



StangSat



Inter-CubeSat Wi-Fi Communication During Launch





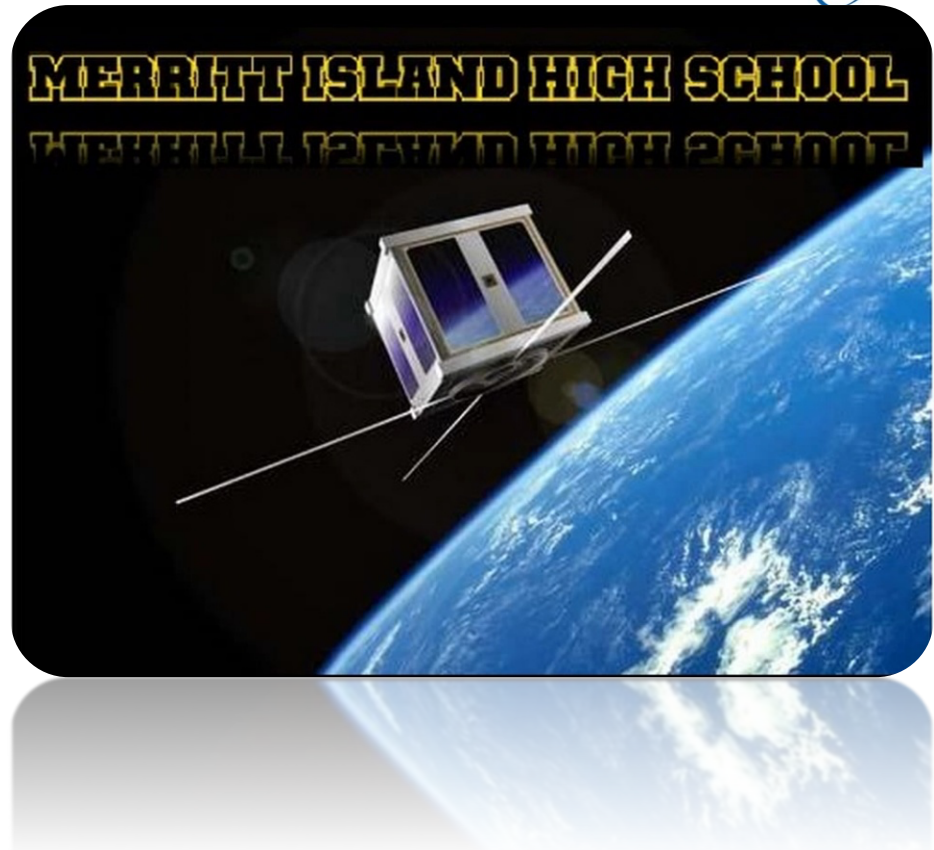
Purpose of Presentation

- Share risk mitigation efforts associated with Wi-Fi telemetry during flight
 - To eliminate the concern that Wi-Fi telemetry poses a risk to:
 1. Rocket telemetry
 2. Range safety
 3. Primary mission payload



