	Document #	Date					
and the second second	LAT-PS-06898						
GLAST	Author(s):						
	E. Bloom						
	K. Fouts						
	B. Grist						
CLAST LAT	M. Nordby						
OLASI LAI	Subsystem/Office						
	Integration and Test Subsystem						
Document Title							

LAT Environmental Test Implementation Plan

# Gamma-ray Large Area Space Telescope (GLAST)

# Large Area Telescope (LAT)

# Environmental Test Implementation Plan

# **Change History Log**

Revision	Effective Date	Description of Changes
		Initial Release

# Contents

1. PURPOSE	5								
2. SCOPE	5								
2.1. Document Organization	5								
3. ACRONYMS / DEFINITIONS	5								
3.1. Acronyms									
4. APPLICABLE DOCUMENTS	6								
5. SAFETY	7								
5.1. LAT SAFETY PLAN	7								
5.2. PERSONNEL SAFETY	7								
5.3. Flight Hardware SAFETY	8								
5.3.1. Electrostatic Discharge	9								
5.3.2. Safe Handling	9								
5.4. Power Protection	9								
5.5. MISCELLANEOUS	9								
6. TEST OPERATIONS									
6.1. Overview	10								
6.2. Test Schedule	10								
6.2.1. Test Scheduling	10								
6.3. Responsibilites and Organization	10								
6.3.1. Environmental Test Organizations	10								
6.3.2. LAT I&T Subsystem Responsibilities	12								
6.3.3. Test Personnel and Descriptions	13								
6.4. Test Methodology	15								
6.4.1. LAT Environmental Test Activities	16								
6.4.2. Test Baseline Control	16								
6.4.3. LAT Operational Controls	19								
7. TEST DOCUMENTATION									
7.1. Requirements Documents	20								
7.1.1. Test Plans	20								
7.1.2. Assembly Drawings	20								
7.2. Assembly Instruction Data Sheets (AIDS)	21								
7.3. Test Procedures	21								
7.3.1. Environmental Test Procedures	22								
7.3.2. Test Procedure Changes	22								
7.3.3. Test Report / Data Sheets	22								

LAT-PS-	06898 GLAST LAT Environmental Test Implementation Plan	Page 4 of 27
7.4. e	Logbook	
7.4.1.	LAT Run Log	
7.4.2.	LAT Component Installation Log	23
7.4.3.	LAT On-Time Log	23
7.4.4.	Connector Mate/De-Mate Log	23
8. QU	ALITY ASSURANCE	
8.1.1.	Quality Assurance Inspection	23
8.1.2.	LAT Non-Conformance Reports (NCR)	23
8.1.3.	Flight Software Problems	23
9. CC	NTAMINATION CONTROL	
9.1. T	VAC Contamination Control Requirements	24
9.2. I	AT Protection	
9.3. I	AT Cleaning	
10. FA	CILITIES AND SUPPORT EOUIPMENT	
10.1.	TEST FACILITY	24
10.1.1	Environmental Test Facility (NRL)	24
10.1.2	Facility Cleanliness	24
10.1.3	Handling, Packaging, and Storage	24
10.1.4	Physical Security	25
10.1.5	Computer Security	25
10.2.	Ground Support Equipment	25
10.2.1	Mechanical Ground Support Equipment (MGSE)	25
10.2.2	Electrical Ground Support Equipment (EGSE) / Online	25
11. PA	THFINDER PLAN	
11.1.	Pathfinder Lifting Operations	25
11.2.	Pathfinder Move Operations	26
11.3.	Pathfinding Equipment Requirements	
12. CC	NFIGURATION MANAGEMENT	
12.1	Documentation configuration management	
120110	2 section comparation management	

1.

#### **PURPOSE**

The purpose of this document is to document the operating plan for environmental test of the Large Area Telescope (LAT).

#### 2. <u>SCOPE</u>

This document is intended to provide the operational requirements and guidelines for activities that occur at Naval Research Laboratory (NRL) in support of environmental testing of the LAT instrument with GSE provided by LAT Design Integration and LAT Electronics. The activities required to support testing of the LAT, are described along with which organization will provide the support and/or facilities. This document discusses the configurations and the test methodologies for the LAT, and hardware/software responsibility.

#### 2.1. DOCUMENT ORGANIZATION

This document is organized as into the following major categories as follows:

- Safety
- Test Operations
- Test Personnel
- Test Documentation
- Quality Assurance
- System Safety and Security
- Contamination Control Plan
- MGSE
- EGSE
- Configuration Management

# 3. <u>ACRONYMS / DEFINITIONS</u>

#### 3.1. ACRONYMS

LAT		Large Area Telescope
GSE	and the second sec	Ground Support Equipment
GLAST		Gamma-ray Large Area space Telescope
I&T		Integration and Test
MGSE		Mechanical Ground Support Equipment
EGSE		Electrical Ground Support Equipment
SVAC		Science Verification, Analysis, and Calibration
GUI		Graphic User Interface

LAT-PS-06898	GLAST LAT Environmental Test Implementation Plan	Page 6 of 27
ISOC	Instrument Science Operations Center	
QA	Quality Assurance	
IRR	Integration Readiness Review	
TRR	Test Readiness Review	
AIDS	Assembly Instruction Data Sheet	
IFCT	Integration, Facilities, Configuration, and Test	
NCR	Non-Conformance Report	
СМ	Configuration Management	
LAN	Local Area Network	
PAIP	Performance Assurance Implementation Plan	
OSHA	Occupational Safety and Health Act	
ES&H	Environmental Safety and Health	
ESD	Electo-Static Discharge	

#### **APPLICABLE DOCUMENTS** 4.

Documents relevant to the LAT Integration and Test Plan.

