EARTH OBSERVING SYSTEM
GEOSCIENCE LASER ALTIMETER SYSTEM

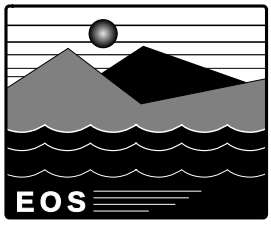
GLAS Science Computing Facility (SCF) Plan

Version 0.4

February 1998

Contact:

B. E. Schutz, schutz@utcsr.ae.utexas.edu
GLAS Science Team



Foreword

This Plan has been prepared by the Geoscience Laser Altimeter System (GLAS) Ground Data System Software Development Team, within the Observational Science Branch, Laboratory for Hydrospheric Processes, of NASA Goddard Space Flight Center, Wallops Flight Facility, at Wallops Island, Virginia. It was prepared in support of Dr. Jay Zwally, the SCF implementation leader for the GLAS Science Investigation. The development of this document was performed under the direction of David W. Hancock III, the Team Leader of the GLAS Ground Data System Software Development; he may be contacted at hancock@osb.wff.nasa.gov (e-mail), (757) 824-1238 (voice), or (757) 824-1036 (fax).

Document Change History

Document Name: GLAS Science Computing Facility (SCF) Plan		
Version Number	**Date**	**Nature of Change**
Version 0.4	**February 1998**	**Original Version**

Items to be Resolved

1) Determine any other ECS security requirements for SCF and add to Section 8. Complete lists of user and administrative responsibilities for SCF security.
2) Sections 6 and 7 briefly describe the operations staffing; what details should be added?
3) We will need to reference version 2.1 of the GLAS Science Requirements document when it is available.
4) We need later-edition Parent Documents for Section 2.1.
5) We need a better definition of the proposed LAM floor plan.
6) Are Bufton's and Spinhirne's SCF equipment included in the GSFC equipment list?
7) No printers are included in the SCF equipment lists. Should they be?

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Preface

This document presents the Plan for the Science Computing Facility (SCF) which will be supporting the Geoscience Laser Altimeter System (GLAS) instrument on the EOS Laser ALT Spacecraft. The GLAS SCF is a distributed, evolving system, providing vital support functions for GLAS during pre-launch, on-orbit, and post-launch time periods. The GLAS SCF provides the environment for: (a) software development and maintenance, (b) algorithm development, (c) generation of Level 3 and Level 4 Standard Data Products, (d) quality assessment of all GLAS Standard Data Products, (e) processing in parallel with ESDIS for one-year, for validation of the ESDIS Level 1 and Level 2 Standard Data Products, (f) data retrieval, (g) research by members of the GLAS Science Team and their associates, (h) generation of ancillary data files, and (i) product verification and validation.

As described herein, the GLAS SCF incorporates a central facility at GSFC, the distributed locations, the hardware, software, communications links, and working environment at each location, as well as the associated personnel who operate and use the Facility.

Section 1

Introduction

1.1 Identification of Document

This is the Plan for the GLAS Science Computing Facility (SCF). This document describes the GLAS SCF requirements, design, implementation, operation, and sustaining engineering planning information.

This Science Computing Facility Plan is a Development Activities Plan document, rolled-out from the GLAS Science Software Management Plan [Reference: Applicable Document 2.2h].This Plan is identified as document number GLAS-SCFP-1300 in the GLAS uniform document numbering scheme, as presented in the GLAS Science Software Management Plan.

Successive editions of this plan document will be uniquely identified by the document version and date marks on the cover and on individual page footers.

1.2 Scope of Document

This Plan encompasses the distributed GLAS Science Team's operational and research facilities, the hardware and the software related to the production of the GLAS ancillary data files, the software development for delivery to ESDIS, the Level 3 and Level 4 GLAS Standard Products, data quality assessment and metadata, and ancillary GLAS instrument performance assessment. The GLAS SCF comprises workstation facilities that are physically located at NASA facilities and at the universities with which the GLAS Science Team members are affiliated. This Plan presents the requirements, design, implementation, operation, and sustaining engineering for the SCF.

This document is being prepared by the GLAS GDS Software Development Team under the direction of the GLAS Science Team Leader. Its content and format are in accordance with the NASA Software Engineering Program [Reference: Applicable Document 2.2a] Management Plan volume. The facility plan process proceeds from the requirements identification to the presentation of the functional requirements necessary to design, implement, operate, and maintain the SCF.

1.3 Purpose and Objectives of Document

The purpose of this Science Computing Facility Plan is to specify the evolving requirements, the plans, the resources, and the responsibilities for implementing, operating, maintaining, and managing the GLAS SCF.

The following objectives are identified for this facility plan:

- to present the purpose and a top-level description of the GLAS SCF, particularly with respect to the SCF as a distributed and evolving facility,

- to present the plans for the implementation, operation, and maintenance (sustaining engineering) of the SCF,
- to present a summary of the requirements for the SCF, and to identify the feasible hardware, software, and physical plant resources to meet these requirements,
- to present the external system interfaces to the SCF, and to allocate the responsibility for the provision of these external interfaces.

1.4 Document Status, Schedule, and Control

This document is a Draft version of the Science Computing Facility Plan. Subsequent editions of the document will include updated facility requirements or specifications relevant to the design, implementation, management, operations, and maintenance of the SCF.

Table 1-1 "Document Production, Delivery, and Revision Schedule" lists the goals for production and distribution of this document.

Table 1-1 Document Production, Delivery, and Revision Schedule

Edition/Revision Designation	Document Edition Description	Edition Delivery Focus	Activity/Delivery Dates
PRELIMINARY	initial document edition for GLAS Science Team Delivery by GLAS Science Team Leader	EOSDIS, EOS	October 1997
UPDATED PRELIMINARY	incremental document edition for EOS Project Delivery by GLAS Science Team Leader	EOSDIS, EOS	December 1997
FINAL	final document edition for EOS Project Delivery by GLAS Science Team Leader	EOSDIS, EOS	December 1999
REVISED	iterative updating of document as required in Project delivery package from GLAS Science team Leader	EOSDIS, EOS	As Required

1.5 Documentation Organization

The organization of this document has been customized to present the SCF Plan. It is based on the Management Plan Volume under the NASA Software Documentation Standard Software Engineering Program [Reference: Applicable Document 2.2a]. Sections 1 and 2 contain the introductory and reference document information. Section 3 provides a brief overview of the objectives and schedule of the GLAS mission, and addresses the purpose and top-level description of the SCF, including the distributed facility. Section 4 contains the facility requirements and the specification of the resources necessary to meet and provide functionality for these requirements.

Section 5 describes the External Interfaces relative to the SCF and the assigned responsibilities for provision and management of these interfaces. Section 6 addresses the implementation plan and resources for the design and installation of the SCF. Section 7 provides the overall management and resource plan for the operational and sustaining engineering phase of the SCF life cycle. Finally, Section 8 addresses the security requirements imposed on the distributed SCF components.

Supplemental information is presented in the abbreviations and acronyms section, and in the glossary section.

Section 2

Related Documentation

This section provides the references for this Science Computing Facility Plan. Document references include parent documents, applicable documents, and information documents.

2.1 Parent Documents

Parent documents are those external, higher-level documents that contribute information to the scope and content of this document. The following EOS Project and GLAS Team documents are parent to this document.

a) Modified GLAS Statement of Work, Description of Required Data, PDRL No. 606 [reference: HIRDLS Statement of Work (424-28-21-05)], June 1995, NASA Goddard Space Flight Center.

b) Memo from Betsy Park, GLAS Instrument Manager, to Bob Schutz, GLAS Team Leader, dated 08/16/95; contains Memorandum subject RE: Contract Modification to amend CDRL for 1995, from Betsy Park, GLAS Instrument Manager, to Doris Watkins, Contract Specialist/GLAS Science.

c) GLAS Mission Requirements (In Press), 1997, the GLAS Science Team.

2.2 Applicable Documents

Applicable documents include reference documents that are not parent documents. This category includes reference documents that have direct applicability to, or contain policies binding upon, or information directing or dictating the content of this SCF document. The following EOS Project, NASA, or other Agency documents are cited as applicable to this facility plan document.

a) NASA Software Documentation Standard Software Engineering Program, NASA, July 29, 1991, NASA-STD-2100-91.

b) Science User's Guide and Operations Procedure Handbook for the ECS Project, Volume 4: Software Developer's Guide to Preparation, Delivery, Integration and Test with ECS, Final, April 1997, Hughes Information Technology Corporation, 205-CD-002-004.

c) EOS Output Data Products, Processes, and Input Requirements, Version 3.2, November 1995, Science Processing Support Office.

d) Data Production Software and Science Computing Facility (SCF) Standards and Guidelines, January 14, 1994, Goddard Space Flight Center, 423-16-01.

e) IRD Between EOSDIS and Science Computing Facilities, May 1995, NASA Goddard Space Flight Center, 505-41-12.

The following GLAS Science Team and Instrument Team documents are cited as applicable to this facility plan document.

f) EOS ALT/GLAS Mission Requirements Document, Version 1.5, July 1993, Center for Space Research, The University of Texas at Austin and the Goddard Space Flight Center.

g) Geoscience Laser Altimeter System (GLAS) Science Requirements (Draft), May 1997, the GLAS Science Team.

h) GLAS Science Software Management Plan (GLAS SSMP), Updated Preliminary, December 31, 1996, NASA Goddard Space Flight Center Wallops Flight Facility, GLAS-SMP-1100.

i) GLAS Science Data Management Plan (GLAS SDMP), Updated Preliminary, December 31, 1996, NASA Goddard Space Flight Center Wallops Flight Facility, GLAS-DMP-1200.

j) Geoscience Laser Altimeter System (GLAS) Science Management Plan (Preliminary), December 1994, the GLAS Science Team.

k) GLAS Science Software Requirements Document (GLAS SSRD), Preliminary, December 31, 1996, NASA Goddard Space Flight Center Wallops Flight Facility, GLAS-PRS-2100.

l) GLAS Investigation Activities Plan (Preliminary), November 1994, the GLAS Science Team.