Agenda

- The StangSat Team
- Mission Overview
- Risk Mitigation Efforts

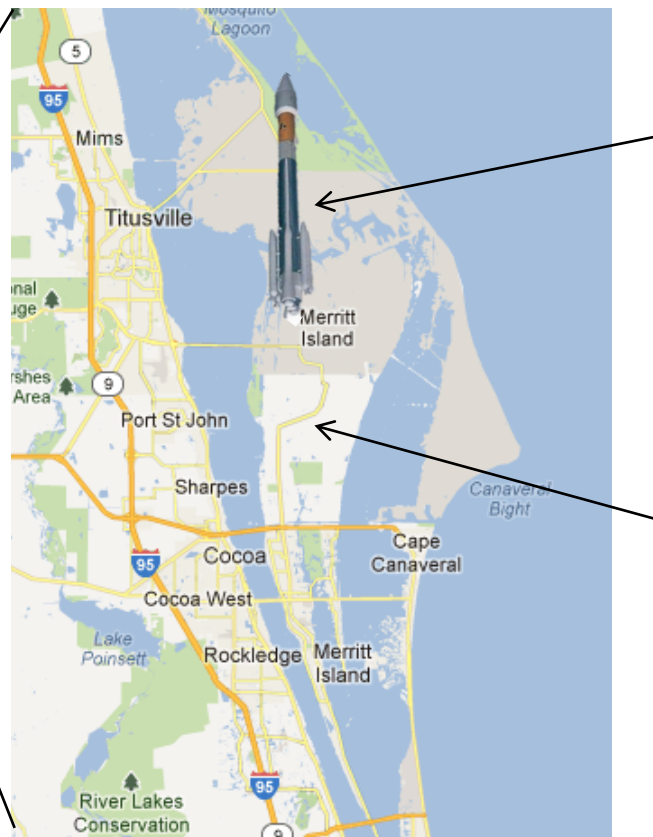


The StangSat Team



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Merritt Island High School

