ASTER Ground Data System (GDS)/EOS Ground System (EGS)

Overall Test Agreement

Baseline

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Contents

Figures

Tables

1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to formalize an agreement and general understanding between Japan's Ministry of International Trade and Industry (MITI) Earth Resources Satellite Data Analysis Center (ERSDAC) Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Ground Data System (GDS) Project and United States National Aeronautics and Space Administration (NASA) Earth Science Data and Information System (ESDIS) Project to identify joint test activities and schedules between the ASTER GDS and the Earth Observing System (EOS) Ground System (EGS). This document provides the mechanism for defining an ASTER GDS/EGS integrated test schedule and for describing objectives for the joint tests. Detail test documentation and schedules will be defined separate from this document but in accordance with the agreements defined within this Test Agreement.

1.2 Scope

This paper establishes the agreements and joint responsibilities of testing the interfaces and the operations readiness between the ASTER GDS and the EGS. The ASTER GDS, residing at the ERSDAC, components include the ASTER Operations Segment (AOS), the ASTER Communications and System Management Segment (CSMS) and the ASTER Science Data Processing Segment (SDPS). The EGS components include the EOSDIS, [comprised of the EOSDIS Core System (ECS), the EOS Data and Operations System (EDOS), and the EOSDIS Backbone Network (EBnet)], and NASA institutional providers.

1.3 Applicable Documentation & Home Pages

421-12-01-01	*Project Implementation Plan, Volume II - Ground Data System, Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) , ESDIS and EOS-AM Projects*
505-41-18	*Interface Requirements Document between Earth Observing System Data and Information System (EOSDIS) Core System (ECS) and MITI ASTER GDS Project*
560-EDOS-0211.0001	*Interface Requirements Document (IRD) between Earth Observing System (EOS) Data and Operations System (EDOS) and the EOS Grond System (EGS) Elements.*
209-CD-002-004	*Interface Control Document between Earth Observing System Data and Information System (EOSDIS) Core System (ECS) and ASTER GDS*
510-CD-EDOS/EGS	*Interface Control Document between Earth Observing System Data Operations System (EDOS) and EOS Ground System (EGS)*
510-CD-EDOS/ASTER	*Interface Control Document between Earth Observing System Data Operations System (EDOS) and ASTER Spaceborne Thermal Emmission and Reflection Radiometer (ASTER) Ground Data System (GDS)*
540-032	*Interface Control Document between EOSDIS Backbone Network (EBnet) and Distributed Active Archive Centers (DAAC)*
540-037	*Interface Control Document between EOSDIS Backbone Network (EBnet) and ASTER GDS*
AG-E-E2060	Interface Requirements Document (IRD) between ASTER Japan IST and ASTER US IST (IST-US)

AG-E-E2061	Interface Control Document (ICD) between ASTER Japan IST and ASTER US IST (IST-US)
ESDIS Project	ESDIS Project Home Page, http://spsosun.gsfc.nasa.gov/EOSDIS_main.html
ESDIS SI&T	ESDIS Project EGS I&T home page & ASTER GDS/EGS Integrated Test Schedule, http://esdis.gsfc.nasa.gov/integ/integ.html
EGS I&T	EGS I&T contractor home page with Confidence Test Program Plan and Confidence Test Packages, http://fairmont.ivv.nasa.gov/it/

1.4 Document Change Procedure

Changes to the terms and conditions of this document can be initiated by either party and changed only by mutual agreement of both parties. This document will not be configuration controlled by the NASA ESDIS Project Configuration Control Board (CCB). However, proposed changes to this document must be approved by the ERSDAC ASTER Project CCBs. The ASTER Project CCB responsibility for this document is established in accordance with the requirements of the document, ERSDAC AG-E-S-0004.

2.0 SYSTEMS OVERVIEW

2.1 ASTER GDS Overview

The ASTER GDS has been defined as a hierarchy of segments, subsystems, and components. Three ASTER GDS segments are defined to support three major operational areas: the ASTER Operation Segment (AOS), the Communications and System Management Segment (CSMS), and the Science Data Processing Segment (SDPS). The segments are further divided into ASTER GDS functional elements to provide the support required by the operational segments. The major elements of the ASTER GDS are described briefly below.

