STEREO
IMPACT

Configuration Management Plan

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Document Revision Record

Rev.	Date	Description of Change	Approved By
A		Preliminary Draft	-
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1.0   Introduction

This document describes the Configuration Management plan and procedures to be used by the STEREO IMPACT development team.

1.1   Scope

This document is applicable to all flight hardware, flight software, and critical ground support equipment. The requirements of this documentation shall be implemented from the time of initial generation through the delivery/launch of the STEREO Observatories.

1.2   Configuration Management Objective

The objective of the IMPACT Configuration Management Program is to actively apply technical and administrative controls which:

- Identify and document the requirements, functions, and history of a configured item.
- Regulates changes to the configured item's characteristics.
- Record and report change processing and implementation status.
- Provide a means to introduce engineering efficiencies, cost savings, and product improvements to a configured item.

1.3   Applicable and Reference 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/

(Use latest approved documents unless otherwise specified)
- 460-PG-1410.2.1 STP Program Configuration management Procedure
- Plans/STEREO-IMPACT-PAIP (Performance Assurance Implementation Plan)

1.4   Definitions

Class I Changes – A Class I change is a change where one or more of the following items is affected: 1) project baselined documentation (except for typographical errors, simple clarification, or other examples of Class II documentation changes); 2) technical requirements contained in the product Configuration Item (form, fit, function); 3) contract end items/ requirements (cost or schedule); 4) interfaces; 5) weight/power/data-rate allocations; 6) technical risks; and 7) science performance). All proposed Class I changes require GSFC approval. This will be achieved through GSFC Instrument Manager.

Class II Changes – A Class II change is a change that does not fall within the definition of a Class I change. Examples of Class II changes are: 1) a change in documentation only (such as correction of errors, addition of

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clarifying notes or views); 2) a minor change in hardware (such as substitution with an approved alternative material) which does not affect any item listed under Class I changes; and 3) drawing changes that do not affect a baseline or interface. A class II change does not require project CCB review unless it is written against CM-controlled documents.

Configuration Control - Configuration control involves the systematic evaluation, coordination, and formal approval/disapproval of proposed changes and implementation of all approved changes to the design and production of a Configuration Item (CI) whose configuration has been formally approved by either the contractor or the National Aeronautics and Space Administration (NASA).

Configuration Item (CI) – the term applied to the product and/or selected components that are designated by the Program/Project as subject to CM requirements and procedures. The "product" may be a system, subsystem, equipment, instrument package, data, software, or component, and includes its related documentation.

Configuration Status Accounting and Reporting – Configuration accounting is the activity that produces records and reports of CI descriptions and all changes to the CI. It includes the recording and reporting of significant information needed to effectively manage configuration items, including such activities as maintaining the Controlled Documents List, status tracking of CCRs, status of CCB activities, and the subsequent reporting of such information to personnel and organizations associated with the Program/Project.

Deviation – a specific written authorization, granted *prior to* the manufacture or testing of an item, to depart from a particular performance or design requirement of a specification, drawing, or document. Requests for Deviations that are classified as Class l undergo the same approval routing as configuration changes.

Waiver – a specific written authorization, granted *after* the manufacture or testing of an item, to depart from a particular performance or design requirement of a specification, drawing, or other document, but is considered suitable for use "as is". Requests for Waivers that are classified as Class l changes undergo the same approval routing as configuration changes.

1.5 Important Note
Appendix A of this document provides streamlining methods (Redline Control Instructions) to this Configuration Management process.

2.0   Overview
IMPACT flight hardware, software, critical GSE, and related documentation (including deliverables prior to delivery) shall be covered by this plan.

2.1   Responsibilities
The function of the IMPACT Configuration Management (CM) System is to control the Instrument configuration baseline; track the status of configured items, and interface with predominant and subordinate CM offices. This includes controlling changes to configuration documentation, maintaining status accounting records, and distributing all pertinent information as necessary.

   IMPACT CM shall be applied at three levels:
   1. Interaction with Project CM
   2. Suite CM
   3. Instrument CM

Suite CM applies to top-level documentation and integrated hardware/software, while Instrument CM relates to sub-assembly level documentation and hardware as developed at each team member's institution.

2.2   IMPACT CM Activities

Once a configuration baseline is established, all changes to the configuration documentation shall be presented to the Configuration Control Board (CCB) via a Configuration Change Request (CCR), as applicable. Once approved, the changes made will be available to IMPACT user community. Lead Engineers are responsible for verifying latest configuration documentation is being used/referenced by their team. All Class 1 and System Level changes require the approval of UCB IPM.