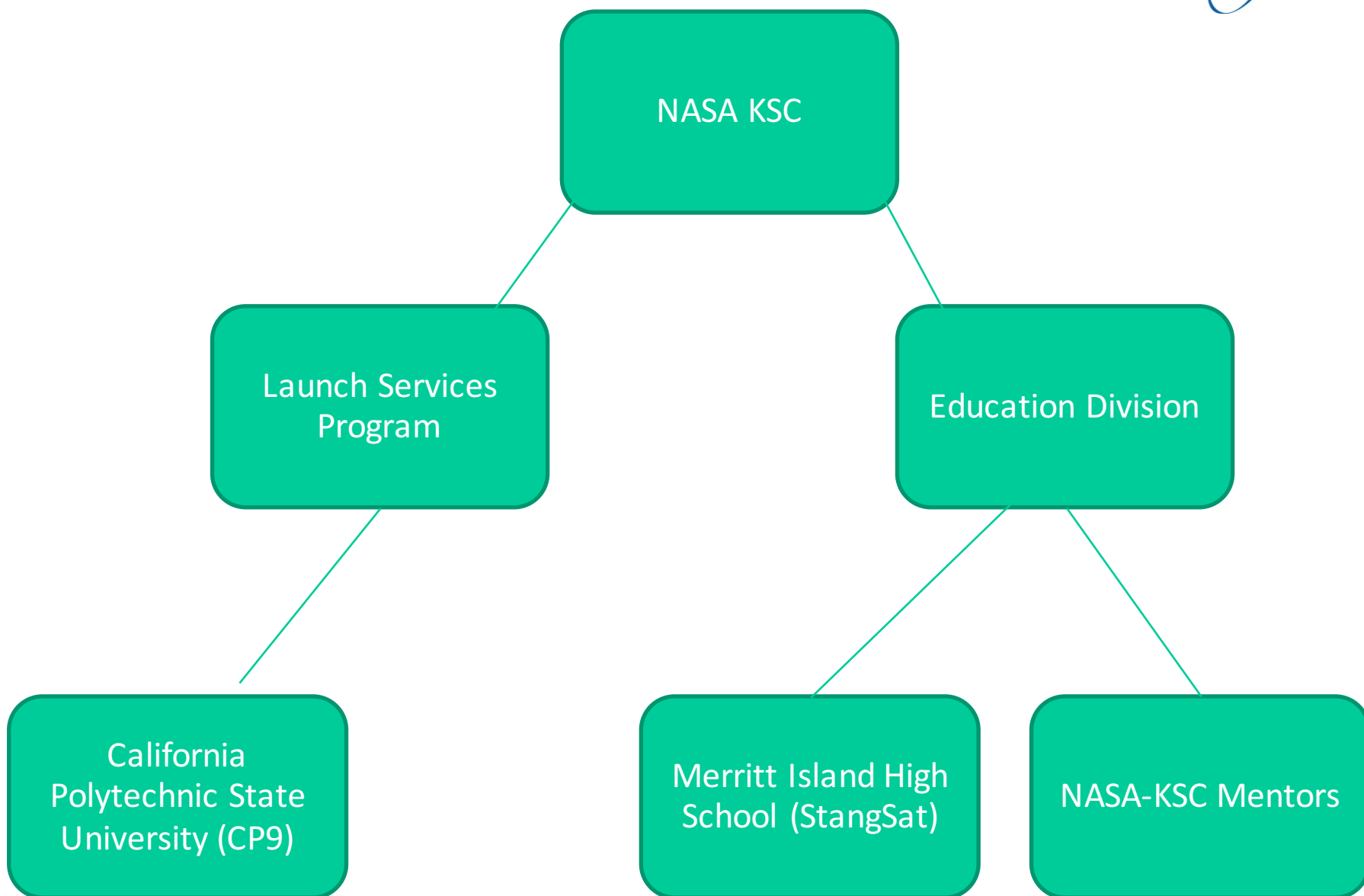




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Space Act Agreement

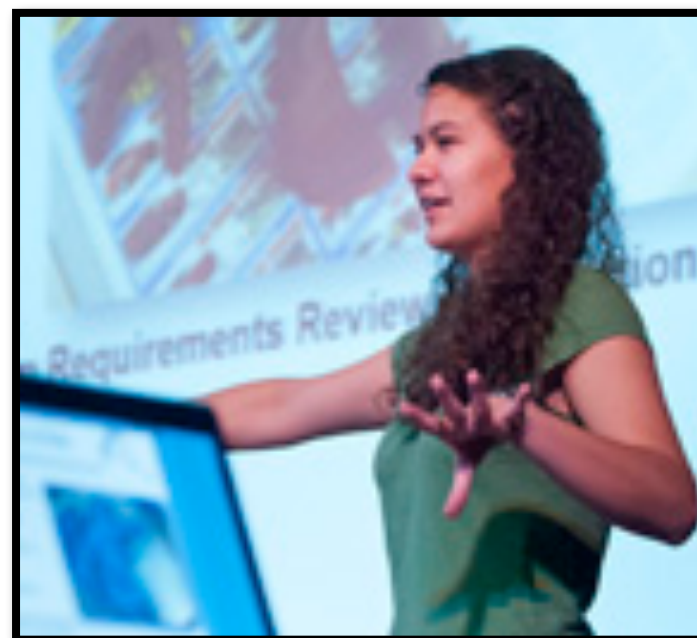
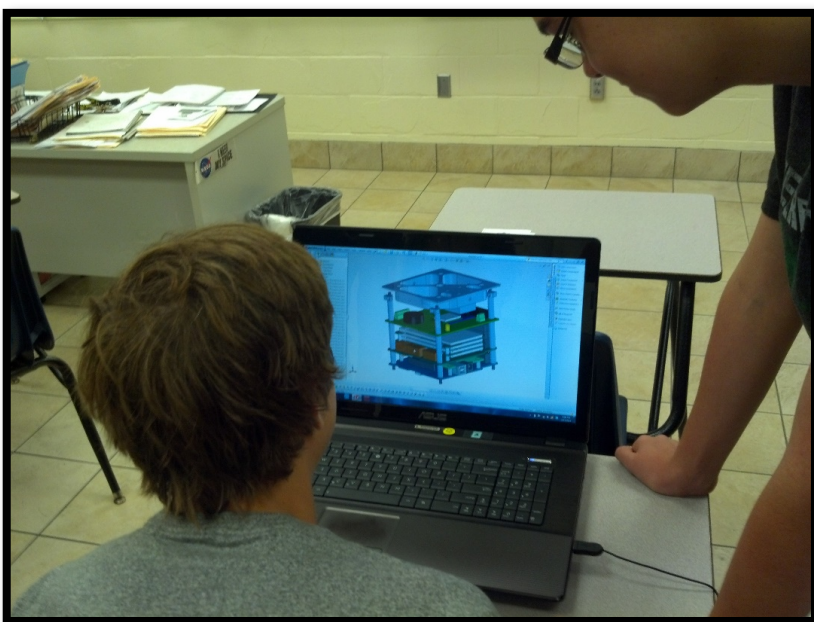






