James Dugan

Mechanical Engineering portfolio

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James Dugan | Overview

James Dugan | About me

A decade of engineering expertise has taught me that the best leadership is rooted in technical mastery and adaptability. Throughout my career in automotive and retail R&D, I have successfully led the delivery of multidisciplinary products by bridging the gap between mechanical design, electrical integration, and software production.

I thrive in the "zero-to-one" phase of development—quickly learning, resourcing, and leading teams through the challenges of uncharted industries. I am dedicated to building high-performing cultures that prioritise innovation and human-centric design. Whether leading a global team or refining a 3D-printed prototype in my personal lab, I am driven by the pursuit of engineering that disrupts the status quo.

Experience

2010 - 2016
CNC machinist/
internship

2017 - 2019
Research and
development
engineer

2019 - 2020
Mechanical
engineer

2020 - 2022
Mechanical Engineer

2023 - 2024
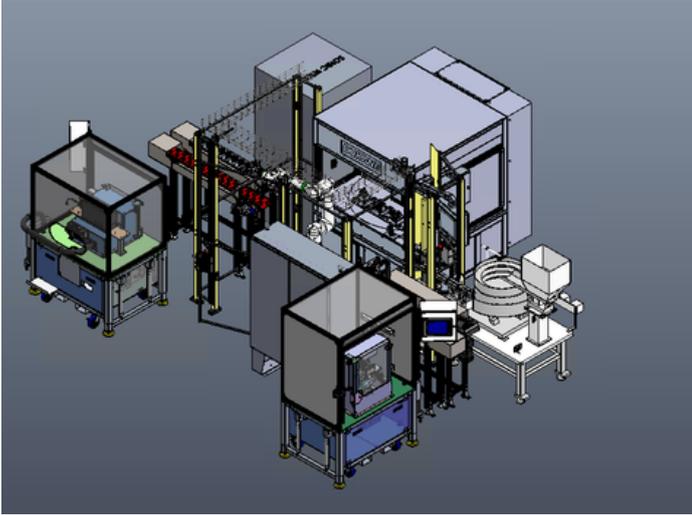Mechanical Engineer

2024 - Current
Design Engineer

Education

Sophmore year mechanical engineering, no degree

Associate Degree Mechanical Engineering

James Dugan | Cummins Valve assembly machine

Involved in the design, and factory acceptance test for an automated valve assembly cell, pre assembly machine, and final test.

Main cell implemented a FANUC robot arm to automatically assemble operated loaded components into a plastic laser welder provided by a custom DUKANE welder

Final assembly and test cell. Cell tested mass flow and leak check
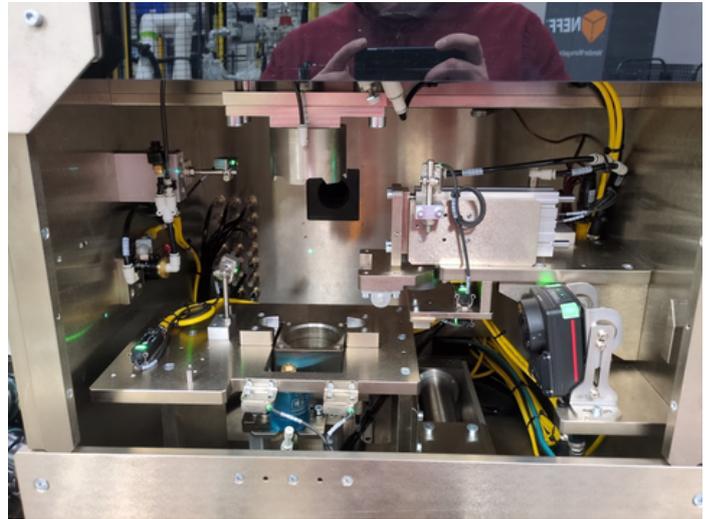
The assembled crank case valve with internal check valve shown next to the full assembly

