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| Testing Summary  Rascal Internal Document  Team: Testing (TST)  10/14/2013 -- Revision: - |  |

Revision History

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| --- | --- | --- | --- | --- | --- |
| Rev | Date | Description | Author | Approved | Pages |
| - | 10/14/2013 |  | Tyler Olson | Tom Moline | All |
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# Background:

The Rascal mission is a complex integration of systems and subsystems that must be tested to the fullest extent possible prior to launch to ensure the greatest chance for mission success. The Rascal mission consists of two spacecraft systems, each with their own Command & Data Handling (CDH), Power (PWR), Communications (COM), Attitude Determination & Control (ADC), Propulsion (PRP), and Structures (STR) subsystems which must all undergo component and subsystem level testing. To this end, there are several general tests that should be conducted.

# Discussion/Results:

## Functional Testing

Functional tests consist of a general checkout of a component, subsystem, or integrated spacecraft. Abbreviated functional tests may be conducted if specific aspects of the subsystem or system level functionality need to be investigated. Functional testing will be conducted periodically throughout the spacecraft’s development.

On the component level, a functional test may involve a visual inspection followed by running through a specified command list to ensure that the component is performing as required.

A subsystem level functional test would be similar to the component level, though it would include commands from all components as well as demonstrate the functionality of the subsystem, such as a start-up sequence or thruster test firing.

Functional testing of the integrated spacecraft will demonstrate as much functionality as physically possible in the testing environment. This includes but is not limited to the start-up sequence, battery charging off of the solar arrays, target acquisition, com link testing, and thruster test firing.

## Vacuum / Environmental Testing

Due to the resources required to conduct the tests, component and subsystem level vacuum and environmental testing will only be applied to components considered to be “at significant risk” of outgassing or being negatively affected by the vacuum or thermal environment of space. Examples of these components are the fuel tank, thruster assembly, propulsion subsystem, and release mechanism. These tests would consist of placing the component inside a thermal vacuum chamber, running an abbreviated functional test on the component or subsystem, sealing and pumping down the chamber, then running the full functional test on the component. Depending on the component, it may be necessary to have external control via chamber feed-throughs.

Integrated spacecraft vacuum and environmental testing will likely be conducted at another facility and will only be conducted on the flight unit prior to delivery. The protocols and procedures for this test are detailed in in the [insert document name and index number here] document.

## Vibration Testing

Vibration testing is required to ensure with a reasonable degree of certainty that the spacecraft will survive launch with minimal to no damage. Due to the difficulty and cost of vibration testing, only a few select components, such as any custom printed circuit boards built for the mission, will undergo vibration testing at SLU. The fully integrated flight unit will undergo vibration testing according to the [Insert standard name here] standards at a to be determined facility prior to launch.

## Propulsive ADC Testing

In order to test the system’s attitude determination & control capabilities, the integrated spacecraft will be secured to a lightweight, rigid support board in a near-frictionless environment, such as an air hockey table, and allowed to fire thrusters in an attempt to approach a simulated target. This setup only enables the spacecraft to be tested in two axes at a time, though the test could be completed multiple times with the spacecraft secured to the support board in multiple orientations. This test will be conducted with the assembled engineering unit prior to the integration of the flight unit.