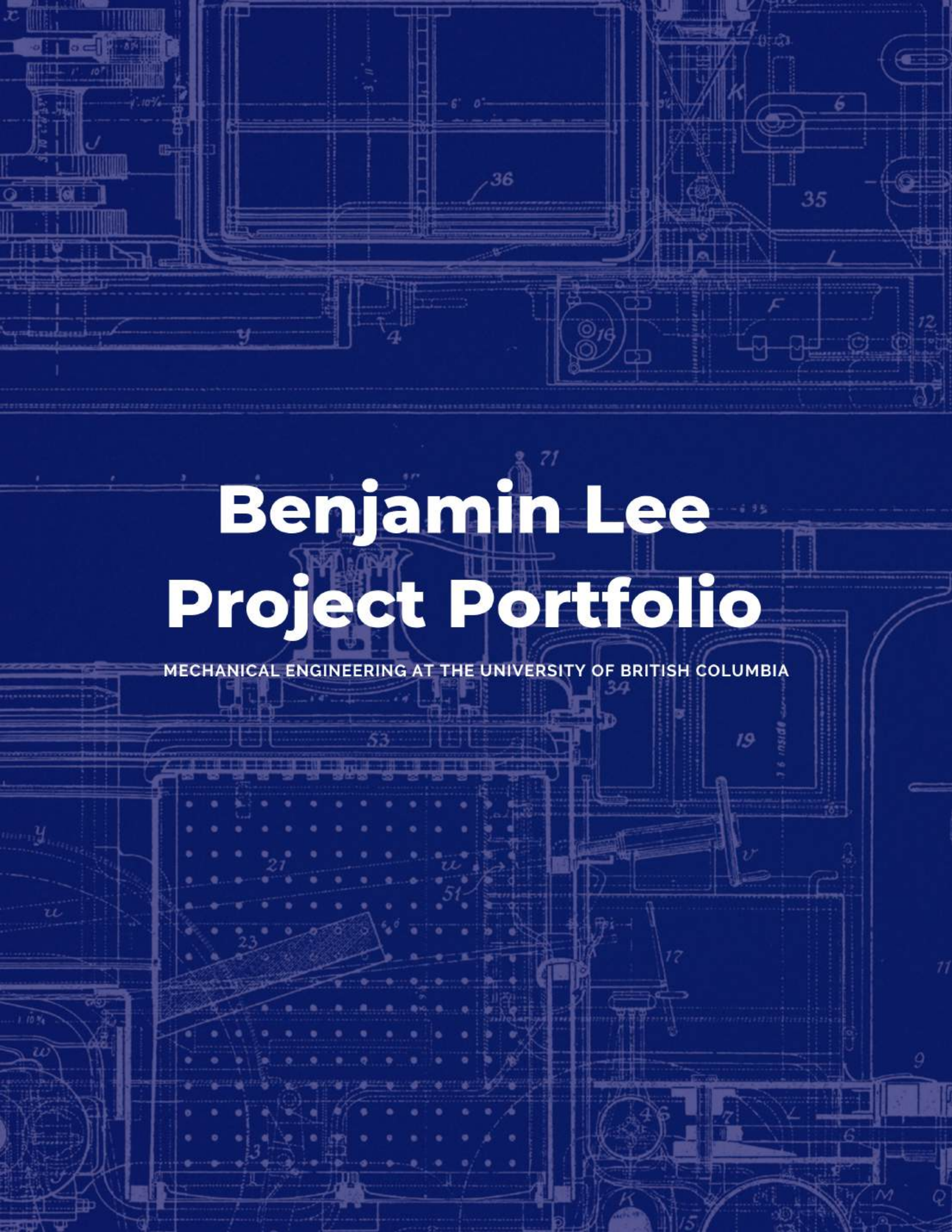
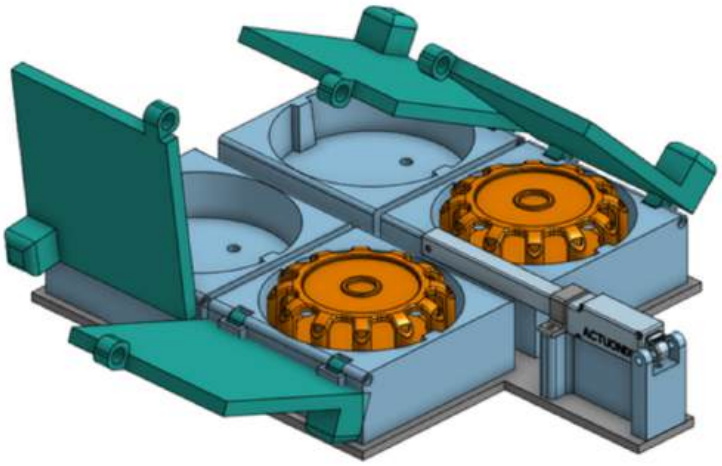


Benjamin Lee
Project Portfolio

MECHANICAL ENGINEERING AT THE UNIVERSITY OF BRITISH COLUMBIA

UBC UAS Design Team: Firefighting/Payload Delivery



What?

