Interfacing and LIDAR Implementation for Space Communications

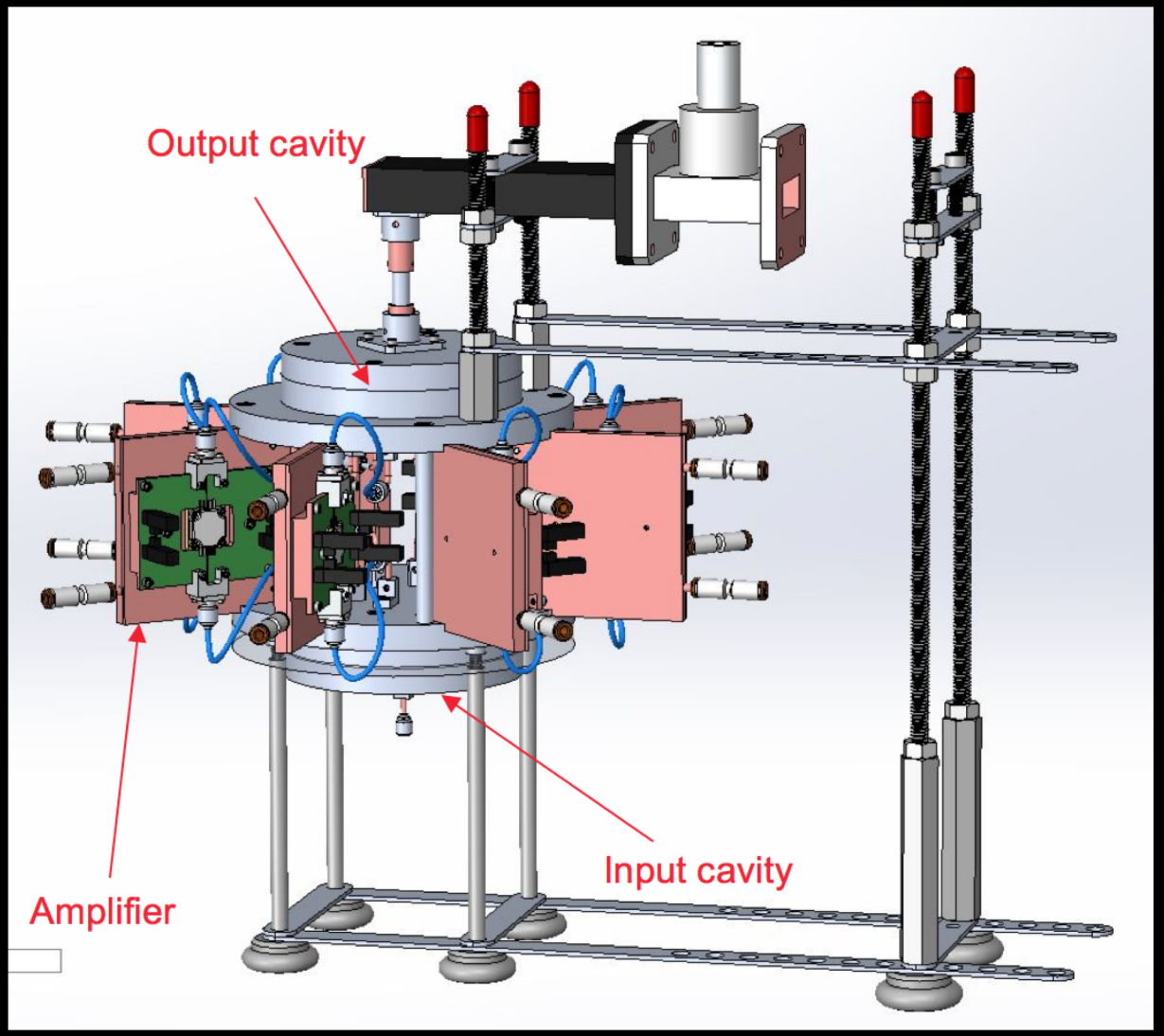
Francisca Vasconcelos

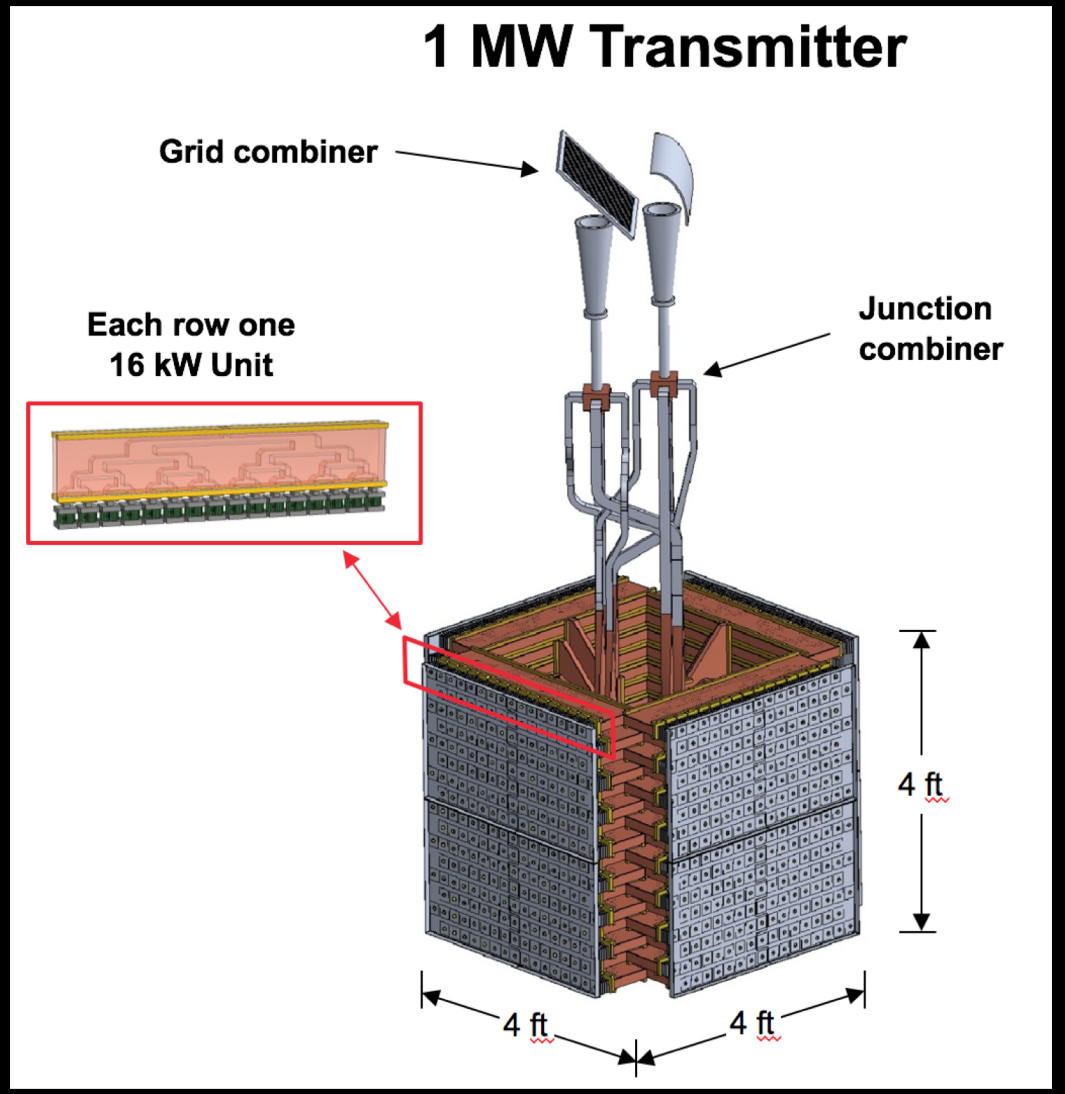
Mentor: Jose Velazco

NASA JPL 333K

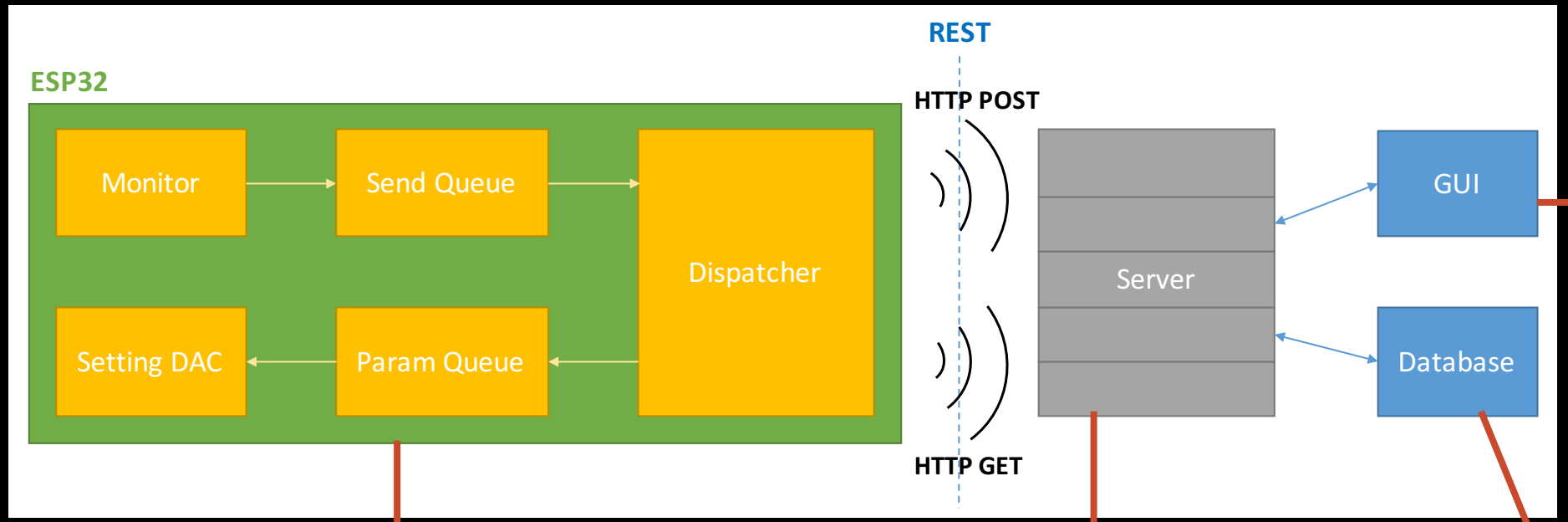
Jet Propulsion Laboratory
California Institute of Technology