2.3 Information Documents

Information documents are those that are not directly applicable as a reference to this facility plan document. They are documents providing information to amplify or clarify facility plan information contained in this document. The following EOS Project, NASA, or other Agency documents are cited as providing background or supplemental information to this facility plan document.

a) Release B.0 SCF Toolkit Users Guide, April 1997, NASA Goddard Space Flight Center, 333-CD-004-001.

b) ICD Between the ECS and SCF, Revision A CH02, September 1996, NASA Goddard Space Flight Center, 505-41-33.

c) A Science User's Guide to the EOSDIS Core System (ECS) Development Process, February 1995, NASA Goddard Space Flight Center, 160-TP-03-001.

d) Operations Concept for Integration and Test of Science Data Production Software, White Paper, March 1995, Hughes Applied Information Systems, Inc., 62-WP-001-002.

Section 3

Purpose of Facility

3.1 GLAS Objectives

The Geoscience Laser Altimeter System (GLAS) has the following science objectives [Applicable Document 2.2j]:

- determine the mass balance of the polar ice sheets and their contributions to global sea level change; obtain essential data for prediction of future changes in ice volume and sea level
- measure cloud heights and vertical structure of clouds and aerosols in the atmosphere
- map the topography of land surfaces
- measure roughness, reflectivity, vegetation heights, snow-cover and sea-ice characteristics, and other surface parameters

The science objectives will be accomplished with a near-nadir pointing laser altimeter operating in the green and infrared, and supported by precision instrumentation for determining the orbit and laser pointing directions.

3.2 Mission Schedule

The development of the GLAS instrument and software systems and the SCF is underway, having begun in 1995 with the setting-up of workstations and peripherals at GSFC and at the remote sites; these workstations are currently being used for algorithm development. Further GLAS SCF implementation is needed in the near-term to support software development, for continued algorithm development, and for instrument testing.

The GLAS launch is scheduled for July 2001. (Six months prior to that date, all GLAS-related ESDIS software is to be in place and successfully tested on the SCF.) Following launch, there is the expectation of a five-year on-orbit operational mission, followed in turn by a one-year phaseout.

Current requirements for the SCF thus extend from the present time to the year 2007. Anticipated GLAS follow-on missions would extend the use of the SCF for at least an additional decade, to 2017. During the earlier years of the time span of 1997-2007, the SCF will grow in capacity and in capability. Emerging technology and algorithm improvements will necessitate hardware and software upgrades throughout the mission.

The GLAS SCF is a distributed system. While the Central portion of the GLAS SCF will be in Building 33 of Goddard Space Flight Center, additional inter-connected GLAS SCF hardware and software will reside at other NASA locations and in host

universities and institutions with which members of the GLAS Science Team are affiliated. The distributed nature of the GLAS SCF is amplified in Section 4.

The GLAS SCF's Central node is planned for Building 33 at Goddard Space Flight Center in Greenbelt, MD. Because this building will not be completed until 1999, present hardware and software components of the GSFC/Central node are being temporarily housed and utilized at other on-site and off-site locations.

3.3 Purpose of the Science Computing Facility

The GLAS Science Computing Facility, in support of GLAS objectives, provides the environment for:

- GDS software development, integration, test, and acceptance
- algorithm development by the Science Team members
- quality assessment of all Standard Data Products
- data retrieval
- generation of ancillary files, e.g., Precision Orbit Determination, Precision Attitude Determination
- generation of Level 3 and Level 4 Standard Data Products by the Science Team
- verification and validation of ESDIS processing (the SCF will provide parallel processing to the ESDIS for one year after launch)
- research by Science Team members and their associates

Section 4

Facility Description

The GLAS SCF is composed of:

- A central node, GSFC/Central, located at Greenbelt, Maryland.
- A distributed system with nodes at the home institutions (including GSFC) of each of the GLAS Science Team members.

All nodes are inter-connected to facilitate the distribution of data. To the extent possible, all nodes will be of the HP class, to allow the central development of common tools to process, analyze, and database the GLAS data so it may be optimally used for GLAS research. GSFC/Central will provide an active archive of the GLAS dataset that can be easily accessed by the Science Team members.

The Atmosphere node and the Land node which support the GSFC Science Team members (Drs. Spinhirne and Bufton, respectively) are also located at GSFC. The remaining Science Team nodes are located at the Team members' affiliated university campuses. Although Science Team member Dr. Bob Thomas is at NASA Headquarters in Washington, D.C., the SCF node for his cryosphere activities is physically located at Ohio State University.

When planning the GLAS SCF, the GLAS Science Team determined that the facility would have the following attributes:

- The system would use a distributed architecture. Workstations and peripherals would be provided to Team Members to support their tasks and responsibilities for algorithm development and science investigations.
- The system must provide evolutionary growth to assure generation of the Data Products and to provide resources to support the generation of experimental data products.
- The system must be compatible with EOSDIS to the extent that EOSDIS-provided software, such as Science Data Processing Toolkits, can be operated on the GLAS Team Member workstations.
- The system must readily adapt to the evolution of EOSDIS and the availability of hardware and software available as Commercial-Off-the-Shelf (COTS), especially EOSDIS-adopted software.
- The system must be robust, with some level of redundancy. For some applications, functions can be duplicated at different institutions, thereby providing redundant operations.

The following sections discuss the design of the GLAS SCF to fulfill these requirements as well as the current state of the facility and future plans for the facility.

4.1 Distributed Facility Definition and Classification

As introduced previously in Sections 1 and 3, the GLAS SCF is a distributed system of nodes. Each node in the SCF is defined within this section. Later sections will define requirements specific to each facility, as well as the design and current status of each facility.

- **Central Node at GSFC/Greenbelt**- GSFC/Central, located in Greenbelt, Maryland, is the central GLAS SCF workstation assigned to the general Laser Altimetry Mission processing. This node supports development of the GLAS Science Software, provides processing in parallel to ESDIS (for the first year after launch) for verification and validation of the GLAS Science Software, provides generation of Level 3 and Level 4 data products, supports algorithm development, and provides a facility for research activities. This node also provides the support for the GLAS Project Scientist, Dr. Jay Zwally.
- **Science Team Nodes** - As part of the distributed GLAS SCF, there will be an interconnected node at each Science Team member's affiliated organization or university. The primary functions of the Science Team nodes are: algorithm development, standard data product validation, generation of precision orbit and attitude files, generation of Level 3 and Level 4 data products, and research activities.

4.2 Central Node at GSFC/Greenbelt

4.2.1 Functional Requirements

4.2.1.1 Processing Requirements

The following requirements have been identified for the GSFC/Central node:

- provide monitoring of overall Laser Altimetry Mission science standard and special data product generation,
- utilize toolkit-compatible high-level programming language and the ESDIS-supplied Science Computing Facility Toolkit, to provide standard, transportable, and reliable software and hardware interfaces to the EOSDIS,
- provide a platform capable of operating in parallel with the DAAC for one year, producing Level 1 and Level 2 GLAS Standard Data Products,
- provide for data quality and metadata generation,
- produce data product sets suitable for verification and validation of ESDIS software activities,
- provide storage for all GLAS-related data, including aircraft and satellite data,
- provide a platform for analysis for all GLAS-related data, including aircraft and satellite data,
- provide a platform for algorithm and ground data system software development,

- provide the primary platform for software assurance, software maintenance, and performance verification/validation testing,
- provide a platform for support of theoretical algorithm evaluation and performance testing, and protocoding in support of software coding and implementation,
- provide a processing platform for Level 3, Level 4, and special science data products generation,
- provide a platform for research activities,

4.2.1.2 Space Requirements

Space requirements for the GSFC/Central node include considerations for the computers and peripherals, furniture, and storage. There are office and work space requirements for the Laser Altimetry Mission Project Scientist, for operations personnel, and for visiting Science Team members. Requirements for space will grow as additional computer equipment is procured and as personnel are added to support the operations.

The specific space requirements are TBD. Typical furniture sizes (reference: General Services Administration) are: Tables/Desks are 32x 62 inches, Credenzas are 22x68 inches, Printer Tables are 26x32 inches, Workstation Tables are 26x50 inches, Racks for servers and for computers are typically 19x24 inches. Additional space is required for chairs, walking space, etc.

4.2.1.3 Power Requirements

Power requirements reflect the physical electrical support requirements for the GSFC/Central node. The basic approach is to require a dedicated 20 ampere circuit of appropriate voltage (120 or 240) for each identified workstation unit. Workstation units consist of a workstation and associated peripherals. Additional dedicated circuits must be provided for loads in excess of 2kVa, and for laser printers. Each workstation unit will interface to the branch circuit through a workstation-rated Uninterruptible Power Supply (UPS) and associated software capable of shutting down the workstation in case of extended power outages. Sufficient battery power should be available to run the workstation unit for at least fifteen minutes to avoid shutdown during brown-outs or power fluctuations. The UPS must also provide power conditioning, or SCF implementation leader-approved surge protectors (APC Surge Arrest Professional or equivalent specifications) must be used to avoid damage to equipment due to power spikes.

