Community Colleges of Colorado
Subsystem Testing Review

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February 19th, 2016
Presentation Outline

• Section 1: Mission Overview
• Section 2: Hardware Procurement Status
• Section 3: Subsystem Testing Results
• Section 4: Subsystem Design
• Section 5: Plan for Full System Testing
• Section 6: Project Management Update
• Section 7: User Guide Compliance
1.0 Mission Overview

CC of CO
Overall Mission for the CC of CO Team

Successfully launch an inter-school payload.

- Measure dual phase fluid flow*
- Test viability of Carbon Fiber Shielding
- Gather successful Cherenkov radiation data
- Test durability of DNA under ascent and reentry conditions.

*Cut from payload
Mission objectives and results

Carbon Fiber: 2 geiger counters
- Large difference in data = good shielding

RICH (Ring Imaging Cherenkov): very small camera
- Any muon data from images may prove that muon detectors are not just for rich scientists

D.N.A.: Tubes filled with gel
- Structure of the DNA will be analysed with the acceleration data to see how high G affects DNA
Fluid Flow Removal Decision

• Fluid experiment has been cut from the payload due to:
  – Decreased size of the experimental apparatus will not allow for fluid flow.
  – Quantity of water is too small to predict with proper accuracy
  – Inability to analyze data recovered from flight (video imaging data) due to lack of flow in apparatus
  – Inability to prove hypothesis due to the previously mentioned reasons
2.0 Hardware Procurement Status
• What has been manufactured/purchased?
  - Prototype 3D print structure for biological payload has been printed using PET+ plastic
  - Parts for Geiger Boards have been purchased*
  - Carbon Fiber and Building materials purchased
  - GoPro (RICH)/Magnesium Fluoride purchased

• What has not been manufactured/purchased?
  - DNA will be purchased closer to launch date, experimentation will occur with existing plasmid DNA
  - Carbon Fiber shield needs to be built
Electrical Elements

• What has been manufactured/soldered?
  ○ 2 RockOn Geiger counters have been assembled and soldered.

• What still needs to be manufactured/soldered?
  ○ 2 Spare RockOn Geiger counters need to be assembled and soldered.
  ○ Final daughter board needs to be etched.
  ○ Rich detector still needs “Hacking”.
Electrical Elements (Continued)

• PCB revision status?
  ○ Final daughter board up to date.

• What electrical components are in house?
  ○ All components are in with exception of the spare geiger counter parts and assorted wire are accounted for.
3.0 Subsystem Testing Results
Subsystems

1. Structures
2. Biology
3. Electronics
4. RICH
5. Radiation
Subsystem Overview Structure
Structure

• Quick Status
  – Have finalized all dimensions
  – In process of printing out prototypes for spatial analysis and further structural testing
  – Physical testing has been delayed due to de-scope decisions which required reviews and modifications of existing structural components.

Bolt Dimensions

Preliminary Structure Planning
Mechanical Testing

- Spin test
  - Build a spin table and rotate payload using acrylic prototype plate at a rotation rate of 10 Hz

- Vibration test
  - Test full payload on a shake table (currently owned) and use an inverted sander with test plate bolted to it to simulate flight/launch vibration
Rough 3d payload
RICH Detector
Isolation box
GoPro is enclosed.

Geiger Box
Mueller tube
within
Geiger Cradle
Biology Secondary Containment 3-d sketch
Bio cradle 3" tubes
1/8" raised slots to hold tubes.
• Quick Status:
  - The mechanical design of the cradle has been changed from original design, but is now signed off on and finalized
  - Waiting on pGlo DNA for initial testing of durability
  - Ideas have been finalized
  - Testing has been planned out
Preliminary 3-d Print
Biological Experiment: (Scheduled Tests)

• Sonication: The process of using sound energy to agitate particles
• Testing: Sonication will be applied to DNA at time intervals of 30, 60, 90, and 120 minutes to simulate vibration of rocket
• Hypothesis: DNA will become more fractured as time increases under sonication.
• Needle shearing: The process of pushing particles through a small gauge needle to create a shear force
• Testing: DNA will be pushed in and out of a needle to examine fracture
• Hypothesis: This is a common method for fracturing DNA, DNA will break down and patterns will be analyzed
Biological Experiment: (Scheduled Tests)

