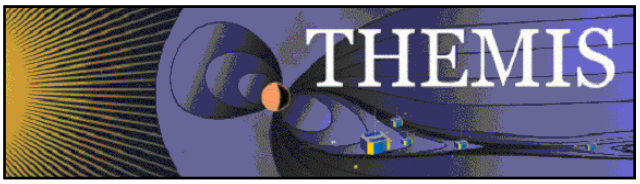

THEMIS
Configuration Management Plan

THM-SYS-011
June 16, 2004
Revision B

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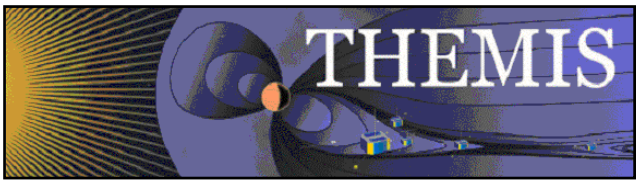

Document Revision Record

Rev.	Date	Description of Change	Approved By
-	11/07/03	Released	-
A	12/08/03	PRH comments, ECN/ECR added, naming convention appendix added	ERT
B	6/16/04	Updated per program implementation	ERT

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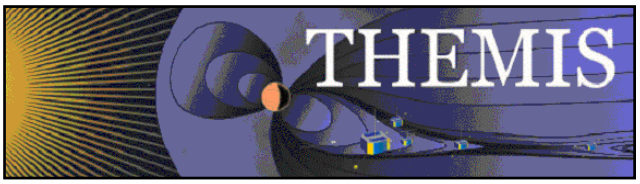
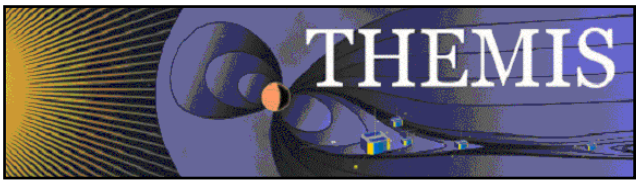
TBD List

Identifier	Description



Appendices



1.0 Introduction

1.1 Overview

THEMIS is a NASA Explorer mission which will launch a constellation of five micro-satellites (probes) in mid-2006. Flying in synchronous orbits within the earth's magnetosphere, the probes will measure the particle processes responsible for eruptions of the aurora. As the prime contractor for THEMIS, the University of California at Berkeley (UCB) will provide the project management, systems engineering, flight instrumentation, ground-based imagers, mission operations, and performance assurance. Swales Aerospace will provide probe buses and lead integration and test activities. Key international partners include teams from Canada, France, Germany, and Austria.

1.2 Scope

This Configuration Management Plan (CMP) establishes how the THEMIS project team will ensure consistency between configured documentation and as-built flight hardware and software. The plan consists of: (1) identifying the engineering data required for project development (*configuration identification*); (2) the process for controlling changes and maintaining the engineering database throughout the project (*configuration control and accounting*); and (3) the plan for reviewing and auditing the engineering data to verify that hardware and software is built as designed and documented (*configuration verification*).

1.3 Applicable Documents

Document #	**Title**	**Revision**
ANSI/ASQC Q9001-1994	Quality Systems - Model for Quality Assurance in Design Development, Production, Installation, and Servicing	Current
GSFC 311-INST-001	Instructions for EEE Parts Selection, Screening, and Qualification	Current
GEVS-SE	The Goddard Space Flight Center's General Environmental Verification Specification for STS and ELV Payloads, Subsystems, and Components	Current

1.4 Objectives

The primary objective of the CMP is to provide final assurance that the configuration of flight hardware and software meets the project's functional requirements and accurately reflects the configuration as designed, approved, and released for each subsystem. The THEMIS project team will automate the configuration process as much as possible while still ensuring that this primary objective is met.

1.5 Revisions

The CMP is living document. As a result, additions, deletions, and modifications will occur as it is used throughout the project. It will be updated as additional configuration activities, information, or documents are defined, and as the work proceeds and the necessity arises. Major revisions will be marked with an increasing version letter and released via configuration control to the THEMIS ftp engineering database.

2.0 Configuration Identification

Configuration identification is the ongoing process of identifying and documenting a product's functional and physical characteristics, from initial selection through design, development, fabrication, test and delivery. The identification of probe/instrument payload configuration is baselined progressively by approving technical documentation at selected times during the development process. This section covers:

- end-items of the THEMIS project (broken into assemblies and sub-assemblies);
- engineering data required for the development of flight software and hardware; and
- proposed schedule of data and document release to facilitate the interface and interaction between subsystems and subcontractors.

