Full Mission Simulation Report

Clemson University

5/10/19
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

The Clemson University RockSat-C 2019 team aims to accomplish two tasks during the flight of the rocket.

(1) Develop a theoretical model of the deflection of a prototype center support beam of a spring type robotic arm.

(2) Successfully aid and launch a simplified GPS module, developed by elementary school students with help from the RockSat-C team.
ConOps

Altitude

Deflection Analysis
Over this interval, the payload will experience the highest amount of deflection. SRA’s stability will be in question at this point.

Apogee
\[ t \approx 173 \text{ sec} \]
Altitude: \( \sim 118 \text{ km} \)

Deflection Analysis
Over this interval, the payload will experience the highest amount of deflection. SRA’s stability will be questioned at this point.

\[ t = -3 \text{ min} \]
- All components are turned on and data collection is started,
- Base line for future measurements is established

Chute Deploys
\[ t \approx 330 \text{ sec} \]

Splash Down
\[ t \approx \sim 750 \text{ sec} \]
Changes since STR

• SRA
  – During the 2019 launch the SRA will not be actuated; both systems will be stand by passive systems
  – The objective of the passive the system to collect data sets of the deflection of the main support beams
2.0 Integrated Subsystem Testing Status
Body Design: 90%

Updated Info:
- All tests and final design specs of the body design are complete
- All attachment holes line up; no interference in solidworks model

Tasks to Complete:
- Final Print
- Spare Parts to print
- Assembly

(To be completed on Wednesday 5/15/19 when printer re-opens)

Henry is working on final rendering and will have final solidworks design with weight on Sunday
Integrated Subsystem Testing Status

SSEO: 90%

Updated Info:
• Transferred over to a regular Arduino Uno (instead of Teensy 3.6) due to unresolved compatibility issues between Teensy and NeoGPS software library
• SD simulation works!
• Accuracy of ±0.001 degrees
• DATA OVERRUN error: result of software trying to write to the virtual SD card and reading GPS data simultaneously
  – Shouldn’t cause errors on rocket

Tasks to Complete:
• Arduino Uno doesn’t have SD card slot, waiting for one (in delivery)
• installation
Strain Gauge Data Collection: 80%

Updated Info:
- Strain gauges acquired and tested in Wheatstone Bridge circuit. Voltage changed as expected in a linear manner.
- Voltage values are in the low range. Needs to be amplified through a differential or instrumentation amplifier.

Tasks to Complete:
- Strain gauges need to be glued to the robot arm
- Instrumentation amplifier will be ordered today, needs to be integrated.
- Final integration
**Integrated Subsystem Testing Status**

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**SRA Software: Updated Info:**

- The camera works! The result from testing is shown below, after manual focusing and some software adjustments.
- Still using a Raspberry Pi 3 with an RPi camera
- Next up: creating code to real-time analyze positioning of the soft body robot
- Camera is with Charlie in Clemson for integration, so I can’t actually test it here in Myrtle Beach, will send over to Charlie for testing
- Takes a long time (at least 5 hours for me) to build and compile OpenCV and raspicam libraries on the RPi 3
- This was after 2 fresh re-installations of Raspbian because of compilation errors ruining the operating system beyond repair
- Code is of test program to take 1 image (from before)
3.0 Full Mission Simulation Results
Full Mission Simulation Results

FMSR’s still untested

Projected Date:
5/15/2019
Full Mission Simulation Results

To be completed...

- Fully functioning deflection sensors
- Final print
- Final assembly
- FMST (Fully Mission Simulation Test)
4.0 Project Management Update
Action Item Summary

• Robotic arm final data collection testing 5/14/2019
• Full payload integration 5/17/2019
<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>.5&quot; off center</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>yes</td>
</tr>
<tr>
<td>Mass at 20±0.2lbs</td>
<td>Currently at 8.46 lbs (rendering final weight)</td>
</tr>
<tr>
<td>Shared canister clearance</td>
<td>Modifiable spacers will allow adjustments to be made on the fly if needed</td>
</tr>
<tr>
<td>No voltage on the can</td>
<td>No opportunity to check yet</td>
</tr>
<tr>
<td>No voltage on multipurpose port</td>
<td>No opportunity to check yet</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>Compliant wires acquired, must be integrated</td>
</tr>
<tr>
<td>Early Activation: current &lt; 1 A</td>
<td>Needs to be tested fully, but initial tests show low draw</td>
</tr>
<tr>
<td>T-0 Activation: current &lt; .1 A</td>
<td>Needs to be tested fully, but initial tests show low draw</td>
</tr>
<tr>
<td>Battery Type</td>
<td>FMSR</td>
</tr>
</tbody>
</table>

Li-Po
Biggest Worries

• Being able to keep open line of communication between everybody while at several different locations
Conclusions

• Work is progressing steadily and most subsystems are nearing completion
• Some structural parts need to be reprinted
• Full simulation will take place in the next two weeks
• Full integration will also take place in the next two weeks