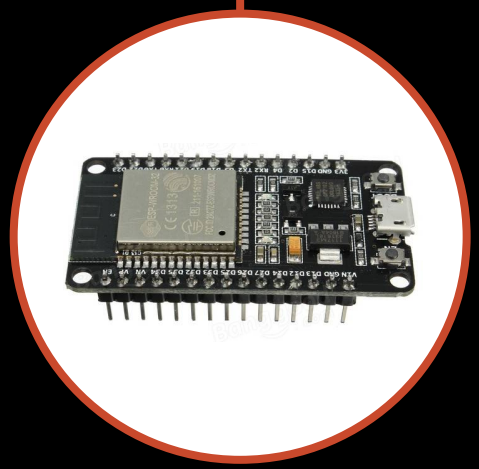
Spatial Power Combining Amplifier





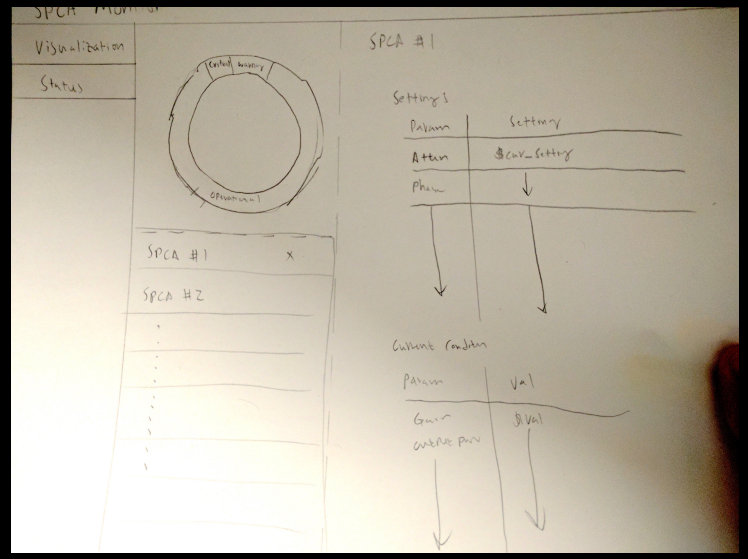
SPCA Prototype System Overview

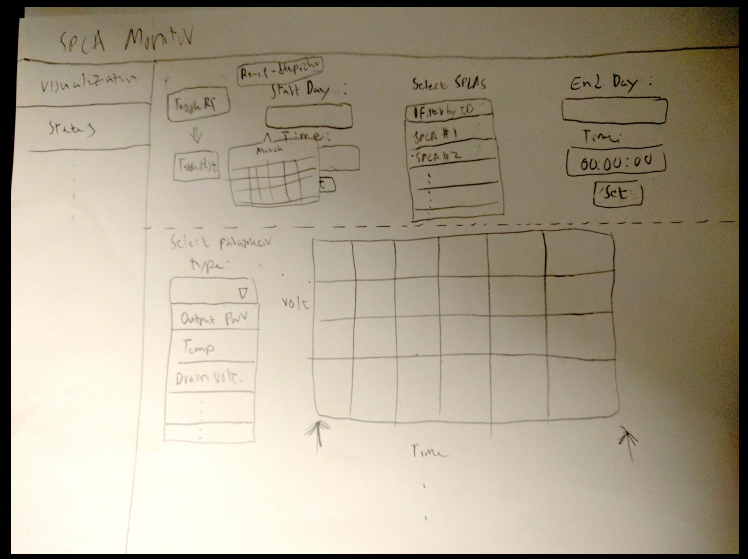




SPCA GUI Overview

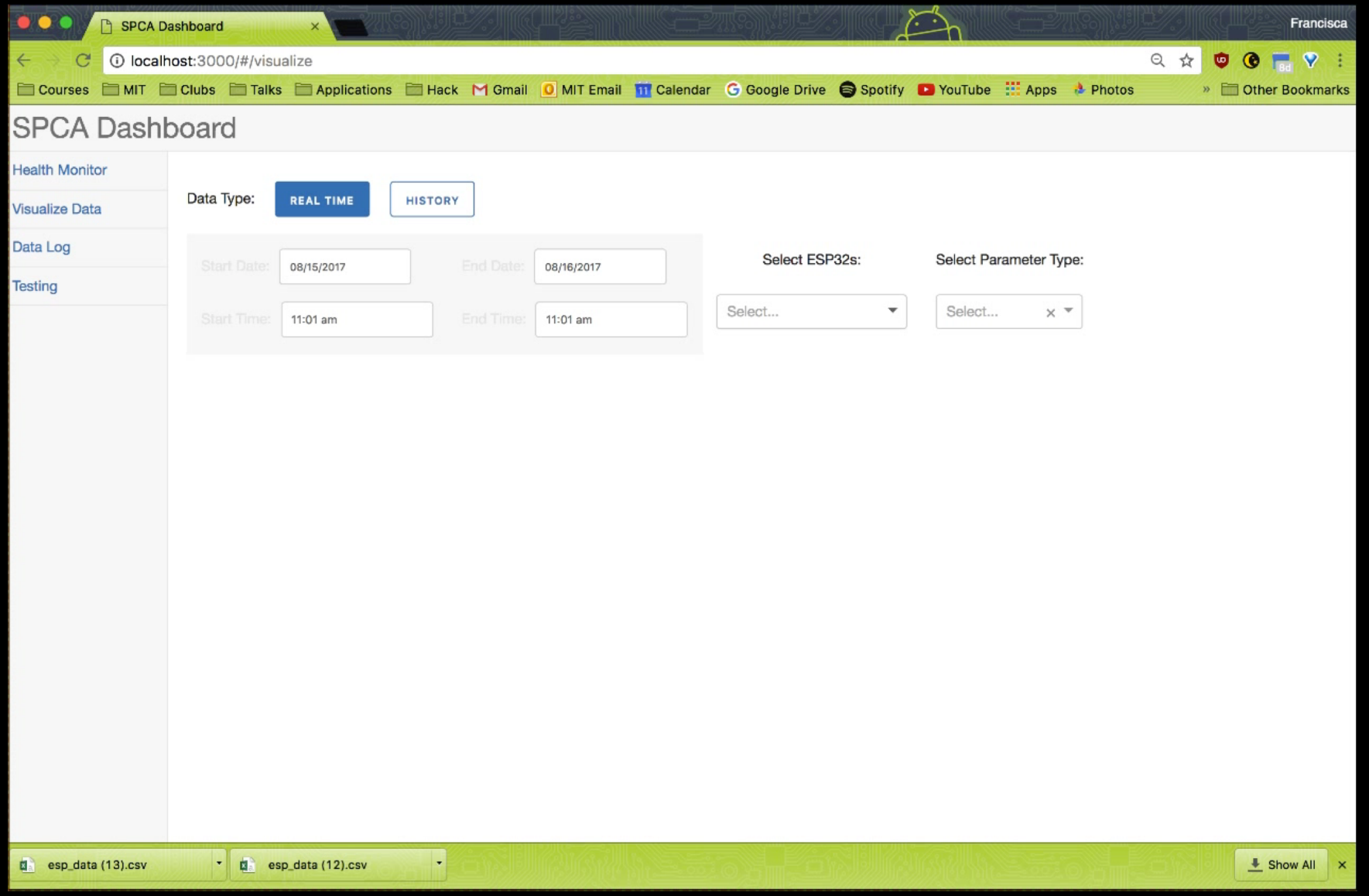
- Goals:
  - Monitor state of the system and individual ESP32s
  - Visualize data – real-time and historic
  - Control ESP32 parameters (gain, temp, ...)
  - Easy-to-use interface
- Learned Javascript and React (used Codecademy)
  - Used Recharts for data visualization



