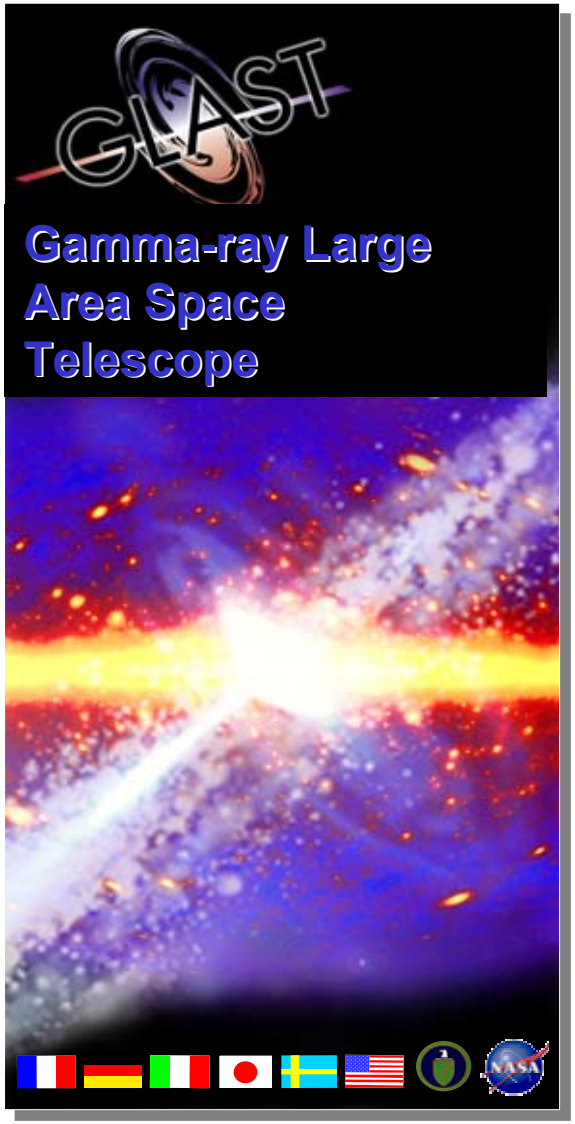


GLAST Large Area Telescope:

ACD Integration & Test

Jim La/ACD I&T Lead
NASA/GSFC/Code 568

james.m.la@nasa.gov

Outline

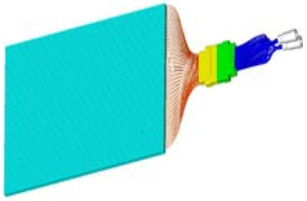
- ACD I&T Overview
- I&T Assembly/Integration Flow
- Electrical Interface and Integration
- Performance Verification
- Environmental Testing
- Performance Tests
- I&T Level Communication
- Key I&T Schedule
- Summary

ACD I&T Overview

- ACD I&T is the focal point of ACD integration activities
  - I&T team plans and manages activities
  - ACD team members provide support for integration & test
- Total I&T effort involves all aspects of the ACD – detectors, mechanical, electrical, assembly, performance testing, and environmental testing
  - Support ACD/LAT integration and test at SLAC
  - Support LAT Environmental Test at NRL
- ACD integration will be in a class 100,000 clean tent at GSFC Building 7/10. Integration area will have sufficient space for electrical works, blanket works, and storage for flight hardware
- GSFC Work Order Authorization (WOA) System will be used
- GSFC Non-Conformance Reporting (NCR) System will be used
- ACD is sensitive to Helium. Helium monitoring is required when the ACD is moved to a new location and then periodic monitoring thereafter

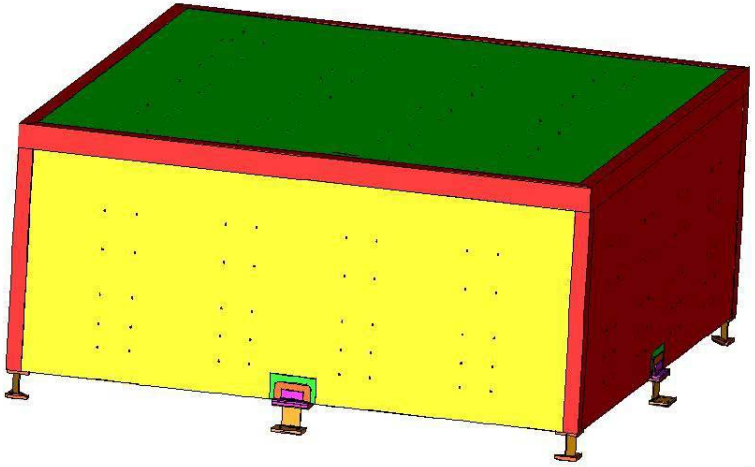
ACD I&T Overview - Assembly

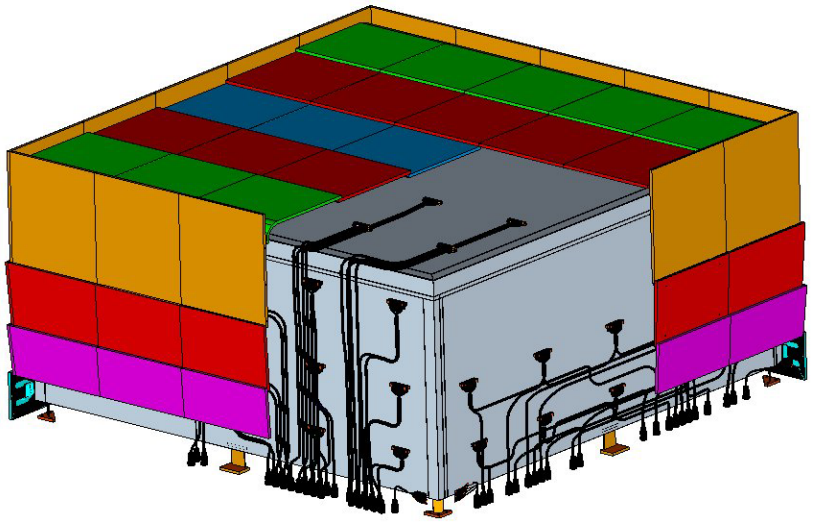
Shell, Tile Detector Assemblies (TDA) & Tile Shell Assembly (TSA)