James Dugan | General Motors Suspension line

This capital project was for an assembly line making the suspension for the Chevrolet bolt. My involvement included 2 overhead Gantries, 4 offload, and on-loading lift assists, and a variety of minor stand alone sub assembly equipemnt
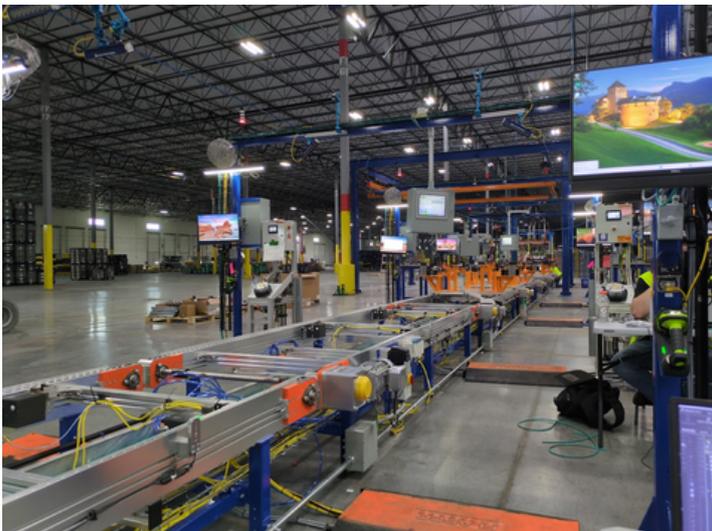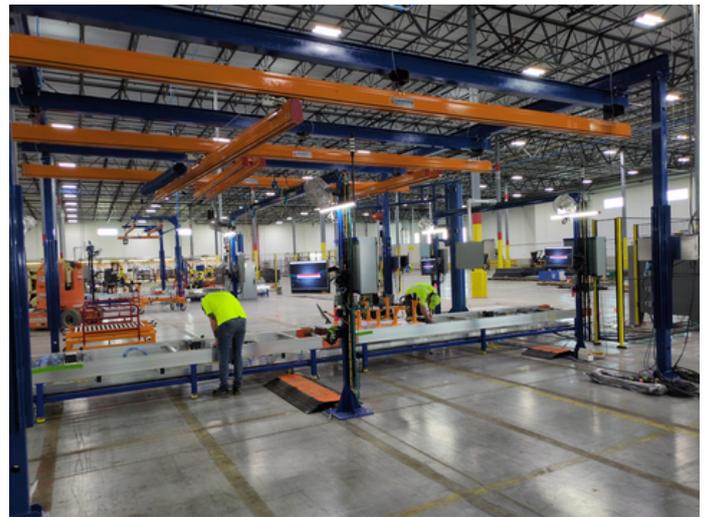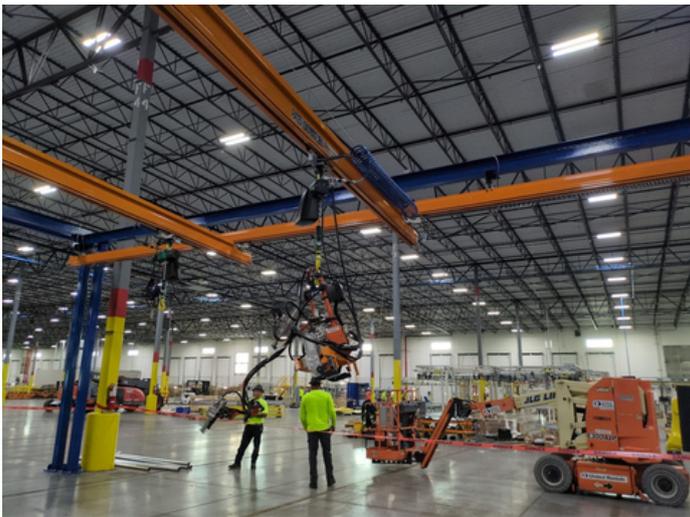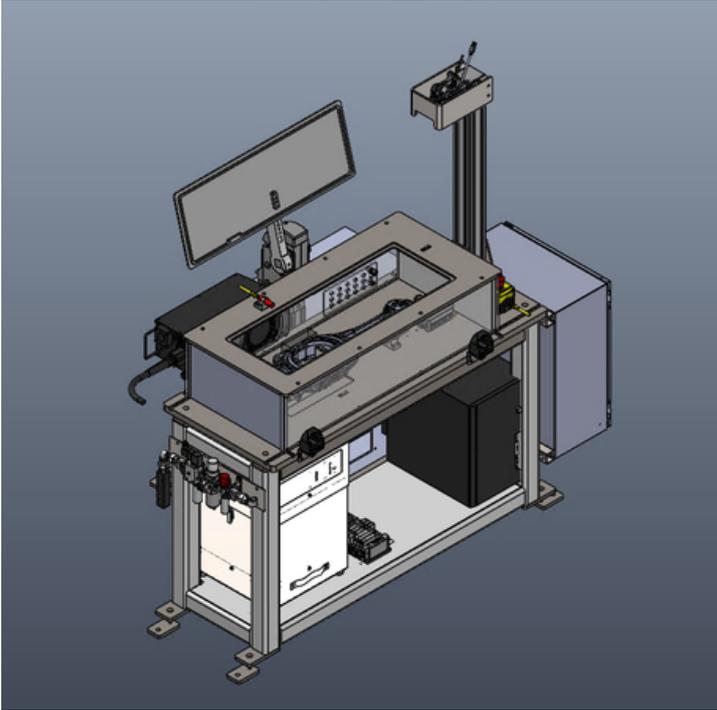
James Dugan | General Motors
Suspension line Shock assembly
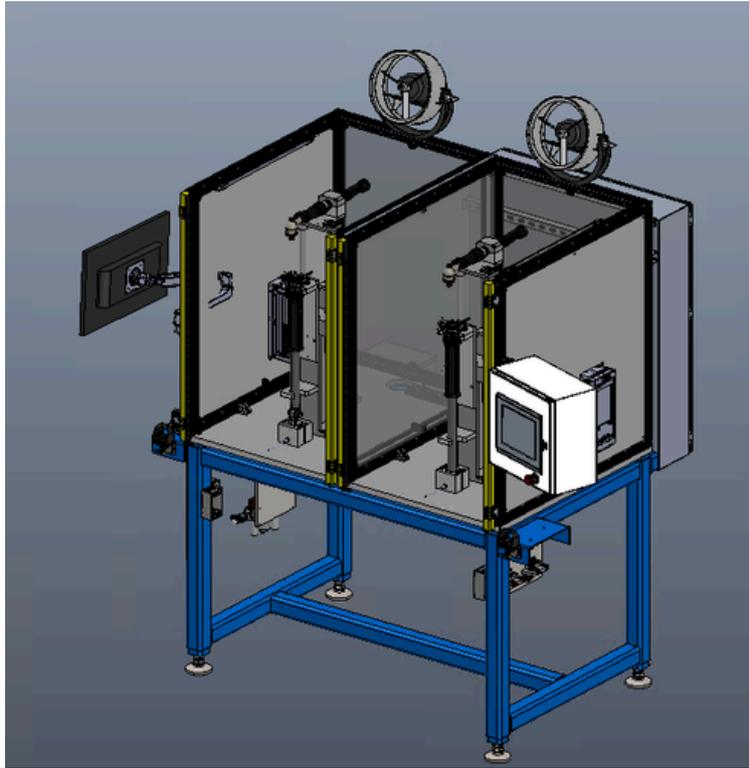
Example of a sub assembly cell from the Gm assembly line. Tasked with the total design to test of a rear suspension assembly machine
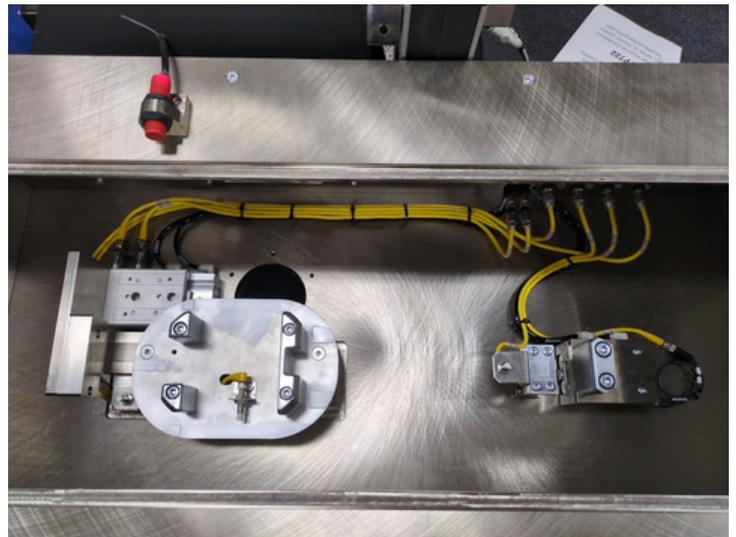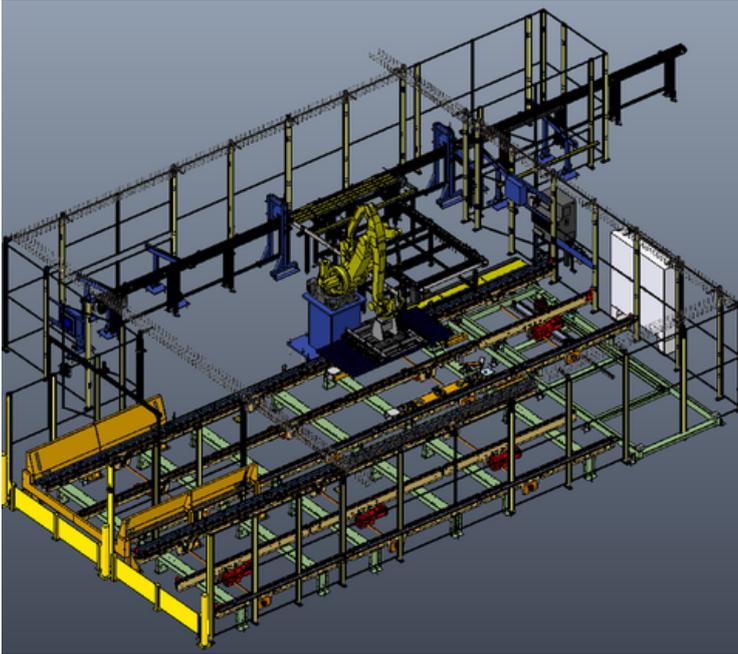
James Dugan | Caterpillar laser table