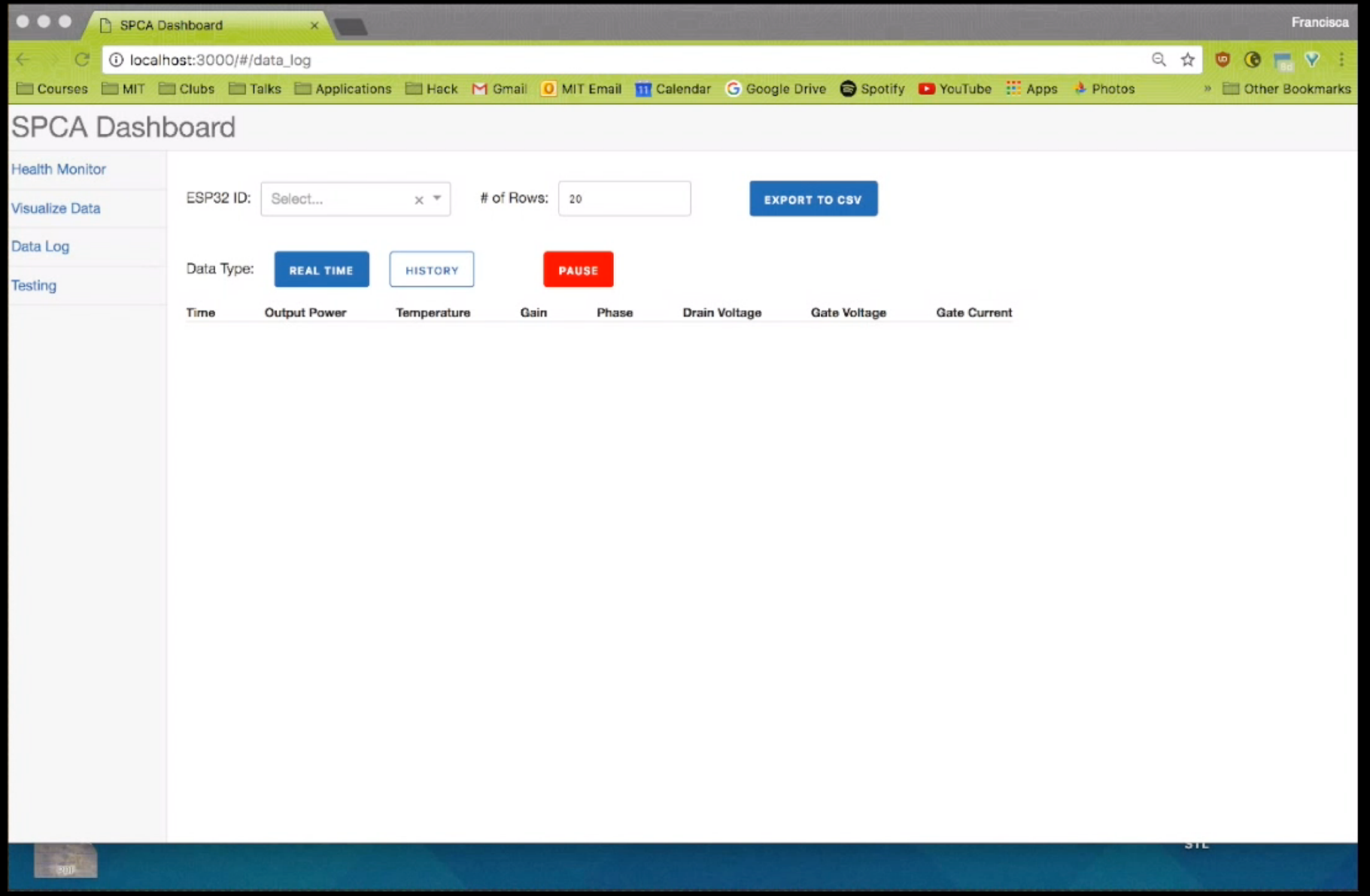


Health Monitor Page

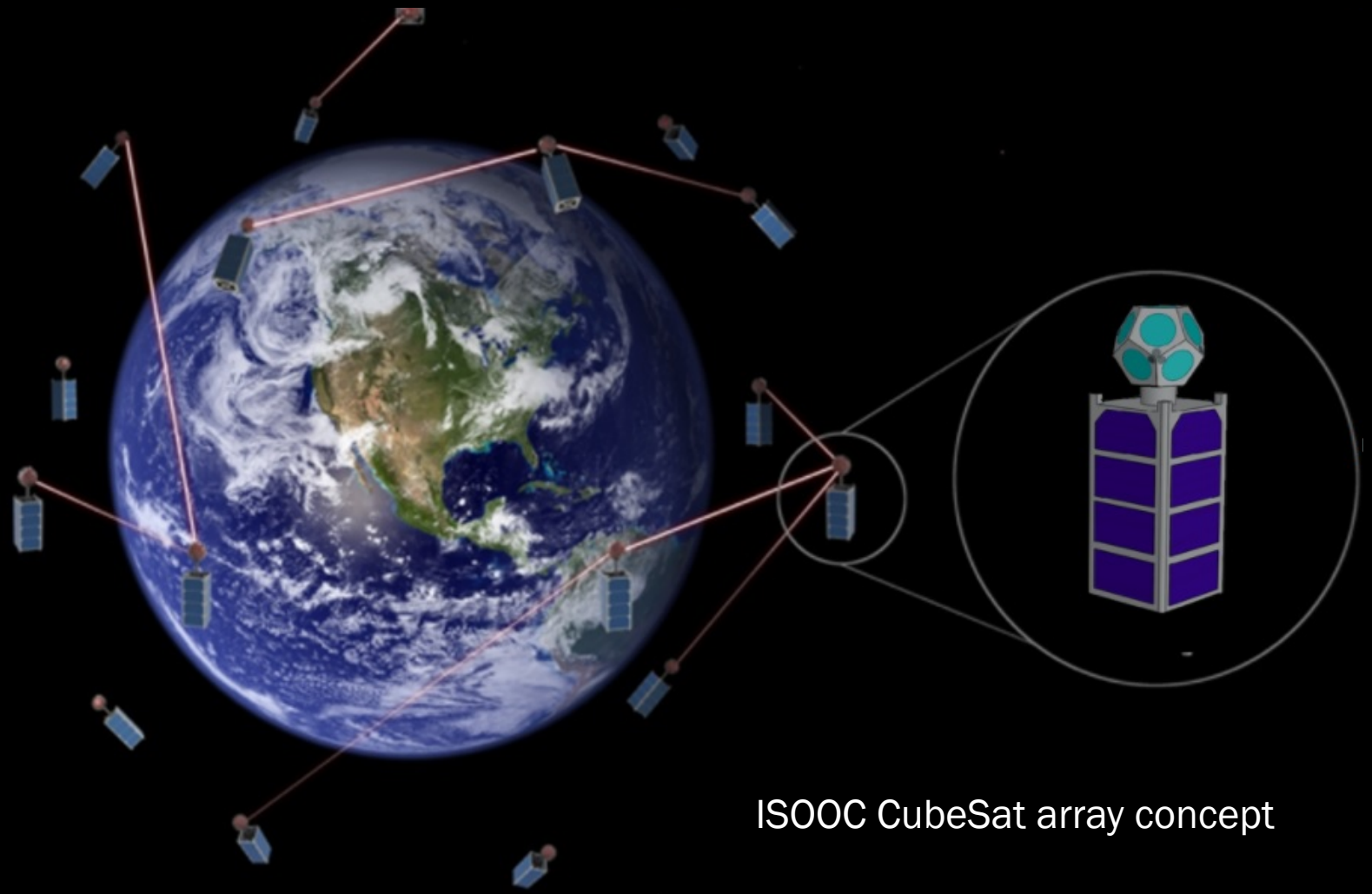
Data Visualization Page



Data Log Page



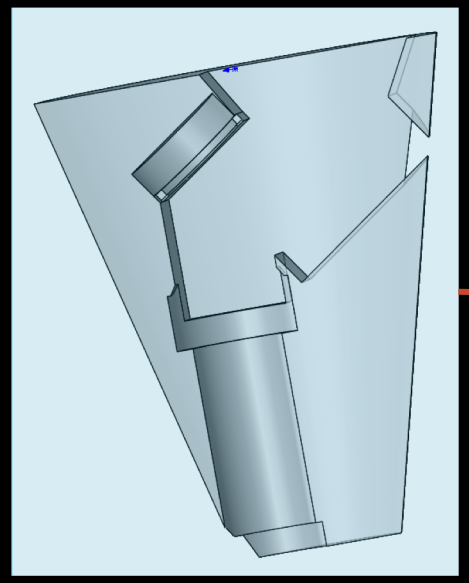
Inter-Satellite Omnidirectional Optical Communicator



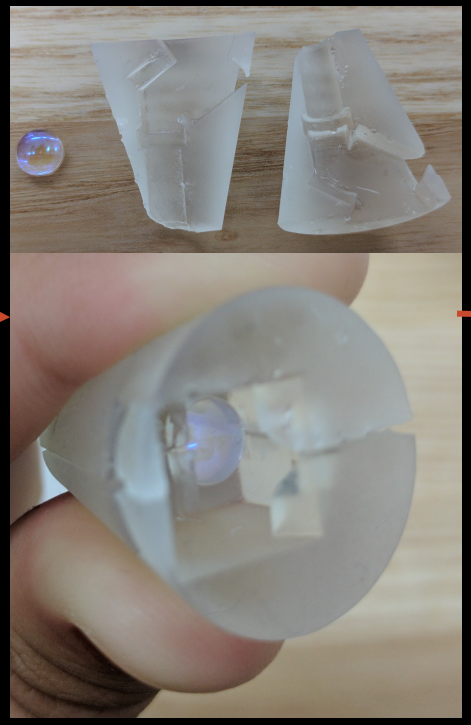
ISOOC CubeSat array concept

ISOOC Project #1: Redesigning the ISOOC TX

- Needed to fit laser, collimator lens, mirror, and MEMs mirror

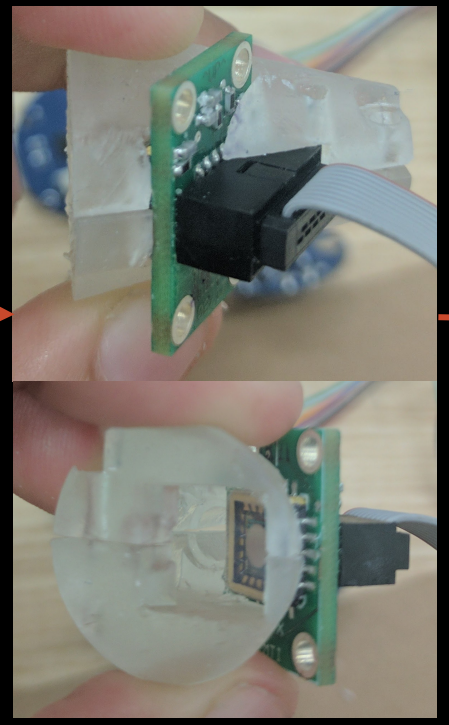


ORIGINAL CAD
[1/2 View]

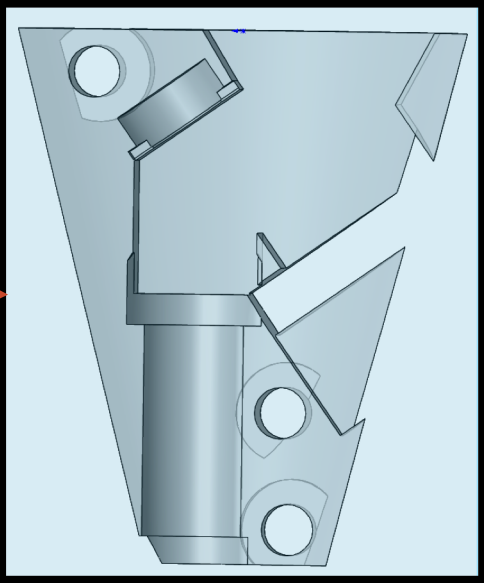


Modify to fit components

Add screw holes



Add room for MEMs board

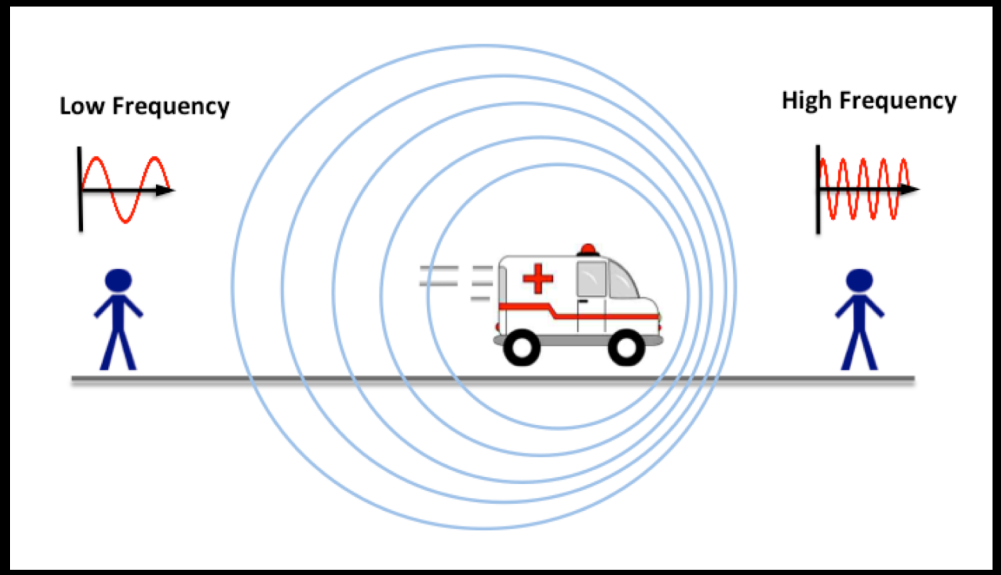


FINAL CAD
[1/2 View]