APPLICABLE DOCUMENTS								
cuments relevant to the LAT Integration and Test Plan.								
LAT-MD-01312	LAT Test Plan Directive							
LAT-MD-00408	LAT Instrument Performance Verification Plan .							
LAT-MD-00649	LAT Handling and Transportation Plan							
LAT-MD-00404	LAT Contamination Control Plan							
LAT-MD-00890	LAT Instrumentation Plan							
LAT-MD-00895	LAT Survey Plan							
LAT-MD-01196	LAT Dynamics Test Plan							
LAT-MD-01600	LAT Thermal Test Plan							
LAT-MD-02726	LAT EMI/EMC Test Plan							
LAT-MD-00446	LAT SVAC Test Plan							
LAT-MD-01533	EGSE Workstation and Software Validation Plan							
LAT-MD-01587	LAT SVAC Test Plan							
LAT-MD-01598	LAT Weight and CG Test Plan							
LAT-MD-01836	LAT Dynamics Test Performance Plan							
LAT-MD-01837	LAT Thermal Test Performance Plan							
LAT-MD-01838	LAT EMI Tests Performance Plan							
LAT-MD-00676	LAT Assembly Sequence							
LAT-MD-01386	LAT Facilities Plan							

LAT-PS-06898	GLAST LAT Environmental Test Implementation Plan Page 7 of	of 27
LAT-MD-015	6 LAT Survey and Alignment Performance Plan	
LAT-MD-010	5 LAT Electrical Test Performance Plan	
LAT-MD-004	6 LAT I&T SVAC Plan	
LAT-TD-0058	6 Online Subsystem Interface Control Document	
LAT-SS-0013	LAT Tracker Interface Control Specification	
LAT-SS-0017	Tracker-LAT Electrical Interface Control Document	
LAT-SS-0023	Calorimeter-LAT Interface Control Document	
LAT-SS-0036	ACD-LAT Interface Control Document	
LAT-DS-0023	Interface Definition Drawing, CAL-LAT Mechanical Interface	
LAT-MD-027	0 Performance and Operations Test Plan	
LAT-MD-034	8 AIDS Preparation Guidelines and Requirements	
LAT-MD-034	4 Requirements for Creating and Using Redlines/Blacklines	
LAT-MD-034	2 I&T Configuration Management plan	
LAT-PS-0445	Mate and Demate Workmanship Standard	

# 5. <u>SAFETY</u>

Safety of the LAT system, its test articles and test personnel is the primary concern in all I&T test activities. Safety awareness is built into all phases of I&T testing. It will be an agenda item at the LAT Daily I&T Test Plan meetings. I&T test methods and procedures shall be developed and executed to ensure that the LAT and its test articles are in no danger due to improper handling, erroneous wiring, electrostatic discharge, contamination, power or operational problems. The details of the I&T safety system are included in this document. This section describes the LAT I&T safety plan, personnel safety, and LAT flight hardware as it relates to LAT Integration and Test environmental test activities.

# 5.1. LAT SAFETY PLAN

All Integration and Test personnel will conform to the GLAST LAT System Safety Program Plan, LAT-MD-00078. All I&T personnel are trained in Employee Orientation to Environmental Safety and Health (ES&H) and General Employee Radiological Training (GERT), provided by SLAC. In addition the LAT project requires, contamination control training, electrostatic-discharge training, and oxygen deficiency training.

# 5.2. PERSONNEL SAFETY

The LAT Safety Program is specifically intended to assure continued compliance with the SLAC ESH-100 and Occupational Safety and Health Act (OSHA) safety regulations and directives. Safety surveillance will be maintained through the program to point out any conditions that could present hazards to personnel or equipment. This surveillance is the responsibility of the LAT Integration Facility manager, the I&T manager, the SLAC Environmental Safety and Health (ES&H) representative, LAT QA, and the entire LAT team. In addition to the continuous monitoring of the facility, an organized monthly walkthrough is performed to by the facility manager and the SLAC

ES&H representative. Hazards that are identified will be documented in compliance with the SLAC ES&H guidelines and sent to the appropriate manager for resolution. It should be noted here that "Personnel Safety" is everyone's responsibility and there is no substitute for safety awareness. It is the responsibility of the LAT project management and QA to see to it that all personnel that work in the LAT facility are briefed on personnel safety policies and procedures. Each of these policies and procedures will be briefed to the participants before working at the LAT facility. Additional safety training will be conducted to familiarize LAT participants with LAT GSE and procedures, security, and applicable LAT facilities operating policies. All persons having access to the LAT clean room areas will be required to attend a training class on contamination control, ESD, and oxygen deficiency training.

### 5.3. FLIGHT HARDWARE SAFETY

The primary objective of LAT I&T throughout its test activities is the safe operation and testing of the flight hardware. The following major safety precautions will be taken to assure test article safety:

- Prior to the start of LAT testing, a briefing will be conducted by the Test Conductor for the test article on the safety of their flight hardware. This briefing will identify those conditions under which the test article is most vulnerable, any testing sequence which increases the vulnerability, the specific characteristics which lead to this condition, what parameters should be monitored, and the specific procedures to be executed to achieve a safe condition. This briefing will also include the identification of any periods during which the test article is most susceptible to contamination. Also, any combination of situations or conditions which are considered materially exclusive will be identified.
- Connector savers are used wherever physically feasible on the LAT test articles to reduce mate/demate cycles on flight connections.
- All LAT flight boxes mate/demate activities will be completed in accordance with the LAT I&T Mate/Demate Workmanship Standard (LAT-PS-04459).
- Mechanical and Electrical procedures shall include Safety provisions which will identify specific actions to be taken in the event of a facility power loss, simulator failure, EGSE failure or any emergency condition.
- Safety will be an agenda item at each LAT Daily I&T Test Plan meeting, the Mechanical Floor Engineer and Test Director will have the responsibility to remind the test team of any unusual mechanical and electrical safety aspects of the impending test.
- Any unusual conditions relating to safety or personnel or system hardware that occurs during a test shall be documented as part of the LAT Test Log.
- Prior to mating and demating all power must be turned off to the specific test article(s) under test.
- LAT I&T personnel will strictly adhere to approved, released test procedures.
- All lifting operations shall lead by the cognizant LAT I&T Mechanical Lead Engineer or a designee.

#### 5.3.1. Electrostatic Discharge

Ground wires are to be maintained with the test article at all times to eliminate ElectroStatic Discharge (ESD) and potential damage to the test article. The grounding cables stay attached to the test article while in the LAT facility. During movement of the test article, an ESD grounding cable will be required to be attached to the test article and single point ground to assure continual grounding. In compliance with the LAT Contamination Control Plan, LAT-MD-00404, LAT I&T shall ensure that the following precautions are taken when handling (installation/removal) any LAT test article to ensure protection against ESD:

- LAT main bus power shall be removed prior to any LAT equipment installation/removal, connector mating/demating operation.
- Wrist straps attached to LAT single point ground shall be used by all personnel involved in handling of any LAT flight hardware.
- All cables, test leads, instrumentation, etc., shall be disconnected from the LAT flight hardware prior to the installation/removal operation.
- All LAT electrical connectors (on the LAT harness or the LAT test articles) shall be protected by using ESD approved caps when not in use.
- The LAT and its test articles shall be grounded to single point ground at all times.
- The ground path shall comply with the "Make Before Break" requirements.
- LAT single point ground is used for electrostatic discharge.

