SWALES AEROSPACE

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EO-1 Spacecraft to Linear Etalon Imaging Spectral Array/Atmospheric Corrector (LEISA/AC) Interface Control Document (ICD)

SAI-ICD-021

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REVISION -

Prepared by:
SWALES AEROSPACE
5050 Powder Mill Road
Beltsville, MD 20705

SIGNATURE PAGE

This is a controlled document. Any changes require the approval of the Configuration Control Board.

Prepared by: _____ 23 Jun 97

Mark Perry/EO-1 S/C Systems Engineer — Date

Reviewed by: _____ 6/24/97

George Andrew/EO-1 Systems Avionics Engineer — Date

Reviewed by: _____ 23 June 1997

Brian Smith/EO-1 Spacecraft Engineer — Date

Reviewed by: _____ 6/23/97

Matt Jurotich/EO-1 Payload Engineer — Date

Reviewed by: _____ 6/23/97

Steve Graham/Lead Engineer (GSFC) — Date

Approved by: _____ 6/23/97

Dennis Reuter/LEISA/AC — Date

Approved by: _____ 6/23/97

Pete Spidaliere/EO-1 Mission Systems Engineer — Date

Approved by: _____ 6/24/97

Mike Cully/EO-1 Spacecraft Manager — Date

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1.0 SCOPE

This Interface Control Document (ICD) defines all interface requirements between New Millennium Program (NMP) technology item Linear Etalon Imaging Spectral Array/Atmospheric Corrector (LEISA/AC) and the other elements of the Earth Orbiter-1 (EO-1) Mission. The ICD documents all interface-related agreements concluded between the technology provider and Swales Aerospace (SAI), the spacecraft contractor.

The purpose of this document is to specify the interface requirements in order to assure compatibility between the equipment furnished by the respective contractors. Changes to this document may be proposed by either party for formal approval by the EO-1 Project Office.

This ICD will serve as the controlling technical document between the LEISA/AC and the EO-1 Spacecraft. This ICD shall apply to all phases of LEISA/AC design, assembly, integration, test, launch and operations. This document is controlled by the Goddard Space Flight Center (GSFC) EO-1 project office.

2.0 APPLICABLE DOCUMENTS

The following documents of the exact issue shown form a part of the ICD to the extent specified herein. In the event of conflict between this ICD and the document referenced herein, the contents of this ICD shall be considered a superseding requirement.

SAI-PLAN-130	EO-1 Integration and Test Plan
SAI-PLAN-138	EO-1 Contamination Control Plan
	Command System Users Handbook - Operations
SAI-SPEC-158	EO-1 Verification Plan and Environmental Specification
AM149-0020(155)	System Level Electrical Requirements NMP EO-1 Flight, Litton Amecom
AM149-0050(155)	Data Systems 1773 ICD, EO-1, Litton Amecom
WARP 735 0026	RS422 to FODB WARP ICD

2.1 REFERENCE DOCUMENTS

GSFC-PPL	GSFC Preferred Parts List (Latest issue)
MIL-M-3810	General Specification for Microcircuits
MIL-S-19500	General Specification for Semiconductors
MIL-STD-1547	Electronic Parts, Materials, and Processes for Space and Launch Vehicles
MIL-STD-975	Standard (EEE) Parts List
MIL-STD-202	Test Methods for Electronic and Electrical Components
MIL-STD-883	Test Methods and Procedures for Microelectronics

3.0 INTERFACE REQUIREMENTS

3.1 INTERFACE DEFINITION

The LEISA/AC experiment is a moderate spatial, high spectral resolution imager. Its output can be used to correct remotely sensed ground image data which has been corrupted by the atmospheric variability.

LEISA/AC consists of a Optics Module and an Electronics Module. The optics module has three camera heads. Each camera head has a 2 D array of 256 X256 IR sensitive pixels operating at near room temperature. The 2 D spatial image is made to vary spectrally in one dimension by means of a Lnear Variable Ethlon (LVE) placed directly over the detector array. The LVE will cover from 6250 to 11700 cm^{-1} (1.6 to 0.85 μ) in a continuous fashion with a resolution of 30 to 40 cm^{-1}. Motion of the S/C causes the image to move with respect to the focal plane, in the direction of the dispersion. In this manner each line of pixels, extending across the detector, is moved along the filter. By timing the frame readout rate, the line of spatial samples can be made to move 1 pixel, permitting sampling of the line in a different spectral band. Continuing the process for all of the 256 line will eventually map the

spectral signature of spatial sample. Water vapor variations can be measured in the 1.6 to 0.86μ band. Although that band can provide some aerosol information, better aerosol information can be determine in 0.76μ O_2 band. To provide this capability a portion of each of the camera head focal planes will have a LVE which is tune to this wavelength.

Each camera will have a 5°X5° field of regard (FOR). The 15° cross track FOR will encompass a 185 Km swath on the ground. Each pixel will sample a 250 X 250 meter spatial area.

3.1.1 INTERFACE FUNCTIONS

The functions provided to the LEISA/AC by the Spacecraft, and conversely, are delineated in the following paragraphs.

3.1.1.1 Spacecraft Interface Functions

The following major interface functions shall be provided by the spacecraft.

a. Transmission of input clock signals via the 1773 bus
b. Transmission of commands via the 1773 bus
c. Provision of Primary Power from 28 VDC power bus
d. Provision of mounting interface for LEISA/AC to spacecraft.
e. Provision of interfaces accommodating mounting, routing, and securing of instrument harness to/ on the spacecraft.

