KENT ROBERTS

Engineering Design Portfolio

Contents

ManTech – NSSL Systems Analyst

During my time as intern and later part-time employee (starting in June of 2020) I worked to develop the automation of National Security Space Launch (NSSL) payload specification compatibility checks and early design analysis leveraging modern simulation and wrapping tools. The aim of this project is to create an easy to use terminal for payload designers to configure and check hypothetical payloads/mission profiles with respect to the Launch Systems Enterprise Directorate Evolved Expendable Launch Vehicle Program Standard Interface Specification (SIS). All simulations and analyses are automated and hosted on remote servers. Due to the nature of this project, I have not included any image or screenshots.

Skills demonstrated: workflow automation (ModelCenter), Launch/Orbit simulation (STK), FEA (Simcenter Femap), SysML (Cameo), data processing (MatLab)

General Atomic – Internship Projects

High Resolution Flash 3D LIDAR Based on Polarization Modulation

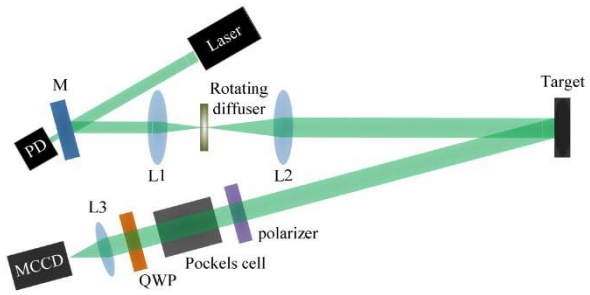


Figure 1: Flash 3D polarization LIDAR optical path [Jo]

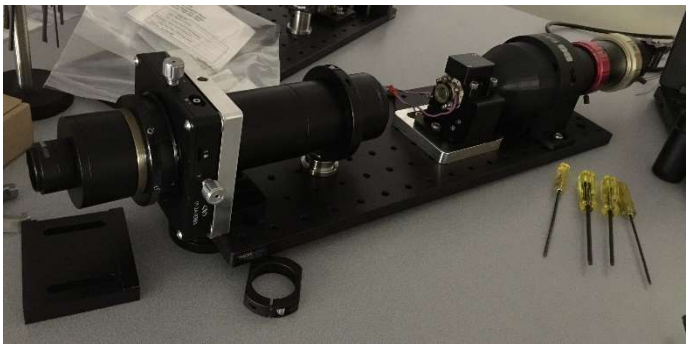


Figure 2: My laboratory prototype

Figure 3: MQ-9 [GA]

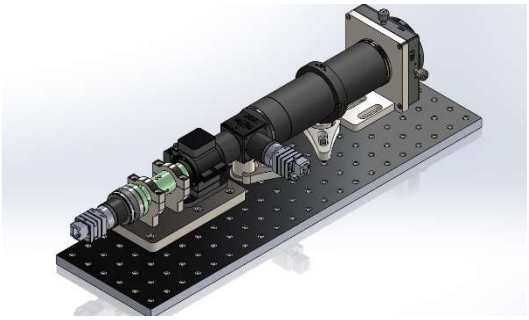


Figure 4: My LIDAR instrument CAD model

General Atomics is a national leader in the UAV and remote sensing industry. During the summer of 2018 I was the responsible engineer for the design and prototyping of a novel Predator drone tracking and targeting system, a high-resolution flash 3D LIDAR system based on polarization modulation. The system collects laser light reflected from a target, encodes time of flight information into the polarization of the light received by the camera. An array of polarization filter is included in front of the camera sensor, filtering the light. The camera data is then process (through a matlab program I wrote) to recover a 3D point cloud of the target.

Skills demonstrated: optical design (Zemax), data processing (MatLab), CAD (Solidworks)

Due Regard Radar Data Correlation

I wrote a MATLAB script to translate and correlate the radar tracks taken by the Due Regard Radar system with those observed by ground-based radar. This project ultimately proved the reliability of the Due Regard Radar system as tested on the Predator-B platform.

