



Deep Impact – Integration and Test Instrument

Document/Drawing Approval Sheet

Ver. 07-16-02 TT

DATE: 02 / 11 / 21 CII: _____ DOCUMENT NO.: 564414 REV.: -

DOC. TITLE: Instrument EMC/EMI Test Procedure

PROJECT CODE: 21099

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GSFC STI PUBLIC DISCLOSURE EXPORT CONTROL CHECKLIST

Title: Deep Impact - Integration and Test Instrument - Document No: 564414

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If your information pertains exclusively to the release of scientific data (e.g., data pertaining to studies of clouds, soil, vegetation, oceans, planets, stars, galaxies and the universe) without the disclosure of information pertaining to articles controlled by the ITAR or EAR, such as flight instruments, high-speed computers, or launch vehicles, the information is exempt. If the information falls into this category, you may attest that you are using this exemption by signing below.

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Edwin J Grayzeck 690.1

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Sept 28, 2005

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Thomas A. Weisz, Code 232 234

Signature

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REVISION STATUS OF SHEETS

UNLESS OTHERWISE SPECIFIED

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INTERPRET DRAWING PER MIL-STD-100 AND PRODUCT STANDARD 25030

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| APPROVED | DATE | APPROVED | DATE |
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| THERMAL J. FERGUSON | 02/06/18 | PREP BY L. HUNTER | 02/06/18 |
| STRL ANAL | | RESP ENGR L. HUNTER | 02/06/18 |
| MASS PROP | | I & T L. HUNTER | 02/06/18 |
| MATL & PRCS | | MECHANICAL DESIGN G. TAUDIEN | 02/06/18 |
| SAFETY | | ELECTRICAL DESIGN M. HENDERSON | 02/06/18 |
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| PROJECT | | C&DM C. HUNSAKER | 02/06/24 |

Instrument EMC/EMI Test Procedure

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1.0 SCOPE

This procedure describes the test processes for the EMI/EMC testing of the HRI SIM Assembly (Drawing #559651), the HRI Instrument Electronics Assembly (Drawing #564303) and the CCD Preamp Box Assembly (Drawing #564307) with the flight cables that connect these items. The operations performed in the course of this procedure will verify compliance with the requirements called out in the EDVP 561185B

2.0 APPLICABLE DOCUMENTS

The following documents form a part of this procedure to the extent specified herein. Unless a specific issue or revision is listed, these documents shall be of the latest issue or revision in effect at the time of test. In the event of a conflict between this procedure and the reference documents the contents of this procedure shall govern.

2.1 Deep Impact Program Documents

| | |
|----------|---|
| 561286 | Deep Impact Integration and Test Plan |
| 561185 | Environmental Design and Verification Plan |
| 559651 | HRI SIM Assembly |
| 564303 | HRI Instrument Electronics Assembly |
| 564307 | HRI CCD Preamp Box Assembly |
| 574498 | CSTOL: HRI SIM Power On |
| 574499 | CSTOL: HRI SIM Power Off |
| 574502 | FUNCTIONAL TEST PROCEDURE, IR SENSOR ASSEMBLY IRFPA Functional Test |
| 574503 | FUNCTIONAL TEST PROCEDURE, CCD SENSOR ASSEMBLY CCD Functional Test |
| 574506 | CSTOL: Deep Impact High Resolution Imager (HRI) Visible (VIS) Detector Single Mode Dark Imaging |
| 576699 | CSTOL: HRI Simultaneous VIS/IR Imaging Sequence |
| 574614 | DI EMC/EMI Qualification Test Procedure |
| SPS 1930 | Special Handling and Packaging for Infrared Detectors |
| SPS 3096 | Electrostatic Discharge Protection, Components & Assemblies Sensitive to 50 Volts or Less |



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3.0 TEST CONDITIONS AND REQUIREMENTS

3.1 Precautions

Failure to follow the procedures contained in this document may result in damage to flight hardware.

3.1.1 ESDS Equipment (if applicable). The test specimen contains electrostatic-discharge sensitive (ESDS) devices that may be exposed at the electrical interfaces. Therefore, it shall be handled per MIL-STD-1686 Class 1, as implemented by SPS 120211. (Note: Some hardware on Deep Impact may be sensitive to less than 50 volts. Reference SPS 3096.) The test specimen, the test operator (using wrist straps), and related electrical test equipment shall be connected to a common ground before any electrical connecting or disconnecting operations, and during the use of any electrical test equipment probes. The following requirements are important:

- a. All personnel within 1 meter of the Instrument or Electronics, and all related test equipment shall be connected to a common ground at all times.
- b. An ionizing blower shall be in place and operating whenever static generators such as nylon sheeting or paper are within one meter of exposed electrical interfaces.
- c. Under no circumstances shall connections be made to the unit under test while power is applied.
- d. Test cables and equipment shall have all pins shorted to equal potential (or ground) prior to being connected to ESDS hardware. This requirement shall be met by using shorting devices on applicable connectors prior to mating.