2.1 THEMIS Assemblies/Sub-Assemblies

Figure 1 illustrates the THEMIS Work Breakdown Structure. The structure is introduced to clearly define boundaries and responsibilities thereby reducing the chances of error or overlap. Further description of each element can be found in the THEMIS WBS Dictionary.

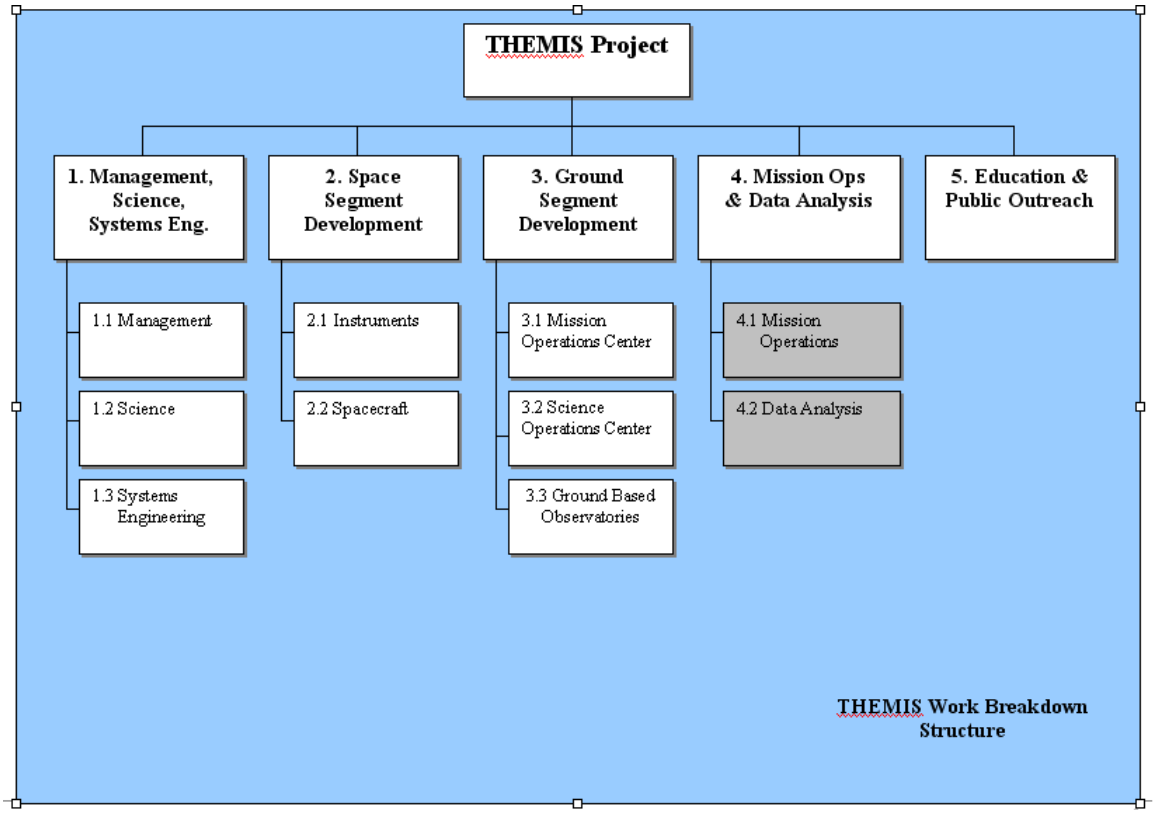
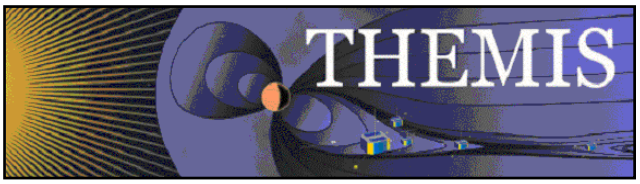


Figure 1: THEMIS Work Breakdown Structure



2.2 THEMIS Documents/Document Types

Configuration identification provides unique identity to complete configuration documentation as well as the end-item itself. Documentation includes all specifications, test procedures, drawings, and data lists, which define or support the end-item and approved changes. Configuration identification further includes physical part numbering and serialization of subassemblies and assemblies.

This section lists the foreseeable documents, and type of documents implemented by the THEMIS team (including a description of the engineering data captured in each document). The purpose of this list is to ensure that all data is captured but not needlessly duplicated. The list also provides an approximate schedule for document 'release or sign-off.' After release, a document or drawing is considered "frozen," formal configuration control is initiated, and changes to released documentation must be tracked and approved as described in Section 3.0.

All released UCB mechanical drawings will be posted on a configuration accounting system using PDMWorks™. The PDMWorks™ accounting process is further described in Section 3.0 of this document.

