TIDI Instrument
Specific Instrument Interface
Specification

7363-9049 b

11/8/96 VB Second Draft (First Draft + KJH's comments)

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REVISION LOG

This log identifies the portions of this specification revised since the formal issue date.

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TIDI SPECIFIC INSTRUMENT INTERFACE SPECIFICATION

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TIDI SPECIFIC INSTRUMENT INTERFACE SPECIFICATION

Section 1.0
General Information

TECHNICAL CONTENT APPROVAL

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1.0 GENERAL

This specification details the electrical, mechanical, thermal, and environmental interfaces between the TIMED Doppler Interferometer (TIDI) instrument and the TIMED spacecraft where the interface is not already defined by the TIMED General Instrument Interface Specification (GIIS). The structure and section numbering of the GIIS and this document are correlated. Because the SIIS is a supplement to the GIIS, the SIIS's section numbers are not consecutively numbered. The GIIS requirements apply, unless amended in the corresponding sections of this document. All instrument-specific interfaces shall be documented in this specification. Note that this TIDI SIIS taken together with the TIMED GIIS and the TIMED Component Environmental Specification form the TIDI Interface Control Document (ICD).

1.1 PURPOSE OF DOCUMENT

This document specifies the interface of the TIMED spacecraft and the TIDI Instrument. This specification assumes interface conformance with the GIIS and shall document unique or specific information and exceptions to the GIIS.

1.6 DOCUMENT CONFIGURATION

1.6.1 Update and Change Control

This document represents the current definition of the interface characteristics between TIDI and the TIMED spacecraft. After formal release, this document shall be revised only through the formal change control procedures as described in the TIMED Configuration Management Plan.

1.7 DELIVERABLES

In the context of this SIIS, the term "deliverable" means an item to be provided by the IDT to support testing and performance verification of the instrument after its arrival at APL. Most of the testing will be carried out by the IDT.

The TIDI Instrument Design Team (IDT) shall deliver items for, or in support of, spacecraft integration. Ground support equipment (GSE), consisting of hardware, software and procedures, shall be shipped with or prior to the delivery of flight hardware. Safety rules, handling constraints and procedures, analytical models, analyses, drawings, test plans and procedures, test results, etc., shall be required prior to instrument delivery or as specified in the SIIS.

The TIDI IDT shall provide the items listed in Table 1.7-1.

TABLE 1.7-1

TIDI INSTRUMENT DELIVERABLES

1. TIDI instrument with flight software;

2. Sealed instrument case (as required);

3. Shipping container (as required);

4. Red-tag items;

5. Green-tag items;

6. Handling fixtures;

7. Electrical GSE for
   a. Stand-alone testing of the TIDI instrument prior to integration with the spacecraft; and
   b. Command and telemetry readout via the Missions Operation Center (MOC) during spacecraft integration.

8. Interface control drawings;

9. Written Procedures, which shall address:
   a. Instrument transport, handling, and storage procedure;
   b. Special mounting concerns;
   c. Bench test procedure;
   d. Pre-launch close-out procedure; and
   e. Spacecraft integration and alignment procedures;

10. Acceptance test data, consisting of:
    a. Electrical test and inrush current data; and
    b. Environmental test data.

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TIDI SPECIFIC INSTRUMENT INTERFACE SPECIFICATION

Section 2.0
Electrical Interface

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2.0 ELECTRICAL INTERFACE REQUIREMENTS

2.3 MAIN AND SURVIVAL POWER

APL shall provide the TIDI instrument with a separate operational heater relay.

2.3.4 Fusing

The minimum fuse size for the TIDI instrument is 1.5 Amperes.