The laser engraving enclosure was used to mark piston conrods for traceability throughout their fabrication process

Internal components were designed to handle all models of conrod as specified by the customer


Final Table assembly during factory acceptance testing

James Dugan | Solar Rail loader line

The Solar rail packout line took newly formed mounting rails for solar panels and palletised them in large containers that were then carried away by forklifts

The enclosure was designed to run with no human intervention. only a reject and inspection chute would deliver a rail directly to a human
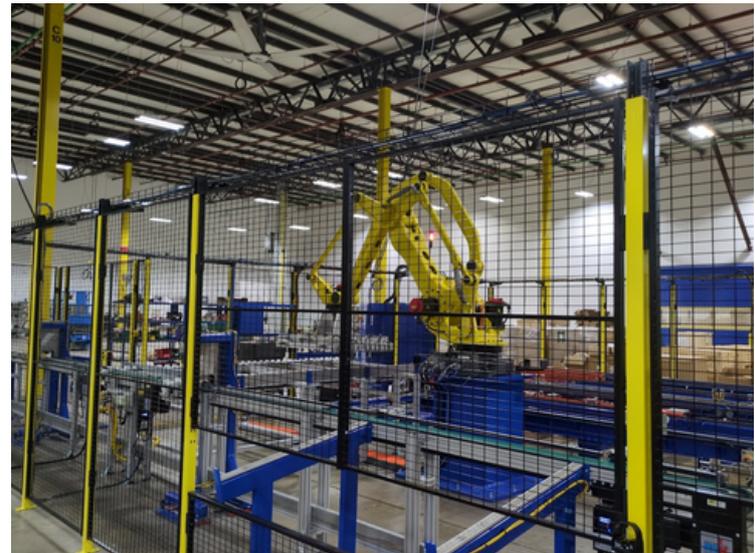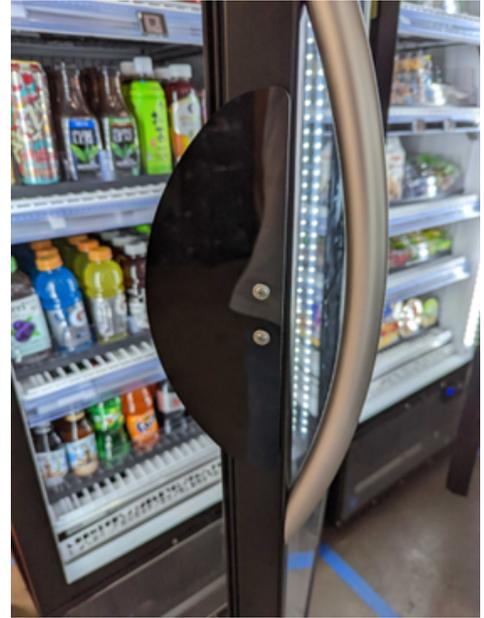

Multiple grippers would take completed rails and place them in a large container to feed an automated assembly line elsewhere
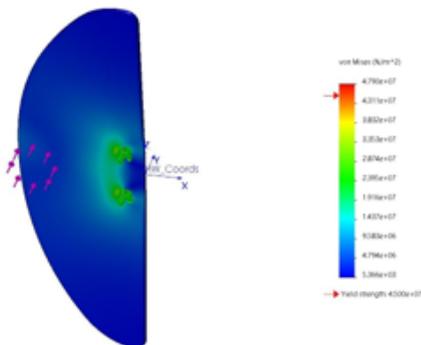
James Dugan | Latch guard stress analysis

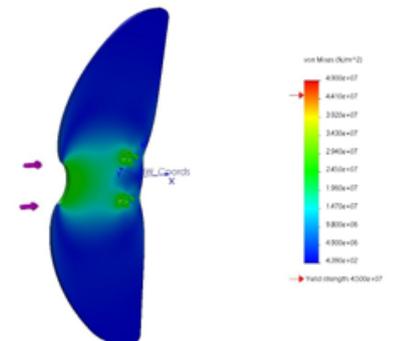Unprotected cooler latch had sharp burrs from supplier

Plastic acrylic cover

Designed, tested and reported findings on a cheap latch guard for cooler lock, that was found to be injuring users. Design included standoffs, which concerened project managers about the possibility of shattering.