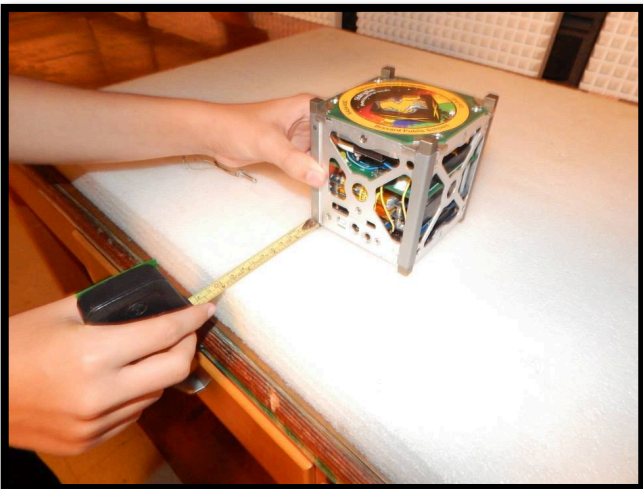
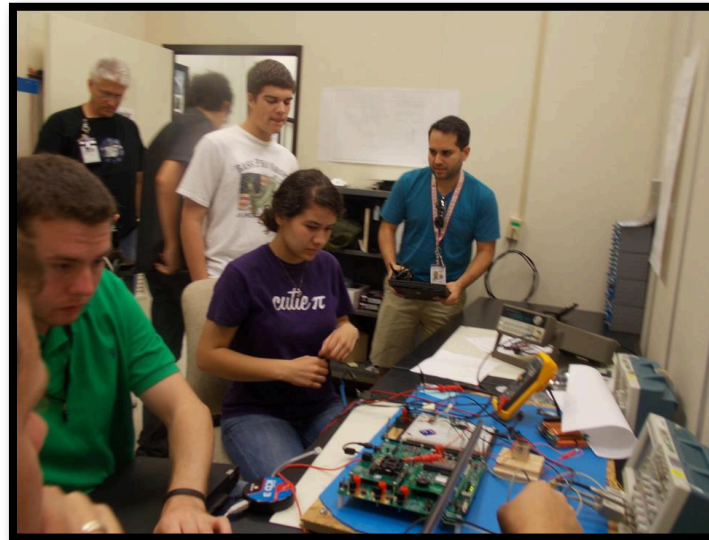
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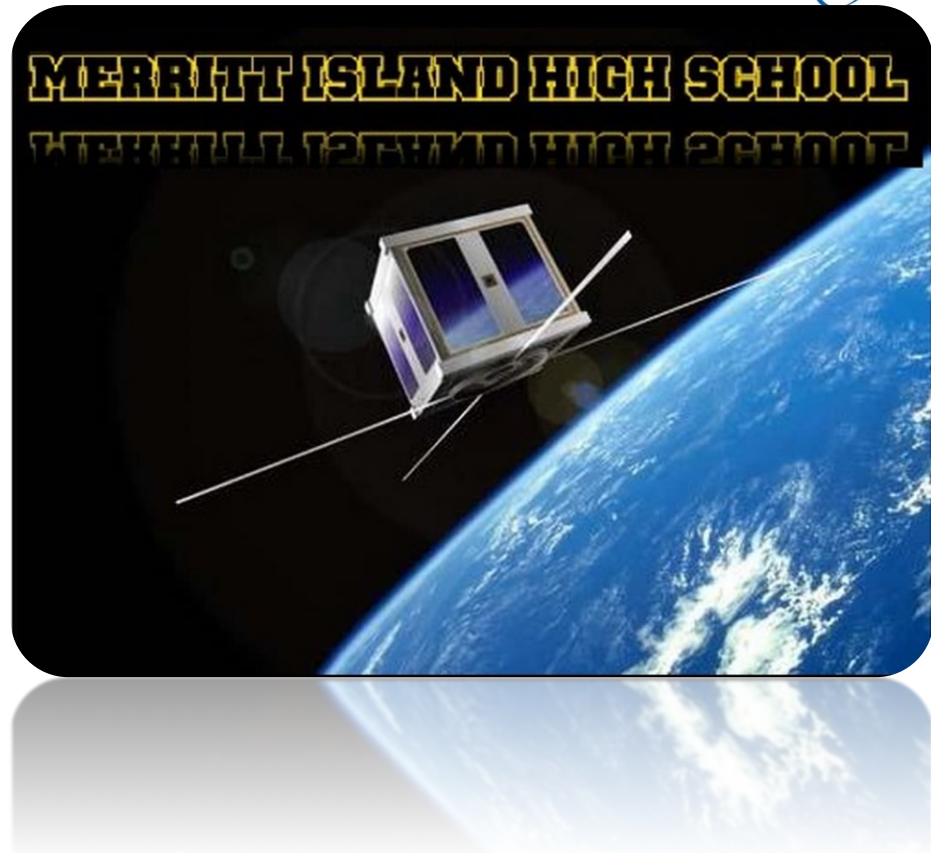
Education & Experience





- StangSat lab at the Kennedy Space Center





Mission Overview



Mission Overview

- Merritt Island High School and California Polytechnic State University will work to:
 - Qualify Environmental Flight Data
 - Measure shock and vibration environments for a CubeSat inside of a Poly Pico-satellite Orbital Deployer (P-POD) in order to better quantify flight environments
 - Use Wireless Data Transmission
 - Demonstrate Radio Frequency transmission between CubeSats within a P-POD with less than 1 Watt during vehicle ascent



Concept of Operations – In Flight



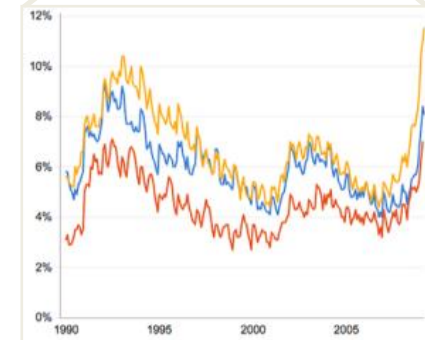
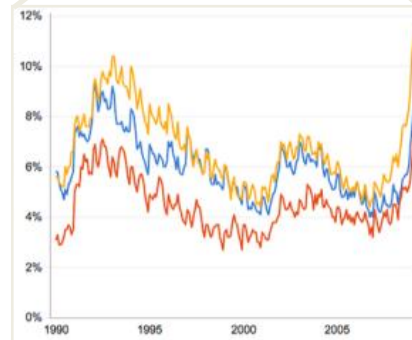
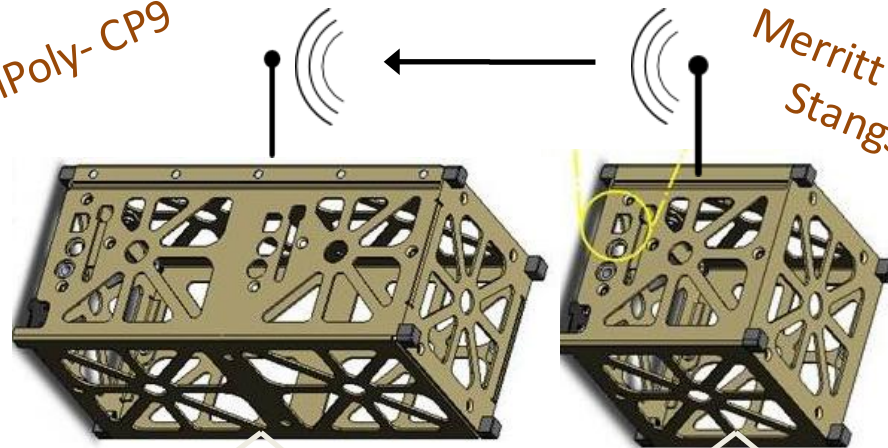
P-POD

