STEREO
IMPACT

Environmental Test Plan

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Document Revision Record

Rev.	Date	Description of Change	Approved By
A	2001-Sep-10	Preliminary Draft	-

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1. Introduction

This document describes the Environmental Test Plan for the STEREO IMPACT instrument suite. This plan covers testing of flight and protoflight hardware prior to delivery to Spacecraft integration. This test plan is intended to meet the requirements of the STEREO Environmental Test Specification (reference 1).

1.1. *Document Conventions*

In this document, TBD (To Be Determined) means that no data currently exists. A value followed by TBR (To Be Resolved) means that this value is preliminary. In either case, the value is typically followed by code indicating who is responsible for providing the data, and a unique reference number.

1.2. *Applicable Documents*

The following documents include related documents and STEREO Project policies. In the event of a conflict between this document and the following documents, this document takes precedence. All documents can be found on the Berkeley STEREO/IMPACT FTP site:

http://sprg.ssl.berkeley.edu/impact/dwc/

1. Project/EnvironmentalSpec7381-9003 – STEREO Environmental Test Specification
2. Project/EMC_7381-9030 – STEREO EMC Requirements
3. Specifications/IMPACTPerformanceSpec – Instrument Performance Specification
4. Plans/VerificationMatricies – IMPACT Instrument Verification Matricies
5. Project/ContaminationControlPlan7381-9040 – Project Contamination Control Plan

2. Verification Requirements

Verification Requirements come from GEVS-ELV, and the STEREO Project Environmental Test Spec (Reference 1) and EMC Requirements (Reference 2). In the event of a conflict, this document takes precedence, followed by the Project documents, then GEVS.

3. Verification Matrices

Reference 4 includes the verification matrices for the testing to be performed on THE IMPACT Suite down to the subassembly level. This is su8mmarized at the top level in Table 3-1. The functional and calibration tests and analyses are designed to verify the Performance requirements as called out in reference 3.

Table 3-1 Environmental Test Matrix

System	EMC	Bakeout	Thermal Vac Cycling (Op/NonOp)	Thermal Balance	Sine Vib	Random Vib	Mass props	Failure Free Hours
SEP								
- SEPT-NS		√	-25 - +35C -25 - +50C	TBR	√	√	√	
- SEPT-E		√	-25 - +35C -25 - +50C	TBR	√	√	√	
- SIT		√	-25 - +30C -25 - +35C	TBR	√	√	√	
- HET, LET, Common Elec.		√	-25 - +35C -25 - +40C	TBR	√	√	√	
Boom Assy		√		TBR	√	√	√	
- Boom	Mag Screening		TBD					
- SWEA	Mag Screening		-25 - +30C -30 - +50C					
- STE	Mag Screening		-50 - -30C -50 - +40C					
- Mag Sensor			-20 - +45C -20 - +45C					
IDPU		√	-23 - +55C -30 - +60C		√	√	√	
Flight Harness		√						
IMPACT Suite	RS,RE,CS,CE per EMC Requiurements							100