Other engineering data in the form of released documents, schematics, block diagrams, drawings, tech memos, reference documentation and minutes from technical meetings are posted on the THEMIS public ftp site (ftp://apollo.ssl.berkeley.edu/THEMIS/). All System Change Notices (SCNs), Engineering Change Notices (ECNs), and Problem Failure Reports (PFRs) are also posted on the ftp site. Folder structure on this site is by WBS number.

2.2.1 Management and Systems Documents

Management and Systems Documents include overall Baseline Development data, Technical Memos, Action Items and Released Documents.

2.2.1.1 Baseline Development

Baseline documentation includes, but is not limited to, sketches, system/subsystem block diagrams, concept studies, write-ups of baseline design discussions, informal trade analyses, test documentation, and any other documentation that makes up the design baseline. Baseline information is posted continually on the THEMIS public ftp site and is formally captured at major milestones in project review presentations.

2.2.1.2 Technical Memos

Tech memos are technical discussions, trade studies, or analyses of interest to other parties. Tech memos are posted on the public ftp site.

2.2.1.3 Action Items

An Action Item List is maintained to track major project Requests for Action (RFAs) or Recommendations. The THEMIS Project Manager is responsible for updating the list after major project reviews. Every action item is identified by the date and event assigned, a short description of the item, scheduled resolution date, the responsible person, and an indication of whether the item is currently open or closed. For Peer Reviews, only the Project Manager can close an action

after a resolution between the cognizant engineer and review member is obtained. For Mission Reviews, the Review Committee chairman or the review member must concur with the response to close an action. Peer Review Actions are listed and tracked on the public ftp site. Mission Review Actions are listed and tracked on Action Item Management System (AIMS).

2.2.1.4 Released Documents

Released Documents are formal project documents generated for the purposes of outside review and oversight, or to convey substantial information within the institution, to a vendor or to a subcontractor. Released documents are posted on the public ftp site, as well as printed, signed and kept in binders. All released documents include a Cover Page, Signature Page, Revision History, List of TBDs, Table of Contents, and Document Body. The Document Body includes the Scope, List of Applicable Documents, Objectives, Revision Policy, and applicable sections relevant to the specific document.

The list of foreseeable system-level released documents is provided below and will be updated as necessary. Released Documents are numbered to indicate the project (THM-), the level (SYS-) and a sequential number. For example, the first released document is numbered THM-SYS-001. The Mission Systems Engineer assigns the sequential number at request of the cognizant engineer. See Appendix A for the UCB THEMIS Numbering Scheme.

2.2.1.4.1 Mission Requirements Document (MRD)

The MRD documents all Level 1,2 and 3 mission requirements. After the System Requirements Review (SRR), this document is put under configuration control at UCB. Any change to the document requires a line item in the Change Log and sign-off by the cognizant engineer and Mission Systems Engineer (MSE). See *THM-SYS-006 Systems Engineering Management Plan* for further description on requirement analysis, tracking and control.

2.2.1.4.2 Contamination Control Plans

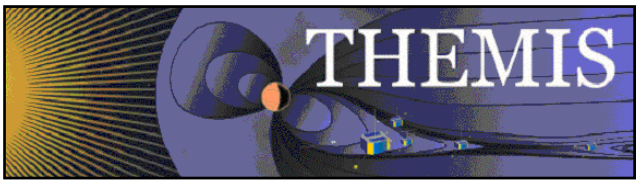
The THEMIS Contamination Control Plans describe the contamination requirements, methods and procedures for three different aspects of contamination on the mission – Magnetics, Electrostatic Cleanliness, and molecular/particulate Contamination. Changes to these documents require approval by the Control Boards described there-in and the MSE.

2.2.1.4.3 Systems Engineering Management Plan (SEMP)

The Systems Engineering Management Plan describes the THEMIS systems engineering process including the requirement process, verification plans and resource tracking. Changes to this document can be made only by the MSE.

2.2.1.4.4 Configuration Management Plan (CMP)

The Configuration Management Plan identifies and describes the overall polices and methods for configuration management during the system and development life cycle phases. Specifically, it addresses configuration identification, control, accounting and verification. UCB and Swales have separately controlling, compatible Configuration Management Plans.



2.2.1.4.5 Interface Control Document (ICD)

The Interface Control documents ensure mechanical and electrical compatibility between the instrument and the spacecraft and include a detailed description of all mechanical, thermal and electrical interfaces. A working version of the ICDs are used during Phase B prior to PDR and marked preliminary. The ICDs are signed off (by Mechanical Leads, Systems Engineers and Project Manager) and put under configuration control at UCB. Any changes to the document are done through the MSE and require notification of everybody on the distribution list. Hardware changes should be made only after the interface change has been reviewed and a new version of the document has been released by the MSE. Mechanical ICD drawings are worked directly between the Mechanical Leads at UCB and Swales and signed off prior to any flight build.