- Autonomous quadcopter drone capable of performing tasks for both AEAC and SUAS competition
- Hot swappable water intake/deployment and package delivery payload

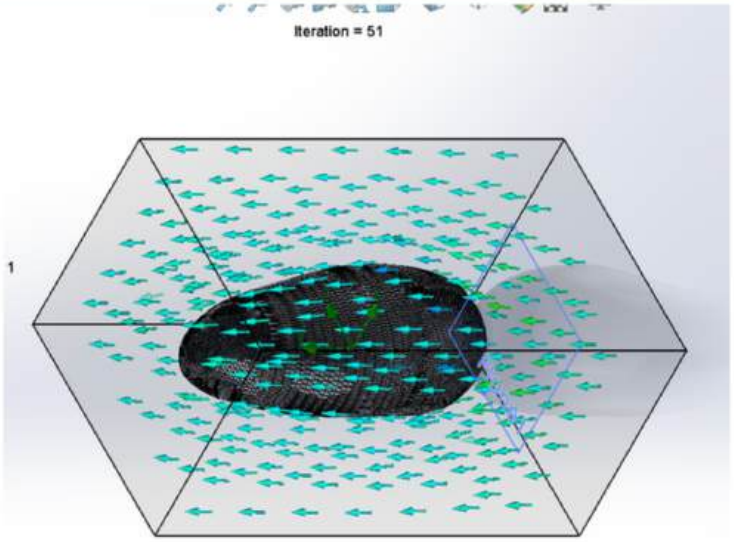
How?

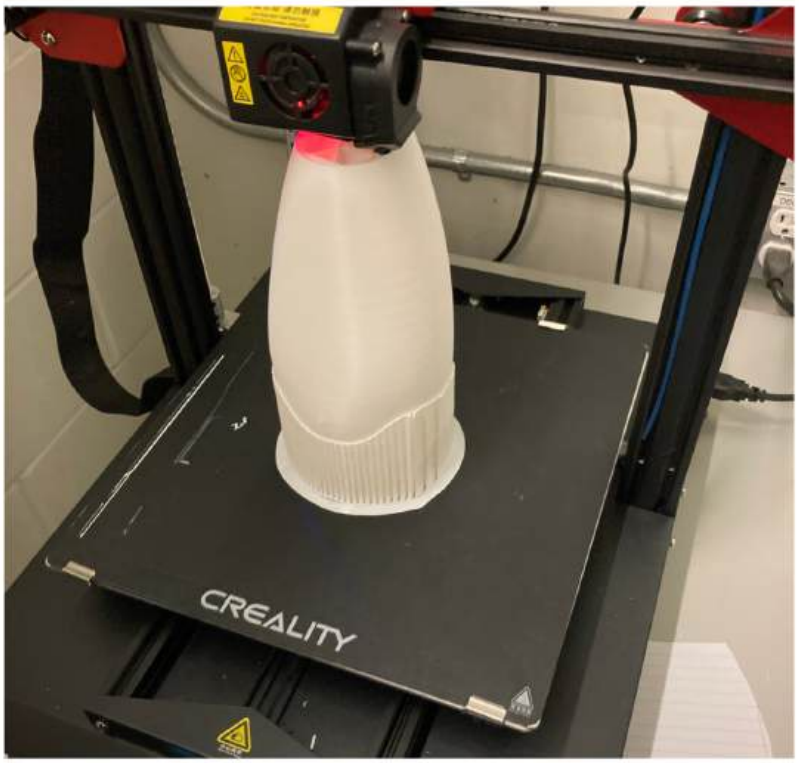
- Designed parts, assemblies, and test fixtures in **CAD** software
- Worked with cross-functional teams to integrate electrical components (actuators, sensors)
- Rapid prototyping using 3D printing, waterjet cutting, and laser cutting

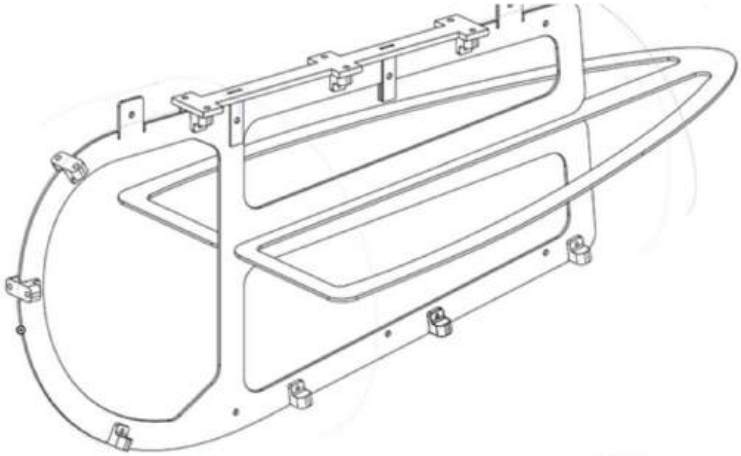
Results

- Achieved 2nd place at AEAC 2025 out of 15 teams
- Reduced production cost of drone by 20%
- Trained newer members design best practices to carry forward in future designs

UBC UAS Design Team: UAV Airbus







What?

