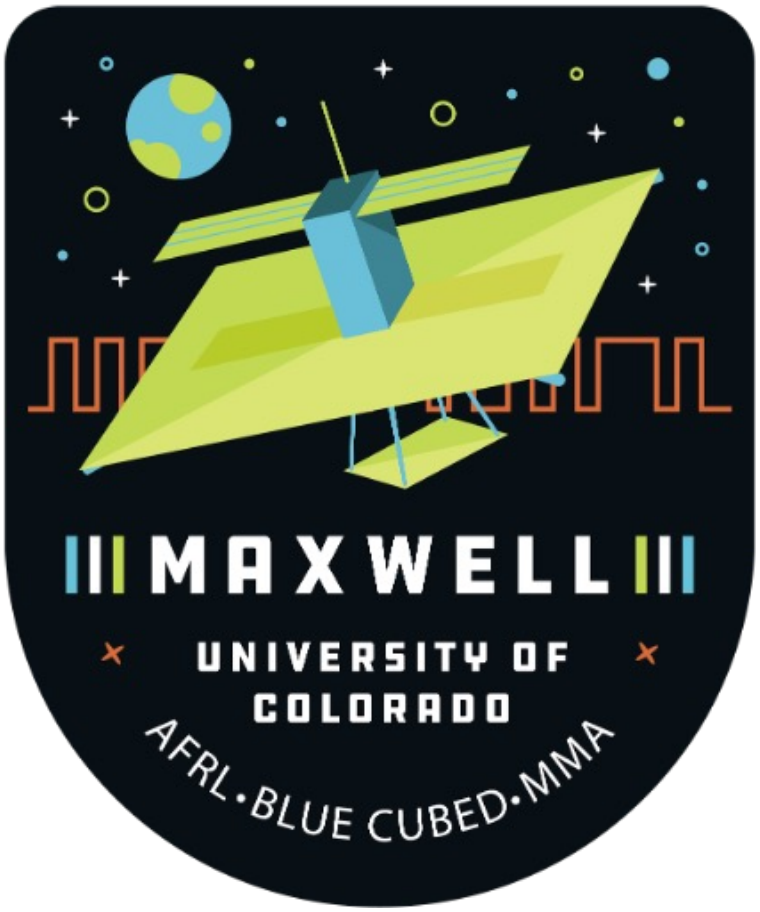
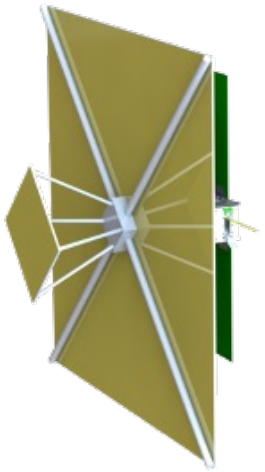
MAXWELL Mid Semester Presentation



@maxwellcubesat

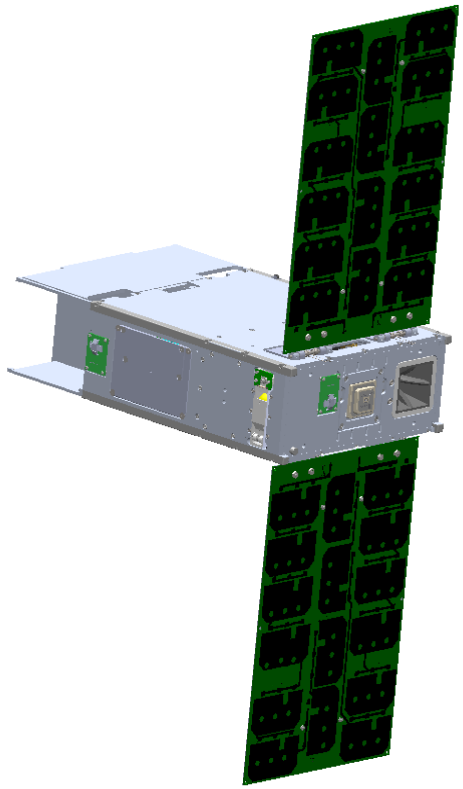
Mission Overview



Overview

Multiple **A**ccess **X**-band **W**ave **E**xperiment **L**ocated in **L**EO

- 6U CubeSat designed, built, and tested here at CU
- Scheduled for completion in 2025
- **Mission level requirements:**
  - Test on-orbit CSAC Performance
  - Demonstrate high-rate communications on a CubeSat using CDMA
  - Characterize the performance of the T-DAGHR antenna.
  - Demonstrate student-built ADCS