2.2.1.4.6 Performance Assurance Implementation Plan (PAIP)

The Performance Assurance Implementation Plan (PAIP) includes: quality assurance plans, reliability demonstration plans, risk identification, mitigation and contingency plans, safety precautions, procedures for processing problem failure reports, and, as appropriate, software assurance plans. Specifically, the plan:

- defines all internal roles and responsibilities related to quality assurance issues and activities including the appropriate chain of authority for issues such as design changes, parts or materials problems, discrepant or non-conforming hardware or software, and test malfunction;
- identifies specific reliability concerns, identification of mission critical failures, and the steps planned to mitigate risk (such as accumulating a hundred hours of failure-free operation at the satellite level prior to the start of environmental testing); and
- describes the THEMIS safety program developed to meet the system safety requirements stated in the launch range safety regulation EWR 127-1 for the Eastern or Western Range, including a description of the system down to the subsystem level with a preliminary assessment of the system's compliance with the applicable safety requirements.

All institutions responsible for flight hardware (CETP, TUBS, and Swales) provide complementary PAIPs, which are reviewed at UCB by the Mission Assurance Manager (MAM), and delivered to NASA. The PAIP is signed off by all parties prior to PDR. Subsequent changes can be made by the MAM only.

2.2.1.4.7 Performance & Environmental Verification Plans

Performance & Environmental Verification Plans assure the satisfaction of requirements by providing a list of specific test or analyses planned to verify successful performance of the flight system. The Goddard Space Flight Center's General Environmental Verification Specification for STS and ELV Payloads, Subsystems, and Components (GEVS-SE), is used in part to develop these plans. System environmental verification (thermal-vacuum, dynamic and Electromagnetic Compatibility /Electromagnetic Interference, (EMC/EMI), vibration, radiation, etc.) will be documented in a project-wide plan with input from all organizations. Lower level verification and qualification test plans and procedures for all flight end-items will be released and controlled independently by UCB and Swales.

2.2.1.4.8 Project Safety Data Packages

Safety data packages are submitted to the launch vehicle and/or the launch site to show compliance with their safety requirements. Safety information provided will be in accordance with the Eastern and Western Range Safety document, EWR 127-1. All hazardous operations, as well as the procedures to control them, are identified. As the principal interface with the Delta II Launch Vehicle, Swales is responsible for these documents.

2.2.1.4.9 Design Review Presentations

Design Review presentations are produced for each major THEMIS subsystem, formally reviewed, and released at major projects reviews throughout the project. The specific format of the presentation is left to the responsible engineer, however the following information should be included and presented to the Review boards.

- *Subsystem Requirements* – all necessary technical and mission requirements for specific functional areas, requirements on or from other functional areas and subsystems, as well as essential physical constraints.

- *Subsystem Description* – initial baseline for the subsystem, where functions are specified in a descriptive manner and qualified by performance parameters. When approved during review, this section establishes the functional baseline for the overall system, subsystem, or equipment. The design of a system or subsystem and its operational and support environments should also be described.

- *Interface Description* – primary interface characteristics of the subsystems. For mechanical subsystems this includes but is not limited to the physical envelope definition for all configurations, mounting interfaces, mass properties, mechanical safety constraints, and ground support and/or handling fixtures. For electrical subsystems this includes but is not limited to power specifications, usage, and dissipation, ground support and data interfaces.

- *Test Requirements Description* – scope of qualification and verification testing for a subsystem, including test organizations and responsibilities, specific requirements, and test activities schedule. Review of this section will ensure that sufficient tests are included so that all required performance characteristics and requirements can be verified.

- *Test Program Results* – overview of all prototype and flight unit testing, including a general description of the test procedure, pass criteria and results. Actions in terms of subsequent testing or analysis taken in response to specific tests should also be included.

2.2.2 Electrical Documents

Electrical documents include Board Schematics, FPGA Designs, Assembly Procedures, Layout Notes and Electrical Parts List.

2.2.2.1 Schematics

When necessary or useful, draft schematics are posted on the THEMIS public ftp site. Prior to any flight board build, schematics are released and posted on the public ftp site. All flight schematics are numbered with the project (THM-), the assembly (i.e. BEB, DFB-, DCB-), a

schematic identifier (SCH-) and a sequential number. For example, the first released schematic of the Boom Electronics Board should be THM-BEB-SCH-001. The three- letter designator for each assembly is provided in Appendix A. The flight schematic is printed and marked as *RELEASED* prior to the layout going to a board house. Changes to boards during assembly or testing are redlined on the *RELEASED* schematic and kept with a Hardware Traveler that stays with each board.

