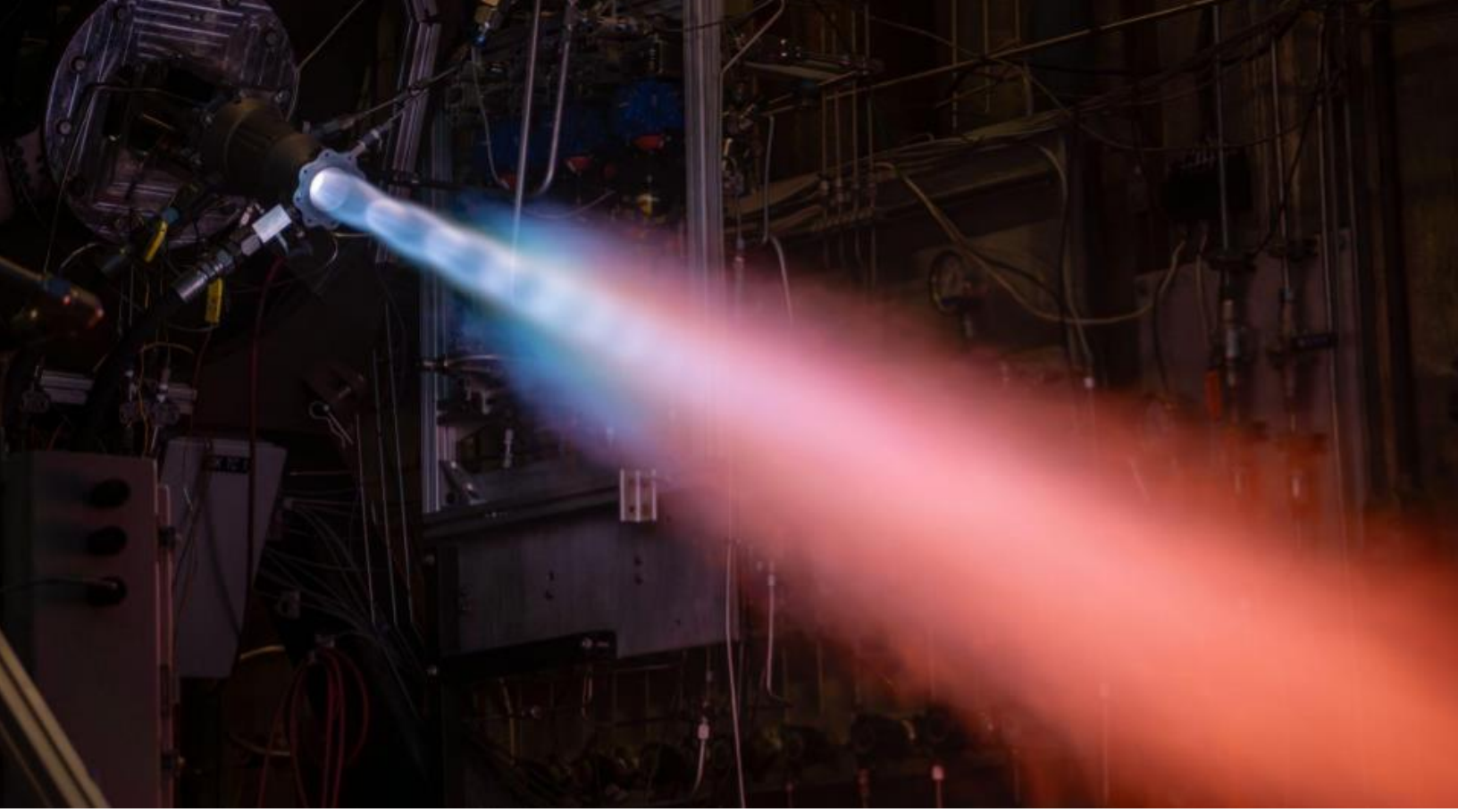