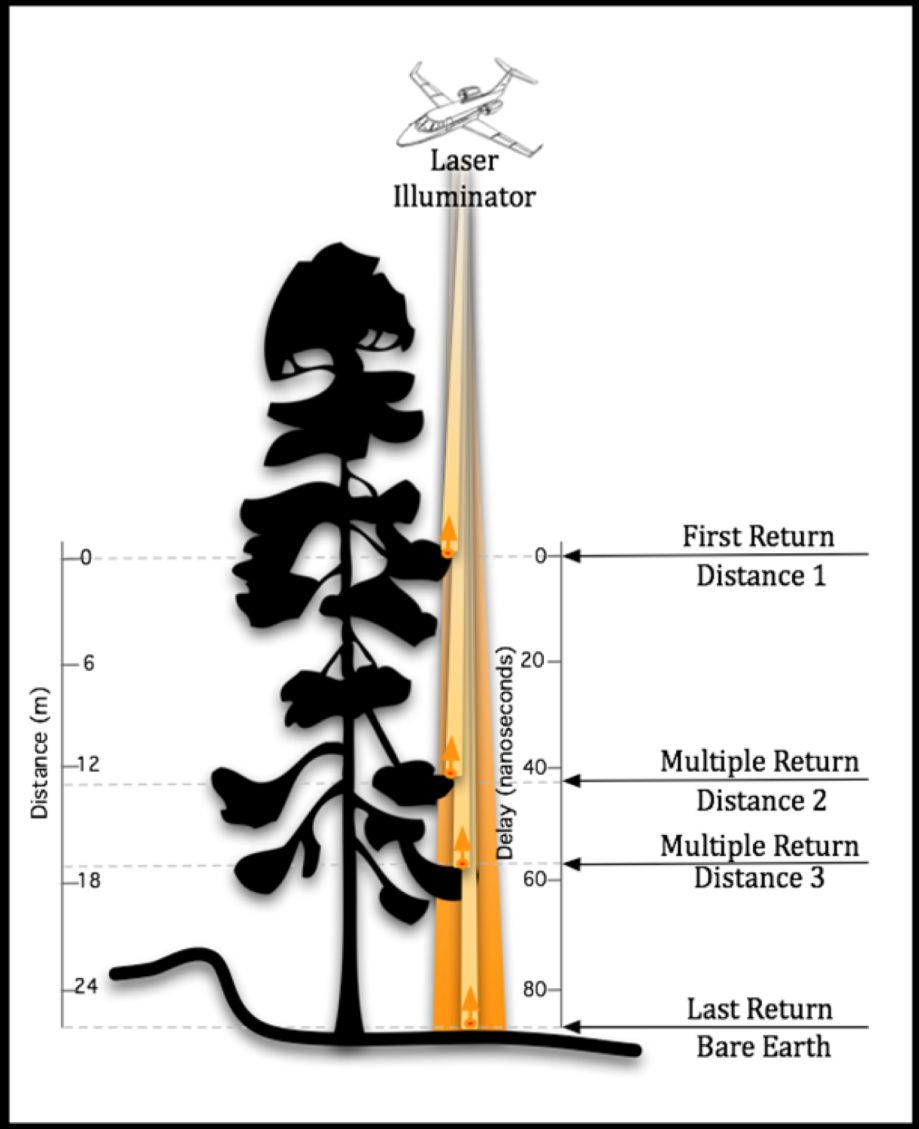
ISOOC Project #2: LIDAR

[Light Detection and Ranging]

- Relative Distance
- Relative Velocity
- Depth Maps

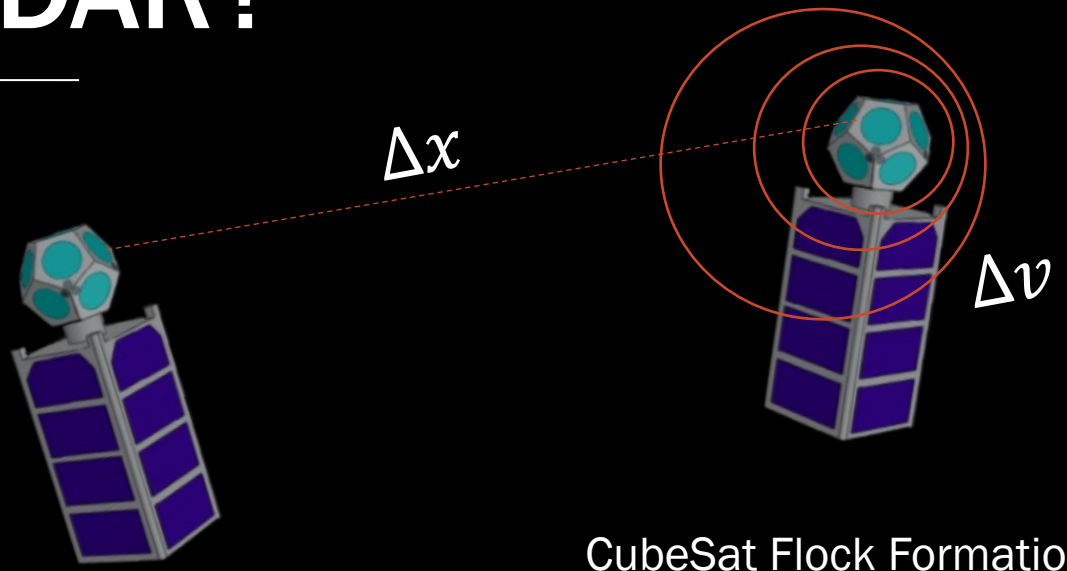


Doppler Effect for velocity measurements

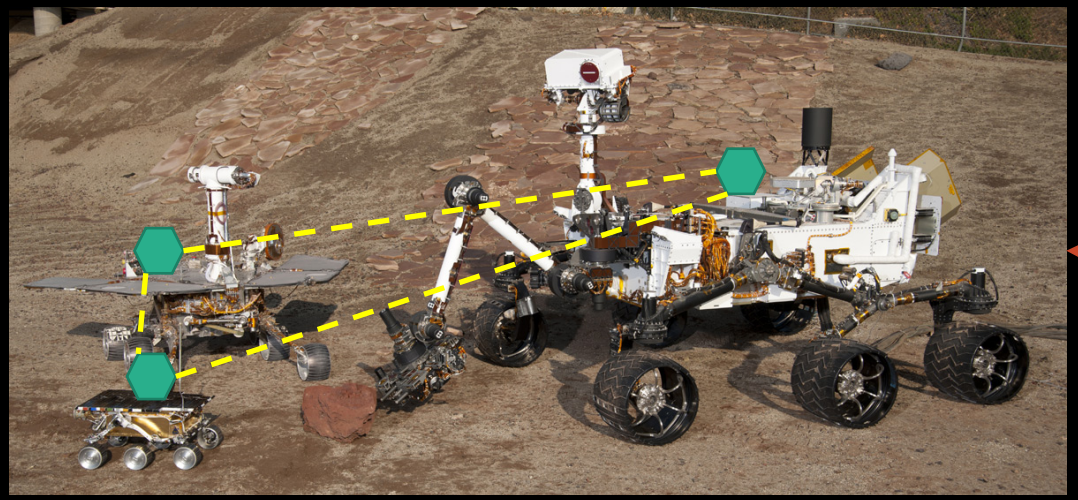


What is LIDAR?

