Attitude **C**ontrol for pr**E**cise **S**ciences

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Team Members: Anshul Jain, Alex Boehm, Nakul Gupta

Date: 3/11/2024

Advisor: Brian Marotta

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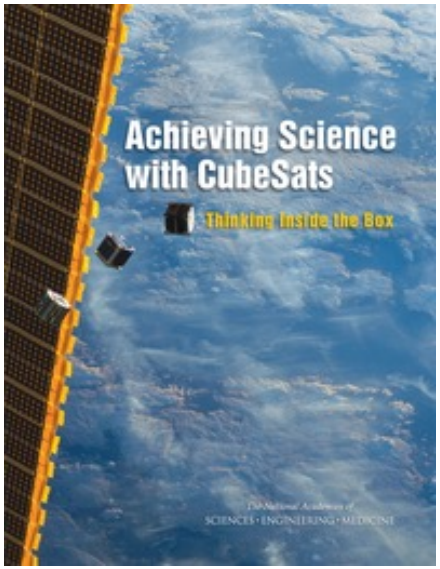
Motivation

"Achieving Science Goals with CubeSats" - 2016 Review



Technology Goals:

- Astrophysics on Cubesats
- LASP will use ACES module for tech demos
- Eventually used on big astrophysics missions

ACES Project Overview

- Description: standalone attitude determination and control system (ADCS) for CubeSats with high-accuracy inertial pointing requirements
- Status of the project at the beginning of the semester:
  - Delta-PDR completed Fall 2023
  - System design created and hardware components selected
  - Functioning simulation
  - C FSW library started with initial utilities
- ConOps: determines and controls the attitude of a CubeSat in low Earth orbit (LEO)