3.1.1.2 LEISA/AC Interface Functions

The following major interface functions shall be provided by the LEISA/AC.

a. Transmission of data to Wide Band Advanced Recorder Processor (WARP) via the RS422 I/F
b. Transmission of telemetry to the EO-1 Attitude Control & Data System (ACDS) via the 1773 bus
c. Provision of mounting interface for LEISA/AC to spacecraft.
d. Provision of mounting interfaces for GSE handling fixture attach points on the LEISA/AC.
e. Electrical GSE and software necessary to integrate and test LEISA/AC.

3.1.1.3 Modes of Operation

The LEISA/AC shall have six modes of operation. They are:

1. Survival
2. Standby
3. Operate
4. Dark Calibrate
5. Sun Calibrate
6. Moon Calibrate

In the Survival Mode no heater or instrument power is supplied. The mounting surface is controlled to be between -10° and +50°C.

In Standby Mode no power is supplied to the instrument. Spacecraft heater power will be supplied to the mounting surface to keep the mounting surface between 0°C and +30°C.

In the Operate Mode the LEISA/AC will be gathering science data. Nine minutes before an observation, the LEISA/AC will enter the operating mode to warm up. During this time the data quality is not guaranteed and the WARP does not collect the data.

The Dark Calibrate mode is used to read the dark current from the detector array. Within two orbits preceding and/or following data taking in the Operate Mode the LEISA/AC will be turned on for 1 sec to do a Dark Calibrate. A nine minute warm-up period is required prior to the dark current read out.

During the Sun Calibrate mode the Spacecraft is slewed in a manner to cause the sun's rays to enter the LEISA/AC calibration tube thereby flooding the focal plane array with sun light. The slew rate,

when the sun is illuminating the focal plane shall be 1°/sec or less. When the sun is in the field of view of the calibration tubes, one second of data will be taken.

LEISA/AC will gather lunar calibration data during the ALI lunar calibration. The LEISA/AC requires the moon to be in the FOV of each of the three detectors. Speed must be less than 1 degree per second, in any direction.

3.2 MECHANICAL INTERFACE REQUIREMENTS

The LEISA/AC consists of 2 units, and RS-422 interface cabling. The Optics Module is mounted on the Nadir Deck of the EO-1. The EO-1 +X axis is parallel to the X_o axis of the LEISA/AC and bisects the LESIA/AC. Its Z_o axis is nadir pointing. The Electronics Module is located in Bay 3. Both modules are mounted such that removal or repairs, of each, are possible while installed on the spacecraft. See Figure 3.1 for the location of the LEISA/AC with respect to the EO-1.

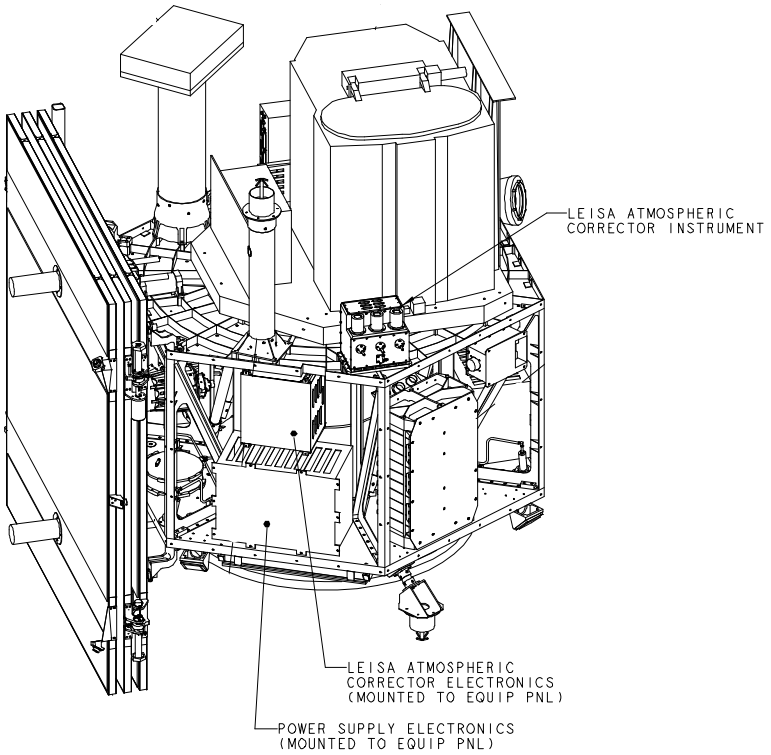

Figure 3.1 Location of LEISA/AC on EO-1

3.2.1 CONFIGURATION

The dimensional drawings of the LEISA/AC Optics Module and Electronics Module are delineated in Figure 3.2 and 3.3. This includes mounting footprints, the location and orientation of electrical connectors, FOVs, access-direction, and purge-line location. The interface control drawing is A0753.

3.2.1.1 Coordinate System

The directions of the orthogonal reference axes are established for the EO-1 spacecraft is shown in Figure 3.4. The LEISA/AC coordinate system is shown in Figure 3.2 and 3.3.