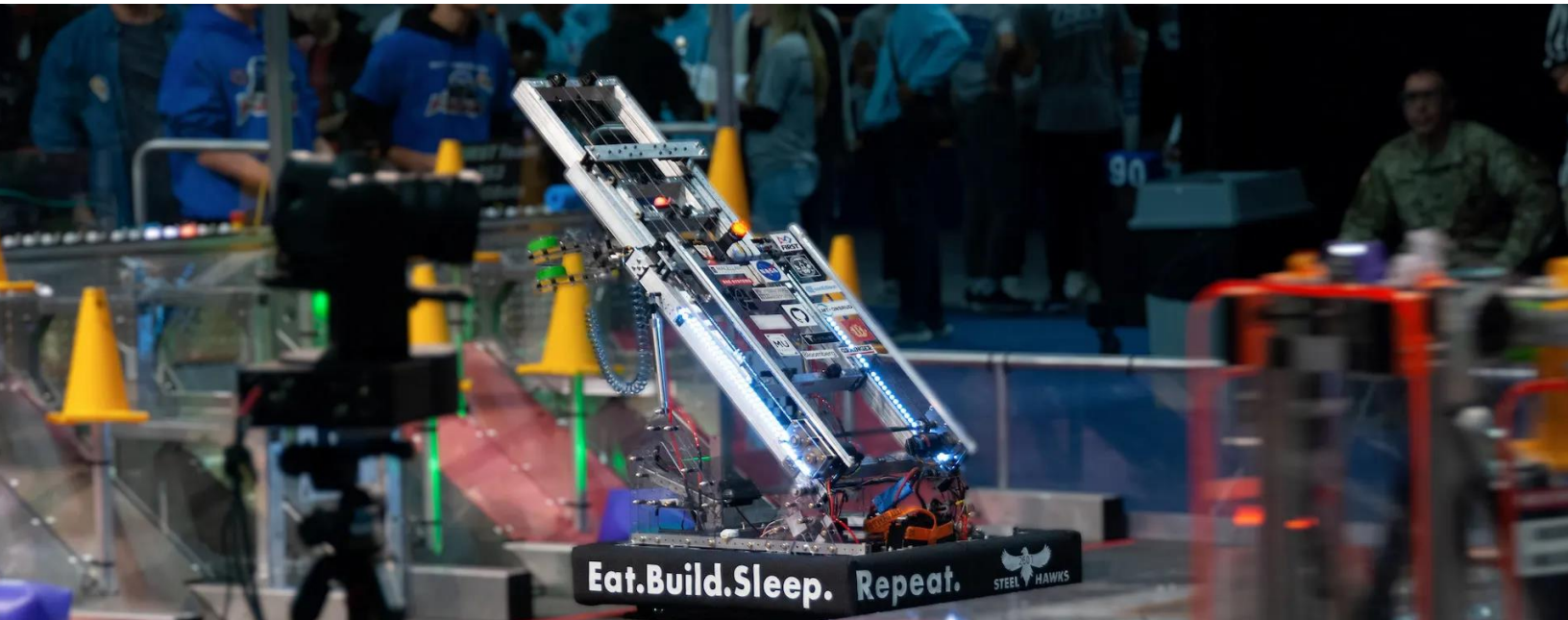