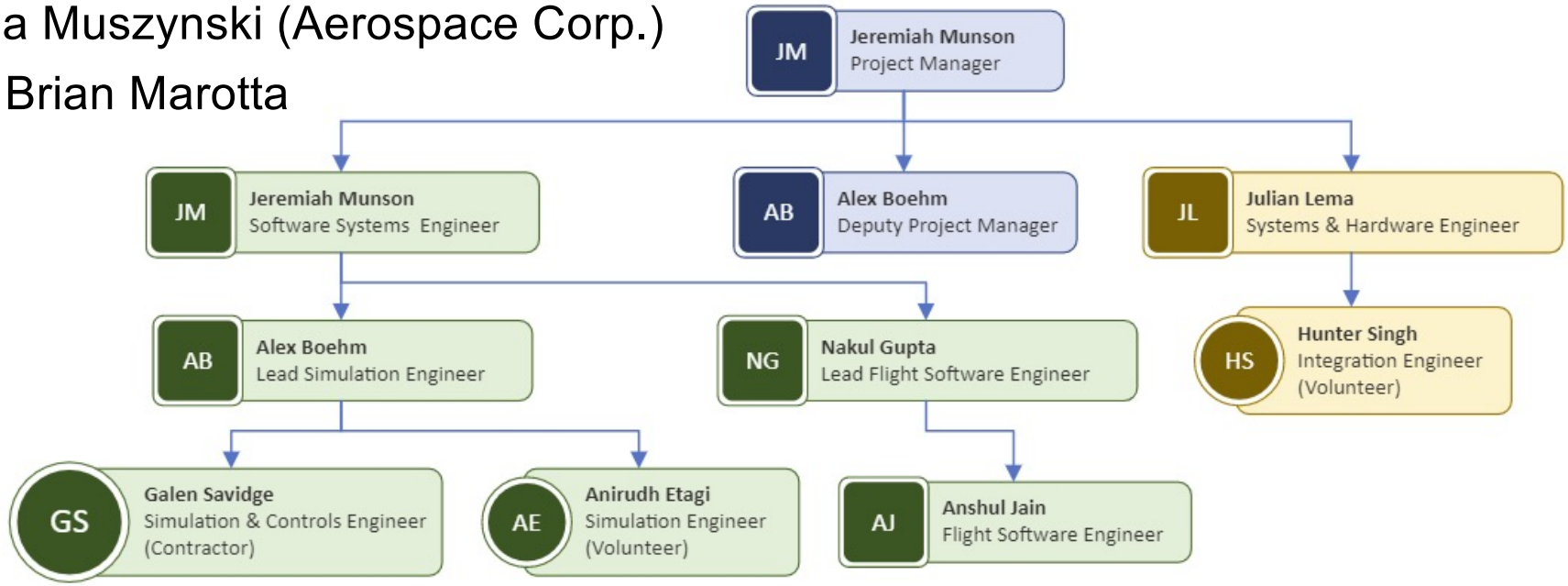
Top Requirements

- Designed for use on a generic CubeSat bus that will perform astrophysics missions
- “Standalone” module: handles ADCS but can interface with the main flight computer
- High accuracy for inertial pointing: 3 arcseconds (= 3/3600 deg) 1-sigma
- Small mass and volume: ~0.9kg, ~0.5U

Organization

Customer: Dr. Daniel Kubitschek (LASP) +
Anastasia Muszynski (Aerospace Corp.)

Advisor: Brian Marotta

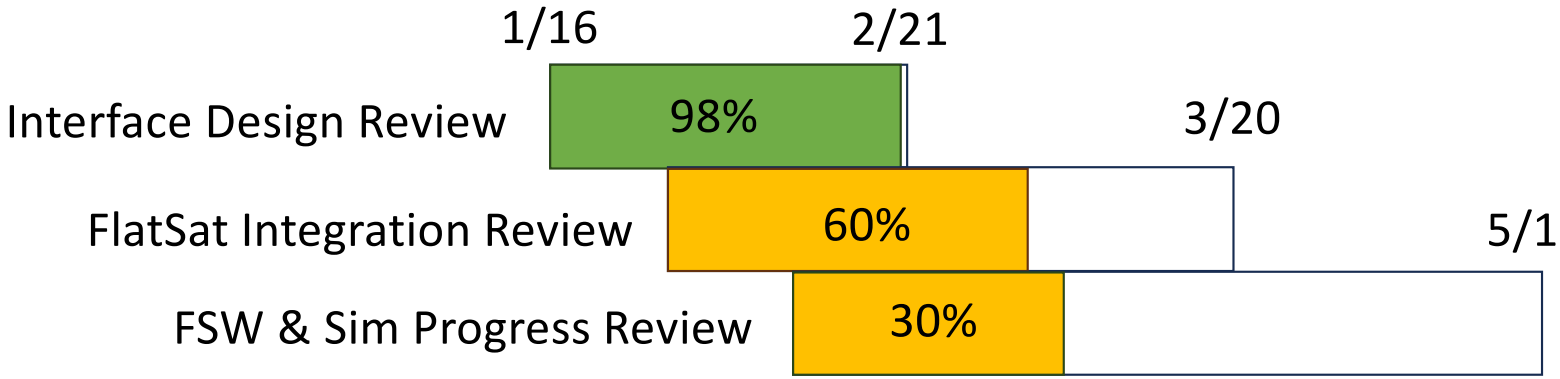


Spring Milestones + Deliverables

- 2/21/24: Software Interface Design Review
  - Interfacing between sim and FSW, interfacing between ACES module and flight computer
- 3/20/24: FlatSat Integration Plan Review
  - Plan for FlatSat development and testing
- 5/1/24: FlatSat + FSW & Simulation Progress Review
  - Improvements to simulation, models, flight software, and testing