2.3.7 Main Bus Component Power Dissipation

The TIDI instrument average power dissipation by assembly for each instrument operating mode is given in Appendix E, Table E-1. The TIDI instrument peak power dissipation by assembly for each instrument operating mode is given in Appendix E, Table E-2. The TIDI orbit average power by orbit mode is given in Appendix E, Table E-3. An orbit mode is defined as a combination of instrument modes operating over an orbital period. Orbit modes are defined in an attempt to obtain a quantitative calculation of orbit average power, daily data rates, etc. Several orbit modes may be defined. For example, an instrument may enter the "calibration instrument mode" for ten minutes every few days. A "calibration orbit mode" can then be defined which includes ten minutes of the "calibration instrument mode" and ninety minutes of the "science instrument mode." In this manner, an orbit-averaged power can be calculated, and the spacecraft design team will get a handle on the range and frequency of orbit average and peak powers that must be designed for.

The power profiles for each of the instrument modes for the TIDI instrument are given in Figures 2.3.7-1 through 2.3.7-6.

2.3.8 Survival Bus Power Dissipation

The survival heater bus peak (+35 V) and average (cold case) power dissipation are given in Appendix E, Table E-4.

2.5 CONNECTORS

2.5.2 Interface Connectors

The nomenclature for each spacecraft-instrument interface connector, the connector type, keying (if applicable) and the drawing number that details the pinout / harness design are given in Table 2.5.2-1.

TABLE 2.5.2-1

TIDI INSTRUMENT CONNECTOR DESCRIPTIONS

Connector No.	Connector Part No.	Description	Connector Keying	Harness Drawing Number
		Main Power		
		1553 Bus "A"		
		1553 Bus "B"		
		Heater Power (5)		
		Temperature Sensors (5)		
		Pyro Connectors (4)		
		Test Connector		
		Purge Intake (4)		

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TIDI SPECIFIC INSTRUMENT INTERFACE SPECIFICATION

Section 3.0
Command and Data Handling Interface

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3.0 COMMAND AND DATA HANDLING INTERFACE REQUIREMENTS

3.2 TIMED C&DH SUBSYSTEM SERVICES

~~In addition to the services identified within the TIMED GIIS, the C&DH subsystem shall provide the following information to the TIDI instrument: sun angle, terminator crossings indication and oblateness information.~~ [This information to be listed in the GIIS]

3.2.3 MIL-STD-1553 Bus Network Services to Instruments

3.2.3.4 Subaddress Assignment Definitions (R = Receive, T = Transmit)

3.2.3.4.2 Transmit Subaddress Assignments T0 through T31

The TIDI instrument will transmit a 64-bit status word at subaddress assignment T12.

T12 The structure for TIDI Instrument's subaddress assignment T12 is given below in Table 3.2.3.4.2-1.

TABLE 3.2.3.4.2-1

TIDI INSTRUMENT'S REAL-TIME ALIVENESS/MODE WORD STRUCTURE (T12)

Word Bit Position	Number of Bits	Definition

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3.5 SUMMARY OF THE TIDI INSTRUMENT'S DATA REQUIREMENTS

APL agrees to allocate sufficient data handling resources to accommodate data generated by the TIDI instrument at the rates given in Table 3.5-1. The number of relays allocated to the TIDI instrument is also given in Table 3.5-1.

TABLE 3.5-1

SUMMARY OF THE TIDI INSTRUMENT'S COMMAND AND DATA HANDLING RESOURCE REQUIREMENTS

Command requirements	2 Kbytes per day
Daily Average Data Rate	2.494 kbps
Peak Recording Data Rate	2.494 kbps
Peak Real-time Data Rate	2.494 kbps
Number of relays allocated to TIDI	**<TBD>**

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TIDI SPECIFIC INSTRUMENT INTERFACE SPECIFICATION

Section 4.0
Thermal Interface

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4.0 INSTRUMENT THERMAL INTERFACE REQUIREMENTS

This section contains the thermal interface requirements for the TIDI instrument and TIMED spacecraft. The thermal control responsibilities, concepts, and high level thermal interfaces (e.g. panel control temperatures and gradients, baseplate average power density limits, thermal gasket interface, heater bus information, etc.) are given in the TIMED GIIS. Much of the detailed thermal interface information (e.g. heater, thermostat, temperature sensor, thermal blanket, thermal control coatings, connector locations, etc.) is given in the Thermal Interface Control Drawings (Appendix C).