2.2.2.2 Parts List

The Electrical Flight Parts inventory is maintained on the THEMIS public ftp site. Prior to ordering a part, the Parts Engineer fills in the Electrical Parts List fields (Company, Military PN, Generic PN, Type, Value, Tolerance, Description, Date Ordered, Date Received, Tracking Number). Request for changes to or number of any part must be made through the Parts Engineer who is the only person who has the authority to change the Parts List.

2.2.3 Mechanical Documents

Mechanical documents include Drawings, a Mechanical Parts List, and Materials and Processes list.

2.2.3.1 Drawings

Mechanical drawings are maintained on the PDMWorks™ Solid Works database with drawing field information. All drawings follow a numbering scheme that provides the project (THM-), the assembly (i.e. ESA-, SST-, IDP-), the type of drawing (i.e. ICD-) and a sequential number. For example the first ICD drawing for the Instrument Data Processor is THM-IDP-ICD-001. The three-letter designator for each assembly and type of drawing is provided in Appendix A. For flight build, the drawings are printed and marked as *RELEASED* when sent to the machine shop. Changes to drawings during build are redlined on the *RELEASED* drawing and kept with a Hardware Traveler that stays with each assembly.

2.2.3.2 Mechanical Parts List

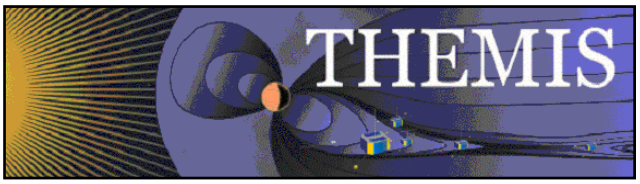
The mechanical parts list is maintained for each assembly.

2.2.3.3 Materials List

The THEMIS Material List is maintained by the Mission Assurance Manager to ensure only proven flight-worthy materials for the predicted flight environment and contamination requirements are used. This list is in compliance with the MIDEX requirement to maintain materials lists and usage records for inorganic, metallic, polymeric materials, lubricants, and processes.

2.2.4 Software Documents

The following documents are planned for the UCB software development process:



File	Title
thm-fsw-001	THEMIS Instrument FSW System Requirement Specification (SRS)
thm-fsw-002	Deleted (Instrument FSW Specification)
thm-fsw-003	THEMIS Command and Telemetry List (ctm.xls)
thm-fsw-004	THEMIS Instrument FSW Development Plan
thm-fsw-005	THEMIS Instrument FSW Performance Calculations
thm-fsw-006	THEMIS Instrument FSW Operation Notes

All software documents are under control of the FSW Engineer and kept on the THEMIS public ftp site.

3.0 Configuration Control and Accounting

Configuration Control and Accounting is the process through which the project controls the revision of a mechanical drawing, ensures a formal approval process for changes, and maintains the history of the revisions through institutional archives. This section describes in detail the THEMIS PDMWorks™ engineering database, and the methods through which the THEMIS team will classify, approve or disapprove, release, implement and confirm changes to agreed specifications and baselines.

3.1 Configuration Accounting – PDMWorks™

PDMWorks™ is a commercially available Product Data Management system contained within SolidWorks. All UCB mechanical drawings on THEMIS are created in SolidWorks. The PDMWorks™ database will provide configuration accounting of mechanical drawings as well as released documents and schematics. Configuration accounting provides traceability from the released design into and through the fabrication phase; traceability, verification and inspection of parts as fabricated and assembled; and identification of non-conformance and corrective actions during fabrication and testing phases.

3.1.1 Database Structure

The database follows the single point SolidWorks file structure. This means that each piece of information is stored in only one file. Any other file that needs that piece of information must reference the file where the information is stored rather than copy the information itself. This creates external references and ensures that any change made to one file is updated on all associated files.

3.1.2 Database Control

Several functions are required to properly maintain the drawings on the database. First, they must be stored securely, so that unauthorized changes cannot be made to the files. Second, they must be made readily available both to people who need to use them and to people authorized to change them. Third, access to the file for revision must be controlled in order to prevent two people changing the same file concurrently. Fourth, they must pass a review process in which responsible authorities can review content and any revisions. Fifth, they must retain with them a ‘person responsible’ trail, in order to ascertain accountability in event of a review, or just to trace

people involved with the file in order to ask questions about the information in the file. These functions are covered below.

3.1.2.1 Security

The PDMWorks™ database is password protected. All users can access the database using their username and password.