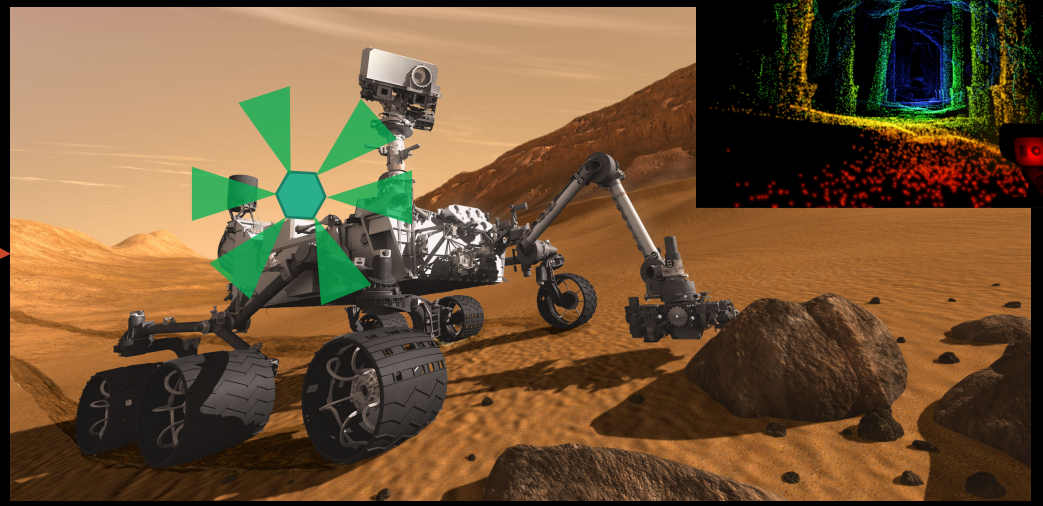
Why ISOOC LIDAR?



