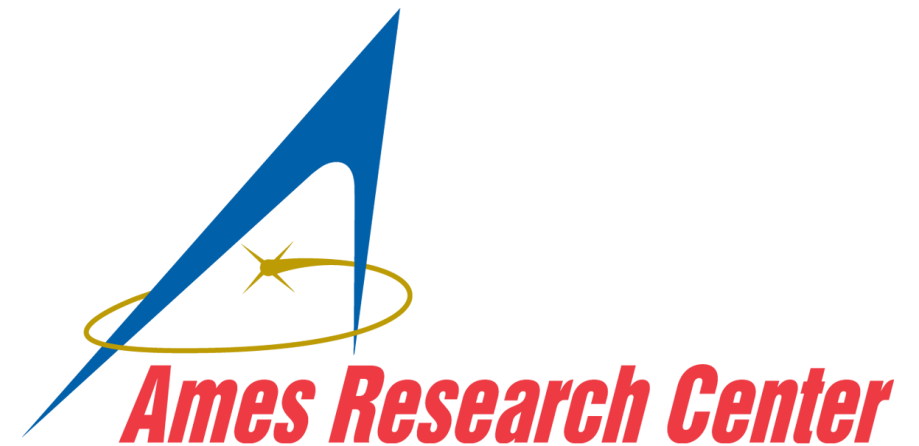


# Team TARDIGRADES

- Finan Bryan (ME)
- Joe Dennison (CompE)
- Robert Goes (Math & CS)
- Cosette King (CS)
- Lily Mortensen (MSE)
- Drew Pilchard (EE)
- Grace Rosenvall (ME)
- Harrison Thomsen (EE)
- Taegan Williams (CS)



Objective: Reduce cost of  
CubeSats by using individual  
components and custom layouts

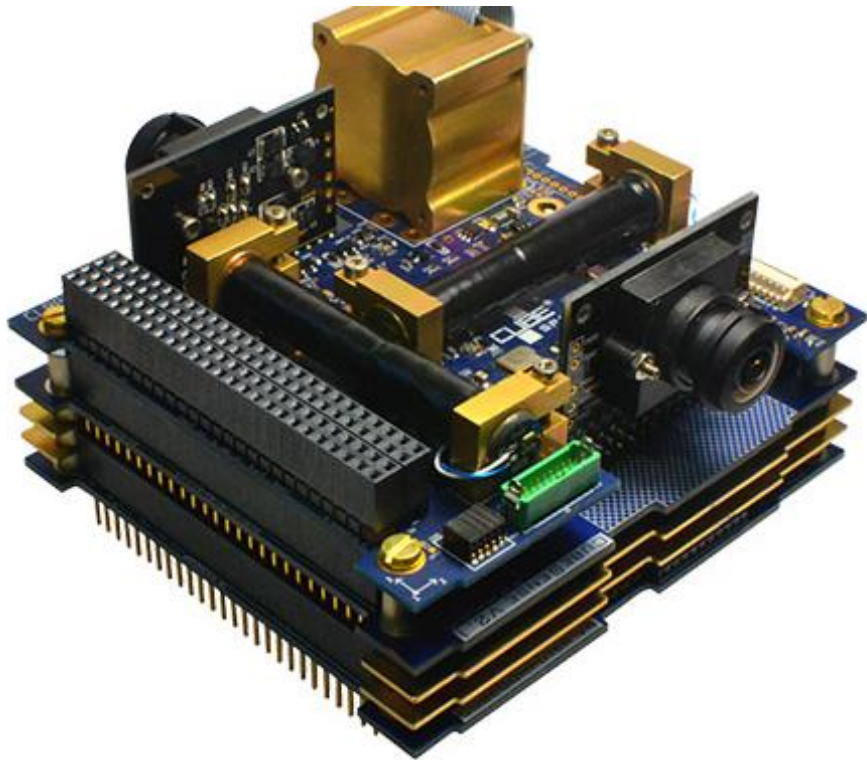
---

# ADCS Subteam

---

- Finan Bryan (ME)
- Lily Mortensen (MSE)
- Grace Rosenvall (ME)