4.2 THERMAL CONTROL CONCEPT

The TIDI instrument consists of six different components, all of which are mounted on the spacecraft's -Z deck. The instrument components are four telescopes, the instrument profiler and an electronic box.

Each of the four identical telescopes are mounted on the corners of the optical bench, located on the spacecraft's -Z deck. Each telescope is covered with MLI blankets, with the apertures and baffle radiators left uncovered on the hot side telescopes. Each telescope is mounted upon a gimbal and supported by a bracket. The bracket is also covered with MLI blankets.

The TIDI profiler is mounted on the upper side of the -Z deck by the +X/+Y corner. There are two TIDI profiler radiators; the CCD radiator and the profiler radiator. The two radiators are co-axial, with the CCD radiator rejecting the CCD heat loads and the profiler radiator controlling the heat loading inside of the profiler enclosure. The CCD radiator will have an earth shield to reduce the heat load from the earth. The radiators are located on the box's +Y-facing side. The profiler is covered with MLI blankets, with the radiators remaining exposed.

The TIDI electronics box is mounted to the underside of the -Z deck.

4.3 MOUNTING INTERFACE

The TIDI instrument will be mounted to different parts of the spacecraft -Z deck. The four telescopes' brackets and the profiler are thermally isolated from the optical bench and the upper side of the -Z deck, respectively. The electronics box is conductively mounted to the underside of the -Z deck. The dimensions of the TIDI instrument and details of its mechanical interface are given in the Mechanical Interface Control Drawings (Appendix A).

4.3.1 Interface Surface

A thermal isolation material will be placed between the TIDI telescopes and optical bench, and the TIDI profiler and spacecraft -Z deck. The TIDI IDT shall provide the isolation hardware. APL shall provide the mounting bolts. A thermal resistance greater than 20 °C/W shall be maintained between each instrument component and its spacecraft mounting interface.

The TIDI electronics box shall be mounted in accordance with the specifications for conductively mounted components given in section 4.3.1 of the TIMED GIIS.

4.3.2 Mounting Interface Temperature Limits

The temperatures to which APL will control the optical bench and -Z panel at the mounting interfaces are defined in Table 4.3.2-1. The TIDI IDT should use these temperatures as boundary conditions for their thermal analysis. Test limits will be addressed in the Acceptance Test Plan.

TABLE 4.3.2-1

MOUNTING INTERFACE TEMPERATURE LIMITS

Mounting Interface	In-spec operating	Survive / Non-op
Optical Bench	-45 to +15 °C	-45 to +15 °C
-Z S/C Panel	-20 to +40 °C	-34 to +60 °C

4.3.3 Mounting Interface Temperature Rate of Change Limits

There is no requirement to limit the TIDI instrument's mounting interface temperature rate of change.

4.3.4 Temperature Gradient Requirements

APL will limit the temperature gradient across the -Z deck to less than 16 degrees C across any diagonal of the TIDI profiler's mounting points. The temperature gradient across the optical bench shall be less than **<TBD>** degrees C across either diagonal.

4.3.5 Power Density Limits

The TIDI electronics box shall have an average power density, over the entire mounting surface, of less than 0.14 Watts per square inch.

4.4 THERMAL CONTROL HARDWARE

All thermal control hardware for the TIDI instrument is documented in the Thermal Interface Control Drawings (Appendix C). The drawings show:

- radiator locations and sizes,
- MLI locations and attach points,
- MLI grounding strap locations,
- heater and spacecraft monitored temperature sensor connector locations,
- operational and survival heater/thermostat locations,
- heater part number and resistance values,
- thermostat part number and set points,
- spacecraft and instrument monitored temperature sensor locations and types,
- thermal control coatings,
- thermal isolation hardware,
- operate, survive, and test temperature specifications for individual box, major subassembly, and critical components.