CubeSat Flock Formation



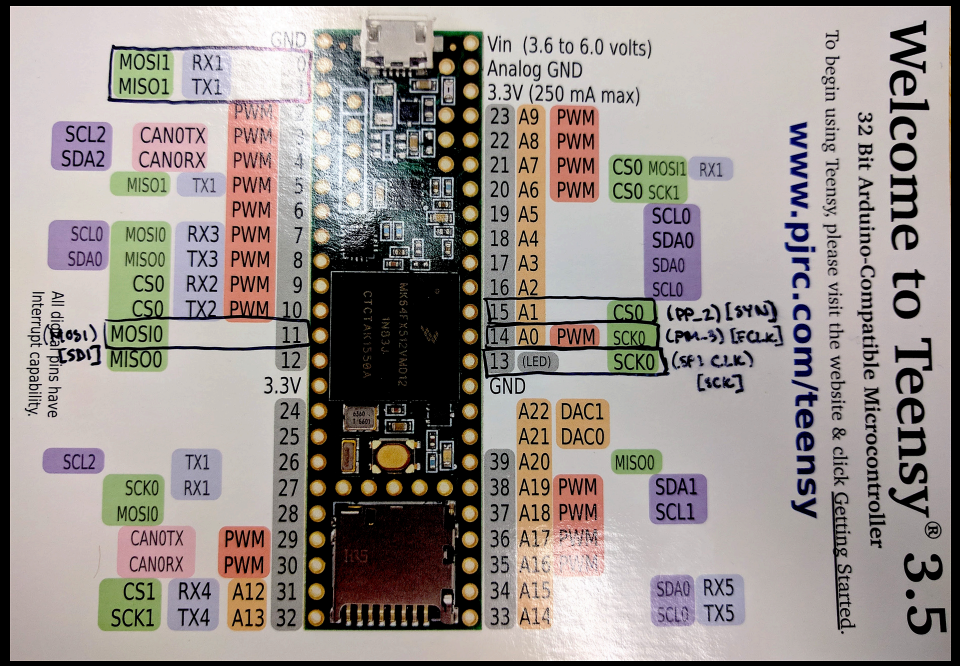
Communications



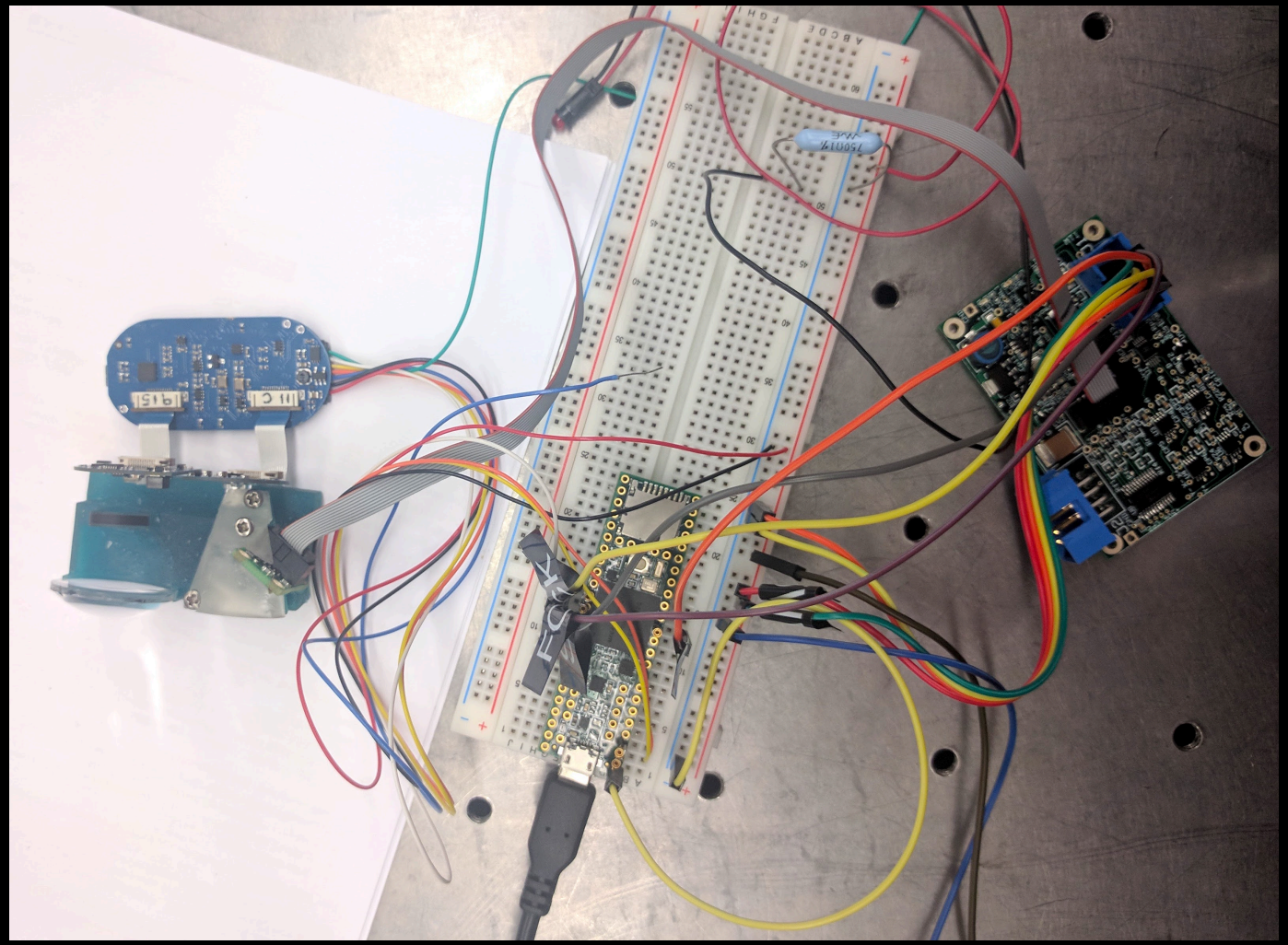
Instrumentation

ISOOC LIDAR Hardware

Ordered + Disassembled Lightware SF11

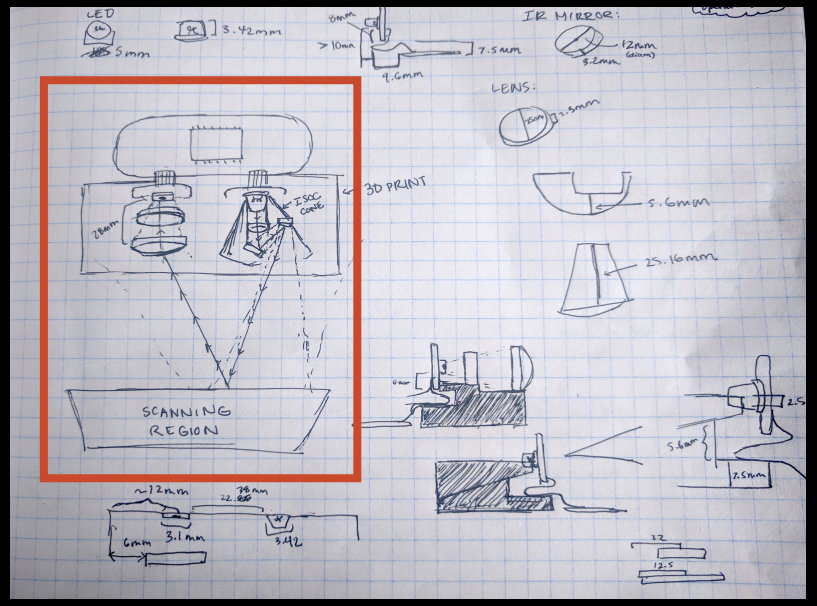


Pin breakout for MEMs driver + rangefinder serial on Teensy

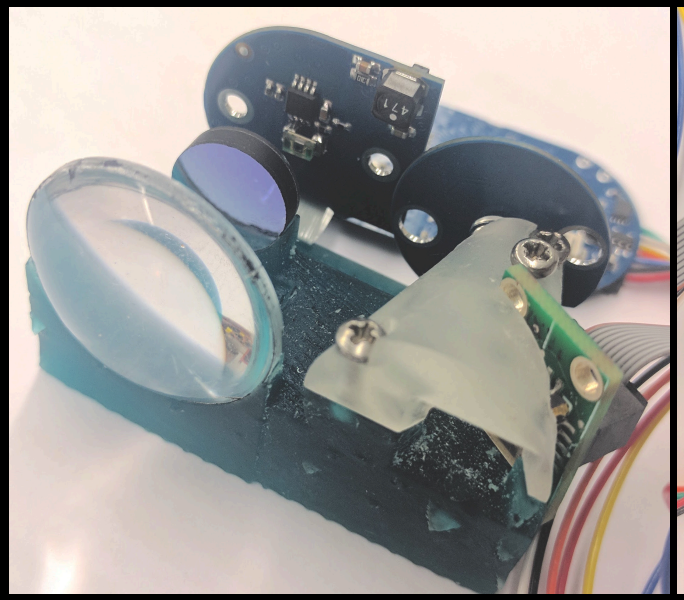


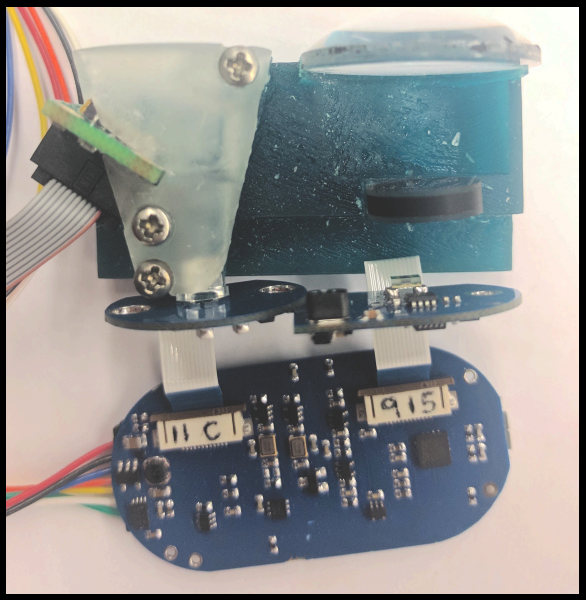
Breadboarding of actual ciruit

ISOOC LIDAR Assembly