2.1.1 ASTER Operations Segment

The AOS manages the ASTER instrument operations and controls the ASTER instrument through the EOS Operations Center (EOC). The AOS elements are the Instrument Control Center (ICC), including the Instrument Control Operation Subsystem, the Instrument Analysis Support Subsystem, and the Instrument Support Terminal (IST). The ICC is responsible for the operations of the ASTER instrument. It performs planning, scheduling, commanding (via EOSDIS), and monitoring. The IST connects the ASTER Science Team Leader to the ICC in support of instrument operation.

2.1.2 ASTER Communications and System Management Segment

The ASTER CSMS provides system resource management, communications services, and a data information system for the entire ASTER GDS project. The CSMS includes the Ground System Management Subsystem (GSMS), and the ASTER Data Network (ADN). The GSMS provides system management services for the ASTER GDS elements, plus coordination of ground system operations within and between these elements. The ADN provides an internal network for communications among the ASTER GDS elements, a network interface to the science user network, network services at the application layer, and a network management facility.

2.1.3 ASTER Science Data Processing Segment

The ASTER SDPS provides a set of processing and distribution elements for ASTER science data, a direct receiving element for ASTER raw data, and a software implementation system for the entire ASTER Product Generation Subsystem (PGS). The ASTER SDPS elements include the PGS, consisting of the Data Processing Subsystem (DPS), the Data Analysis Subsystem (DAS) and other subsystems, the Information Management Subsystem (IMS), the ASTER Data Archive and Distribution Subsystem (DADS), and the Software Implementation Support Subsystem (SISS). The PGS and DADS facilities processing the data from Level 0 data up to standard higher data products, provide short- and long-term storage for the ASTER project, and distribute the data to users. The IMS provides a data and information management service including a catalog system in support of user data selection and ordering.

2.2 EGS Overview

The EGS is an aggregation of ground stations, control center, data centers, institutional facilities, services and organizations to support the operations of the EOS spacecraft and instruments, and data processing of the EOS instruments for scientifically useful products. The EGS includes the dedicated EOSDIS components and the necessary institutional, inter-agency, and international facilities.

The EOSDIS components include:

- ECS - provides EOS flight operations, science data processing, archival and distribution, and EOSDIS communications and system management;
- EDOS - provides EOS data capture, Level 0 processing and backup archive;

- EBnet - provides all EOS operational communication services, along with EOSDIS internal communication services;
- EOSDIS Test System - provides test data generation and EGS simulation capabilities
- DAACs - provides EOSDIS and host provider services for production, archive, and distribution of EOSDIS science data products;
- Science Computing Facilities - provides science data processing software/algorithms, data product quality assessment, and user support;
- EOSDIS Ground Stations - provide mission support post-AM-1, X-band and S-band.

Additional ground system facilities include:

- Flight Dynamics Division - provides orbit and attitude data and orbit adjust and maneuver computations for EOS spacecraft
- Space Network - provides Telemetry Data Relay Satellite System (TDRSS) services for EOS AM-1 spacecraft and backup for subsequent missions
- Wallops Orbital Tracking Stations (WOTS) and the AM-1 backup/contingency sites at Gilmore Creek, Alaska and Svalbard, Norway - provides low-rate emergency communications, commanding, and housekeeping telemetry
- EOSDIS Ground stations - X-Band Ground Stations - provides space-to-ground communications services and data acquisition for EOS AM-1 mission
- Affiliated Data Centers (ADCs) and Other Data Centers (ODCs) - provide selected non-EOS data and metadata to DAACs for archive and user access
- International Partners Facilities - provide interface with international participants
- Spacecraft Development and Launch Support - provides real-time spacecraft simulations, generation and test of flight software updates, and operational launch support services
- NASA Science Internet (NSI) - provides external communications services between EOSDIS and EOSDIS users.