Stress test simulations involving worst case scenario loads on the plastic piece as it is attached to the cooler door

James Dugan | Satellite store structure

Completed structure, complete with access panels

Tasked with the design and procurement of an all weather autonomous satellite store. These stores would be similar to vending machines, but would allow easier restocking, and wider selections. Security, and weather proofing was a top concern, as well as regulations regarding placement in gas stations

Fully stocked satellite store

Requirement stated that coolers must be 18 inches from the ground. This picture shows stand underneath coolers

# James Dugan | Smart shelf in working environment

Deployed store at Valet market San Diego
(see: https://www.valetmarket.com/)
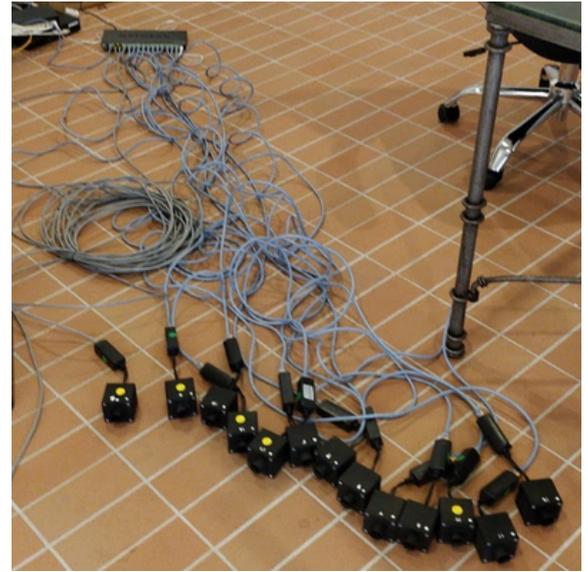

Super heavy case

Worked internationally with a team responsible for a shelf capable of recognizing products stored on it. My involvement was with both the concept and design of new shelvesw, as well as retirement of older model shelves
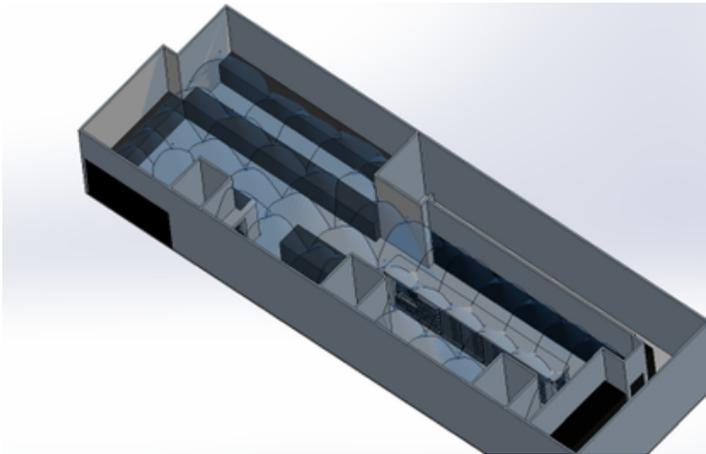

Cold cases

James Dugan | Smart store retrofit
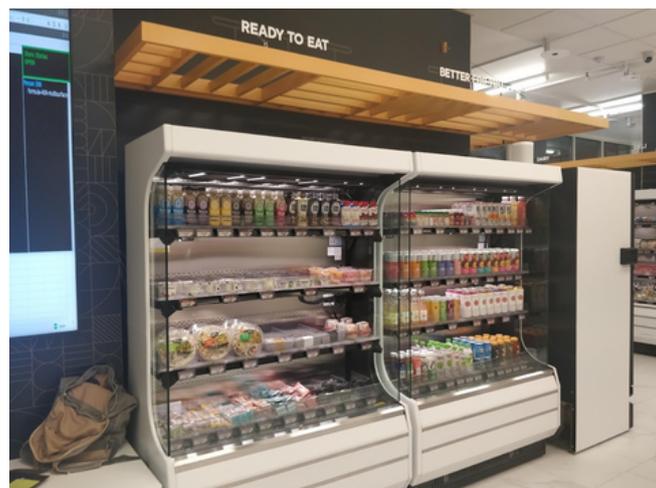
CV IP camera module


Networked and focused cameras

CAD verification of camera coverage

Camera modules installed in roof

This project was in collaboration with Softbank, and Lawson at Softbank's new HQ at Takeshiba, Tokyo. This project required many of my different skills, and required me to learn new ones. From conceptual designs, production, computer vision and networking, I successfully deployed the first stage of making an autonomous retail store, with aid from an international team.
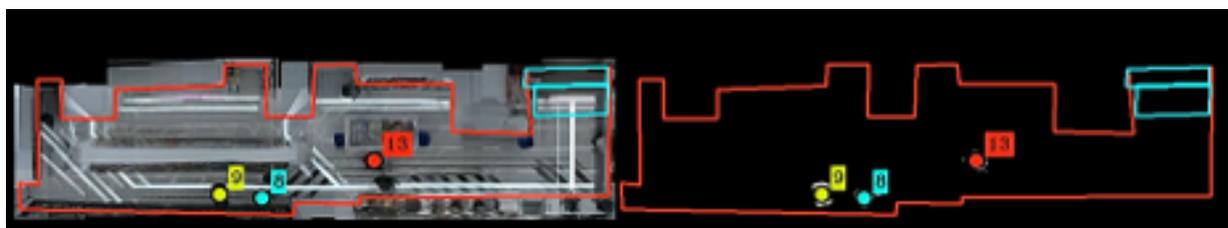
Successful person tracking and tagging

(NDA for this project has expired, contract broken off after stage 1)

James Dugan | Human Proximity detector
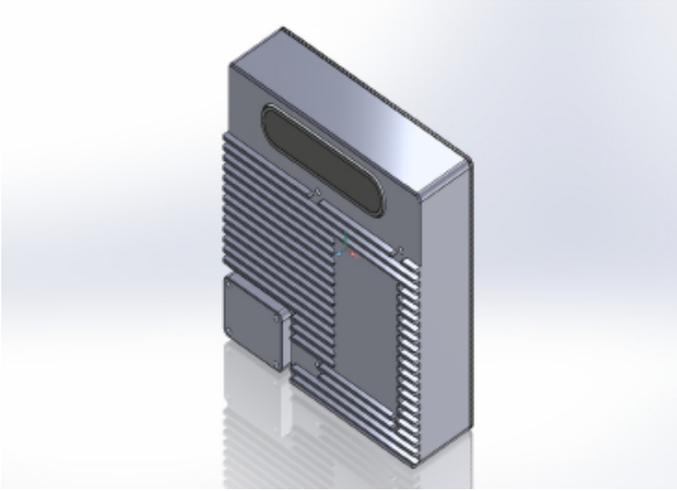
Initial CAD design

3D printed prototype


First article, and -02 version

Completed units after final revision

Designed, and sourced components for a human detection camera. These units were powered by an Nvidia nano and Intel Realsese to detect construction workers around moving industrial equipment