# Background/Requirements

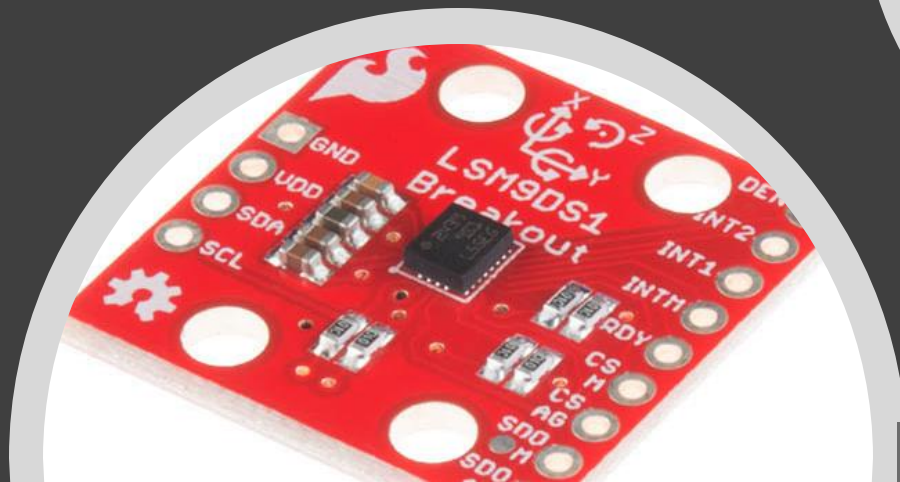
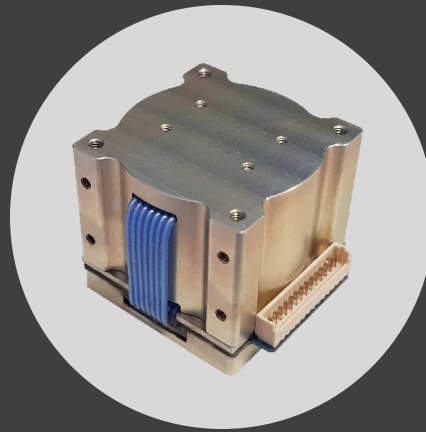


Commercial  
Example (\$25K-\$37K)

- Commercial ADCS units are very expensive
- Individual components are relatively cheap
- Our goal is to build a more effective system for a fraction of the cost.

# Individual Components

- Reaction Wheels
- Sun Sensors
- Magnetorquers/Torque Rods
- IMU
- Magnetometers