3.0 ASTER GDS/EGS INTERFACE DEFINITION

The ASTER GDS interfaces with EGS for exchange of information and data related to the operations and science processing of the ASTER instrument on-board the AM-1 spacecraft. The ASTER GDS interfaces with EDOS and ECS for level zero (L0), level 1 (L1), and user data product exchange via communication circuits provided by the EBnet Project or via physical media . The EBnet Project provides the communications infrastructure via the EBnet system and the NSI circuits as defined in the EBnet level 2 requirements and traffic database. These circuits interface with the ASTER Data Network (ADN) and will be tested and installed prior to the required activation dates to support the ASTER GDS to EGS test activities. The following sections describe the ECS and EDOS interfaces.

3.1 ASTER GDS to ECS Interfaces

The ASTER GDS to ECS interfaces can be divided into the ECS FOS, SDPS, and SMC; with CSMS providing the communication infrastructure.

3.1.1 ECS FOS - ASTER GDS

The ECS FOS to ASTER GDS AOS/ICC interface supports the exchange of the following data:

- Planning & scheduling information
- Instrument commanding and loads
- Command & telemetry monitoring
- Other ECS IST/AOS ICC functions as defined in the ICD between ECS and ASTER GDS and the IRD between EOSDIS and the MITI ASTER GDS.

3.1.2 ECS SDPS - ASTER GDS

The ECS SDPS to ASTER GDS interface supports the following:

- System interoperability for ASTER or EGS user search and request of either the ASTER GDS and ECS catalogs of data holdings via IMS
- Exchange of Data Acquisition Requests (DARs), DAR status, user data product requests/status (Data Processing Requests - DPRs) and user data products via media distribution.
- Ingest of L1 data products from ASTER GDS via media and ECS EDC DAAC processing of higher level products for archive & distribution
- ASTER Expedited Data Sets (EDSs) via the GSFC DAAC
- Exchange of information related to the LTIP, and LTSP
- The integration and test of the ASTER GDS software
- ASTER SCF to ECS EDC DAAC interface testing
- And other functions as defined in the ICD between ECS and ASTER GDS, and the IRD between EOSDIS and the MITI ASTER GDS.

3.1.3 ECS SMC - ASTER GDS

The ECS SMC to ASTER GDS interface supports the system & network management of the EGS and the ASTER GDS including monitoring and coordination as defined in the ICD between ECS and ASTER GDS, and the IRD between EOSDIS and the MITI ASTER GDS.

3.1.4 ASTER IST-US - ASTER GDS IST

ERSDAC is developing ASTER IST software and will supply Jet Propulsion Laboratory (JPL) with an IST client. The ASTER software will be used to build US ASTER IST. US ASTER IST is used by Science Scheduling Support Group (SSSG) at JPL to communicate recommended ASTER instrument schedules to the Japan AST SSSG (SSSG-Japan). The interface is described in the Japan IST - ASTER US IST IRD and ICD.

3.2 ASTER GDS to EDOS Interfaces

EDOS interfaces with the ASTER GDS SDPS for L0 Production Data Sets (PDSs) via physical media. The EDOS interfaces with ASTER GDS AOS/ICC for AM-1 housekeeping data, EDUs, CODAs, SCS reports, and other functions as defined in the ICD between EDOS and the ASTER GDS and the ICD between EDOS and EGS.

4.0 TEST ACTIVITIES

4.1 ASTER GDS TEST ACTIVITIES

The ASTER GDS test activities will exercise the ASTER GDS internal interfaces and support the external interfaces to the EGS. ASTER GDS/EGS interfaces for international data exchange will be accomplished via electronic networks and postal delivery. The ASTER GDS to EGS interface tests are documented in the EGS I&T Confidence Test Program Plan and EGS I&T confidence test packages. The ASTER GDS I&T Master Plan and procedures will reference the applicable EGS I&T confidence test package. These interfaces tests documented in the confidence test packages will be agreed to as part of the EGS/ASTER GDS IPT negotiations and meetings. ASTER GDS will support the mission operations tests and rehearsals as defined by the ESDIS Project Mission Operations and Science Operations Managers.

The ERSDAC Integration and Test construction of ASTER GDS is as follows and is referenced in table 4.3.2-1.