3.0 Configuration Control at:

3.1 IMPACT Suite Level CM

Suite-level Configuration Management shall be the responsibility of the IMPACT Project Manager (IPM). This shall include all system-level documentation, interface control documents between the IMPACT subsystems and institutions, subsystem requirements, resource allocations, and science goals (as opposed to science requirements, which are controlled by the Project). In addition, the flight hardware, software, and critical GSE shall fall under the Suite CM system following IMPACT integration.

3.1.1 Responsibilities at IMPACT Suite Level

The IPM will be the ultimate authority on change requests, deviations, or waivers to Suite CIs, and will be responsible for gathering the required information to make these decisions and verifying that any changes decided upon are implemented. The IPM shall refer to the PI any science-related items. No fixed CCB shall be maintained, but appropriate input from relevant parties shall be obtained by the IPM prior to authorizing a change. The IPM shall also be responsible to notifying all affected parties of a change, in addition to maintaining records of the current configuration in an accessible on-line format.

Subsystem and Instrument Lead Engineers shall be responsible for identifying changes, deviations, or waivers to their CI that might effect suite of Project level controlled items and passing those change requests on to the IPM for disposition. This includes changes to subsystem cost, schedule, or other resources (in general Class 1 changes).

3.1.2 Document Control at IMPACT Suite Level

Suite-level controlled documents shall reside on the IPM-controlled web site. Documents shall include a revision code appended to the file name and included on the cover page to identify the document revision. Documents shall include a change page to identify what changes have been made since the initial release, as well as change bars in the text. The IPM shall be responsible for notifying the appropriate team members of any change to a controlled document and getting approval when required via e-mail.

3.1.3 Flight Hardware/Software Control at IMPACT Suite Level

Flight hardware shall be under the control of the subsystem engineer until it is integrated into the Suite. The subsystem engineer shall handle changes/deviations/waivers that do not affect Suite-controlled documents such as interface requirements, resources, performance requirements & goals, schedule milestones, etc. Otherwise changes shall be submitted to the IPM for disposition.

At the time of delivery of flight hardware to suite integration, documentation of the status of all waivers, deviations, problems shall be included. Completed as-built documentation such as schematics and drawings shall be maintained by the subsystem engineer, and shall be available upon request.

Following integration, all changes/deviations/waivers to the flight hardware or software shall be controlled at the Suite level by the IPM. Any change to a subsystem shall be referred back to the subsystem lead, who shall perform the change and update the as-built documentation accordingly.

3.2 IMPACT Subsystem Level CM

Below the Suite level is the subsystem (Instrument / Subcontractor) level Configuration Management. This shall be carried out independently at each team institution using existing in-house procedures. Items covered at this level are schematics, parts drawings, subsystem fabrication records, subsystem test plans, procedures, and reports, and other subsystem documentation, as well as the subsystem hardware/software itself up to the time of integration. Typically these will be controlled by the lead engineer for the subsystem, who will be responsible for maintaining configuration control on the subsystem. Any change, deviation, or waiver at the subsystem level that effects an IMPACT Suite or Project level controlled item shall be passed on to the IPM for disposition.

3.2.1 Document Control at IMPACT Subsystem Level

Subsystem-level documents, including schematics, drawings, low-level specifications, etc., shall be controlled by the subsystem lead. Document control shall be adequate to unambiguously determine the current and as-built design. Documentation shall come under formal control as the design matures, typically around the time of CDR, but no later than the start of fabrication of the flight hardware. At that time a configuration baseline shall be established which includes all the design, fabrication, and test documentation. Once under control, documentation shall include change history information to identify why the change was made, who authorized it, and when it was incorporated into the flight hardware.

3.2.2 Flight Hardware Control at IMPACT Subsystem Level

During fabrication, configuration documentation shall be accumulated in the form of a traveler that is kept with the hardware. This traveler shall include or contain reference to the as-built documentation, such as schematics, part drawings, fabrication instructions, part lot date codes, test procedures and results, etc. All changes to flight hardware shall be documented in this traveler. When the hardware is delivered to the suite level, the subsystem engineer shall maintain the traveler, available upon request.

3.2.3 Flight Software Control at IMPACT Subsystem Level

 The subsystem programmer shall maintain a development log for each subsystem's flight software. This log shall include development and test history of the software, including all problems found and their resolution. This log shall be used to identify and control the software configuration. Upon installation of the flight software into the flight hardware, this log shall become part of the traveler by reference. Flight software shall include a revision code that shall be accessible via telemetry. This revision code shall be traceable to the software build and test history via the software log.

Once integrated into the flight hardware, the flight software shall be subject to the same problem reporting system as the flight hardware, as described in section 4.4.

All versions of the flight software starting no later than the first version loaded into flight hardware shall be archived, including all source code, documentation, etc, such that an earlier configuration can be recreated at any time.

3.3 Configuration Control Backups
All controlled documentation and flight software shall be backed up regularly (at least weekly).

