Full Mission Simulation Report

Old Dominion University
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Presentation Outline

• Section 1: Mission Overview
• Section 2: Integrated Subsystem Testing Status
• Section 3: Full Mission Simulation Results
• Section 4: Project Management Update
1.0 Mission Overview

Cian Branco
Mission Overview

- Monarch 3 will employ a pressure sensor in a special port to measure boundary layer pressure through rocket ascent.
- This experiment will benefit ODU’s continued development of space exploration education and the on-going CubeSat project.
ODU ConOps, “Monarch-3”

- **t = 0 min**
  - G switch triggered
  - All systems on
  - Begin data collection
  - Begin Transmitting

- **t ≈ 15 min**
  - Splash Down

- **t ≈ 4.0 min**
  - Apogee
  - Altitude: 95 km

- **t ≈ 2.8 min**
  - Altitude: ≈115 km

- **t ≈ 2.4 min**
  - Karman line:
    - Altitude: 100 km
    - Pressure eff. 0

- **t ≈ 0.6 min**
  - End of Orion Burn – Spin Rate Largest
  - Altitude: 52 km

- **t ≈ 5.5 min**
  - Low N2, Low spin
  - Chute Deploys

- **t ≈ 15 min**
  - Splash Down
Changes since ISTR

• All boards procured and in various states of assembly/testing
• Ground Station radio systems rebuilt
• Battery bracket needed a re-design
• Full payload model complete
• Port design complete
2.0 Integrated Subsystem Testing Status

Cian, Connor, Jason
Integrated Subsystem Testing Status: Mech. 1

Mechanical Structure

Mechanical Structure Holds the payload together, it consists of several components:

• Final Assembly layout is complete, CG and mass estimates are within tolerance.

• All critical mechanical components (plates, brackets, stand-offs) procured; battery bracket redesign is finished and bracket is being reprinted

• Plates need final drilling and electronics boards for full assembly
Integrated Subsystem Testing Status: Mech. 1

G: G switch
Y: Power
R: Processor
B: Radio
Integrated Subsystem Testing Status: Mech. 2

Special Port

Special Port design is finished, minor tweaking may be required:

• Port layout follows very closely with last year’s design, is otherwise complete

• Addition of pressure sensor vs solar cell required minor adjustment

• Procurement of aluminum for door and antenna material is action item
Integrated Subsystem Testing Status: Mech. 2
Integrated Subsystem Testing Status: Power

Power to Other Boards

Power supply is a critical portion of our system’s proper functionality. There are three boards to supply power to:
• Processing
  – Voltages tested and validated
• Radio
  – Radio power consumption and supply validated
  • Identified and mitigated circuit design issue (improper supply)
  – PA waiting on heatsink for testing
• Port
  – Testing in progress

45%
Integrated Subsystem Testing Status: Data

Data Communication

This test will ensure that the communication between data sources and sinks

• Port and Processing Board
  – Connection testing ongoing
• Processing Board and Radio
  – Radio control and operation validated
  – Issue identified with DAC to Mic connection, mitigation on-going.
    • Potential Causes are improper DAC operation or insufficient output drive
    • Solutions under consideration are code modifications or adding an amplifier
Integrated Subsystem Testing Status: Radio

Radio Transmission

System is waiting on PA, current tests are using a known good antenna. Tests will use the antenna output elements once the PA is complete. Estimated delivery next week.

- Coax Link
- Balun
- Antenna
3.0 Full Mission Simulation Results
Connor & Cian
Full Mission Simulation Results

• Full mission sim is waiting on full component assembly, current soak tests have been with intermediate stages.

• Results positive
  – No system dropouts over run time
  – Power Consumption within bound
    • Missing heaviest draw (PA stage)

• Next Tests
  – Enclosed system for limited thermal transfer
  – Battery droop
  – Complete System
Full Mission Simulation Results

Action Items

• Finish Missing Systems
  – Power Amplifier
    • Heatsink waiting (Arrival Friday)
    • Low risk: Kit built
  – Port
    • Antenna
    • Balun
    • PCB
    • Moderate Risk : Limited time for revision
  – Processing Board
    • 50% Assembled and tested
  – Code
    • Code is being built as a test framework with processing
    • Final pass to smooth edges and optimize
    • Re-use of previous code as much as possible
4.0 Project Management Update

Cian
Action Item Summary

- Power Amplifier
  - Heatsink arrival Friday, complete this weekend
- Port Board
  - Complete by end of next week
- Processing Board
  - Complete by Friday
- Code
  - Minor Revisions: Complete with other components
- Payload Assembly
  - Drilling complete by Friday
  - Door milling requested complete by next week (dependent upon machine shop)
  - Final Assembly awaiting remaining boards; trivial (a few hours) once boards complete
<table>
<thead>
<tr>
<th>Requirement</th>
<th>Status/Reason (if needed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center of gravity in 1&quot; mid-can?</td>
<td>0.03in X direction; .03 in Y Direction</td>
</tr>
<tr>
<td>Contained in can</td>
<td>Not yet</td>
</tr>
<tr>
<td>Connected to can by 4/5 bulkheads on top and bottom only</td>
<td>Will mount Bottom</td>
</tr>
<tr>
<td>Mass at 20±0.2lbs</td>
<td>ODU is at 3.8 lbs: will ballast</td>
</tr>
<tr>
<td>Shared canister clearance</td>
<td>Will not interfere, 1” separation between payloads</td>
</tr>
<tr>
<td>No voltage on the can</td>
<td>Can is isolated</td>
</tr>
<tr>
<td>Activation wires at least 4 ft</td>
<td>Yes</td>
</tr>
<tr>
<td>Activation wire at least 24 gauge</td>
<td>20 gauge</td>
</tr>
<tr>
<td>T-0 Activation: current &lt; .1 A</td>
<td>G-switch as before : ~30mA</td>
</tr>
<tr>
<td>Early Activation: current &lt; 1 A</td>
<td>Not using</td>
</tr>
<tr>
<td>Battery Type</td>
<td>Lithium Polymer (will not charge at Wallops)</td>
</tr>
</tbody>
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Biggest Worries

• Progress is being made to shrink the “budget gap”, but any major hiccup at this point will throw us off; can’t plan for unknown unknowns other than being careful.

• End of semester has freed up more time, but shop accessibility may be limited; we have other mechanical options available.
Conclusions

• Issues and concerns?
• Closing remarks
• Discuss Check-In Procedure: 3rd time through; we’ll be massed and ballasted, and volt checked before we arrive for 9am check-in.
• Discuss Presentation to RockOn! 2017
• Discuss Final Report
• Discuss extra launch attendees
Thank you!