# Conceptual Development Process

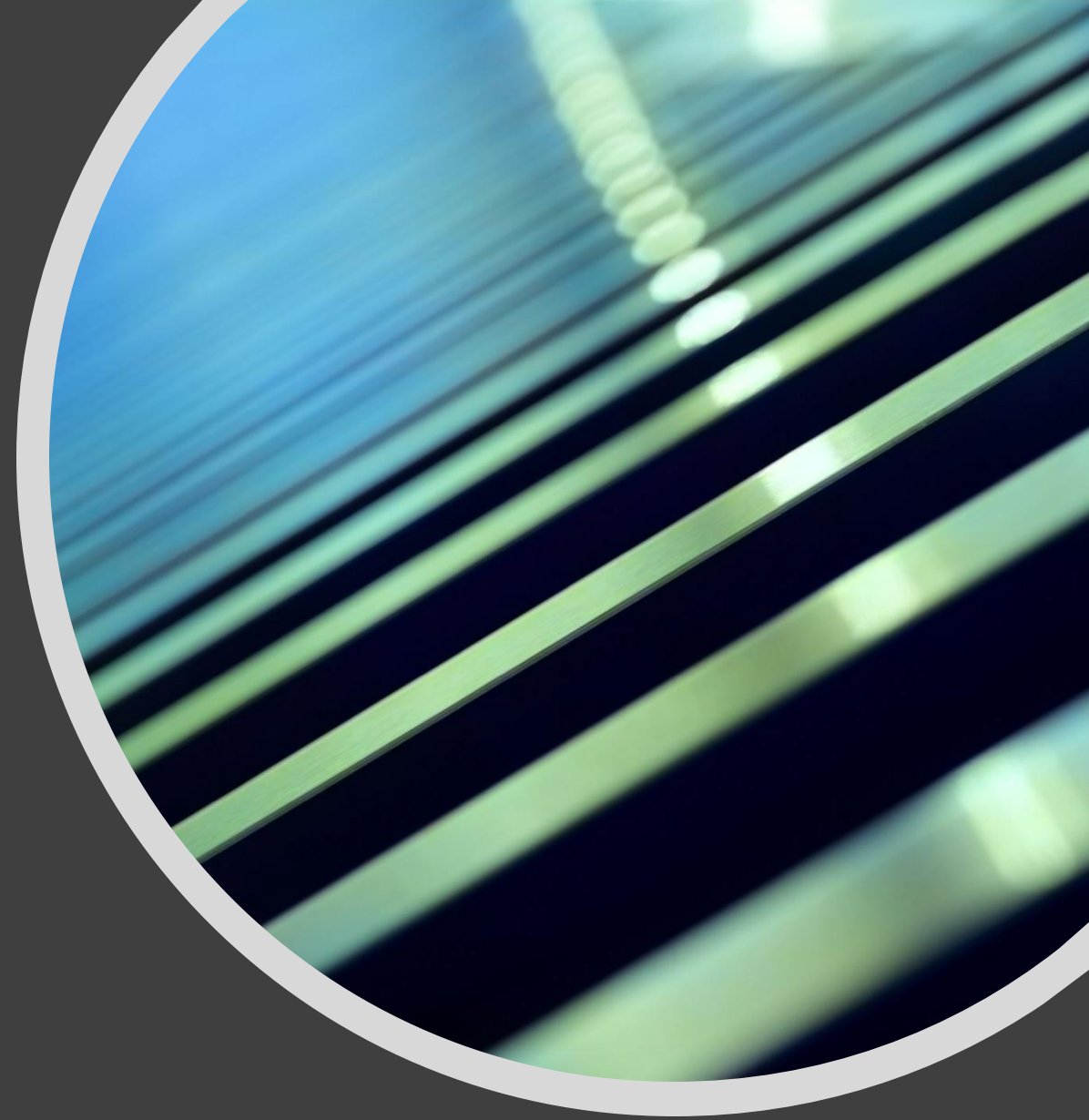
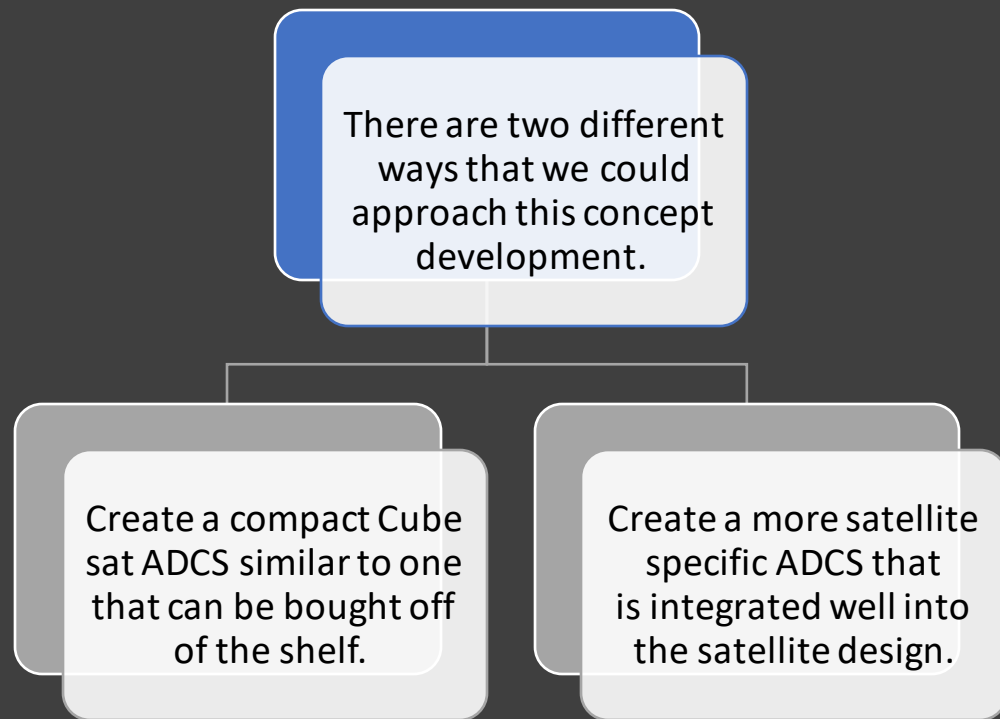
1. Research each component's function.
2. Mathematical Analysis to narrow down requirements for potential units.
3. Choose the best component based on an established design matrix.