- National AEAC Competition passenger transport VTOL UAV piloted autonomously
- Worked on aircraft cabin that seats 4 Barbie Dolls and 2kg of cargo

How?

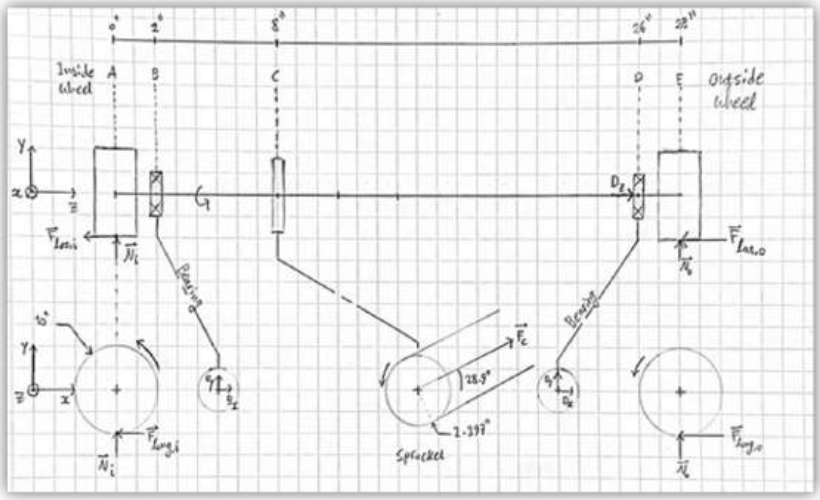
- Used **SolidWorks/OnShape** to **CAD** cabin components, test mounts, and carbon fibre layup molds
- Conducted **FEA** and **CFD** in SolidWorks to optimize cabin structure and aerodynamics
- Rapid prototyping using 3D printing, waterjet cutting, and laser cutting

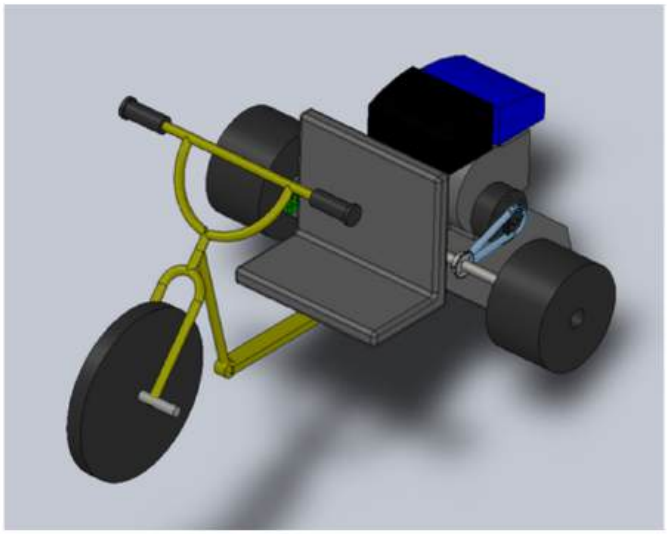
Results

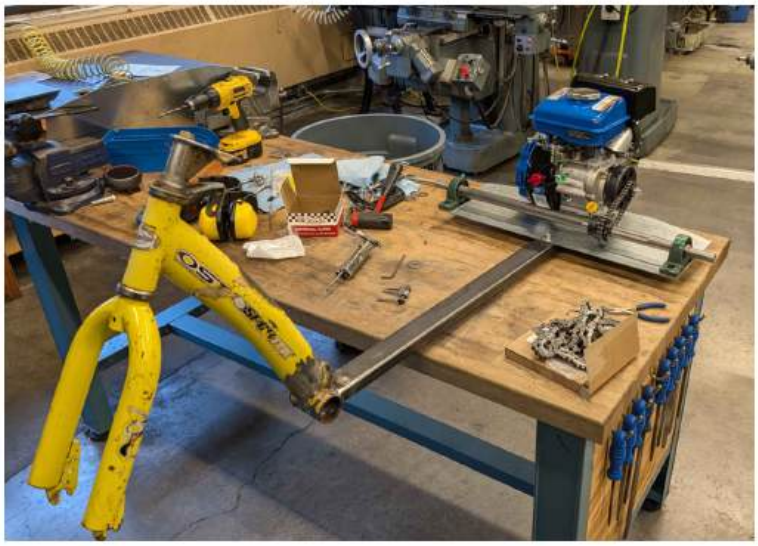
- Reduced aircraft fuselage internal structure weight by 20% and increased rigidity by 15%
- Reduced previous layup mold material by 67% and exterior weight by 30%
- 2nd in Design Presentation and 3rd Place in Flight Demonstration at AEAC 2024