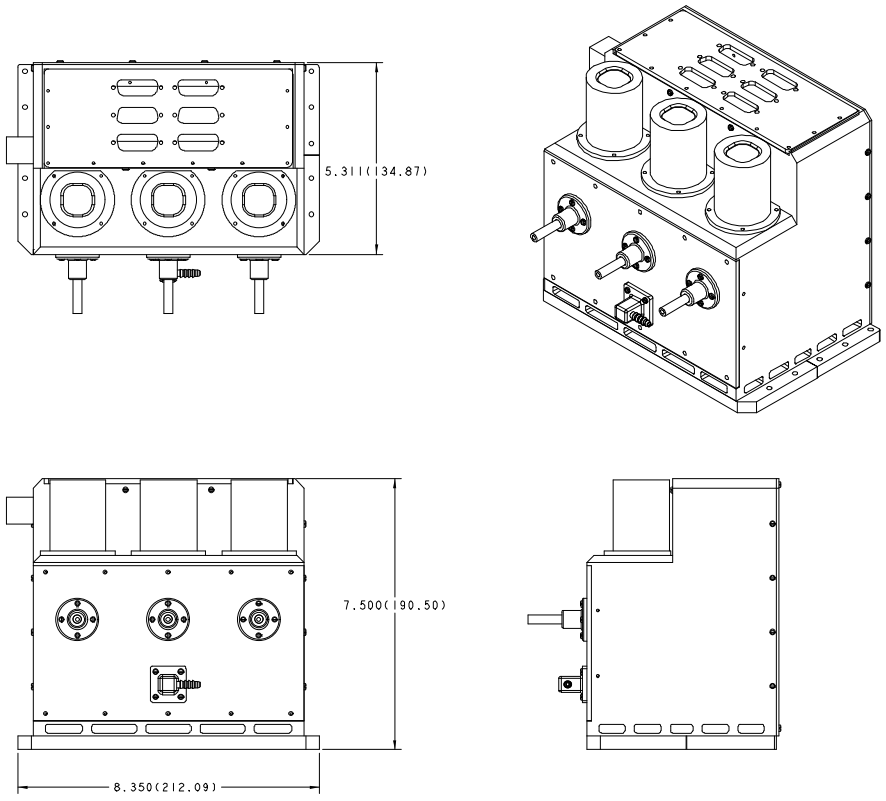

Figure 3.2 LEISA/AC Optics Module

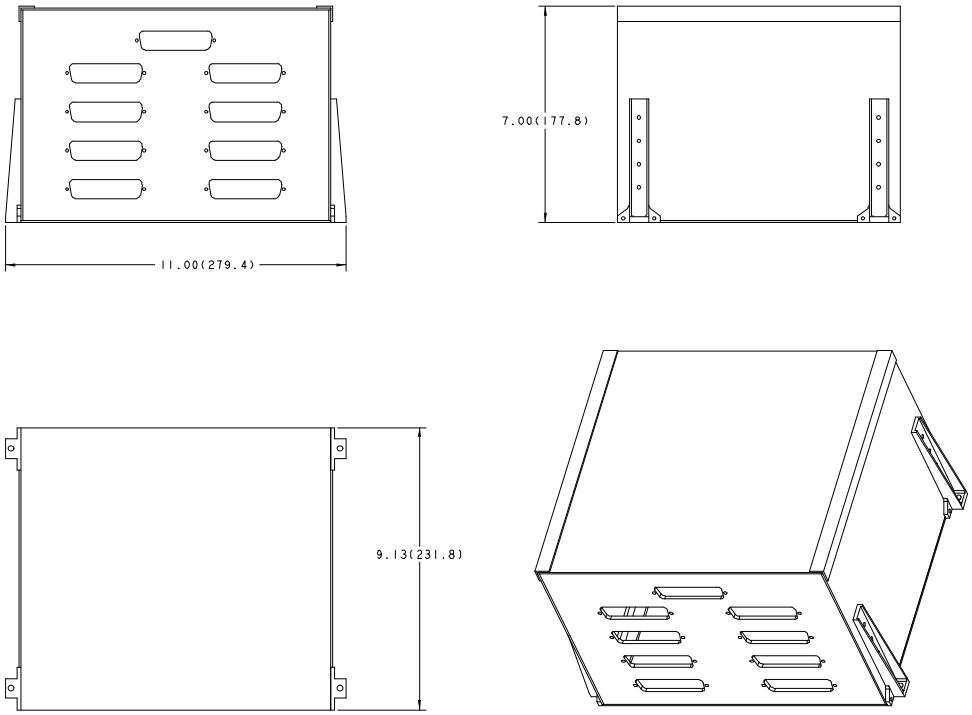

Figure 3.3 LEISA/AC Electronics Module
(connector positions TBR)