The existing power configuration meets the present needs; however, the power requirements will increase with increases in size and number of components. The final power requirements are TBD.

4.2.1.4 Environmental Conditioning

Environmental conditioning requirements comprise the heat, ventilation, air-conditioning, and humidity control requirements based on equipment specifications, operating characteristics, and typical component heat gain/facility heat loss

computations. Presently, GSFC/Central operates in an office environment augmented by additional air conditioning of 25,000 BTU. The environmental requirements for the relocated and upgraded facility are TBD. Due to the large amount of equipment and due to the possible need for 24-hour operation, independent (separate from the central HVAC system) heating and cooling capabilities are required.

4.2.1.5 Communications

The communications requirements for the GLAS/Central node are:

- provide general team e-mail, and intra-science team electronic communications,
- provide world-wide-web site access for the Laser Altimetry Mission,
- access EOSDIS facilities, systems, and services through the NSI network connectivity,
- provide access to archived data within the DAAC,
- provide voice communications capabilities (telephones)
- provide a T1 line for off-site communications

Data communications are to be accomplished with Ethernet and TCP/IP communications using 10/100BaseT/FDDI network access equipment. Thus, each workstation and each X-station/X-terminal within the node are to be equipped with an appropriate 10/100BaseT/FDDI adapter. The node itself is then concentrated through a networking switch/hub component, isolating the node as a subnet. As the EOS Project requires added network security, the switch/hub can be isolated through a router.

4.2.2 Computer Equipment

The GSFC/Central node will be a processing facility consisting of multiple HP workstations and their peripherals, x-terminals, and mass storage systems interconnected through an Ethernet arrangement. During preparations for the Laser Altimetry Mission, and during the mission itself, the node will be added to and upgraded. The phased computer equipment configurations are TBD. The procurement plans for the GSFC/Central node's computer equipment are discussed in Section 6.

The present GSFC/Central node equipment list is shown in Table 4-1.

Table 4-1 GSFC/Central Node Equipment

Serial Number	Description	Manufacturer	Model
gdglas_cdrom	CD-ROM Drive - 600Mb SE SCSI	Toshiba	XM-3401B
GB00220228	DAT Drive - DDS 120m SE SCSI	HP	C1533-69203
SG46008413	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
SG46008233	Disk Drive - 2.1Gb FW SCSI	HP	3554UW

Table 4-1 GSFC/Central Node Equipment (Continued)

Serial Number	Description	Manufacturer	Model
FT117949	Disk Drive - 2.1Gb FW SCSI	Seagate	C3550
SG46008401	Disk Drive - 2.1Gb FW SCSI	Seagate	3554UW
K4762834	Disk Drive - 4.25 Gb FW SCSI	Seagate	ST15150WD
K4704690	Disk Drive - 4.25 Gb FW SCSI	Seagate	ST15150WD
K4655105	Disk Drive - 4.25 Gb FW SCSI	Seagate	ST15150WD
CX53801163	DLT4700 Tape Autochanger	Quantum	TH5FA-EA
JP01071977	Monitor - 19" Color	HP	A4033A
JP01020844	Monitor - 19" Color	HP	A4033A
JP01071968	Monitor - 19" Color	HP	A4033A
JP01071978	Monitor - 19" Color	HP	A4033A
JP01180431	Monitor - 19" Color	HP	A2094A
JP04060670	Monitor - 19" Color	HP	A2094A
JP01180430	Monitor - 19" Color	HP	A2094A
JP01071966	Monitor - 19" Color	HP	A4033A
3325A00568	Optical Library - 187Gb	HP	200T
3421A00246	Optical Library - 83.2Gb	HP	80ST
**ND4444	RAM - 64MB upgrade board for HP735/125MHZ	Newport Digital	
**ND3333	RAM - 64MB upgrade board for HP735/125MHZ	Newport Digital	
US45002678	Tower - w/2Gb SE Disk - SE SCSI	HP	C3023T
SG05002297	Tower - w/2x2Gb FW Disks - FW SCSI	HP	C3550TW
6452A00158	Workstation - HP 735/125 CRX (to be replaced by HP K460)	HP	A1950A
3729A64977	Workstation - HP K460 Server (to replace HP 735/125)	HP	K460
CA3B890233	X-Terminal - ENVIZEX	HP	C2732A
CA45B90056	X-Terminal - ENVIZEX	HP	C2732A
CA47690003	X-Terminal - ENVIZEX	HP	C2732A

Table 4-1 GSFC/Central Node Equipment (Continued)

Serial Number	Description	Manufacturer	Model
CA59C93032	X-Terminal - ENVIZEX	HP	C2732A
CA59693185	X-Terminal - ENVIZEX	HP	C2732A

4.2.3 Node Design

4.2.3.1 Location

The current distributed locations for the central node are: (a)NASA Goddard Space Flight Center (GSFC), Building 22, Greenbelt, Maryland; (b) an offsite Contractor's (Hughes STX) office in Greenbelt; and (c) NASA GSFC Wallops Flight Facility (WFF), Building N-159, Wallops Island, VA. Upon completion of the new building, locations (a) and (b) will move to the NASA GSFC Earth System Science Building (Building 33) at Greenbelt, Maryland.

4.2.3.2 Floor Plan

The GSFC/Central node currently occupies 100(?) square feet at GSFC, 300(?) square feet in the off-site contractor's Greenbelt, MD, office, and 100 square feet in WFF Building N-159.

Figure 4-1 "Building 33 Floor Plan for the GSFC/Central Node of GLAS SCF" on page 4-7 presents the proposed floor plan for the GSFC/Central node, to be located in the Earth Science System Building.

4.2.4 Office Equipment

4.2.4.1 Furniture

The central facility is currently furnished with appropriate tables, desks, chairs, computer racks, server racks, and storage cabinets. As additional SCF hardware is procured for the Laser Altimetry Mission, and as the staff increases in number, additional furnishings will need to be acquired. Each workstation requires a computer rack, a table and a chair, and each person requires a desk and chair.

The furniture currently in use will need to be moved to or replaced by similar furniture in Building 33.

Detailed furniture lists are TBD.

4.2.4.2 Record and Documentation Storage

The storage and filing cabinets currently within the GSFC/Central node, occupying??? cubic feet of space, are presently adequate for record and documentation storage. There will need to be adequate storage facilities within the relocated and upgraded central facility to hold records and documentation through launch plus six years (five years of mission support plus one year of close-out activities). Additional storage requirements are TBD, and equipment will need to be procured as required.

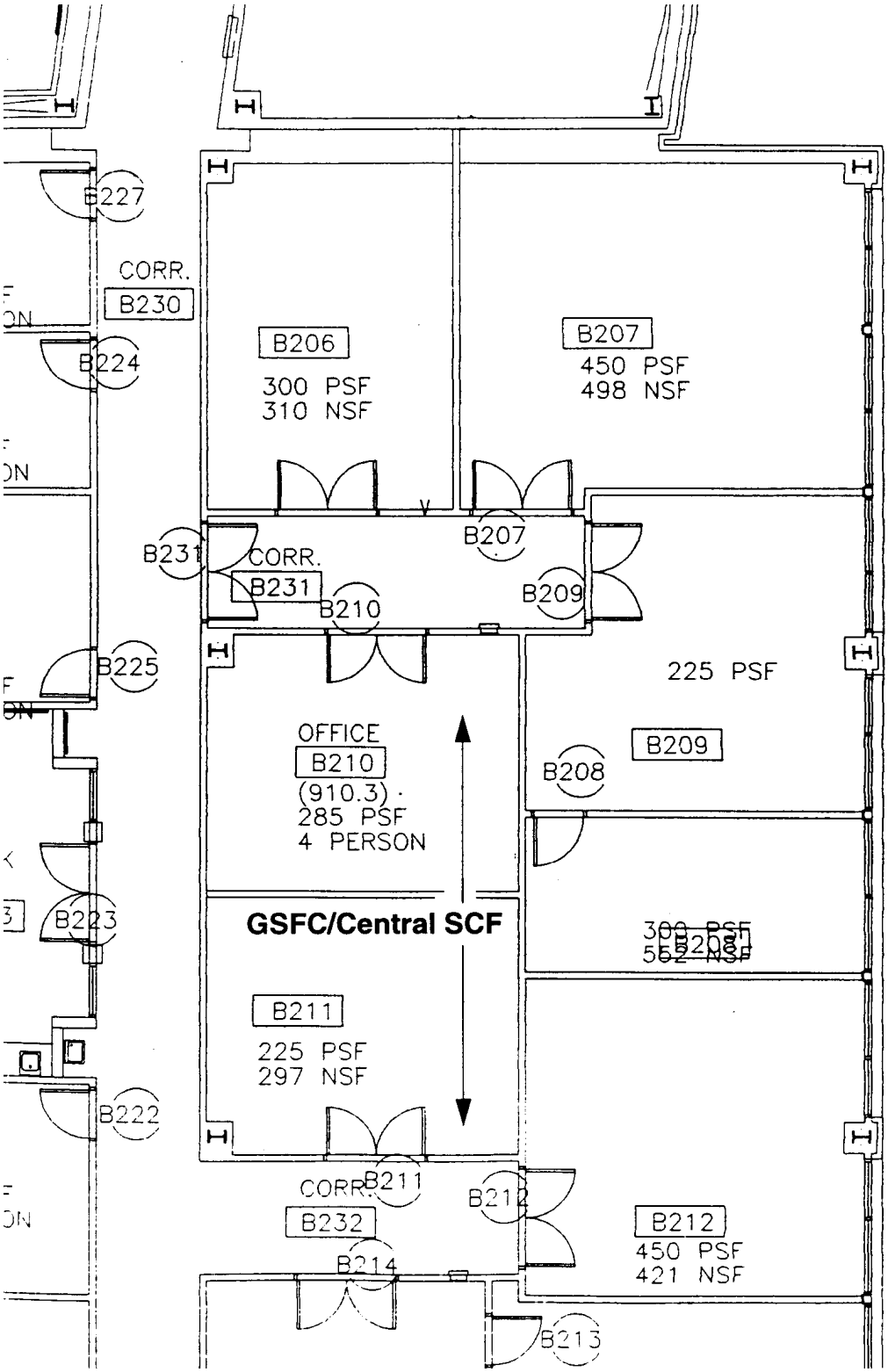

Figure 4-1 Building 33 Floor Plan for the GSFC/Central Node of GLAS SCF

4.2.4.3 Supplies

The required general supplies for the GSFC/Central node will include:

- office supplies (paper, pens, pencils, etc.)
- DAT and DLT tape media
- optical R/W media
- CD media
- laser toner cartridges
- inkjet and paintjet cartridges
- fusion roller assemblies and fuser oil
- 8-mm tapes
- laser printer and plotter paper stock
- TBD

4.3 Science Team Computing Facilities

In this section, we provide information specific to each Science Team member's GLAS SCF node. The Science Team nodes and their associated Science Team member are:

- University of Texas - Dr. Bob Schutz, Science Team Leader
- Goddard Space Flight Center/Land - Dr. Jack Bufton, Science Team Member
- Goddard Space Flight Center/Atmosphere - Dr. James Spinhirne, Science Team Member
- The Ohio State University - Dr. Robert Thomas, Science Team Member
- University of Wisconsin - Dr. Charles Bentley, Science Team Member
- Massachusetts Institute of Technology - Professor Thomas Herring, Science Team Member
- University of California San Diego - Professor Jean-Bernard Minster, Science Team Member

As mentioned in Section 4.2, the SCF node associated with the GLAS Project Scientist, Dr. Jay Zwally, is a part of the GSFC/Central node.

4.3.1 University of Texas (UTGLAS) Node- Dr. Bob Schutz, Science Team Leader

4.3.1.1 Functional Requirements

4.3.1.1.1 Processing Requirements

The following requirements have been identified as applicable for the University of Texas (UTGLAS) SCF node:

- provide a platform for the computation of the Precision Orbit Determination (POD) and Precision Attitude Determination (PAD) products,
- provide a platform for research using the GLAS products,
- provide for development, analysis, and testing of specific science processing algorithms for the production of the science data products,
- provide for monitoring of overall GLAS algorithm development and verification/validation, and science standard and special data product generation,
- utilize toolkit-compatible high-level programming languages and the ESDIS-supplied Science Computing Facility Toolkit, to provide standard, transportable, and reliable software and hardware interfaces to the EOSDIS,
- provide a processing platform for post-processing data product quality and metadata generation,
- provide a processing platform for Level 3, Level 4, and special data product generation,
- provide data storage and a platform for analysis of the Level 1 and Level 2 data products, ancillary data, and corrections to the standard data products,
- provide support for data storage and analysis of GLAS-emulation and satellite experiment data in support of precision attitude determination, precision orbit determination, waveform processing, ground-track repeat, and orbit characteristics assessment,
- provide support for the Science Team Leader's activities, including data storage and analysis, instrument error budget assessment, ground array calibration methods analysis, precision attitude determination, precision orbit determination, and waveform processing,
- provide support for data storage and analysis of aircraft and satellite experiment data in support of calibration/verification.

4.3.1.1.2 Space Requirements

Space requirements for the UTGLAS node include considerations for office and work space for the Science Team Leader and support personnel, computers and peripherals, other equipment, furniture, and storage. The specific requirements are TBD. The current situation is TBD.

4.3.1.1.3 Power Requirements

Power requirements reflect the physical electrical support requirements for the UTGLAS node. The basic approach is to require a dedicated 20 ampere circuit of appropriate voltage (120 or 240) for each identified workstation unit. Workstation units consist of a workstation and associated peripherals. Additional dedicated circuits must be provided for loads in excess of 2kVa, and for laser printers. Each workstation unit will interface to the branch circuit through a workstation-rated Uninterruptible Power Supply (UPS) and associated software capable of shutting down the workstation in case of extended power outages. Sufficient battery power

should be available to run the workstation unit for at least fifteen minutes to avoid shutdown during brown-outs or power fluctuations. The UPS must also provide power conditioning, or SCF implementation leader-approved surge protectors (APC Surge Arrest Professional or equivalent specifications) must be used to avoid damage to equipment due to power spikes.

The existing power configuration meets the present needs; however, the power requirements will increase with increases in size and number of components. The final power requirements are TBD.

4.3.1.1.4 Environmental Conditioning

TBD

4.3.1.1.5 Communications

The communications requirements for the UTGLAS node are:

- provide general team e-mail, and intra-science team electronic communications,
- access EOSDIS facilities, systems, and services through the NSI network connectivity,
- provide access to data within the GLAS SCF,
- provide the data collection and communication node to external supporting systems,
- provide voice communications capabilities (telephones)

4.3.1.2 Computer Equipment

Currently, the University of Texas SCF node is equipped with an HP workstation and peripherals. Additional computer equipment will be added and replaced as required. The University of Texas may supplement their SCF node with additional computer equipment. The detailed list of SCF computer equipment at the UTGLAS node is shown in Table 4-2.

Table 4-2 University of Texas SCF Equipment

Serial Number	Description	Manufacturer	Model
6451A50812	CD-ROM Drive - 600Mb SE SCSI (stand-alone)	HP	A2655A
3352E76534	DAT Drive - DDS 120m SE SCSI (stand-alone)	HP	C1520B
GB17000967	DAT Tape Autochanger - 6 slots - SE SCSI	HP	C1560B
JP01042817	Monitor - 19" Color	HP	A4033A
3325A00555	Optical Library - 187Gb	HP	200T

Table 4-2 University of Texas SCF Equipment (Continued)

Serial Number	Description	Manufacturer	Model
**PA9999	RAM - 64MB upgrade board for HP735/125MHZ	Dataram	
**PA8888	RAM - 64MB upgrade board for HP735/125MHZ	Dataram	
US40001556	Tower - HP 6000 SE SCSI Mass Storage-7 bay	HP	C3023T
6450A00226	Workstation - HP 735/125 CRX	HP	A1950A

4.3.1.3 Facility Design

4.3.1.3.1 Location

The address of this UTGLAS node is: Center for Space Research, University of Texas Austin, 3925 West Braker Lane, Suite 200, Austin, Texas

Detailed location information (room numbers, etc.) is TBD.

4.3.1.3.2 Floor Plan

TBD

4.3.1.4 Office Equipment

4.3.1.4.1 Furniture

TBD

4.3.1.4.2 Record and Documentation Storage

TBD

4.3.1.4.3 Supplies

The University of Texas SCF node's general supplies will include:

- office supplies (paper, pens, pencils, etc.)
- DAT and DLT tape media
- optical (CD) media
- laser toner cartridges
- inkjet and paintjet cartridges
- fusion roller assemblies and fuser oil
- laser printer and plotter paper stock
- TBD

4.3.2 Goddard Space Flight Center/Land Node - Dr. Jack Bufton, Science Team Member

4.3.2.1 Functional Requirements

4.3.2.1.1 Processing Requirements

The following requirements have been identified as applicable for the GSFC/Land node:

- provide for development, analysis, and testing of land-related science processing algorithms for the production of the science data products,
- utilize toolkit-compatible high-level programming languages and the ESDIS-supplied Science Computing Facility Toolkit, to provide standard, transportable, and reliable software and hardware interfaces to the EOSDIS,
- provide a processing platform for post-processing data product quality and metadata generation,
- provide a processing platform for land-related Level 3, Level 4, and special data product generation,
- provide data storage and a platform for analysis of the Level 2 data products, ancillary data, and corrections to the land data products,
- provide support for data storage and analysis of GLAS-emulation and satellite experiment data in support of land and associated waveform processing.
- provide support for the Dr. Bufton's particular areas of expertise, e.g., land processes, vegetation canopies, and waveform processing,
- provide support for data storage and analysis of aircraft and satellite experiment data in support of calibration/verification.

4.3.2.1.2 Space Requirements

Space requirements for the GSFC/Land node include considerations for office and work space for the Science Team member and support personnel, computers and peripherals, other equipment, furniture, and storage. The specific requirements for the GSFC/Land node are TBD. The current situation is TBD.

4.3.2.1.3 Power Requirements

Power requirements reflect the physical electrical support requirements for the GSFC/Land node. The basic approach is to require a dedicated 20 ampere circuit of appropriate voltage (120 or 240) for each identified workstation unit. Workstation units consist of a workstation and associated peripherals. Additional dedicated circuits must be provided for loads in excess of 2kVa, and for laser printers. Each workstation unit will interface to the branch circuit through a workstation-rated Uninterruptible Power Supply (UPS) and associated software capable of shutting down the workstation in case of extended power outages. Sufficient battery power should be available to run the workstation unit for at least fifteen minutes to avoid shutdown during brown-outs or power fluctuations. The UPS must also provide

power conditioning, or SCF implementation leader-approved surge protectors (APC Surge Arrest Professional or equivalent specifications) must be used to avoid damage to equipment due to power spikes.

