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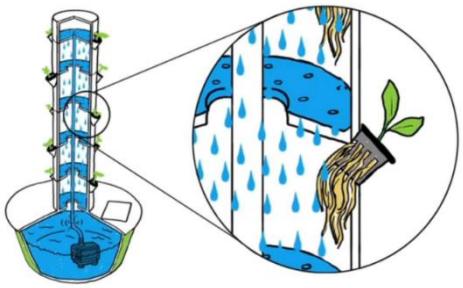
PINGA: ARCTIC AEROPONICS SYSTEM

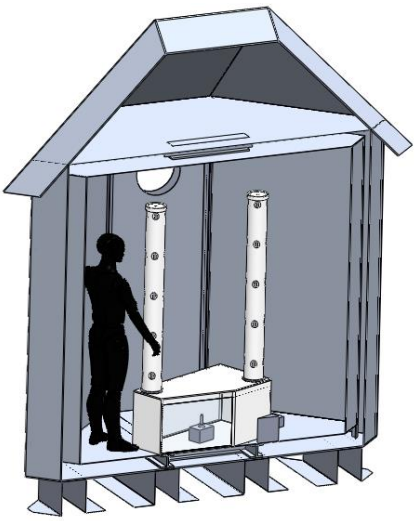
Purpose

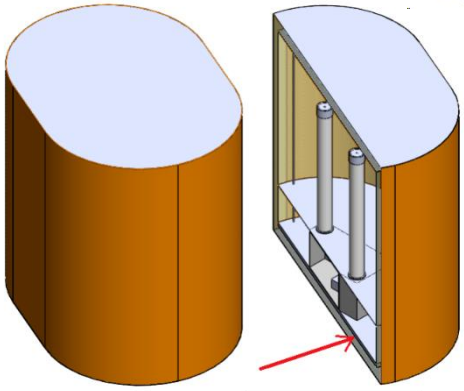
- Remote northern Canadian communities suffer from food insecurity.
- Created a system to allow growing produce and fight food insecurity in remote arctic communities as my fourth-year design project.
- Named after Pinga, the goddess of the hunt, fertility, and medicine in Inuit religion on northern Canada.

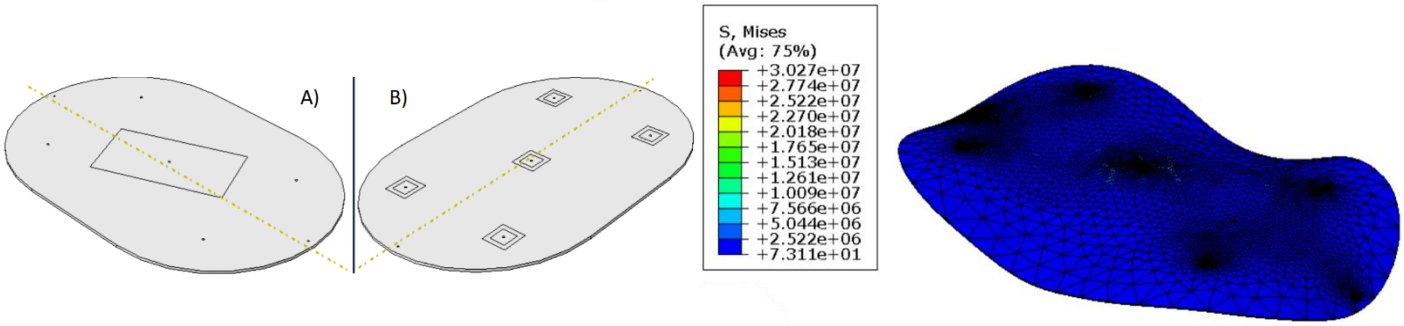


Responsibilities/Achievements

- I was responsible for the structural design and mechanical testing.
- Biggest considerations were wind force, heat loss, price, and reliability.
- Conducted a Finite Element Analysis (FEA) study on an early iteration of the design as seen below.
- The red arrow points at the critical component of FEA study.
- Conducted H-refinement and P-refinement to select the optimum mesh size for the critical zones, and to select quadratic elements for the analysis.
- Decreased the thickness from 2" to 3/16" reducing the weight by 90% which increased the stress level by 2291.45%. But the stress was only 20.62% of the yield stress. The initial thickness was found to be too big.



