PORTFOLIO

Kyle Tam

Mechanical Design Engineer

University of Waterloo - Mechatronics Engineering 2023

647-927-1006 · kyle.m.tam@gmail.com · linkedin.com/in/kyle-m-tam

QUANSER
INNOVATE · EDUCATE

Automated Smart Factory Project

Dec 2023 – Aug 2024

Background

- Custom applications project to develop an automated smart factory that combines robotic manipulators, autonomous ground robots, and 3D printing

Contributions

- Worked on the design and manufacturing of multiple products in this factory including the actuated shelves, QArm manipulators, and QBot ground robots
- Researched and developed novel concepts for a custom packaging dispenser
- Designed parts to integrate electrical hardware and wiring into the actuated shelves
- Led manufacturing and integration of customized QBot ground robots to interact with self-charging stations and shelves

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QUANSER
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QArm Gripper Redesign

Sept 2023 – Jan 2024

Background

- Used extensively in the Automated Smart Factory, this is a core Quanser product usually sold for both large undergraduate settings and for robotics & controls research
- Gripper was previously designed under a tight budget and constraint timelines
- To be released in Q4 24/Q1 25

Contributions

- Redesigned the gripper to provide improved strength and additional joint dexterity
- Adapted outer appearance to match the visual aesthetics of the base of the arm and other Quanser core products to improve marketability
- Improved manufacturability and assembly leading to reduced building times and part counts by more than 50%

Note: Pictures show old design (redesign has yet to be officially released to the public)

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TRIUMF Particle Accelerator Co-Axial Cavity Research and Test Platform

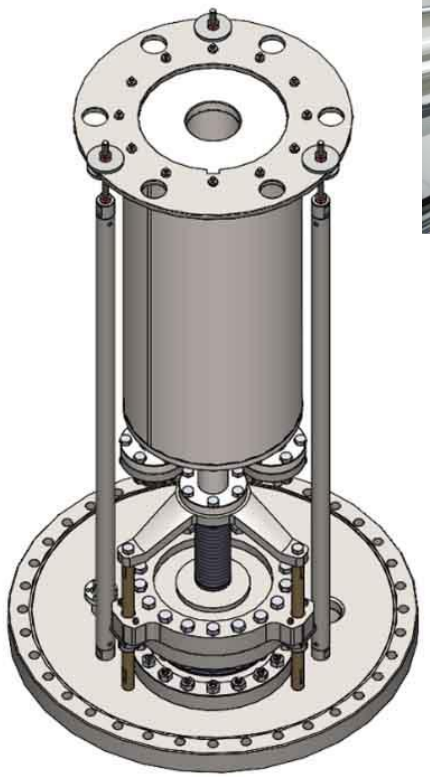
Jan 2022 – Apr 2022

Background

- SRF cavities are the heart of most modern particle accelerators
- The performance and characteristics of accelerator cavities from around the world need to be tested and qualified
- Further tests on cavities can provide insight in superconductive radiofrequency research and improve future accelerators

Contributions

- Worked on the conceptual and detailed design of a test platform
- Designed to submerge cavities in a pressure vessel filled with cryogenic liquid helium at 2°K and isolated by a vacuum
- Learned a lot about different materials and their interactions at different temperatures and pressures



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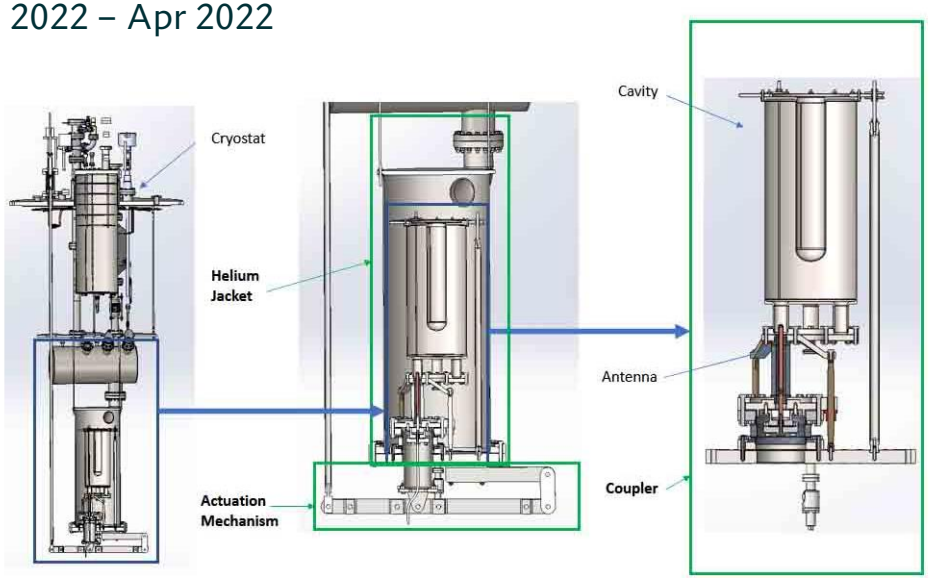