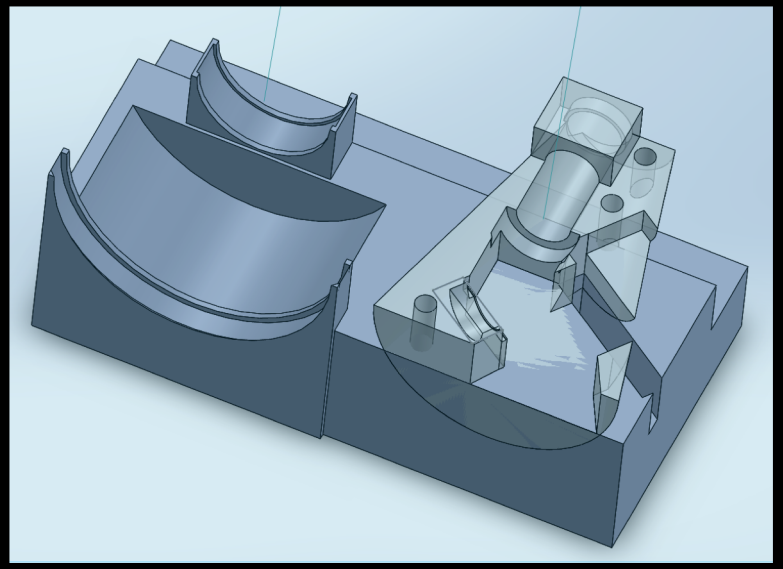


Measurement + Design





3D-printed enclosure with hardware for final assembly



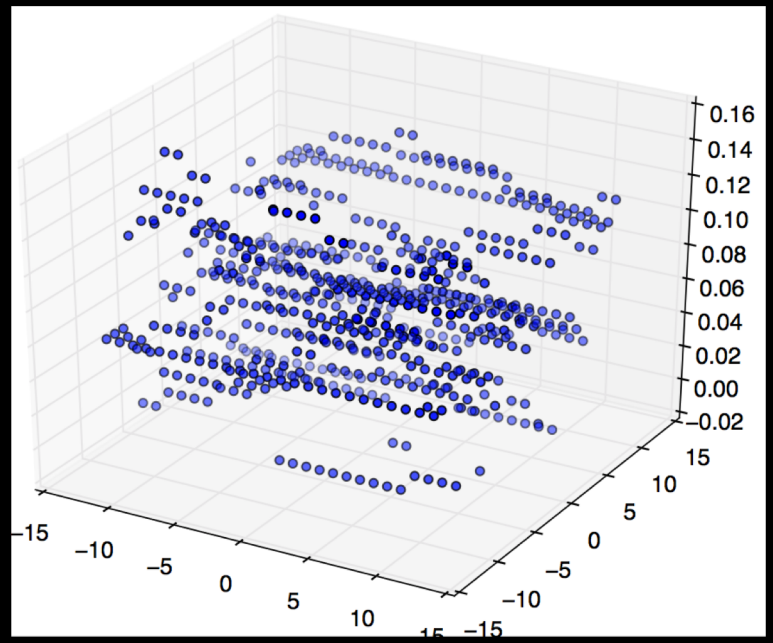
CADing a base/enclosure

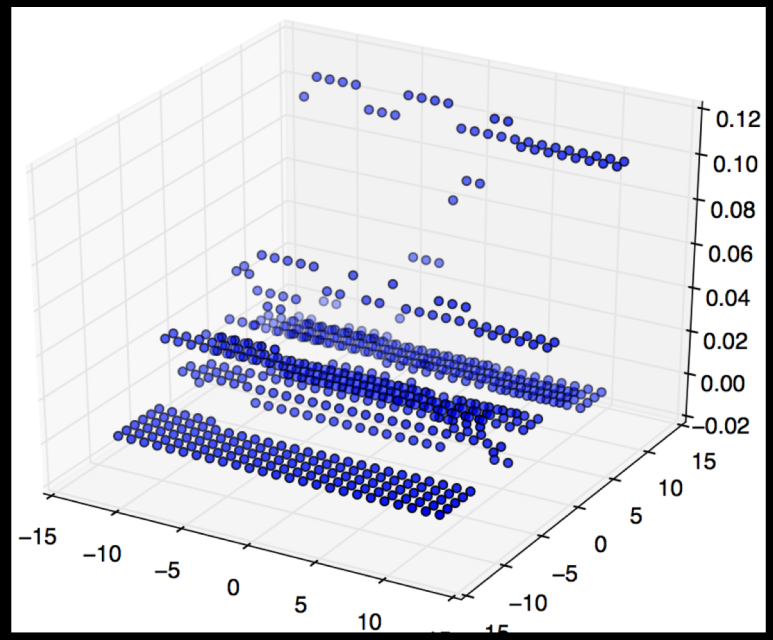
Debugging optics

ISOOC LIDAR Software

MEMs scanning in action! (Bright spot = IR light reflected on paper, video edited to make more visible)

[Arduino Teensy - C]





3D depth maps created using the LIDAR system!