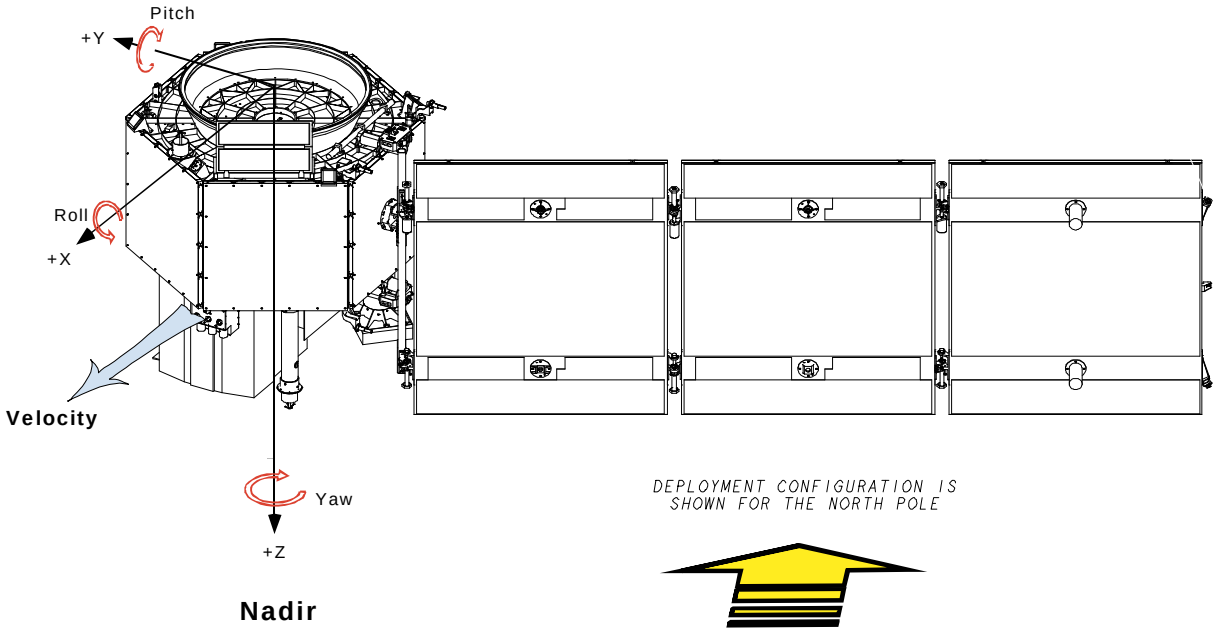

Figure 3.4 EO-1 Coordinates

3.2.1.2 Configuration Drawing

The interface configuration drawing number is A0753.

3.2.1.3 Fields of View

The LEISA/AC shall be located in accordance with the following field-of-view requirements:

a. Each of the LEISA/AC optical heads shall has a field of regard of approximately 5° cross track and approximately 5° along track.

b. The two outside optical heads have the detectors in the focal plane offset by 5° to give a cross track field of regard of 15.03°.

c. As viewed from the first LEISA/AC optical element, in any of the three optical heads, there will be no visible structure inside a field defined by a pyramid whose angles are ± 5 °, measured around an axis parallel to the X_o, and ± 7.5°, measured around the Y_o. The altitude of the pyramid will be parallel to the paraxial ray of the optical head and its vertex may be located any where on the surface of the first element. See Figure 3.5.

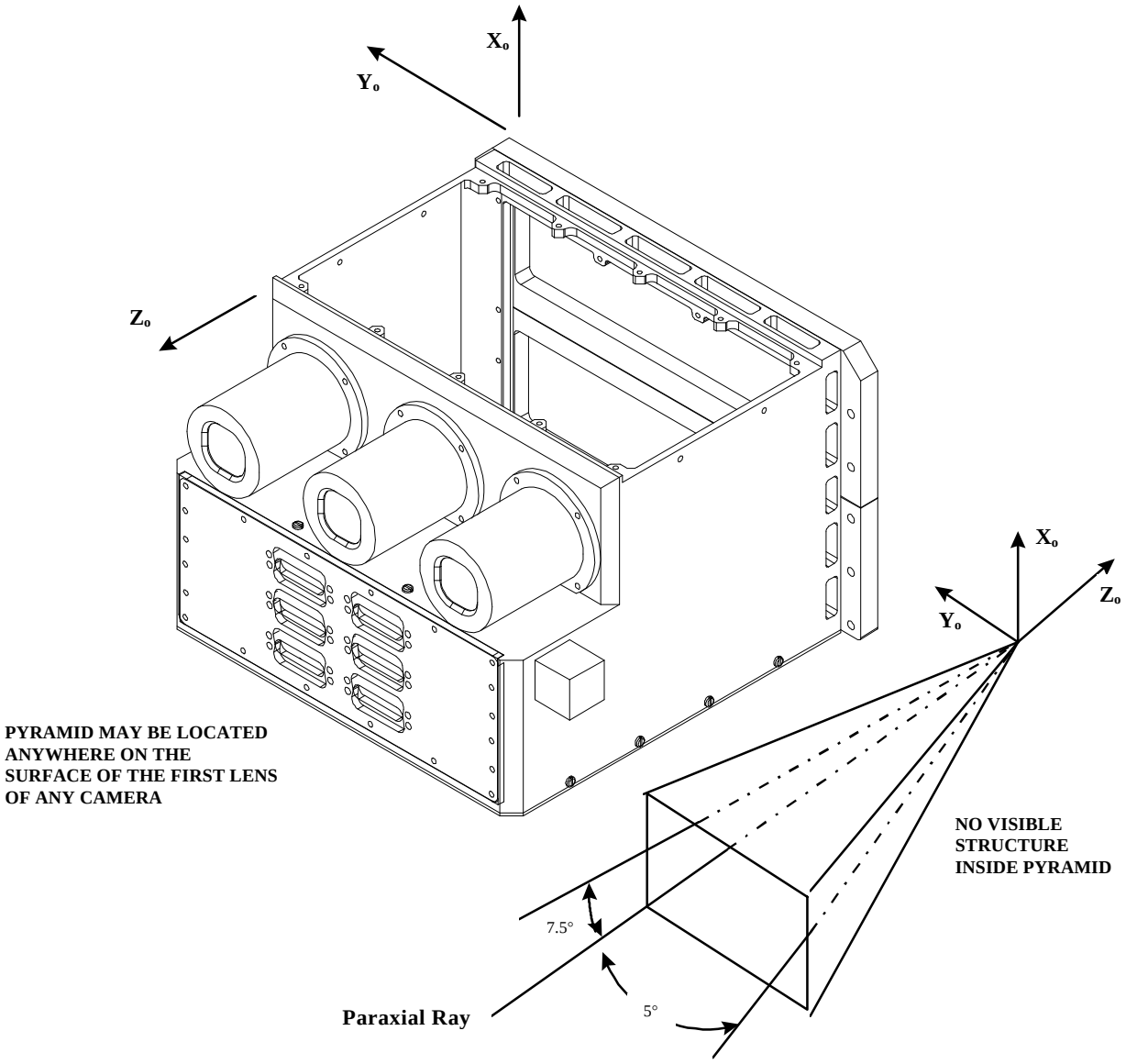

Figure 3.5

3.2.1.4 Mounting Interface

The LEISA/AC units are mounted to the spacecraft on the nadir deck at the points as shown in the ICD Drawing specified in section 3.2.1.2.

