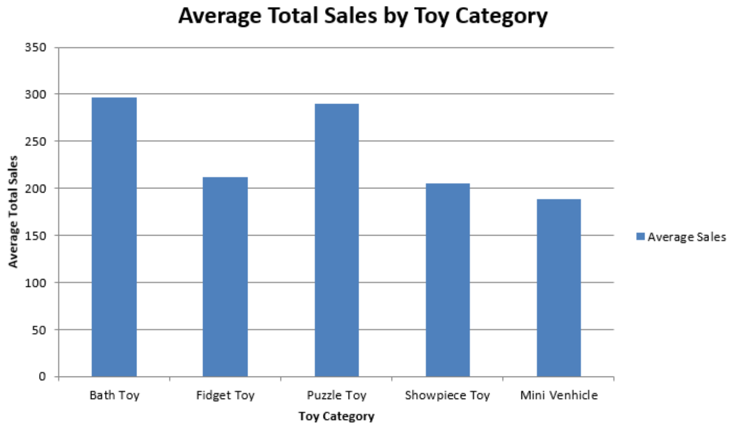
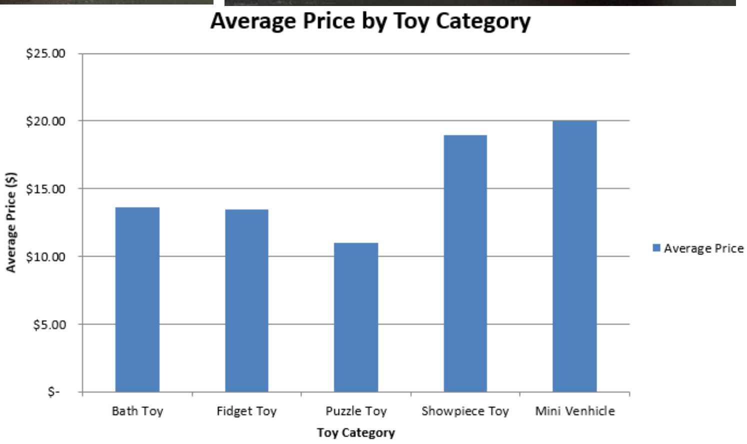
3D printing DFM Study: Mar 2025 - Today





What?

- Explore 3D printing and Design for Manufacturability (DFM) while creating toys that are actually fun to play with. Test ideas for small-scale production and see if people would want them on Etsy or Amazon.

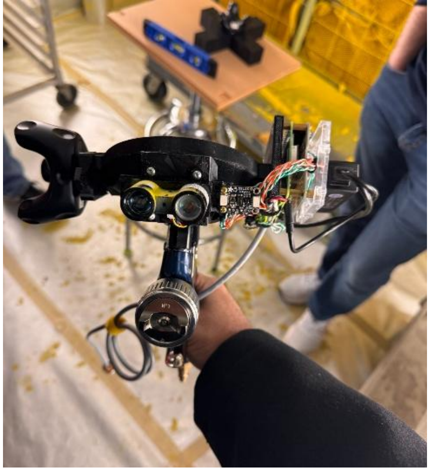
How?

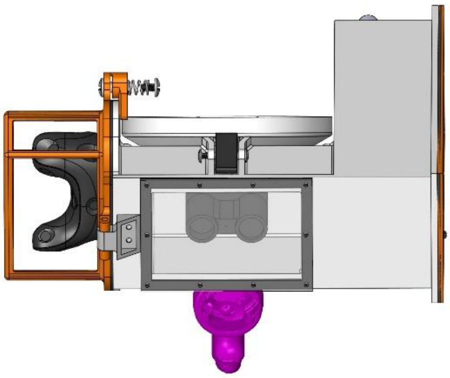
- **Design & CAD:** Created playful prototypes—a small boat, a sports car, and a propeller airplane. Focused on fit, functionality, and printability to make sure each toy worked and looked good.
- **Rapid Prototyping & Iteration:** Produced multiple iterations of each model to refine **print quality, dimensional accuracy, and structural integrity**. Applied supports, hollowing, and orientation adjustments to reduce failures and improve surface finish.
- **Testing & Feedback:** Shared prototypes with friends to see how they played with them. Used feedback to improve ergonomics, durability, and overall “fun factor.”