3.1.2.2 Controlled Access – Viewing, Adding and Deleting Documents

The PDMWorks™ system provides permissions. Permissions are set regarding who may see or alter files. Permissions are granted to either individuals or groups and can be Read access, Write access or both.

Read access allows a user to see the drawings, copy them to their local drive and open them. Users with Read Access only cannot take ownership of the files or check them back in.

Write access allows users to take ownership of drawings, check them back into the database, and optionally delete them. The owner of a drawing has the authority to change the drawings and check it back in. Only one person can have ownership of a drawing at any one time. A drawing is locked whenever someone has ownership, protecting any user, other than the owner, from checking in a modified version.

3.1.2.3 Controlled Revisions – Editing a Document

The PDMWorks™ system provides automated revision control and history tracking. Revision numbers are established during installation and the scheme is maintained by the administrator. Revision numbers can only go forward, never backwards. Each revision of the drawing is kept in the database so any version is available throughout the project. Anytime a document is copied from the database, modifications are made, and the document is checked back in, the revision number is automatically incremented.

3.1.2.4 Review Process

It is the responsibility of each cognizant engineer to be aware of the information on the THEMIS database and ensure that the most recent information is being used in design and development. For major changes, the Mechanical Lead will notify the appropriate engineers through the use of Engineering Change Orders. In addition, on-going peer reviews and formal reviews are held throughout the design process for outside review and oversight purposes. See the THEMIS Systems Engineering Management Plan for more about the review process.

3.1.2.5 Accountability

The PDMWorks™ system maintains a log of all persons responsible for any change, addition, or deletion to the database.

3.2 Change Approval/Disapproval

Formal change approval/disapproval is required for major system changes to control the technical baseline, ensuring the overall configuration will be protected from uncoordinated and unauthorized change. Major system changes include baseline changes resulting from the

identification of problem areas, changes in requirements or interfaces, and changes to resource allocations. The formal change process involves an Impact Assessment (IA) followed by a formal approval process. The IA is attached a System Change Notice (SCN) and submitted to the Configuration Control Board (CCB) for approval. The MSE controls and monitors the documentation, review, and approval of all system design changes. Changes that impact subsystems across institutions (i.e affects Swales Probe Bus subsystems and UCB Instruments) require tracking in the Project-wide SCN system. Changes that impact subsystems within an institution (i.e. affects Instrument Data Processor and Instrument) require tracking in an institutional Engineering Change Request/Engineering Change Notice (ECR/ECN) system. Each aspect of this change process is described in the following sections below.

3.2.1 Impact Assessment (IA)

Technical design descriptions, analyses, models, and trade studies that support a recommended design change are documented in an Impact Assessment (IA). At a minimum, the Impact Assessment shall include rationale for the change (such as reference to a Problem Failure Report (PFRs) or specific analysis as appropriate), a summary the impact of or revised requirements and specification changes. IAs (often in Power Point form) are distributed to appropriate team members as a precursor to a System Change Notice. Although IAs supply supporting rationale and justification for the technical design change, they do not in themselves authorize changes or necessarily reflect current baseline information.

3.2.2 System Change Notices (SCN)

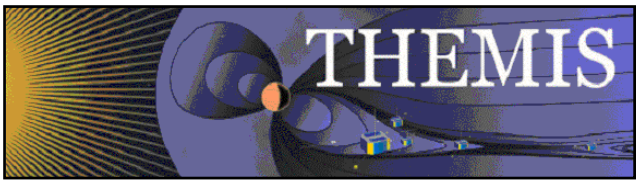
Once the baseline has been established, the change control system is formalized, and significant changes require an SCN. The SCN is used to officially change the Project baseline design, in accordance with NASA procedures. The MSE maintains a log of all SCNs with the status of each notice. Engineering changes made through the SCN require supporting rationale and analysis, usually in the form of one or more impact assessments. The SCN also includes the impact of the change on other elements of the system or subsystem, and estimates of the time and cost of implementation. The SCN prompts a systematic evaluation of the proposed changes to the established baseline. See Appendix B for a sample SCN form.

3.2.3 Problem Failure Reports (PFR)

A PFR is used to officially notify the project of a flight hardware failure. Once a problem is identified, the PFR documents the program impacts, assessing alternative solutions and providing recommended courses of action is necessary. The PFR includes sign-off by the Project Manager, MAM, MSE and cognizant engineer. The MSE maintains a log of all PFRs, the criticality of each item and the date of closure. See Appendix C for a sample PFR form.

3.2.4 Engineering Change Request/Engineering Change Notice (ECR/ECN)

An ECR/ECN is used to notify affected engineers of a major change. The cognizant engineer requesting a change fills out ECN/ECR form marking the Request box, Change Description and Disposition Code (i.e. replacement, rework, etc.). The request goes to people listed in approval box (Project Manager, MSE and MAM), who make sure change is carried out, provide Date effective, mark EC as a Notice (in red), date and sign. See Appendix D for a sample ECR/ECN form.