	Cost	Moment	Power	Flight History	SUM
Weights:	5	3	3	3	
Torque Rods/Magnetorquers					
SatBus MTQ M6P	9	9	7	6	111
CSCT (Small)	7	9	8	8	110
MTQ200	3	9	9	7	90

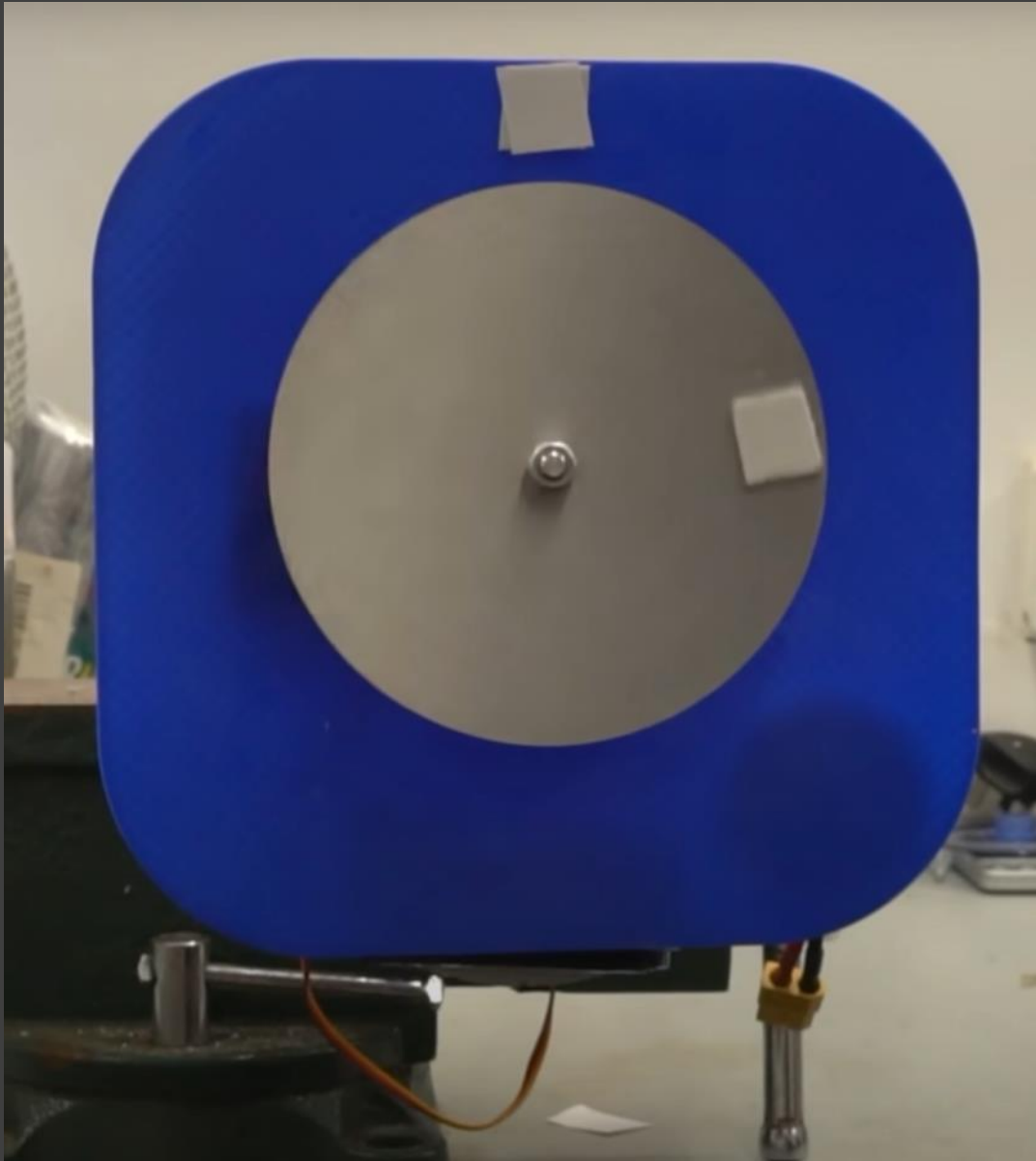
Static Imbalance  
Requirement

$$\mathbf{F}_s = M^w(\omega^w)^2 \mathbf{w} \times (\mathbf{w} \times \mathbf{x}) = -M^w(\omega^w)^2 \begin{bmatrix} x_1 \\ x_2 \\ 0 \end{bmatrix}$$

# Recommendations







# Validation

- Fly Wheels
- Magnetorquers
- Sensors
- Full Assembly Check



# Potential Risks Identified

- Under-Research
- Purchase Incorrect Components
  - Power Requirement
  - Improperly sized (Under or Over)
- Mis-Assembly