4.4.1 Heaters/Thermostats

4.4.1.1 Operational Heaters

Power for the operational heaters is supplied by the main bus. The location, size, and designation of the operational heaters and location and designation of the operational thermostats on the TIDI instrument are shown in the Thermal Interface Control Drawings (Appendix C). The schematic which details the electrical hookup of the operational heaters and thermostats, including the heater part number and resistance and thermostat part number, open and close temperatures, etc. for the TIDI instrument are shown in the Spacecraft Harness Drawing (Appendix B). The TIDI IDT is responsible for providing all hardware up to and including the interface connector.

4.4.1.2 Survival Heaters

Power for the survival heaters is supplied by the survival bus. The location, size, and designation of the survival heaters and location and designation of the survival thermostats for the TIDI is given in the Thermal Interface Control Drawings (Appendix C). The schematic which details the electrical hookup of the survival heaters and thermostats, including the heater part number and resistance and the thermostat part number, open and close temperatures, etc. for the TIDI instrument is given in the Spacecraft Harness Drawing (Appendix B). The TIDI IDT is responsible for providing and mounting this hardware up to and including the interface connector.

4.4.2 Temperature Sensors

4.4.2.1 Spacecraft-Monitored Temperature Sensors

The TIDI instrument will have five spacecraft-monitored temperature sensors, each covering the temperature range of -60 to 100 °C. The nomenclature, type, and location of the spacecraft-monitored temperature sensors located on the TIDI instrument is given in the Thermal Interface Control Drawings (Appendix C). The schematic which details the electrical hookup of the spacecraft-monitored operational temperature sensors located on the TIDI instrument, including the electrical part number, wiring information, etc. is given in the Spacecraft Harness Drawing (Appendix B).

4.4.2.2 Instrument-Monitored Temperature Sensors

The TIDI IDT is responsible for providing, mounting, and monitoring any additional temperature sensors required over and above the "spacecraft-monitored" temperature sensors. The nomenclature, type, and location of the instrument-monitored temperature sensors is given in the Thermal Interface Control Drawings (Appendix C).

4.4.3 Radiators

The TIDI telescopes and profiler have thermal radiators located on each of their housings. The thermal radiators will be provided as part of the instrument components, and are the responsibility of the TIDI IDT. The radiator size, location, thermal control coatings, etc. are detailed on the Thermal Interface Control Drawings (Appendix C). The clear fields-of-view are given in TIDI Fields-of-View Drawing (Appendix A).

4.4.4 Thermal Control Coatings

The thermal control coatings are the responsibility of the TIDI IDT. Details regarding the thermal control coating type, thickness, and locations are given on the Thermal Interface Control Drawings (Appendix C). Details of the thermal control coatings will be agreed to by the spacecraft thermal engineer.

4.4.5 Thermal Blankets

The TIDI IDT is responsible for the design and manufacture of all TIDI thermal blankets. Details regarding the thermal blanket sizes and locations, and grounding strap locations are given in the Thermal Interface Control Drawings (Appendix C) and will be agreed to by the spacecraft thermal engineer.

TIDI SPECIFIC INSTRUMENT INTERFACE SPECIFICATION

Section 5.0
Mechanical Interface

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5.0 MECHANICAL INTERFACE REQUIREMENTS

5.1 STRUCTURAL / MECHANICAL

This section contains the mechanical interface requirements for the TIDI instrument and the TIMED spacecraft. Much of the detailed mechanical interface information (e.g. instrument envelope, location of major components, spacecraft interface bolt hole locations and dimensions, spacecraft interface mounting hardware type, locations of spacecraft interface connectors, purge ports, optical cubes, and thermal gaskets, fields of view, GSE access, etc.) are defined in the Mechanical Interface Control Drawings (Appendix A).

5.1.2 Instrument Mounting Concept

The TIDI instrument's mounting concept is shown in the Mechanical Interface Control Drawings (Appendix A).

