Engineering Portfolio

Arturo Negrette, June 2025

Table of Contents

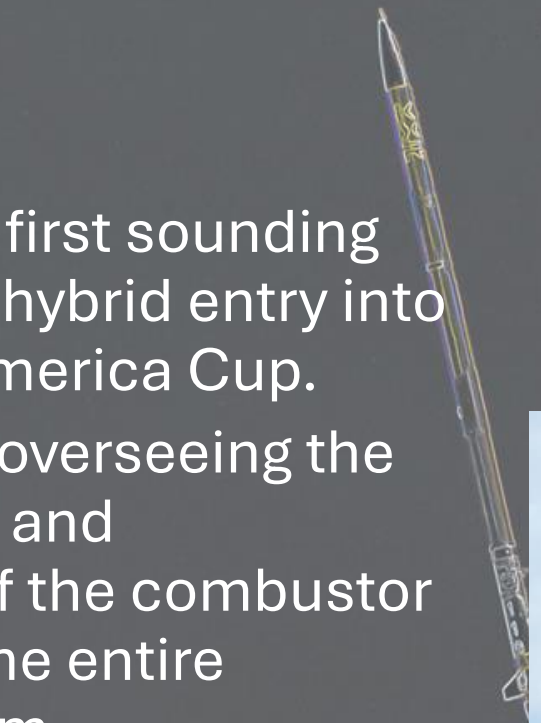
* - Particularly Relevant for Lumafield

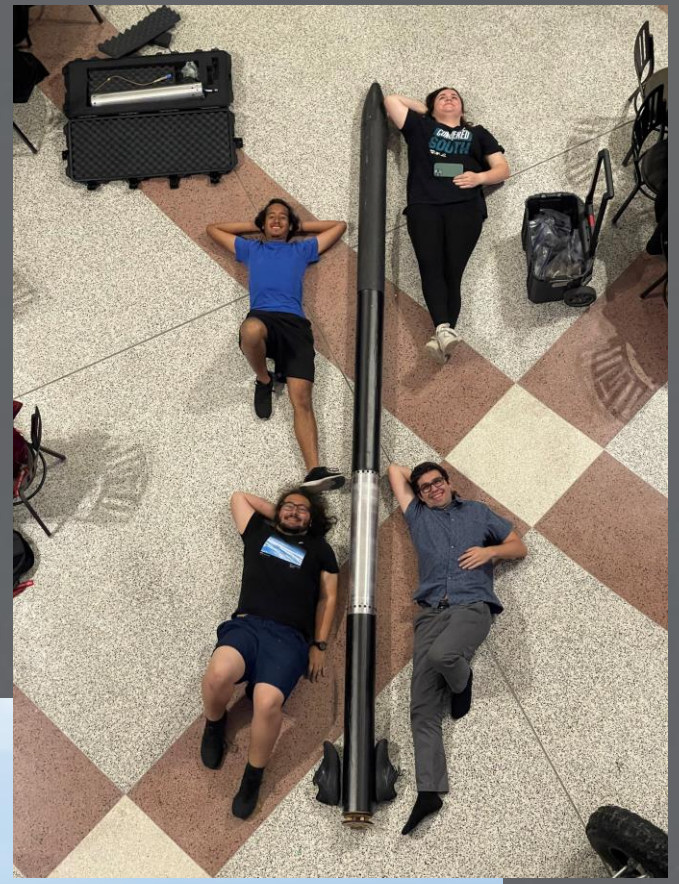
About Me

- About Me
  - Graduated from the University of Central Florida on May 3rd 2025 with a degree in Aerospace Engineering
  - I have 2-3 years of experience in sounding rocketry propulsion and my background focuses in research and development for these systems.

Projects at UCF

- Pegasus
  - Pegasus was my first sounding rocket project, a hybrid entry into the Spaceport America Cup.
  - My role involved overseeing the research, design and manufacturing of the combustor itself, and later the entire propulsion system.
  - Particularly, I spearheaded the development of our fuel grain.