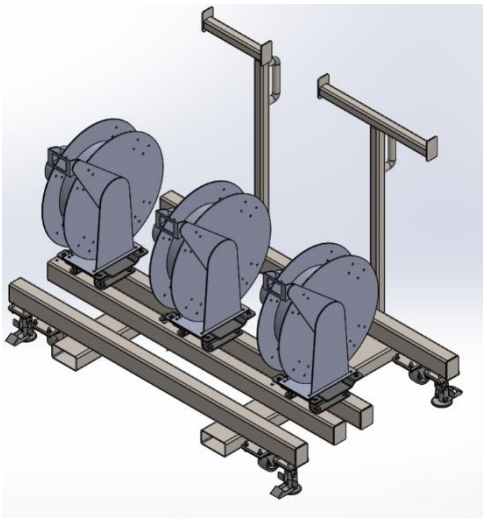




CABLE MANAGEMENT SYSTEM

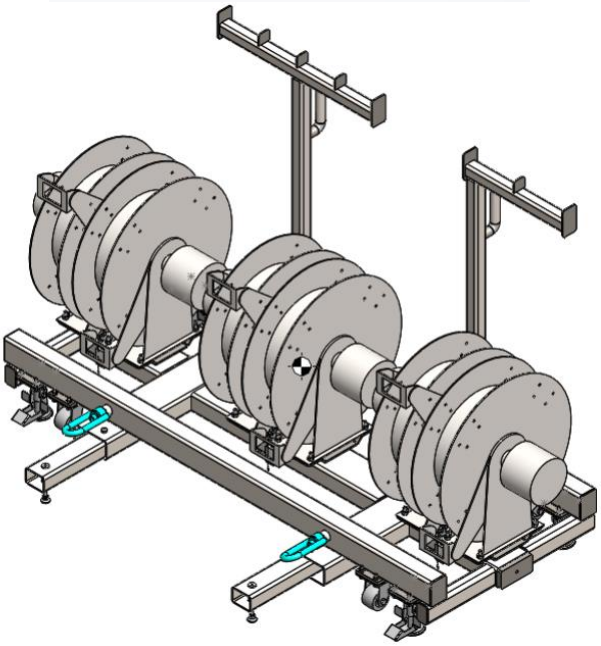
Introduction

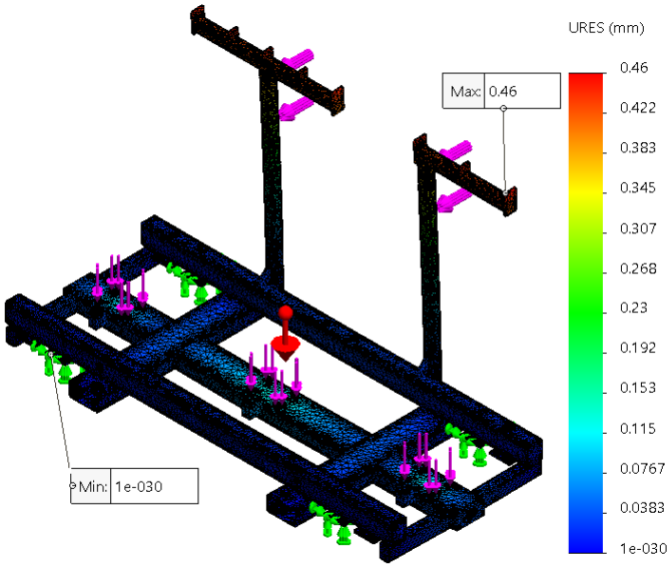
- Besnovo was developing a fully automated laser de-coating solution for aerospace, automotive, advanced manufacturing and other sectors.
- The system had to be mobile to go around large vehicles such as Boeing 737. For that reason, it needed a cable management system.
- I was tasked with updating the cable management system design on the right to increase the cable capacity from 3 to 6.

