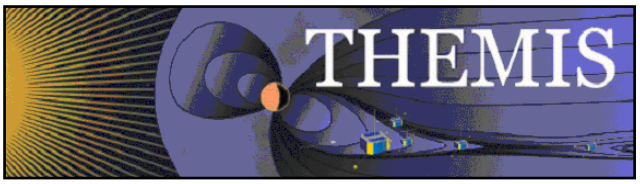

THEMIS
Probe-to-EFI Axial Booms
Interface Control Document (ICD)

thm_sys_109AE_AXB_ICD
Version: AE
Release: 11 March 2005

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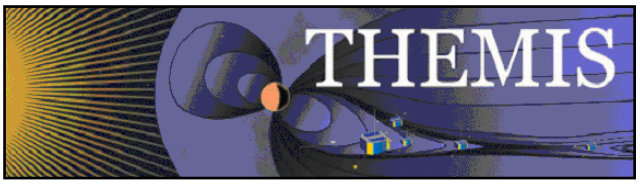

Document Revision Record

Rev.	Date	Description of Change	Approved By
D1	28 AUG 2003	Preliminary Draft	-
D2	13 OCT 2003	Second Draft – Design updates	-
-	31 MAR 2004	Final Release: Updated per ICD drawings. Updated Thermal Sections.	
AA	25 MAY 2004	Baseline: Updated per Swales comments Appended Mechanical ICD Drawings	
AB	09 AUG 2004	Drawing update. Not an official release	
AC	11 JAN 2005	Drawing update.	
AD	24 JAN 2005	Drawing Update	
AE	11 MAR 2005	Removed thermal information which has been relocated to the THEMIS Instrument Thermal Specification, THM_SYS_119_ITH_ICD	

Drawing Revision Record

Rev.	Date	Description of Change	Approved By
AA	5/25/04	THM-AXB-ICD-001 Baseline Release	
AB	8/9/05	Mass Properties Update, Stacer Length Change	
AC	1/10/05	Mass Properties Update, Stacer Length Change	
AD	1/24/05	Stacer Length Adjustment	
AE	3/11/05	Updated and improved thermal information Signature Page; Updated the Swales Systems Lead.	

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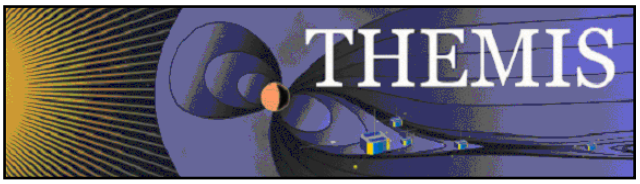

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TBD List

Identifier	Description

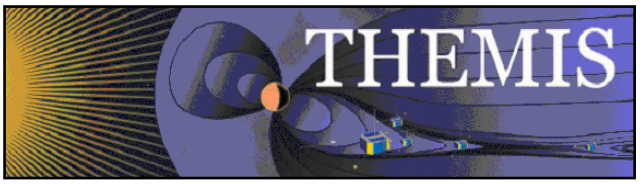
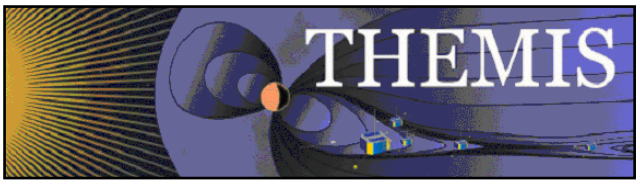


Table of Contents



1. Introduction

This document shall describe the interface between the THEMIS probe bus and the Axial EFI Booms. Each THEMIS probe shall carry 2 Axial EFI Booms. The booms are identical to one another.

1.1 Scope

This Interface Control Document (ICD) will define the flight hardware interface requirements, mechanical and thermal model requirements, data/information deliverables, GSE/Developmental unit requirements, and Verification Matrix with Verification requirements. Functional/Performance requirements are found in the requirements database, and Environmental requirements are found in the Verification Plan and Environmental Specification.

1.2 Component Description

The EFI measures the 3D electric field in the frequency band from DC to 300 kHz. The two Axial EFI instruments are thin tubular sensors suspended on rigid axial booms along the probe spin axis. Data is compiled from the Axial and Radial EFI Booms to complete the electric field survey.

1.3 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 UCB (University of California at Berkeley) and / or SA (Swales Aerospace) indicating who is responsible for providing the data, and a unique reference number.