3.4   CCB Meeting
CCB meetings will be scheduled at the discretion of the IPM. Meetings requested by other CCB members shall be elevated to the IPM or designee.

Once a CCB meeting is scheduled, CCB documentation shall be forwarded to each member prior to the scheduled meeting. This will allow the member to obtain any required technical information.

If a CCR, Dev, or Wvr is denied, the documentation will reflect (denied) and requester notified.

All Class 1 and System Level changes require the approval of UCB IPM.

4.0   Configuration Changes
Configuration Change Request (CCR) will be categorized by Type of Change and Approval Level required. Changes will also be subject to confirmation. The confirmation level is generally the next higher approval level, which verifies that the change was processed at the appropriate level. The IMPACT Configuration System has four types of changes:

4.1   Types of Changes

4.1.1 Class 1 Changes (GSFC Approval Required)
Class 1 changes are those that impact the form, fit, function, interfaces, weight allocation, power allocation, scientific performance, performance assurance, cost, schedule, etc. of a baseline configured item.

As a list, a change request may be classified as Class 1 when one or more of the following are affected, at the discretion of the IPM:

- Cost   - Parts
- Safety   - Power
- Memory   - Operations
- Purchases   - Materials
- Facilities   - Reliability
- Telemetry   - Performance
- Interfaces   - Mass Properties
- Transporter   - NASCOM Network
- Requirements   - Integration and Test
- Launch Vehicle   - Transport Operations
- Other Procurements   - Launch Site Operations
- Component Contracts   - Science Operations Center
- Civil Service Manpower   - Mission Operations Center
- Qualification/Acceptance   - Procurement
- Support Service Contract Task   - Schedule

4.1.2 Class 2 Changes (GSFC Approval is not required)
Changes are classified as Class 2 when they do not fall within the
definition for Class 1 changes (correction of error, addition of clarifying
notes).

4.1.3 Deviations
A Deviation is a specific written authorization, granted **before** the
manufacture or testing of an item, to depart from a particular performance,
design, or verification requirement of a specification, drawing, or other
document. Request for deviations are processed through the CCB as Class 1
changes.

4.1.4 Waivers
A Waiver is a specific written authorization, granted **after** the manufacture
or testing of an item, to depart from a particular performance, design, or
verification requirement of a specification, drawing, or other document.
Request for waivers are processed through the CCB as Class 1 changes.

4.2 Document Changes and Revisions
Documents under configuration control use a Document Change Record to
chronicle all changes to the document.

4.2.1 Document Change Record
The Document Change Record is updated when changes are made or revisions
are made to a document. The Document Change Record will list all changes
and revision that have been made since the initial release. Each revision
will be signed or initialed by the Instrument Project Manager or designee.

4.2.2 Document Changes
The CCR form shall detail the document change(s). Changes per CCR shall be
referenced by: Was and Now, Add, and Delete. Document sheets may be
attached to the CCR to reflect changes. In cases where copies of the
document sheets are attached placing change bars to the right margin
adjacent to change item shall identify the changes. All Class 1 and System
Level changes require the approval of UCB IPM.
4.2.3 Document Revisions
Document revisions shall be complete reprints of the entire document.

4.2.4 Distribution
The CM System will maintain all document changes for review and historical
record file keeping. Every IMPACT team member shares the responsibility to
verify the revision level of the document/drawing prior to using; keeping
in mine not all CCRs will be incorporated.

4.3 Drawing Changes
Class 1 Drawing Changes will require the originator to submit a CCR to UCB
supporting the change(s), and shall be incorporated into the document or
redlined as stated in the Redline Control Procedure as outlined in Appendix
A.

Class 2 Drawing Changes will require the originator to submit a CCR to
support change, or shall be documented in accordance with the Redline
Control Procedure as outlined in Appendix A.

4.4 Software Changes
All software subsystems shall implement configuration control of software.
All Class 1 changes require IMPACT CCB approval. Software configuration
control shall follow the requirements established within this plan.

5.0 Integration and Test Configuration Management

5.1 Hardware Delivery
As hardware is fabricated, tested, and delivered, the Product Assurance Representative or designee will participate in audits of the CM system and hardware certification tracking procedures. When hardware is delivered to IMPACT for integration and test, functional and physical configuration audits will be performed prior to acceptance of the item for I&T. A library of all acceptance data packages delivered with the hardware shall be maintained by the IPM or designee.

5.2 Software Configuration Management
The IMPACT Project Manager will establish a CCB prior to the start of the I&T and Software Independent Verification and Validation.

5.2.1 IMPACT Software Configuration Control Board
The goals of the Software CCB are to:

- Ensure configuration control of the software release process for I&T, SIVVF, and Flight.
- Direct implementation of software modifications to optimize software performance, and minimize cost and schedule impacts.
- Ensure all flight software undergoes the IV&V process prior to Observatory Flight.

