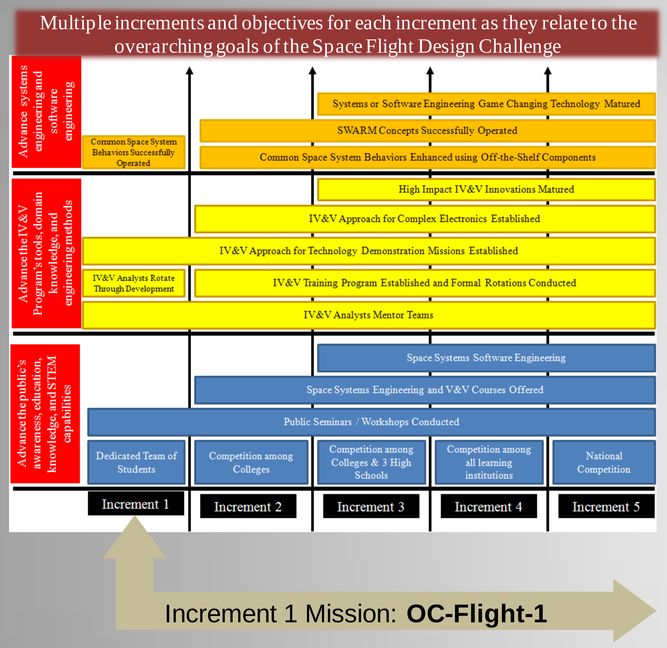
NASA IV&V Space Flight Design Challenge

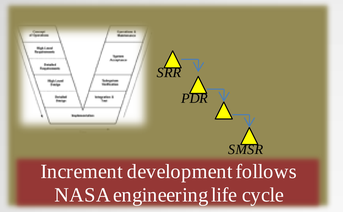
Project Manager: Marcus Fisher
Office Lead: Jeff Northey
Lead Systems Engineer: Steven Hard

Marcus.S.Fisher@nasa.gov
Jeffrey.R.Northey@nasa.gov
Steven.L.Hard@nasa.gov

The NASA IV&V Program has embarked on an initiative where teams from academic institutions across the state develop knowledge and gain practical experience in designing, building, launching, and operating space-based vehicles. The Space Flight Design Challenge serves to remove obstacles posed by the complexities inherent in developing critical systems by making the knowledge required and practices utilized for such endeavors commonly understood topics. This initiative will serve to advance IV&V approaches and provide practical test beds for IV&V engineers to maintain their domain expertise and rapidly mature innovative solutions for the application of IV&V on NASA's missions.



