Rascal Requirements Verification Document

Saint Louis University

Rascal



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Copper Operational

Test Plan

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# INTRODUCTION

# NOMENCLATURE

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# REQUIREMENT STAGES

# Pre-Launch Requirements

1. **The Total CubeSat System Volume Shall Not Exceed 6U**
2. **The Total CubeSat System Mass Shall Not Exceed 8.0 kg**
3. **All Materials Used in the CubeSat System shall have a Total Mass Loss of Less Than 1.0%**
4. **All Materials Used in the CubeSat System Shall Have a Collected Volatile Condensable Material of less than 0.1%**
5. **The CubeSat System Must be in Orbit for at Least 6 Months**
6. **The CubeSat System Must Deorbit within 25 Years of being Launched**
7. **Jade and Ruby Shall be Conjoined Prior to Launch Vehicle Integration**
8. **The CubeSat System Shall Incorporate a Deployment Switch**
9. **No Protrusion Shall Extend beyond 6.5 mm Normal to Any External Surface of Jade or Ruby**
10. **No External Components Other than the CubeSat Rails of Jade and Ruby may make Contact with the Deployer**
11. **The Deployer Shall not be Used to Secure Any CubeSat Deployables**
12. **The Center of Gravity of the total CubeSat System Shall be Located within a Sphere of 2 cm of the Geometric Center of the System**
13. **The Center of Gravity of Jade and Ruby Shall be Located within a Sphere of 2 cm of their Geometric Center**
14. **The CubeSat System Coordinate System Shall be Defined As Specified in Figure 1-1**
15. **The Local Coordinate System of Jade and Ruby Shall be Defined as Specified in Figure 1-1**
16. **The Ends of the Rails on the +Z/-Z Faces of the CubeSat System Shall have a Minimum Surface Area of 6.5 mm x 6.5 mm**
17. **The +Y/-Y Faces of Ruby and Jade Shall have a Length of 100 mm**
18. **Jade and Ruby Shall be Capable of Determining Relative Displacement between Each Other**
19. **The CubeSat System Shall be Capable of Recording Relative Displacement Data between Jade and Ruby**
20. **Low Friction, 2D Testing of the CubeSat System Release Mechanism Shall be Conducted**
21. **All Pressure Vessels Shall have a Factor of Safety of No Less Than 4**
22. **All CubeSat Components Shall be Rated to Operate within Temperature Range of at least -20⁰C to 70 ⁰C**
23. **Static Thrust Testing Shall be Performed with the Flight Version of All Pressure Vessels at a Pressure No Greater than 1x10-4 Torr Prior to CubeSat Integration**
24. **All Pressure Vessels Must Pass Thermal Cycle Testing between Temperatures of -30 ⁰C and 70 ⁰C for at Least Two Cycles or for 10 Hours**
25. **Low Friction, 2-D Dynamic Thrust Testing Shall be Conducted with All Pressure Vessels**
26. **The CubeSat System Must Survive Random Vibration Testing Relative to the NASA GEVS Qualification Profile**
27. **The CubeSat System Shall be Subjected to a Temperature of 60 ⁰C at a Pressure No Greater than 1x10-4 Torr for a Minimum of 6 Hours**
28. **The CubeSat System Shall be Able to Execute All Commands Associated with its Operation over RF**
29. **The CubeSat System Shall be Able to Close a Link with the SSRL Ground Station from a Distance of at least 200 meters**
30. **The CubeSat System Shall be able to Document the Functionality of Each of its Subsystems through the Running of a Full-Functional Test**

# Post-Launch Ejection Requirements

1. **The CubeSat System Shall not Broadcast in RF Until Ejection +45 Minutes**
2. **The CubeSat System Shall not Release Deployables Until Ejection +45 Minutes**
3. **The CubeSat System Shall Establish Communication Between Itself and the SSRL Ground Station**
4. **The CubeSat System Shall Pass a Health Check Administered from the SSRL Ground Station**

# Separation and Stabilization Requirements

1. **Jade and Ruby Shall be Capable of Separating from One Another with a Relative Velocity of No Greater than 5 cm/s**
2. **Jade and Ruby Shall Achieve a Local Slew Rate of Less than 1 deg/s**
3. **Jade and Ruby Shall Continuously Record Relative Displacement Data Between Each Other**

# Stationkeeping Requirements

1. **Jade and Ruby Shall be Able to Stationkeep within a 10-75 meter Sphere of Each Other for at Least 5 Orbits**

# “Escape” Requirements

1. **Jade and Ruby Shall be Able to Perform an “Escape” Maneuver that Increases the Relative Displacement Between Each Other to at Least 100 Meters within 1 Orbit**

# Rendezvous Requirements

1. **Jade and Ruby Shall be Able to Perform a Rendezvous by Decreasing the Relative Displacement Between Each Other to Within 50 meters for at Least 5 Orbits**