ASTER GDS Test Phase	Test Phase Scope	ERSDAC Organization Lead
Segment Integration Tests		Segment I&T developer
Segment Interface Tests	Within ASTER GDS	ASTER GDS I&T (SI)
Conformance Test	Within ASTER GDS	ASTER GDS I&T (SI)
Compatability & Integration Tests	Within ASTER GDS, between ASTER GDS & EGS	ASTER GDS I&T (SI)
End-to-End Tests	Within ASTER GDS, between ASTER GDS & EGS	ASTER GDS I&T (SI)

4.2 EGS TEST ACTIVITIES

The EGS test activities will exercise and validate the EGS interfaces and EGS functional and performance requirements. The EGS test activities are structured around two EGS Versions (e.g. Version 1 & Version 2). The EGS Versions are represented by defined releases for each of the EOSDIS components and institutional systems (e.g. ECS release A and EDOS releases V2 & V3 are part of EGS Version 1, while ECS release B and EDOS C1 are part of EGS Version 2). The EGS I&T plans and procedures are to be documented in the EGS I&T Confidence Test Program Plan and the associated Confidence Test Package documents. These documents include the ASTER GDS to EGS interface tests. These interfaces tests documented in the confidence test packages will be agreed to as part of the EGS/ASTER GDS IPT negotiations and meetings. The ASTER GDS I&T Master Plan and procedures will reference the applicable EGS I&T confidence test packages. EGS test activities include the following four types of unique testing. These are further described in section 4.3.

- Engineering Testing between development organizations (EOSDIS and ERSDAC)
- EGS Integration and Test (I&T)
- Science Software Integration and Test (SSI&T)
- Operations Readiness Test

ERSDAC SI and EGS I&T will define in the detailed confidence test packages information on test data needed and post-test analysis to be performed. In addition, ERSDAC SI and EGS I&T will discuss the test results and provide a test results that has been collectively reviewed by both sides.

4.3 ASTER GDS/EGS JOINT TESTS

System integration between the ASTER GDS and EGS is conducted in a series of phased, incremental tests on delivered EGS and ASTER GDS components. These tests are intended to exercise system components, and to confirm that relevant interfaces and end-to-end system performance meet mission requirements. Mission operations testing follows system integration and certification test activities.

The complete list of agreed upon tests will be contained in the joint ASTER GDS/EGS Integrated Test Schedule (See Section 4.3.3) which will be maintained on the ESDIS SI&T homepage (url= http://esdis.gsfc.nasa.gov/integ/integ.html). The types of tests planned are listed below and described in subsequent paragraphs:

- Engineering Tests
- EGS I&T
- SSI&T
- Operations Readiness Tests

Figure 4.3-1 shows the EGS Test activities and their relationships to the ASTER GDS test activities. Interdependencies.