5.1.3 Reference Coordinate Systems

5.1.3.2 Instrument Component Reference Coordinate Systems

The TIDI instrument's reference coordinate system is defined in the Mechanical Interface Control Drawings (Appendix A). The TIMED spacecraft reference coordinate system is defined in section 5.1.3.1 of the TIMED GIIS.

5.1.4 Instrument/Component Mounting

5.1.4.1 Mounting Interface Description

5.1.4.1.1 Instrument Mounting Locations

The mounting locations on the spacecraft of the TIDI instrument components are shown in the Mechanical Interface Control Drawings (Appendix A).

5.1.4.1.1.1 Instrument Mounting Hardware

Payload instrument enclosures will be mounted with fasteners as shown in the Mechanical Interface Control Drawings (Appendix A).

5.1.4.1.1.2 Instrument Mounting Repeatability

The TIDI telescopes shall be pinned to facilitate realignment (if necessary). The TIDI IDT shall provide details of the pinning requirements within this section.

5.1.4.1.2 Instrument Bolt Hole Locations

The dimensions, sizes and tolerances of the bolt holes on the payload instrument mounting plates are given in the Mechanical Interface Control Drawings (Appendix A).

5.1.4.1.3 Thermal Gaskets and Washers

APL is responsible for providing the thermal gaskets to be placed between the TIDI electronics box and the spacecraft's -Z deck. These gaskets are shown in the Thermal Interface Control Drawing (Appendix C) and the Mechanical Interface Drawings (Appendix A).

The TIDI IDT will supply the Ultem washers to be used to thermally isolate the TIDI telescopes and TIDI profiler. These washers are shown in the Thermal Interface Control Drawing (Appendix C) and the Mechanical Interface Drawings (Appendix A).

5.1.4.1.4 Grounding Strap

The instrument locations to which ground straps will be tied are shown in the Mechanical Interface Drawings (Appendix A).

5.1.5 <u>Mass Properties</u>

5.1.5.1 Mass

The TIDI instrument's mass, itemized by component, is shown in Appendix D, Table D-1.

5.1.5.2 Center-of-Mass Location

The TIDI instrument components' centers-of-mass, both in the launch configuration and after cover ~~ejection~~ opening, with respect to the instrument's coordinate system shall be determined and specified in Appendix D, Table D-2.

5.1.5.3 Moments of Inertia

The TIDI IDT shall provide the flight- and launch-configuration moments of inertia for their instrument in accordance with the guidelines specified in the TIMED GIIS. These are tabulated in Appendix D, Table D-2.

5.1.6 <u>Envelopes and Fields-of-view</u>

5.1.6.1 Static Envelope

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The TIDI Instrument's Mechanical Interface Drawing (Appendix A) shows the TIDI Instrument's static envelope.

5.1.6.2 Dynamic Envelope

The TIDI Instrument's Mechanical Interface Drawing (Appendix A) shows the TIDI Instrument's dynamic envelope.

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5.1.6.3 Integration and Test Access Requirements

The TIDI Instrument Access Drawing (Appendix A) contains a separate sheet for each of the different test configurations required during spacecraft integration and test.

<TBD> shall provide an extension cable to bring the TIDI instrument's test connector to an accessible bracket on the spacecraft. Both the extension cable and the bracket are shown in the TIDI Instrument's Mechanical Interface Drawing (Appendix A).

5.1.6.4 Payload Instrument Fields-of-view

The primary active fields-of-view requirements of the TIDI instruments are contained in the TIDI Instrument Fields-of-View Drawing (Appendix A). The drawing includes location and size of apertures, boresight directions, and fields-of-view extent. The glint-free or clear fields-of-view is also provided as required.

5.1.6.5 Thermal Radiator Fields-of-View

Each of the four TIDI telescopes and the TIDI profiler have thermal radiators. Each radiator's field-of-view is contained in the instrument's Fields-of-View Drawing (Appendix A).