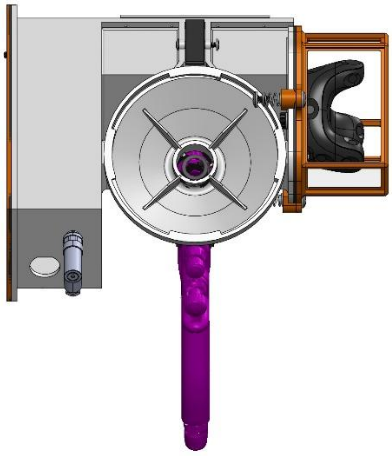
Results:

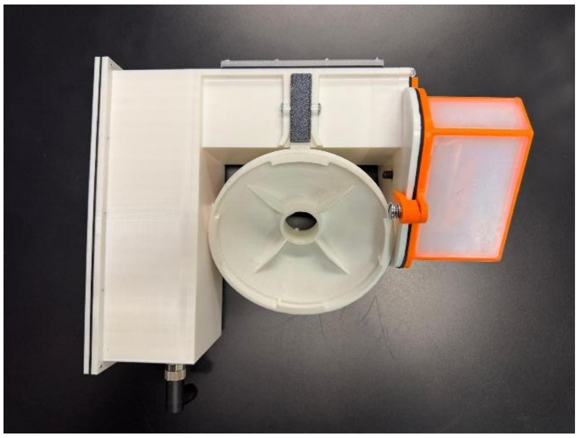
- Produced toys that are **playable, functional, and visually appealing.**
- Finishing (sanding, painting, acetone smoothing) is **still in progress**, being iterated to achieve the best look and feel.
- Market research helped me identify which types of toys are more profitable, showing trends in demand and optimal pricing relative to average sales.
- Explored intellectual property considerations, ensuring designs are original and could be modified safely without infringing on copyrights or patents. These insights guided technical decisions—like which designs to avoid and what kind of license could be used—so the toys remain functional, fun, and have future market potential.

A&B Project: Rapid Prototyping Mar 2025 – Aug 2025









What?

- Customer requested a prototype to study hand-painting patterns and layer deposition, aiming to gather data for designing fixtures compatible with robotic spray arms used in aircraft and yacht manufacturing.
- The project involved taking the prototype from initial concept, through design, prototyping, and testing, to delivering a fully working unit ready for use in robotic paint systems.

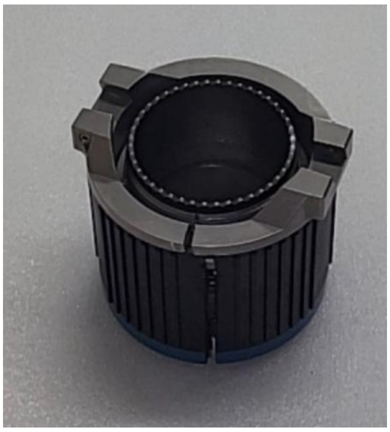
How?

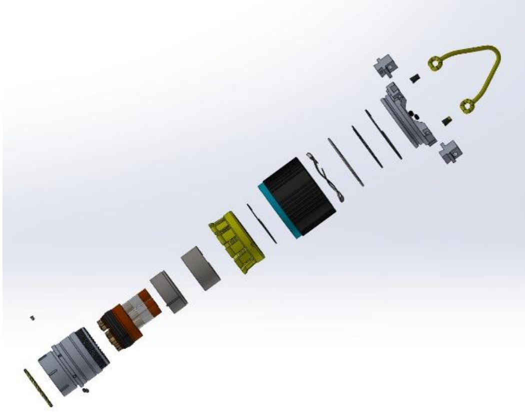
- Conducted market research on electronic parts, understanding their functionalities and communication protocols for integration into the prototype.
- Applied Design for Manufacturability (DFM) principles to ensure easy production and assembly. Created detailed 3D models in SolidWorks, shared interim designs with the customer, and incorporated feedback to reduce redesigns and speed up development.
- Researched and selected materials resistant to solvents like acetone, other chemicals, and fire, ensuring safety in paint both environments.
- Iterated through multiple design revisions, optimizing weight balance, HMI accessibility, and aesthetics to make the prototype practical, safe, and manufacturable.