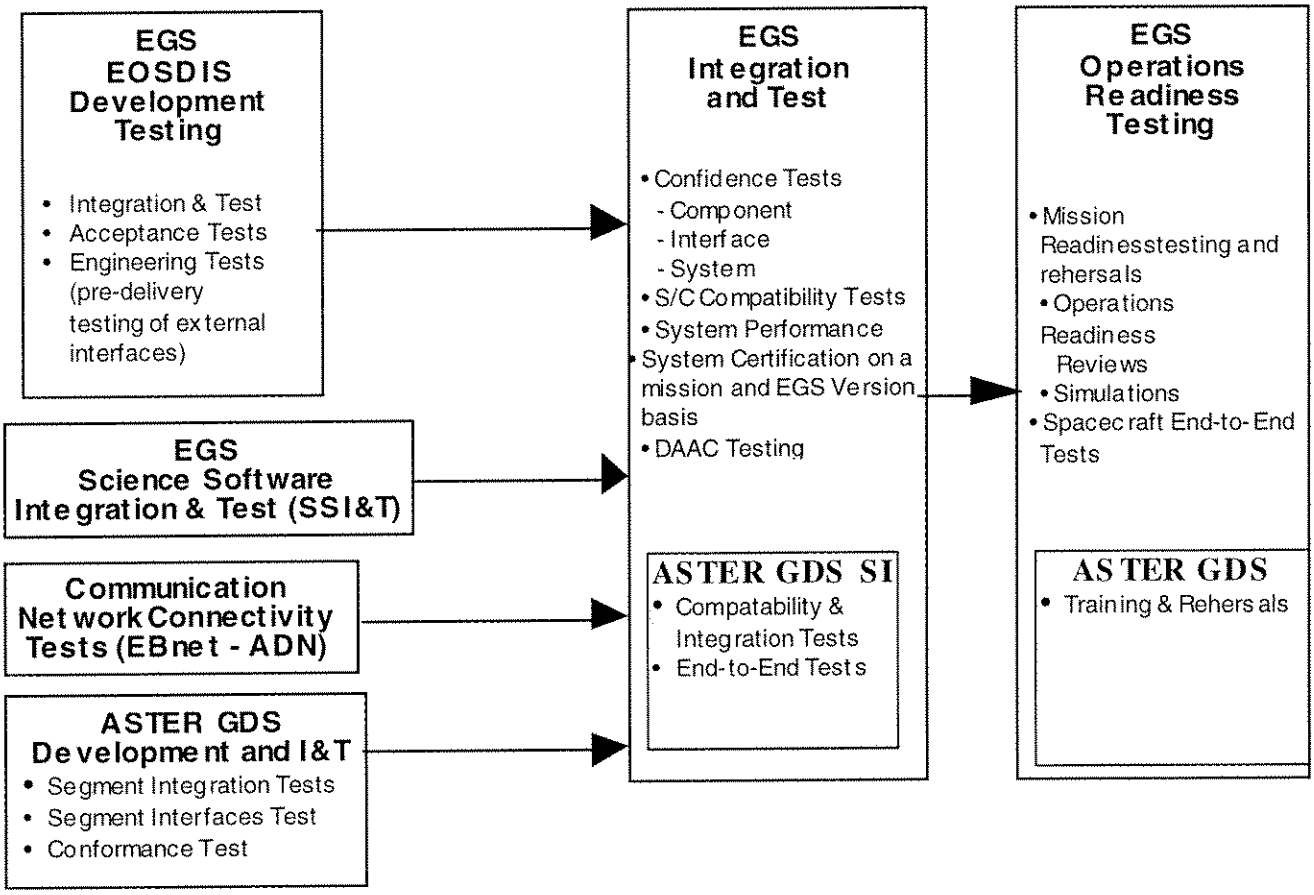

Figure 4.3-1 ASTER GDS/EGS Test activities and relationships

Engineering tests and data flows between relevant elements of the ASTER GDS and EGS will be conducted as opportunities and needs arise. These engineering tests will be performed prior to the formally scheduled ASTER GDS and EGS test activities to provide an early assessment of the interface compatibility and/or the functionality of the point-to-point systems. These test will be negotiated between the development organizations on either side of the interface. ERSDAC and EGS development organization will agree on engineering tests. These engineering tests will be documented and described in separate engineering test agreements between the two interface development organizations. The EGS I&T/ASTER GDS SI teams should participate in these engineering tests so that the information learned is included in the joint EGS/ASTER GDS confidence testing performed by ERSDAC SI and EGS I&T.

The EGS I&T includes a series of confidence tests (component, interface, and system) to verify mission critical functionality, requirements, system performance, spacecraft compatibility tests, and system

certification on a mission/EGS version basis. EGS I&T component level confidence tests exercise delivered EOSDIS components (EOC, DAACs, SMC, EDOS, and EBnet) key functions in the operational environment in a standalone configuration. EGS I&T interface level confidence tests verify the EGS internal (EOSDIS and institutional) interfaces and external interfaces (e.g. ASTER GDS) functionality against the agreed to IRDs and ICDs in an operational environment. EGS I&T system level tests exercise system level functionality between multiple EGS and ASTER GDS components (e.g. spacecraft compatibility tests, end-to-end tests, and system certification on a mission/EGS version basis). Additionally, the DAAC may define and execute tests that are felt necessary to further verify unique functionality specific to their facilities. Details of the EGS I&T activities are documented in the EGS confidence test packages and ASTER GDS test procedures.

The ASTER Level 1 software is provided by the ERSDAC and will be integrated into the ECS at the EROS Data Center (EDC) DAAC primarily by the EDC personnel and the ECS Operations and Maintenance (O&M) staff. Although ASTER Level 1 data products are generated by ASTER GDS and provided to ECS at the EDC DAAC, the integration effort will ensure that the Level 1 software can be integrated and run for testing purposes. Details of the ASTER Level 1 SSI&T will be documented in the Science Software Integration and Test (SSI&T) Procedures Document Between the GSFC ESDIS Project and the ASTER GDS for the ASTER Level-1 Software.