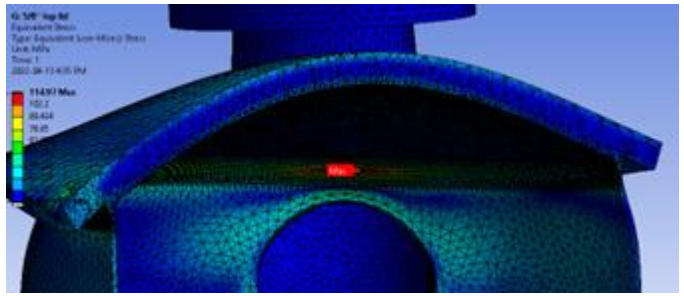

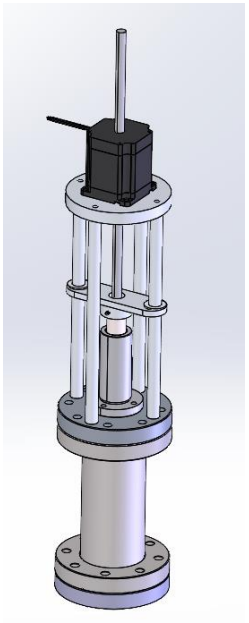

Contributions

- Consulted with different teams including physicists, material specialists, and machinists to design for operations in Class 100 and Class 10 cleanroom environment
- Designs were validated using ASME BPVS calculations and ANSYS Mechanical
- The cavity test platform hangs from the lid of a 10 ft tall cryostat and can be broken up into 3 sections:
  - Co-Axial Coupler
  - Actuation Mechanism
  - Helium Jacket Pressure Vessel

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WATERLOO ROCKETRY

Leviathan of the Sky (LotS)

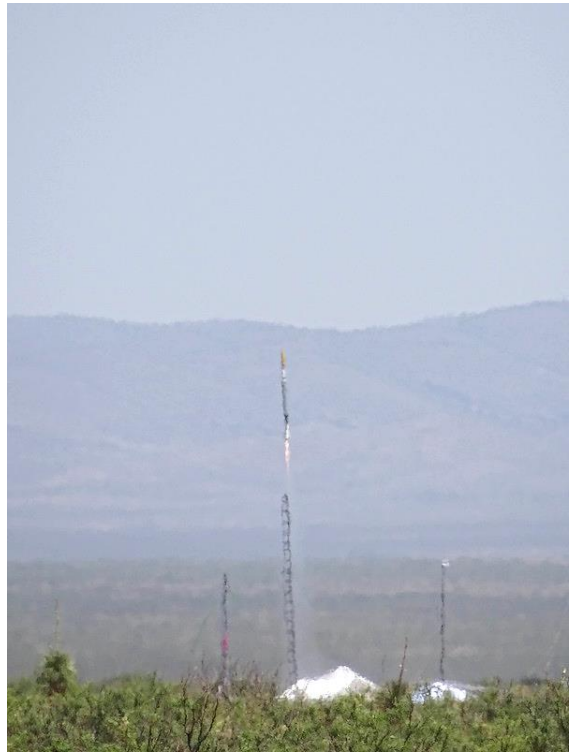
Sept 2022 – Jun 2023

Background

- Each year Waterloo Rocketry designs and builds a high-powered sounding rocket for competition at the Spaceport America Cup
- During the majority of my university career, I participated in a number of roles including Team Lead, Payload Subteam Lead, Core Member, and Finance/Marketing Member
- Here are some statistics from our 2023 award-winning hybrid rocket Leviathan of the Sky:

Wet Mass: 57 kg / 126 lb
Length: 4.5 m / 14.5 ft
Motor Classification: O motor
Maximum Altitude: 31,000 ft
Propellants: Liquid N2O, Solid HTPB

2nd Place in the 30,000 ft hybrid division at the 2023 Spaceport America Cup



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WATERLOO ROCKETRY

Payload CubeSats (Nanosatellites)

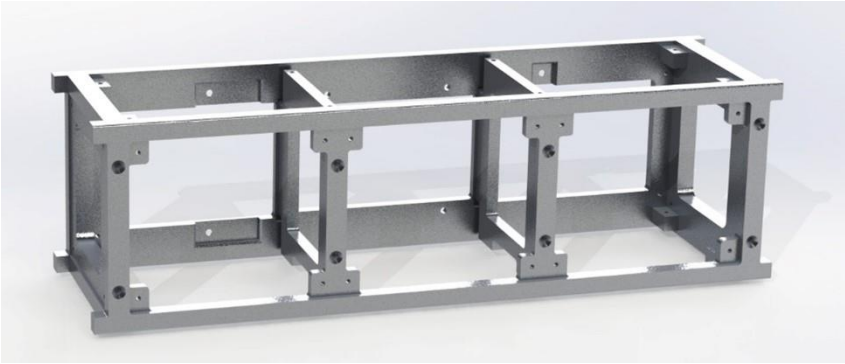
Sept 2018 – Jun 2023

Background

- Payloads developed by the team are scientific experiments that take advantage of the high altitudes, extreme launch forces, and micro-gravity experienced during flight
- Led the design of a 3U CubeSat and radiation sensor suite to test material samples and detect secondary cosmic radiation passing through our rocket
- Top 10 Payload in the SDL Payload Challenge and won the prize for Most Professional Design at the Spaceport America Cup 2021/2022 competition
- In other years, I supported the development of payloads focusing on creating a magnetic ferrofluid pump and the hypergravity effects of sourdough starters

Overview

- Led the mechanical design of the team's CubeSats and payloads following the CubeSat Standard Specification



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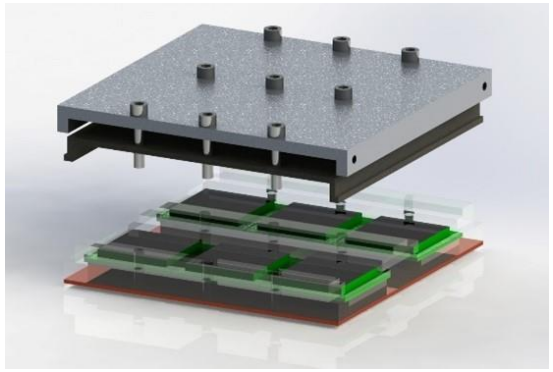
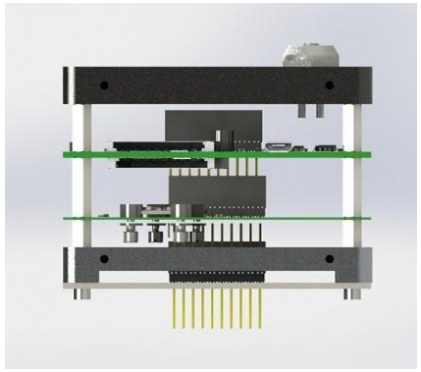
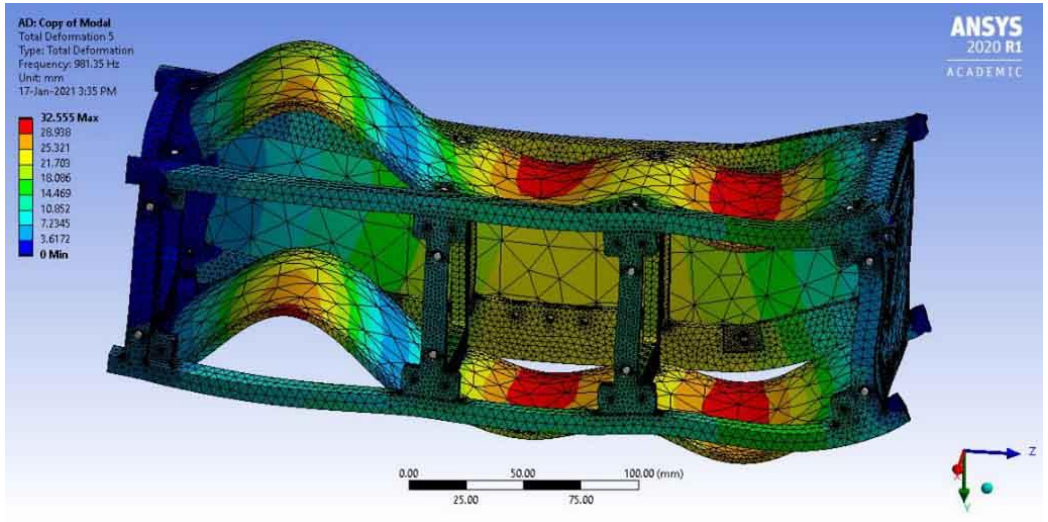
WATERLOO ROCKETRY