The current power configuration meets the present needs; however, the power requirements will increase with increases in size and number of components. The final power requirements are TBD.

4.3.2.1.4 Environmental Conditioning

TBD

4.3.2.1.5 Communications

The communications requirements for the GSFC/Land node are:

- provide general team e-mail, and intra-science team electronic communications,
- access EOSDIS facilities, systems, and services through the NSI network connectivity,
- provide access to data within the GLAS SCF,
- provide the data collection and communication node to external supporting systems,
- provide voice communications capabilities (telephones)

4.3.2.2 Computer Equipment

Currently, the GSFC/Land node is equipped with an HP workstation and peripherals. Additional computer equipment will be added and replaced as required. Dr.button may supplement his SCF node with additional computer equipment. The detailed list of computer equipment at the GSFC/Land node is TBD.

4.3.2.3 Facility Design

4.3.2.3.1 Location

This GSFC/Land node is currently located at NASA Goddard Space Flight Center, Building 22, Greenbelt, Maryland. It will relocate to NASA Goddard Space Flight Center, Earth System Science Building (ESSB, Building 33), Greenbelt, Maryland upon completion of that building.

Detailed location information (room numbers, etc.) is TBD.

4.3.2.3.2 Floor Plan

TBD

4.3.2.4 Office Equipment

All equipment in the GSFC/Land S ode will need to be moved from the NASA GSFC Building 22 location to the new location in NASA GSFC Building 33.

4.3.2.4.1 Furniture

TBD

4.3.2.4.2 Record and Documentation Storage

TBD

4.3.2.4.3 Supplies

The GSFC/Land SCF node general supplies will include:

- office supplies (paper, pens, pencils, etc.)
- DAT and DLT tape media
- optical (CD) media
- laser toner cartridges
- inkjet and paintjet cartridges
- fusion roller assemblies and fuser oil
- laser printer and plotter paper stock
- TBD

4.3.3 Goddard Space Flight Center/Atmosphere Node - Dr. James Spinhirne, Science Team Member

4.3.3.1 Functional Requirements

4.3.3.1.1 Processing Requirements

The following requirements have been identified as applicable for the GSFC/Atmosphere node:

- provide for development, analysis, and testing of atmosphere-related science processing algorithms for the production of the science data products,
- utilize toolkit-compatible high-level programming languages and the ESDIS-supplied Science Computing Facility (SCF) Toolkit, to provide standard, transportable, and reliable software and hardware interfaces to the EOSDIS,
- provide a processing platform for post-processing data product quality and metadata generation,
- provide a processing platform for Level 3, Level 4, and any special data product generation,
- provide data storage and a platform for analysis in development of the Level 1 and Level 2 atmosphere data products, ancillary data, and corrections to the standard data products,
- provide support for data storage and analysis of GLAS-emulation and satellite experiment data in support of atmosphere products and processes,

- provide support for the Dr. Spinhirne's particular areas of atmosphere-related expertise,
- provide support for data storage and analysis of aircraft, and satellite experiment data in support of calibration/verification.

4.3.3.1.2 Space Requirements

Space requirements for the GSFC/Atmosphere SCF node include considerations for office and work space for the Science Team member and support personnel, computers and peripherals, other equipment, furniture, and storage. The specific requirements are TBD. The current situation is TBD.

4.3.3.1.3 Power Requirements

Power requirements reflect the physical electrical support requirements for the GSFC/Atmosphere node. The basic approach is to require a dedicated 20 ampere circuit of appropriate voltage (120 or 240) for each identified workstation unit. Workstation units consist of a workstation and associated peripherals. Additional dedicated circuits must be provided for loads in excess of 2kVa, and for laser printers. Each workstation unit will interface to the branch circuit through a workstation-rated Uninterruptible Power Supply (UPS) and associated software capable of shutting down the workstation in case of extended power outages. Sufficient battery power should be available to run the workstation unit for at least fifteen minutes to avoid shutdown during brown-outs or power fluctuations. The UPS must also provide power conditioning, or SCF implementation leader-approved surge protectors (APC Surge Arrest Professional or equivalent specifications) must be used to avoid damage to equipment due to power spikes.

The current power configuration meets the present needs; however, the power requirements will increase with increases in size and number of components. The final power requirements are TBD.

4.3.3.1.4 Environmental Conditioning

TBD

4.3.3.1.5 Communications

The communications requirements for the GSFC/Atmosphre node are:

- provide general team e-mail, and intra-science team electronic communications,
- access EOSDIS facilities, systems, and services through the NSI network connectivity,
- provide access to data within the GLAS SCF,
- provide the data collection and communication node to external supporting systems,
- provide voice communications capabilities (telephones)

4.3.3.2 Computer Equipment

Currently, the GSFC/Atmosphere node is equipped with an HP workstation and peripherals. Additional computer equipment will be added and replaced as required. Dr. Spinhirne may supplement his SCF node with additional computer equipment. The detailed lists of computer equipment at the GSFC/Atmosphere node are TBD.

4.3.3.3 Facility Design

4.3.3.3.1 Location

The GSFC/Atmosphere node is currently located at NASA Goddard Space Flight Center, Building 22, Greenbelt, Maryland. It will move to NASA Goddard Space Flight Center, Earth System Science Building (ESSB, Building 33), Greenbelt, Maryland upon completion of that building.

Detailed location information (room numbers, etc.) is TBD.

4.3.3.3.2 Floor Plan

TBD

4.3.3.4 Office Equipment

All equipment in the GSFC/Atmosphere SCF node will need to be moved from its present NASA GSFC Building 22 location to its new location in NASA GSFC Building 33.

4.3.3.4.1 Furniture

TBD

4.3.3.4.2 Record and Documentation Storage

TBD

4.3.3.4.3 Supplies

The GSFC/Atmosphere SCF node general supplies will include:

- office supplies (paper, pens, pencils, etc.)
- DAT and DLT tape media
- optical (CD) media
- laser toner cartridges
- inkjet and paintjet cartridges
- fusion roller assemblies and fuser oil
- laser printer and plotter paper stock
- TBD

4.3.4 The Ohio State University (OHGLAS) Node - Dr. Robert Thomas, Science Team Member

4.3.4.1 Functional Requirements

4.3.4.1.1 Processing Requirements

The following requirements have been identified as applicable for the OHGLAS node:

- provide for development, analysis, and testing of cryosphere-related science processing algorithms for the production of the science data products,
- utilize toolkit-compatible high-level programming languages and the ESDIS-supplied Science Computing Facility (SCF) Toolkit, to provide standard, transportable, and reliable software and hardware interfaces to the EOSDIS,
- provide a processing platform for post-processing data product quality and metadata generation,
- provide a processing platform for cryosphere Level 3, Level 4, and special data product generation,
- provide data storage and a platform for analysis of the Level 2 data products, ancillary data, and corrections to the standard data products,
- provide support for data storage and analysis of GLAS-emulation and satellite experiment data in support of precision attitude determination, precision orbit determination, waveform processing, ground-track repeat, and orbit characteristics assessment,
- provide support for the Dr. Thomas' particular areas of cryosphere expertise, e.g., data storage and analysis, ground array calibration methods analysis, and waveform retracking,
- provide support for data storage and analysis of aircraft and satellite experiment data in support of calibration/verification.

4.3.4.1.2 Space

Space requirements for the OHGLAS node include considerations that Dr. Thomas is located at NASA Headquarters in Washington, D.C., and the node is located at Ohio State University. Space planning involves both locations for office and work space for Dr. Thomas, support personnel, computers and peripherals, other equipment, furniture, and storage. The specific requirements for the OHGLAS node are TBD. The current situation is TBD.

4.3.4.1.3 Power

Power requirements reflect the physical electrical support requirements for the OHGLAS node. The basic approach is to require a dedicated 20 ampere circuit of appropriate voltage (120 or 240) for each identified workstation unit. Workstation units consist of a workstation and associated peripherals. Additional dedicated circuits must be provided for loads in excess of 2kVa, and for laser printers. Each work-

station unit will interface to the branch circuit through a workstation-rated Uninterruptible Power Supply (UPS) and associated software capable of shutting down the workstation in case of extended power outages. Sufficient battery power should be available to run the workstation unit for at least fifteen minutes to avoid shutdown during brown-outs or power fluctuations. The UPS must also provide power conditioning, or SCF implementation leader-approved surge protectors (APC Surge Arrest Professional or equivalent specifications) must be used to avoid damage to equipment due to power spikes.

The current OHGLAS power configuration meets the present needs; however, the power requirements will increase with increases in size and number of components. The final power requirements are TBD.

4.3.4.1.4 Environmental Conditioning

TBD

4.3.4.1.5 Communications

The communications requirements for the OHGLAS node are:

- provide general team e-mail, and intra-science team electronic communications,
- access EOSDIS facilities, systems, and services through the NSI network connectivity,
- provide access to data within the GLAS SCF,
- provide the data collection and communication node to external supporting systems,
- provide voice communications capabilities (telephones)

4.3.4.2 Computer Equipment

Currently, the OHGLAS node is equipped with an HP workstation and peripherals. Additional computer equipment will be added and replaced as required. Dr. Thomas may supplement his SCF node with additional computer equipment. The detailed list of SCF computer equipment at the OHGLAS node is shown in Table 4-3.