The concept was to use commercially available aluminium extrusion to dictate length. This could be easily adjusted with new belt length
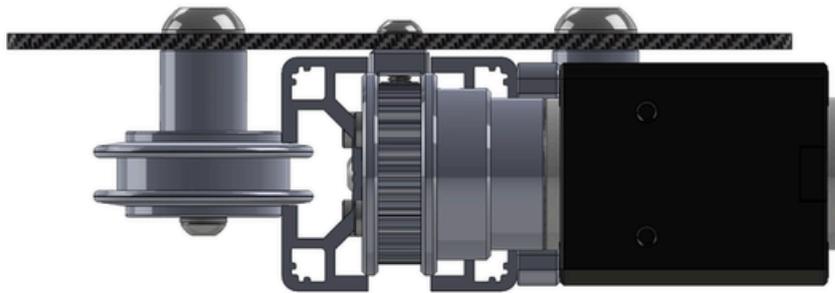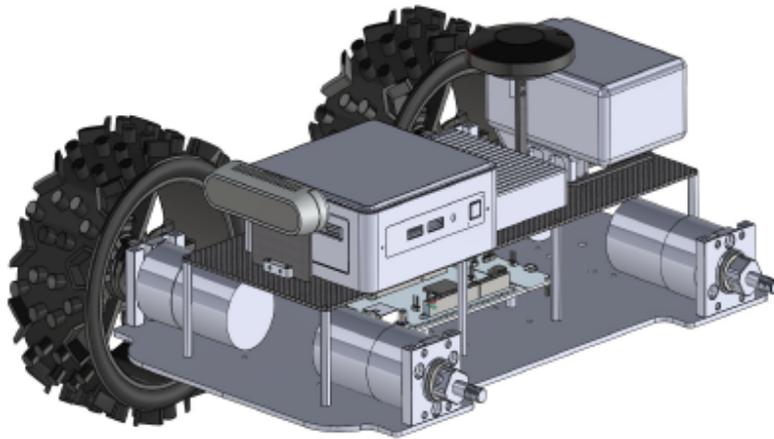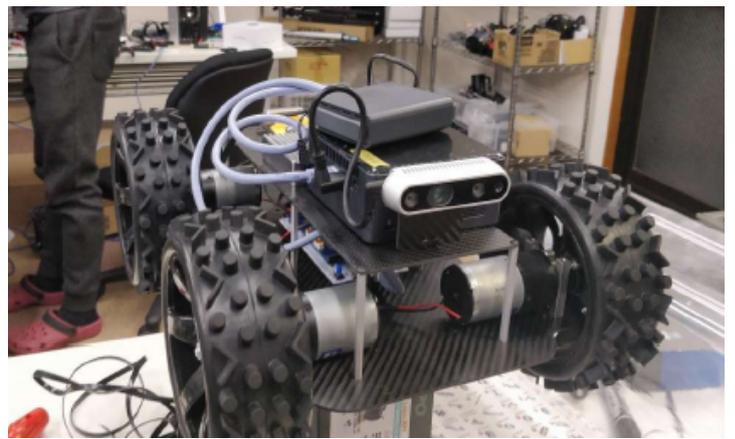

Full view of gear train

Some 3D printed components

Conceptual design of a low cost closed loop linear actuator that would be powered by a Dynamixel servo, and belt driven. The designed torque was 1.8 N*M, and would ultimately be used for moving DSLR cameras
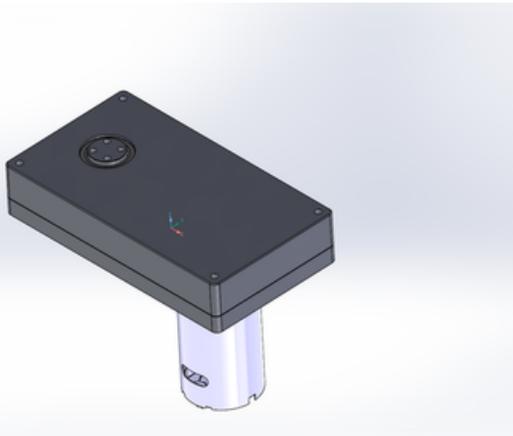
James Dugan | Person following robot

Designed parts, platic cover, and programmed a sample program for a human following vehicle. This product was intended as a development platform for universities using chap motors, and Attrac lab's custom motor controller.
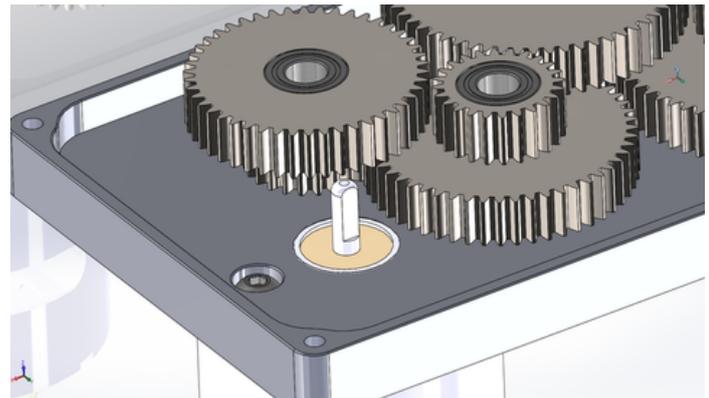

working prototype video here:
https://photos.app.goo.gl/coR32SJT3qi4VdQp8

James Dugan | Large format servo concept

view of gear train

Cover on without bottom case

close up without input gear

Calculations for geartrane using desired tourque, and space inputs

Calculated, and designed gears and geartrain to drive large robotic arms. Servo was designed to be low cost, which involved material selection, and manufacturing techniques.