Operations readiness testing includes a series of mission readiness tests, rehearsals, and end-to-end test to ensure the ground system components and the operation's staff function as a unit. Mission readiness tests and rehearsals will be defined to train the operations staff and to verify the operations procedures/policies that will be used during the mission. An Operations Readiness Review (ORR) will be conducted prior to launch to assess the operational readiness of the AM-1 ground system and mission operations staff to support mission operations. Operational readiness test objectives are to be cooperatively defined by the ESDIS Mission Operations and Science Operations Managers and the ASTER GDS Project. See section 4.4 for addition information on operations readiness testing.

4.3.1 JPL/ASTER GDS IST Interface

ERSDAC is developing a client server IST. The ASTER GDS IST client (IST-US) will be provided to JPL and the ASTER IST-Server will reside at the ASTER GDS AOS/ICC. The purpose of the ASTER IST at JPL is to allow JPL to communicate recommended ASTER instrument schedules to the Japanese AST, SSSG-Japan, and ASTER Team Leader all located in Japan. Testing of the ASTER developed IST software is the responsibility of ERSDAC with some support from JPL. Testing of the IST-US communication networks between JPL and the ASTER GDS AOS/ICC is the responsibility of JPL and ERSDAC.

4.3.2 Common Test Terminology

Both the ASTER GDS and the EGS I&T will participate as appropriate, in the integration and test activities between their common interfaces. Table 4.3.2-1 provides a description of agreed to test description terminology used to describe the ASTER GDS and EGS test activities. The tests shown in this table are examples to clarify common test descriptions and test terminology. Details of the joint EGS I&T /ASTER GDS tests will be defined in the EGS I&T confidence test packages and the corresponding ASTER GDS test procedures. Joint interface testing will defined in accordance with section 3 of this document and the approved IRDs/ICDs signed between ERSDAC and NASA. Scheduling information for the joint tests is discussed in section 4.3.3.

4.3.3 ASTER GDS/EGS Integrated Test Schedule

The schedule for the interface and operations testing and related ASTER GDS-to-EGS joint pre-mission events will be mutually agreed and documented in the "ASTER GDS/EGS Integrated Test Schedule." The test schedule will be maintained by the ESDIS Project by the Science Data and External Interface Manager and will be updated based on mutual agreement between ERSDAC and NASA ESDIS Projects; with due consideration given to joint development schedules, test goals, mission-driven readiness and reviews.

4.4 ASTER GDS/EGS Operations Readiness Tests and Rehearsals

The description of the mission operations readiness tests and rehearsals to be conducted between the ASTER GDS and the EGS. These readiness tests and rehearsals will be defined jointly by the ESDIS Project Mission and Science Operations Managers, ERSDAC, ASTs (US and Japan), and the ASTER Team Leader in Japan. The details of these activities will be documented in a separate document.

Supplied as a separate file electronically

Table 4.3.2-1 Joint ASTER GDS/EGS Test Definitions

Appendix A

Abbreviations and Acronyms

ADC	Affiliated Data Center
ADN	ASTER Data Network
AST	ASTER Science Team (US and Japan)
AT	acceptance test
AOS	ASTER Operations Segment
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
C1	EDOS Release Configuration 1 used for AM-1 operations
CCB	Configuration Control Board
CODA	Customer Operations Data Accounting
COTS	Commercial Off-the-Shelf (products)
CSMS	Communications and Systems Management Segment
DAAC	Distributed Active Archive Center
DADS	Data Archive and Distribution System
DAR	Data Acquisition Requests
DDL	Direct Downlink
DPS	Data Processing System
DRS	DDL Receiving System
DSN	Deep Space Network
EBnet	EOSDIS Backbone Network (combines Ecom and ESN)
ECS	EOSDIS Core System
EDC	EROS Data Center
EDOS	EOSDIS Data and Operations System
EDS	Expedited Data Sets
EDU	EDOS Data Units
EGS	EOS Ground System (comprised of EOSDIS plus institutional systems)