3.1.2 Proof Load Certification (as applicable). All equipment to be used for flight hardware lifts shall have current proof load certification. If certification paperwork does not exist, or is out of date, proof load testing must be performed, using a technique appropriate for the device in question. Immediately prior to use, each such device shall be visually inspected for damage. Any hardware exhibiting cracks, or any cable having parted strands, or any similar defects, shall be disposed of and replaced or documented on an MDR, regardless of its state of certification.

3.1.3 General Precautions for Connectors:

- a. Use connector savers on all flight hardware electrical connectors that require them per the Deep Impact Connector Guidelines.
- b. Flight hardware electrical connectors shall be capped with ESD approved covers when they are not in use, to minimize contamination, and to prevent damage from electrostatic discharge.
- c. Before mating any connector, examine the connector to assure that there is no interference or visible contaminants at the pin or socket interface. Notify QA if connectors exhibit any problems.



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- d. Extreme care shall be exercised should connectors need to be probed at any time, and the following precautions taken:
 - The probing pin shall be a mating pin or socket that is insulated to prevent shorting.
 - The probing pin shall be gold plated, or of a non-marring smooth surface.

3.2 Safety Requirements

In accordance with the Reliability, Parts and System Safety Handbook SP0031A-014, the System Safety Engineer or his delegate has final authority over safety provisions contained in this procedure, and in controlling any hazardous conditions which may arise during any operations performed in accordance with this procedure.

3.2.1 Responsibility for Safety. All personnel are responsible for maintaining a safe work environment. The Test Conductor or cognizant operator shall assure that appropriate safe practices are implemented during these operations, and that operations are performed in a proper order.

3.2.2 Test Readiness reviews. Prior to the commencement of any activities detailed in this document, and again at each shift change, the Test Conductor or cognizant operator shall conduct a pre-test briefing. Also, immediately prior to each hazardous sequence of operations, the Test Conductor or cognizant operator shall conduct a pre-task briefing. Both the pre-test and pre-task briefings shall include a discussion of:

- a. Test sequence, objectives, and equipment
- b. Nature and location of the specific hazards to be encountered
- c. Hazard controls, including protective equipment, safety boundaries, personnel access, etc.
- d. Limitations on concurrent activity
- e. Emergency instructions and response, and, when the situation warrants, the availability of emergency shutdown procedures.

3.2.3 Caution and Warning Notations. In this procedure follow these definitions:

- Caution: Operational step, etc., which if not adhered to or observed could result in damage to the equipment
- Warning: Operational step, etc., which if not adhered to or observed could result in loss of life, or personal injury, or exposure

3.2.4 Mechanically Assisted Lift Hazard. Severe damage to personnel and flight hardware may result if lifting fixtures are excessively loaded. Lifting hardware shall never be used in a configuration that may apply loads greater than the working load that is clearly marked on each piece of lifting hardware. Never use lifting hardware that is not marked with a working load and proof test date. A properly certified crane operator shall control the lift.

3.3 Cleanliness and Environment

Hardware cleanliness requirements at the different assembly levels are delineated in the assembly certification log. If required by that cert log these operations shall be conducted in a



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Export or re-export of information contained herein may be subject to restrictions and requirements of U.S. export laws and regulations and may require advance authorization from the U.S. government.

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class 10,000 clean area as defined in FED-STD-209B, and as implemented by BATC process standard BPS 21.04. Cleanliness of the test units shall be established and maintained per BATC specification SPS 2756.

Standard laboratory conditions of atmospheric temperature (18 to 28°C), pressure (520 to 810 torr), and relative humidity (25 to 70 percent) are acceptable for the operations defined herein.

3.4 Controlled Redline Procedures

BATC DEEP IMPACT test procedure change control shall be implemented in compliance with DEEP IMPACT QWI.