Next Year: integrate components into FlatSat

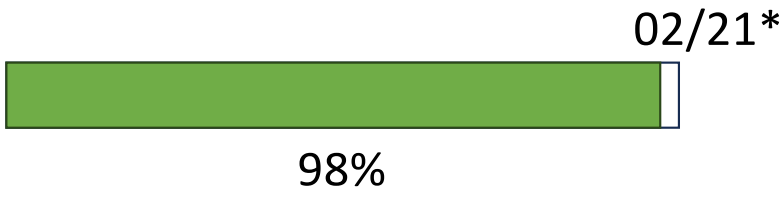
Spring Progress



Interface Design Review

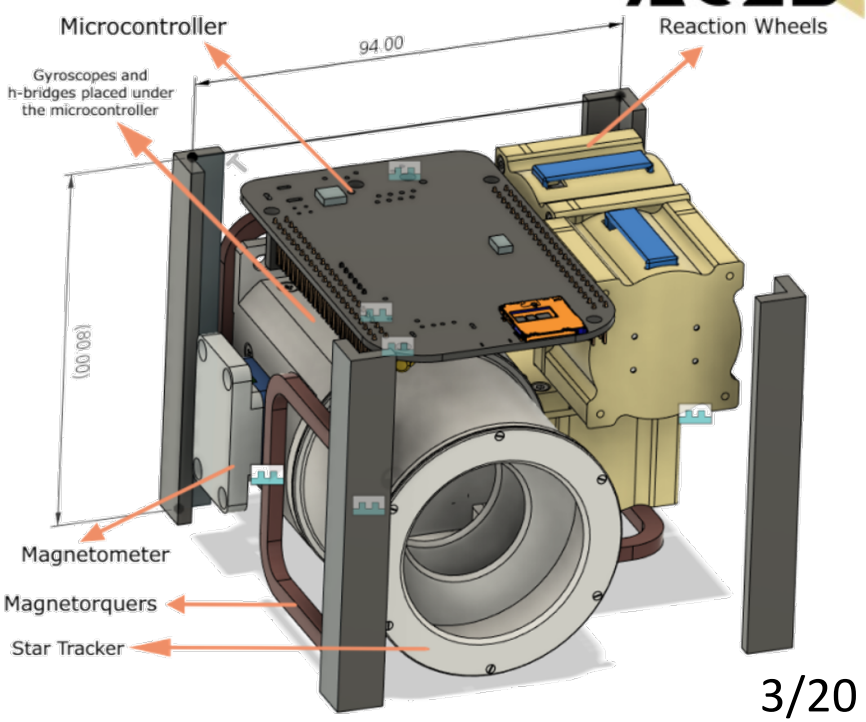
- ✓Define packet header and ending
- ✓Define initial simulation-FSW packets
- ✓Define initial ACES-Bus packets
- ✓Provide documents to sponsors
- ✓Present to sponsors (2/21)
- ❑Update documents and get sponsor sign-off

- Document updates have been made
- Sponsors have been sent the documents to review and sign



Delta-PDR and HSR: Hardware Updates

- ✓Trade studies:
  - ✓Magnetorquers
  - ✓Reaction Wheels
- ✓DeSat Analysis
- ✓Sun Sensor Coverage Tool
- ❑Finish Interfacing Documentation
- ❑Finish Hardware Verification & Validation Plan



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FSW & Sim Progress Review

- ✓Create FSW library with initial functionality
- ✓Create main flight computer emulation module
- ❑Connect FSW to Sim
- ❑Replace FSW models in sim with FSW library
- ❑Implement coarse navigation

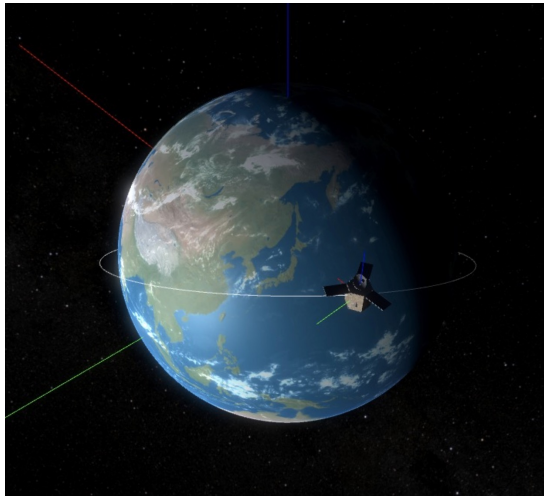

Image Credit: AVS Lab

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Concerns

- Money: deficit of >$30k
- NDAs

Questions?