Results:

- Successfully delivered **three fully functional prototypes**, meeting all customer requirements.
- During testing, the acrylic barrier was found to degrade when exposed to paint booth solvents. Replaced it with FEP sheets for superior chemical resistance, while ensuring that the barrier remained transparent to infrared signals, allowing the IR-based sensors and receiver station to function without interference.
- With a little more market research I found out that FEP sheet was far more superior to acrylic sheets in chemical resistance and IR radiance.
- Provided a **complete, production-ready solution** from concept to delivery, including design documentation, material selection guidance, and SOPs for safe operation
- Customer was highly satisfied and awarded additional prototype projects, recognizing the comprehensive, technical and engineering support.

A&B Project: Reverse Engineering **Jan 2025 – Mar 2025**





What?

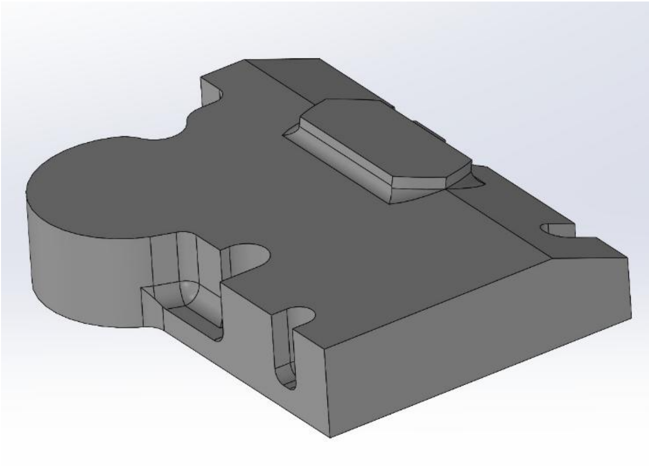
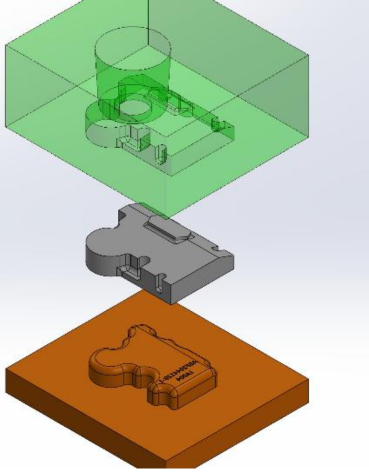
- Customer reported issues with a legacy electrical connector during quick disconnection.
- The original manufacturer was no longer in business, leaving no replacement options available.
- The customer requested a complete documentation package for the connector so it could be replaced with new, in-production connectors and provide a reference for future manufacturing if required.

How?

- Carefully disassembled the customer's sample connector (sacrificing one part) to study internal functionality and capture design dimensions.
- Identified and documented each sub-component, conducting dimensional analysis and material review to replicate original performance.
- Created detailed CAD models and engineering drawings in SolidWorks, highlighting intricate geometries and manufacturing processes.
- Researched and applied relevant Military Standards and ASME specifications to ensure compliance for aerospace applications.

Results:

- Delivered a verified drawing and CAD documentation package that was approved by the customer.
- Customer praised the level of detail captured in the documentation and the on-time delivery within a 4-month window.
- Delivered documentation to aerospace standards with sufficient technical detail to ensure the connector could be consistently manufactured and supported by any future supplier.

What?

- Designed and manufactured a series of small, reverse-engineered parts of a fluid flow meter to validate fit, form, and functionality.
- Reverse engineer legacy fluid flow meter and identify potential upgrades and design changes.

How?

- Conducted 3D scanning to capture complex part geometry and develop accurate surface models for comparison.
- Reconstructed detailed CAD models using SolidWorks alongside legacy engineering drawings.
- Applied Design for Manufacturability (DFM) principles, add machining stock, draft angles, and tolerance allowances to create an optimized *As-Cast* design.
- Designed and 3D printed pattern models and molds, enabling test castings that revealed potential design issues and guided process optimization.

Results:

- Developed a production-ready mold design that could be directly 3D printed and used for test pours.
- Test castings provided valuable insights into design modifications and process refinements, ensuring smooth transition to production.
- Successfully implemented improvements and completed a full production run, achieving consistent part quality.
- Final castings were compared against original scanned components and verified for accuracy, with sufficient stock for machining and finishing.

ASD Project: Casting Cell Part Marking Station **Jul 2024 – Aug 2024**

What?

- The customer required a part **marking station** for their casting cell, capable of marking **two different parts** using same equipment with **minimum changes.**
- **Initial requirements** were provided by the customer, which were further **refined through feedback.**

How?