1.4 Applicable Documents

The following documents include drawings and THEMIS Project policies, and are part of the Interface Requirements. In the event of a conflict between this ICD and the following documents, this ICD takes precedence. All ICD documents and drawings can be found on the Berkeley THEMIS FTP site:
ftp://apollo.ssl.berkeley.edu/pub/THEMIS/

1. THEMIS AXB Interface Drawing, THM-AXB-ICD-001
2. THEMIS Instrument Thermal Specification, THM_SYS_119_ITH_ICD

The following documents are government documents, provided as references for the Interface Requirements.

1. EWR-127-1: Eastern and Western Range Safety Requirements

2. MIL-HDBK-340A: Application Guidelines for MIL-STD-1540; Test Requirements for Launch, Upper Stage, and Space Vehicles
3. MIL-STD-1522A: Standard General Requirements for Safe Design and Operation of Pressurized Missile and Space Systems
4. MIL-STD-1540D: Product Verification Requirements for Launch, Upper-stage, and Space Vehicles
5. NPG 6000.1E: Requirements for Packaging, Handling and Transportation for Aeronautical and Space Systems, Equipment, and Associated Components, dated April 26, 1999

1.5 Units

The drawings contained in this document are dual dimensioned, inches (mm).

2. Mechanical Interface

2.1 Interface Drawing

The mechanical configuration of the Axial EFIs is shown in the AXB Interface Drawing THM-AXB-ICD-001. These include a dimensioned drawing detailing envelope, mounting, and connector locations, CG location, coordinates, thermal surface finishes, and thermal interface reference.

2.1.1 Instrument Envelopes

The envelope specified is the static envelope, inclusive of all instrument hardware and blankets. The actual flight instrument as delivered to Swales is to be within this envelope. Dynamic deflections of the instrument in Launch Mode will be accounted for by Swales as long as the instrument minimum frequency requirement is met. The Axial EFI Boom instrument and overall envelope geometry and dimensions are as shown in the AXB Interface Drawing, THM-AXB-ICD-001.

2.1.1.1 Instrument Stowed Envelope

The Interface Drawing**,** THM-AXB-ICD-001 is the controlling reference that specifies the Launch mode mechanical interfaces.

2.1.1.2 Instrument Deployed Envelope

The Instrument Interface Drawing, THM-AXB-ICD-001 is the controlling reference that specifies the On-Orbit mode mechanical interfaces.

2.2 Coordinate Systems

The instrument coordinate system relative to the instrument interface is shown in the Interface Drawing**,** THM-AXB-ICD-001. All instrument information is defined relative to this Instrument coordinate system.

2.3 Field of View

2.3.1 Field of View

The Instrument Interface Drawing, THM-AXB-ICD-001 is the controlling reference that specifies the On-Orbit mode Fields of View.

2.3.2 Field of Travel

The Instrument Interface Drawing, THM-AXB-ICD-001 is the controlling reference that specifies the On-Orbit mode Fields of Travel.

2.4 Mass Properties

The mass of the AXB shall be measured prior to delivery to within ±0.01kg. The Center of Gravity (CG), as documented in THM-AXB-ICD-001 and referenced to the Instrument coordinate axes described there, shall be predicted through analysis. The stowed and deployed Moments of Inertia (MOIs) of General Instrument, as documented in THM-AXB-ICD-001 and referenced to the Instrument coordinate axes described above, shall be predicted through analysis.

2.5 Mounting

2.5.1 Mounting Method

The Instrument shall be mounted to the Probe Bus via bolt connections as shown in the Instrument Interface Drawing THM-AXB-ICD-001. The Instrument has the electrical connectors as shown in the Instrument Interface Drawing THM-AXB-ICD-001.

2.5.2 Mounting Interface

Mounting hole coordinates, dimensions, orientation, and tolerances are shown in the General Instrument Interface Drawing, THM-AXB-ICD-001. Mounting hole tolerances shall be dimensioned in accordance with ANSI Standard Y14.5M, "Dimensioning and Tolerancing", 1999 or later revisions.

2.5.3 Mounting Hardware

All fasteners shall be provided by Swales. Swales shall provide all shims as required to meet alignment requirements.