3.2.5 Configuration Control Board (CCB)

System architecture changes that impact subsystem/system interfaces or resource allocations (Level 3/Level 2) require concurrence by the Configuration Control Board (CCB). The CCB controls and minimizes the impact of design changes, and ensures that authorized changes are implemented efficiently. The CCB reviews all IAs, and SCNs written by development team engineers, and is the final authority for all changes. The CCB consists of the Principal Investigator, the Project Manager, the Mission Systems Engineer (MSE), the Spacecraft Systems Engineer, and the Mission Operations Manager. Affected Team Leads are called in as needed to support evaluation of specific technical changes, depending on the topic. The GSFC Mission Manager has insight to changes at this level. Changes that impact Level 1 *baseline* science/programmatic requirements must include approval by the GSFC Mission Manager. Changes that impact Level 1 *minimum* science/programmatic requirements must include have approval by NASA HQ.

3.3 Subcontractor Control

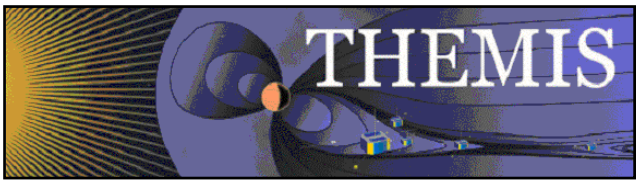
The THEMIS major subcontractor, Swales, will implement configuration management procedures compatible with this Configuration Management Plan and will be able to prove, if requested by the Explorers Program Office, that all end-items are procured or built to approved documentation.

Responsibility for developing baseline documentation for the probe (specifications, schematics, processes, material/parts lists, software programs and test procedures) resides with the Swales PM, Systems Engineers and lead engineers. The mission baseline will be established at specified design reviews or other approved milestones. Maintenance of the baseline documentation is the responsibility of both UCB and Swales with lead engineers responsible for verifying that all approved changes are reflected in the applicable documents, drawings and procedures.

All approved changes to the baseline will be submitted to UCB using a project-level SCN. The implementation of all approved changes will be closely monitored to ensure the control and protection of program costs and delivery schedules and continued compatibility of the technical system. Swales will maintain their own change and problem reporting system (equivalent to the UCB ECN/ECR and PFR systems described above) and report major failures within 10 days as required by the Explorer's Office. System deficiencies that result in not meeting mission level requirements (as documented in the MRD) result in a written request for deviation or waiver submitted to UCB.

4.0 Configuration Verification

Configuration verification is the reporting of data concerning configuration identification, approval status of proposed changes and implementation status of approved changes during all phases of the project. Configuration verification is accomplished by end-item inspection and documentation review at each level of development to determine product compliance with the latest approved THEMIS baseline. The responsibility of the configuration verification rests principally with the MAM. The THEMIS Performance Assurance and Implementation Plan (PAIP) provides the plans for inspection and test, requirements for end-item acceptance, and procedures for numbering and serializing accepted parts, subassemblies, and assemblies.



APPENDIX A: UCB Numbering Scheme

THM_XXX_TTT_NNNR_title

XXX is one of the following assembly designators:

Flight System
SYS Systems (any document that crosses institutions or assemblies, requires signature page)

Instrument Assemblies
EFI Electric Field Instrument
SST Solid State Recorder
ESA Electric Static Analyzer
FGM Flux Gate Magnetometer
SCM Search Coil Magnetometer
IDP Instrument Data Processor Unit

Instrument Data Processing Unit Boards
DAP SST IDPU Board
DFB Digital Fields Board
BEB Boom Electronics Board
ETC ESA/SST Interface Board
DCB Digital Control Board
PCB Power Control Board
FGE Flux Gate Electronics
LPS Low Voltage Power Supply
FSW Instrument Flight Software

Ground System
MOC Mission Operations Center
SOC Science Operations Center
GSE Ground Support Equipment

Ground Based Network
GBO Ground Based Observatory

TTT is one of the following drawing/document types:

Documents (blank)
SCH Electrical Schematics
MEC Mechanical Drawings

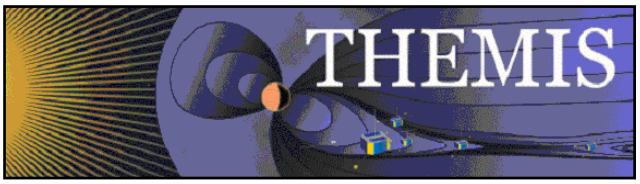
NNN is sequential number assigned by assembly Lead Engineer