Payload CubeSat (Nanosatellite)

Sept 2018 – Jun 2023







Overview

- CubeSat structure was designed to be a modular assembly that can easily swap out different modules every year
- This overall structure was standardized and adopted for payloads from 2019 - 2023
- Part count was minimized to facilitate assembly and decrease cost while the assembly was designed for easy access and operation in the field
- Testing and analysis were done to validate the performance of the system (structural and vibrational)
- Different coatings were explored including anodizing, powder coating, and alodining

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WATERLOO ROCKETRY

Airframe Manufacturing

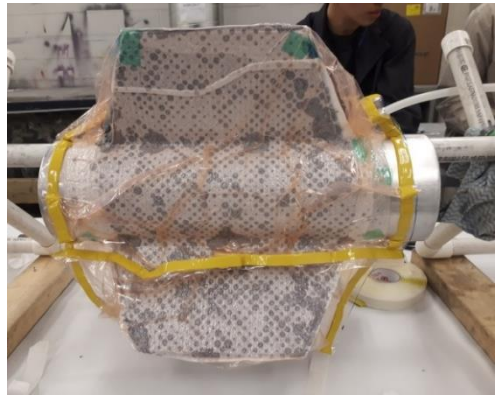
Jan 2019 – Dec 2019

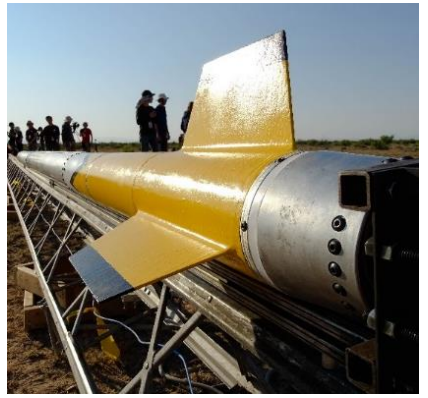
Background

- Airframes are the main structure of the rocket
- As a large contributor to the overall weight of the rocket, great efforts were made to reduce the weight of the airframe while keeping it strong

Overview

- Design and manufacture of carbon and fiberglass parts like a Von Kármán nosecone and fin can
- Vacuum bag layups were conducted extensively to perfect the manufacturing of these parts





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PLANTER A Holistic Automated Hydroponics System – Final Year Undergraduate Capstone Project