- High Temperature/Testing: DNA will be exposed to a temperature between 80-90 °C and DNA fragmentation will be examined.
- Hypothesis: DNA is expected to show minor fractures due to increased temperatures
Biological Experiment: (Scheduled Tests)

- Low Temperature: DNA will be exposed to temperatures between -70 and -60 °C, DNA fragmentation will be examined.
- Hypothesis: DNA is expected to show no difference due to a decrease in temperature.
• Ultraviolet Irradiation/Testing: DNA will be exposed to ultraviolet light and fragmentation patterns will be examined. DNA samples will be exposed to UV for periods of 30, 60, 90, and 120 minutes.
• Hypothesis: DNA fragmentation is expected to increase as time increases
Subsystem Overview - Electronics
Electrical System

• Quick Status
  - Have finalized all dimensions
  - In process of printing out prototypes for spatial analysis and further structural testing
  - Physical testing has been delayed due to de-scope decisions which required reviews and modifications of existing structural components.
• The payload will be turned on at full operational capacity until the battery is fully discharged
  • est. 3 hour 51 minutes until dead
Electrical Testing

• Electrical integration
  • Connect and confirm power and code requirements of all electrical systems integrated together.

• Full electronics data logging test
  • Record data from integrated electronics system for a 24 hour period
Hazardous Mechanical Items:

• No hazardous materials

• Biological material will be flown, though
Electrical Design:
Electrical Schematic V2.3
# Updated Power Budget

## Power Totals

<p>| | | | |</p>
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<td><strong>Hours of Operation</strong></td>
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<td><strong>Surplus Operation Time</strong></td>
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</table>
Hazardous Electrical Items:

- Geiger counters will generate 500+ volts of pulsed DC!
- Piezo Sensor will be capable of generating 100+ Volts AC!
- Lithium Ion Polymer (LiPo) power cells!
Our software block diagram is definitely due for some evolution, but here it is in its current state.
Software control scheme overview

- We chose the Netduino architecture over the Arduino for 3 reasons:
  - Faster (alot...)
  - More Flash Memory/RAM
  - Multi-threading capabilities
- We’ve developed the underlying execution method of the main processing unit. A thread-pool will manage a static number of “thread workers” that wait for “work orders” to be added to the execution queue by the Main Flight computer of the payload.

- A “work order” is a wrapper around a ThreadStart and various event triggering capabilities. It can be marked as persistent, which means it will run repetitively by available thread workers.

- Any “work order” can trigger an “event” after it executes. Any other sensor, controller, or component can subscribe to these events, allowing them to add their own responsive “work orders” upon the event being triggered.
Software control scheme overview (continue)

- An “event” could be a notification that a geiger counter just updated its latest data. The “event” will include the data pertaining the event, such as the most recent geiger data.

- Example: A “work order” might be an update of the geiger counters, such that when it finishes it triggers an event which is listened for by the SD Logging system, who takes the geiger counter data and logs it.
Software Elements

• What discrete blocks of code are completed?

  • The thread-pool has been developed and optimized against pure while loops with no performance loss.

  • The master flight computer has been built, such that it can communicate with sensors and the thread-pool efficiently.

  • Basic geiger-counter collection data has been written and used for all geiger counting testing. It has not been integrated into the flight computer yet, but this is a trivial task we will be taking care of in our next coding session.

  • Our next session is focused on finishing and testing the SD logging system.
Subsystem Overview RICH Detector
Quick Status

- Due to software and spacing issues, the astronomical camera can’t be used
- A GoPro Hero is being tested as a smaller, more compatible alternative
- A prototype RICH is being built and tested to determine if this design will collect viable data
- If the prototype RICH fails, the RICH detector may be removed from the payload.
First and foremost
- Can the GoPro modified with a magnesium fluoride filter be protected from external visible light?
- This light would show up as noise, obscuring the Cherenkov data
- Place the modified GoPro in a dark room
- Measure whether the amount of white in the image is statistically significant
- If so, back to the drawing board

High ISO creates high noise
(High quality CMOS allow very low ISOs)
GoPro Noise testing