5.1.7 Payload Instrument Alignment Provisions

5.1.7.1 Alignment Position Requirement

APL shall mount each of the four TIDI telescopes on the optical bench such that each telescope base's optical cube is aligned to the star camera's optical cube to within ± 0.5 degrees along each of the spacecraft's X, Y and Z axes.

5.1.7.2 Alignment Knowledge Requirement

APL shall measure the alignment of each TIDI telescope base's optical cube with respect to the spacecraft's optical cube along the X, Y and Z axes to within ±**<TBD>** degrees. APL shall ensure, by analysis, that the post-launch alignment error of each TIDI telescope's base optical cube with respect to the star camera boresight is is less than ± 64 arcseconds (1σ).

5.1.7.4 Optical Alignment Cube Location

The location of each TIDI telescope's optical alignment cube is documented within the TIDI Instrument's Mechanical Interface Drawing (Appendix A).

5.1.8 Mechanisms, Moving Parts, and Dynamics

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The TIDI instrument has the following moving parts: four telescope covers, four telescope gimbals and a filter wheel.

5.1.8.1 Operation

Dynamic forces and torques induced at the component mount by the TIDI components shall be described and recorded within this section by the TIDI IDT and shall comply with the limits specified within the GIIS.

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5.1.8.1.1 Non-recurring Transient Events

The forces, torques, and/or total momentum imparted to the spacecraft by each non-recurring transient event on the TIDI instrument shall be defined within Table 5.1.8.1.1-1.

TABLE 5.1.8.1.1-1

TABLE OF FORCES, TORQUES AND ANGULAR MOMENTUM IMPARTED TO THE TIMED SPACECRAFT FROM THE TIDI INSTRUMENT'S NON-RECURRING TRANSIENT EVENTS

Event	Force* (N)	Torque* (N-m)	Angular Momentum * (kg m^2/s)
Event 1	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$
Event 2	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$
Event 3	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$
Event 4	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$

* Vectors are specified along the axes of the spacecraft coordinate system defined within section 5.1.3.1 of the TIMED GIIS.

5.1.8.1.2 Recurring Forces and Torques (spectra)

Disturbance torques at the component mount generated by the TIDI instrument are specified within Table 5.1.8.1.2-1.

TABLE 5.1.8.1.2-1

TABLE OF RECURRING FORCES AND TORQUES GENERATED BY THE TIDI INSTRUMENT

Maneuver	Force* (N)	Torque* (N-m)
Maneuver 1	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$
Maneuver 2	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$
Maneuver 3	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$
Maneuver 4	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$	$0\hat{\mathbf{x}} + 0\hat{\mathbf{y}} + 0\hat{\mathbf{z}}$

* Vectors are specified along the axes of the spacecraft coordinate system defined within section 5.1.3.1 of the TIMED GIIS.

5.1.8.2 Caging

The TIDI IDT shall list all instrument components requiring caging within this section. The TIDI IDT is responsible for the design, development and operation of any caging mechanism. For mechanisms which do not require caging, the TIDI IDT shall provide an analysis justifying that decision.

5.1.10 Protective Covers (Flight, Red Tag, etc.)

Protective covers (flight and non-flight) associated with the TIDI instrument shall be documented by the TIDI IDT within this section.

5.2 PAYLOAD INSTRUMENT IDENTIFICATION AND MARKING

The TIDI instrument components shall be marked as follows: TIDI telescopes 1, 2, 3 and 4 are marked A300, A301, A302 and A303, respectively; the TIDI electronics box is marked A320, and the TIDI profiler is marked A325. Interface connectors, test points and adjustments shall be clearly labeled. (A3XX-JXX).