Motorized Drift Tricycle

	Component A			Component B			Component C			Component D			Component E		
	Left	Middle	Right	Left	Middle	Right	Left	Middle	Right	Left	Middle	Right	Left	Middle	Right
Design Factor	2.5			2.5			2.5			2.5			2.5		
Stress Concentration Factor	0	0	2.18	3	0	2.5	0	2.18	0	2.5	0	3	2.18	0	0
Shear Magnitude	47.40674271			81.41908115			77.6852678			59.83454801			56.99632238		
Moment Magnitude	7.654292896			94.81348542			454.5252677			86.60294948			55.98920144		
Torque	**104.8422**			**0**			**126.05**			**0**			**21.2078**		
Retaining Ring	NO			YES			YES			YES			NO		
Corrected Endurance Limit	33112.05439			33112.05439			33112.05439			33112.05439			33112.05439		
Yield Strength	100000			100000			100000			100000			100000		
Torque & Bending Diameter [eq12-24]	0.284885	0.284885	0.297924	0.602534	0	0.567006	0.302927	0.913592	0.302927	0.550143	0	0.584614	0.454658	0.167233	0.167233
Alternating Shear Diameter	0	0	0.15146	0.232849	0	0.212561	0	0.193887	0	0.18222	0	0.199612	0.166074	0	0
Adjusted Diameter for RR	0.284885	0.284885	0.297924	0.638686	0	0.601027	0.321103	0.968408	0.321103	0.583152	0	0.619691	0.454658	0.167233	0.167233
Final Calculated Shaft Diameter	**0.297924**			**0.638686**			**0.968408**			**0.619691**			**0.454658**		
Largest Min Diameter from All	**0.968408**														







What?

- Worked in a team of 6 to create a functional 3HP motorized drift tricycle
- Recycled kids bicycle cut and welded to a steel extrusion and machined base plate

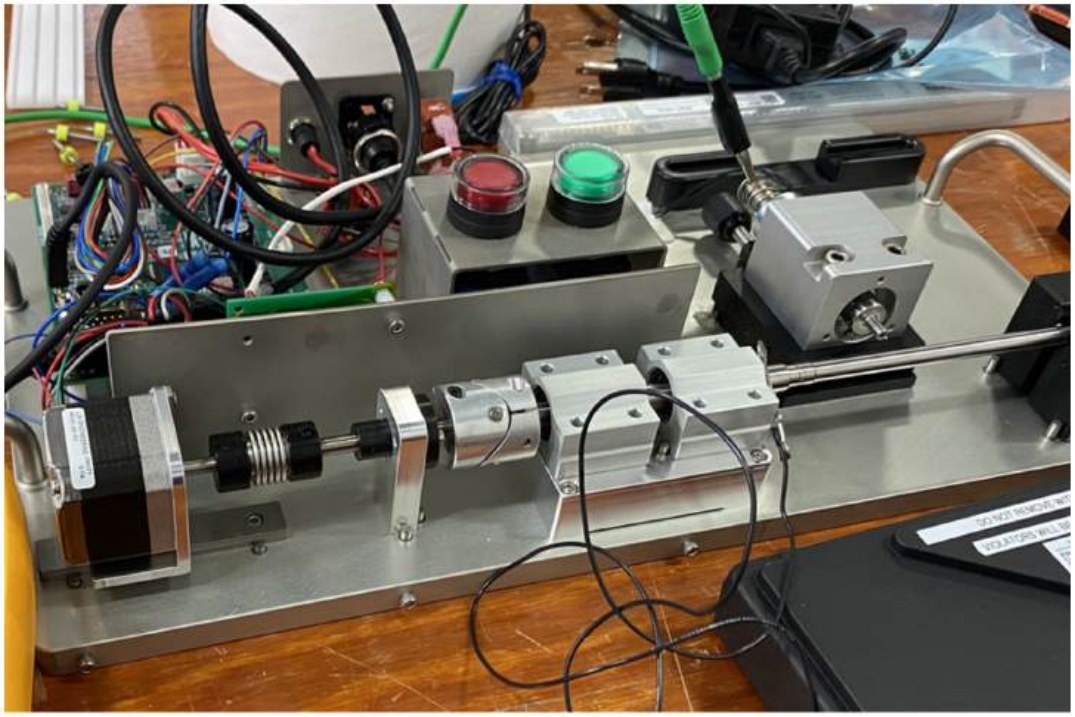
How?

- Designed and iterated concepts through hand calculations and **SolidWorks** modelling
- Programmed scripts to conduct force analyses in **MATLAB** to ensure structural safety and FOS of 3
- **Machined** custom steel components and **welded** steel parts to assemble and test the final prototype

Results

- Presented the project in front of mechanical engineering faculty members
- Gained hands-on experience designing a project from sketch to working assembly
- Quick way to get across campus (NOT ROAD LEGAL)!

Kardium Inc. Facility Expansion Equipment



What?