Table 4-3 Ohio State University SCF Equipment

Serial Number	Description	Manufacturer	Model
45560C13210	CD-ROM Drive - 600Mb SE SCSI	HP	C3560U
GB00042812	DAT Drive - DDS 120m SE SCSI	HP	C1533A
GB42003262	DAT Tape Autochanger - 6 slots	HP	C1560B
SG46008408	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
C3550	Disk Drive - 2.1Gb FW SCSI	HP	C3550

Table 4-3 Ohio State University SCF Equipment (Continued)

Serial Number	Description	Manufacturer	Model
SG46008418	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
SG46008411	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
SG46008410	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
K4729239	Disk Drive - 4.25 Gb FW SCSI	Seagate	ST15150WD
JP01071970	Monitor - 19" Color	HP	A4033A
**PA2222	RAM - 64MB upgrade board for HP735/125MHZ	Dataram	
**PA3333	RAM - 64MB upgrade board for HP735/125MHZ	Dataram	
4100042173	RAM - 64MB upgrade board for HP735/125MHZ	Kingston	KTH700/128
4100042171	RAM - 64MB upgrade board for HP735/125MHZ	Kingston	KTH700/128
US41005085	Tower - w/2Gb SE Disk - SE SCSI	HP	C3023T
SG05002242	Tower - w/2x2Gb FW Disks - FW SCSI	HP	C3550TW
6252A00146	Workstation - HP 735/125 CRX	HP	A1950A

4.3.4.3 Facility Design

4.3.4.3.1 Location

The location of the OHGLAS node is at The Ohio State University in Columbus, Ohio.

Detailed location information (room numbers, etc.) is TBD.

4.3.4.3.2 Floor Plan

TBD

4.3.4.4 Office Equipment

4.3.4.4.1 Furniture

TBD

4.3.4.4.2 Record and Documentation Storage

TBD

4.3.4.4.3 Supplies

The OHGLAS node general supplies will include:

- office supplies (paper, pens, pencils, etc.)
- DAT and DLT tape media
- optical (CD) media
- laser toner cartridges
- inkjet and paintjet cartridges
- fusion roller assemblies and fuser oil
- laser printer and plotter paper stock
- TBD

4.3.5 University of Wisconsin (UWGLAS) Node - Dr. Charles Bentley, Science Team Member

4.3.5.1 Functional Requirements

4.3.5.1.1 Processing Requirements

The following requirements have been identified as applicable for the UWGLAS node:

- provide for development, analysis, and testing of cryosphere-related science processing algorithms for the production of the science data products,
- utilize toolkit-compatible high-level programming languages and the ESDIS-supplied Science Computing Facility (SCF) Toolkit, to provide standard, transportable, and reliable software and hardware interfaces to the EOSDIS,
- provide a processing platform for post-processing data product quality and metadata generation,
- provide a processing platform for cryosphere Level 3, Level 4, and special data product generation,
- provide data storage and a platform for analysis in development of the cryosphere Level 2 data products, ancillary data, and corrections to the standard data products,
- provide support for data storage and analysis of GLAS-emulation and satellite experiment data in support of precision attitude determination, precision orbit determination, waveform processing, ground-track repeat, and orbit characteristics assessment,
- provide support for Dr. Bentley's particular areas of cryosphere expertise, e.g., including waveform processing and retracking,
- provide support for data storage and analysis of aircraft and satellite experiment data in support of calibration/verification.

4.3.5.1.2 Space Requirements

Space requirements for the UWGLAS node include considerations for office and work space for Dr. Bentley and support personnel, computers and peripherals, other

equipment, furniture, and storage. The specific requirements for the UWGLAS node member are TBD. The current situation is TBD.

4.3.5.1.3 Power Requirements

Power requirements reflect the physical electrical support requirements for the UWGLAS node. The basic approach is to require a dedicated 20 ampere circuit of appropriate voltage (120 or 240) for each identified workstation unit. Workstation units consist of a workstation and associated peripherals. Additional dedicated circuits must be provided for loads in excess of 2kVa, and for laser printers. Each workstation unit will interface to the branch circuit through a workstation-rated Uninterruptible Power Supply (UPS) and associated software capable of shutting down the workstation in case of extended power outages. Sufficient battery power should be available to run the workstation unit for at least fifteen minutes to avoid shutdown during brown-outs or power fluctuations. The UPS must also provide power conditioning, or SCF implementation leader-approved surge protectors (APC Surge Arrest Professional or equivalent specifications) must be used to avoid damage to equipment due to power spikes.

The current power configuration meets the present needs; however, the power requirements will increase with increases in size and number of components. The final power requirements are TBD.

4.3.5.1.4 Environmental Conditioning

TBD

4.3.5.1.5 Communications

The communications requirements for the UWGLAS node are:

- provide general team e-mail, and intra-science team electronic communications,
- access EOSDIS facilities, systems, and services through the NSI network connectivity,
- provide access to data within the GLAS SCF,
- provide the data collection and communication node to external supporting systems,
- provide voice communications capabilities (telephones)

4.3.5.2 Computer Equipment

Currently, the UWGLAS node is equipped with an HP workstation and peripherals. Additional computer equipment will be added and replaced as required. Dr. Bentley may supplement his SCF node with additional computer equipment. The detailed list of SCF computer equipment at the UWGLAS node is shown in Table 4-4.

Table 4-4 University of Wisconsin SCF Equipment

Serial Number	Description	Manufacturer	Model
JP40002691	CD-ROM Drive - 600Mb SE SCSI	HP	C3560U
GB00044295	DAT Drive - DDS 120m SE SCSI	HP	C1533A
GB42003258	DAT Tape Autochanger - 6 slots	HP	C1560B
TT989682	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
TT908187	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
TT908052	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
TT869007	Disk Drive - 2.1Gb FW SCSI	Seagate	C3550
TT822391	Disk Drive - 2.1Gb FW SCSI	Seagate	C3550
K4762881	Disk Drive - 4.25 Gb FW SCSI	Seagate	ST15150WD
JP01071496	Monitor - 19" Color	HP	A4033A
**PA4444	RAM - 64MB upgrade board for HP735/125MHZ	Dataram	
**PA5555	RAM - 64MB upgrade board for HP735/125MHZ	Dataram	
**K6666	RAM - 64MB upgrade board for HP735/125MHZ	Kingston	KTH700/128
**K5555	RAM - 64MB upgrade board for HP735/125MHZ	Kingston	KTH700/128
US42005126	Tower - w/2Gb SE Disk - SE SCSI	HP	C3023T
SG05002245	Tower - w/2x2Gb FW Disks - FW SCSI	HP	C3550TW
6452A00152	Workstation - HP 735/125 CRX	A1950A	A1950A$

4.3.5.3 Facility Design

4.3.5.3.1 Location

The address of the UWGLAS node is the Geophysical and Polar Research Center, University of Wisconsin Madison, 1215 W Dayton Street, Madison, Wisconsin

Detailed location information (room numbers, etc.) is TBD.

4.3.5.3.2 Floor Plan

TBD

4.3.5.4 Office Equipment

4.3.5.4.1 Furniture

TBD

4.3.5.4.2 Record and Documentation Storage

TBD

4.3.5.4.3 Supplies

The UWGLAS node supplies will include:

- office supplies (paper, pens, pencils, etc.)
- DAT and DLT tape media
- optical (CD) media
- laser toner cartridges
- inkjet and paintjet cartridges
- fusion roller assemblies and fuser oil
- laser printer and plotter paper stock
- TBD

4.3.6 Massachusetts Institute of Technology (MTGLAS) Node - Professor Thomas Herring, Science Team Member

4.3.6.1 Functional Requirements

4.3.6.1.1 Processing Requirements

The following requirements have been identified as applicable for the MTGLAS node:

- provide for development, analysis, and testing of tropospheric- and GPS-related science processing algorithms for the production of the science data products,
- utilize toolkit-compatible high-level programming languages and the ESDIS-supplied Science Computing Facility (SCF) Toolkit, to provide standard, transportable, and reliable software and hardware interfaces to the EOSDIS,
- provide a processing platform for post-processing data product quality and metadata generation,
- provide a processing platform for troposphere- and GPS-related Level 3, Level 4 products, and special data product generation,
- provide data storage and a platform for analysis of the Level 2 data products, ancillary data, and corrections to the standard data products,
- provide support for data storage and analysis of GLAS-emulation and satellite experiment data in support of troposphere and GPS studies.

- provide support for Dr. Herring's particular areas of expertise,
- provide support for data storage and analysis of aircraft and satellite experiment data in support of calibration/verification.

4.3.6.1.2 Space Requirements

Space requirements for the MTGLAS node include considerations for office and work space for Dr. Herring and support personnel, computers and peripherals, other equipment, furniture, and storage. The specific requirements for the MTGLAS node are TBD. The current situation is TBD.

4.3.6.1.3 Power Requirements

Power requirements reflect the physical electrical support requirements for the MTGLAS node. The basic approach is to require a dedicated 20 ampere circuit of appropriate voltage (120 or 240) for each identified workstation unit. Workstation units consist of a workstation and associated peripherals. Additional dedicated circuits must be provided for loads in excess of 2kVa, and for laser printers. Each workstation unit will interface to the branch circuit through a workstation-rated Uninterruptible Power Supply (UPS) and associated software capable of shutting down the workstation in case of extended power outages. Sufficient battery power should be available to run the workstation unit for at least fifteen minutes to avoid shutdown during brown-outs or power fluctuations. The UPS must also provide power conditioning, or SCF implementation leader-approved surge protectors (APC Surge Arrest Professional or equivalent specifications) must be used to avoid damage to equipment due to power spikes.