# 5.3.2. Safe Handling

All operations and handling involving the LAT flight hardware will be in accordance with released procedures.

# 5.4. POWER PROTECTION

The protection for the LAT flight hardware and EGSE/Online against power problems is inherent in the design of the LAT EGSE/Online and operational, emergency and troubleshooting procedures. Anytime the LAT main bus power is ON, all critical parameters shall be monitored by LAT EGSE/Online and archived. The limits shall be set to prevent exceeding critical LAT and test article hardware limits and LAT EGSE/Online will control the application and removal of power automatically. During all LAT I&T tests all telemetry data shall also be continuously monitored and critical data analyzed, to verify that the test articles are within specified limits.

Power provided to the LAT instrument for test purposes shall be provided only by LAT Electronics approved power supplies via the Bus Protection Unit (BPU).

At a minimum, power and ground isolation shall be checked prior to EGSE and flight hardware connector mates.

# 5.5. MISCELLANEOUS

All miscellaneous safety procedures for future items will comply to the same LAT safety standards and undergo the same review and approval as other procedures.

#### 6. <u>TEST OPERATIONS</u>

#### 6.1. OVERVIEW

This document forms the implementation plan for operations during environmental test of the Gamma-Ray Large Area Space Telescope (GLAST) LAT. The GLAST project requires verification of the Large Area Telescope (LAT) instrument against design and engineering requirements, mission assurance requirements, science requirements and quality assurance requirements. For each of these verifications, there are tests and subsequent analyses of the produced test data. This data will be used to verify that the article being evaluated meets the requirements and specifications necessary for that article. LAT-MD 00408 identifies the tests and analyses required to demonstrate compliance with requirements of the GLAST LAT instrument. The LAT Performance and Operations Test Plan, LAT-MD-02730 describes that required tests and test phase in which they are required. The GLAST LAT Environmental Test Implementation Plan, this document, describes the operational guidelines for the LAT Instrument during the environmental test at NRL. The detailed test objectives, success criteria, approach and methods to verify that the LAT performance requirements defined in the LAT-MD 00408 are contained in individual test plans for each of the environmental tests. Integration and Test receives the test requirements from the LAT Performance and Operations Test Plan LAT-MD-02730 and from the MAR. The LAT Environmental Test Sequence (LAT-MD-02717) provides the sequence and description environmental test activities.

#### 6.2. TEST SCHEDULE

The proposed environmental test schedule is shown in Figure X. The proposed durations are for planning purposes and the dates represent current plan dates and are subject to change based hardware deliveries and LAT I&T performance.

#### 6.2.1. Test Scheduling

The environmental test schedule is managed with an integrated project management schedule. The schedule is maintained by the Project Controls subsystem with daily input from I&T personnel.

# 6.3. RESPONSIBILITES AND ORGANIZATION

#### 6.3.1. Environmental Test Organizations

The Environmental Test is supported by several key organizations listed below with the principal responsibility.

Organization	Responsibility
LAT Systems Engineering	Test Requirements Definition,
LAT Design Integration/Analysis and Engineering	Test Plans, MGSE Design, Transportation Plans
LAT Electronics	EGSE Design and Fabrication, Test Cables
LAT Integration and Test	Test Software, Assembly Procedures, Test Procedures, Handling Procedures.
NRL	Test Services, Facility Operations,

al Test	2nd Quarter Wrs Wrs Wrs Wrs Wrs Wrs Wrs Wrs Wrs Wr									•			•		*	<b>.</b>	***	<b>→</b>
LAT Environment	Finish 1st Quarter	Fri 5/26/06	Fri 1/20/06	Fri 1/27/06	Wed 2/1/06	Thu 2/9/06	Mon 2/13/06	Thu 2/16/06	Thu 3/2/06	Mon 3/6/06	Wed 3/8/06	Wed 3/15/06	Mon 3/20/06	Mon 5/15/06	Thu 5/18/06	Mon 5/22/06	Wed 5/24/06	Fri 5/26/06
	Start	Mon 1/16/06	Mon 1/16/06	Mon 1/23/06	Mon 1/30/06	Thu 2/2/06	Fri 2/10/06	Tue 2/14/06	Fri 2/17/06	Fri 3/3/06	Tue 3/7/06	Thu 3/9/06	Thu 3/16/06	Tue 3/21/06	Tue 5/16/06	Fri 5/19/06	Tue 5/23/06	Thu 5/25/06
	Duration	95 days	5 days	5 days	3 days	6 days	2 days	3 days	10 days	2 days	2 days	5 days	3 days	40 days	3 days	2 days	2 days	2 days
	Task Name	Environmental Test	Deliver LAT/Offload/Set-up	CPT	Vibe Test Prep/Check-out	Sine Vibe Test	Install Radiators	LPT	EMI/EMC Test	Acoustic Test Prep/Checkout	Acoustic Test	TVAC Prep/Check-out	TVAC Open Door Test	TVAC	CPT	Remove Radiators	Weight & CG	Pack and Ship
	₽	-	2	en	4	9	9	7	œ	в	6	÷	12	13	4	<u>9</u> 1	18	41

Figure 3: LAT Environmental Test Schedule

### 6.3.2. LAT I&T Subsystem Responsibilities

The I&T subsystem has the responsibility deliver the LAT instrument to NRL with the appropriate procedures, ground support equipment and personnel to complete required testing.

#### 6.3.2.1. Integration and Test Subsystem Management

The responsibility of I&T management is to: ensure that all aspects of LAT environmental test planning are in place and that the plans are executed in accordance with appropriate program controls. Among other things, this entails setting I&T priorities, providing program scheduling, cost accounting, performance tracking and reporting for entire subsystem. Ensure the implementation of the LAT Environmental Test plans and the LAT Performance and Operations test plan are achieved. Ensure that scientific performance and requirements are met per applicable requirements.

I&T Management is responsible for the preparation and execution of LAT environmental tests and for supporting mission level environmental testing. Responsible for coordinating and performing EMI/EMC, random vibration/acoustic testing, TVAC, and in accordance with released test plans. Responsible for coordinating with LAT subsystem engineering to complete the environmental tests. Responsible interface with the environmental test facility at Naval Research Laboratory (NRL).