- Implemented a new chemical-based cleaning process
- Assembled and integrated custom mechanical/electrical jigs for facility expansion
- Conducted installation qualification testing for test equipment and jigs

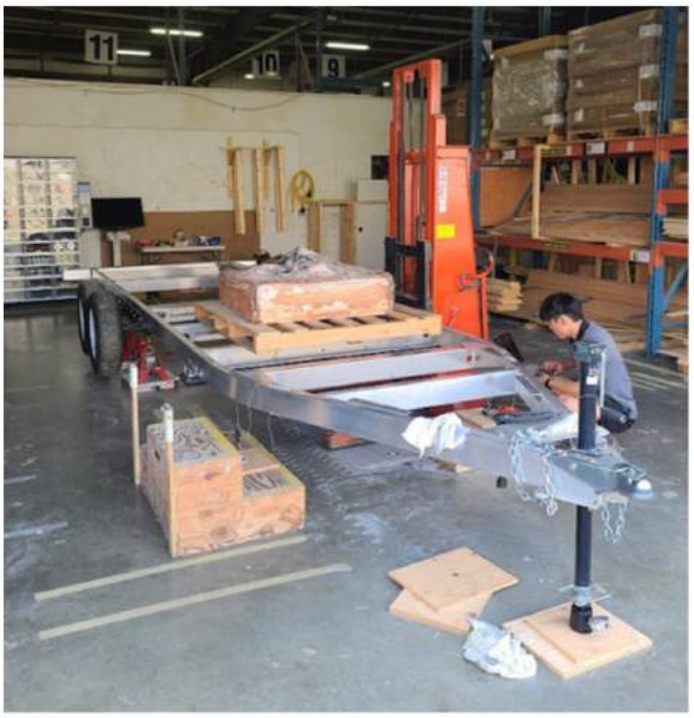
How?

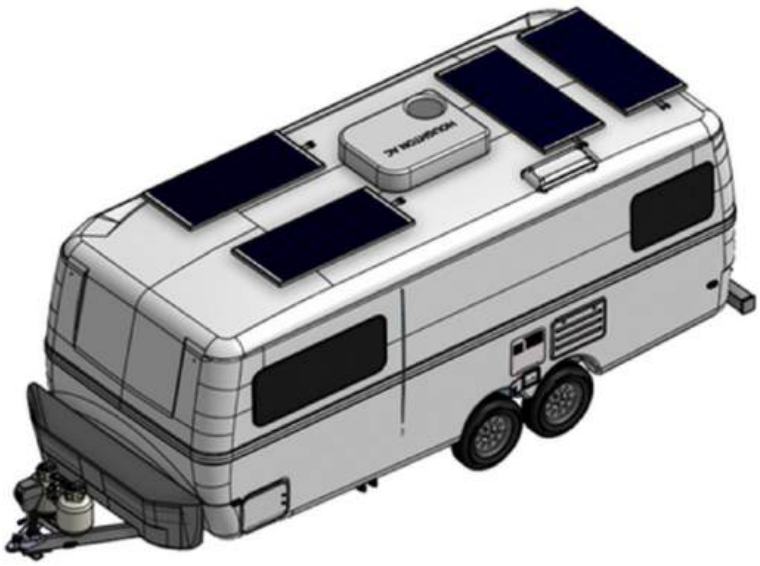
- Designed and implemented new tooling, jigs, and fixtures in **SolidWorks**
- Interpreting engineering drawings per **ASME Y14.5** standards utilizing various machine shop tools (mill, laser welder) to reproduce parts
- Did troubleshooting and performance verification, to complete formal reports for review

Results

- New cleaning process resulted in a **75% reduction in process time** and improved production efficiency in a clean-room environment.
- **Doubled facility production capacity** from equipment duplication
- **21 new production jigs**, tested and qualified

Escape 23 Trailer





What?

- Contributed to the successful launch of a new product line (Escape 23)
- Brought project from concept sketches all the way to full-scale production for consumers
- Redesigned existing trailer parts for improved manufacturability

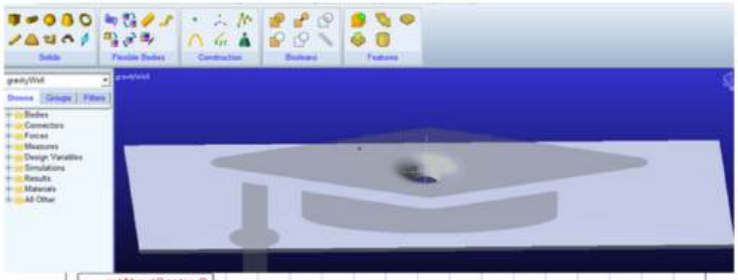
How?

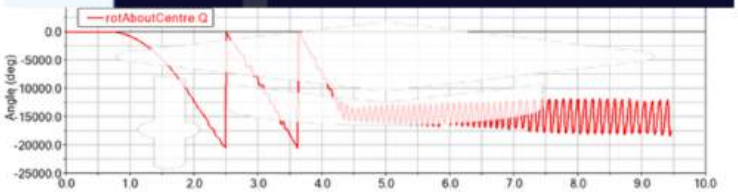
- Designed interior layout with **CAD** software (**OnShape/SolidWorks**).
- Designed a strain gauge system for testing chassis structure and validating FEA models
- Implemented **Lean Six Sigma** Principles to reduce material waste and introduced **CNC manufacturing** into the production line for E23 and existing products