The current power configuration meets the present needs; however, the power requirements will increase with increases in size and number of components. The final power requirements are TBD.

4.3.6.1.4 Environmental Conditioning

TBD

4.3.6.1.5 Communications

The communications requirements for the MTGLAS node are:

- provide general team e-mail, and intra-science team electronic communications,
- access EOSDIS facilities, systems, and services through the NSI network connectivity,
- provide access to data within the GLAS SCF,
- provide the data collection and communication node to external supporting systems,
- provide voice communications capabilities (telephones)

4.3.6.2 Computer Equipment

Currently, the MTGLAS node is equipped with an HP workstation and peripherals. Additional computer equipment will be added and replaced as required. Dr. Herring may supplement his SCF node with additional computer equipment. The detailed list of SCF computer equipment at the MTGLAS node is shown in Table 4-5.

Table 4-5 Massachusetts Institute of Technology SCF Equipment

Serial Number	Description	Manufacturer	Model
4560C123840	CD-ROM Drive - 600Mb SE SCSI	HP	C3560U
GB00042862	DAT Drive - DDS 120m SE SCSI	HP	C1533A
GB42003264	DAT Tape Autochanger - 6 slots	HP	C1560B
SG50009857	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
SG46008409	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
SG46008406	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
SG46008224	Disk Drive - 2.1Gb FW SCSI	Seagate	3554UW
FT104309	Disk Drive - 2.1Gb FW SCSI	Seagate	C3550
K4766097	Disk Drive - 4.25 Gb FW SCSI	Seagate	ST15150WD
JP01074738	Monitor - 19" Color	HP	A4033A
**PA0000	RAM - 64MB upgrade board for HP735/125MHZ	Dataram	
**PA1111	RAM - 64MB upgrade board for HP735/125MHZ	Dataram	
4100042189	RAM - 64MB upgrade board for HP735/125MHZ	Kingston	KTH700/128
4100042191	RAM - 64MB upgrade board for HP735/125MHZ	Kingston	KTH700/128
US43005145	Tower - w/2Gb SE Disk - SE SCSI	HP	C3023T
SG05002304	Tower - w/2x2Gb FW Disks - FW SCSI	HP	C3550TW
6451A00169	Workstation - HP 735/125 CRX	HP	A1950A

4.3.6.3 Facility Design

4.3.6.3.1 Location

The address of the MTGLAS node is: Massachusetts Institute of Technology, 77 Massachusetts Ave, Rm 54-618, Cambridge, Massachusetts.

Detailed location information (room numbers, etc.) is TBD.

4.3.6.3.2 Floor Plan

TBD

4.3.6.4 Office Equipment

4.3.6.4.1 Furniture

TBD

4.3.6.4.2 Record and Documentation Storage

TBD

4.3.6.4.3 Supplies

The MTGLAS node general supplies will include:

- office supplies (paper, pens, pencils, etc.)
- DAT and DLT tape media
- optical (CD) media
- laser toner cartridges
- inkjet and paintjet cartridges
- fusion roller assemblies and fuser oil
- laser printer and plotter paper stock
- TBD

4.3.7 University of California San Diego (SCGLAS) Node - Professor Jean-Bernard Minster, Science Team Member

4.3.7.1 Functional Requirements

4.3.7.1.1 Processing Requirements

The following requirements have been identified as applicable for the SCGLAS node:

- provide for development, analysis, and testing of solid tide correction and other specific science processing algorithms for the production of the science data products,
- utilize toolkit-compatible high-level programming languages and the ESDIS-supplied Science Computing Facility (SCF) Toolkit, to provide standard, transportable, and reliable software and hardware interfaces to the EOSDIS,
- provide a processing platform for post-processing data product quality and metadata generation,
- provide a processing platform for Level 3, Level 4, and any special data product generation,

- provide data storage and a platform for analysis in development of the solid tide-related Level 2 data products, ancillary data, and corrections to the standard data products,
- provide support for data storage and analysis of GLAS-emulation and satellite experiment data in support of Dr. Minster's particular areas of expertise,
- provide support for Dr. Minster's particular areas of solid tide expertise,
- provide support for data storage and analysis of aircraft and satellite experiment data in support of calibration/verification.

4.3.7.1.2 Space Requirements

Space requirements for the SCGLAS node include considerations for office and work space for Dr. Minster and support personnel, computers and peripherals, other equipment, furniture, and storage. The specific requirements for the SCGLAS node are TBD. The current situation is TBD.

4.3.7.1.3 Power Requirements

Power requirements reflect the physical electrical support requirements for the SCGLAS node. The basic approach is to require a dedicated 20 ampere circuit of appropriate voltage (120 or 240) for each identified workstation unit. Workstation units consist of a workstation and associated peripherals. Additional dedicated circuits must be provided for loads in excess of 2kVa, and for laser printers. Each workstation unit will interface to the branch circuit through a workstation-rated Uninterruptible Power Supply (UPS) and associated software capable of shutting down the workstation in case of extended power outages. Sufficient battery power should be available to run the workstation unit for at least fifteen minutes to avoid shutdown during brown-outs or power fluctuations. The UPS must also provide power conditioning, or SCF implementation leader-approved surge protectors (APC Surge Arrest Professional or equivalent specifications) must be used to avoid damage to equipment due to power spikes.

The current power configuration meets the present needs; however, the power requirements will increase with increases in size and number of components. The final power requirements are TBD.

4.3.7.1.4 Environmental Conditioning

TBD

4.3.7.1.5 Communications

The communications requirements for the SCGLAS node are:

- provide general team e-mail, and intra-science team electronic communications,
- access EOSDIS facilities, systems, and services through the NSI network connectivity,
- provide access to data within the GLAS SCF,

- provide the data collection and communication node to external supporting systems,
- provide voice communications capabilities (telephones)

4.3.7.2 Computer Equipment

Currently, the SCGLAS node is equipped with an HP workstation and peripherals. Additional computer equipment will be added and replaced as required. Dr. Minster may supplement his SCF node with additional computer equipment. The detailed list of SCF computer equipment at the SCGLAS node is shown in Table 4-6.

Table 4-6 University of California San Diego SCF Equipment

Serial Number	Description	Manufacturer	Model
4560C13205	CD-ROM Drive - 600Mb SE SCSI	HP	C3560U
GB00044700	DAT Drive - DDS 120m SE SCSI	HP	C1533A
GB42003267	DAT Tape Autochanger - 6 slots	HP	C1560B
TT821391	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
SG46008407	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
SG46008402	Disk Drive - 2.1Gb FW SCSI	HP	3554UW
FT119419	Disk Drive - 2.1Gb FW SCSI	Seagate	C3550
SG50010000	Disk Drive - 2.1Gb FW SCSI	Seagate	3554UW
K4762290	Disk Drive - 4.25 Gb FW SCSI	Seagate	ST15150WD
JP01071952	Monitor - 19" Color	HP	A4033A
JP01071969	Monitor - 19" Color	HP	A4033A
**PA6666	RAM - 64MB upgrade board for HP735/125MHZ	Dataram	
**PA7777	RAM - 64MB upgrade board for HP735/125MHZ	Dataram	
**K8888	RAM - 64MB upgrade board for HP735/125MHZ	Kingston	KTH700/128
**K7777	RAM - 64MB upgrade board for HP735/125MHZ	Kingston	KTH700/128
US41005089	Tower - w/2Gb SE Disk - SE SCSI	HP	C3023T
SG05002296	Tower - w/2x2Gb FW Disks - FW SCSI	HP	C3550TW

Table 4-6 University of California San Diego SCF Equipment (Continued)

Serial Number	Description	Manufacturer	Model
6451A00194	Workstation - HP 735/125 CRX	HP	A1950A
CA42N90089	X-Terminal - ENVIZEX	HP	C2732A

4.3.7.3 Facility Design

4.3.7.3.1 Location

The address of the SCGLAS node is: Scripps Institute of Oceanography, IGPP 0225, University of California San Diego, 9500 Gilman Drive, La Jolla, California.

Detailed location information (room numbers, etc.) is TBD.

4.3.7.3.2 Floor Plan

TBD

4.3.7.4 Office Equipment

4.3.7.4.1 Furniture

TBD

4.3.7.4.2 Record and Documentation Storage

TBD

4.3.7.4.3 Supplies

The SCGLAS node general supplies will include:

- office supplies (paper, pens, pencils, etc.)
- DAT and DLT tape media
- optical (CD) media
- laser toner cartridges
- inkjet and paintjet cartridges
- fusion roller assemblies and fuser oil
- laser printer and plotter paper stock
- TBD

Section 5

External System Interfaces

This section identifies the GLAS SCF external system interfaces and the proposed mechanisms for implementing each interface. This section also identifies the assigned responsibilities with respect to each external system interface.

5.1 EOS Data Information System/DAAC

The EOSDIS is the GLAS SCF's primary external system interface. This interface is described in applicable document 2.2e, Interface Requirements Document (IRD) Between EOSDIS and Science Computing Facilities. The interfaces from the IRD that may be applicable to the GLAS SCF are:

1) Data Production Software Development - this interface allows for the delivery of the SDP Toolkit to the SCF and for the delivery of the GLAS Science Software to the EOSDIS.
2) Product QA - provides a mechanism to notify the GLAS Science Team of problems in standard product generation and to allow the team to analyze the situation and determine action(s) to take.
3) Data Product Processing - mechanism that provides status of standard data product generation to the SCF.
4) Data Product Reprocessing - mechanism to request standard data product reprocessing.
5) Calibration Coefficients Update - mechanism to request current calibration coefficients and to update calibration coefficients.