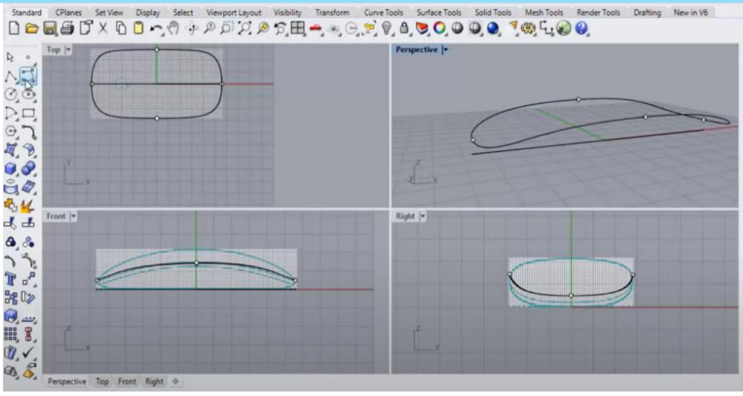
Used **SolidWorks** to:

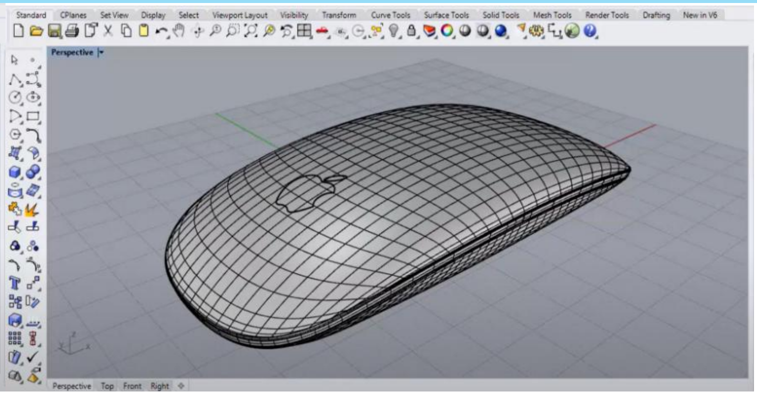
- Design the structural frame using **structural steel tools**, ensuring **strength and stability** for the station.
- Implemented **motion studies** in **SolidWorks** to simulate and **optimize the operation** of the marking station.
- Created detailed **technical drawings** for manufacturing, including **bill of materials (BOM)** and exploded views for **assembly instructions.**

Results:

- Successfully delivered a fully **detailed and refined design** that met all customer requirements and specifications.
- The design was created with a strong focus on **precision and quality**, ensuring the part marking station would perform reliably in the **production environment**.
- Generated **comprehensive technical drawings** and documentation, enabling smooth transition to manufacturing with **minimal revisions needed.**

Magic Mouse: A Product Design Study — Jun 2024





What?

- This project aimed to deepen my understanding of **product design** by analyzing the **Magic Mouse**, specifically its limitation of not being usable while charging.

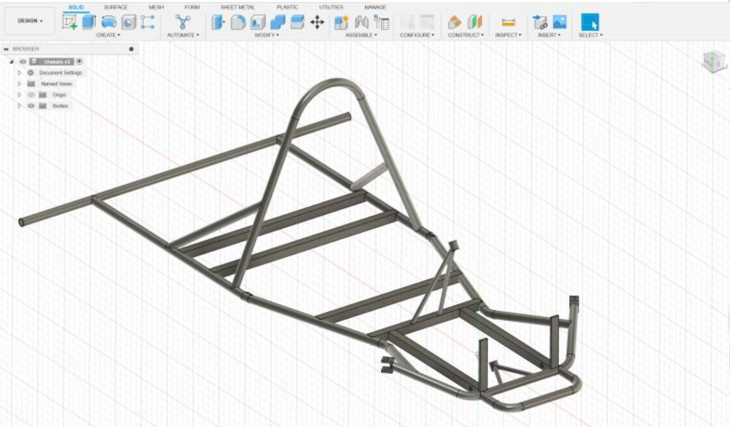
How?