6.0   Configuration Identification

6.1   Configured Baseline
Each subsystem shall provide development plans and performance specifications in accordance with IMPACT Statement of Work, which document the baseline requirements and characteristics of the subsystem. Progressive development of more thorough documentation shall be accomplished at each significant phase in the development of the subsystem. As the documentation is baselined, it shall be placed under configuration control.

6.2   Configuration Items
Specific configured items (CI) shall be identified as the principle elements. Major deliverable items (such as electrical harness, structure, etc.), major ground support equipment (I&T computer, lift sling, etc.), and software (flight software, I&T Computer software, etc.) are considered to be configured items.

6.3   Document Identification
All documents shall be assigned a unique document control identifier. The document control shall remain in force until the document is retired.

6.4   Drawing Identification
All drawings shall be assigned a unique control identifier.

6.5   Product Identification
All parts, subassemblies, and assemblies shall be marked with a manufacture's identification and part identifier. Functional assemblies shall be serialized. All production and inspection records shall use the assigned part identifier and serial numbers to ensure traceability.

6.6 Software Identification
Each Software Subsystem shall assign unique control identifiers to their software and its supporting documentation.

7.0   Configuration Status Accounting

The IMPACT Lead Engineers shall generate and maintain the following status accounting reports, as necessary.

- Document/Drawing Release Records
- CCR Status Reports
- Configured Articles List
- Configuration Status Log

7.1   Document/Drawing Release Records

The Document/Drawing Release Records track the status of all released documents and drawings and defines all changes and revisions that have been issued against them.

Reference IMPACT Site: http://sprg.ssl.berkeley.edu/impact/dwc/

7.2   CCR Status Reports

The CCR Status Report identifies each CCR that has been submitted and used to track the status and final disposition of all CCRs.

7.3   Configured Articles List

The responsible Lead Engineer shall maintain the Configured Articles Lists (CAL) that describe all configured item hardware, software, GSE, and supporting documentation. The exact configuration definition of the hardware and software can be determined from these listings.

7.4   Configuration Status Log

The Configuration Status Log is started at the beginning of the build cycle to track the history and current status of the configuration. The Configuration Status Log is also used to track red/green tag items for flight.

7.5 Configuration Records Required to Support Item

At the time of delivery or next level of integration, documentation shall be provided to support "as built vs. as design" verification audit. Records to support requirements include: (Build Records)

- Configuration Status Log
- Serialization Status Log
- Completed Work Order / Traveler
- Deviations/Waivers
- Listing of Shortages/Opens

APPENDIX A

Redline Control Instructions

1.0 Purpose
The Redline Control Instruction provides a streamlined method of change control for hardware and software (flight & non-flight). This procedure only applies to items previously released under Configuration Control.

2.0 Scope
The requirements of this instruction can be implemented from the time of initial release through the delivery of the item to its next level of operation.

3.0 Procedure
Documentation recommended for change must be under Configuration Control prior to being able to redline.

Each Lead Engineer is responsible for control of the documentation being redlined. Only one redlined document is acceptable for each item. The document shall be labeled "Control Copy". The safety and storage of the redlined drawing is the full responsibility of the Lead Engineer.

Each redlined change must have the initials and date of the Lead Engineer prior to incorporation or initiation.

All redline changes that effect hardware configuration must be documented on a Work Order and inspected by Quality Assurance, or designee prior to proceeding to the next operation/step. The Work Order is generated/updated in parallel to drawing red line.

Prior to delivery of the item to the next level (ex. subsystem to spacecraft), all permanent redlines shall be incorporated into the documentation through Configuration Control and released.

4.0 Responsibilities
Lead Engineer - Responsible for overall implementation and integrity of item(s) requiring redline changes. Evaluates the risk involved with each and every change prior to approving. Lead Engineer consults with Systems Engineer, other Lead Engineers and experts as necessary to reduce any potential dangers to item(s) being reviewed for change.

Instrument Project Manager (IPM)- Responsible for overall IMPACT project. The IPM is the technical authority for the IMPACT and provides technical oversight as it pertains to overall systems.

Quality Assurance - Responsible for performing random verification checks to verify that the Redline Procedure is being implemented correctly. Provides resources as requested to support Lead Engineer or IPM during redline review. Performs inspections (workmanship) on all hardware configuration changes.

APPENDIX B

Sample Forms / Links

Document Revision Record (Sample)
Recommend Placing on IMPACT Web for Easy Access

Rev.	Date	Description of Change	Approved By

Sample Waiver / Deviation Form
(See File DDform1694.pdf)
Recommend Placing on IMPACT Web for Easy Access
Attached for Reference Only

Sample Configuration Change Request Form

(See File CCRTEMPLATE.doc)
<u>Recommend Placing on IMPACT Web for Easy Access</u>
Attached for Reference Only