Maker/Engineering Portfolio

Nickolas Koe | B.S MechE Purdue University, 2028
(646) 726-7801
nkoe@purdue.edu

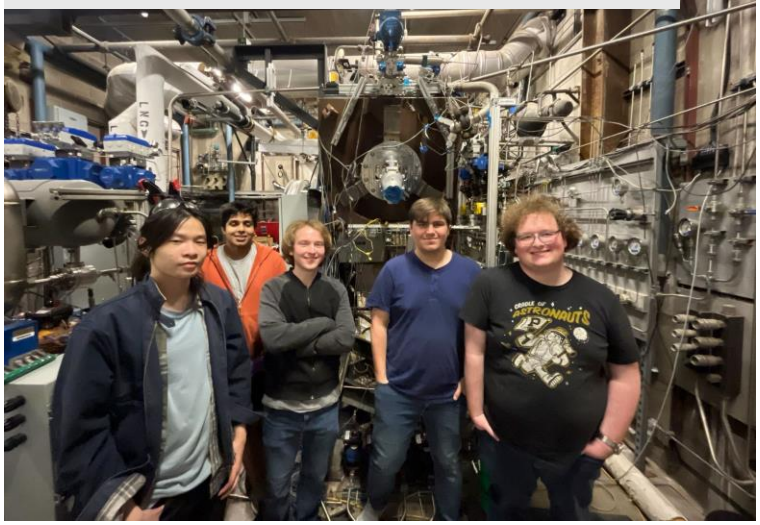


TADPOLE Engine & Torch Buildup/ Test Ops

(Purdue Space Program – Active Controls)

Bending tubes for TADPOLE

Ops crew after mounting TADPOLE to the stand



Torch testing assembly

TADPOLE 1st hotfire!

During Fall 2024, I assisted in Purdue Space Program's torch testing campaign; and following the integration of the torch onto the team's TADPOLE engine, joined the engine qualification testing campaign throughout Spring 2025.

Tasks:

- Tube bending, flaring, and assembly according to engineering drawings
- Leak-checking and troubleshooting of high-pressure gas lines
- Manufacture (CNC) and assembly of throttle valve mounts and subcritical venturi flowmeters

Results:

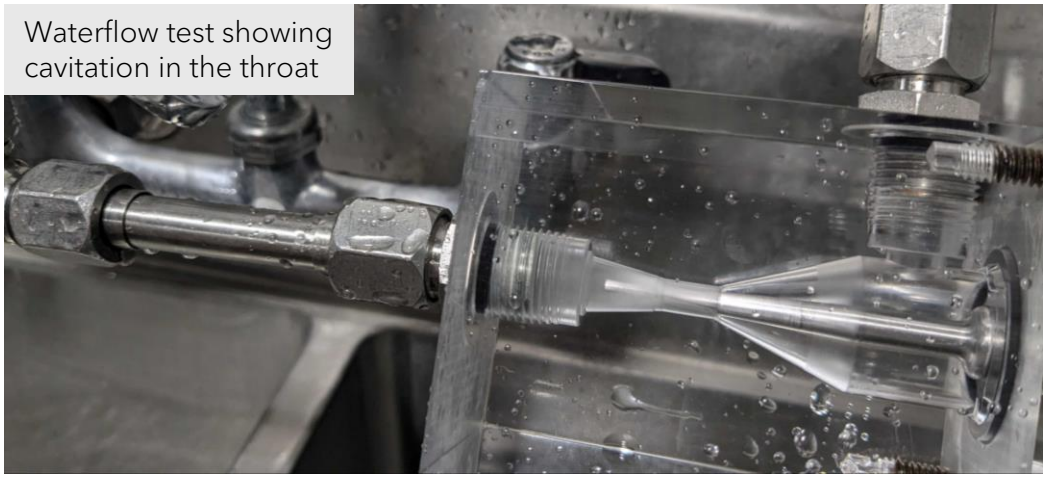
Test setups enabled:

- Successful torch ignitor testing and integration with engine.
- 16 static hotfires (of up to 20 seconds) to validate engine reusability
- Successful throttled hotfire following a +- 5% thrust curve, winning the team a $15K award.