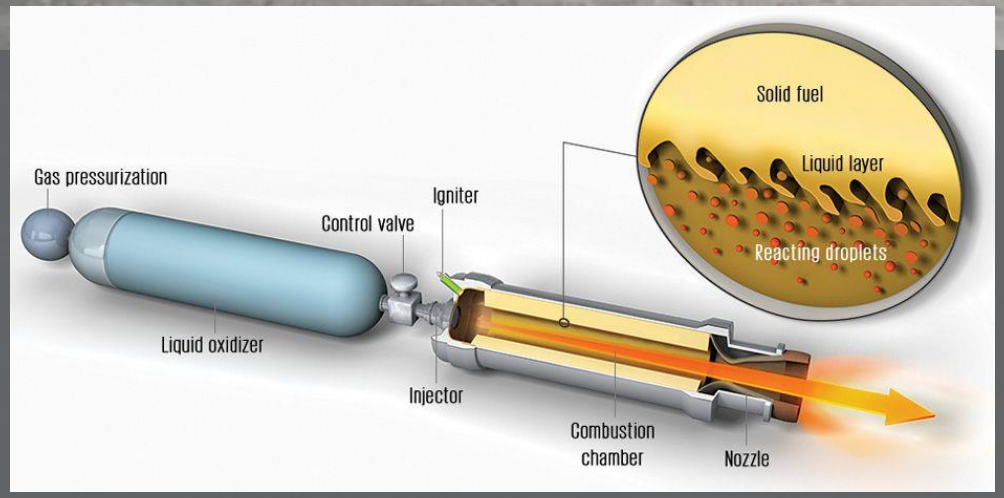


Image Source: IEEE, Emily Cooper

Projects at UCF

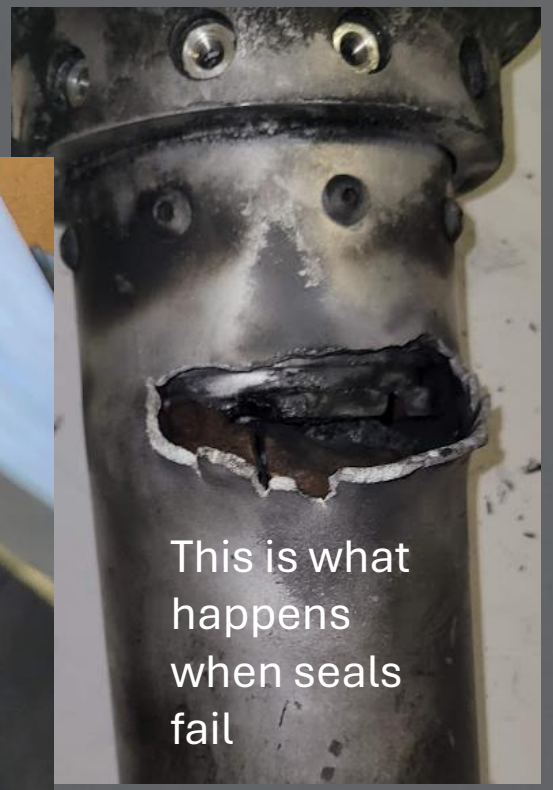
- Pegasus
  - Hybrid rocket motors utilize a solid fuel and a liquid or gaseous oxidizer.
  - They are plagued with fuel grain issues, whether it is mediocre performance or structural failure during a burn.
  - My goal with this new composition was to alleviate performance issues without sacrificing safety or integrity
  - Ultimately, I combined techniques from candle-making to stabilize the paraffin which allowed me to increase its concentration in the fuel without losing structural integrity.

Projects at UCF

- Helios
  - Project Helios is an upgraded version of Pegasus, aiming for better performance for higher altitudes.
  - Helios for the most part focused on improving pain points from Pegasus in terms of operation and performance.
  - Additionally, a new purpose-designed avionics system was adopted, for which I designed the harnesses connecting the various components.