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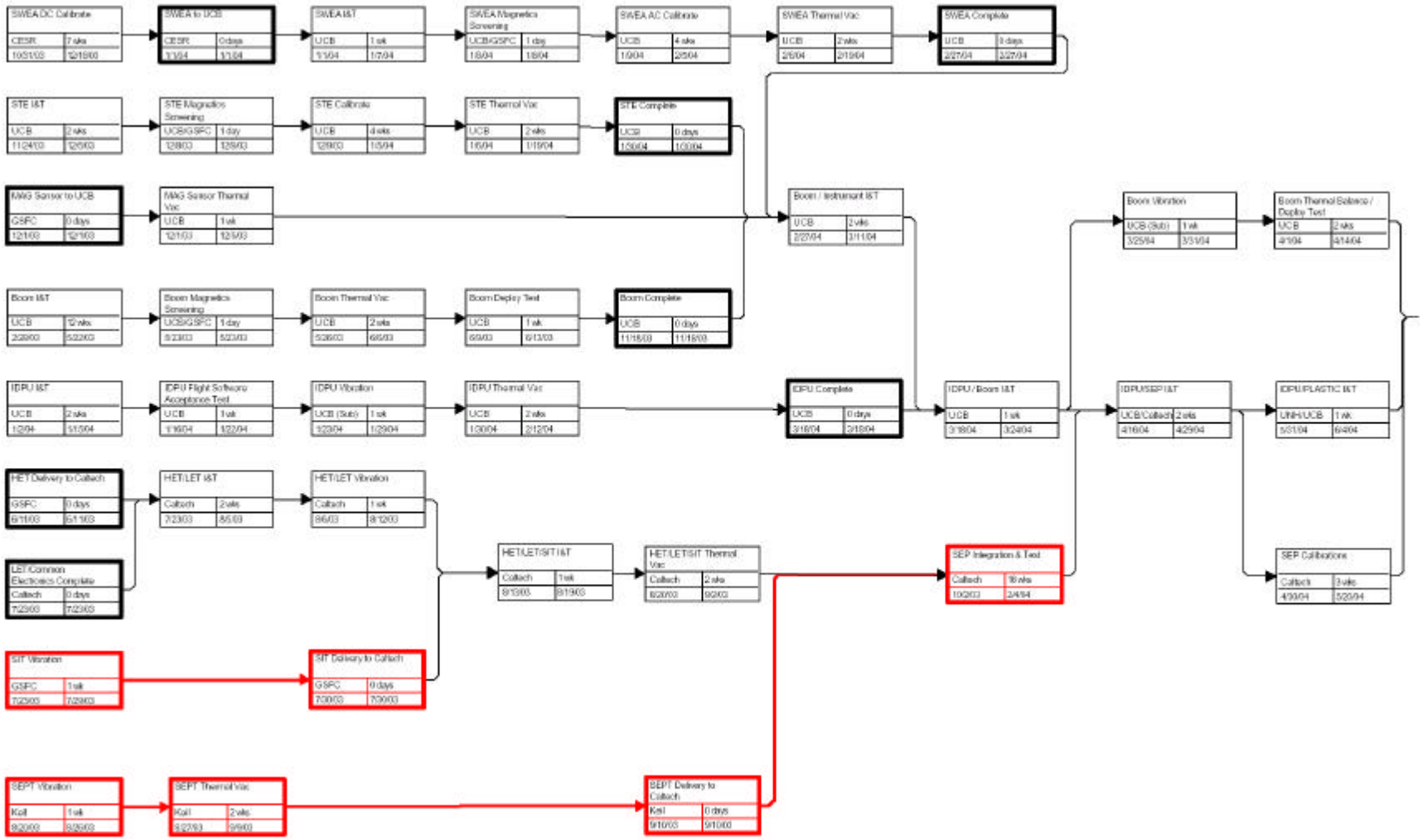
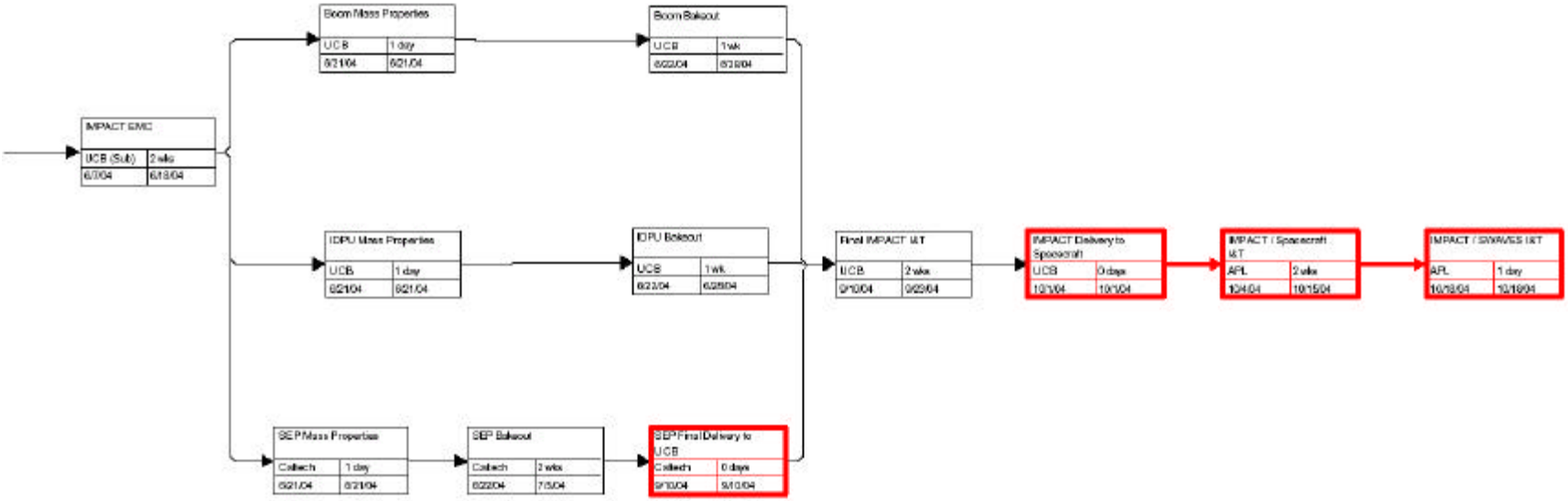
System	EMC	Bakeout	Thermal Vac Cycling (Op/NonOp)	Thermal Balance	Sine Vib	Random Vib	Mass props	Failure Free Hours
SEP								
- SEPT-NS		√	-25 - +35C -25 - +50C	√	√	√	√	
- SEPT-E		√	-25 - +35C -25 - +50C	√	√	√	√	
- SIT		√	-25 - +30C -25 - +35C	√	√	√	√	
- HET, LET, Common Elec.		√	-25 - +35C -25 - +40C	√	√	√	√	
Boom Assy		√		√	√	√	√	
- Boom	Mag Screening		TBD					
- SWEA	Mag Screening		-25 - +30C -30 - +50C					
- STE	Mag Screening		-50 - -30C -50 - +40C					
- Mag Sensor			-20 - +45C -20 - +45C					
IDPU		√	-23 - +55C -30 - +60C		√	√	√	
Flight Harness		√						
IMPACT Suite	RS,RE,CS,CE per EMC Requiurements							100