R is revision letter

Examples:

PCB Specification	THM_PCB_001B_PCBSpecification
PCB ETU Schematic	THM_PCB_SCH_001A_ETUBoard

(Title should be in document body footer)



APPENDIX B: System Change Notice (SCN) Form

Proposed Change Level (1, 2, 3, 4): 3 **Proposed Change: Replace 1N Thrusters with 5N Thrusters**	**Lead Engineer: Taylor** **Subsystem: Thrusters**

Reason for Change:

Reference Documentation Summary

Subsystem Impacted: (**Bold** indicates an impact)

ACS	C&DH	Mechanical	Propulsion	Booms	IDPU S/W
Battery	EGSE	MGSE	RF Comm	EFI	SST
Bus	Harness	Mission Ops	Solar Array	ESA	SCM
Avionics Unit	I&T	Power	Thermal	FGM	
BUS S/W	Launch Vehicle			IDPU	

Minutes Summary:

Approval

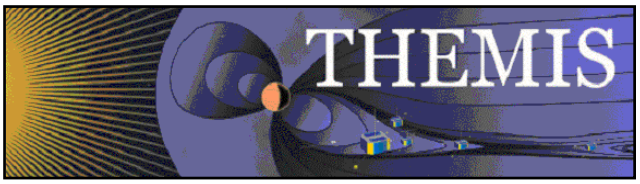
PROPRIETARY YES ☐ NO ☐

Project Manager _____ Date

Systems Impacted Subsystem Lead _____ Date

Distribution

- Subsystem trades (level 4) can be made within the resources of the subsystem. Systems Engineer insight and involvement.
- Trades that impact subsystem/system interfaces or resource allocations (level 3/level 2) require concurrence by the Configuration Control Board (CCB): Principal Investigator, Project Manager, Mission Systems Engineer (MSE), Probe Systems Engineer, Mission Operations Manager and affected Team Leads. GSFC Mission Manager insight.
- Trades that impact Level 1 *baseline* science/programmatic requirements must include approval by Principal Investigator and GSFC Mission Manager.
- Trades that impact Level 1 *minimum* science/programmatic requirements must include approval by NASAHQ.



APPENDIX C: Problem Failure Report (PFR) Form

PFR- Title:

Assembly :	**SubAssembly :**
Component :	
Originator:	**Organization:**
Phone :	**Email :**

Failure Occurred During (Check one √)

□ Functional test □ Qualification test □ S/C Integration □ Launch operations

Environment when failure occurred:

□ Ambient □ Vibration □ Shock □ Acoustic
□ Thermal □ Vacuum □ Thermal-Vacuum □ EMI/EMC

Problem Description

(In this section it is important to document the specific symtoms which exhibited the problem. In the event we see it happen again, we would like to know as much as possible.)

Analyses Performed to Determine Cause

(How do we know how the failure happened? Was it a bad part, bad handling, what?)

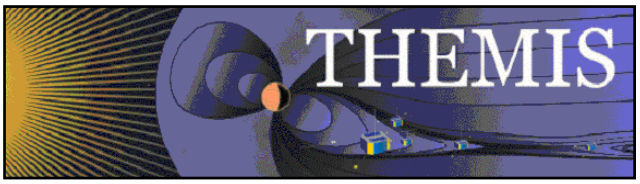
Corrective Action/ Resolution

(How do we fix the unit? And how do we make sure it doesn't happen again?)

Acceptance:
MAM: Ron Jackson_____; MSE: Ellen Taylor_____

PM Peter Harvey_____; Cognizant Engineer_____

Date of Closure_____



APPENDIX D: Engineering Change Request/Notice (ECR/ECN) Form

ENGINEERING CHANGE FORM

ENGINEERING REQUEST	DRAWING/DOCUMENT TITLE	DATE
Request ☐ Notice ☐ Number ☐		

SERIAL NUMBER (If Applicable)	ITEM TYPE	DRAWING/DOCUMENT NUMBER	PROJECT
	Hardware ☐ Software ☐		

REASON FOR REQUEST	REQUESTER	
	Disposition	Date Effective
CHANGE DESCRIPTION (Request/Response)		

DISPOSITION/REMARKS	DISPOSITION CODES
	1) Replace 2) Rework 3) Use As Is 4) See Note/Attachment 5) Change Quantity 6) New Part
COGNIZANT ENGINEER — Class 1 ☐ Class 2 ☐	
APPROVALS (Initials/Date) Lead Engineer _____ Assurance Manager _____ Project Manager _____ Systems Engineer _____	CLASS CODES 1 Major Cost/Schedule 2 Minor Cost/Schedule
	NEXT HIGHER ASSEMBLY _____ _____ _____