- a. Any testing of flight hardware shall be required to be done in accordance with a test procedure that has been formally released prior to the start of the applicable test. This means that test procedures must be released through BATC Engineering Document Control prior to use.
- b. Once the test procedure is released, it may be changed in compliance with WI Test.4.3.005 Controlled Redline Test Procedure. Such changes may also be made during the test.
- c. Applicable personnel as prescribed in program plan QSP 1.4 Program Management must approve such changes.
- d. The Test Engineer controls the "AS-RUN COPY" of the test procedure containing such changes.
- e. Subsequent to completion of the applicable test, but before final buyoff of that test in the applicable Certification Log, the redline changes to the "AS- RUN COPY" test procedure shall be incorporated in a formal revision of the test procedure.

3.5 Software Configuration

Prior to beginning any DEEP IMPACT test, the revision of any and all flight software and test software shall be recorded. The listing will include the software version numbers, tables, and database version numbers. If any software is revised during the testing, record the revision information required identifying the software configuration used during each test operation.

4.0 QUALITY ASSURANCE (QA) PROVISIONS

QA provisions operative during activities defined in this procedure are derived from the DEEP IMPACT Product Assurance (PA) Plan and the DEEP IMPACT Quality Work Instructions (QWI) document. These provisions, summarized below, identify the interfaces between QA and test personnel.

- a. The PEQA shall be notified, in advance, of performance of any activities described in this procedure. A QA Inspector shall be assigned to monitor those activities as is deemed necessary or appropriate, in accordance with the QWI. When required, QA shall notify the customer and/or government representatives, who may, at their option, monitor or witness the activity. The PEQA shall attend the "Ready-to-Test" meeting with assigned QA personnel, to assure QA support during the test, and to address and resolve outstanding QA items.



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- b. The PEQA shall assure that the proper "as-run copy" of this procedure document has been prepared, and that the required Cert Log is in proper order. When all pre-test conditions have been met, the PEQA shall complete the "Ready-to-Test" entry in the applicable Cert log.
- c. During testing, the PEQA shall approve, prior to its implementation, any major changes to the test procedure involving actual testing deviation, test set-up, measurement methodology, or tolerance changes, along with the cognizant design engineer and the Test Conductor.
- d. Test Support provided by the QA Inspector shall be as follows:
 - Verify that calibration is current for test and measuring equipment in accordance with QSP 11.1 " Selection, Maintenance, and Control of Inspection, Measuring, and Test Equipment".
 - Verify that applicable project-specific electrical ground support equipment (GSE) has been properly certified and tagged in accordance with QSP 11.2 "Development, Certification, and Control of Ground Support Equipment".
 - Verify that applicable lifting and handling GSE has been properly proof tested and tagged.
 - Assure that the proper change control practices are applied as described in section 3.4, which implements the applicable provisions of QSP 4.4 Design Changes.
 - Assist in assuring that the precautionary and safety requirements stated in sections 3.1 and 3.2 are met.
 - Assist in the inspection of test setups prior to application of power to a test specimen, and prior to any mechanism-assisted lifts or moves.
 - Witness all flight article movements, and stamp data as being approved where such data meets the requirements specified in the procedure.
 - Monitor all automated tests, and stamp data collected per procedure requirements.
 - Approve, along with the Test Conductor, any minor changes to the procedure document (such as misspellings, grammar, administrative-type errors, and non-functional operational changes).
 - Prepare quality assurance test documents as applicable. In the Action Item List of the Certification Log, document any discrepancies or non-conformances noted during or after testing, and immediately notify the PEQA.
- e. At completion of the test, the PEQA/Inspector shall perform the following:
 - Review all test data for completeness, and to verify that all measurements are within tolerances.
 - Assure that the resulting test data fulfills the test requirements of the end item.
 - Verify completion of any related action items and disposition of any related MDR's in the test Cert Log.



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- f. Upon the occurrence of a test anomaly (any event that deviates from the planned procedures, exceeds normal variations, or generates unexpected data), operation of the test article shall be stopped immediately, All other test conditions and parameters shall be maintained (except as those conditions that may pose an immediate hazard). The Inspector and the Test Conductor shall review the anomaly. Minor, non-destructive, investigative troubleshooting that will not change the failure mode of the article under test, may be conducted by the Test Conductor, with PEQA concurrence. All troubleshooting shall be performed in accordance with QSP 13.1 Control of Nonconforming Product and WI PA.13.1.004 Test Anomaly Work Sheet (TAWS). At no time will anything other than minor troubleshooting be allowed without Material Review Board (MRB) approval. If the anomaly is found to result from human error or test equipment problems that have not affected the test article, corrective action shall be taken and testing may continue. The PEQA checks the continue test box, the approval box, and signs the TAWS along with the Responsible Engineer.
- g. If a test anomaly cannot be resolved as described above, the PEQA shall be notified, and an appropriate entry shall be made in the Action Item List (AIL) portion of the Certification Log. The PEQA shall prepare a Material Discrepancy Report (MDR) and convene the Material Review Board (MRB) for action as specified in WI PA.13.1.002 "Completion of Material Discrepancy Report". The MRB convened to resolve an anomaly that occurred during testing shall include a representative of the project test group. Testing of the failed item shall then not continue without prior authorization from the MRB.