3.2.1.4.1 Flatness Specification

The mounting points on the spacecraft shall not be out of plane more than 0.25mm.

3.2.1.4.2 In-Plane Accuracy

The mounting point centerlines shall not change more than 0.25mm from nominal.

3.2.1.4.3 Drill Template

A drill template is not required. The interface configuration drawing contains the tolerances for positioning the bolt holes.

3.2.2 MASS PROPERTIES

Table 3.1 delineates the mass, dimensions, center of gravity (CG), and moments of inertia of each unit or box of LEISA/AC.

TABLE 3.1 Mass Properties

PROPERTY	ELECTRONICS MODULE	OPTICS MODULE
MASS including intra-module harness	5.0 Kg	3.0 Kg
CENTER OF GRAVITY (X, Y, Z)	(4.5, 5.5, 3.5) ±1 inch	(2.5, 4.0, 4.0) ±1 inch

3.2.2.1 Mass

The total weight of the LEISA/AC shall not exceed the value stated in Table 3.1. All changes in mass estimates, including expected growth, shall be reported promptly. The final LEISA/AC total instrument mass shall be measured to an accuracy of 0.25 Kg.

3.2.2.2 Center of Gravity

The CG of the instrument shall be located as specified in Table 3.1. The final LEISA/AC CG shall be measured to 5% accuracy.

3.2.2.3 Moment of Inertia

The moment of inertia of each box shall be calculated with 5% accuracy.

3.2.3 MECHANICAL DESIGN and ANALYSIS REQUIREMENTS

Unless specified below, the LEISA/AC shall meet the requirements of the EO-1 Verification Plan and Environmental Specification, SAI-SPEC-158.

3.2.3.1 Structural Design Safety Factors

All hardware shall be designed and analyzed to the applicable safety factors defined below. The analyses shall indicate a positive margin of safety. Limit loads are defined as the maximum expected flight loads.

All flight hardware except pressure vessels	Test Qual	Analysis Only
Material Yield Factors =	1.25	2.0
Material Ultimate Factors =	1.4	2.6

Ground support handling hardware
Design to a factor of safety of 5 (ultimate loads)
and test to a minimum factor of safety of 2 without
any permanent deformation occurring.

3.2.3.2 Limit Load Factors

All hardware shall be designed to withstand the quasi-static limit loads (with applicable safety factors) defined below. These loads should be applied simultaneously in three mutually perpendicular directions at the component center of gravity.

Limit Load

± 25 g, each axis

3.2.3.3 Structural Stiffness Requirement

In the launch configuration, the LEISA/AC shall have a first mode frequency greater than 80 Hz.

3.2.3.4 Stress Analysis Requirement

A stress test or analysis shall be performed by the instrument provider to verify the integrity of the component structure and attachments when subjected to the specified loads with the applicable safety factors. Margins of safety shall be determined, dominant failure modes identified and this information transmitted to the satellite integrator. Existing mechanical stress analysis reports and data may be used if applicable.

3.2.3.5 Fastener Capacity

The deliverable hardware will be attached to the spacecraft panel using threaded fasteners. The fasteners will be specified by the instrument provider via this ICD and supplied by the S/C integrator. A positive margin factor of safety shall be maintained for all the fasteners used on the spacecraft.

3.2.4 ALIGNMENT

The LEISA/AC shall be aligned with respect to the ALI with the following accuracy:

Z axis Rotation	0.0 ± 1.2 arc minutes
X axis Rotation	0.1 ± 0.1 Degree
Y axis Rotation	0.0 ± 0.5 Degrees

The line-of-sight vector of each instrument shall be determined with respect to its optical cube. The location and orientation of each optical cube is shown in Figure 3.2. The X-axis rotation tolerance is zero in the +Y direction to ensure an overlap with the multi-spectral pixels of the ALI. The LEISA/AC provider shall be required to perform an alignment measurement before and after exposing the instrument to the test environment (i.e., vibration, cover retraction, thermal vacuum, etc.) to verify proper retention of alignment of the optical cube to the boresight(s).

3.2.4.1 Alignment Stability

During on-orbit operations the maximum shift in alignment between the S/C axes and the LEISA/AC body axes, due to launch loads and thermally induces motions, shall be 30 arcseconds in Pitch, Roll, and Yaw. The maximum shift in alignment during an orbit is 10 arcseconds.

3.2.5 POINTING REQUIREMENTS

The spacecraft shall provide attitude control and knowledge as specified in the Level 2 Mission Requirements. The LEISA/AC will not drive the pointing accuracy or stability requirements.

3.2.5.1 Avoidance

The sun may not dwell on one spot in the LEISA/AC FOV for more than 2 minutes. There is no moon-avoidance requirement.

3.2.5.2 Uncompensated Momentum

The LEISA/AC has no moving parts. There is no uncompensated momentum or torques produced by the LEISA/AC.