[Python - matplotlib]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DARE
MIGHTY
THINGS


TELECOMMUNICATIONS
LABORATORY
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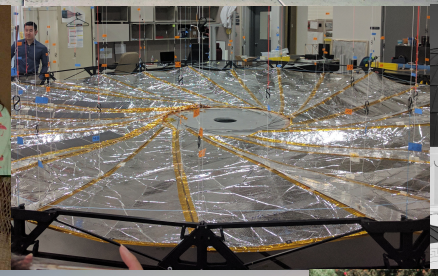
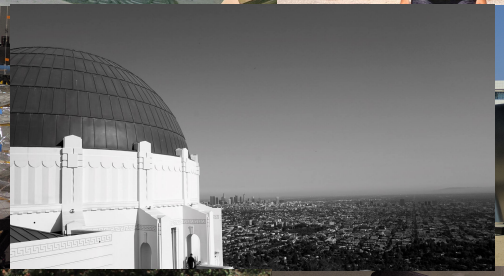
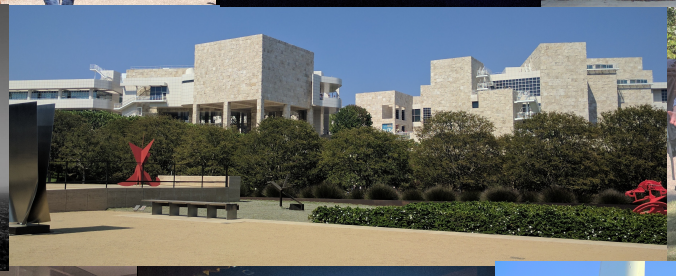


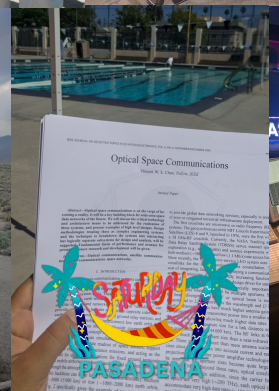


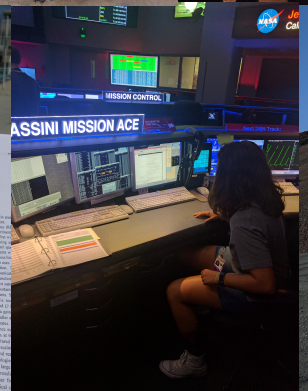


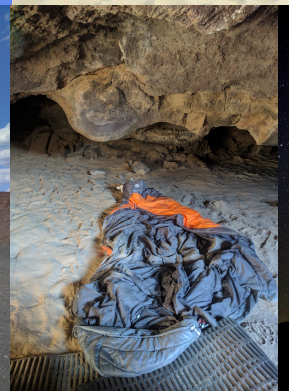

California Institute of Technology


On Sept 14 2015...
LIGO Hanford Data (shifted)
LIGO Livingston Data
Strain (10⁻²¹)
Time (sec)


JUPITER
NASA

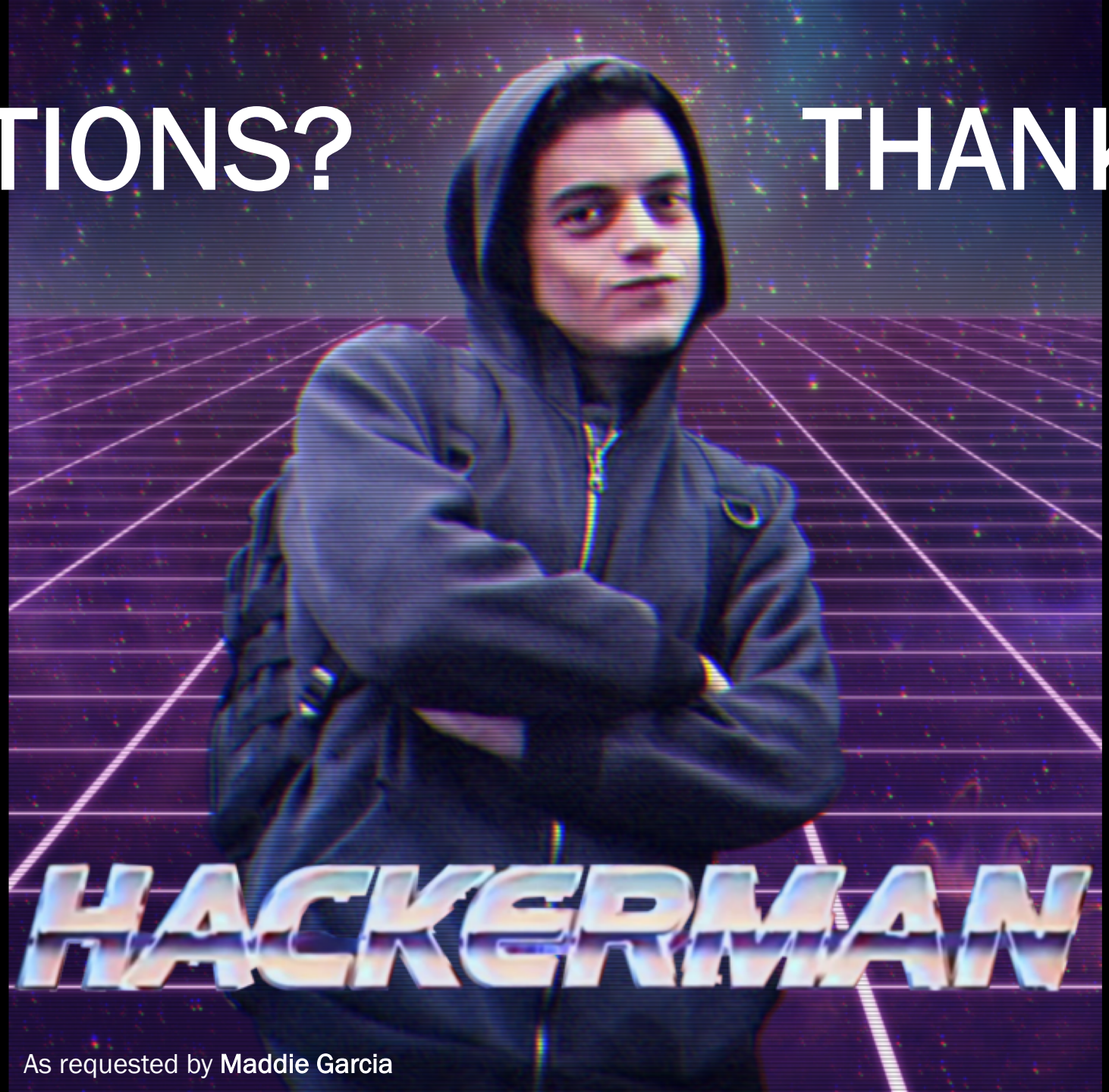

Optical Space Communications
SAVORY
PASADENA


MISSION CONTROL
ASSINI MISSION ACE



QUESTIONS?

THANK YOU!



As requested by **Maddie Garcia**