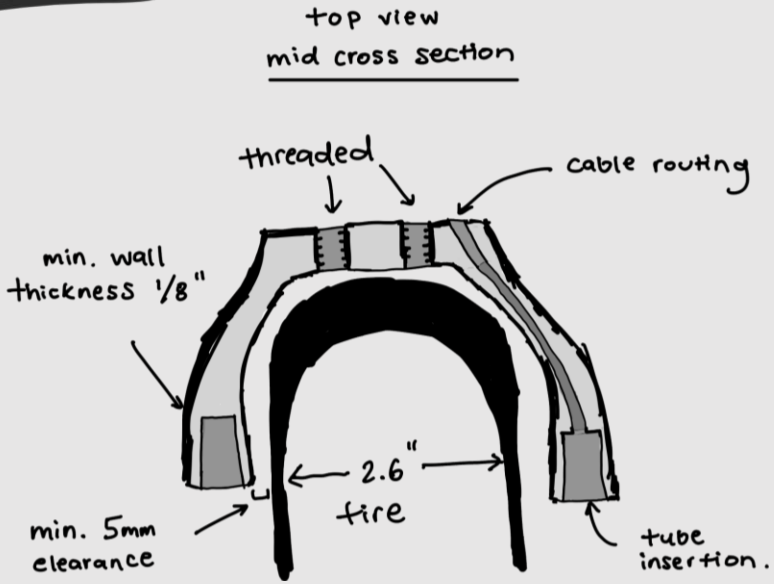

Gluebi
SLM
Solutions GmbH

Parametric CAD & Yoke Design

I developed the yoke to complete the chainstay connection, relying on simulation and industry standards to maintain adequate clearance. The yoke relies on bolts and adhesives to provide the strength and stiffness that a typical welded connection might.