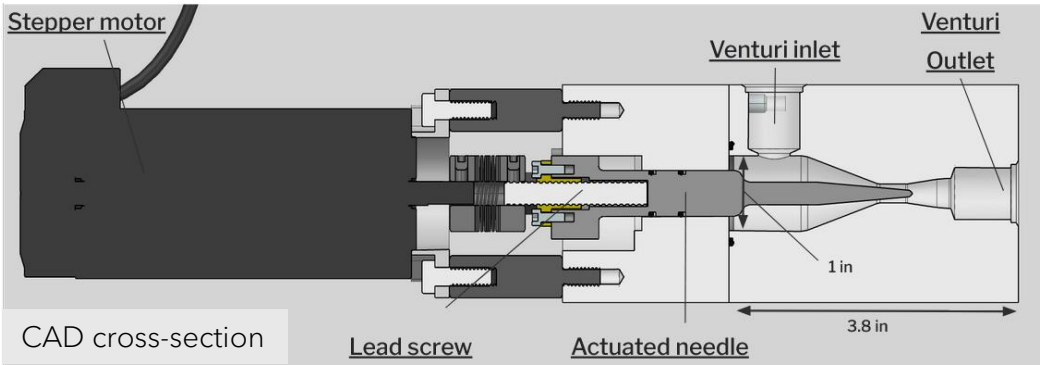
Variable-Area Cavitating Venturi

(Purdue Space Program – Active Controls)

Waterflow test showing cavitation in the throat



Full VACV assembly



CAD cross-section

In Spring 2025, I took over the development of a motor-actuated variable-area cavitating venturi throttling system for Purdue Space Program's 550-lbf liquid bipropellant engine. While the project has since been shelved in favor of using motor-actuated ball valves due to limited development time, initial prototyping showed promising results.

Tasks:

- Sized and designed dynamic and static seals.
- Sized and selected leadscrew + stepper motor.
- CAD of all components + assembly
- CAM & fabrication of parts on CNC mills and lathes

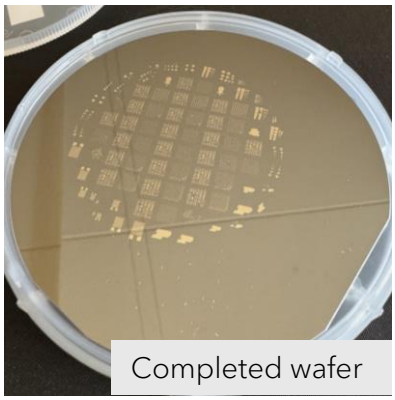
Results:

- Concept demonstration prototype fully operational
- Cavitation validated in low-pressure tests, preliminary Cd values determined
- Pending completion of high-pressure water test rig for high-pressure testing.

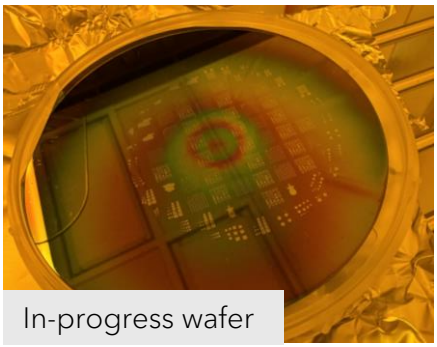
STARS Semiconductor Manufacturing Research

(Birck Nanotechnology Center – Purdue University)