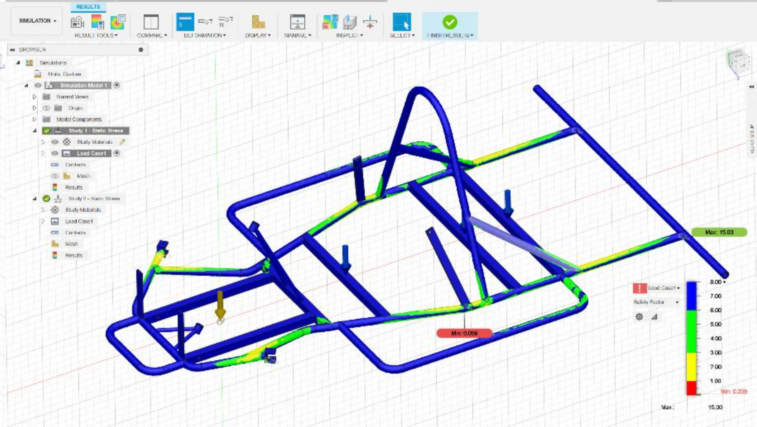
- Used **Rhino 3D's line and surface tools** to model the mouse body.
- Applied **surface modeling** techniques to refine the shape.

Results:

- Gained hands-on experience in **product design** and mastered key tools in **Rhino 3D**.
- Enhanced my proficiency in **3D modeling** and developed a foundational understanding of the **iterative design process**, preparing me for future design projects.

High-Performance Go-Kart Chassis Design: — Feb 2024 – Apr 2024





What?

- Designed a **go-kart chassis** with a focus on **structural integrity**, **lightweight design**, and performance optimization.
- Aimed to create a chassis that balances **stability and agility** for **racing applications.**

How?

- Used **CAD** software (such as **Fusion 360 or AutoCAD**) to model the **chassis frame**, ensuring **precise dimensions and geometry**.
- Performed finite element analysis **(FEA)** to evaluate the chassis' strength and stress distribution under various load conditions.
- Iteratively **refined the design** and **modified material** to optimize for **weight reduction** while maintaining safety and durability.

Results:

- Gained proficiency in **CAD modeling** and **FEA,** further developing my understanding of **mechanical design** principles.
- Improved skills in **structural analysis** and **design optimization** for high-performance vehicles.
- Achieved **15% weight-to-strength** efficiency in chassis design.

Tesla Project: Casting Rework Equipment for Scrap Reduction — Aug 2023 – Dec 2023

What?

- **Designed and fabricated** equipment to rework casting parts that would otherwise be rejected as scrap due to dimensional issues.
- Conducted **need analysis** to gather initial design requirements and understand the importance of reducing scrap.

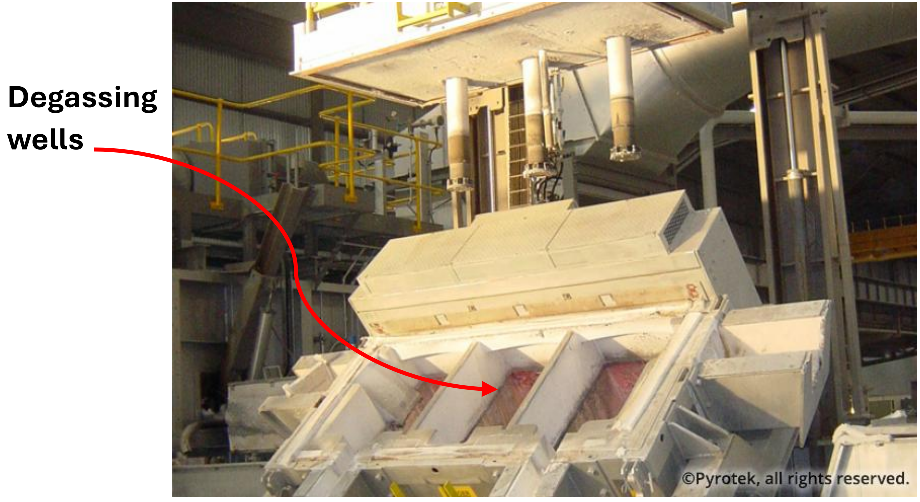
How?

- Utilized **structural steel tools** in **SolidWorks** to design the equipment's body, ensuring durability and functionality.
- Performed **finite element analysis (FEA)** to validate the safety and stability of the design under operational conditions.
- **Collaborated** with the factory team to fabricate the frame using **in-house resources**.

Results:

- **Conducted initial tests** on the frame, **generating results** that supported the hypothesis and **confirmed the design's viability**.
- Achieved desired results, leading to the project being passed on to the process team for **integration** into the production line**, reducing 25% scrap rates** and **improving efficiency.**

Tesla Project: Enhanced Degassing Well Cover Design — May 2023 – Sep 2023



What?