Teams of Students & NASA IV&V Engineers



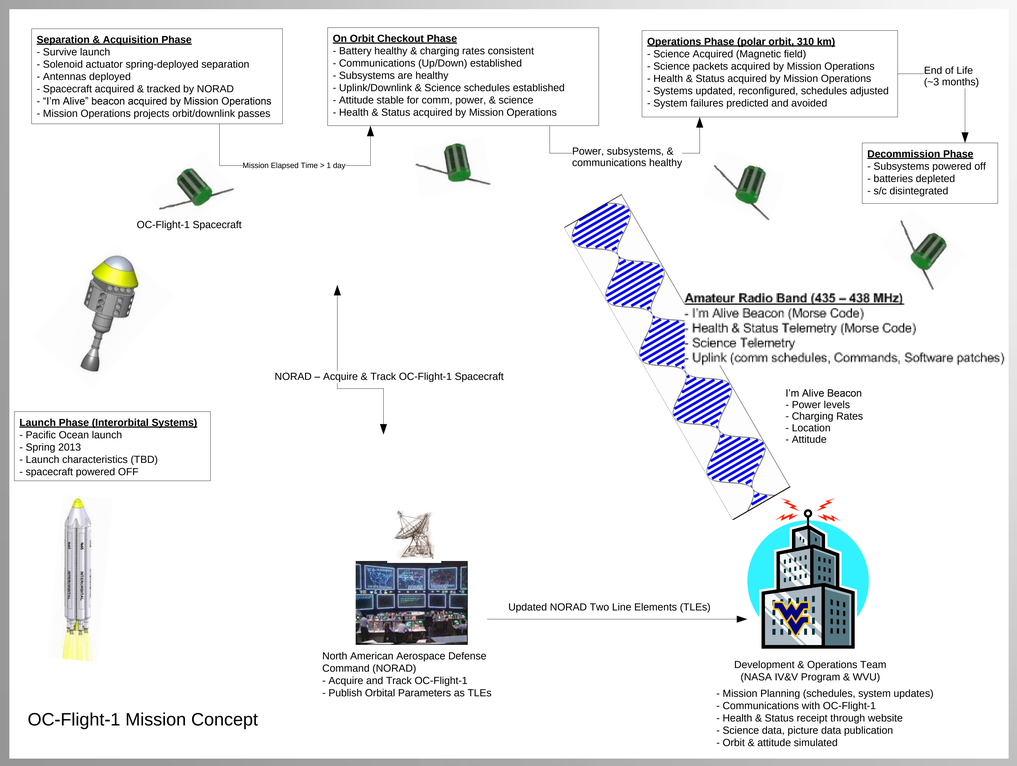
Increment 1

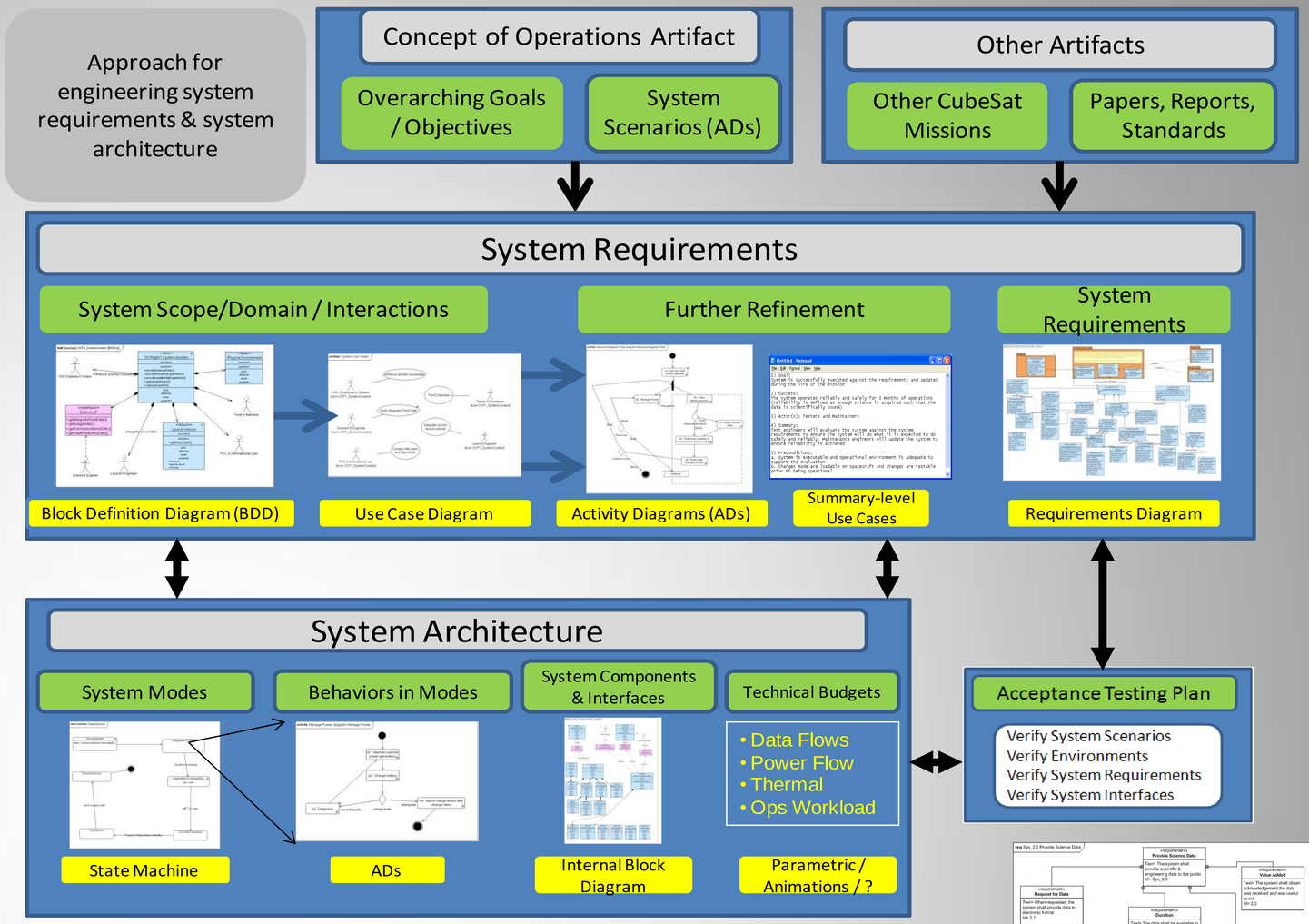
Mission: OC-Flight-1

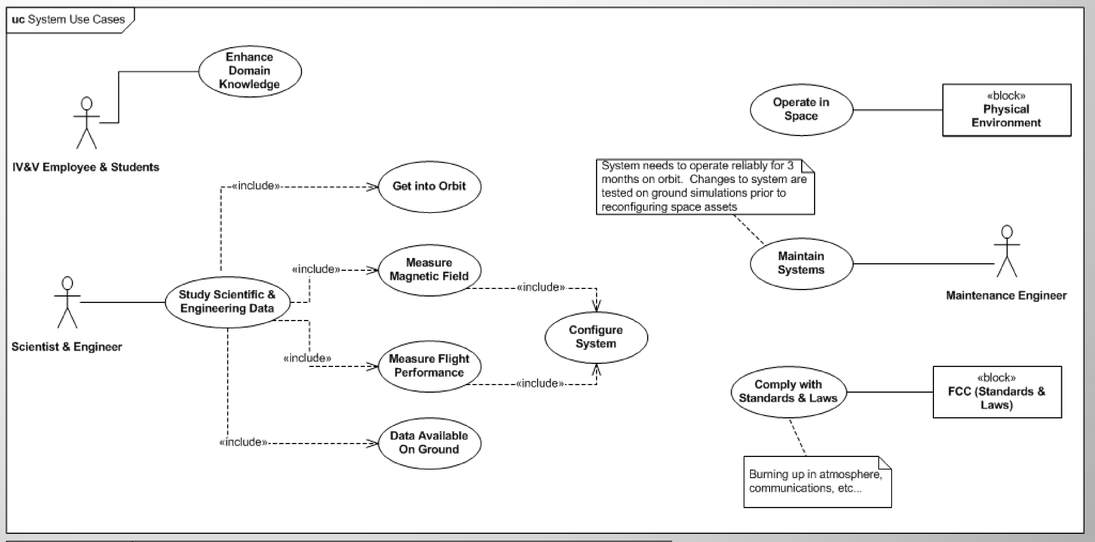
Launch: Spring of 2013

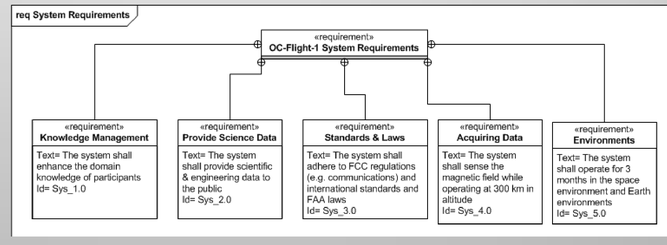
Launch provided by Interorbital Systems

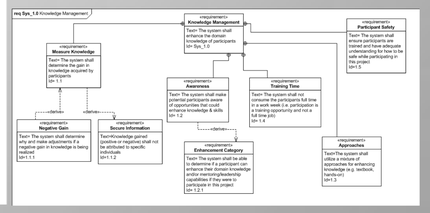
1. Spacecraft kits (TubeSats)
2. Low cost – off the shelf components
3. Development team responsible for requirements, designs, fabrication, integration, testing, operations in LEO (~ 3 months at 310 km)
4. Development team conducts milestone reviews with SFDC Advisory Committee
5. Development team responsible for publishing results, and conducting public workshops/seminars