Measure Shock
& Vibration

Data transferred using
802.11 Wi-Fi

CalPoly-CP9

Merritt Island-
StangSat



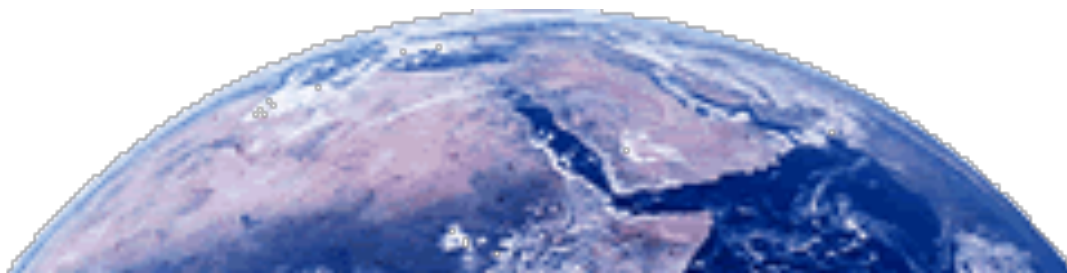


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Concept of Operations- Photo Documentation



Record image of the
aft face and StangSat



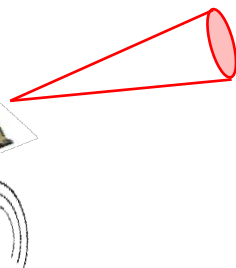
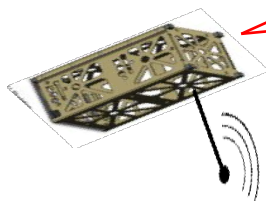


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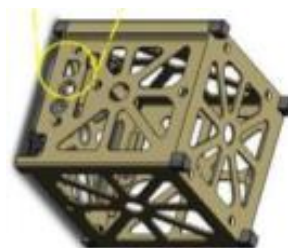
Concept of Operations – Downlink



CalPoly-CP9



Merritt Island-
StangSat

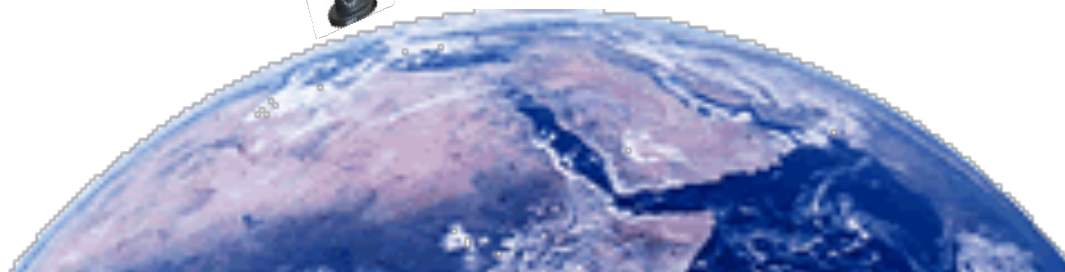


EOM

Downlink Data
to ground station
via UHF



Ground
Station





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StangSat Mission Timeline

LAUNCH SERVICES PROGRAM



T+15s to Ejection

+500ms
(turn on)

+15s

Ejection – 4s

Ejection

E+60s

CTS

Orbital Mission

- Turn on CS with LED (immediately following T-0)
 - CS buffers data until CTS-C&DH board boots
 - CTS begins data acquisition
- CTS-CS Interface (ICD)
- Wi-Fi connects (prior to +15s)
 - CS begins transmitting after [TBD] s
- Data Telemetry
- Record for T+500ms to T+5 min
 - Up to 5 more minutes for “Events of Interest”
- Abort
- CTS begins abort monitoring
 - At T-0+35s, CTS send abort command if minimum pressure differential is not reached