James Dugan | Pipe robot concept
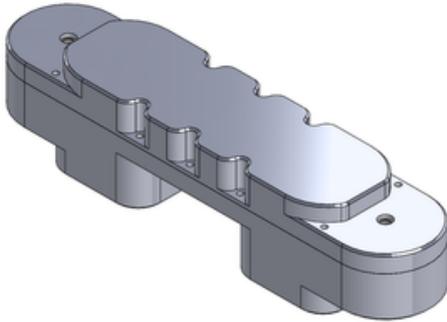
Case assebbly, this was also intended to have a central tread
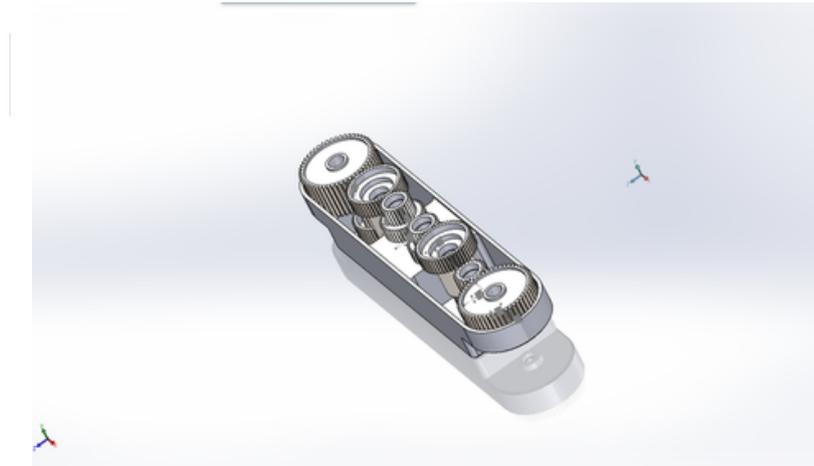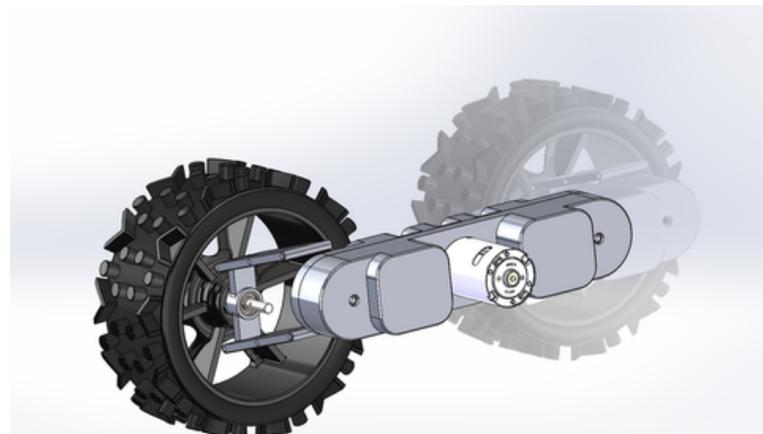

Cover removed

Designed geartrain and robust case for an all wheel drive inspection rover to crawl through drainpipes with computer vision cameras, and inspect for cracks

Full view of gear train

With wheel and basic suspension concept

James Dugan | Tri wheel concept
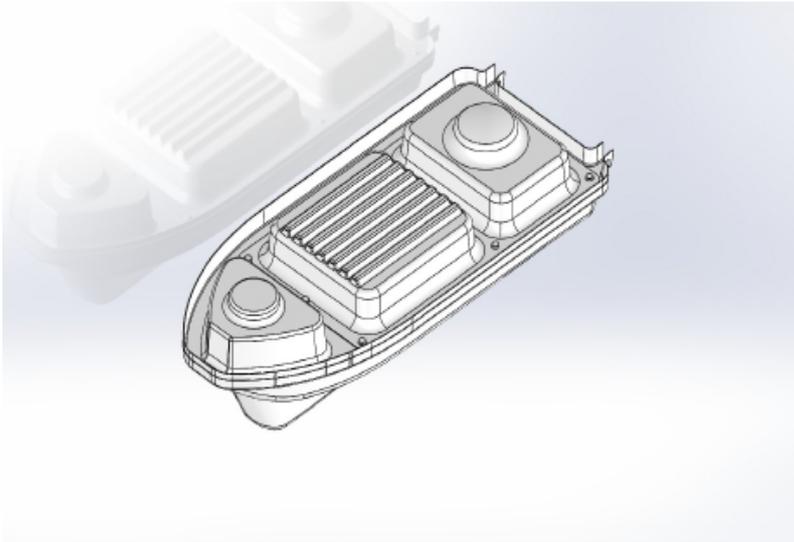

Full assembly
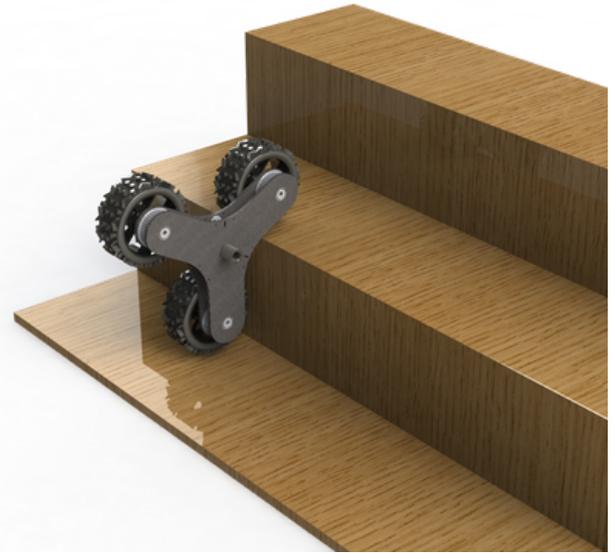
Geometry testing to accommodate most step dimensions

Internal view of drive system

Designed concept for a wheelchair motor driven tri wheel to climb stairs. The entire system was driven by a single belt. While the concept wass never made, a 3D prototype was successfully tested

CAD of boat hull

Designed plastic injection mold for ABS RC boat hull. The boat consists of 3 different pieces that fit together to prevent water from entering the hull where batteries and electronics were mounted.
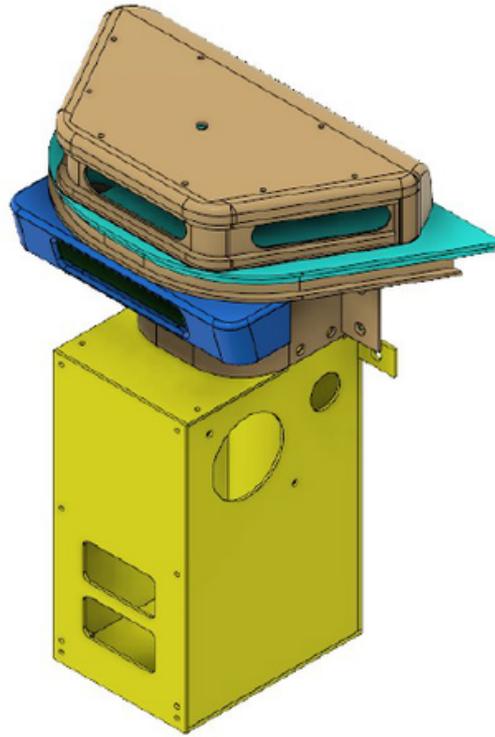

View of completed assembly

Side view of assembled boat

Video of the boat can be found here:
https://www.youtube.com/watch?v=FYc7bkeK4XU&t=136s