5.0 CONFIGURATION AND TEST DESCRIPTION

5.1 Test Item Configuration

The HRI SIM Assembly (559651) will be mounted on the HRI SIM Thermal Vac Fixture (T131461) with the flight flexures (559620) and flight-like fasteners. The setup will include the HRI Instrument Electronics (564303) and the HRI CCD Preamp Box (564307) and the flight cables that connect them.

5.2 Test Description

- a. The HRI SIM Assembly and associated components will be placed in the EMC/EMI chamber.
- b. The HRI SIM will be set to take continuous IR and CCD images during the EMC sweeps.
- c. The Filter Wheel and Shutter will be operated for a short time to measure EMI radiation.

6.0 REQUIRED EQUIPMENT

This list of equipment is necessary but not sufficient to perform all procedures incorporated by reference. Each referenced procedure will contain a list of specific hardware required to perform that procedure. The engineer responsible for the referenced procedure shall assemble the specific hardware and software and report readiness to the test conductor.

6.1 HRI SIM Assembly Flight Hardware



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- 559651 Spectral Imaging Module (SIM) – HRI
- 564303 HRI Instrument Electronics
- 564307 HRI CCD Preamp Box
- Flight Cables

6.2 GSE, Tooling, and Other Test Equipment

- T131461 SIM Thermal Vac Fixture Assembly
- T131489 ITOC TVAC Cables
- 568641 ITOC
- Ionizing air blower (2ea)

7.0 TEST SETUP

Prior to executing the test procedure contained in section 8 the Test Engineer and Test Conductor(s) shall confirm that the following operations to set up the hardware and test equipment are complete.

- a. Verify that the Test Readiness Review and test prerequisites have been satisfied. Review the Cert Log and confirm that the hardware is ready to proceed.
- b. Verify that all GSE and other equipment required and listed in section 6.0 is available, correctly configured for the test procedure, and have current calibration stickers or certification.

7.1 Mechanical Installation

- a. Install the HRI SIM on the T131461 SIM Thermal Vac Fixture Assembly.
- b. Install the HRI CCD Preamp Box on the T131461 SIM Thermal Vac Fixture Assembly.

7.2 Electrical Installation

- a. Connect the Instrument Electronics to the ITOC as shown in Figure 2.
- b. Connect Mechanism Cable and the TLM Cable to the MECH/TLM Board in the IE.



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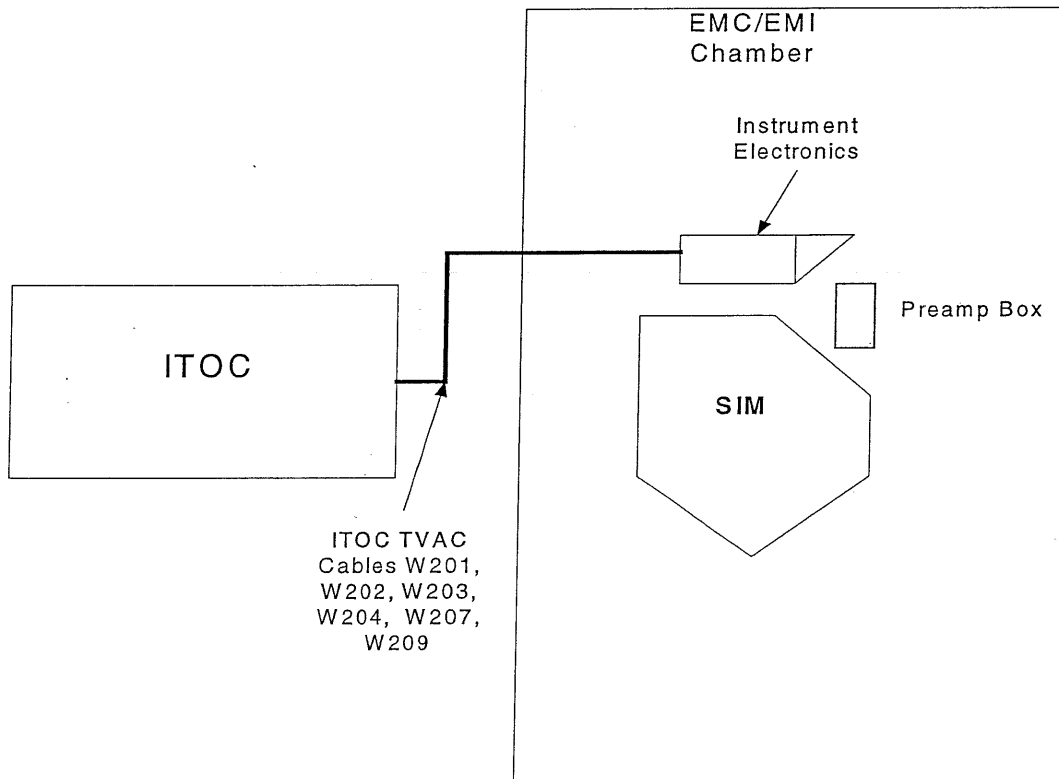
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CAUTION