- CTS continues recording data
- Cease CTS-CS communications

- CTS captures image of CS

CS

End of Mission

- CS wake
 - Create Wi-Fi network
 - Power up of accelerometers
 - Store data to internal SD memory
- CS begins transmitting stored and real time data via Wi-Fi after connection is established approximately 15+/- 2 s
 - CS is capable of reentering sleep mode if abort LED signal is received from CTS
 - CS test TX Wake flag to 1 if no abort is received during the first 35s of operation

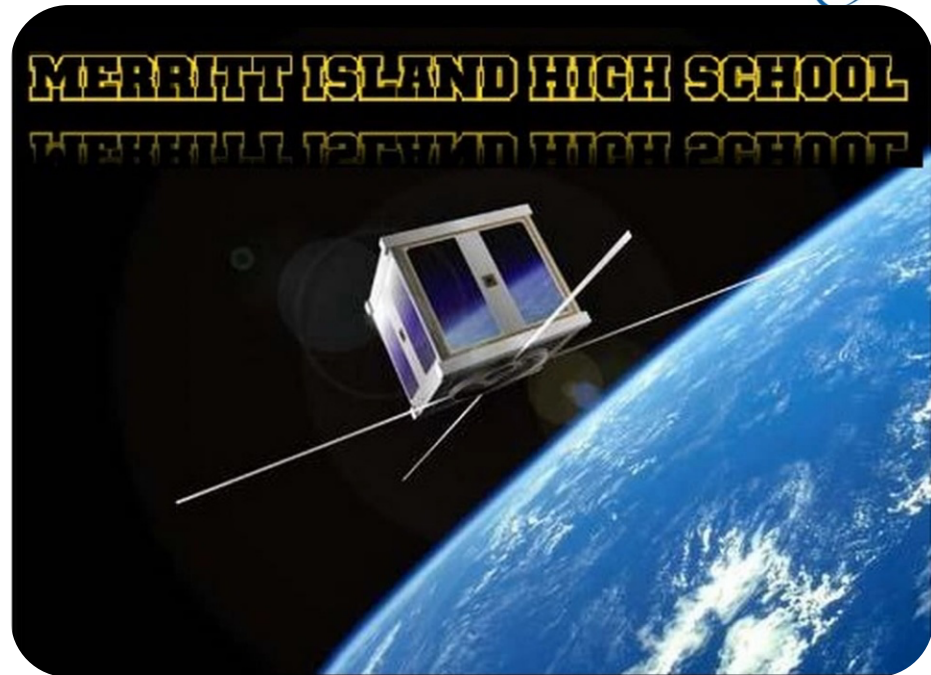
- CS Terminates transmission of data after receiving end of mission LED signal from CTS
- Reenters sleep mode waiting for ejection indication

- CS enters bleed down mode if TX Wake flag is set to 1 and deployment switch has been set



Current Status

- Phase A: Concept exploration
 - Completed: March, 2011
- Phase B: Design
 - Completed: August, 2012
- Phase C: Build and Test
 - Estimated Completion: May, 2014
- Phase D: Final Verification
 - Estimated Completion: Pending Manifest assignment

