Rev.	ECO	Description	Checked	Approval	Date
01	32-173	Release	M. Smith		

CRaTER
E.U. Mock-up with E.U. Telescope VibrationTest Procedure

Dwg. No. 32-06004.02

Revision 01
9/12/06

1. Introduction

1.1. Activity Description

This activity mechanically tests for the frequencies of the Crater Engineering Unit as well as the structural integrity of the telescope assembly.

1.2. Test Item Description

The Unit Under Test is the engineering unit housing, 32-20203 with the engineering top and bottom covers, 32-20204, 32-20205, a bare engineer digital PCB 32-20202, with the actell and TO can mounted, a mock Analog PCB, supplied by Aerospace with one connectors mounted at J1. The Engineering Unit telescope assembly is installed as supplied by Aerospace. The Nitrogen Purge input tube assembly is installed.

NOTE: The E-box housing is made form Aluminum 7075-T651, all other aluminum parts are 6061-T6. The FLIGHT E-box will be made of 6061-T651.

The overall weight of the assembly is 9.4 lbs, excluding weight of the accelerometers.

1.3. Support Item Description

None Required

1.4. Applicable Documents

Document	Title
431-SPEC-000012	LRO Mechanical System Specification

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2. Requirements

2.1. Acceptance criteria

2.1.1. Complete testing to limit levels with the appropriate test factor.

2.1.2. No structural degradation after test.

2.1.3. Unexplained frequency shifts less than 5% between pre and post test.

2.1.4. No visible damage that is a result of the test environment.

2.1.5. Pass all functional performance testing performed during and upon completion of the test.

2.2. Vibration Testing Levels

2.2.1. Low Level Resonance Search(Sine Sweep)

This test is to determine the natural frequencies of the assembly, as well as determining the baseline for verification that no significant changes occur during each vibration test. Low level resonance search shall be at 1/2g. Rate is 2 Octaves per minute.

2.2.2. Sine Vibration Environment

2.2.2.1. The following are the levels to be applied at the Shake Table/Instrument interface.

Table 1. Sine Vibration Levels

Frequency (Hz)	Level
5-17.7	1.27 cm D.A.
17.7-50	8 g's

2.2.3. Random Vibration

2.2.3.1. Random vibration shall be subjected to the following levels.

Table 2. Random Vibration Levels

Frequency (Hz)	Level
20	0.26 g^2/Hz
20-50	+6dB/Octave
50-800	0.160 g^2/Hz
800-2000	-6dB/Octave
2000	0.026 g^2/Hz

2.2.4. Post Low Level Resonance Search (sine Sweep)

This test is to verify that the natural frequencies of the assembly have not changed more than 5% from the pre shake sine sweep. Low level resonance search shall be at 1/2g. Rate is 2 Octaves per minute.

2.3. List of Required Items

- EU Crater Assembly with top and bottom covers and telescope installed.
- Shake fixture
- 6 Accelerometers, single axis, Endevco model _____.
- 3 Triax accelerometers. Endevco model number_____
- Torque tools, in oz, in-lbs
- Alcohol
- Wipes
- 2-56 x 3/16 screws and #2 FW, qty 50
- #4-40 x 5/16 screws and washers, qty 50
- #10-32 SHCS x 5/8" and Heavy #10 FW, qty 8.

2.4. Safety

All personnel involved in testing/operations shall have reviewed this procedure prior to beginning testing and will understand what hazards may be encountered during testing.

When unsafe conditions exist, the test conductor shall take whatever actions necessary to prevent injury to personnel and/ or equipment.

2.5. Data

The following shall be included as part of the CRaTER Acceptance Vibration Test Data Package:

2.5.1. Control and response accelerometer PSD plots for all resonance searches.

2.5.2. The as run filled in copy of this procedure.

3. Facilities and Configuration

3.1. Facility

The Facility and shaker used for this test is provided by Charles Stark Draper Labs, Cambridge MA.

3.2. Test Configuration

The CRaTER Assembly is configured for test is attached to the vibration test fixture at the mounting flange by a total of six (6) bolts, #10-32UNC x 5/8 High Strength, and six (6) washers. The control accelerometer is attached to the vibration fixture.

4. Procedures

Space is provided for recording information of particular significance pertaining to this test by the test conductor. In addition, the test conductor may red line the procedure to more accurately document the actual flow of events, both routine and anomalous. The following pages plus the facility data will be attached to the test report filed at the conclusion of these activities. The order of test axes is not significant. The order of the testing within each axis should be as specified.

4.1. Test Anomaly

Deviation from any expected result or observation of any anomalous behavior of the test article during vibration testing shall require the testing to be stopped and noted in the test log. The test conductor will determine the proper course of action to be taken and when to continue with the remainder of the test procedure.

4.2. Identification

4.2.1. Equipment

Table 8. Accelerometer identification.

Description	Acc Model number	accel S/N	Calibration Date
1. Telescope @1			
2. Telescope @2			
3. E-box @3			
4. E-box @4			
5. Top Cover			
6. Analog Board			
7. Digital Board			
8. Bottom Cover			

4.2.2. Personnel

Table 9. Personnel

Test conductor	Date

4.3. Expected frequencies

Frequency (Hz) X Axis	Location
435,	Top Cover
710	Analog board
880	Digital Board
980	Crater Assembly
1400	telescope
Z Axis	
260, 320	Bottom cover
408	Top COver
620, 880	Digital Board
435, 710	Analog Board
1024, 1400, 1700	Crater, Telescop
Y axis	
1024, 1400,	Crater/ Telescop

4.4. X Axis

4.4.1. Preparation

Attach shake plate to shaker head.