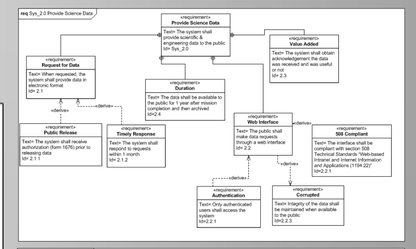


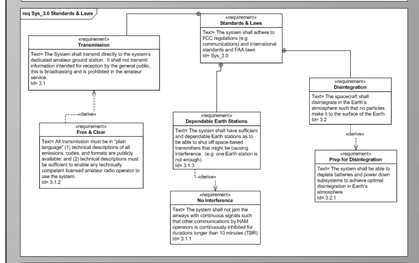


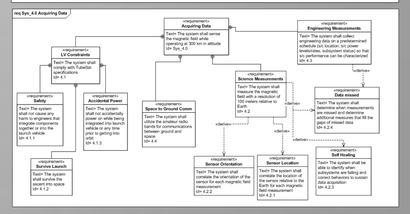


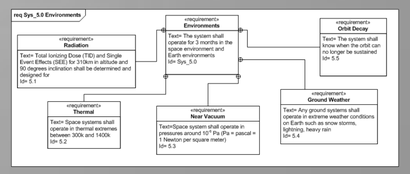












OC-Flight 1

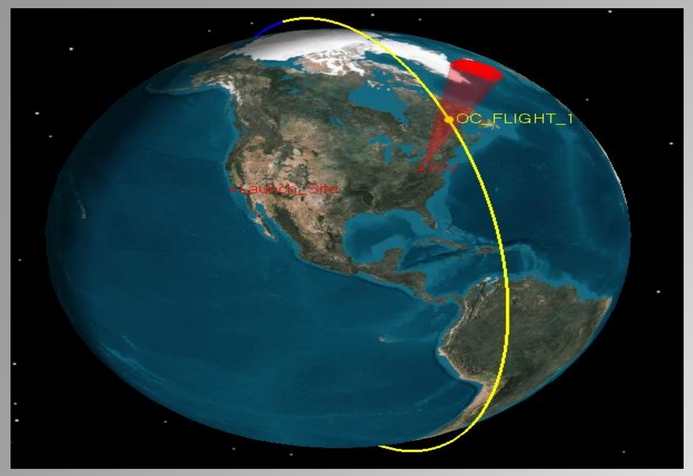
Steven Hard
Scott Zemerick
Ricky Forquer
Sam Cilento

Alan Didion
Alex Bouvy
Matt Cunningham
Ben Knabenshue

Joelle Spagnuola-Loretta
Stephen Driskell
Jackson Driskell
Greg Black

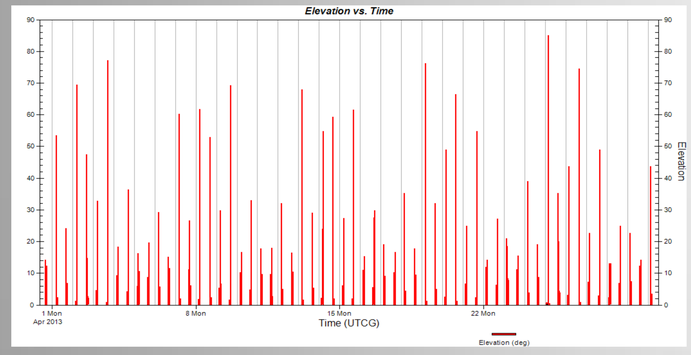
The first mission in the NASA IV&V Space Flight Design Challenge is dedicated to Bryan O'Connor and serves to represent the "yes if" attitude required to meet the far-reaching goals that have been set forth. Our first flight reaches new heights, drives critical thinking, and demands excellence that Bryan O'Connor has exemplified during his tour as Chief of the Office of Safety and Mission Assurance at NASA. The first flight is named "OC-Flight 1 in honor of Bryan O'Connor.