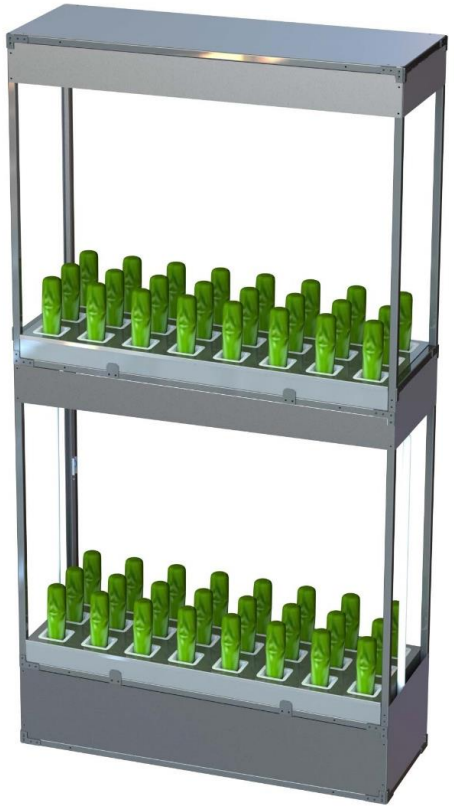
Sept 2022 – Mar 2023

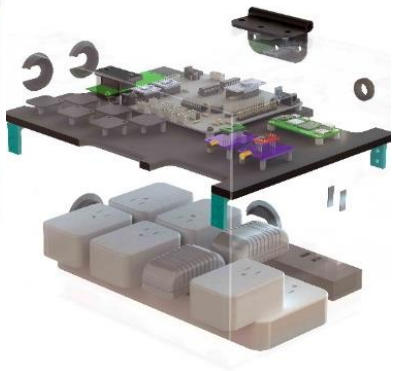
Background

- Hydroponics systems that exist on the market today lack automation and have a high barrier to entry for small-scale users
- Planter's mission is to build a system that fully automates all the key components of a plant's growth lifecycle while making it super user-friendly!

Contributions

- Focused on the mechanical design and electro-mechanical integration
- Design for manufacturing & assembly of the structure, electronics enclosure, and peripheries
- Structure was optimized to be strong & durable while easy to assemble in minutes; electronics module designed for easy access and display; full failure and tipping analysis conducted for overall system





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LamperLabs

Autonomous Robotic Fish Project

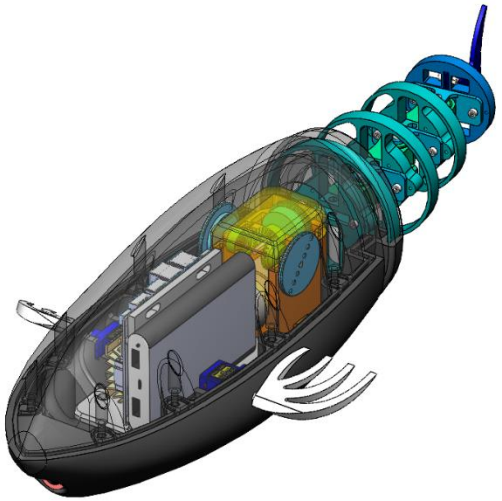
May 2021 – Sept 2021

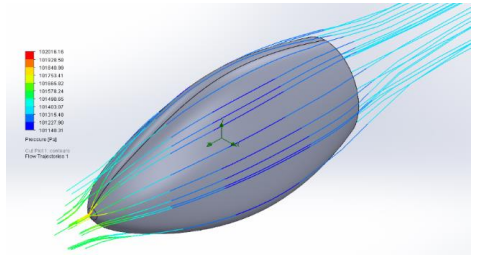
Background

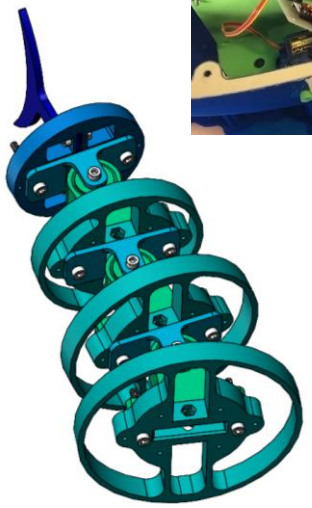
- Objective was to develop a robotic fish capable of gathering data in shallow ocean environments while blending into its environment for marine biology research
- Robotic fish is autonomous and wirelessly controlled and features a range of sensors and instrumentation to facilitate research purposes