3.2.6 RESERVED

3.2.7 LEISA/AC HANDLING OPERATIONS and LIFT POINTS

3.2.7.1 Handling Operations

The LEISA/AC I&T plan defines the handling and installation procedures for the LEISA/AC. Normal care shall be exercised during handling and installation of the equipment. Protective covers shall be supplied by the LEISA/AC contractor for protection of the hardware.

3.2.7.2 Lift Points

The LEISA does not require lift points.

3.2.8 ACCESS REQUIREMENTS

Access requirements to the LEISA/AC shall be as defined in the LEISA/AC I&T Plan. Access requirements include connector mate/demate clearances, removal and replacement clearances for electronic components and protective covers, and access to purge fittings, etc. There will not be any access through the fairing.

3.2.9 EXTERNAL TEMPERATURE SENSOR MOUNTING

There are no external temperature sensors.

3.2.10 APERTURE COVERS

There will be an aperture cover on the LEISA/AC which will be in place when not under test. The cover shall be removed prior to encapsulation in the fairing.

3.2.11 NITROGEN PURGE

Dry nitrogen purge will be required during ground storage. When not in the storage container a class 100,000 cleanroom environment shall be provided. While on the S/C a nitrogen or manufactured air purge will be supplied by the S/C I&T team. The purge gas will be Grade B. The purge may be interrupted for periods up to 48 hours. Purge will continue until fairing close-out.

3.2.12 MOUNTING PALLET

Not applicable

3.2.13 THERMAL

3.2.13.1 Mounting Surface Temperature

The maximum temperature of the mounting surface shall be 50°C and the minimum temperature shall be -10°C.

3.2.13.2 Mounting Surface Temperature, Operating

While operating in the standby or science data taking mode the temperature of the mounting surface shall be less than +30°C and greater than 0°C.

3.2.13.3 Thermal Stability
While the LEISA/AC is in the operational mode, the temperature of the mounting surface will not change by more than 1°C/min.

3.2.13.4 Heat Flow Across the Interface
Each of the LEISA/AC modules shall dissipate power through their baseplates.

3.2.13.5 Radiant Heat, Electronics Module
The radiating surfaces of the electronics modules will be black anodized with an effective emissivity of 0.8 or greater (standard practice). During operate and calibrate modes, the electronics module will be dissipating 15 - 20 watts.

3.2.13.6 Radiant Heat, Optics Module
All aluminum surfaces will be treated with an irridite finish. During operate and calibrate modes, the optics module will dissipate 20 - 25 watts.

3.2.13.7 Operating Timeline
For all 70 minute periods, the LEISA shall be on for no longer than 20 minutes.

3.2.13.8 Survival
With the mounting surface at or above -10°C and less than 50°C and the LEISA/AC not powered, the instrument will survive and return to full performance after power is re-applied and temperatures rise above 0°C.

3.3 ELECTRICAL INTERFACE REQUIREMENTS

3.3.1 ELECTRICAL INTERFACES

The location of the electrical connectors is shown in Figures 3.2 and 3.3. These connectors shall be the interface for all power, data, and commanding between the LEISA/AC and the spacecraft.

3.3.2 POWER REQUIREMENTS

The spacecraft operating bus voltage is 28 ±7V, with power characteristics as specified in System Level Electrical Requirements NMP EO-1 Flight, Litton Amecom document AM-149-0020(155). The instrument provider shall ensure that the LEISA/AC shall successfully operate within this power regime.

3.3.2.1 Power/ Load Characteristics
Must meet all requirements of the System Level Electrical Requirements NMP EO-1 Flight, Litton Amecom document AM-149-0020(155).

3.3.2.1.1 Power Requirement
Power will be supplied via PSE.

The total LEISA/AC power allocation is as follows:

Nominal operation, orbit average	10 watts
Power off modes	0 watts (not including S/C heater power)
Peak power	40 watts

The nominal operating power is only a few watts less than the peak power.

3.3.2.1.2 Noise Suppression

All inductive loads associated with the LEISA/AC, such as relay coil circuits shall be provided with suppression circuits to prevent excessive transients and associated EMC noise due to power interrupts. Must meet all requirements of the System Level Electrical Requirements NMP EO-1 Flight, Litton Amecom document AM-149-0020(155).

3.3.2.1.3 Reflected Ripple

As specified in the System Level Electrical Requirements NMP EO-1 Flight, Litton Amecom document AM-149-0020(155).

3.3.2.1.4 Load Profile

The LEISA/AC will require 40 watts for periods as long as 20 minutes, and will require 0 watts otherwise. Nominally, the on time is contiguous and no more than 20 minutes per orbital period.

3.3.2.1.5 Turn-On Transients

As specified in System Level Electrical Requirements NMP EO-1 Flight, Litton Amecom document AM-149-0020(155).

3.3.2.1.6 Power Variations

The LEISA/AC shall survive power interruptions and voltage variations as follows:

3.3.2.1.6.1 Power Interruptions

During testing, the LEISA/AC shall be able to survive, without damage, a voltage drop to zero for up to 20 seconds followed by a re-powering of the LEISA/AC. In the time interval bounded by the loses power to the re-powering commands to reconfigure the LEISA/AC may not be available.

3.3.2.1.6.2 Over-Voltage

The LEISA/AC shall not be required to operate at voltages above +35 VDC and shall not be damaged by transient voltages defined in section 3.2.5 of Litton System Level Electrical Requirements New Millennium Program EO-1 Flight".