Orbital Profile



- STK was used to perform an analysis on the expected orbital profile for 1 year projection
- Launch site and permanent ground station displayed on 3D map
- Conical projection illustrates communication window between ground station

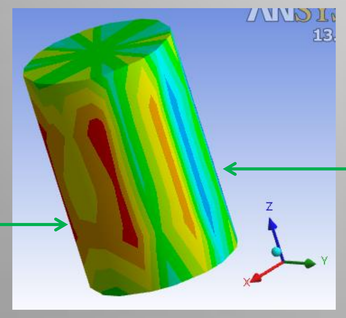
Elevation Angle Projection



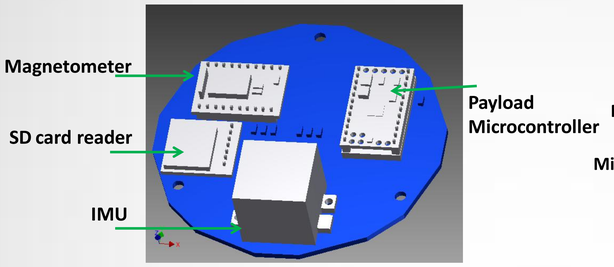
- Spikes in elevation angle plot show overhead pass opportunities
- 2-3 overhead passes expected per day for permanent ground station
- Best opportunities for communication are mid elevation passes

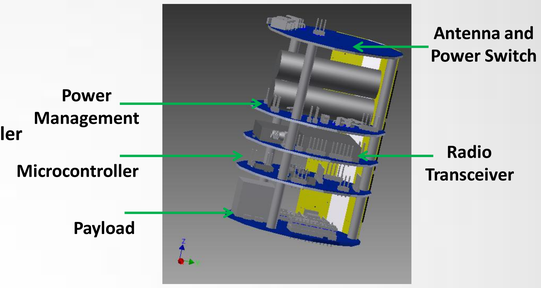
Thermal Analysis

- Preliminary FEA performed to obtain surface temperature distribution due to radiation heating