TIDI SPECIFIC INSTRUMENT INTERFACE SPECIFICATION

Section 6.0
Navigation and Attitude Control Interface Section
Signature Page

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6.0 NAVIGATION AND ATTITUDE CONTROL

6.1 NAVIGATION ACCURACY

6.1.1 Position Knowledge

6.1.2 Velocity Knowledge

6.1.3 Position and Velocity Reference

6.2 ATTITUDE CONTROL AND DETERMINATION

6.2.1 Attitude Coordinates

6.2.2 Pointing Direction

6.2.3 Attitude Control Capability

6.2.4 Attitude Determination Capability

6.2.5 Attitude Jitter

6.2.6 Attitude Stability

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TIDI SPECIFIC INSTRUMENT INTERFACE SPECIFICATION

Section 7.0
Integration, Qualification, and Field Test Requirements
Signature Page

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7.0 <u>INTEGRATION, QUALIFICATION, AND FIELD TEST REQUIREMENTS</u>

7.1 DELIVERY

7.1.1 <u>Instrument Receiving/Acceptance At JHU/APL</u>

7.2 PRE-INTEGRATION INSTRUMENT INTERFACE TESTING

7.2.1 <u>Initial Electrical Checks</u>

7.2.1.1 Isolation Verification

7.2.1.2 Electrical Power/Signal Harness Check

7.3 INITIAL ELECTRICAL CHECK

7.3.1 <u>Preliminary Electrical Test</u>

7.4 POST-INTEGRATION COMPREHENSIVE PERFORMANCE TEST RESPONSIBILITIES

7.4.1 Electrical Test Procedures

7.4.1.1 Performance Test Procedure

7.4.1.2 Functional Test Procedure

7.4.1.3 Aliveness Test

7.4.1.4 Displays

7.4.2 Mechanical Procedures

7.4.2.1 Crane Requirements

7.5 PAYLOAD INSTRUMENT ACCESSIBILITY

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Instrumenters shall identify the times at which they will need access to their instruments. Type of instrument access, duration, test equipment required and procedures shall be spelled out.

7.6 INSTRUMENT OPERATION AND HANDLING CONSTRAINTS AND HAZARDS

The TIDI IDT shall summarize all constraints and hazards which apply to the handling and operation of their respective hardware.

7.7 LAUNCH PAD REQUIREMENTS

7.7.1 <u>Pad Requirements</u>

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TIDI SPECIFIC INSTRUMENT INTERFACE SPECIFICATION

Section 8.0
Payload Instrument Ground Support Equipment
Signature Page

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8.0 PAYLOAD INSTRUMENT GROUND SUPPORT EQUIPMENT

8.1 GENERAL

8.1.1 GSE Logistics

8.1.1.1 Physical Size / Layout

8.1.1.2 Communication Requirements

8.1.1.3 Power Requirements

8.1.1.4 Grounding Requirements

8.1.1.5 Special Requirements

8.1.1.6 Minimum Distance Drive Capability

8.1.1.7 Faults /Safety

8.2 GSE INTERFACES

8.2.1 Telemetry Interface

8.2.2 Command Interface

8.3 GENERAL DESIGN FEATURES

8.3.1 Power

8.3.2 Identification and Marking

All hardware delivered by the TIDI IDT for integration with the TIMED spacecraft shall be marked with the identification labels given within section 5.2 of this document.

8.3.3 Calibration

The calibration of the GSE shall be the responsibility of the payload instrument provider. Spares, consumables and field replaceable critical components shall be defined and documented in the instrument-specific SIIS.

8.3.4 Documentation

8.3.5 Radioactive Sources

The TIDI instrument requires the use of a radioactive source for calibration purposes. The source's activity is 0.1 millicuries. **The specific procedures for transporting the radioactive material to APL and its subsequent handling in the integration and test facility will be described within this section.**

8.3.6 Thermal Vacuum (TV) Testing

8.4 MECHANICAL GSE

8.4.1 Responsibility for Handling

8.4.2 Mechanical GSE List / Drawings

Mechanical GSE required during shipping, installation, calibration, and testing are listed in each instrument's SIIS. Signed-off, configured drawings of each piece of mechanical GSE shall be included in the instrument-specific SIIS documents.