# 6.3.2.2. Integration Facilities, Configuration, and Test (IFCT) Department

Develop detailed operations and test procedures. Provide properly trained and certified technicians for LAT flight hardware handling. Record and maintain records of installation and logs of activities to provide configuration control of the LAT during environmental test. Within the IFCT department there are key integration positions with unique responsibilities.

- IFCT Manager and IFCT Engineer: Managers for the department. Coordinate activities between IFCT staff. Oversee the coordination with other subsystem liaison test groups. Building manager and assistant building manager for the Integration Facility (SLAC building 33).
- Mechanical Floor Engineer: Oversee and work on the mechanical and thermal aspects of the instrument assembly, integration, and test operations. Supervise mechanical technicians. Develop and document flight hardware handling procedures and training. Lead the mechanical assembly, and preparation of the LAT for environmental tests. Responsible engineer for the assembly procedures. Responsible for the Assembly Instruction Data Sheets (AIDS). Supervises the mechanical technicians. Prepares and coordinates the daily tasks. This person is the test conductor for the mechanical operations.
- Electrical Floor Engineer: Responsible engineer for the electrical test procedures. Supervises the electrical technicians. Prepares and coordinates the daily tasks for the electrical test team. The Electrical Floor Engineer is a test conductor for the electrical testing. Responsible for identifying, acquiring and maintaining electrical ground support equipment (EGSE).
- Mechanical Technicians: Responsible for hands on mechanical assembly of the LAT under the supervision of the Mechanical Floor Engineer. Follow written procedures and Assembly Instruction Data Sheets (AIDS). Review and implement procedures for test preparation of the LAT instrument. Support assembly and use of mechanical ground support equipment (MGSE). Conduct daily integration operations assigned by lead technician/floor engineer. Identify, maintain and inventory tools and support equipment related to LAT mechanical

integration. The mechanical technicians are responsible for the physical mate and demate of flight connectors.

• Electrical Technicians: Responsible to execute written electrical test procedures under the direction of the Electrical Floor Engineer. Follow written procedures and Assembly Instruction Data Sheets (AIDS). Perform tests using automated test and diagnostic equipment, troubleshooting digital and analog interfaces using oscilloscopes, logic and protocol analyzers, multi-meters, and signal generators, and perform interface verifications. Responsible for proper set-up, use and maintenance of EGSE at the direction of the Electrical Floor Engineer.

#### 6.3.2.3. Mechanical Ground Support Equipment Department

Supports the other LAT I&T departments in their MGSE needs. This includes development, fabrication or procurement, assembly and qualification testing of all needed MGSE. It also includes support during use of the equipment.

#### 6.3.2.4. Online Software Department

Develop, test, and support software used to collect data from the EM units, CU and LAT test stands, saves them to persistent storage, and to monitor and control the test stand and data acquisition system. We define a "test stand" to be a collection of hardware and embedded software that communicates with the online software system via Ethernet over a Local Area Network (LAN). The Online Software department is responsible for the online software, workstations on which the online software operates, and network connections. The online software includes a test executive that communicates with the embedded system to control the test stand, collects data from the hardware under test, a scripting language, Graphical User Interface (GUI) tools, a database, analysis and monitoring tools, and a mechanism to archive data. The Online Software Department will also provide a code management and release control system. The Online Software department is responsible for the design and implementation of a standard test suite (scripts) used to qualify the instrument and instrument components. The supplied tools will allow people external to the online department to develop independent test procedures (scripts) for specific situations as they find appropriate. The Electronics Subsystem is responsible for substantial elements of the test stand. Thus, there will be close coordination between the Online Software department and Electronics Subsystem. Online will provide a release control and code management system to configuration control the Online software, this includes the all test scripts used by I&T.

#### 6.3.2.5. Science Verification, Analysis, and Calibration (SVAC) Department

The SVAC department is responsible to coordinate and help perform the data analysis for particle beam and cosmic ray tests. These tests are designed to ultimately calibrate the LAT, and to validate the Monte Carlo simulations that will be used to verify the LAT science performance requirements. The SVAC department plan builds gradually on the knowledge acquired from low-level calibration tests on hardware units by the subsystems, in the process of I&T, and from particle tests using EM units, and the LAT. The SVAC manager is responsible for developing and leading the collaboration support for offline data analysis of data taken during the LAT integration and testing phases.

#### 6.3.3. Test Personnel and Descriptions

The test team members are defined with the following responsibilities:

- Environmental Test Director
- LAT Instrument Test Director
- Test Conductor
- Mechanical Lead Engineer
- Test Technician (Electrical)
- Test Technician (Mechanical)
- Quality Assurance Engineer

#### 6.3.3.1. Environmental Test Director (ETD)

Responsible for planning, scheduling, and coordinating all resources and organizations to accomplish the test. The ETD chairs the Test Readiness Review (TRR), the coordination meetings, and the Post Test Review (PTR). The ETD is the authority for the test plan, instrument configuration definition and facility readiness.

#### 6.3.3.2. LAT Instrument Test Director (ITD)

Responsible for the EGSE configuration and data taking during environmental test. The ITD reviews the test configuration for correct data taking configuration, reviews quick look data for pass fail criteria and controls the LAT Instrument electrical performance tests. The ITD is the authority for the detailed test procedures, EGSE configuration and the data collected during testing. The ITD is responsible for coordinating and authorizing the "Okay to break configuration" after each test. The ITD signs off the data packages. The ITD shall oversee completion of a final test report and the chairs the Post Test Review (PTR).

#### 6.3.3.3. Test Conductor (TC)

The TC shall carry out testing of subsystems and components, in accordance with the test procedure, shall record all data, and sign the data packages. No testing is to be performed without the TC present. The TC shall report to the TD and document all anomalies and equipment failures in the test log book. The TC shall assure that changes in the environment, including the test fixtures shall not jeopardize the health and safety of the flight unit. The TC has the overall responsibility for accomplishing the test according to the test plan/procedure and to insure that the safety and welfare of the equipment is not compromised during the test. For example, the TC must ensure that QAE is present or on call during testing.

The TC is the engineer responsible for test procedure changes or revisions as a result of errors and omissions discovered during testing.

#### 6.3.3.4. Mechanical Lead Engineer

Develop LAT handling and assembly procedures and associated training. Oversee the mechanical and thermal aspects of the instrument preparation for environmental test operations. Supervise mechanical technicians. Lead the mechanical assembly, and test preparation of the LAT for environmental tests. Responsible for the Assembly Instruction Data Sheets (AIDS). Prepares and coordinates the daily tasks.