Our GoPro Hero3+ Silver
darkroom noise test
RICH Detector Testing

• Next
  • With Magnesium Fluoride medium attached, run on ground with 10 second exposures to test particle detection
Subsystem Overview Radiation Shielding
- Shield design changed to cubical from a cylinder, simplifying design and mounting
- A Geiger Tube on one of the Rock-On boards broke, occurred after testing
- Geiger parts, including replacement tube, have been purchased
Radiation Block Diagrams

- Geiger counter shielded
- Power
- Data Collection
- Activation with payload

- Geiger counter unshielded

- Flight Computer
- Activation with payload
- Stand Alone Data Logging and Power

- RICH detector unshielded
Geiger Testing

• Quick Status
  – Preliminary Geiger tests are complete!
  – Tests showed that the results from both Geiger counters are not significantly different from each other
  – This also proved that the Geigers do not interfere with each other when run from the same board
  – However, the one of the Geigers broke, so these tests will be redone with the new Geiger
  – The main takeaway is that this testing methodology is a sound way to test the Geigers against each other
Quick Status

- Shielding comparison tests are still underway (current on-going)
Description of Geiger Tests

• To ensure that both Geiger counters collected data that matched each other, each Geiger was run in different scenarios:
  
  • Test 1: A 10 minute 31 second long run of both Geiger Counters at 1-second intervals.
  
  • Test 2: A 67 minute test with 2 distinct radiation spikes to test each Geiger counter’s ability to collect counts separately with directed radiation while both are running.
  
  • Test 3: Test the clarity of counts at different intervals while exposed to radiation and not exposed (ambient) with both interrupts being run by one microcontroller.
    – Part 1: 5 minute, radiation exposure t=0 – t= 2:30. 1/20 second count interval
    – Part 2: 5 minute, radiation exposure t=0 – t= 2:30. 1/10 second count interval
    – Part 3: 60 minute, no radiation exposure (ambient only), 1/20 second interval
  
  • Test 4: Test whether the Geiger can reliably detect radiation by comparing Geiger readings from inside a lead shield and outside when exposed to a constant radiation source

All tests completed except test 4
• To analyze the results of the tests, two statistical tests were done.

1. First was an overall two-tailed paired t-test, over the entire data set, evaluating whether the average Geiger reading is significantly different between the two Geigers.
   a. However, this just says whether the two Geigers are different on average.
      i. In every case, the p-values were not significantly different.

2. For a more precise determination of difference, the same two-tailed paired sample t test, but this time I did the test on every ten points, yielding a large number of p-values
   a. In every case, the number of significant p-values was less than 5% of the overall number of p-values.
## Geiger Test 1 Results

<table>
<thead>
<tr>
<th>Geiger1</th>
<th>Geiger2</th>
<th>Overall T-Test Result</th>
<th>Moving Average T-Test Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0.283386</td>
<td></td>
</tr>
<tr>
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<td>0</td>
<td>0.72435</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0.340893</td>
<td></td>
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</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0.16689</td>
<td></td>
</tr>
<tr>
<td>0</td>
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<td>0.221235</td>
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<td>0</td>
<td>0.221235</td>
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<td>0</td>
<td>0.778725</td>
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</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0.211059</td>
<td></td>
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<td>0</td>
<td>0</td>
<td>0.391097</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0.676081</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0.340893</td>
<td>54</td>
</tr>
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<td>0</td>
<td>1</td>
<td>0.192127</td>
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<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Test 1: 10 minute 31 second long run of both Geiger Counters at 1-second intervals.

The data from the two Geigers are not significantly different.

Number of Significantly Different Sets of 10: 2
Number of Insignificant Sets of 10: 54
# Geiger Test 2 Results

<table>
<thead>
<tr>
<th>Geiger1</th>
<th>Geiger2</th>
<th>Overall T-Test Result</th>
<th>Moving Average T-Test Result</th>
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<td></td>
</tr>
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</table>

**TEST 2:** 67 minute test with 2 distinct radiation spikes to test each Geiger counter’s ability to collect counts separately with directed radiation while both are running.