James Dugan | Olympic field support robot
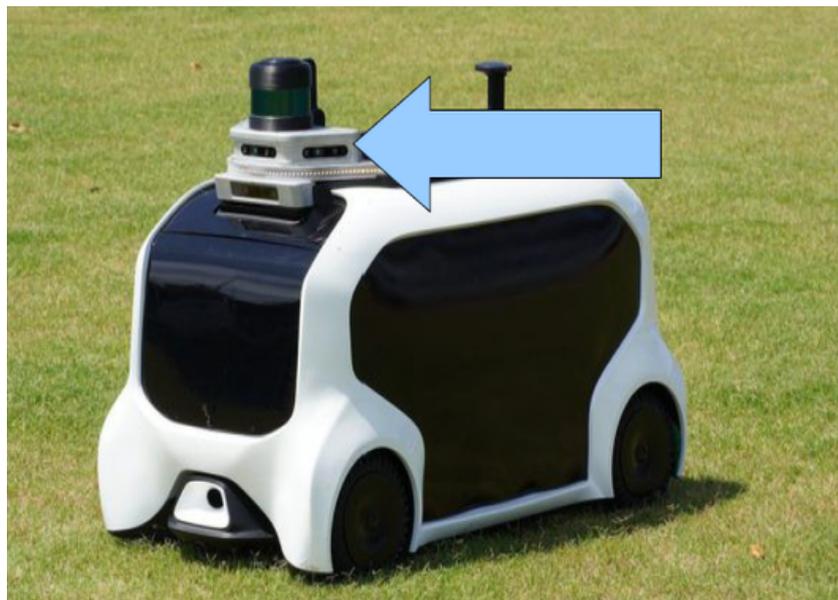
Aided in the design of the Feild service robot in collaboration with Toyota for the 2020 Tokyo olympics. My designs housed the control electronics, and image processing computers

Full assembly outside of vehicle

Location on Feild service robot

More information can be found here:

https://technabob.com/blog/2019/10/24/toyota-field-support-robot/
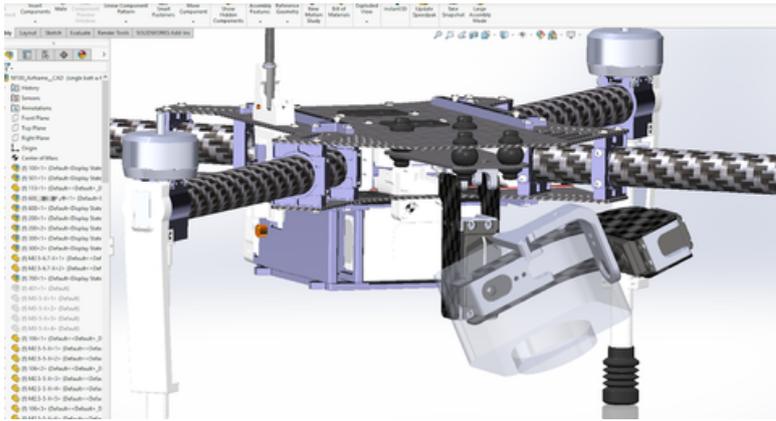
Initial CAD prototype before structural, and weight balance analysis

designed a servo controlled camera gimbal from concept to deployment. specifically designed for the RedEdge camera to be attached to a DJI drone

Completed first article

Installed on drone

James Dugan | UAV Design

low cost/ lightweight drones for university research. included lightweight computer and camera

Holonomic drone. Tilted propellers offered increased manoeuvrability

"Hyoko" octarotor drone designed in collaboration with other employer

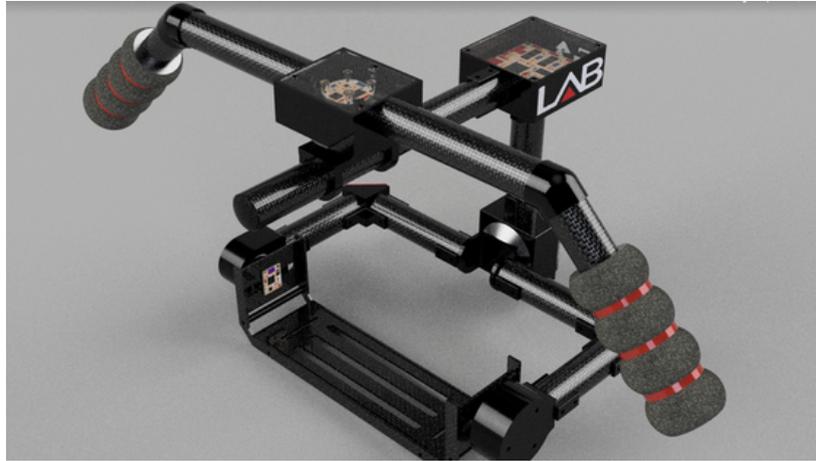**Designed Various UAVs (multirotor drones) for research and development for search and rescue**

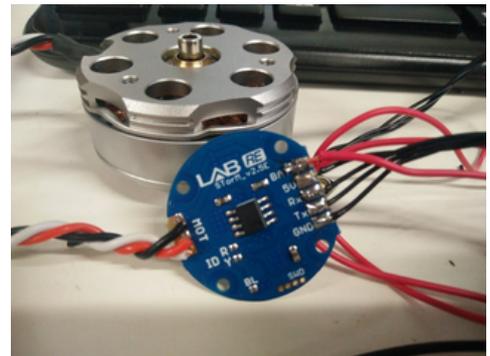Completed "Hyoko" drone sent out to customer

James Dugan | UAV Gimbal

Prototyped, produced, Lead project for all components on a large format DSLR camera brushless gimbal for large drones, and handheld. Based off of the experemental STORM32 gimbal system
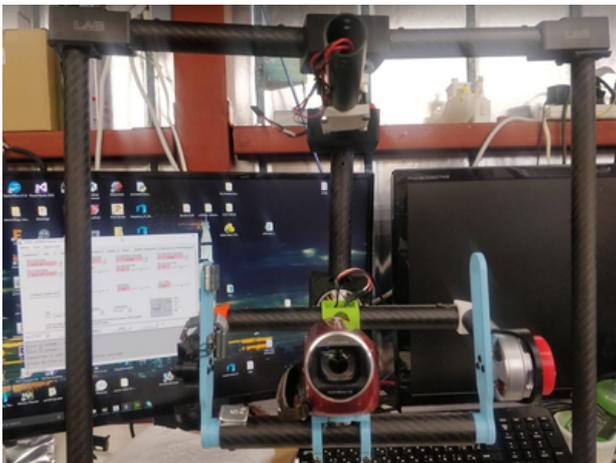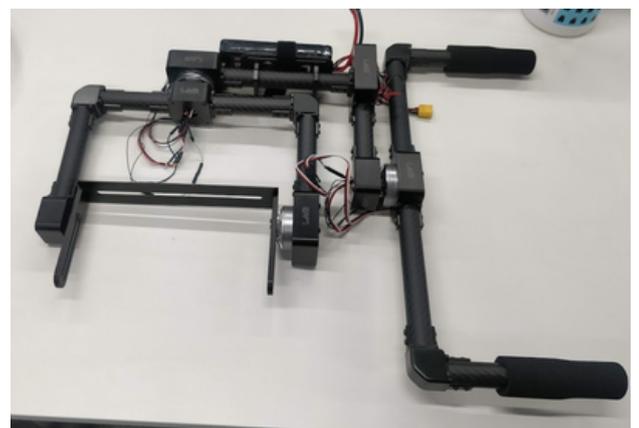