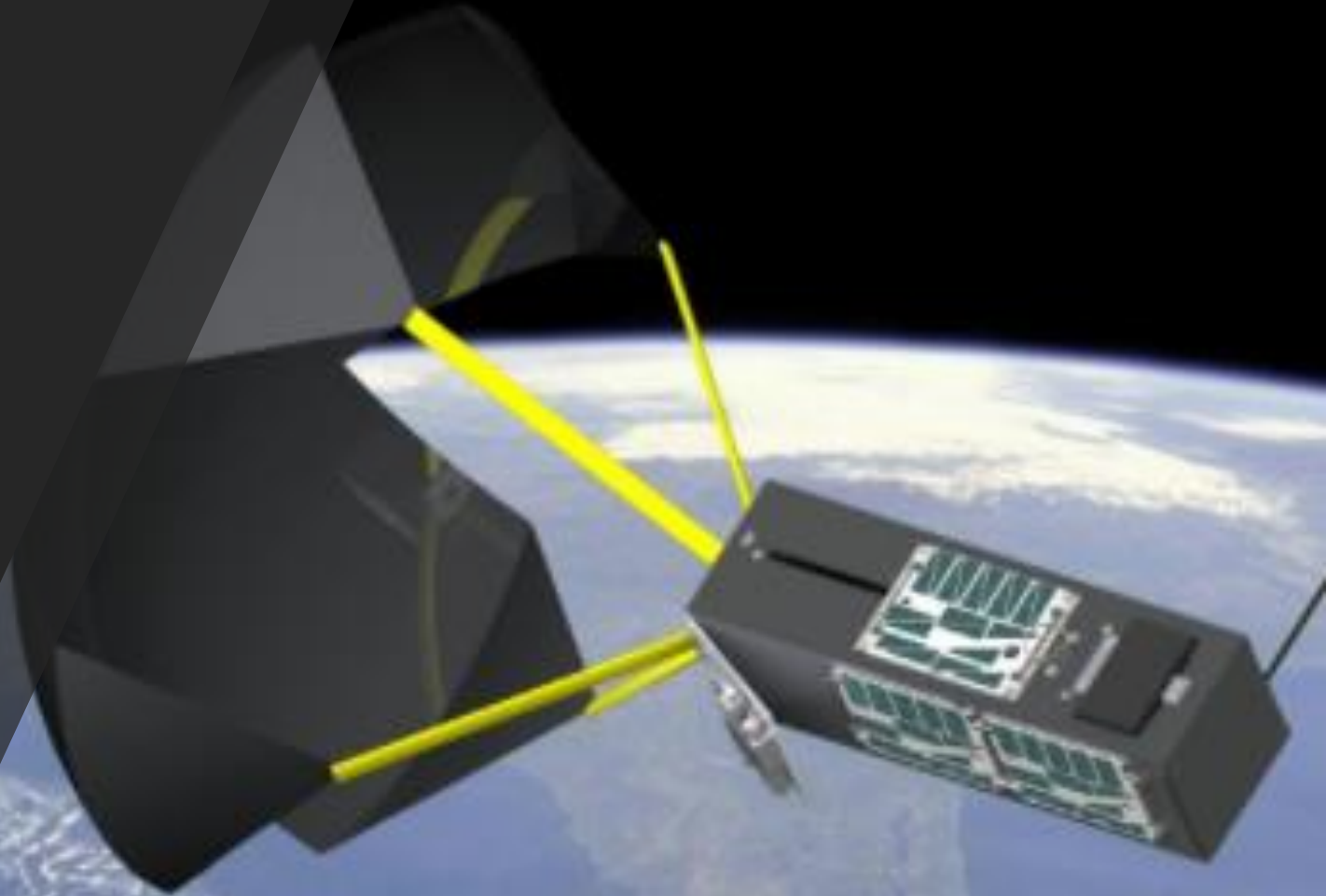
# 9523 Subteam

---

- Joe Dennison (CompE)
- Robert Goes (Math & CS)
- Cosette King (CS)
- Drew Pilchard (EE)
- Harrison Thomsen (EE)
- Taegan Williams (CS)

# Background

- Focusing on the use of low power consumption technology
- We will be creating a more power-efficient satellite design with encryption protocols



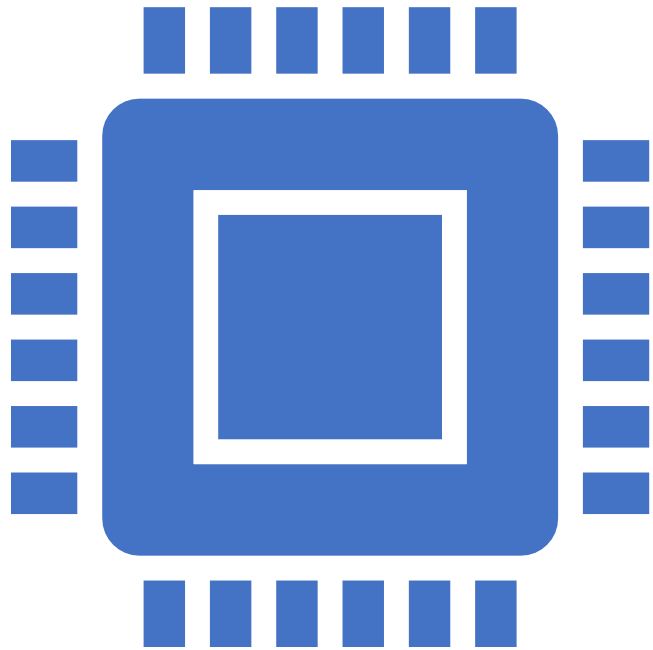


Iridium 9523

# Previous Team

- Team SCUBEE(2018-2019) developed a working carrier PCB.
- Team FIRE(2019-2020) developed and tested the base code for Short Burst Data mode.