Mission CONOPS

Phase 1: Ejection and LV Separation
45 min RF Silent and hazard timer

Phase 2: Commissioning & Deployments of Solar Panels & UHF Antenna

Phase 3: (MO1,2) Communications demonstration, telemetry downlink, and sun-point charging

Phase 4: (MO-3) - CSAC Experiment

Phase 5: (MO-4) T-DaHGR Deployment & Characterization

Phase 6: Deorbit, End of Mission

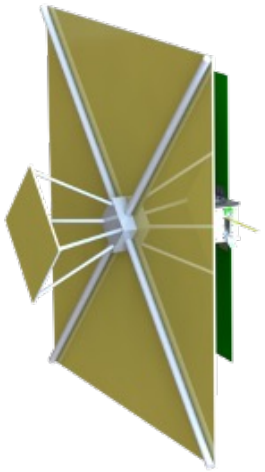
MAXWELL

Top-Level Requirements

Reference Number	Misson Objectives
MO-1	MAXWELL shall downlink 150MB of data at 10Mbps during one pass at X-band
MO-1.1	MAXWELL should downlink 450 MB of data at 30Mbps during one pass at X-band
MO-2	MAXWELL shall downlink 15MB of data at 1Mbps in a single contact without the presence of other narrow band signals in the same frequency
MO-2.1	MAXWELL should downlink 15MB CDMA data at 1Mbps in the presence of other narrow band signals in the same frequency
MO-3	MAXWELL shall characterize the Allan Variance of the Chip Scale Atomic Clock on orbit
MO-4	MAXWELL should deploy the MMA T-DaHGR antenna on orbit
MO-4.1	MAXWELL should characterize the antenna gain pattern of the MMA T-DaHGR antenna on orbit