Skills demonstrated: data processing (MatLab)

FASE- Formula Slug

FS – 1 Aerodynamics Design Lead (& Body Panel Design)

Figure 6: Complete aerodynamic design

Figure 7: Reduced aerodynamic design to body panel (deadline pressure)

Figure 5: Working on the car with the side panel installed and nosecone remove

I designed a complete aerodynamics package for the FS-1 electric racecar, refined via CFD and lap simulation (Figure 5). However, with the rapidly approaching competition deadline and the limited resources of the team, the design was reduced to simple body panels (Figure 6). We manufacture the carbon fiber panels via a DIY autoclave after the laborious mold making process. The team ultimately could not compete in the 2017 Lincoln competition due to issues with our BMS and I moved on from my role on the team to start the UCSC high power rocket team to compete in NASA SL (Next section).

Skills demonstrated: CAD (Solidworks), CFD (Solidworks Flow Sim, Ansys Fluent), design optimization, composite manufacturing, CAM, Aerodynamics

NASA SL- University of California, Santa Cruz Rocket Team

I founded the UCSC Rocketry team in the fall of 2017 with the primary intention of entering the NASA SLI competition. The team's first year under my leadership was successful, completing the major milestones of the NASA SLI competition and growing to a team of 30+ dedicated students interested in learning and promoting space related STEM education. Since 2017, the team has taken on more ambitious projects, gained influence on campus, and fostered community fellowship. I personally serve as the primary technical resource enabling the team's projects. For more information, checkout the team's website here: https://ucscrocketry.org/

Skills demonstrated throughout rocket team experience: Leadership, data processing (Python), FEA (Ansys and Solidworks), CFD, CAD(Solidworks), rocketry, composite manufacturing, flight dynamics

She'll Be Right (NASA SLI 2017/18 Sub-scale)

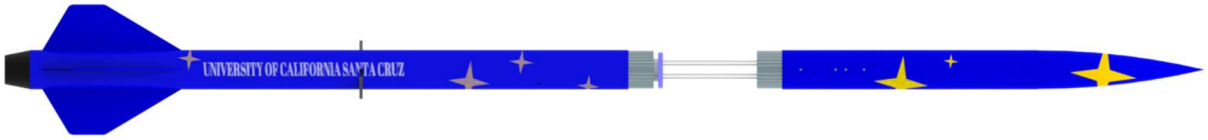
Motor: J420

Apogee: 767m

Max Velocity: 125 m/s

This was the first major project completed by the UCSC Rocket team. As the founding team captain, I not only handled the primary logistics of the team but also served as the vehicle designer. Because the team was new and its members inexperience, I was the principal source of technical knowledge for the team. I wrote most of the team's documentation, submitted for review by NASA engineers in accordance with the NASA SLI guidelines, while doing my best to educate other members. This rocket was a proof of concept for its successor (Effecitve-1). Read more about She'll Be Right:
https://ucscrocketry.org/docs/University%20of%20California%20Santa%20Cruz%20-%202018%20-%20CDR%20-%20Report.pdf

Effective – 1 (NASA SLI 2017/18 Full-scale)