The Mechanical Lead Engineer is required to attend the Test Readiness Review (TRR), the coordination meetings and the Post Test Review (PTR).

### 6.3.3.5. Test Technician (ETech & MTech)

Test technicians may be used to conduct and support testing as required. The technician duties are divided into the following two areas:

*Electrical Test Technician:* Supports the TC as necessary to complete the testing goals. Specially trained to use the EGSE and probe the Break-Out-Box (BOB) in accordance with test practices. Uses electronic troubleshooting skills to fault isolate problems that arise during testing. The ETech is responsible for ensuring all electrical test equipment and tools required to perform the electrical testing as defined in the appropriate test procedure, are available at the test location and is in calibration.

*Mechanical Test Technician:* Supports the Mechanical Lead Engineer as necessary to complete the testing goals. Specially trained to use the MGSE in accordance with test practices. The MTech with appropriate certification is permitted to mate or demate connectors, including BOBs (that mate to flight connectors). Specially trained in flight hardware installation techniques, including connector mate/demate techniques. The MTech is responsible for ensuring all tools and test equipment required by the released test or assembly procedure are available and in calibration.

# 6.3.3.6. Quality Assurance Engineer (QAE)

Responsible for reviewing and approving test procedures; approving red line changes to the procedures; verifying the test is being run according to approved procedures, and signing the data packages. The QAE is required to be present and shall observe all flight hardware testing. The QAE is responsible for the oversight of the following:

- Ensuring that all hardware and test logs are maintained.
- Ensuring that the procedure is performed as written and is the current released version.
- Ensuring that all test requirements are accurately met.
- Ensuring that any procedural deviation is approved and documented prior to being performed.
- Ensuring that any unsatisfactory result is documented and understood prior to continuing the test.

The QAE is required to attend the Test Readiness Review (TRR), the coordination meetings, and the Post Test Review (PTR). The LAT Program Instrument Performance Verification Plan, LAT-MD-00408 shall be utilized to further define the test personnel. The test personnel responsibilities are detailed in LAT I & T Subsystem Test Plan, LAT-MD-01376.

# 6.4. TEST METHODOLOGY

LAT I&T test methodology emphasizes the safe, systematic verification of the LAT system. It is based on a progressive testing method utilizing the building block approach. First the EGSE hardware and software is verified and validated by the I&T group, of which some EGSE hardware is provided by the Electronics Group. Safe to mate and interface verification procedures are applied to the connections to flight hardware as the LAT test articles become available. Each test article shall be tested individually and then integrated with safe-to-mate and interface checkout procedures and tested in the LAT system.

#### 6.4.1. LAT Environmental Test Activities

The following methods are employed during LAT I&T test activities.

- All the LAT I&T documentation (requirements, plans, procedures, drawings and reports) shall be approved and placed under LAT configuration management control.
- A Test Readiness Review (TRR) is conducted before each test or test phase to ensure that the test procedures are complete and all is in readiness for the test to be performed.
- Only signed off and approved procedures shall be used by I&T for LAT assembly or testing.
- All LAT I&T test procedures and Assembly Instruction Data Sheets (AIDS) will conform to the document format used during LAT I&T.
- All the LAT I&T test procedures shall be under configuration control, so that the state of a procedure at the time it was used in a test will always be known.
- QA approval is required for all mate or demate of LAT EGSE-to-flight or LAT flight-to-flight connectors, per LAT-PS-04459.
- All LAT flight box mate/demate activities will be recorded in the LAT Mate/Demate log. The LAT Mate/Demate log is part of the I&T e-log system as defined by LAT-MD-04601.
- For all mating and demating of LAT test articles the LAT will be powered off, per LAT-PS-04459.
- Connector savers are used wherever physically feasible on the LAT test articles to reduce mate/demate cycles on flight connections.
- All LAT I&T tests require a LAT I&T Test Conductor. There will be an Electrical Test Conductor for electrical tests and a Mechanical Test Conductor for mechanical tests.
- A detailed test schedule will be maintained by the LAT I&T LAT I&T Management in conjunction with the LAT Project Controls group. The detailed schedule will be used to plan mechanical and electrical tasks, test start and complete dates, readiness reviews and test data reviews.

#### 6.4.2. Test Baseline Control

The LAT instrument configuration for environmental tests shall be specified in the appropriate released Environmental Test Plan document. LAT I&T is responsible for controlling and tracking the LAT instrument configuration for testing using LAT e-logbooks. The e-logbook will control and track the Online software releases, flight software, EGSE configuration, and hardware configuration of test articles on the LAT system. These items are controlled and kept up to date by the LAT I&T IFCT Management and/or the LAT I&T Test Conductors. These controls ensure that the most current LAT system hardware and/or software elements are integrated and tested for each LAT test configuration.

The LAT flight software released to I&T will be under LAT CM control. All changes to LAT flight software configuration must be logged. Only LAT I&T configuration controlled and accepted releases of LAT EGSE/Online scripts are used for LAT I&T testing. I&T will conduct a standard set of acceptance tests on new releases of LAT EGSE/Online prior to use by LAT. I&T acceptance tests will also be done for all new releases of the data base files used by the EGSE/Online.

LAT-PS-06898

The I&T IFCT department will also conduct a standard set of acceptance tests on new or modified LAT EGSE prior to use in the LAT system.

Each LAT I&T test procedure shall have a Test Procedure Data Sheet on which to record the configuration used, date and time test started and/or terminated, along with the names of test personnel. Each test shall also have a Test Completion Data Sheet to record the pass/fail criteria and its rationale, plus identify Non-Conformance Reports generated during the test.

QA shall approve all levels of LAT I&T testing. All changes to the LAT I&T test baseline are tracked by I&T CM via NCR forms. Once LAT I&T has successfully completed testing for a specific LAT system configuration, the test baseline then becomes the formal LAT baseline on which future updates or changes will be compared.

#### 6.4.2.1. Evaluation of Test Results

The LAT I&T Subsystem evaluates test results to determine whether or not the LAT and/or its test articles satisfied part or all of the I&T requirements for the test (or re-test) that was executed. The evaluation shall include, but not be limited to, the following: analyze specified test data; compare the expected responses to actual responses; review the overall test findings and observations as related to expected results as measured against the acceptance criteria; generate a test report; and the test conductor performs a timely post-test review.