Install Accelerometers at positions 6, 7, and 8. Install acc cables and test accelerometers.
After verifying that the accels and cables are ok at these 3 locations, mount and secure top and bottom covers using #2-56 by 3/16 screws. Torque to 54 in-oz.

torque	Date	Initial

Mount Crater assembly to shake table in X Direction:

First mount screw at the 0,0,0 location due to hardware interference with the housing.
Torque #10-32 screws to 35 in-lbs.

Install accelerometers 1 thru 5. Document serial numbers above.
Orientate the accels in the proper orientation.
Connect accel cables and verify function.

Operator	Date	Initial

Table 8. Accelerometer identification.

Description	Acc Model number	accel S/N	Calibration Date
1. Telescope @1			
2. Telescope @2			
3. E-box @3			
4. E-box @4			
5. Top Cover			
6. Analog Board			
7. Digital Board			
8. Bottom Cover			

4.4.2. Low level Resonance Search, X Axis.

Perform Low Level Resonance vibration sine sweep at 1/2g for a minimum of 2 Oct/min.

Frequency	Response	Date	Initial

4.4.3. Perform Sinusoidal Vibration per Table 1, X Axis,

Axis	Frequency	Response	Date	Time	Initial
X					

4.4.4. Perform Random Vibration per Table 2, X Axis,

Axis	Frequency	Response	Date	Time	Initial
X					

4.4.5. Low level Resonance Search, X Axis.

Perform Low Level Resonance vibration sine sweep at 1/2g for a minimum of 2 Oct/min.

Frequency	Response	Date	Initial

4.4.6. Resonance Comparison, X Axis.

Compare the results of the 2 tests for differences in recorded resonances.

Differences	Date	Time	Initial

4.4.7. Post X axis Inspection

	Date	Initial

4.4.8. Post Axis functional performance test

	Date	Initial

4.5. Y Axis

4.5.1. Preparation

Attach shake plate to shaker head.

Install Accelerometers at positions 6, 7, and 8. Install acc cables and test accelerometers.
After verifying that the accels and cables are ok at these 3 locations, mount and secure top and bottom covers using #2-56 by 3/16 screws. Torque to 54 in-oz.

torque	Date	Initial

Mount Crater assembly to shake table in X Direction:

First mount screw at the 0,0,0 location due to hardware interference with the housing.
Torque #10-32 screws to 35 in-lbs.

Install accelerometers 1 thru 5. Document serial numbers above.
Orientate the accels in the proper orientation.
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4. E-box @4			
5. Top Cover			
6. Analog Board			
7. Digital Board			
8. Bottom Cover			

4.5.2. Low level Resonance Search, Y Axis.

Perform Low Level Resonance vibration sine sweep at 1/2g for a minimum of 2 Oct/min.

Frequency	Response	Date	Initial

4.5.3. Perform Sinusoidal Vibration per Table 1, Y Axis,

Axis	Frequency	Response	Date	Time	Initial
Y					

4.5.4. Perform Random Vibration per Table 2, Y Axis,

Axis	Frequency	Response	Date	Time	Initial
X					

4.5.5. Low level Resonance Search, Y Axis.

Perform Low Level Resonance vibration sine sweep at 1/2g for a minimum of 2 Oct/min.

Frequency	Response	Date	Initial

4.5.6. Resonance Comparison, Y Axis.

Compare the results of the 2 tests for differences in recorded resonances.

Differences	Date	Time	Initial

4.5.7. Post Y axis Inspection

	Date	Initial

4.5.8. Post Axis functional performance test

4.6. Z Axis

4.6.1. Preparation

Attach shake plate to shaker head.

Install Accelerometers at positions 6, 7, and 8. Install acc cables and test accelerometers.
After verifying that the accels and cables are ok at these 3 locations, mount and secure top and bottom covers using #2-56 by 3/16 screws. Torque to 54 in-oz.

torque	Date	Initial

Mount Crater assembly to shake table in X Direction:

First mount screw at the 0,0,0 location due to hardware interference with the housing.
Torque #10-32 screws to 35 in-lbs.

Install accelerometers 1 thru 5. Document serial numbers above.
Orientate the accels in the proper orientation.
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Operator	Date	Initial

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4. E-box @4			
5. Top Cover			
6. Analog Board			
7. Digital Board			
8. Bottom Cover			

4.6.2. Low level Resonance Search, Z Axis.

Perform Low Level Resonance vibration sine sweep at 1/2g for a minimum of 2 Oct/min.

Frequency	Response	Date	Initial

4.6.3. Perform Sinusoidal Vibration per Table 1, Z Axis,

Axis	Frequency	Response	Date	Time	Initial
Z					

4.6.4. Perform Random Vibration per Table 2, Z Axis,

Axis	Frequency	Response	Date	Time	Initial
Z					

4.6.5. Low level Resonance Search, Z Axis.

Perform Low Level Resonance vibration sine sweep at 1/2g for a minimum of 2 Oct/min.

Frequency	Response	Date	Initial

4.6.6. Resonance Comparison, Z Axis.

Compare the results of the 2 tests for differences in recorded resonances.

Differences	Date	Time	Initial

4.6.7. Post Z axis Inspection

	Date	Initial

4.6.8. Post Axis functional performance test

	Date	Initial

4.7. Removal CRaTER Assembly From Shaker fixture

Remove the accelerometer cables from the facility recording devices. Disconnect the CRaTER Assembly form the vibration plate. Remove top and bottom covers to remove the remaining accelerometers.

4.8. Post Vibration Inspection

4.8.1. External

Visually inspect the exterior of the Sensor Base Assembly for structural damage, backed out screws or other anomalies.

location	Date	Initial

4.8.2. Internal

Visually inspect the exterior of the CRaTER Assembly for structural damage, backed out screws or other anomalies.

inspections	Date	Initial