- Due to changes in the degassing operation, the old cover design presented **operational challenges** necessitating a **new cover design.**
- Conducted a **situation analysis** to generate the **initial design requirements** for the new cover.
- **Collaborated with floor engineers** to gather insights on operational issues and understand **real-world challenges**.

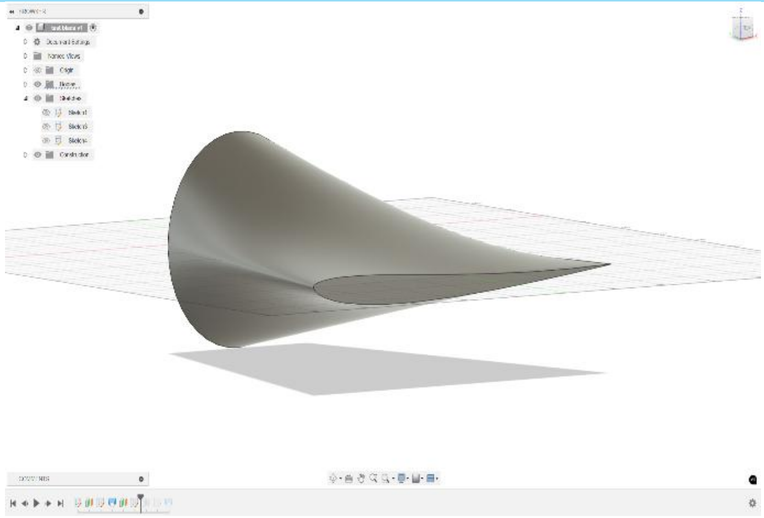
How?

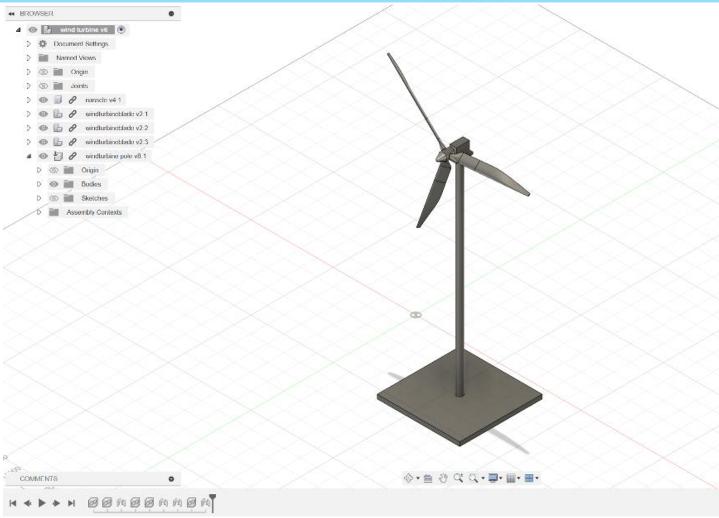
- Used **SolidWorks** and its tools like **structural steel tools** to design the frame of the cover, ensuring structural integrity.
- Applied **sheet metal functions** to enclose the frame efficiently.
- Performed finite element analysis **(FEA)** to verify the safety and stability of the design under operational conditions.
- **Applied GD&T** for precise dimensioning of the cover to **withstand high temperatures**.

Results:

- The new covers **successfully eliminated operational difficulties.**
- The design was **adopted for all other degassing wells** and was considered for implementing across **multiple factories**, enhancing overall **performance and efficiency.**

Terrain-Effect Wind Turbine Model: Aug 2022 – Dec 2022





What?

- The experiment aimed to evaluate the effects of **different terrain** types on **wind turbine efficiency**.
- The design required a **scaled model** small enough to fit inside a 30 by 30-centimeter **wind tunnel for testing.**

How?

- Utilized **NACA airfoil software** to determine **optimal profiles** aimed to **increase drag and reduce lift** to improve efficiency.
- **Applied GD&T** to scale the wind turbine dimensions accurately, ensuring it **replicated full-size characteristics.**
- used **forming tools** to achieve an **aerodynamic surface finish** on the blades.

Results:

- The design received **positive feedback** from the professor, confirming its alignment with the project objectives.
- Achieved a **90% dynamic similitude** in **testing**, indicating that the scaled blades effectively replicated the performance characteristics of full-scale wind turbines under **real-world conditions.**