Initial CAD prototype

Custom controller board

Custom designed
motor controller/ sensor board

Working prototype

First article of production model

James Dugan | Thermopile camera
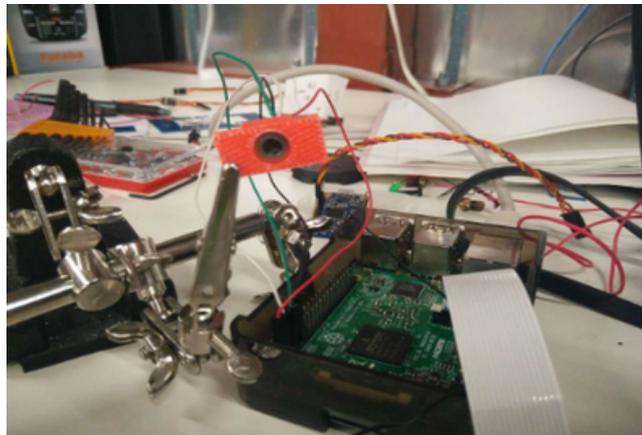
A cheap, and lightweight thermal camera based off of a the Thermografree github project. This sensor was used in a development setting for small drones with limited software capacity

Thermopile sensor used in project

Setup, excluding the raspberry pi camerea
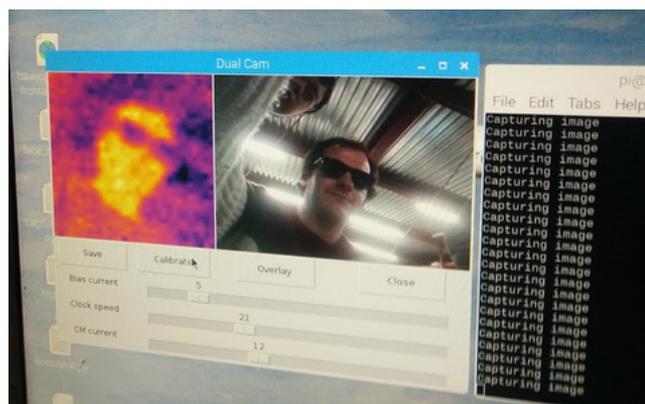
Project with c++ code running thermopile, and raspberry pi camera

Whiile I worked at Allison, I was primarily focused on the assembly, manufacturing, and troubleshooting of the Allison 4000 series, and its production equipment. Due to ITAR I am unable to show any of my works.

James Dugan | Skills

Mechanical

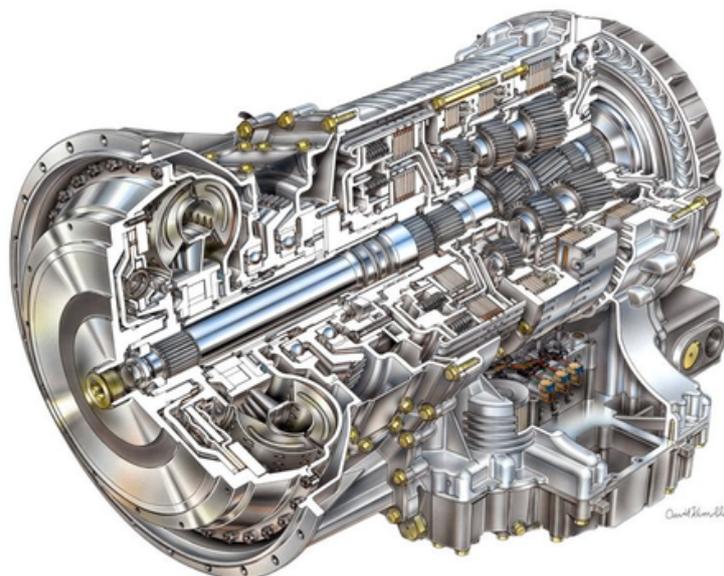- CAD modeling (SolidWorks, Fusion360 , Onshape)
- Drafting and GD&T
- Tolerance analysis
- Finite analysis
- Rapid prototyping / 3D printing / laser cutting
- Plastic Injection molding
- Soldering / brazing
- Developing product requirements
- Creating work instructions
- Machining processes (lathe, mill EDM, Welding)
- Material selection

Computer

- C++
- Python
- Ruby on rails
- Arduino
- Lunix (Debian / Arch)
- Docker
- ANSYS

Project management

- PowerPoint / Word / Excel
- Financial documentation, and awareness
- Jira / Confluence
- Progress reporitng
- Design reviewing

testing

- Failure mode analysis
- Worst-casing
- FEA
- Testing development / planning
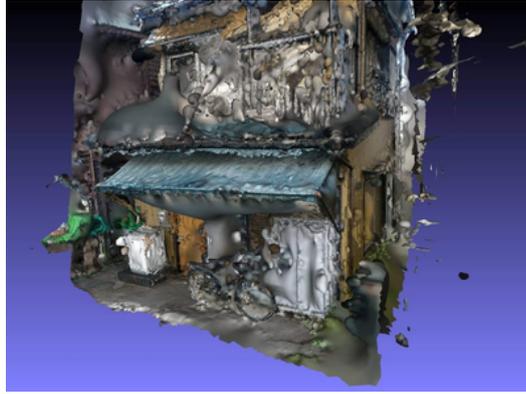- Machining analysis

Intrapersonal

- Supplier communication
- remote communication
- client / manager presentations
- Leadership
- Multi-disciplinary Teamwork
- Teambuilding

James Dugan | Personal intrests

Photo from the Tama river

3D reconstruction from 2D photos, of my old Japanese house

3D printed hand from InMoov project

I am a maker, my professional life has benefited from this hobby in many different ways. Especially in the areas of electronics and programming.

Aside from engineering interests, I enjoy the outdoors, and documenting historic places.. My travels have afforded me the luxury of exploring many different places in the United States and Japan.

I love Travelling, and new technologies for the challenge that each new experience has to navigate.

View of the salton sea, California

Bike and camping gear