The data from the two Geigers are not significantly different

7 Number of Significantly Different Sets of 10
184 Number of Insignificant Sets of 10

Perform T Test
## Geiger Test 3 Part 1 Results

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<th>Moving Average T-Test Result</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0.283386</td>
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<tr>
<td>0</td>
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<td>0.137658</td>
<td></td>
</tr>
</tbody>
</table>

**TEST 3, PART 1:** Test the clarity of counts at different intervals while exposed to radiation and not exposed (ambient) with both interrupts being run by one microcontroller.

5 minute, radiation exposure $t=0 - t=2:30$. 1/20 second count interval

The data from the two Geigers are not significantly different.

2 Number of Significantly Different Sets of 10

54 Number of Insignificant Sets of 10
Sub-Mission Overview

Radiation Team
CC of CO
Shielding Experiment

- Two identical Geiger counters will be flown
- One will be coated in 3 cm. of Carbon fiber epoxy shielding
- Radiation counts per unit time will be recorded from each Geiger counter and compared post-flight
4.0 Subsystem Design
Plate Birds-Eye
Geiger cradle with boards
Geiger Cradle with geiger
Geiger tube inside carbon fiber
Side view, carbon fiber with tube
Bio: Secondary - left, cradle- right

36 tubes Uneven spacing is driven by $\frac{1}{8}$" spacing on plate.
Subsystem -
Approximate amount of lead needed to meet mass
Radiation Hardware/Weight

- COSGC Geiger Counters: 52g (Each)
  - Flight Tested
  - Acquired
  - 1 Geiger no longer works and will be replaced

- Carbon Fiber (2 Yards)
  - Shield + epoxy mass: 832.4g
  - Acquired

- RICH Detector: (115g)
  - GoPro, Magnesium Fluoride, hardware

Total Mass: 1051.4g
## Predicted Payload Weight

<table>
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<td>Balast Weight</td>
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<tr>
<td>Payload weight</td>
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**Over Weight?**  
FALSE

**GO**
5.0 Plan for Full System Testing
Plan for Subsystem Integration

• We have already begun testing of how the different subsystems will integrate (spatially, in software, etc)

• Hurdles include receiving all parts and overcoming hardware and human failures.
6.0 Project Management Update
Organizational Chart

Project Manager
David Colclazier

Electronics Team Lead
Wesley Perkins

Data Analysis Team Lead
George Pandya

Software Team Lead
David Colclazier

Lead Structural Engineer
Chris Littlefield

Biology Team Lead
Lef Seyferman

Radiation Team Lead
Phil Baranowski

RICH Detector Team Lead
Jamie Principato

Electronics Team
George Pandya
David Colclazier
Chris Littlefield

Data Analysis Team
Wesley Perkins
Thomas Horning

Software Team
Wesley Perkins
Thomas Horning
Juan Garcia-Coque
Peer Seyferman

Structural Team
Blake Levien
Phil Baranowski
Jamie Principato
Sara Vigil

DNA Specialists
Sara Vigil
Blake Levien
Duncan Smith
Peer Seyferman

Radiation Team
Jamie Principato
Thomas Horning
Juan Garcia-Coque
Gregoria Olivas

RICH Team
Thomas Horning
David Colclazier

Faculty Advisors
Henry Weigel
Jennifer Jones - Structural
Barb Sobhani - DNA
Brandon English - DNA
Victor Andersen - Radiation
Jeromie Rand - Software

Organization and Scheduling
Joe Hamvas

Controller
Wesley Perkins
Budget

• Present your current EXPENSE and INCOME budget
  • How much have you spent? How much more do you need to spend?
  • Where is funding coming from and do you already it have in house?
  • Acknowledge your sponsors

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<th>Item</th>
<th>Supplier</th>
<th>Estimated, Specific Cost</th>
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Total (no margin): $973.00
Total (w/ margin): $1,216.25
## CC of CO Budgets

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<th>College</th>
<th>Amount</th>
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</tr>
<tr>
<td><strong>Total estimated price from parts list</strong></td>
<td><strong>$953.93</strong></td>
</tr>
</tbody>
</table>
# Team Contact Matrix