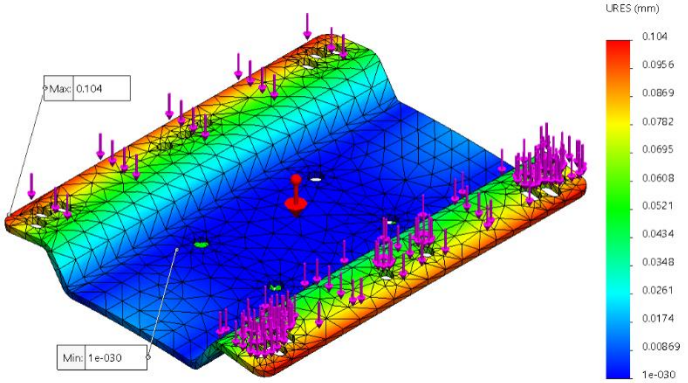


Responsibilities/Achievements

- The final design I produced is on the right.
- Conducted a few tests to verify design specifications:
  - Finite Element Analysis tests
  - Tipping calculation to make sure the system can handle the tension load from the cables.
  - Test to ensure no cable obstruction.
- Some of the tests are depicted below.
- New design was 25% cheaper, 50% smaller and 40% lighter, with a 100% increase in the cable capacity.



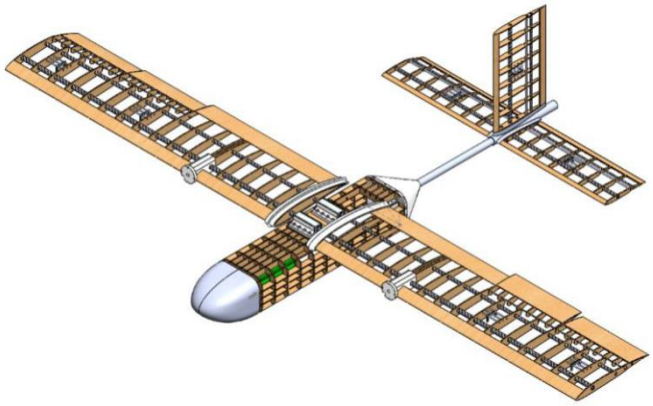


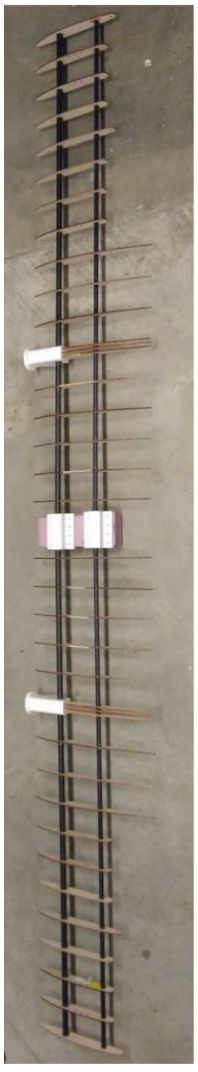


PROJECT BOREAS

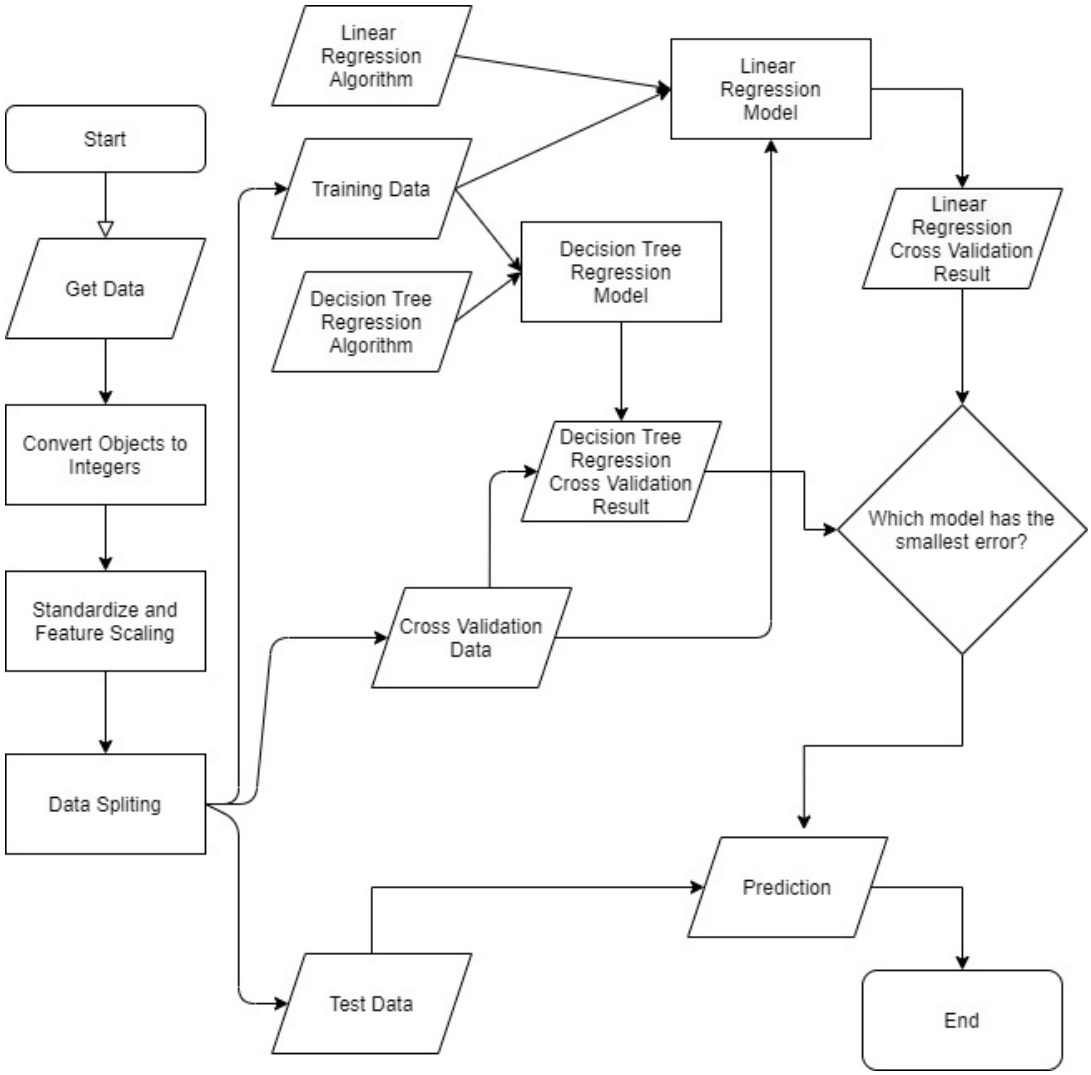
Introduction

- I was primarily responsible for designing mounts and critical joints for motors and sensors, and wing and tail assemblies, respectively. I was also responsible for designing the wing modules.
- Developed and implemented tests to verify the parts met design specifications I identified earlier in the design process. Examples:
  - Tests to study the radial deflection of the carbon fiber support tube while connected to the wing joint.
- Conducted FEA studies to optimize stress and weight in the connection parts, decreasing the weight by up to 15%.
- I was also responsible for fabrication and integration of the system.
- Materials used PET thermoplastic, 6061 Aluminum, rubber, balsa wood and carbon fiber.
- Fabrication methods: laser cutting, machining and, FFF/FDM and SLA 3D printing.





PREDICTIVE MACHINE LEARNING (ML) MODEL FOR 3D PRINTING MATERIAL



- Designed a predictive model for 3D printing material using print settings through Machine Learning.
- Used numpy, scikit-learn, and pandas python library.
- Performed data pre-processing:
  - Converted categorical data with object datatype to integers datatype.
  - Used mean normalization to for feature scaling.
  - Split data into training (60%), cross validation (20%), and testing dataset (20%).
- Trained and validated Linear Regression and Decision Tree Regression models in order to choose the best model.
- Implemented the Linear Regression model, resulting in the model predicting the validation set with an accuracy of 94.4%.