3.3.2.1.6.3 Over-Voltage Protection

The LEISA/AC provider shall ensure that adequate over-voltage protection is provided in the GSE when the instrument is under test after spacecraft integration.

3.3.2.1.6.4 Under-Voltage

Voltage drops down to 21 VDC steady state shall not damage the LEISA/AC.

3.3.2.1.6.5 GSE Reverse Polarity Protection

All GSE which connects to flight hardware will have protection on power and signal lines to prevent damaging reverse polarity signals from being impressed on the flight hardware. Protection is not required if the reverse polarity can be shown to be non-damaging under worst case conditions.

3.3.2.2.7 Over-Current Protection

The S/C Power System Electronics (PSE) shall supply 1 switched 1.5 amp services to the LEISA/AC. The PSE output is switched by a re-settable circuit breaker.

3.3.3 COMMAND REQUIREMENTS

Figure 3.8 shows the command and telemetry architecture for LEISA/AC. All commands shall be through the 1773 connection. Details of the 1773 command structure are in the Data Systems 1773 ICD, document AM149-0050(155).

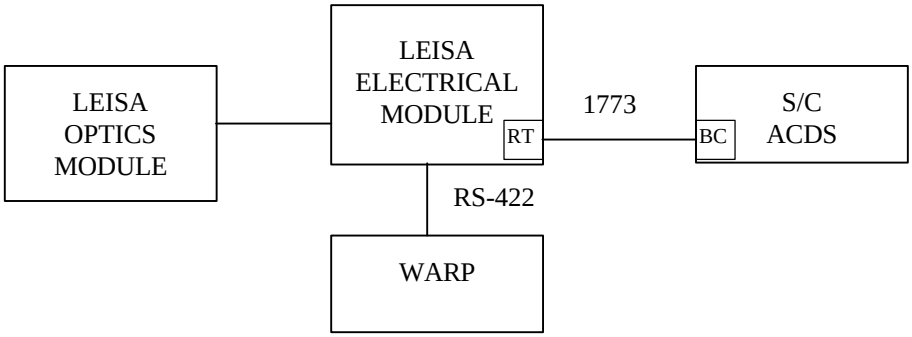

Figure 3.8 Command and Telemetry Interface Architecture

3.3.3.1 Command List

Eight commands. Each of the commands will be issued once per observation or about once per orbit.

- Power on (This command is from the M5 to the PSE to turn on the power to the LEISA/AC)
- Logic Reset
- Frame Rate
- Sensitivity Select
- TEC Setpoint
- Data Start (write enable, begin at Frame Boundary)
- Data Stop
- Power Off (This command is from the M5 to the PSE to turn off power to the LEISA/AC)

3.3.4 TELEMETRY/DATA REQUIREMENTS

3.3.4.1 Telemetry Data Requirements

- Five Voltages (±15 Analog; ±5 Analog; +5 Digital)
- Twenty Temperatures (3 Focal Planes, 2 Boxes)
- Three Bias Voltages (3 Focal Planes)

Each piece of telemetry data is 16 bits. The frequency is once every 32 seconds.

3.3.4.2 Prime Science Data

The science data interface is described in the RS422 to FODB WARP ICD, WARP735 0026.

3.3.4.3 Mission Elapsed Time (MET)/ Universal Time (UT) Interface

MET/UT will be used by LEISA/AC for all internal time sequences and will be inserted into a record header for each observation, independently of the spacecraft housekeeping system. The timing diagram for the MET/UT interface is in the Data Systems 1773 ICD, document AM149-0050(155). An MET/UT is sent once per second to LEISA/AC by the spacecraft. The time sent in the message is valid at the following MET/UT strobe.

3.3.4.4 Housekeeping Requirements

None other than telemetry requirements.

3.3.4.4.1 Prime Power Current Monitors

Prime power current monitors are contained within the EO-1 spacecraft power distribution.

3.3.4.4.2 Thermal Monitors

The EO-1 spacecraft will provide the type S#44906, GSFC 5311818-0657R6 thermal monitors and cabling to the monitors on the panel near the LEISA/AC assemblies to provide a gross measurement of the LEISA/AC thermal balance, to provide a thermal measurement for EO-1 thermal balance, and for control during safehold. The mounting points are described in section 3.2, the mechanical ICD section. LEISA/AC provides no interface other than providing a mounting point on all external monitors. The EO-1 spacecraft will provide the thermal monitors and all cabling and conditioning.

3.3.4.5 Science Data

There is a separate ICD, RS422 to FODB WARP ICD, WARP735 0026, that describes the flow of science data and communication between the WARP and the LEISA/AC.

3.3.5 INTERFACE CONNECTORS AND PIN ASSIGNMENTS

Three connections: Optical (1773), power, and science-data.

3.3.5.1 Description

The LEISA/AC experiment consists of 2 assemblies as described in Section 2.0. The LEISA/AC provider will fabricate, qualify and provide to the spacecraft integrator all inter-connecting flight cabling.

Table 3.2 delineates the connectors, pin assignments and wiring interfaces for the power interface.

The LEISA/AC provider shall supply to the spacecraft integrator three complete sets of flight interface connectors, pins and backshells.

The science-data interface is described in the WARP ICD (WARP 7350026) and the 1773 interface is described in the Data Systems 1773 ICD (AM149-0050(155)).