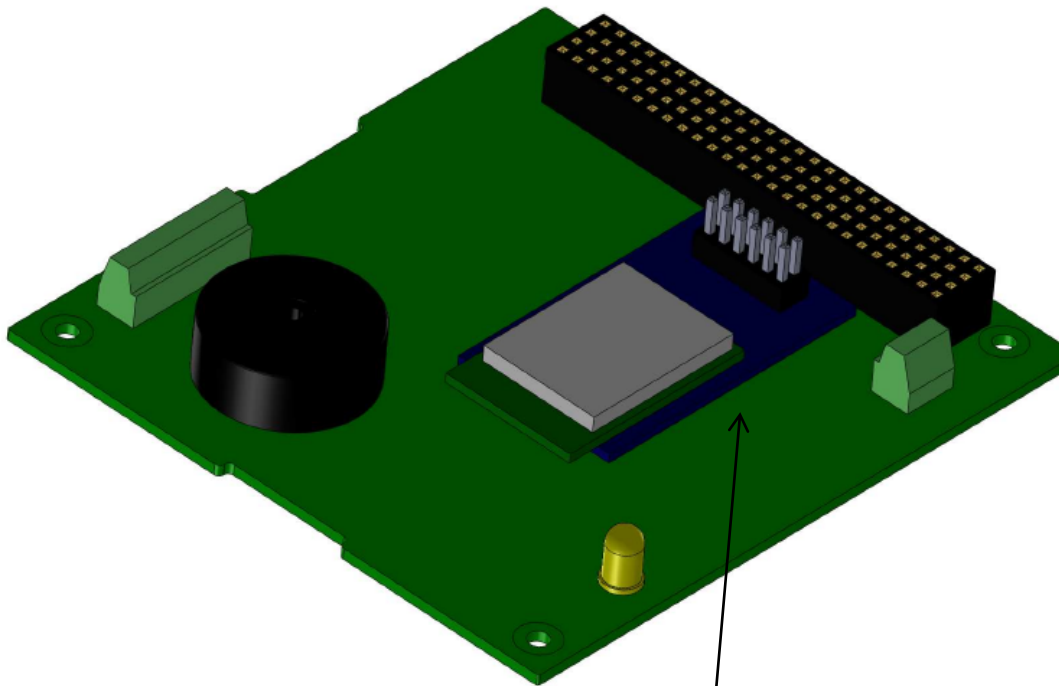


Risk Mitigation Efforts

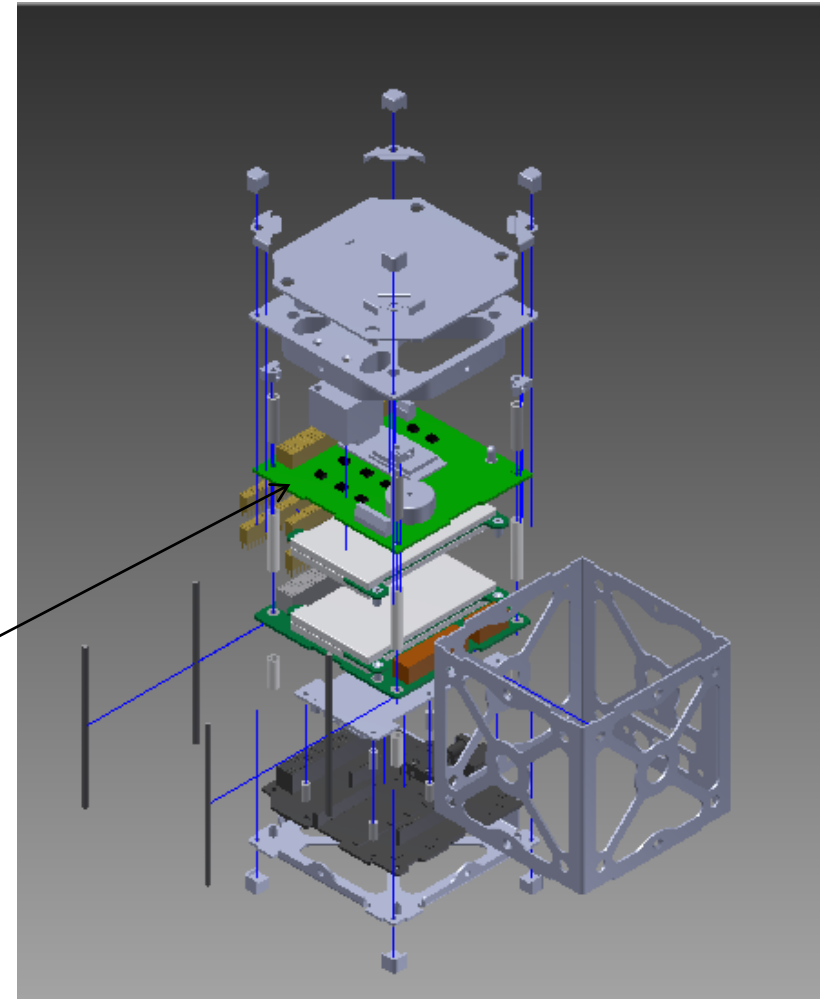


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Telemetry Board



Wi-Fi Module





Digilent Pmod Wi-Fi

- 802.11-compliant RF transceiver
- 1 to 2 Mbps data rate
- 400m (1300ft) range
- Integrated PCB antenna





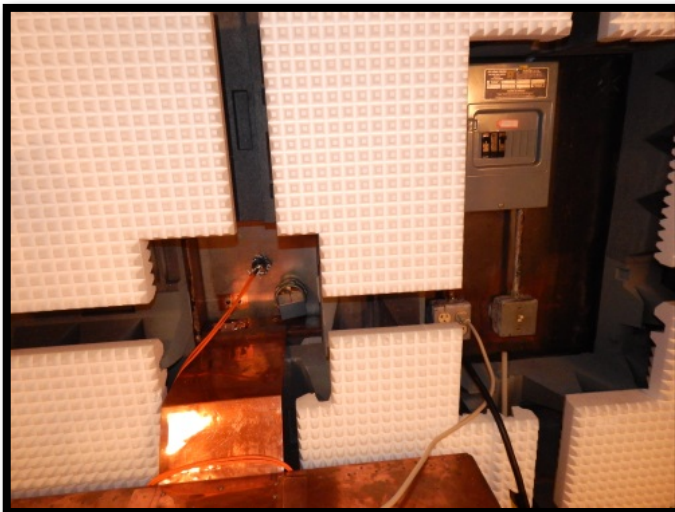
Purpose- Characterize and quantify electromagnetic emittance and interference

