

Rev.	ECO	Description	Author	Approved	Date
A	32-129	Initial Release	B. Klatt		
A	32-129	Initial Release	B. Klatt		
B	32-164	Interim Report	B. Klatt		

CRaTER

Preliminary Hazard Analysis

Dwg. No. 32-04015

Revision B

August 21, 2006

Interim Report

Preliminary Hazard Analysis

The CRaTER Instrument is designed to characterize the global lunar radiation environment and its biological impacts. Hardware is composed of six (6) silicon detectors, six (6) analog measurement chains, eight (8) analog to digital converters, digital processing, standard housekeeping, DC to DC power conversion, high voltage bias generation, telemetry, a telescope housing and an electronics enclosure.

CRaTER has performed a Hazard Analysis and identified three (3) potential hazards.

- Pressure Vessel *a dry nitrogen purge bottle*
- High Voltage *for detector bias voltage*
- Ionizing Radiation *radioactive source for test*

Preliminary Hazard Analysis is Contract Data Requirements List (CDRL), item number 7.

PAYLOAD HAZARD REPORT		No. CR 01
Payload CRaTER Instrument on LRO		HRI (Intermediate) II-D
Subsystem Ground Support Equipment	Hazard Group Pressure Vessel	Date 8/21/06
Hazard Title Nitrogen Purge Bottle		
Applicable Safety Requirement		Hazard Category
		<input type="checkbox"/> Catastrophic
		<input checked="" type="checkbox"/> Critical
Description of Hazard Silicon Detectors in the CRaTER telescope are not hermetically sealed and need environmental Protection. After telescope assembly, the telescope interior is periodically purged with dry nitrogen. The dry nitrogen is under pressure in a steel cylindrical bottle.		
Hazard Cause 1. Dry nitrogen must be kept under pressure to prevent evaporation.		
Hazard Controls 1.1 Gas is purchased in OSHA approved and tested cylinders 1.2 Gas cylinders are not provided with flight hardware. After CRaTER delivery, purge must be provided by NASA until launch.		
Safety Verification Methods 1.1 Inspect gas cylinders to insure only approved cylinders are used 1.2 N/A		
Status of Verification 1.1 Completed 1.2 N/A		
Approval	Payload organization Boston University-CSP	

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PAYLOAD HAZARD REPORT		No. CR 02
Payload CRaTER Instrument on LRO		HRI (Intermediate) II-D
Subsystem Digital Electronic Assembly	Hazard Group High Voltage	Date 8/21/06
Hazard Title Detector Bias Voltage		
Applicable Safety Requirement AFSPCMAN 91-710, Chapter 14, Mil-HDBK 454A.		Hazard Category
		<input type="checkbox"/> Catastrophic
		<input checked="" type="checkbox"/> Critical
Description of Hazard Silicon Detectors in the CRaTER telescope require high voltage for proper operation. A bias of 225 VDC and 75VDC is produced in the electronics assembly from 5 VDC.		
Hazard Cause 1. Telescope detectors require bias voltage greater than 50 volts. 2. Partial pressure environment (less than 10 psia but greater than vacuum) could results in pre-corona, arcing, and damage to instrument.		
Hazard Controls 1.1 The bias voltage is fed to the detectors within the totally contained enclosure. 1.2 High voltage is not available outside the CRaTER enclosure. 2.1 Develop procedure for managing power to instrument in partial pressure environments during verification, I&T, and thermal vacuum.		
Safety Verification Methods 1.1.1 During acceptance testing, potential difference from earth ground will be tested at the CRaTER housing and at all electrical outputs. 1.2.1 Inspection confirms silicon detectors physically confined and inaccessible within the instrument. 2.1.1 Procedure approved by instrument team and placed under configuration management.		
Status of Verification 1.1.1 Open 1.2.1 Open 2.1.1 Open		
Approval	Payload organization Boston University-CSP	

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PAYLOAD HAZARD REPORT		No. CR 03
Payload CRaTER Instrument on LRO		HRI (Intermediate) II-D
Subsystem Ground Support Equipment	Hazard Group Ionizing Radiation	Date 8/21/06
Hazard Title Radioactive Source		
Applicable Safety Requirement		Hazard Category
		<input type="checkbox"/> Catastrophic
		<input checked="" type="checkbox"/> Critical
Description of Hazard		
1. A hand-held radioactive source is required to provide input to the detectors in the telescope in order to test the CRaTER Instrument. Cobalt 60 (Co60) provides the proper stimulus for CRaTER testing.		
Hazard Cause		
1.1 Cobalt 60 is a radioactive isotope, 5.0 μCi		
Hazard Controls		
1.1.1 CRaTER test personnel at MIT are trained and certified for handling this class of radioactive materials. A radioactive source is not provided with the flight hardware. For CRaTER testing after delivery, NASA must provide trained/certified testers and a CO60 source. The radioactive source is not required after integration and testing at GSFC.		
Safety Verification Methods		
1.1.1.1 Confirm Certification with the MIT/CSR Radiation Safety Officer		
Status of Verification		
1.1.1.1.1 Open		
Approval	Payload organization Boston University-CSP	