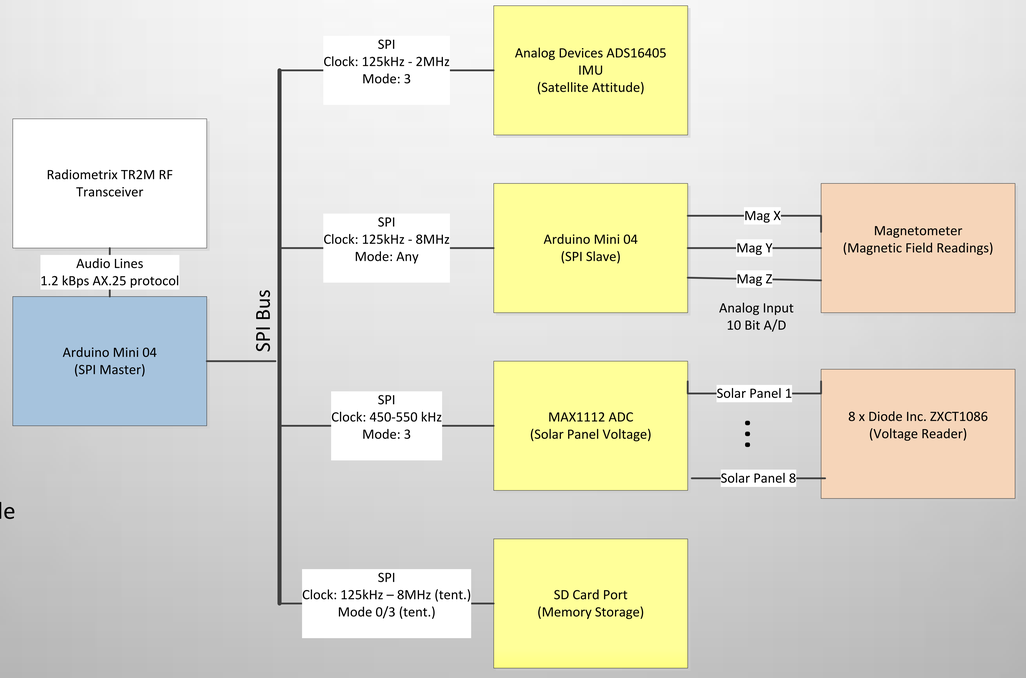
3D Modeling



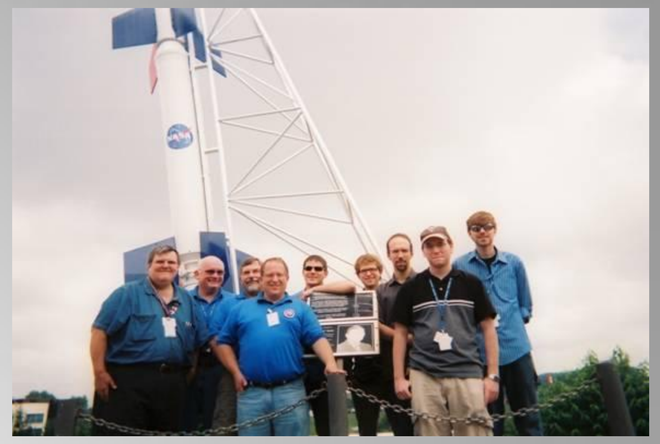


- 3D mockup of TubeSat design created using Autodesk Inventor
- Payload configuration designed to incorporate additional microcontroller
- IMU integrated into payload design to correlate spacecraft orientation with magnetometer data
- SD card reader permits use of mass storage micro-SD memory card
- 3D model printed using in-house rapid prototyping machine

Hardware Architecture

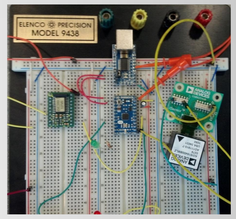


Amateur Radio Licensing

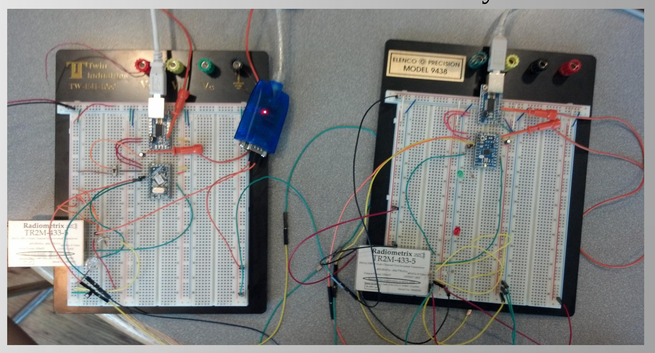


- Communications team photo w/ examination committee after successfully obtaining Technician Class amateur radio privileges

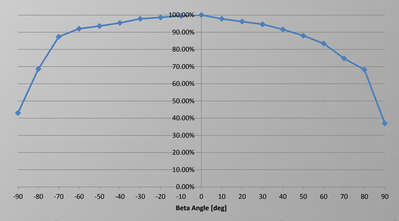
Subsystem Testing

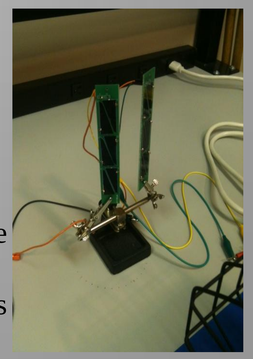


- Each payload component tested individually and verified to be working correctly
- Data successfully written to micro-SD memory



- Communication tested between two identical transceivers
- Handy talkie serves as mobile ground station





- Voltage output vs. beta angle tested using halogen lamp
- Investigated use of solar panels to correlate a sun vector