Use data to make changes to our code to accommodate any exceedances to meet regulations

Confirmed known spike at 2.4GHz due to Wi-Fi



- Electromagnetic Interference Lab at KSC





- Modified code to lower the amplitude of the Wi-Fi module frequency
 - Additional testing to be performed for confirmation

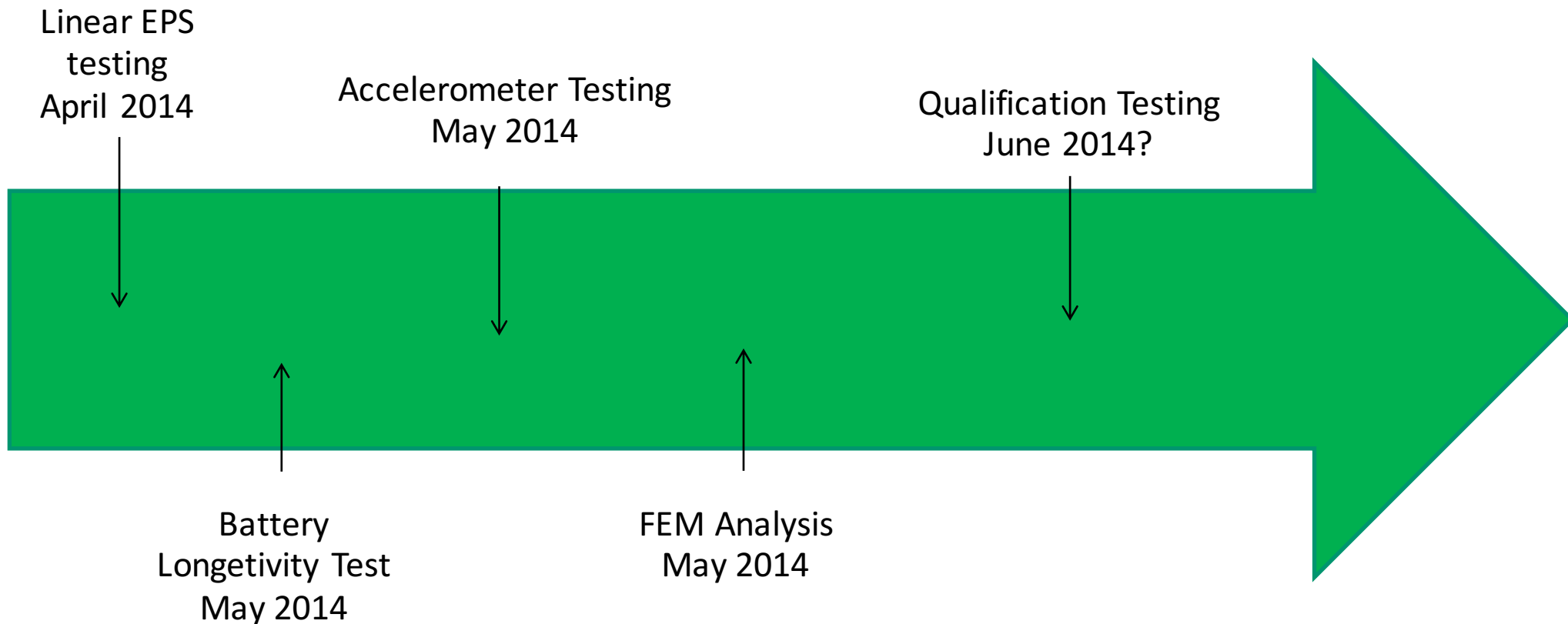


- CP9 tested with StangSat at KSC
 - LED Command Bench and P-POD Tests
 - Confirmed LED commands from CP9 are successfully detected by StangSat outside and inside P-POD
 - Confirmed that StangSat executes proper functions after LED detection
 - Wi-Fi Bench and P-POD Tests
 - Confirmed wireless communication between CP9 and StangSat outside and inside P-POD
 - Verified data rates and packet format
 - Simulated Mission Test
 - Verified that configuration can successfully complete a simulated mission
 - Verified abort and re-triggering of CP9 and StangSat
 - Verified data acquisition and storage at mission completion



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Additional Testing





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Thank you