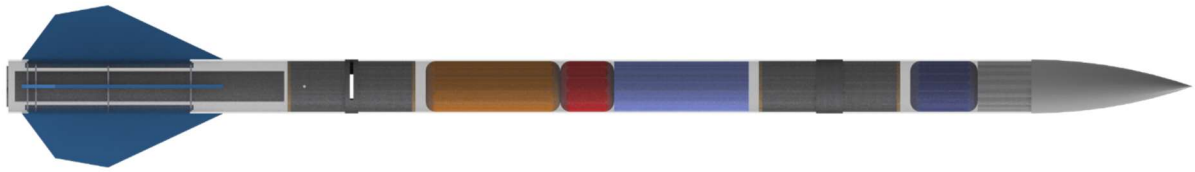
Motor: K535

Apogee: 1578m

Max Velocity: 200 m/s

Effective-1 was the UCSC Rocket Team's full-scale entry into the NASA SLI competition. I served as team captain and project lead during this project. This rocket featured a ground target detection system (hence the polycarbonate clear section) and the preliminary rendition of an adaptive aerobraking system. The target detection system performed flawlessly, capturing images of the area bellow the rocket and identifying targets based on color (see included image). The adaptive aerobraking system, which was designed to decelerate the vehicle to reach exactly 1-mile apogee did not perform as expected. Experience from this rocket has fueled later iterations of the adaptive aerobraking system. This rocket was launched numerous times and taught valuable lessons about recovery parachute preparations each of those times. Ultimately the team attended the NASA SLI launch week with a broken rocket but shared the lessons we learned along the way. Read more about E-1:
https://ucscrocketry.org/docs/University%20of%20California%20Santa%20Cruz%20-%202018%20-%20FRR%20-%20Report.pdf

Take Me Home (NASA SLI 2018/19 Sub-scale)



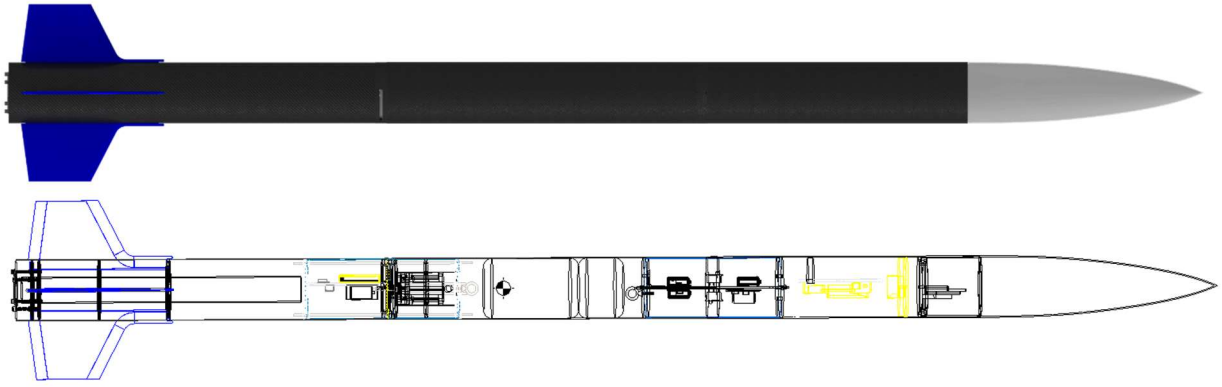
Motor: J420

Apogee: 609m

Max Velocity: 91 m/s

Now, in the second year, the UCSC Rocket Team has grown and I have stepped down from the team captain position to fill the primarily technical role of project manager. The Take Me Home rocket was built as a testbed for the team's 2018/19 NASA SLI entry. This rocket features the team's first in-house carbon fiber manufactured airframe (produced via a scrappy technique I pioneered), the first revision of the removable fin system I designed, and the second revision of the adaptive aerobraking system. The rocket's flight was overwhelmingly successful, performing all mission critical tasks and executing a flawless recovery. Learn more about Take Me Home here:
https://ucscrocketry.org/docs/UCSC%20SLI%202019%20CDR.pdf

Country Roads (NASA SLI 2018/19 Full-scale)



The primer launch of the Country Roads rocket is slated for February 2019 on a L1000 motor. I have served as the project manager and principal technical lead for this project. This rocket features a 5.3" diameter airframe which houses the team's soil sample collection rover within it's payload structure. This rocket features yet another revision of the adaptive aerobraking system. Also based on the success of my removable fin mechanism included in the Take Me Home rocket, Country Roads will feature a similar mechanism. Read more here: https://ucscrocketry.org/docs/UCSC%20SLI%202019%20CDR.pdf

References

Jo, Sungeun et al. "High resolution three-dimensional flash LIDAR system using a polarization modulating Pockels cell and a micro-polarizer CCD camera." Optics express 24 26 (2016): A1580-A1585.

https://www.ga-asi.com/remotely-piloted-aircraft/mq-9a