EOC	EOS Operations Center
EOS	Earth Observing System
EOSDIS	EOS Data and Information System (comprised of ECS, EBnet, EDOS)
ERSDAC	Earth Resources Satellite Data Analysis Center (Japan)
ESDIS	Earth Sciences Data and Information System
ETE	End-to-End (Test)
FDD	Flight Dynamics Division (formerly Flight Dynamics Facility)
FOS	Flight Operations Segment
GDS	(ASTER) Ground Data System
GN	Ground Network
GSMS	Ground System Management Subsystem
GSFC	Goddard Space Flight Center
GUI	Graphical User Interface
I&T	integration and test
ICC	Instrument Control Center
ICD	Interface Control Document
IMS	Information Management System
IPT	Integrated Product Team
IRD	Interface Requirements Document
IST	Instrument Support Terminal
IST-US	Instrument Support Terminal - United States (at JPL)
JPL	Jet Propulsion Laboratory
LTIP	Long Term Instrument Plan
LTSP	Long Term Science Plan
MITI	Ministry of International Trade and Industry
MOM	Mission Operations Manager
NASA	National Aeronautics and Space Administration
NSI	NASA Science Internet
ODC	Other Data Center
O&M	Operations and Maintenance
PDS	Product Data Set

PGS	Product Generation System
SCS	Spacecraft Contact Session
SDPS	Science Data Processing Segment
SI	ERSDAC ASTER GDS System Integrator contractor (JGI)
Simulations	Rehearsals
SISS	Software Implementation Support System
SI&T	system integration and test
SSI&T	Science Software Integration and Test
SMC	System Monitoring and Coordination Center
SOM	Science Operations Manager
SSSG	Science Scheduling Support Group (US and Japan)
TBD	to Be Determined
TBR	to be resolved
TBS	to Be Supplied
TDRSS	Tracking and Data Relay Satellite System
US	United States
V2	EDOS Release Version 2, Initial Operations demonstration
V3	EDOS Release Version 3, Operational Prototype
WOTS	Wallops Orbital Tracking Station

ASTER GDS Test Description	ERSDAC Lead Organization	Equivalent EGS Test Description	ESDIS Test Phase	US Lead Organization	Generic Test Description
* **Segment Integration Tests**	ERSDAC Segment Developer	* ECS Release I&T * EDOS I&T * EBnet I&T	Developer Testing	* ECS Developer * EDOS Developer * EBnet Contractor	* Developer (ASTER GDS or EGS) internal segment testing with simulator or test data to verify hardware & software
* **Segment Interface Tests**	ASTER GDS System Integrator with Segment Developer support	* ECS Release I&T * EDOS System I&T * EBnet I&T	Developer Testing	* ECS Developer * EDOS Developer * EBnet Contractor	* Developer (ASTER GDS or EGS) interface test between two or more segments of a system(e.g. AOS to SDPS, or ECS SDPS - FOS)
* **Conformance Tests**	ASTER GDS System Integrator with Segment Developer support	* ECS Site AT * EDOS AT (C1 only)	Developer Testing	* ECS Developer	* Developer system testing to verify functional, performance, and operability requirements
* **Compatibility & Integration Tests** • **End-to-End Tests (ground system)**	ASTER GDS System Integrator with Segment Developer support	* EGS I&T - interface tests - system & end-to-end tests including ECTs and System Certification tests	EGS I&T (interface & system confidence tests)	* ESDIS EGS I&T	* ERSDAC ASTER GDS to NASA ESDIS EGS formal interface, system and end-to-end testing to verify system interface (IRD/ICDs) functionality including verification of user interfaces, EGS/ASTER GDS system certification, and spacecraft End-to-End tests
* **Operations Training & Rehersals**	ASTER GDS System Integrator with Segment Developer support	* Spacecraft End-to-End * Mission readiness tests and rehearsals	Operations Readiness Testing	* ESDIS SOM & MOM	* Mission readiness tests and rehearsals with operations personnel for training and mission operations readiness

Table 4.3.2 - 1 Joint ASTER GDS/EGS Test Descriptions