8.4.3 Design Factors of Safety

8.4.3.1 Proof Test Requirements

8.4.3.2 Instrument Lifting or Attach Points

TIDI SPECIFIC INSTRUMENT INTERFACE SPECIFICATION

Section 9.0
Payload Instrument Contamination and Facility Environment Control
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9.0 PAYLOAD INSTRUMENT CONTAMINATION CONTROL

9.1 GENERAL

9.2 PURGING

9.2.1 Purge Connectors

9.2.2 Purge Gas Purity

9.2.3 Purge Gas Flow Rate

9.3 MATERIALS OUTGASSING

9.4 FACILITY REQUIREMENTS

9.4.1 Facility Cleanliness Requirements

9.4.1.1 Cleanliness Requirements

9.4.1.2 Hydrocarbon Limits

9.4.2 Facility Temperature Requirements

9.4.3 Facility Humidity Requirements

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TIDI SPECIFIC INSTRUMENT INTERFACE SPECIFICATION

Section 10.0
Payload Instrument EMC Control
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10.0 PAYLOAD INSTRUMENT ELECTROMAGNETIC CONTROL INTERFACE REQUIREMENTS

10.1 PROGRAM REQUIREMENTS

10.1.1 Objectives

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APPENDIX A

TIDI INSTRUMENT MECHANICAL INTERFACE CONTROL DRAWINGS

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APPENDIX B

TIMED SPACECRAFT HARNESS DRAWINGS

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APPENDIX C

TIDI INSTRUMENT THERMAL INTERFACE CONTROL DRAWINGS

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APPENDIX D

TIDI INSTRUMENT MECHANICAL PROPERTIES SUMMARY

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TABLE D-1

TIDI INSTRUMENT'S MASS ITEMIZED BY COMPONENT

TIDI Component	Mass (kg)
TIDI Telescope 1	
TIDI Telescope 2	
TIDI Telescope 3	
TIDI Telescope 4	
TIDI Profiler	
TIDI Electronics Box	
TOTAL	

TABLE D-2

TIDI INSTRUMENT TABLE OF MASS PROPERTIES

PROPERTY	COMPONENT	VALUE	
		Launch	Flight
Center-of-mass Location	TIDI Telescope 1 TIDI Telescope 2 TIDI Telescope 3 TIDI Telescope 4 TIDI Profiler TIDI Electronics Box		
Moments of Inertia	TIDI Telescope 1 TIDI Telescope 2 TIDI Telescope 3 TIDI Telescope 4 TIDI Profiler TIDI Electronics Box		

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APPENDIX E

TIDI INSTRUMENT POWER CONSUMPTION

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TABLE E-1

TIDI INSTRUMENT: AVERAGE POWER DISSIPATION , ITEMIZED BY ASSEMBLY AND INSTRUMENT MODE

ID	Element	Average Power Dissipation Per Instrument Mode (W)				
		OFF	STANDBY	DATA COLLECTION	DIRECT CONTROL	DIAGNOSTIC
SUBTOTAL						
Operational Heaters (Cold case)						
TOTAL						

TABLE E-2

TIDI INSTRUMENT: ORBIT-PEAK ELECTRICAL POWER DISSIPATION, ITEMIZED BY ASSEMBLY AND INSTRUMENT MODE

ID	Element	Orbit-Peak Power Dissipation Per Instrument Mode (W)				
		OFF	STANDBY	DATA COLLECTION	DIRECT CONTROL	DIAGNOSTIC
SUBTOTAL						
Operational Heaters (at 35 V)						
TOTAL						

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TABLE E-3

TIDI INSTRUMENT: ORBIT-AVERAGED ELECTRICAL POWER DISSIPATION, ITEMIZED BY ASSEMBLY AND OPERATING MODE

Orbit Mode	Instrument Mode	Period of Instrument Mode	Average Power of Instrument Mode	Orbit-Averaged Power of Orbit Mode (W)

TABLE E-4

TIDI INSTRUMENT SURVIVAL HEATER BUS POWER ALLOCATIONS

Peak Power (+35 V)	Average Power (Cold Case)

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