Figure 4-1 IMPACT I&T Flow




Boom Mass Properties
UCB
1 day
Boom Bakeout
UCB
1 wk
IMPACT EMC
UCB (Sub)
2 wks
IDPU Mass Properties
UCB
1 day
IDPU Bakeout
UCB
1 wk
Final IMPACT I&T
UCB
2 wks
IMPACT Delivery to Spacecraft
UCB
0 days
IMPACT / Spacecraft I&T
APL
2 wks
IMPACT / SWWISS I&T
APL
1 day
SEP Mass Properties
Caltech
1 day
SEP Bakeout
Caltech
2 wks
SEP Final Delivery to UCB
Caltech
0 days

4. Test Plan

Environmental testing is performed at various levels of assembly, as appropriate. Figure 4-1 shows the planned assembly and test flow. Dates shown in this figure are approximate.

5. Test Levels

5.1. *EMC Tests*

EMC test levels are called out in Reference 1 and 2. EMC testing will be done at the suite level using flight intra-instrument harnesses. The PLASTIC instrument shall also be tested with the IMPACT Suite.

5.1.1. Magnetics

IMPACT Suite elements shall be surveyed magnetically no later than the EMC test using equipment provided by the MAG team. Of particular interest is the boom suite components mounted close to the MAG sensor.

5.2. *Vibration Tests*

Vibration testing (Sine and Random) shall be as listed in Reference 1, section 3.4, at the level of integration that they are attached to the spacecraft (see Table 3-1). Self-shock testing shall consist of at least two firings of each actuator. The subsystems shall be vibrated in launch configuration. Boom and bracket mounted instruments shall be vibrated on their booms and brackets.

5.2.1. Acoustics

Instrument-level acoustic tests shall only be performed if indicated by analysis or heritage. While IMPACT contains a number of thin foils, they are mostly identical to foils previously qualified and flown.

5.3. *Mass Properties*

Mass, CG, and Moments of Inertia shall be provided to the accuracy stipulated in Reference 1 section 3.4.4. Measurements shall be made where the required accuracy cannot be verified by analysis.

5.4. *Thermal Vac*

Subassemblies shall be subjected to four thermal vacuum cycles as called out in reference 1, to the temperature limits called out in table 3-1. Thermal modeling shall verify a 10°C margin between these temperatures and predicts (no margin required where maintained by heaters). One cycle shall include un-powered excursion to the non-op limits to verify survivability. Functional testing shall be included at each operational plateau; the first and last cycle shall have comprehensive functional testing (including turn-on), while the intermediate cycles may use a shorter aliveness test.

5.5. *Thermal Balance*

Thermal Balance testing is used to verify thermal modeling results. The test shall simulate interfaces to the spacecraft and to space in a vacuum environment, without requiring accurate simulation such as a solar simulator. The differences between the space environment and the test environment shall be modeled. The instruments shall be in flight configuration for this test, with thermal blankets installed. Boom and bracket mounted instruments shall be tested on their booms and brackets. Typically this test is performed as part of the Thermal Vac test, though for the boom, Thermal Balance is performed at the boom suite integration level, while thermal vac is performed at the sub-assembly level since the thermal conditions for the boom and instruments are different. The details of the thermal balance test shall be negotiated with the APL spacecraft thermal engineers to the extent that the test must verify the spacecraft-level thermal modeling also.

5.6. *Bakeout*

Late in the I&T program the subassemblies shall be cleaned and baked out, and outgassing rates shall be verified by TQCM monitoring per reference 5. Following this step instruments shall be bagged or otherwise maintained in a clean environment to meet the delivery cleanliness requirements called out in reference 5. For instruments with thermal constraints that preclude a high bakeout temperature, those parts of the instrument that can be will be baked out prior to assembly to minimize the final bakeout time.