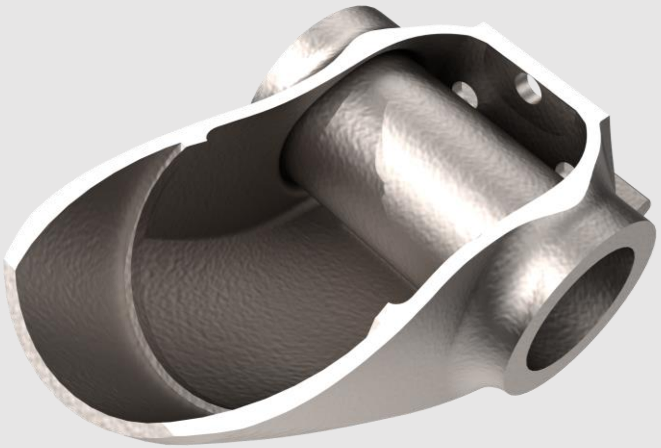


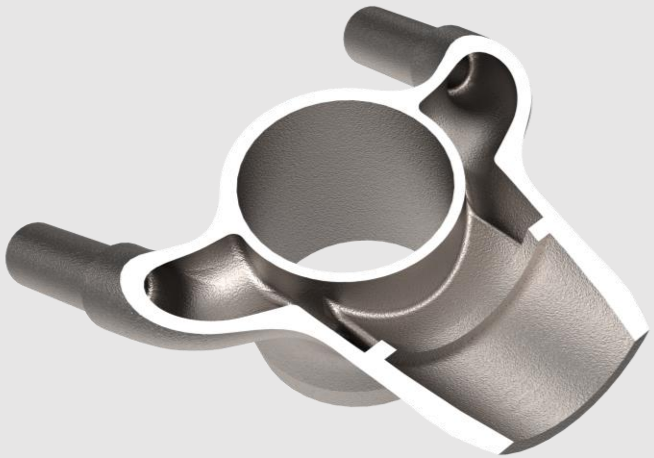




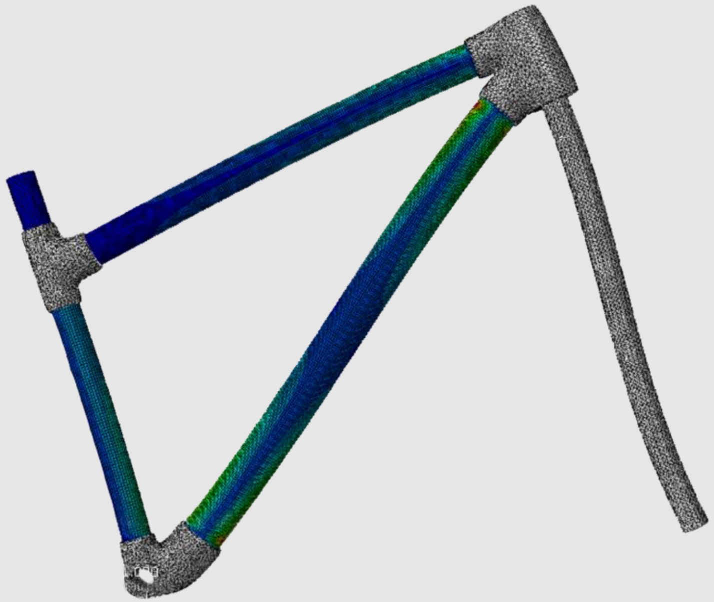
Lug Surface Modeling

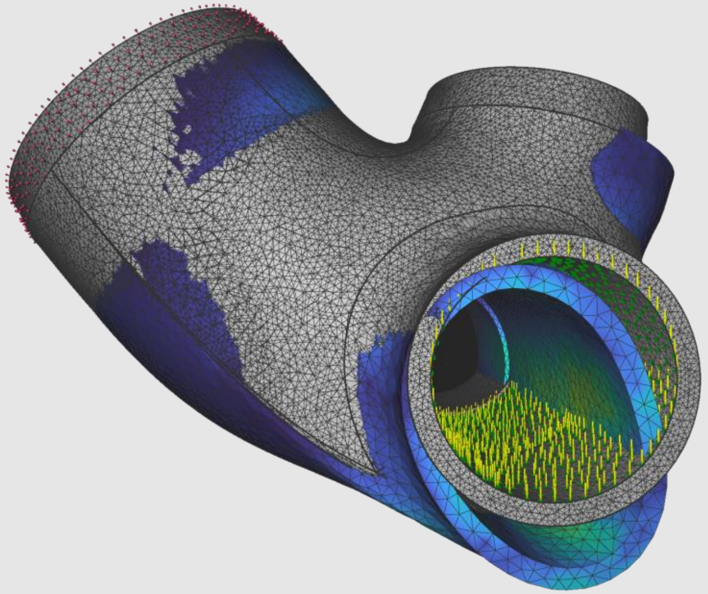
Using complex surface modeling maximizes the benefits of 3D printing and reduces assembly complexity. Despite parts requiring discontinuous surfaces, each part was topology optimized while still retaining design beauty.





Abaqus & nTopology FEA



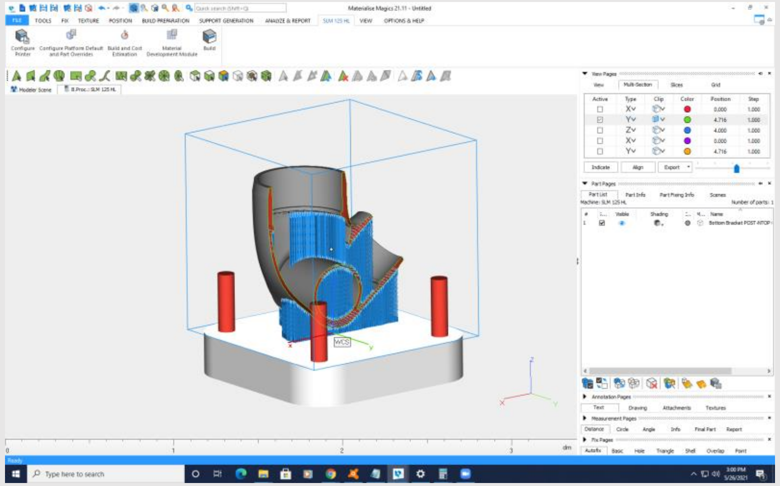


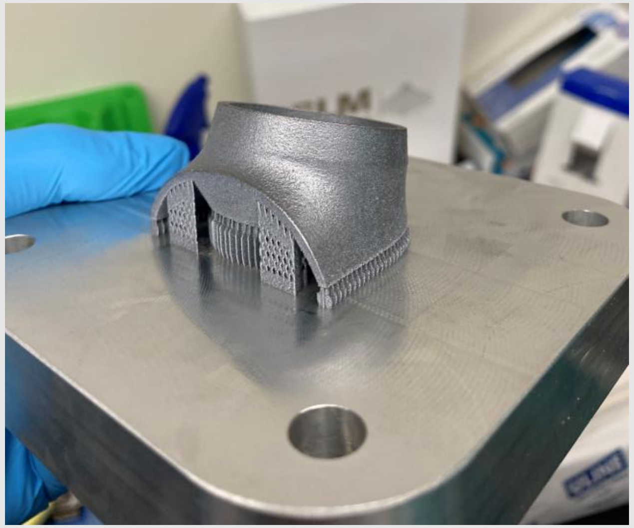
My Abaqus simulation shows the bike frame undergoing a dynamic loading on the fork with a fixed bottom bracket. This simulation illustrates the concentration of forces on the downtube and its torsional strength requirements.

The nTopology simulation prepared by a teammate demonstrates von mises stress given a typical pedaling force of an average rider. The sim aided in surface optimization and conducting shell operations for printing.

The lug has an FoS of 13 while simultaneously maintaining an optimally thin wall thickness. Peak stress occurs at tube interfaces (expected). There is room for optimization in lightweighting and improving vertical consistency.

Prototyping & Manufacturing





The project is completed from a process standpoint as testing has validated critical design choices. Improvements might be made to the design by inspecting density or completing fatigue simulation on complex adhesive joints. Final manufacturing will occur when I gain access to a LPBF machine or have the funding to outsource production.