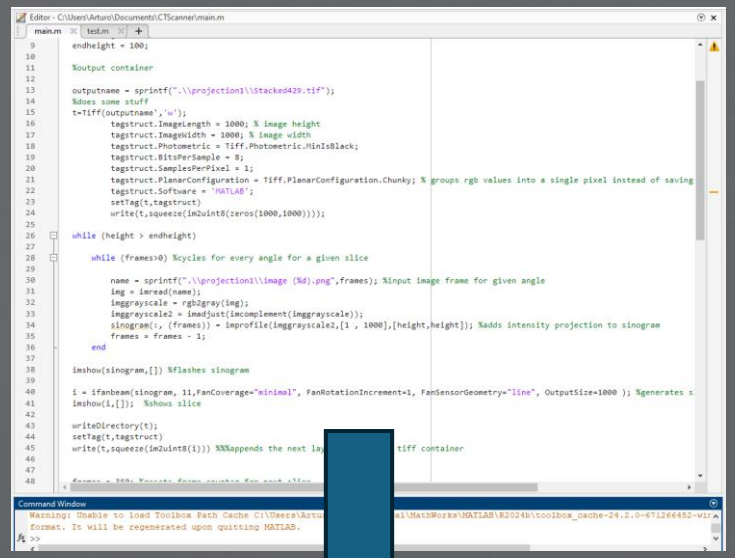
Projects at UCF

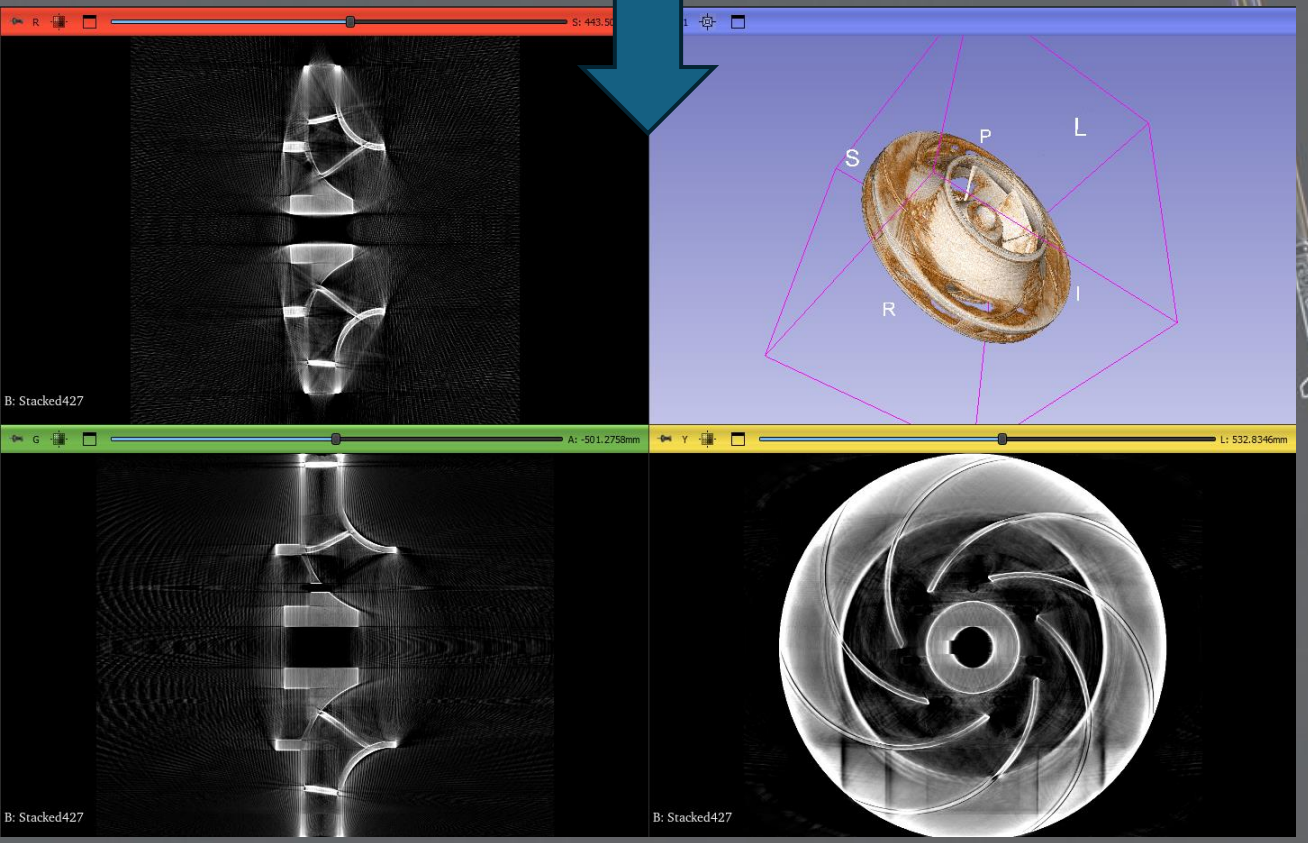
- Helios
  - Particularly, inter-part seals were the focus, as well as overall ease of assembly.
  - Minimized hard to access fasteners and fittings, with an overall focus on how tools interact with the assembly.