For a more detailed set of requirements, see the MAXWELL RVM

Team Organization



Stakeholders & Partners

Ann and H.J. Smead Aerospace Engineering Sciences
UNIVERSITY OF COLORADO BOULDER

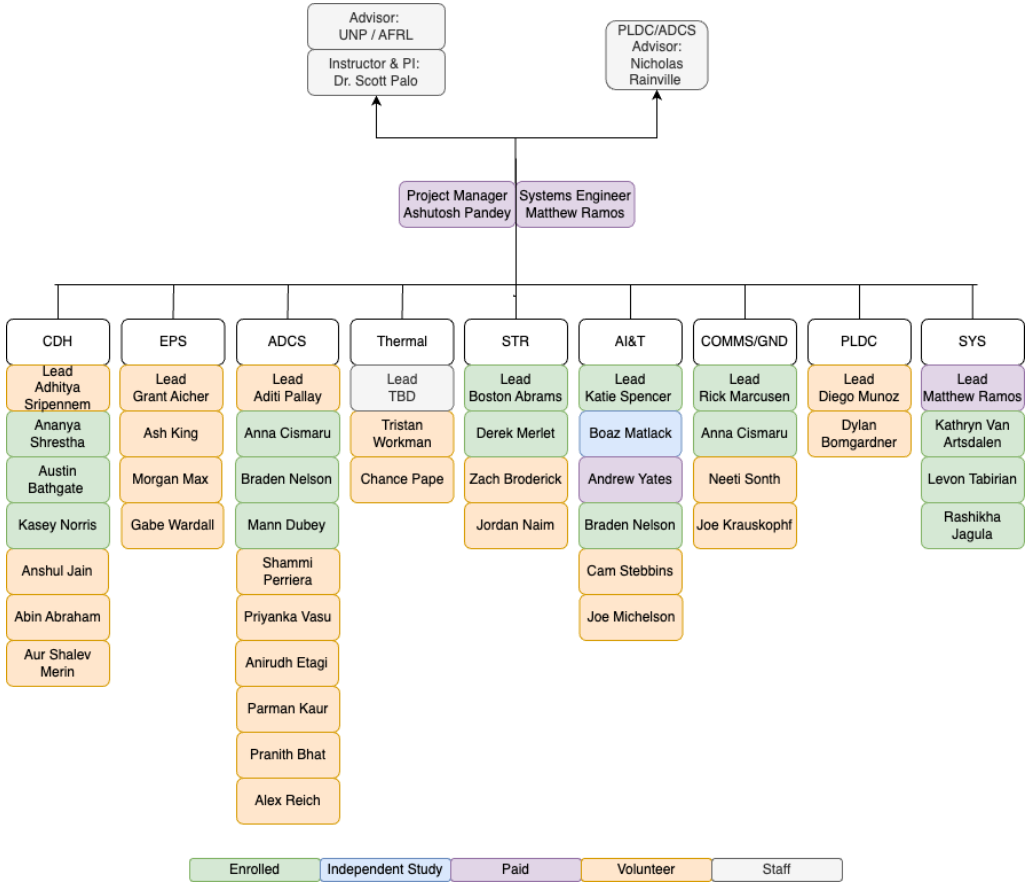
AFRL
THE AIR FORCE RESEARCH LABORATORY
LEAD | DISCOVER | DEVELOP | DELIVER

UNP UNIVERSITY NANOSATELLITE PROGRAM

BLUE CUBED

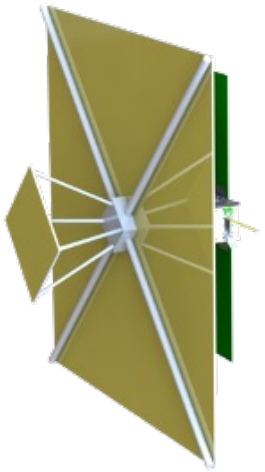
MMA Design

Org Chart

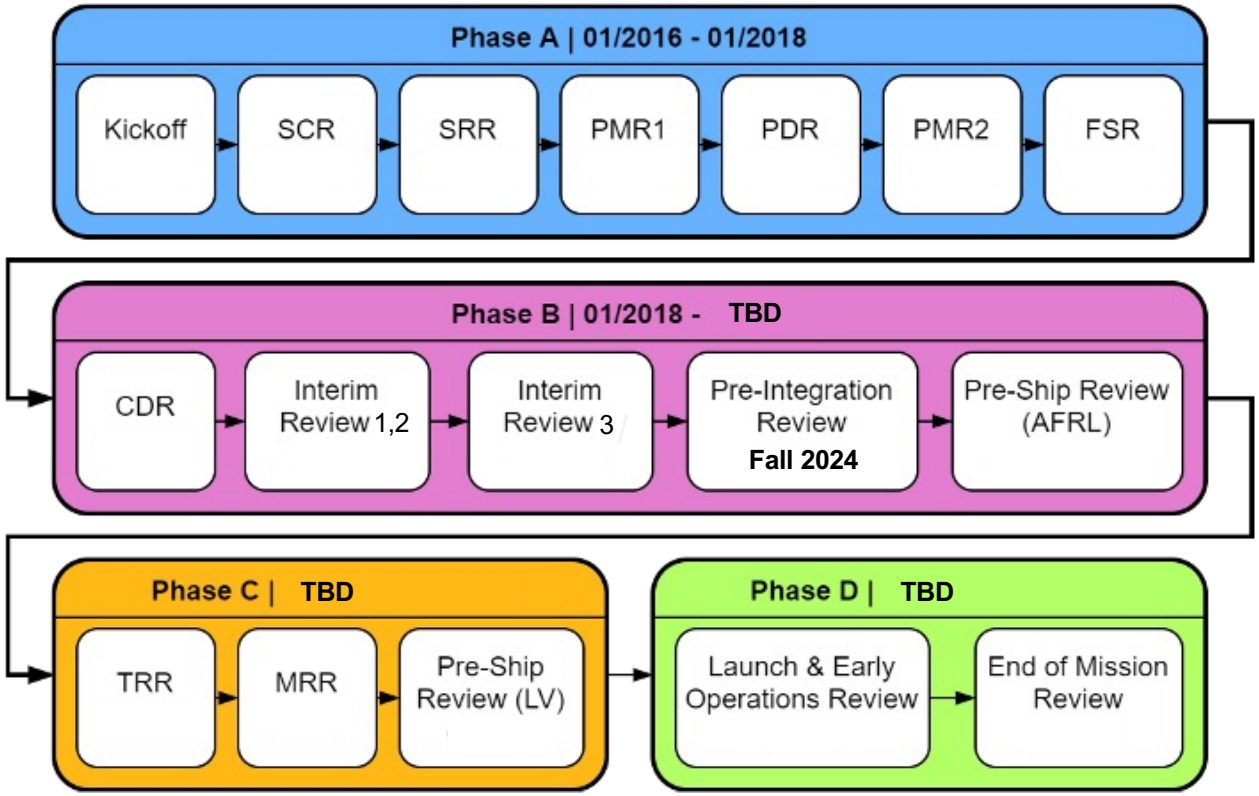

Advisor: UNP / AFRL
Instructor & PI: Dr. Scott Palo
PLDC/ADCS Advisor: Nicholas Rainville
Project Manager Ashutosh Pandey
Systems Engineer Matthew Ramos
CDH
Lead Adhitya Sripennem
Ananya Shrestha
Austin Bathgate
Kasey Norris
Anshul Jain
Abin Abraham
Aur Shalev Merin
EPS
Lead Grant Aicher
Ash King
Morgan Max
Gabe Wardall
ADCS
Lead Aditi Pallay
Anna Cismaru
Braden Nelson
Mann Dubey
Shammi Perriera
Priyanka Vasu
Anirudh Etagi
Parman Kaur
Pranith Bhat
Alex Reich
Thermal
Lead TBD
Tristan Workman
Chance Pape
STR
Lead Boston Abrams
Derek Merlet
Zach Broderick
Jordan Naim
AI&T
Lead Katie Spencer
Boaz Matlack
Andrew Yates
Braden Nelson
Cam Stebbins
Joe Michelson
COMMS/GND
Lead Rick Marcusen
Anna Cismaru
Neeti Sonth
Joe Krauskopf