2.5.4 Mounting Surface Requirements

2.5.4.1 Flatness

The mounting surface of the instrument shall be fabricated to a flatness tolerance of 0.002 inches or less to ensure the required electrical and thermal contacts as well as the required alignment accuracy. The Probe Bus mounting surface shall be flat to the

tolerance 0.003 inches or less. Instrument mounting surface characteristics shall be documented in the Instrument Interface Drawing THM-AXB-ICD-001

2.5.4.2 Surface Finish

The mounting surface of the instrument shall be fabricated to a surface finish of 32 micro-inches RMS or less to ensure the required electrical and thermal contacts as well as the required alignment accuracy.

2.5.5 Mounting Location

2.5.6 Each axial boom will be mounted in the central tube as shown in THM-AXB-ICD-001

2.5.6 Drill Templates

No drill templates will be required. All Axial EFI Boom interfaces will match if all conditions of this specification are maintained.

2.5.7 Probe Mounting

2.5.7.1 Orientation During Integration

Instruments shall be capable of being installed/removed with the Probe Bus X/Y axes horizontal.

2.5.7.2 Mounting Impacts

The Axial EFI Boom shall be capable of being removed during ground operations without degradation, damage or disqualification of the flight hardware with the understanding that removal would require major disassembly of the spacecraft. Note the Axial EFI Boom Assembly will protrude through the deck holding the Solar Panels.

2.6 Alignment

2.6.1 Alignment Responsibilities

Swales is responsible for aligning the instrument to the bus. The Instrument is responsible for aligning the sensing elements to the interface plate.

2.6.2 Alignment Requirements

The instrument shall be placed relative to the bus coordinate system within the tolerances shown in THM-AXB-ICD-001. The Alignment method shall be bolt-hole tolerances.

2.7 Mechanisms

2.7.1 Axial Boom Deploy Mechanism

Each boom has a deployment mechanism that is actuated by a frangibolt within the assembly. The stowed force along the Z Axis of each boom, as shown in the Instrument Interface Drawing THM-AXB-ICD-001, is approximately 30 lbs. Each boom will deploy from the upper and lower ends of the boom tube, respectively. Deployment is a one time operation.

2.8 Access To Instrument

2.8.1 General Access

All items to be installed, removed, or replaced at the Probe Bus/Carrier level shall be accessible without disassembly of the item.

2.8.2 Specific Access

The following table provides a list of test connectors, contamination covers, and any other I&T equipment that must be installed or removed during integration, environmental test or at the launch site.

Table 2.8.2: Access Requirements

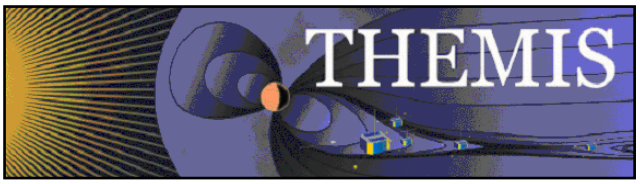
Item	Last Access	Function
AXB Boom Restraint	Launch Site prior to Probe Carrier Assembly Integration	Provides safety guard for inadvertent axial boom deploy
AXB Boom Simulator	Swales: Instrument Integration	Provides electrical test of boom deploy

Test Items: All items to be removed prior to test shall be tagged with a red tag stating, “REMOVE BEFORE TEST”. All items to be installed prior to test shall be tagged with a green tag.

Flight Items: All items to be removed prior to flight shall be tagged with a red tag stating, “REMOVE BEFORE FLIGHT”. All items to be installed prior to flight shall be tagged with a green tag.

2.8.3 Mechanical Test Instrumentation Access

The Instrument shall accommodate mounting area and access to temporarily installed acceleration sensors and supporting hardware for purposes of monitoring accelerations during Instrument, Probe Bus, and Probe Carrier Assembly ground test.



3. Thermal Interface

Thermal interface information has been transferred to Ref 11 THEMIS Instrument Thermal Specification, THM_SYS_119_ITH_ICD

3.1 Thermal Design

This section has been moved to Reference 11.

3.2 Thermal Design & Analysis Responsibilities

This section has been moved to Reference 11.

3.3 Heat Transfer

This section has been moved to Reference 11.

3.4 Power Dissipation

The nominal and maximum power dissipation is provided in THM_SYS_009. Power levels used in thermal modeling are given in Reference 11

3.5 Temperature Requirements

This section has been moved to Reference 11.

3.6 Temperature Monitoring and Control

This section has been moved to Reference 11.

3.7 Contamination Control

This section has been moved to Reference 11.