# Requirements

- Hardware
  - Flight Ready Iridium Carrier Board
  - Exchange SAMD21 microcontroller to an SAMD51
  - RF Flyback Converter to Gallium Nitride
- Software
  - RUDICS communication
  - 2-way Communication with ground server
  - NASA compliant encryption

# Conceptual Development Process

## Before:

- Waiting for SAMD51 Thing Plus
- Getting the chip working with VS
- Researching 9523

## Now:

- Still researching 9523
- Command central?
- Finding all the empty broken code
- Getting the hardware and software to work together



# Recommendations



More Research on the 9523



Fix code



Meet in person & get working components together

# Identification of Risks



Timeline



WARNING: High-Power RF Transmitter Do Not Operate in Proximity of GPS Devices.

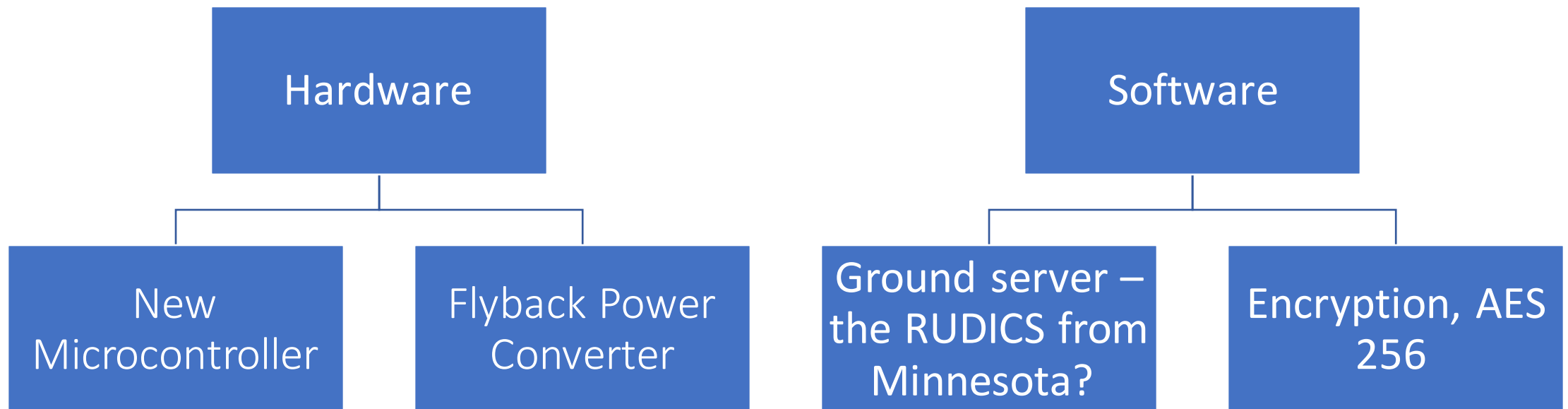