Personal Projects

- Radon Transform Code
  - After graduating, I decided to pursue a fascination I've had: How do CT Scanners work?
  - One of my best friends was independently working on a small-scale X-Ray imaging setup, although with no plans of image processing.
  - My goal became to develop the back-end software necessary to process the images into usable 3D models.



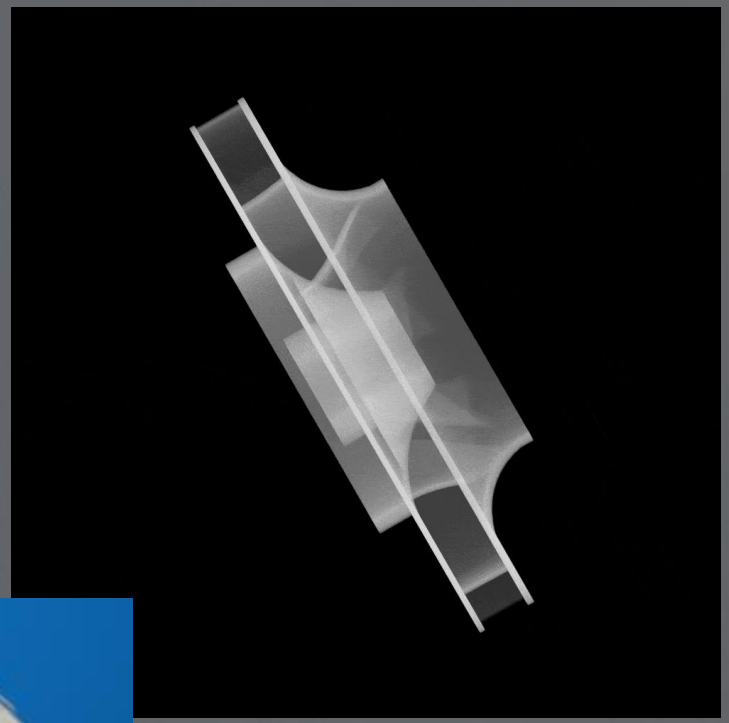


Personal Projects

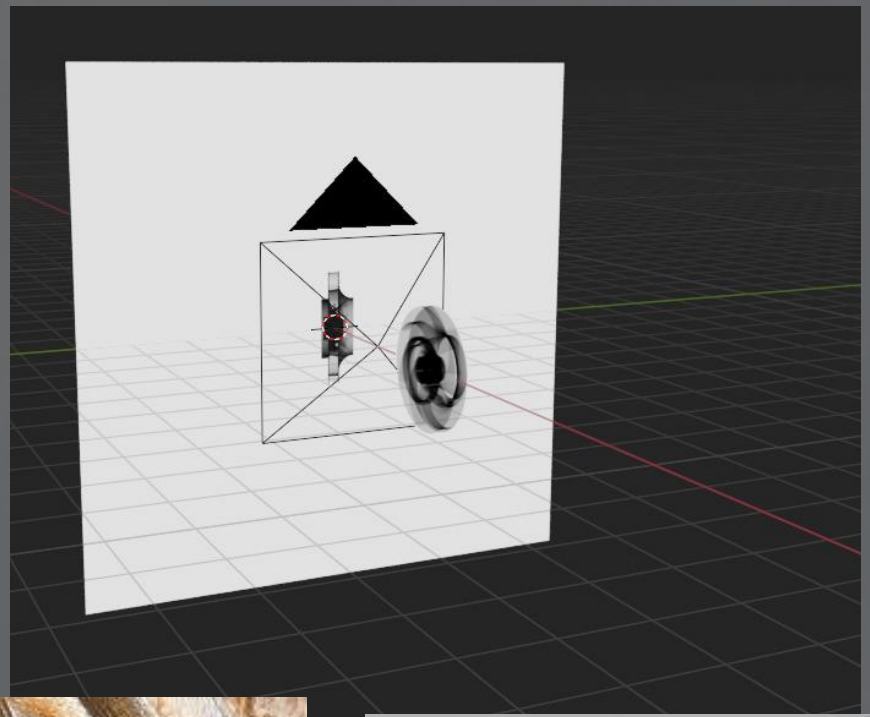
- Radon Transform Code
  - Using what I had learned throughout my degree and from my own research, I developed a Matlab application that used the Radon transform function to generate a slice stack to feed into medical CT display software.
  - It receives 360 .png files, processes each row of pixels for each angle through an inverse radon transform to recover a slice, and outputs each slice to a multi-page .tiff.