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>Role</th>
<th>Email</th>
<th>Phone #</th>
<th>US Citizen?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jennifer Jones</td>
<td>Arapahoe Community College</td>
<td>Faculty</td>
<td><a href="mailto:jennifer.jones@arapahoe.edu">jennifer.jones@arapahoe.edu</a></td>
<td>303-797-5839</td>
<td>Yes</td>
</tr>
<tr>
<td>Jeromie Rand</td>
<td>Arapahoe Community College</td>
<td>Faculty</td>
<td><a href="mailto:jeromie.rand@arapahoe.edu">jeromie.rand@arapahoe.edu</a></td>
<td>303-797-5230</td>
<td>Yes</td>
</tr>
<tr>
<td>Henry Weigel</td>
<td>Arapahoe Community College</td>
<td>Faculty</td>
<td><a href="mailto:henry.weigel@arapahoe.edu">henry.weigel@arapahoe.edu</a></td>
<td>303-797-5831</td>
<td>Yes</td>
</tr>
<tr>
<td>David Colclazier</td>
<td>Arapahoe Community College</td>
<td>Student</td>
<td><a href="mailto:david@jdc.tech">david@jdc.tech</a></td>
<td>720-496-9118</td>
<td>Yes</td>
</tr>
<tr>
<td>Joe Hamvas</td>
<td>Arapahoe Community College</td>
<td>Student</td>
<td><a href="mailto:jhamvas@student.cccs.edu">jhamvas@student.cccs.edu</a></td>
<td>720-878-7080</td>
<td>Yes</td>
</tr>
<tr>
<td>Chris Littlefield</td>
<td>Arapahoe Community College</td>
<td>Student</td>
<td><a href="mailto:chrllitt@comcast.net">chrllitt@comcast.net</a></td>
<td>303-981-6064</td>
<td>Yes</td>
</tr>
<tr>
<td>Lawrence Perkins</td>
<td>Arapahoe Community College</td>
<td>Student</td>
<td><a href="mailto:lwpmoon@me.com">lwpmoon@me.com</a></td>
<td>720-935-0931</td>
<td>Yes</td>
</tr>
<tr>
<td>Jamie Principato</td>
<td>Arapahoe Community College</td>
<td>Student</td>
<td><a href="mailto:jprincipato@student.cccs.edu">jprincipato@student.cccs.edu</a></td>
<td>239-810-4981</td>
<td>Yes</td>
</tr>
<tr>
<td>Victor Andersen</td>
<td>Community College of Aurora</td>
<td>Faculty</td>
<td><a href="mailto:victor.andersen@ccaaurora.edu">victor.andersen@ccaaurora.edu</a></td>
<td>303-340-7085</td>
<td>Yes</td>
</tr>
<tr>
<td>Phillip Baranowski</td>
<td>Community College of Aurora</td>
<td>Student</td>
<td><a href="mailto:flipamtbkk@yahoo.com">flipamtbkk@yahoo.com</a></td>
<td>313-729-1462</td>
<td>Yes</td>
</tr>
<tr>
<td>Thomas Horning</td>
<td>Community College of Aurora</td>
<td>Student</td>
<td><a href="mailto:horning.thomas@yahoo.com">horning.thomas@yahoo.com</a></td>
<td>303-319-5712</td>
<td>Yes</td>
</tr>
<tr>
<td>Juan Garcia-Coque</td>
<td>Community College of Aurora</td>
<td>Student</td>
<td><a href="mailto:garco.ja@gmail.com">garco.ja@gmail.com</a></td>
<td>303-253-5765</td>
<td>Yes</td>
</tr>
<tr>
<td>Gregoria Olivas</td>
<td>Community College of Aurora</td>
<td>Student</td>
<td><a href="mailto:golivas88@hotmail.com">golivas88@hotmail.com</a></td>
<td>719-329-4627</td>
<td>Yes</td>
</tr>
<tr>
<td>Barb Sobhani</td>
<td>Red Rocks Community College</td>
<td>Faculty</td>
<td><a href="mailto:barbra.sobhani@rrcc.edu">barbra.sobhani@rrcc.edu</a></td>
<td>303-914-6366</td>
<td>Yes</td>
</tr>
<tr>
<td>Brandon English</td>
<td>Red Rocks Community College</td>
<td>Faculty</td>
<td><a href="mailto:brandon.english@rrcc.edu">brandon.english@rrcc.edu</a></td>
<td>303-914-6783</td>
<td>Yes</td>
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<tr>
<td>Blake Levien</td>
<td>Red Rocks Community College</td>
<td>Student</td>
<td><a href="mailto:blakezlevien@gmail.com">blakezlevien@gmail.com</a></td>
<td>773-387-6278</td>
<td>Yes</td>
</tr>
<tr>
<td>Lev Seyferman</td>
<td>Red Rocks Community College</td>
<td>Student</td>
<td><a href="mailto:lseyferman@hotmail.com">lseyferman@hotmail.com</a></td>
<td>720-987-1218</td>
<td>Yes</td>
</tr>
<tr>
<td>Peer Seyferman</td>
<td>Red Rocks Community College</td>
<td>Student</td>
<td><a href="mailto:pseyferman@gmail.com">pseyferman@gmail.com</a></td>
<td>303-718-6499</td>
<td>Yes</td>
</tr>
<tr>
<td>Duncan Smith</td>
<td>Red Rocks Community College</td>
<td>Student</td>
<td><a href="mailto:duncan-smith@live.com">duncan-smith@live.com</a></td>
<td>720-810-0249</td>
<td>Yes</td>
</tr>
<tr>
<td>Sara Vigil</td>
<td>Red Rocks Community College</td>
<td>Student</td>
<td><a href="mailto:svmvigil70@gmail.com">svmvigil70@gmail.com</a></td>
<td>303-842-2964</td>
<td>Yes</td>
</tr>
</tbody>
</table>
## Team Availability Matrix