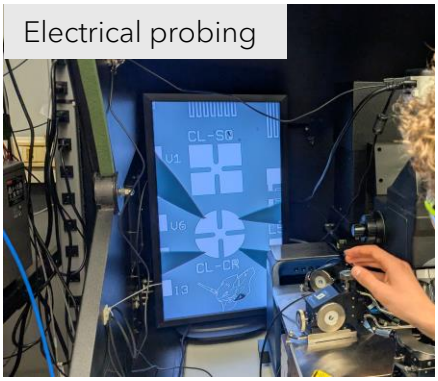
Metallization evaporator operation

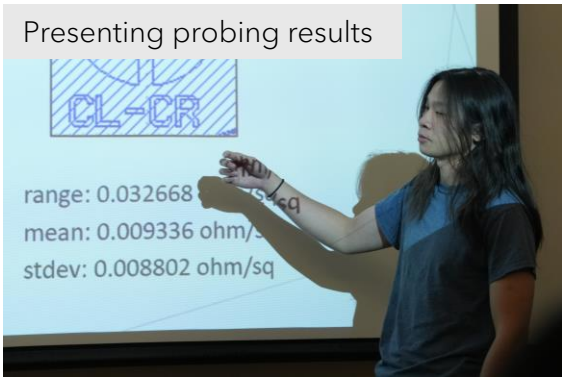


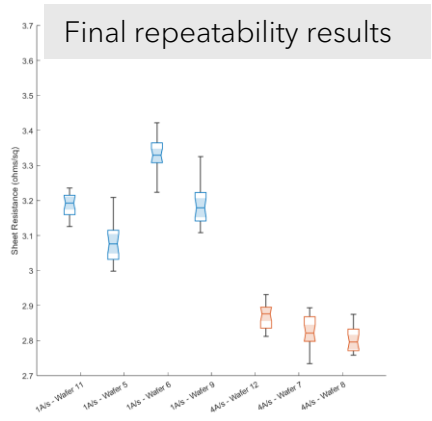
Completed wafer



In-progress wafer







As part of Purdue University's Summer 2025 STARS (Student Training, Awareness, and Readiness for Semiconductors) program, I participated in semiconductor manufacturing research at the Birck Nanotechnology Center, working to better characterize the metal film deposition ("metallization") process used at the Center to improve future research.

Tasks:

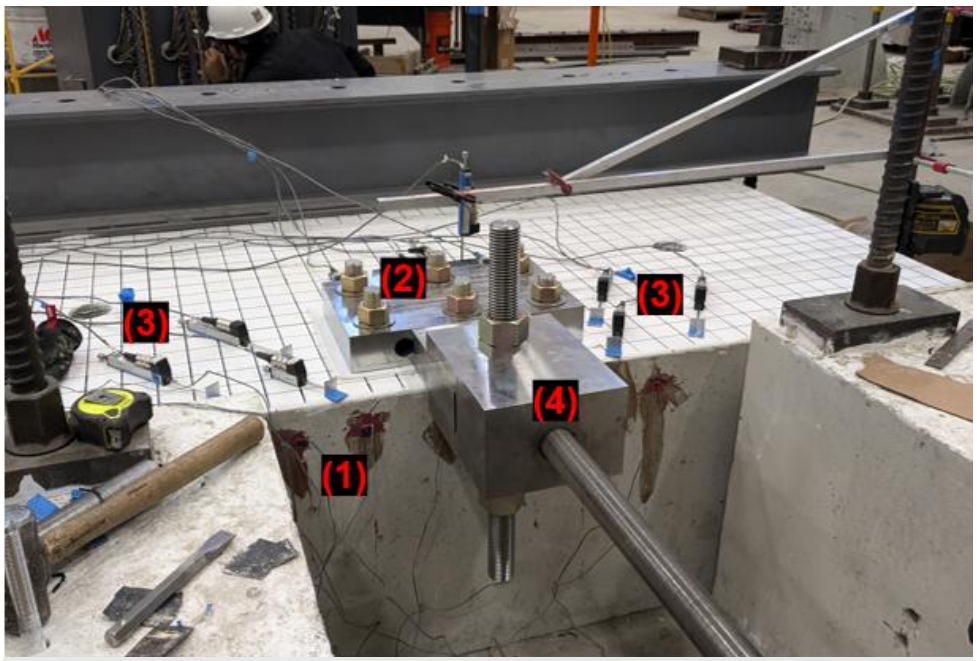
- Designed experiment and custom microelectronic test pattern to test sheet resistance repeatability of metallization.
- Utilized photolithography and metallization equipment to fabricate 7 wafers.
- Performed 1800+ electrical and optical measurements; developed a MATLAB script to process the data

Results:

- Successfully fabricated and characterized 7 wafers.
- Determined preliminary statistical process control bounds for the metallization process at two different deposition rates.
- Documented findings, processes, and remaining work for future teams.