LAT I&T shall identify, mark and compile all test data for a given test during and after its execution. LAT performance data from Environmental test shall delivered to SLAC via the network for offline processing.

Test data reduction and analysis will be performed in a combination of real-time and post-test activities. For real-time analysis, the LAT EGSE/Online provides real-time monitors and printouts, These capabilities are used to monitor the progress of a test and will provide the primary indications of test success or failure.

Any time any test article or the LAT is powered, telemetry data shall be monitored and recorded via the EGSE/Online test stand.

The test conductor shall review the overall test findings which shall determine if the test passed or failed, and/or what requirements were demonstrated or not tested. All differences between expected results and actual results will be explained. All discrepancies generated during and after the test are evaluated and listed in the LAT Non-Conformance Reporting (NCR) system. All LAT I&T test reports shall contain the evaluation of the tests and any conclusions or recommendations.

#### 6.4.2.2. Test Problem Management

During LAT testing, the LAT I&T Test Conductors have responsibility for determining proper action for managing problems encountered during testing to include: halting, aborting, suspending, rerunning, or canceling any test, or generating an NCR. Any person working with the flight hardware should stop work and report to the Test Conductor if they believe that LAT personnel, the LAT system, and/or its test article(s) are in danger. Real-time decisions by the LAT I&T Test Conductors to extend testing beyond the scheduled test duration or to take other appropriate action to accommodate the test shall be allowed only after approval by the Test Director. When a potential problem or test anomaly develops, all pertinent data derived from tests shall be analyzed, discrepancies documented on an NCR and, if possible, resolved and/or safe workarounds identified

LAT-PS-06898

prior to proceeding. All such decisions and actions shall be promptly entered into the shift log and reported at the next status meeting.

LAT EGSE/Online limit checking capability shall be on at all times. All unexplained limit failures must be promptly logged on a LAT NCR.

In the event of a failure or hazardous condition the immediate action will be to assure the continued safety of LAT personnel, the LAT system, and/or its test article(s) under the failed condition. Once the safety of LAT personnel, the LAT, and/or its test article(s) have been established, a series of real-time actions or decisions will be made by the LAT I&T Test Conductor and these may include:

- Rerun the failed test sequence
- Continue the test, documenting the anomaly on a NCR
- Execute a workaround which would permit continuing the test
- Stop work and escalate the decision to a higher level
- Stop work and open a NCR

Every reasonable effort shall be made to determine the cause of LAT I&T test problems (i.e., anomalies and/or failures). On-line troubleshooting of LAT test problems may be done under the direction of the LAT Test Conductors in order to resolve a problem or to isolate an anomaly or failure to a LAT module/component. Once the anomaly or failure is established to the Test Conductors satisfaction, a NCR is generated.

Troubleshooting operations shall be controlled, pre-planned, approved by QA, and documented as specified in the open NCR.



#### 6.4.2.3. **Re-Tests**

The Test Conductor may decide that a re-test is required if problems or anomalies occur during testing which create uncertainty as to the source of a problem. A test may be repeated in its entirety or just portions thereof, in order to ensure accuracy of a test measurement or confirm a problem or a suspicion of a problem. If retest determines that there is an anomaly all work stops and a NCR is opened.

The LAT Material Review Board (MRB) will determine and approve all other re-tests, in response to the NCR, on a case-by-case bases. I&T shall re-test the LAT system hardware, software and/or test articles to verify that they satisfy requirements after problems are found and corrected. Re-tests will be done using the same LAT I&T test procedures used when the problem occurred. The re-test shall ensure that the correction to either the LAT system hardware and/or software elements have fixed the specified problem(s) documented on LAT NCRs. It shall also verify that the corrections made and tested do not invalidate or degrade the previous tests for the same LAT test baseline configuration.

#### 6.4.3. LAT Operational Controls

#### 6.4.3.1. Daily I&T Test Plan Meetings

The LAT I&T will hold daily test plan meetings at the beginning of each shift worked during the Environmental Testing of the LAT. The primary function of the meetings are to facilitate daily coordination of each phase of testing by reviewing the daily plan and the test progress against these plans, and make changes as necessary. The meeting will be chaired by the LAT I&T Manager or his designate and the attendees will include: I&T shift workers, QA, representatives from the associated LAT subsystems as required, Systems Engineering and NRL test personnel. Other personnel or groups will be invited as required. These meetings will generally be an open forum for any issue that affects the day-to-day environmental test activities and can be used to raise more global issues.

#### 6.4.3.2. Test Readiness Review

A Test Readiness Review (TRR) will be held prior the start of each major environmental test; EMIEMC, Acoustic, Sine Vibration and TVAC. The review meetings are conducted by the Deputy for Systems Engineering and supported by I&T to confirm the readiness of all LAT test and support items prior to test execution and other operations. The TRR shall be attended by I&T personnel who will participate in the testing, representatives from the LAT subsystems, QA, Systems Engineering, plus other interested groups as designated by the Deputy for Systems Engineering. The TRR will cover any issue that affects the readiness of the LAT system and/or test article(s) to undergo I&T testing. The TRRs will include as a minimum, a review of the:

- Test plan and schedule
- Facility readiness
- LAT instrument configuration
- Status of test documentation.
- Open NCR's
- Open Liens or action items that need to be closed prior to test.

#### 6.4.3.3. Post Test Review (PTR)

The Post Test Review (PTR) shall be chaired by the Instrument Test Director (ITD). The PTR shall include but not be limited to:

- Test data review
- Pass/Fail status of individual tests
- NCR's generated during the test
- Lessons Learned

#### 6.4.3.4. LAT Configuration Control Board

The LAT Configuration Control Board roles and responsibilities are documented in LAT-MD-03492.

#### 7. <u>TEST DOCUMENTATION</u>

#### 7.1. REQUIREMENTS DOCUMENTS

Integration and Test receives test requirements from the LAT Performance and Operations Test Plan LAT-MD-02730. The LAT Environmental Test Sequence (LAT-MD-02717) provides the instrument configuration for test and sequence of environmental tests.