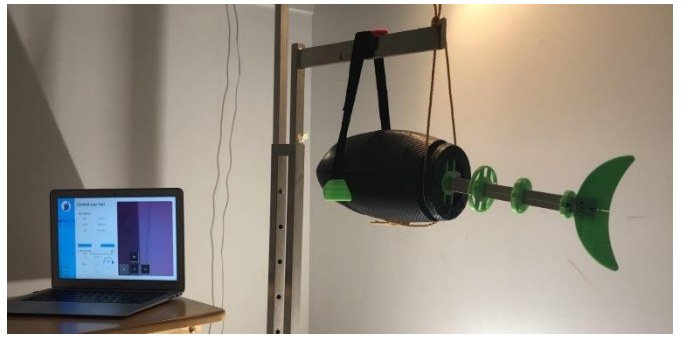
Overview

- Led mechanical design of system
- Development of a propulsion system that mimics the natural movement of fish – multiple design iterations to fine-tune the caudal fin propulsion system









The propulsion system is a continuous-rotating system where two oppositely rotating turntables (green box) pull on a set of wires routed through the ribs of the tail seen on the left.

As the turntables rotate opposite of each other, each wire will alternate being in tension while the other remains slack, oscillating the tail similar to the movements of a tuna when swimming.

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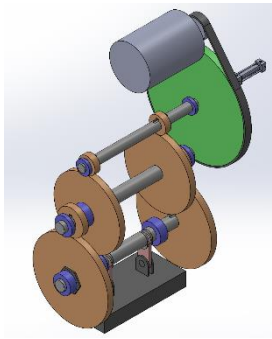
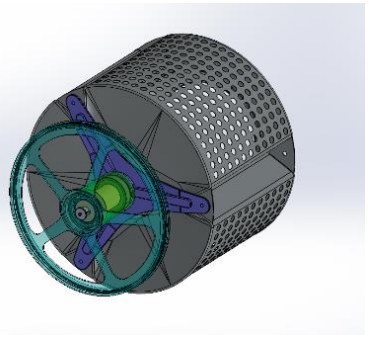
And Much More...



Double-Geared Twin-End Drive Sheet Metal Press Design & Analysis

MSAM - 5-Axis Laser Metal Deposition 3D Printer Control Software & Paper

Canadian Reduced Gravity Experiment – Microgravity Fluids Experiment and Flight Campaign



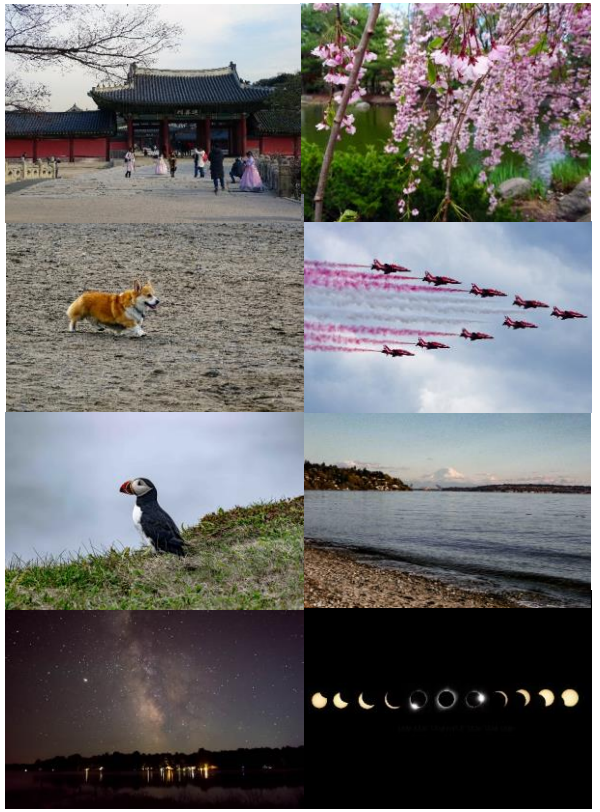
Front Load Washing Machine Drive Assembly – Bearing, Shaft, and Seal Design & Analysis

MasterCAM CNC Programmed and Machined Aluminum Shield

Canadensys Aerospace – Space Cameras Manufacturing, Testing, Calibration, Design

Hatch – Large, High-Speed Bearing and Damper System in Collaboration with General Fusion

Flash Forest – Semi-Automated Seed Pod Manufacturing and Design of Drone Planting System



Digital and Film Photography – Nature, Landscapes, Astrophotography (Nikon D5300, Nikon FG)