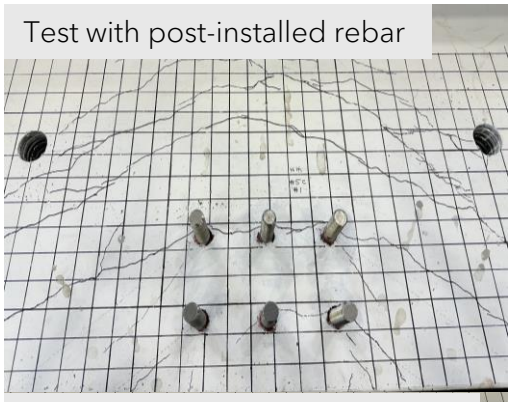
Reinforcement of Anchors Under Shear Loading

(Bowen Laboratory for Large-Scale Civil Engineering Research)

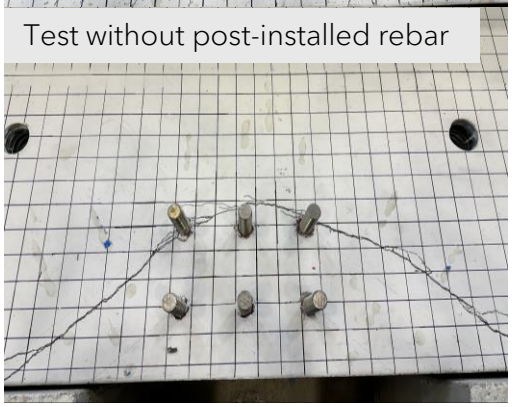


Test Setup: 1) Post-installed rebars (embedded in block); 2) Post-installed anchors; 3) Potentiometers; 4) Connection to hydraulic actuator

Test with post-installed rebar



Test without post-installed rebar



As part of the First-Time-Researcher Fellowship class of Spring 2025, I worked in Dr. Akanshu Sharma's group on the testing of post-installed rebar tensile members to reinforce anchors loaded in shear to validate theoretical models.

Tasks:

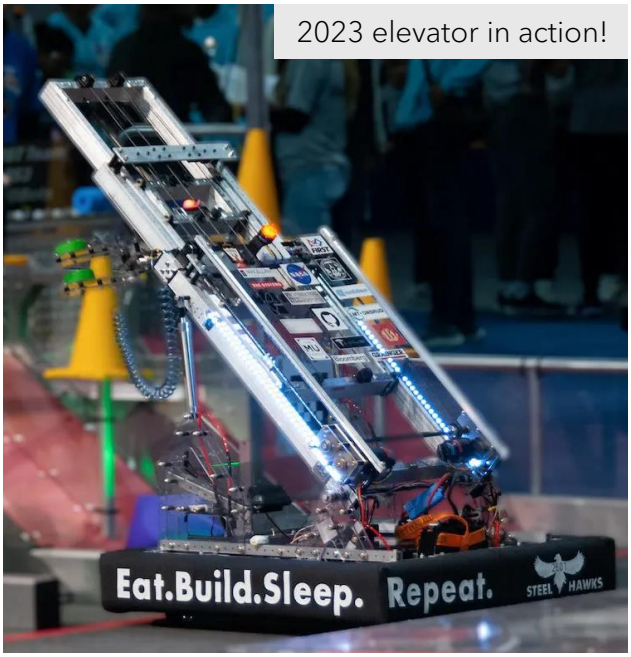
- Prepared reinforced concrete samples (rebar bending, tying, and casting of blocks; drilling and epoxying for post-installed anchors)
- Assembled and assisted in the operation of hydraulic test setups

Results:

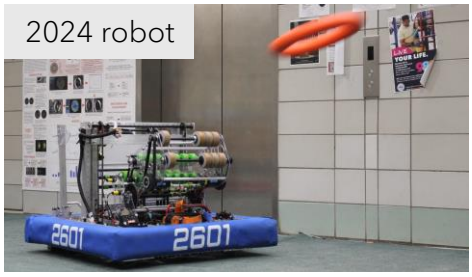
- It was found that the post-installed rebars could improve the ultimate capacity of the anchors by up to 220%.
- Presented research poster at the Spring 2025 Undergraduate Research Conference

FIRST Robotics Competition

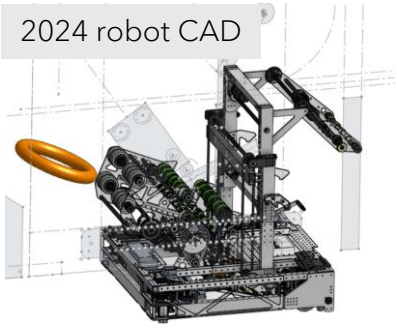
(Team 2601 – The Steel Hawks)

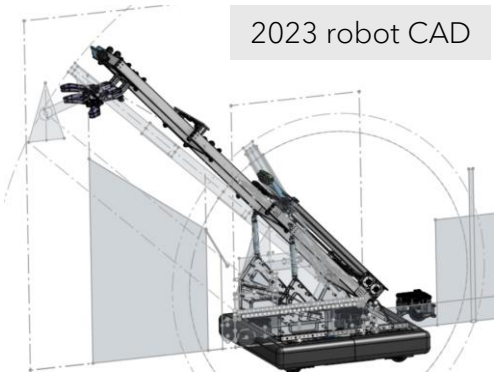


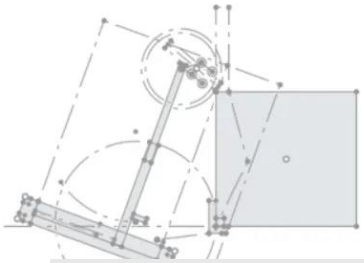
2023 elevator in action!



2024 robot


2024 robot CAD


2023 robot CAD


2024 layout sketching

As the Head of Design for 2023 & 2024, I led the rapid development of our large-scale competition robot. I was responsible for defining and managing our ideation and CAD processes, as well as coordinating design/fabrication/ testing timelines with the team's electrical, mechanical, and programming departments.

At both the system and component levels, I pushed for simple solutions and multi-functional designs to minimize cost, development time, and weight.

Tasks:

- Overhauled CAD process to use top-down design and layout sketches, allowing for rapid design iteration.
- Implemented agile workflow to enable rapid testing and improved collaboration between teams.
- Led full-system integration and guided subsystem/component design for 2024 competition robot
- Owned design and integration of primary elevator mechanism in 2023 competition robot.
- Trained team members in CAD and mechanical design

Results:

- Industrial Design Award (NYNY 2024) & the Quality Award (NYNY 2023).
- 200% growth in design team membership.
- Best team performance in history, ranking 5th (2023) and 6th (2024) in New York State.

Parallel-Axis Tripteron

(Personal Project)

During Summer 2024, using parts from a dumpster-bound 3D printer, and inspired by this video: https://youtu.be/6EtXycVGJg4, I designed, assembled, wired, and programmed controls for a Parallel-Axis Tripteron from scratch.

Tasks:

- Designed system in CAD, 3D printed parts, assembled and wired everything together.
- Developed basic control algorithm by modelling each slider as a plane constrained to move along the slider axis and the intersection point as the "head" of the robot. Given desired coordinates of the head, slider positions could be back-calculated and sent to stepper motors.

Results:

- Working frog-robot, able to do linear movements between two points! Demo link: https://youtu.be/7AQ2jnR9hsM
- Control code available at: https://github.com/BoredlyGit/Tripteron/blob/master/main.py