#### 7.1.1. Test Plans

The Environmental Test Plans document instrument test configurations and contain detailed information including test specific instrumentation. Test instrumentation and test specific configuration details from the Test Pan documents shall be incorporated into the detailed test procedures identified in Section 7.4. The Environmental Test Plans are listed below:

LAT-MD-01196 Dynamics Test Plan LAT-MD-02726 EMI Test Plan LAT-MD-01600 TVAC Test Plan

#### 7.1.2. Assembly Drawings

Test assembly drawings are prepared unique environmental test set-up configurations for the LAT. The Assembly Instruction Data Sheet (AIDS) or Test Procedure will direct the use of installation drawings for test set-up and preparation. The LAT assembly drawings developed and controlled by Design Integration.

The Environmental Test Assembly Drawings are as follows:

Horizontal Vibe Config Assy Drawing	LAT-DS-06187
Vertical Vibe Config Assy Drawing	LAT-DS-06190
Acoustic Config Assy Drawing	LAT-DS-06188
Handling Config Assy Drawing	LAT-DS-06186

	_
Transport Config Assy Drawing	LAT-DS-06184
EMI/EMC Test Config Assy Drawing	LAT-DS-06189
TVAC Test Config Assy Drawing	LAT-DS-06185

#### 7.2. ASSEMBLY INSTRUCTION DATA SHEETS (AIDS)

Assembly Instruction Data Sheets (AIDS) are a document that defines step-by-step instructions for hardware assembly, integration, test, inspection, data review, rework, repair, etc. Each AIDS is created on the AIDS database located on the LAT QA website. AIDS act as a record on the floor to document hardware processing. AIDS requires LAT QA and Engineering signature approval for release. LAT QA is responsible for final review, acceptance, closure and retention of hard copy AIDS. The requirements for creating an AIDS are defined in LAT-MD-03468.



Figure 4: Assembly, Integration Documentation Flow

#### 7.3. TEST PROCEDURES

Test specific procedures are written by LAT I&T to provide the detailed assembly, instrumentation and test processes, etc. The test procedures provide the detailed instruction required to properly configure the LAT instrument per the appropriate Test Plan for each Environmental Test. The test procedures, as minimum, shall require review and approval by the cognizant Environmental Test Director, LAT Systems Engineering, LAT I&T Management, NRL Test Personnel and Quality Assurance. The test procedures will be released in configuration management before the start of test. The test procedures shall be called out in Assembly Instruction Data Sheets (AIDS). The procedures shall have Procedure Data Sheets (check lists) that will include sign-off for each procedural step by the operator and QA. The data sheets will record the step by step progress and data and will be attached to the authorizing AIDS upon completion. The procedure will call out the use of additional logs as needed, such as component installation, mate/demate etc. Test configuration and setup conditions shall be defined within each test procedure. The test configuration and set-up conditions include: reference to the appropriate test plan, test article configuration and setup; test article GSE; initial conditions to start the test; resources (facilities, personnel, test equipment and simulators, etc.), and test limitations for the type of tests.

#### 7.3.1. Environmental Test Procedures

The following Test Procedures are required for Environmental Test:

LAT Instrument Handling LAT-PS-

LAT Sine Vibration Test Procedure

LAT Acoustic Vibration Test Procedure

LAT EMI Test Procedure

LAT TVAC Test Procedure

LAT Weight and CG Measurement

LAT Pack and Ship

LAT Transportation

#### 7.3.2. Test Procedure Changes

The latest released version of a test procedure will be used to start a test. Redlines are used to incorporate an immediate change to a released document or drawing and allow flight hardware processing to continue. The redlined document or drawing now becomes the latest revision. Redline changes must be incorporated and a new document or drawing must be released. Requirements for the use of redline and blackline changes are defined in LAT-MD-03474, Requirements for Creating and Using Redlines for GLAST LAT Documents and Drawings.

#### 7.3.3. Test Report / Data Sheets

The test procedure shall have data sheets to record the completion of procedure steps (checklist) and to record details pertinent to the procedure. Test reports will be printed from automated tests and attached to the data sheets. The test reports and data sheets from a completed procedure will be attached to the Assembly Instruction Data Sheet which authorized the procedure.

# 7.4. E-LOGBOOK

The e-Logbook shall be used to meet program requirements for maintain the instrument configuration, runtime, cumulative power-on time, connector mate and demate, etc.

# 7.4.1. LAT Run Log

Integration and Test will maintain a test log. The log will be used to record the daily activities, tests, issues. The Test Conductors will be responsible to timely entries into the log.

### 7.4.2. LAT Component Installation Log

Integration and Test will maintain a component installation log. This log will be used to uniquely identified and serialized components and their locations in the LAT system.

### 7.4.3. LAT On-Time Log

The EGSE/Online will record the on-time of the LAT per the MAR.

### 7.4.4. Connector Mate/De-Mate Log

As the Assembly Instruction Data Sheet (AIDS) or Test Procedure directs an activity that requires a connector mate and/or demate, the Connector Mate/De-Mate Log will be updated along with time and date information. The log must be updated as the work proceeds by the appropriate personnel. The connector Mate/Demate will be performed per LAT-PS-04459, the connector mate and demate procedure.

# 8. QUALITY ASSURANCE

The quality assurance for LAT Integration and Test is performed by the LAT QA department who reports to the LAT project office. The QA responsibilities and processes can be found in the LAT Performance Assurance Implementation Plan (PAIP), LAT-MD-00039.

### 8.1.1. Quality Assurance Inspection

Quality assurance support is provided by the QA Subsystem and will be an integral part of the Assembly Item Data Sheets. A QA representative is required to witness and stamp off on each procedural step. QA is responsible for closeout and archive of all AIDS and datasheets.

# 8.1.2. LAT Non-Conformance Reports (NCR)

The Nonconformance Reports are created and maintained on the NCR database located on the LAT QA website. A NCR documents an observed nonconformance with the form, fit, function, performance or specified requirements of a specific part or assembly. A NCR can be created by anyone; once the problem is documented, LAT QA assigns the problem to the appropriate engineering personnel to provide cause, corrective action and instructions to resolve the problem. A LAT Material Review Board (MRB) procedure is in place for review of NCRs as required. MRB, as a minimum shall consist of the cognizant Subsystem Engineering representative, Systems Engineering, LAT I&T, LAT QA and Safety Engineering when appropriate. LAT QA is responsible for closing NCRs.

# 8.1.3. Flight Software Problems

Flight software problems shall be identified on an Non-Conformance Report (NCR). The Material Review Board (MRB) will be the mechanism by which flight software problems are tracked and changes are configuration managed.

# 9. <u>CONTAMINATION CONTROL</u>

Contamination control during Environmental Test shall be as specified in the LAT Contamination Control Plan LAT-MD-00404-03 Section 7.3.