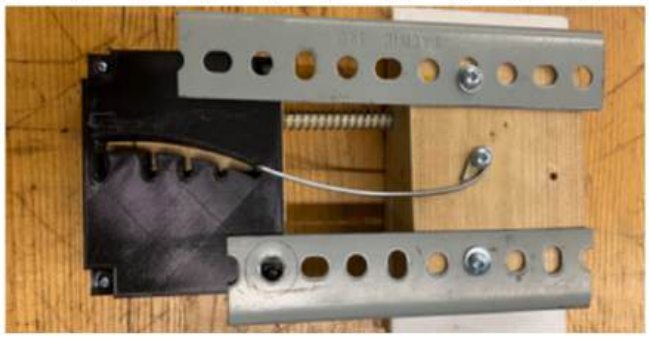
Results

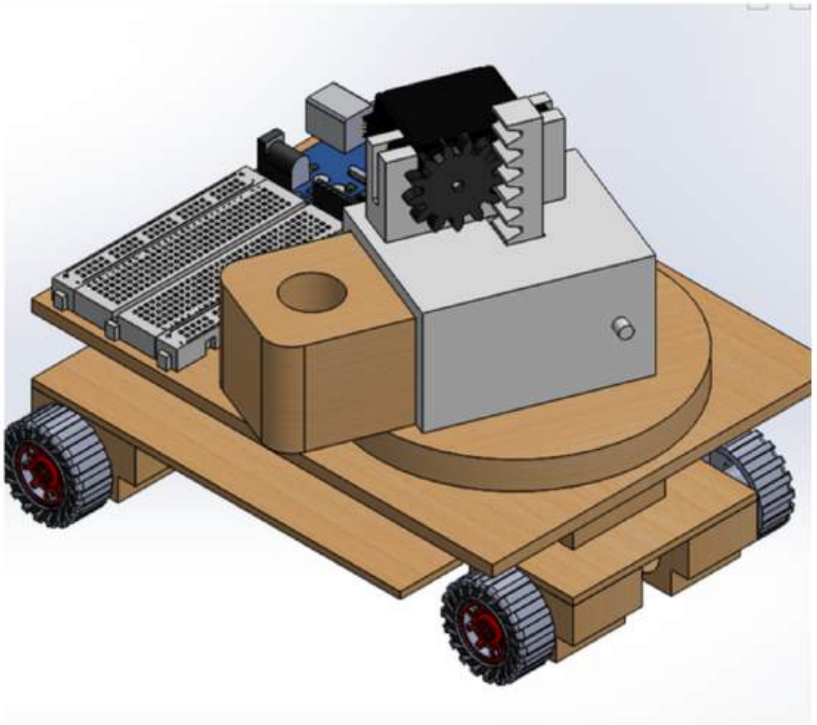
- Reduced initial production cycle time down 60%
- Increased CNC machinery machine uptime rate by 50%
- Reduced defect rates by 40% and reduced material waste by 66%
- Generated **$1.2M** in product presales

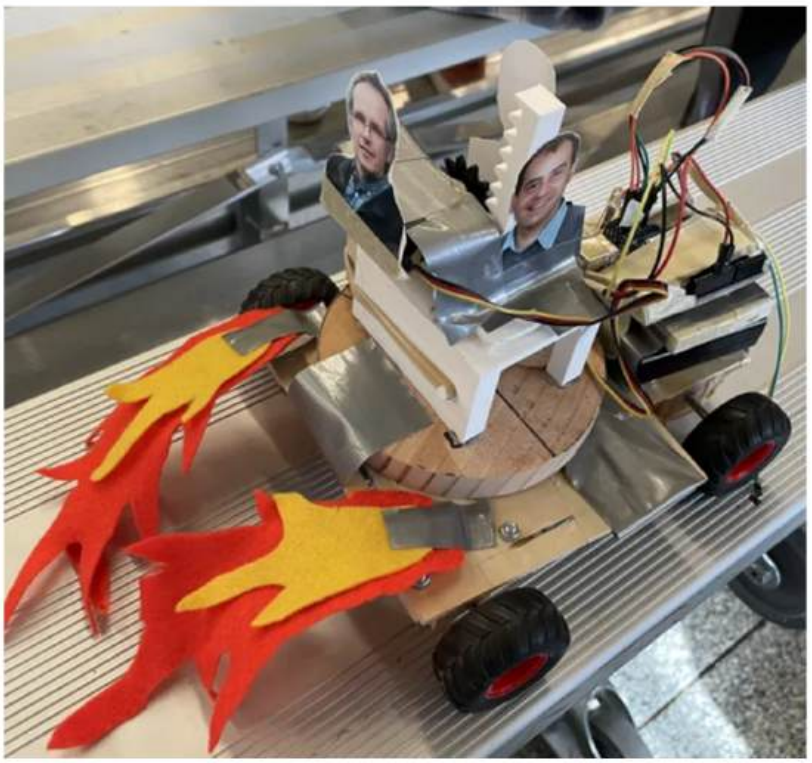
Titan Endurance Launcher & Orbiter











What?