The GLAS GDS Software Development Team has identified an additional interface between the SCF and the EOSDIS. This interface is:

1) Data Retrieval and Delivery - mechanism to retrieve standard data products and to deliver metadata, ancillary files, and Levels 3 and 4 data products.

The following entities share the responsibility for establishing and maintaining interface compatibility with the EOSDIS:

- GLAS GDS Software Development Team
- GLAS SCF Operations Team
- EOSDIS Operations Team

Compatibility between the EOSDIS and the GLAS SCF will be assured by following EOSDIS guidelines and constraints. There are no planned departures from the EOSDIS compatibility guidelines.

5.2 Host Facility

The SCF will be compatible with other systems at each of the Science Team Member's affiliated institution or agency. Interfacing with the hosts' systems is the responsibility of the SCF Operations Team.

Section 6

Implementation

6.1 Schedule

The GLAS SCF is presently being used for simulations, algorithm development, and related activities. The requirement for the GLAS SCF extends to the year 2007, allowing for five years of mission operations following the launch in 2001, and allowing for one year of close-out processing and research following the end of the on-orbit operational phase.

The detailed implementation/procurement schedule is TBD.

6.2 Responsibilities

The GLAS SCF will be implemented under the direction of the GLAS Science Team, with Dr. Jay Zwally being the implementation leader.

6.3 Procurement

The procurements related to the facility are TBD, and will follow standard NASA procurement procedures.

6.4 Staffing

Current staffing at the GSFC/Central node consists of one operations person, and it is anticipated that, after launch, two persons will work staggered shifts to provide 12-hour operations coverage.

Staffing at the Science Team nodes of the GLAS SCF presently is comprised of part-time operators. After launch, the staffing requirements at these distributed nodes are TBD.

6.5 System Upgrades

System upgrades are anticipated for the GLAS SCF, due to the expected emergence of new technology during the 1998-2007 time period, and due to the increasing amounts of data collected and the extended data analyses to be performed.

6.6 Training

As required, system administrators and users will be trained on the computer systems in the SCF.

Section 7

Operations and Maintenance

7.1 Operations

The detailed GLAS SCF operations schedule is TBD. Some scheduling items are:

- Multi-year algorithm and software development (Present-to-2001)
- Moving the GSFC/Central node, as well as the GSFC/Land and the GSFC/Atmosphere nodes into Building 33 upon the building's completion in 1999
- For one year after launch, GLAS ESDIS software execution on the GSFC/Central node in parallel with the ESDIS processing, for assessment of the ESDIS products
- During the five-year mission, post-processing quality assurance and metadata generation activities
- During the five-year mission, Precision Orbit Determination (POD) and Precision Attitude Determination (PAD) activities
- Standard data product retrieval during the five-year mission
- Level 3 and Level 4 processing during the five-year mission
- Ancillary file production during the five-year mission
- Post-mission phase-out of SCF operations for one year after the end of the mission

7.2 Maintenance

Hardware maintenance will be performed as needed. The SCF equipment will be covered by either: (a) a hardware maintenance contract with a hardware vendor, or (b) by an SCF implementation leader-approved alternative. The SCF implementation leader will maintain a stock of spare parts for unmaintained or obsolete components.

Software support will be purchased from software vendors for all COTS packages used in the SCF.

7.3 Responsibilities

The operations and maintenance activities will be performed under the direction of the GLAS Science Team.

7.4 Staffing

For the GLAS mission, there is expected to be an operations staff of two members located at the GSFC/Central node. Staffing at the other SCF locations is TBD.

7.5 Evolution/Lifetime

The SCF will evolve, and has a lifetime which spans the time period from the present through to the year 2007. Anticipated follow-on GLAS missions will extend the GLAS SCF lifetime for an additional ten years, to 2017.

7.6 Training

New users will be trained as required. Operations personnel will be trained by the GLAS GDS Software Development Team.

Section 8

Security Requirements

8.1 Requirements

8.1.1 EOSDIS Requirements

Table 8-1 "EOSDIS Security Requirements" contains the security requirements imposed on the GLAS SCF by the EOSDIS. The requirements are taken from applicable document 2.2e, IRD Between EOSDIS and Science Computing Facilities.

Table 8-1 EOSDIS Security Requirements

Requirement Number	Requirement
SCF-0025	The SCF interface platform shall provide one of the following levels of security for inter-operation with EOSDIS: a) Kerberized authentication for bi-directional file transfers. b) Use of Distributed Computing Environment (DCE) for authentication of users, authorization of users for access to services such as remote file access, and provision for integrity of data being transferred.

8.1.2 GLAS Requirements

Table 8-2 "GLAS Security Requirements" contains the security requirements imposed on the GLAS SCF by the GLAS Science Team. The requirements are taken from applicable document 2.2k, GLAS Science Software Requirements Document.

Table 8-2 GLAS Security Requirements

Requirement Number	Requirement
GESS-0170	GLAS ESDIS Software baselined code products and documentation will be stored in designated controlled directory and file space to ensure the maintenance of product integrity.
GDSS-0090	The use of the fail-safe/back-up activities and approaches shall support the maintenance of product integrity throughout the life cycle and the operational mission.
GDSS-0100	Access, userids, passwords, and directory space information will be protected throughout the configuration management processes. All operations will be performed in accordance with GSFC and ESDIS security guidelines and requirements.

Table 8-2 GLAS Security Requirements (Continued)

Requirement Number	Requirement
GDSS-0120	The policies and standards imposed by the ESDIS Project and the GLAS Science Team will be used.

8.2 User Responsibilities

The GLAS SCF user has the following responsibilities to maintain the security and integrity of the SCF:

- Do not share userids, passwords, or any other secure information with any other user.
- Adhere to all security procedures and guidelines as provided by SCF administrative personnel.
- TBD

8.3 Administrative Responsibilities

The GLAS SCF administrative personnel have the following responsibilities to fulfill in order to maintain the security and integrity of the SCF:

- Determine security procedures and guidelines, and ensure that security requirements in Section 8.1 are fulfilled.
- Ensure security procedures and guidelines are being used.
- Determine and employ methods to prevent unauthorized entry into GLAS SCF computer systems.
- TBD

Abbreviations & Acronyms

ALT	designation for the EOS-Altimeter spacecraft series
DADS	Data Archival and Distribution System
DCE	Distributed Computing Environment
ECS	EOSDIS Core System
EOS	NASA Earth Observing System Mission Program
EOSDIS	Earth Observing System Data and Information System
ESDIS	Earth Science Data and Information System
GDS	Ground Data System
GLAS	Geoscience Laser Altimeter System
GSFC	Goddard Space Flight Center
IRD	Interface Requirements Document
IST	Instrument Support Terminal
LAM	Laser Atimeter Mission
LASER	Light Amplification by Stimulated Emission of Radiation
LIDAR	Light Detection and Ranging
N/A	Not (/) Applicable
NASA	National Aeronautics and Space Administration
PAD	Precision Attitude Determination
POD	Precision Orbit Determination
QA	Quality Assurance
SCF	Science Computing Facility
SDP	Science Data Production
TBD	to be determined, to be done, or to be developed
UNIX	the operating system jointly developed by the AT&T Bell Laboratories and the University of California-Berkeley System Division
V&V	Verification and Validation
WFF	Wallops Flight Facility

Glossary

Level 0	The level designation applied to an EOS data product that consists of raw instrument data, recorded at the original resolution, in time order, with any duplicate or redundant data packets removed.
Level 1A	The level designation applied to an EOS data product that consists of reconstructed, unprocessed Level 0 instrument data, recorded at the full resolution with time referenced data records, in time order. The data are annotated with ancillary information including radiometric and geometric calibration coefficients, and georeferencing parameter data (i.e., ephemeris data). The included, computed coefficients and parameter data have not however been applied to correct the Level 0 instrument data contents.
Level 1B	The level designation applied to an EOS data product that consists of Level 1A data that have been radiometrically corrected, processed from raw data into sensor data units, and have been geolocated according to applied georeferencing data.
Level 2	The level designation applied to an EOS data product that consists of derived geophysical data values, recorded at the same resolution, time order, and georeference location as the Level 1A or Level 1B data.
Level 3	The level designation applied to an EOS data product that consists of geophysical data values derived from Level 1 or Level 2 data, recorded at a temporally or spatially resampled resolution.
Level 4	The level designation applied to an EOS data product that consists of data from modeled output or resultant analysis of lower level data that are not directly derived by the GLAS instrument and supplemental sensors.
metadata	The textual information supplied as supplemental, descriptive information to a data product. It may consist of fixed or variable length records of ASCII data describing files, records, parameters, elements, items, formats, etc., that may serve as catalog, data base, keyword/value, header, or label data.
product	Specifically, the Data Product or the EOS Data Product. This is implicitly the labeled data product or the data product as produced by software on the SDPS or SCF. A GLAS data product refers to the data file or record collection either prefaced with a product label or standard formatted data label or linked to a product label or standard formatted data label file. Loosely used, it may indicate a single pass file aggregation, or the entire set of product files contained in a data repository.
Standard Data Product	Specifically, a GLAS Standard Data Product. It represents an EOS ALT-L/ GLAS Data Product produced on the EOSDIS SDPS for GLAS data product generation or within the GLAS Science Computing Facility using EOS science community approved algorithms. It is routinely produced and is intended to be archived in the EOSDIS data repository for EOS user community-wide access and retrieval.