Fault tolerant code



Radiation

# Validation



# AI in the sky Subteam

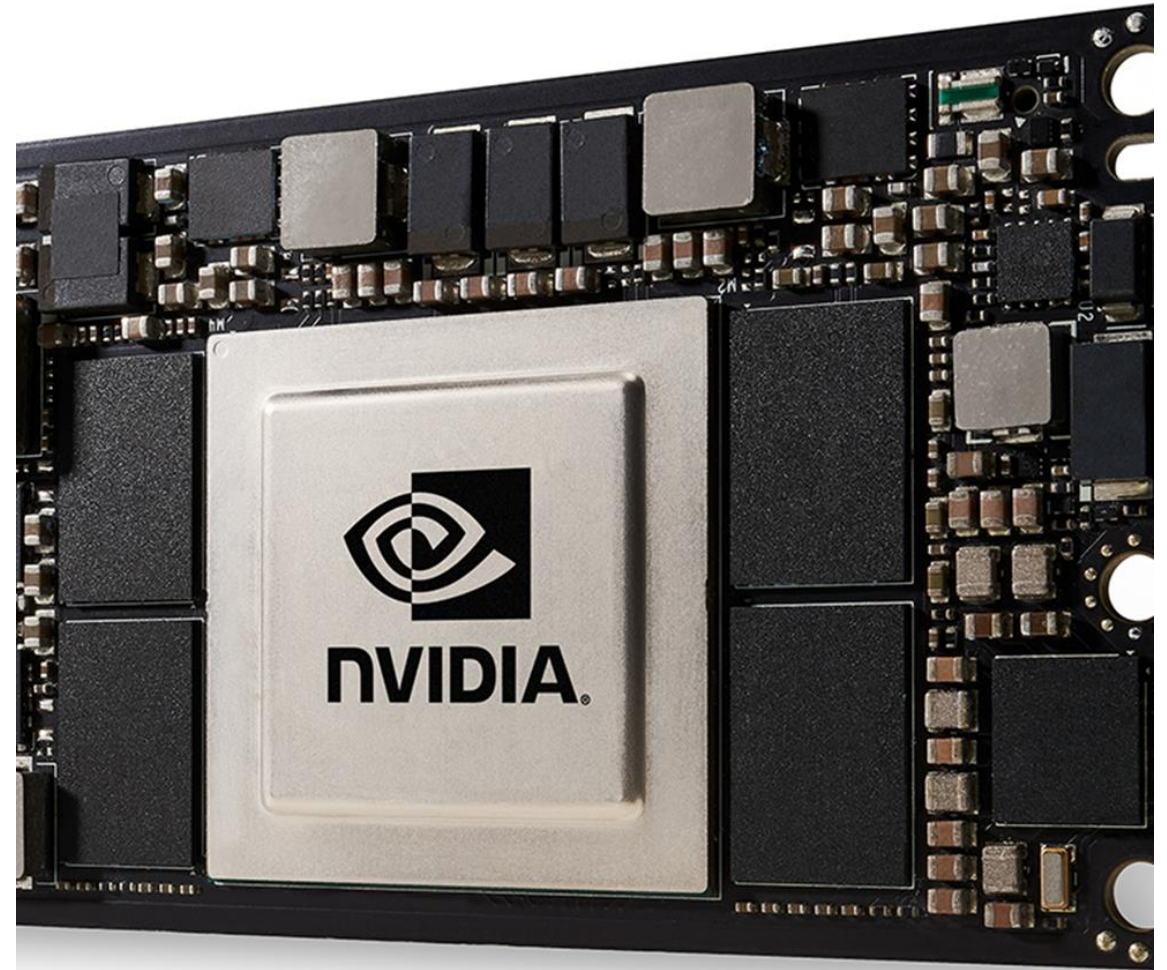
---

- Robert Goes (Math & CS)
- Lily Mortensen (MSE)

# Background

---

- Harness unique capabilities of GPUs
- Demonstrate active Machine Learning
  - Enable Star Tracker
- Incorporate a heat pipe to cool GPU
- Design nontoxic and durable radiation shielding for AI unit



# Project Management

---





# Budget

Date of Purchase	Expense Item	Vendor	Amount	Shipping	Total amount	Quantity	Total Budget
9/30/2020	25 pk M2F jumper wire	Banna Robotics	2.99	3.65	6.94	1	3,000
9/30/2020	Adafruit Grand Central M4 Express featuring the SAMD51	Adafruit	37.5	11.18	48.68	1	
9/30/2020	SparkFun Thing Plus - SAMD51	Sparkfun	19.85	7.09	66.94	3	
				<b>Total Spent</b>	<b>122.56</b>		

Questions?

---