- Potential energy launcher that propels an electronic catapult on wheels that launches a sphere
- **Goal:** Launch a sphere of unknown mass into a funnel and achieve maximum spirals before reaching the bottom

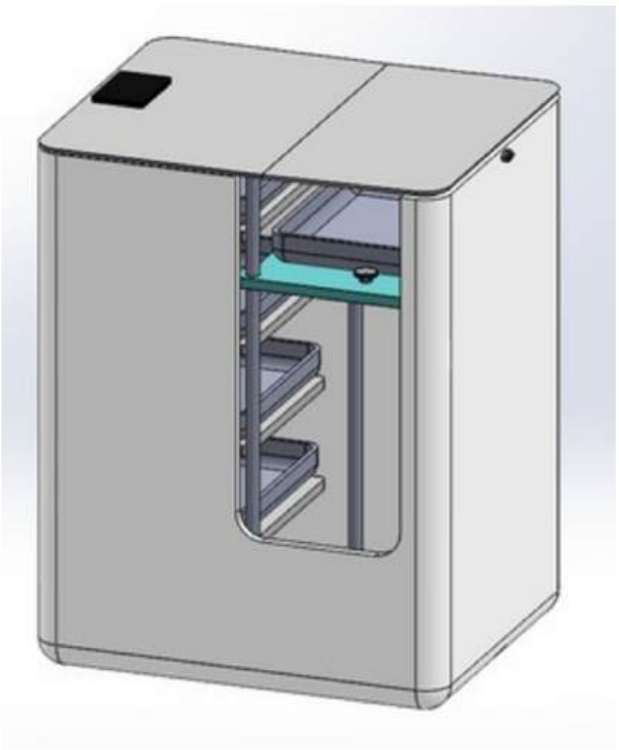
How?

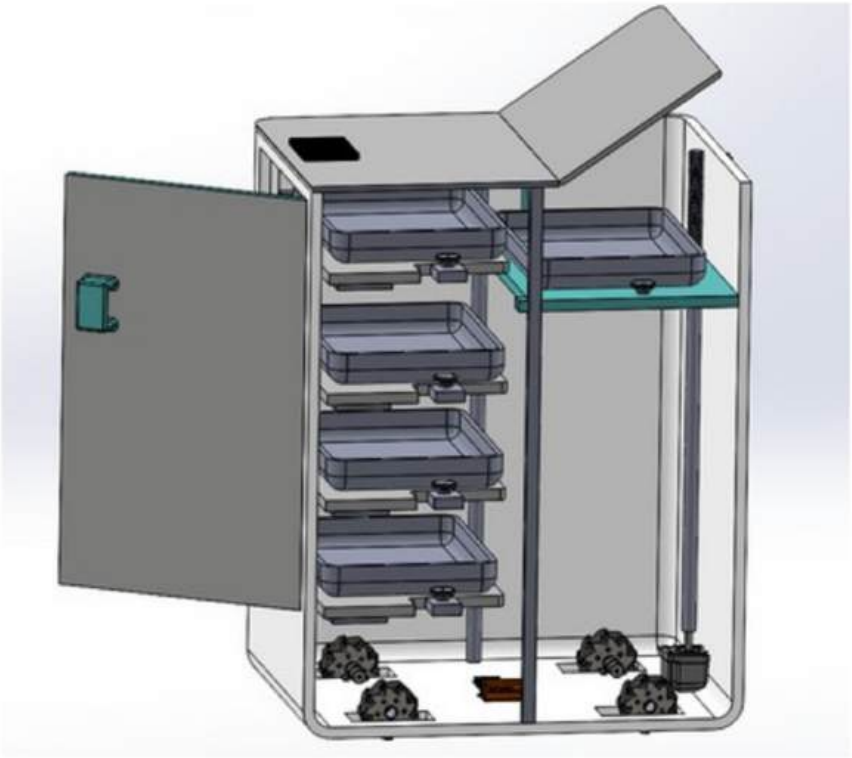
- Optimized ball launch velocities by using **MSC Adams** to simulate and predict launch trajectories
- Used **SolidWorks** to CAD prototype launcher builds
- Manufactured parts using 3D printing, waterjet cutting, and laser cutting