PLDC
Lead Diego Munoz
Dylan Bomgardner
SYS
Lead Matthew Ramos
Kathryn Van Artsdalen
Levon Tabirian
Rashikha Jagula
Enrolled
Independent Study
Paid
Volunteer
Staff

Spring Semester Goals

Demonstrating Launch Readiness



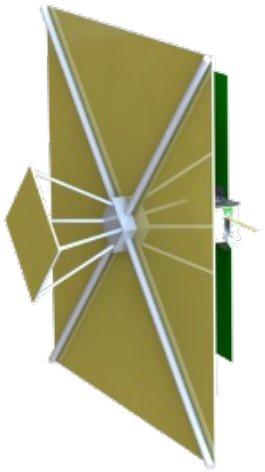
Project Timeline



Deliverables

- ❏ Preliminary Integration Review – Fall 2024
  - ❏ **Complete Charge Cycle Test (Complete Fall 2024)**
  - ❏ **Long Range Communications Test (Complete Fall 2024)**
  - ❏ **Command Execution Test (Complete Fall 2024)**
  - ❏ **ADCS Verification Test (Complete Fall 2024)**
  - ❏ Day In The Life Test

Subsystem Deliverable Updates



CDH Updates & Semester Plans

Updates:

- ❏ CET 3.2 completed (ADCS mode logic and image upload)

Semester Plans:

- ❏ Complete CET-4 (PLDC) and CET-5 (Comm)
- ❏ Support SYS with Day in the Life Testing (Commissioning Process)
- ❏ Continue supporting other subsystem tests
  - SCT-3 and SCT-4
  - CCCT

COMMs Updates & Semester Plans

Updates:

- ❑ Ground Station
  - ❑ Operational at amateur frequencies (437.513 MHz)
- ❑ Simulated COMMs Tests (SCT)
  - ❑ SCT 1 and 2 completed!
  - ❑ SCT 3 ready to perform, pending balcony/roof access

Semester Plans:

- ❑ Complete over-the-air RF testing!
  - ❑ SCT 3 and 4
- ❑ Continue Ground Station Development
  - ❑ Functionality for 401 MHz and GND software

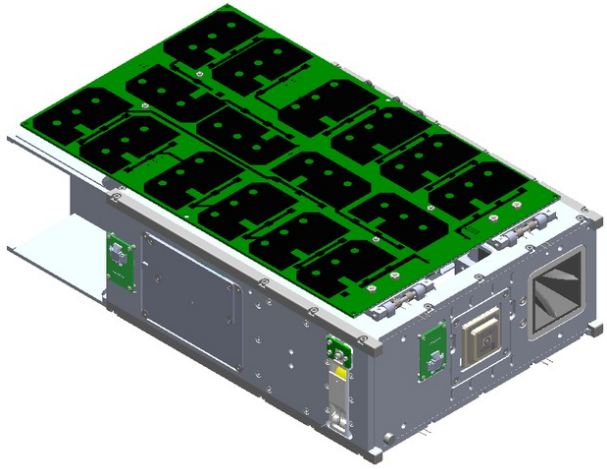
Structures Updates & Semester Plans

Updates:

- ❏ Made CAD Changes Required by AI&T
- ❏ Did MGSE Analysis

Semester Plans:

- ❏ Order Flight Model
- ❏ Final Analysis of Structure
- ❏ Fabricate Misc Flight and Test Fixture Parts
- ❏ Prepare for PIR Presentation



AI&T Updates & Semester Plans

Updates:

- ❑ Verified structural changes through assembly dry-runs
- ❑ Revised assembly procedure document
- ❑ Completed thermal chamber testing of the UHF antenna

Semester Plans:

- ❑ Finalize assembly procedure document
- ❑ PIR Deliverable: Master Equipment List
- ❑ Solar panel deployment testing
- ❑ Harness fabrication readiness

UHF Antenna Thermal Chamber Testing

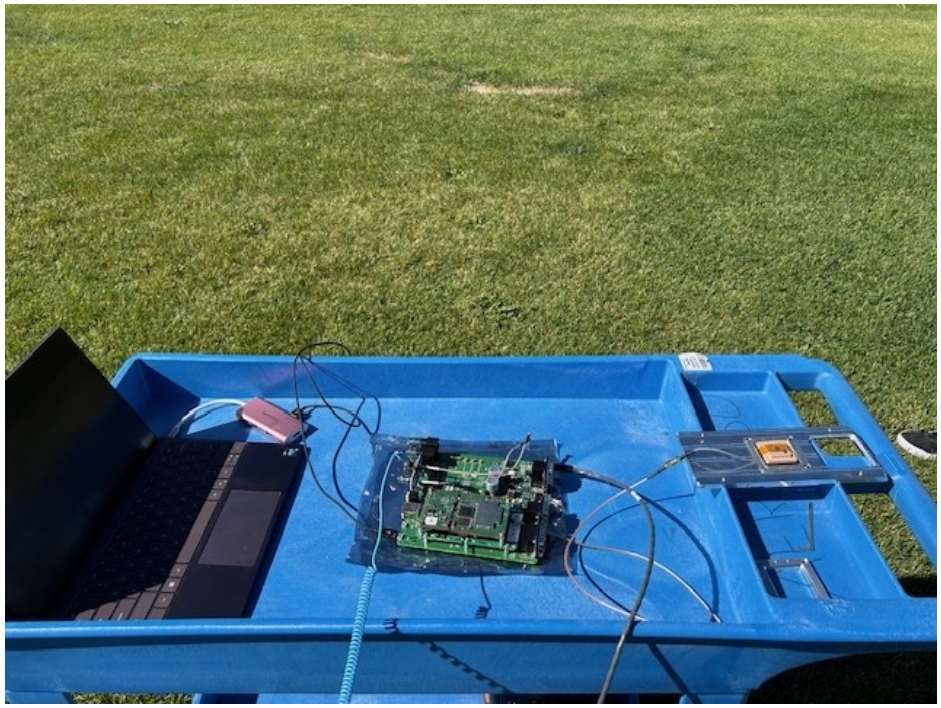
MAXWELL ADCS Updates and Semester Plans

Updates:

- ❑ GPS board integrated into MAXWELL FlatSat
- ❑ GPS antenna placement and configuration tested and decided
- ❑ Made great progress on flight mode testing of ADCS related ground commands

Semester plans:

- ❑ Finish software integration of GPS system
- ❑ Integrate Chip Scale Atomic Clock (CSAC)
- ❑ Finish integration of remaining hardware elements
- ❑ Documentation of all test and integration efforts

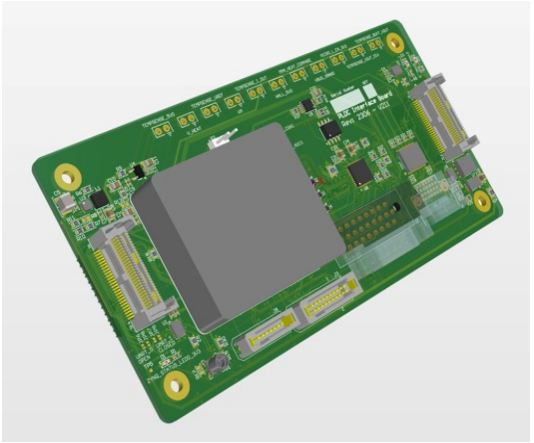


GPS Antenna Test

PLDC Updates & Semester Plans

Updates:

- ❏ The communications link between the CDH and the PLDC has been fixed!
  - ❏ Made test boards, tested individual boards, found the error, set up the stack, UART



Semester Plans:

- ❏ Complete revision and changes on all scripts to allow for testing of all standalone functions between the CDH and PLDC (CET 4.0)
  - ❏ Many scripts to work with in embeded c and pentalinux
  - ❏ Reach on out if interested!

EHW Update and Semester Plans

Update

- ❏ This semester, we have built a set of CSS boards, various breakout boards, and a ADCS board

Semester Plans

- ❏ Flight builds for MAXWELL and flat-sat builds for SW-EX

Ad Time

- ❏ Many of our tasks are dependent on electronics hardware
- ❏ We need you!
  - To build!
  - To test!

Scan to get linked with EHW!

SYS Updates & Semester Plans

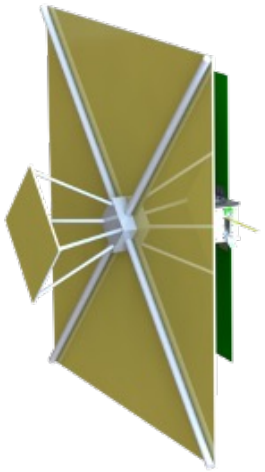
Updates:

- ❑ Coordinating with subteams to confirm power and data budgets, documentation plans for X-band radio and RF hardware, and requirements verification
- ❑ Research and writing in progress for Mission Ops Plans
- ❑ Finished Day In The Life Test Procedures
- ❑ Finished UHF ground data documentation

Semester Plans:

- ❑ Verify most if not all subsystem requirements
- ❑ Finish Mission Operations Plan – write CONOPs & Experiment Plan, outline anomaly resolution, develop operating procedures, outline flight rules
- ❑ Update and finalize link budget, power budget, pointing budget, and data budget
- ❑ Document X-band radio and RF hardware, operating software, networking system and compile UHF ground data documentation

Project Concerns



Project Concerns

ADCS

- ❏ Software debugging often takes longer than anticipated, and there are more tasks that need to be done besides debugging
  - ❏ Mitigating this risk by onboarding two new members to help with debugging

CDH

- ❏ Software Development delays Command Execution Test
  - ❏ Individual subsystem software and changes may delay the testing schedule
- ❏ Errors that might arise from Day in the Life Test

PLDC

- ❏ MMA antenna integration and motor driver scripts
- ❏ Advanced language on Zynq, need more than simple c on this end

Project Concerns

Comms

- ❏ Student turnover and knowledge transfer
  - ❏ Actively looking for new members interested in RF/ground control software/hardware
- ❏ FCC licensing (NOAA coordination)
- ❏ Acquiring GND components

Structures

- ❏ May need to modify the flight structure in spring semester

Thank You!