Personal Projects

- Radon Transform Code
  - In order to even begin to test my code, I needed sample xrays.
  - Our xray imaging setup was (and isn't) ready yet, so I came up with the next closest equivalent.
  - In Blender, I raytraced light scattering through a volume with the shape of a couple 3d models I had laying around / made myself.



I also found out what happens when things aren't aligned correctly!

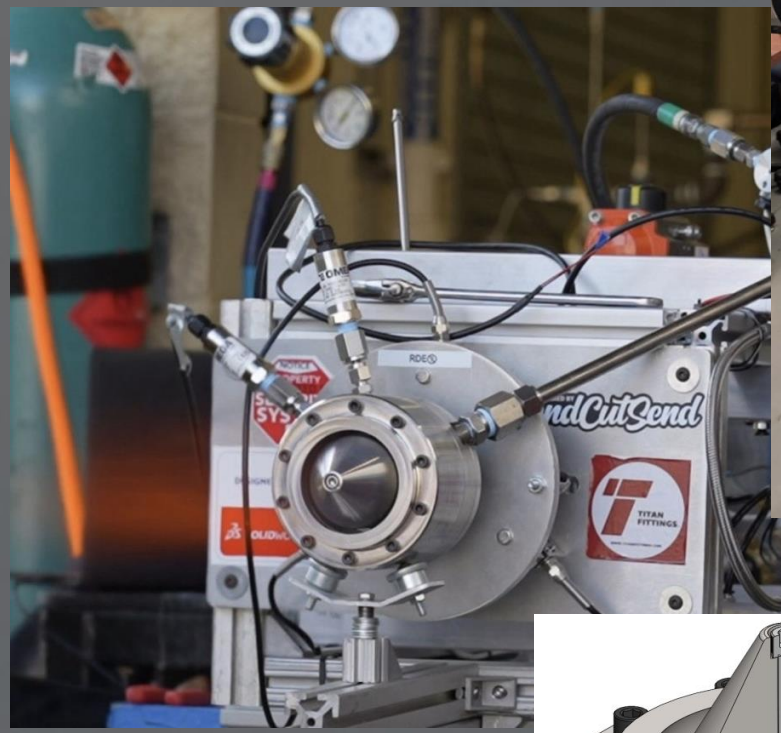


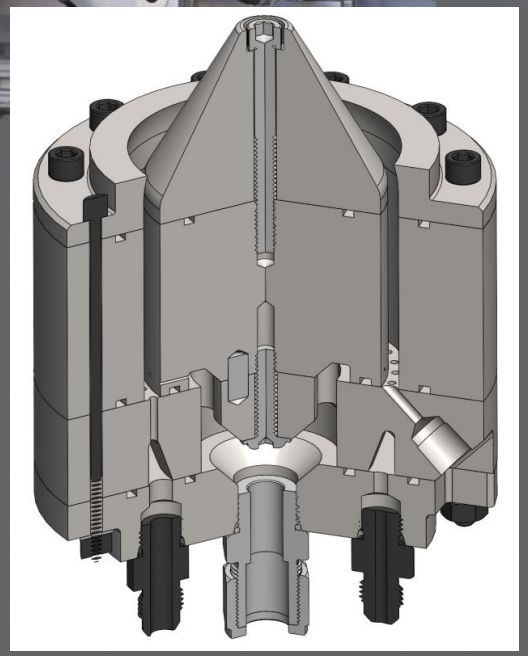
Personal Projects

- Radon Transform Code
  - While they sufficed, I still believed there was a source of blur somewhere that I could not fix, so I got creative.
  - I recreated the real setup in Blender, in terms of having the shadow of the object project on a screen.
  - This led to a sharp quality increase, down to being able to identify details like lettering on the model.

Personal Projects

- Radon Transform Code
  - Future plans:
    - Finish the xray side of things to continue validating the post-processing code.
      - Power supply, shielding, control electronics.
    - Research further into identification of materials based on density
    - Improve noise removal and filtering to get rid of ghosting in the 3d model output.