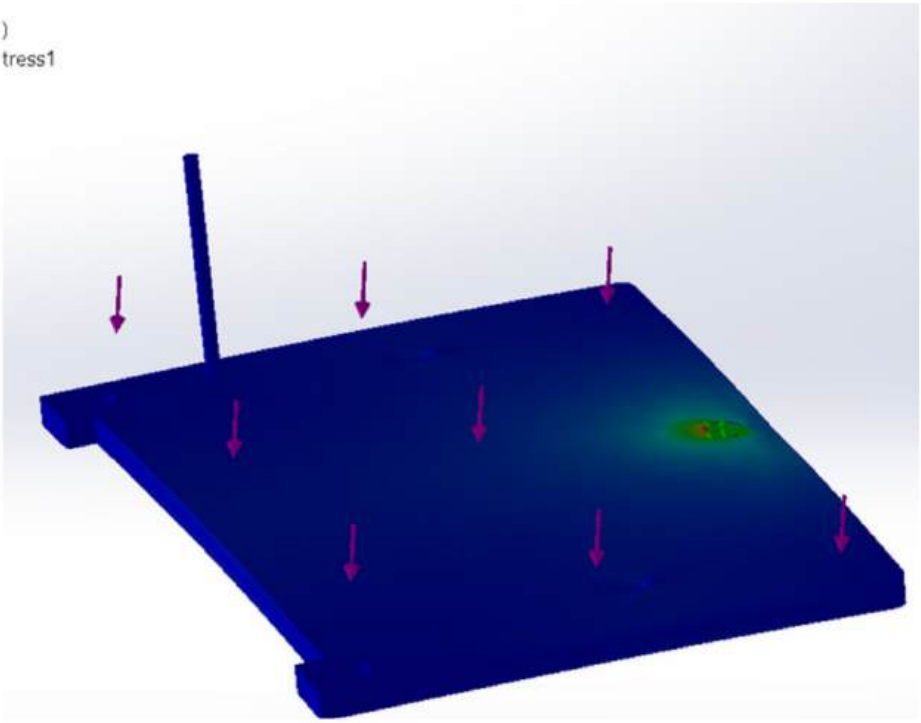
Results

- Predicted launch parameters with 85% accuracy using the simulation model
- Gained project management and technical documentation experience
- Successfully hit the target and achieved a spiral time of 56 seconds

Restaurant Robot Server







What?

- Designed a restaurant robot that automatically delivers food for a design competition
- Ultrasonic sensors and mecanum wheels drive robot; Servos, and power screws raise food tray to customer.

How?

- Use **SolidWorks** to design and produce a 3D render for presentation
- Conducted FEA simulations validated with hand calculations to justify component selection

Results

- Formally presented concept to a group of judges and placed 8th out of 20 teams
- Strengthened skills in mechanical design, FEA, and part modelling

POSTURE-INO Posture Corrector

```
Postureino_Code
  Serial.begin(9600);      // sets the serial port to 960
}

void loop()
{
  x = analogRead(0);       // read analog input pin 0
  y = analogRead(1);       // read analog input pin 1
  z = analogRead(2);       // read analog input pin 1
  /*Serial.print("accelerations are x, y, z: ");
  Serial.print(x, DEC);    // print the acceleration in t
  Serial.print(" ");       // prints a space between the
  Serial.print(y, DEC);    // print the acceleration in t
  Serial.print(" ");       // prints a space between the
  Serial.println(z, DEC);  // print the acceleration in t
  delay(100);              // wait 100ms for next reading
  int yDEC = (y, DEC);
      Serial.print("Your sitting angle is " );
      Serial.print(abs(390 - y));
      Serial.print(" from vertical");
      Serial.println();
  //detect slouching
  if (y < 375){
    tone(buzzer, 1000);
    Serial.println("SIT UP STRAIGHT! YOU'RE SLOUCHING");
  }
  else {
```

What?

- Electronic posture corrector that alerts of poor sitting posture and tracks sitting data
- Made with minimum waste and recycled materials

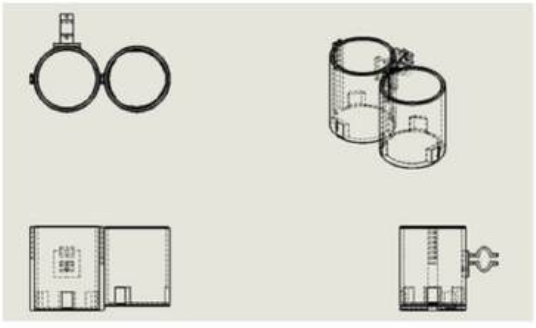
How?

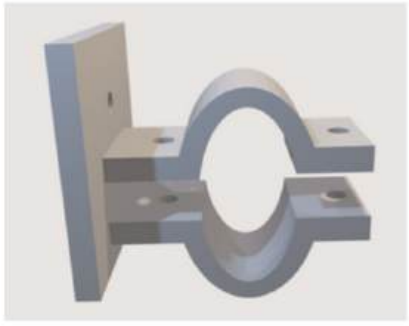
- Used prototyping boards and **Arduino** hardware to create circuitry
- Programmed data collection and feedback delivery features in **C++**

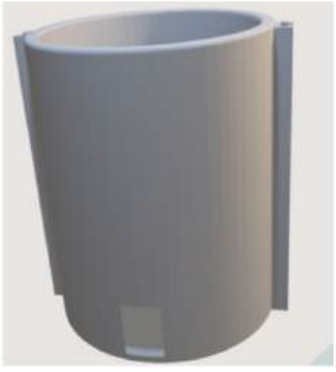
Results

- Posture-ino recorded data and alerted 14 students of their poor sitting posture
- Experience writing engineering reports and presenting to stakeholders

Baby Stroller Cupholder







What?

- Custom-designed dual beverage cup holder that mounts onto a baby stroller
- Affordable and practical solutions resolve the lack of beverage holders for this specific problem

How?

- Engaged with client to understand requirements and determine design constraints
- Produced 3D **CAD** models and detailed 2D engineering drawings for assembly using **SolidWorks**

Results

- Gained experience in **SolidWorks**, **3D printing**, and technical documentation and presentation
- Client uses product daily with positive feedback