# 9.1. TVAC CONTAMINATION CONTROL REQUIREMENTS

In addition to the requirements specified in LAT-MD-00404-03, all MGSE and EGSE that is required in the chamber during TVAC test shall be baked-out a minimum of twelve (12 hours) or until chamber vacuum reaches (TBD).

#### 9.2. LAT PROTECTION

The LAT shall be protected at all times from contamination. Outside of the clean tent the LAT shall be protected from contamination by bagging with appropriate ESD protective plastic.

#### 9.3. LAT CLEANING.

In the event that the LAT cleanliness is not maintained the exposed LAT surfaces shall be cleaned by wiping gently ethanol and clean lint free wipes. Cleaning shall be done by wetting the surface of a clean lint free wipe, wiping in one continuous motion and disposing of the wipe. A new, clean wipe sheet shall be used for each successive wipe.

### 10. FACILITIES AND SUPPORT EQUIPMENT

This section is for the facilities and support equipment.

### **10.1. TEST FACILITY**

There are two major facilities that will be used during the integration and test of the LAT. They are the LAT Integration facility at SLAC and the Environmental Test Facility at NRL.

# 10.1.1. Environmental Test Facility (NRL)

The LAT will go though environmental test at the Naval Research Laboratory (NRL) in Washington D.C.

#### 10.1.2. Facility Cleanliness

Work areas where the LAT instrument is present shall be maintained neat and orderly. In uncontrolled areas of the facility every attempt shall be made to minimize the introduction of particulate and other contaminants.

Records shall be kept of the particle count, temperature, humidity in the clean tent. The process for monitoring the facility is documented in the LAT Environmental Test Facilities Plan, LAT-MD-XXXX. Supplemental Helium measurements will be made as required by the Contamination Control Plan, LAT-MD-00404.

#### 10.1.3. Handling, Packaging, and Storage

Flight hardware shall be handled, packaged, and stored to prevent contamination, deterioration, or damage. Special handling constraints shall be specified on the exterior container to prevent mishandling. Packaging shall be adequate to protect hardware from contamination, deterioration, or damage. Storage areas shall be controlled to prevent contamination, loss, or damage. Access to storage areas for flight hardware shall be limited to authorized personnel only. QA shall monitor handling, packaging, and storage of flight hardware to ensure compliance with specified handling and storage requirements.

#### 10.1.4. Physical Security

The LAT and its major components must be under the direct supervision of a GLAST team member or located in a locked secure facility. For cases when it is known that either of these conditions will not be met, for example while transporting the LAT, arrangements must be made in advance to post a security guard at the location of the LAT to protect the GSE and flight hardware.

#### 10.1.5. Computer Security

During LAT Environmental Test all critical EGSE/Online Software and the LAT must be protected against the threat of inadvertent commanding or reconfiguration over the internet. Specifically, all commanding of the LAT will be performed by dedicated Local Area Network (LAN) that is isolated from the rest of the facility network via a firewall.

#### **10.2. GROUND SUPPORT EQUIPMENT**

The ground support test support falls into two general categories. Electrical Ground Support Equipment and Mechanical Ground Support Equipment.

#### 10.2.1. Mechanical Ground Support Equipment (MGSE)

The MGSE is defined in the MGSE/STE Requirements, LAT-SS-06640. The MGSE development plan lists and describes the required MGSE associated design criteria. This plan also defines the applicable standards that are used in the MGSE designs.

LAT MGSE is designed and tested to the East West Range (EWR) 127.1 and all SLAC/DOE requirements outlined in DOE-STD-1090-2004 (Latest Version)

#### 10.2.2. Electrical Ground Support Equipment (EGSE) / Online

The EGSE /Online plan for Environmental Test is described in LAT-MD-XXXXX (TBD).

#### 10.2.2.1. EGSE/Online Software Problem Report / Change Request

The Online Department within Integration and Test will maintain a software problem report/change request system in JIRA to aid in the tracking and resolution of EGSE/Online software problems. Changes to the EGSE/Online software will be managed and configuration controlled by the Online CCB process defined in LAT-MD-03492.

#### 11. PATHFINDER PLAN

The detailed plan for pathfinding the activities for environmental test shall be maintain in the LAT Environmental Test Pathfinding Plan LAT-PS-XXXXX (TBD).

#### **11.1. PATHFINDER LIFTING OPERATIONS**

The following lifting operations shall be included in the Pathfinding Plan:

- 1. Installation into and Removal from Shipping Container with the GPR.
- 2. Installation into and removal from the Test Stand with GPR
- 3. Onto and off of the Vibe Table with the GPR
- 4. Test Stand Turnover with Complete Mass Simulator and SLAC lift slings

5. Installation of the rotated test stand and LAT onto the TVAC table/Trolley

#### **11.2. PATHFINDER MOVE OPERATIONS**

The following moving operations shall be included in the Pathfinding Plan:

- 1. Transport weighted shipping container
- 2. Move LAT in the test stand from clean tent to Sine Vibe.
- 3. Move LAT and test stand from clean tent to EMI test chamber.
- 4. Move LAT and test into Acoustic test chamber.
- 5. Move LAT and test stand TVAC staging area.

#### **11.3. PATHFINDING EQUIPMENT REQUIREMENTS**

The list of equipment required for pathfinding activities and the organization responsible for providing the equipment can be found in Table 1

	Equipment	Provided By
	Tug/Forklift	NRL
	Ramp for EMI	NRL
	Ramp for Acoustic	NRL
	GPR Simulator	NRL
	TVAC table	NRL
	TVAC Trolley	NRL
	Shipping container	NRL
	Shock recorders	NRL
	LAT Volume Simulator	NRL
	Test Stand	SLAC
	LAT Mass Simulator	SLAC
	Spreader Bar/Wire rope for turnover	SLAC
	4x4 Lift Fixture	SLAC
	Hydroset	SLAC
	Inclinometers	SLAC
	Radiator Simulator	SLAC
	Radiator lift fixture	SLAC

Table 2

# 12. <u>CONFIGURATION MANAGEMENT</u>

This section describes the configuration managements of the I&T documentation, hardware, and software.

#### **12.1. DOCUMENTATION CONFIGURATION MANAGEMENT**

The documents used for Environmental test shall be controlled per the LAT project Configuration Management (CM) system. The CM system is defined by the document LAT-MD-00068.