Do not connect the IR Detector or the CCD to the Instrument Electronics at this time. Exposed focal plane interfaces are to be in the flow of ionized air at all times.

Figure 1 Test Electrical Configurations



CAUTION

Connection of the IR Detector and CCD to the Instrument Electronics is to be done by Detector Engineering per 574503 for the IR Detector and 574504 for the CCD. Failure of any procedure incorporated by reference in this document is grounds for halting operations as per Section 4 item F. Pass/fail criteria are defined in the procedures incorporated by reference.

- c. Perform a Shorts/Open test on the IR Detector at the IR Thermal Isolation Connector per FUNCTIONAL TEST PROCEDURE, IR SENSOR ASSEMBLY (574502).



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- c. Perform a Shorts/Open test on the IR Detector at the IR Thermal Isolation Connector per FUNCTIONAL TEST PROCEDURE, IR SENSOR ASSEMBLY (574502). ✓
- d. Perform a Shorts/Open test on the CCD detector as per FUNCTIONAL TEST PROCEDURE, CCD SENSOR ASSEMBLY (574503). ✓
- e. Perform an IR Safe-to-Mate test at the IE-SIM cable connectors INSTR_P7, INSTR_P6, and INSTR_P8 as per FUNCTIONAL TEST PROCEDURE, IR SENSOR ASSEMBLY (574502). ✓
- f. Perform a CCD Safe-to-Mate test as per FUNCTIONAL TEST PROCEDURE, CCD SENSOR ASSEMBLY (574503). ✓
- g. Ensure that the IE is powered off before proceeding to the next step. ✓
- h. Connect the IR Detector to the Instrument Electronics per FUNCTIONAL TEST PROCEDURE, IR SENSOR ASSEMBLY (574502). ✓
- i. Connect the CCD to the Instrument Electronics per FUNCTIONAL TEST PROCEDURE, CCD SENSOR ASSEMBLY (574503). ✓
- j. Warm-clock the IR Detector and verify functionality of IR temperature sensors as per FUNCTIONAL TEST PROCEDURE, IR SENSOR ASSEMBLY (574502). ✓
- k. Warm-clock the CCD and verify functionality of CCD temperature sensors and filter wheel as per 574506 CSTOL: Deep Impact High Resolution Imager (HRI) Visible (VIS) Detector Single Mode Dark Imaging and 574503 FUNCTIONAL TEST PROCEDURE, CCD SENSOR ASSEMBLY. ✓
- l. Enclose the HRI SIM and IE under a GN2 purge tent and begin GN2 flow. ✓

8.0 TEST PROCEDURE

8.1 EMC test ✓

- a. Use 576699 CSTOL: HRI Simultaneous VIS/IR Imaging Sequence to take images during the EMC sweeps called out in 574614 DI EMC/EMI Qualification Test Procedure. ✓

8.2 EMI test ✓

- a. Run the Filter Wheel and Shutter as required during the EMI sweeps called out in 574614 DI EMC/EMI Qualification Test Procedure. ✓
- b. Dismantle the test setup and return items to cleanroom. ✓

DLH 12/5/02



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Export or re-export of information contained herein may be subject to restrictions and requirements of U.S. export laws and regulations and may require advance authorization from the U.S. government.

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EQUIPMENT LIST

List all test equipment used in these tests including items used to take engineering data that may not be called out in this procedure. Verify all Calibration Due Dates.

| Equipment | Make | Model | Metrology No. | Cal Due Date |
|------------------------|-------|-------------|---------------|--------------|
| Ionizing air blower | | EM5000019 | P130723 | 2/19/03 |
| Ionizing air blower | Simco | Aerostat XC | P130724 | 2/25/03 |
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