### Community Colleges of Colorado (CC of CO)

### Spring 2016 RS-C Team Availability Matrix

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>2:00 PM</td>
<td></td>
<td></td>
<td>Mostly</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>3:00 PM</td>
<td></td>
<td></td>
<td>Mostly</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>4:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SCHEDULE IS MOUNTAIN TIME
7.0 User Guide Compliance
Center of Gravity Compliance

• Verification of Center of Gravity is pending
  – Fluid Flow has been descoped, requiring a reevaluation of payload arrangement

• This will be finished in the coming weeks, as the payload design is finalized, pending testing of the RICH
Bio Package: DNA will be contained inside 1.5mL centrifuge tubes with a lid, each tube will be placed inside a structural tube with a secondary containment “shell” with a lid extending to the top of a structural tube.
Activation Compliance

- Electronics will no longer be activated via G-Switch
- Payload electronics will be activated 1 minute before launch
- When rocket relays are activated, the battery will be connected to the payload
- User guide compliance of 0.SYS.1 and 1.SYS.1 (p. 15-16)

Shall not latch and a peak current of 1000 mA**
<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>1.2&quot; as of last test, still need reevaluation after redesign</td>
</tr>
<tr>
<td>Contained in can</td>
<td>Fits in CAD drawings</td>
</tr>
<tr>
<td>Connected to can by 4/5 bulkheads on top and bottom only</td>
<td>Will use 4/5 bulkheads on bottom</td>
</tr>
<tr>
<td>Mass at $20\pm0.2$lbs</td>
<td>19lb (Currently making 1lb ballast)</td>
</tr>
<tr>
<td>Shared canister clearance</td>
<td>1&quot; separation between payloads</td>
</tr>
<tr>
<td>No voltage on the can</td>
<td>No opportunity to check yet</td>
</tr>
<tr>
<td>Activation wires at least 4 ft</td>
<td>No opportunity to check yet</td>
</tr>
<tr>
<td>Activation wire at least 24 gauge</td>
<td>22 gauge</td>
</tr>
<tr>
<td>Early Activation: current &lt; 1 A</td>
<td>876 mA (.876 A)</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>
Canister Sharing

• We have met with our partners
• They will be responsible for the mid-plate
• We have slight concerns regarding their final weight.
• Still planning on using half of the total mass
• We also need to plan time with them to create 3d models of the entire payload.
Worries and Concerns

• Awaiting data on GoPro viability for RICH detector
• Slight concern with high voltage transformer availability for the Rock On! Geiger Counter
• A final design is not yet available, as COM and ballast distributions are still being finalized
• Shared canister arrangements not fully planned out
Conclusion

- We are still figuring out ballasting and electronics mounting placement, pending COM compliance plan
- We are done with the first phase of testing
- We’re excited to get this payload ready for launch!