Table 3.2 Interface Connectors and Pin Assignments for Power Interface
Connector Type: 9 pin D male #311P409-1P-B-12
LEISA/AC

					FROM			TO		
Subsystem /Card	Signal Name	Type	AWG	Twist Group	Reference Designator	Conn. #	Pin #	Reference Designator	Conn. #	Pin #
PSE/OM2	AC 28A+	TP	20	aa	BAY4C029	J52	1	BAY4C058	J1	2
PSE/OM2	AC 28A-	TP	20	aa	BAY4C029	J52	4	BAY4C058	J1	7
PSE/OM2	AC 28B+	TP	20	bb	BAY4C029	J52	2	BAY4C058	J1	4
PSE/OM2	AC 28B-	TP	20	bb	BAY4C029	J52	5	BAY4C058	J1	8

3.3.5.2 Connector Mounting Configuration

The configuration drawings in Section 3.2.1-2 show the connector location and orientation.

3.3.6 ELECTROMAGNETIC COMPATIBILITY

LEISA/AC shall comply with the sections of the Litton Amecon Document titled EO-1 Electrical System Level Requirements which pertain to the subsections listed below.

3.3.6.1 EMC Requirements

LEISA/AC shall comply with the electromagnetic requirements of MIL STD 461C for category A2a (space flight equipment).

3.3.6.1.1 Conducted Emissions

LEISA/AC shall comply with CE 01, CE 03 and CE 07 DC power leads D.C.

3.3.6.1.2 Conducted Susceptibility

LEISA/AC shall comply with CS 01 (28 V RMS or 40 Watts), CS 02 (1V RMS per Watt), CS 03, CS 06 (+28VDC for 10μ sec and -28 VDC for 10 μ sec).

3.3.6.1.3 Radiated Emissions

LEISA/AC shall comply with RE 01, RE 02 to the levels shown in the EO-1 Systems Level Electrical Requirements Document.

3.3.6.1.4 Radiated Susceptibility

LEISA/AC shall comply with RS 03 14 Khz to 2 Ghz 2 V/M ; 2 Ghz to 3 Ghz 20 V/M.

3.3.6.2 Grounding

The grounding scheme utilized by the LEISA/AC shall be consistent with the grounding philosophy shown in the EO-1 Systems Level Electrical Requirements Document under the heading of “Electrical Grounding”.

3.3.6.3 Bonding

All bonding between the EO-1 and LEISA/AC will conform to the EO-1 Systems Level Electrical Requirements Document. The applicable section is titles “Mechanical Bonding and Bonding Measurement”.

3.3.6.4 Harnessing

For harness which connects the Optics Module to the Electronics Module and the I/F with the S/C harness LEISA/AC cables shall comply with the EO-1 Systems Level Electrical Requirements Document for;

1. Wire size
2. Shielding
3. Signal Segregation
4. Signal, Relay Data Bus and Power lines

3.3.6.5 Connectors

All connectors not inside a shielded enclosure shall use EMI backshells to minimize radiation and susceptibility. Cylindrical MIL-C type connectors are preferred for power connectors. Integral filter pins are allowed. D-type connectors may be used for data and control signal connections.

3.3.6.6 Isolation

The method used to electrically isolate the LEISA/AC shall comply with the section title “Electrical Isolation” of the EO-1 Systems Level Electrical Requirements Document.

3.3.6.6.1 MIL-STD-461C Testing

The LEISA/AC shall be tested for compliance to the modified requirements of MIL-STD-461C, Part 3, Class A2a specified in this document. The testing shall be performed using the procedures specified in MIL-STD-462, or according to an approved test plan.

3.3.6.6.2 Spacecraft Self-Compatibility System Testing

The entire spacecraft shall be tested as an integrated assembly for self-compatibility. This testing involves the powering and operation of all (or a selected complement of) spacecraft subsystems to ensure that no spacecraft subsystem or instrument causes or receives interference to or from any other subsystem or instrument. Such testing includes the operation of transmitter(s) with their antenna "hat couplers" removed so that the antennas radiate freely. This testing shall be conducted by the payload integration team under the guidance of the system EMC engineer.

3.3.6.7 ESD

Meet electrical systems specifications.

3.3.7 HARNESS

Routing, length, etc.

3.4 SAFETY

The LEISA/AC presents no unusual safety hazards. Items presenting potentially hazardous conditions are listed below:

a. Purge System, utilizing gaseous Nitrogen or manufactured air as per section 3.2.1.1.

4.0 OTHER GSE

Data processing GSE is described in the LEISA/AC I&T plan.

5.0 LIST of DELIVERABLES

GSFC will deliver the following items to Swales, ready for integration, on or before June 15, 1998 (There is a separate ICD for RS 422 AC to WARP interface):

1) Optics Module (fig. 3.2.1-1) (vibration, T/V and EMI/EMC tested per ICD).
2) Electronics Module (fig. 3.2.1-2) (vibration, T/V and EMI/EMC tested per ICD).
3) Inter-box connection cable.
4) 3 sets of flight interface connectors, backshells and pins.
5) Aperture cover (red-tag item, removed before fairing installation).
6) Copies of vibration, T/V and EMI/EMC test results.
7) Database and test procedures (preliminary database by February 15, 1998).

Swales will provide, by June 15, 1998, the following items:

1) Hardware for mounting optics module and electronics module (includes fasteners and other mounting hardware such as thermal pads).
2) Mounting of interbox cables, including mounting hardware.
3) Interface cabling for 1773 and power connections.
4) Thermal isolation blankets (MLI) for optics module and electronics module.
5) Dry nitrogen or air for purge and gas handling system (per ICD).
6) Command and telemetry software required to operate AC, accept SOH outputs and provide time identification (per ICD).