Full Mission Simulation Report

Temple 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
Mission Overview

• MISSION:

To detect the frequency of muons as a function of altitude. Capture accelerometer data to model payload orientation during flight.
ConOps

- **T - 3:**
  - power on
  - Udoo and FEB power on

- **T - 2:**
  - Udoo automatic login
  - Scripts start
  - Data collection begins

- **T - 1 until battery depletion:**
  - Data collection continues (will run on full charge for at least 30 minutes)
Changes since STR

• No changes since STR
2.0 Integrated Subsystem Testing Status
Integrated Subsystem Testing Status

电气:
Final integration and testing completed as of March 1st

机架:
Final integration and testing completed April 10th

软件:
Final integration and testing completed April 15th

感应器:
Final integration and testing completed April 25th
Integrated Subsystem Testing Status: Electrical

**Power regulator:**

Power regulator is complete. Testing shows steady and adequate power is being provided to subsystems for a minimum of 30 minutes.

**Wiring:**

Wiring is complete. Wiring is staked with hot glue and machine ties. Full system testing shows no loose connections and no electrical faults.

**Purpose:**

The electrical system testing verified that adequate power is being supplied to each reliant subsystem and Wallops electrical requirements are met.
Early activation current,
lower bound = 0.89 A

Early activation current,
upper bound = 1.02 A

No voltage on canister (base)
Integrated Subsystem Testing Status: Chassis

- Payload fits in canister
- Payload meets shared canister weight requirements
- Payload meets shared canister height requirements
- Payload is mounted securely to base-plate
- Payload withstood vibration testing

Purpose:

The chassis testing verified that the payload fits inside the canister with required clearances and mounts securely to the canister base. Vibration testing confirms the payload will not destruct during flight.
Payload mounted to base plate with 4 standoffs

Payload under 5 inches height in canister

Payload fits inside canister walls
Payload weight results:

Payload (with 4 feet of activation wire), weights \textbf{5.950 lbs.}

20 lbs total - 6.7 lbs canister - 1.5 lbs mid mount = 11.8 lbs for both payloads together, 11.8 lbs / 2 = 5.9 for each payload,

\textbf{Space Owl payload = 5.950 lbs}

Can remove some additional weight by grinding ballast plates if necessary. Will depend on final weight of RockOn payload to determine if this is necessary.
Integrated Subsystem Testing Status: Software

- System boots and logs in automatically on power on
- Shell scripts autorun and start accelerometer and FEB data collection GUI. Data is saved to a CERN .root file.

**Purpose:**

The software system testing verified that the front end board, accelerometer, and automatic startup scripts function as expected throughout the mission simulation.
Integrated Subsystem Testing Status: Sensing

- FEB captures signals from SiPMs and records data in histograms showing ADC value and number of events.

- CERN Root object browser opens captured data after FEB has finished running a capture session.

**Purpose:**

The Sensing system testing verified that the front end board software functioned as desired and recorded particle detection data.

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GUI displaying event rate

Root object browser
3.0 Full Mission Simulation Results
Full Mission Simulation Results

- David Horowitz ran a full mission length simulation, at least 10 simulations on finished payload
- Tests conducted at apartment from April 15th - 25th
- Simulations last for at least 6 minutes, most runs are much longer with a maximum run time of about 30 minutes tested. System is capable of much longer up time.
- Two issues encountered during testing:
  1. Sweet spot for ADC discriminator threshold setting appears to fluctuate
  1. Detection rate spikes when payload is touched by a human
Analysis of Simulation Results

- **ADC ideal threshold fluctuation**
  - Level of battery charge seems to influence event trigger rate
  - Tests conducted on full charge are more stable
  - A workable ADC threshold setting will need to be finalized before launch

- **Trigger rate spikes when payload is touched**
  - Human touching payload near detector or on metal part causes a spike in detection rate
  - Insulated touching has no effect on trigger rate
  - Touched components are electrically isolated from any circuit
  - Suspect body is acting as antenna? Conducting noise from charge on body?
  - Does not seem to be affected by known sources of electronic noise
Things To Do before LRR

• Nail down a best case ADC threshold setting

• Determine source of trigger rate spike on touch and eliminate if possible
4.0 Project Management Update
Action Item Summary

• Issues mentioned on Simulation Analysis slide require experimenting and troubleshooting

• Target date for resolution of issues is by May 15th.
## User Guide Compliance

<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>unknown, feels like it</td>
</tr>
<tr>
<td>Contained in can</td>
<td>yes</td>
</tr>
<tr>
<td>Connected to can by 4/5 bulkheads on top and bottom only</td>
<td>4 bottom mounted standoffs</td>
</tr>
<tr>
<td>Mass at 20±0.2lbs</td>
<td>20 total - 6.7 canister - 1.5 mid mount = 11.8 for both payloads, 11.8 / 2 = 5.9 for each payload, Space Owl payload = 5.9 lbs</td>
</tr>
<tr>
<td>Shared canister clearance</td>
<td>yes</td>
</tr>
<tr>
<td>No voltage on the can</td>
<td>yes</td>
</tr>
<tr>
<td>No voltage on multipurpose port</td>
<td>not using</td>
</tr>
<tr>
<td>Activation wires at least 4 ft</td>
<td>yes</td>
</tr>
<tr>
<td>Activation wire at least 24 gauge and Teflon coated</td>
<td>20 gauge</td>
</tr>
<tr>
<td>Early Activation: current &lt; 1 A</td>
<td>0.89 &lt; A &lt; 1.02</td>
</tr>
<tr>
<td>T-0 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>
</table>
Biggest Worries

• Saved .root files sometimes fail to open in Root browser after mission simulation. Must be able to reliably open the recorded data contained in the .root file.

  - Will experiment with transferring .root files from payload to laptop and opening
  - If file can be open successfully on the laptop, issue is considered resolved
  - If file can not be opened on laptop, source of failure needs to be identified
Conclusions

• Bringing old canister?
• Are canister machine screws available at Wallops? (we don’t have the right size screws to put the canister skin or lid on)