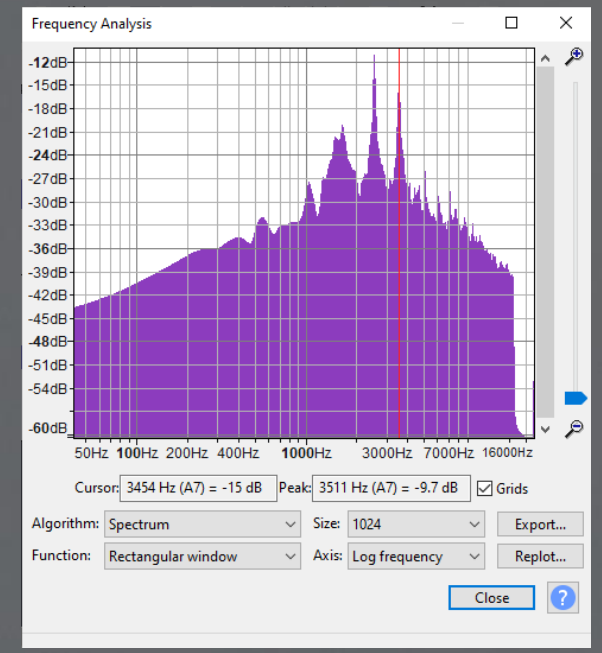


Senior Design

- RDE
  - For my senior design project, me and my team chose to produce a Rotating Detonation Engine (RDE).
  - The working principle involves a supersonic combustion process, which releases more energy from a given amount of fuel.
  - Our goal was to create a small-scale, air-breathing system centered around integrating with a flight vehicle (plane, missile).

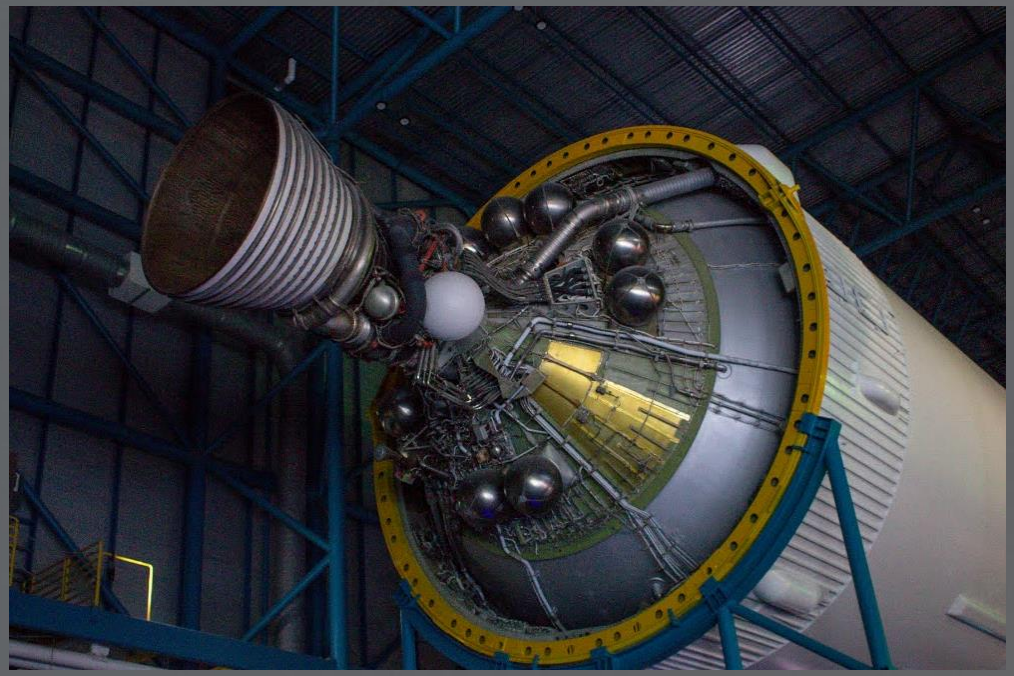
Senior Design

- RDE
  - My role was ignition and later diagnostics and data post-processing.
  - In terms of ignition, I created the torch igniter and its supporting systems (particularly the spark driver circuit)
  - For data analysis, I processed audio to find the operating mode based on the pressure oscillations generated by the rotating shockwave



Hobbies

- Amateur Radio (KO4YIX)
- Videography / Photography
- Machining



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