Tile Detector Assembly (89)

Composite Shell

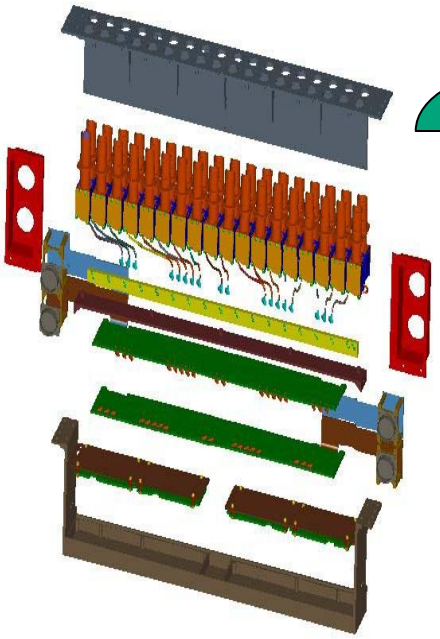




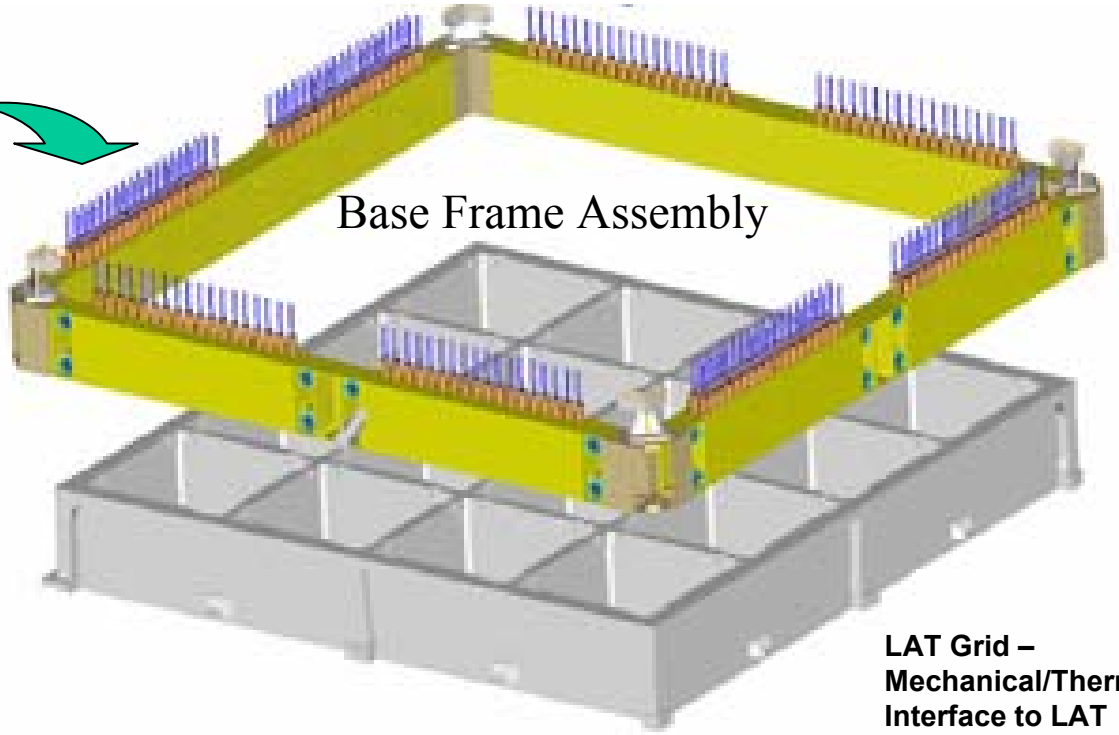
Mounting the TDAs and ribbons on the shell forms the TSA

ACD I&T Overview - Assembly

Electronics Chassis, Base Frame, and Base Electronics Assembly (BEA)



Electronics Chassis (12) – Phototubes, FREE Cards, HVBS

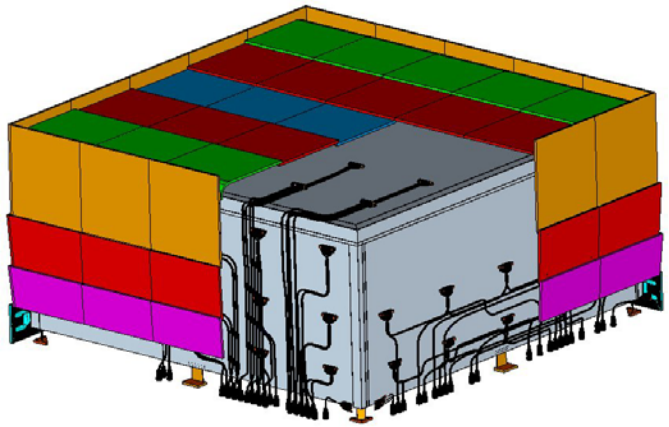


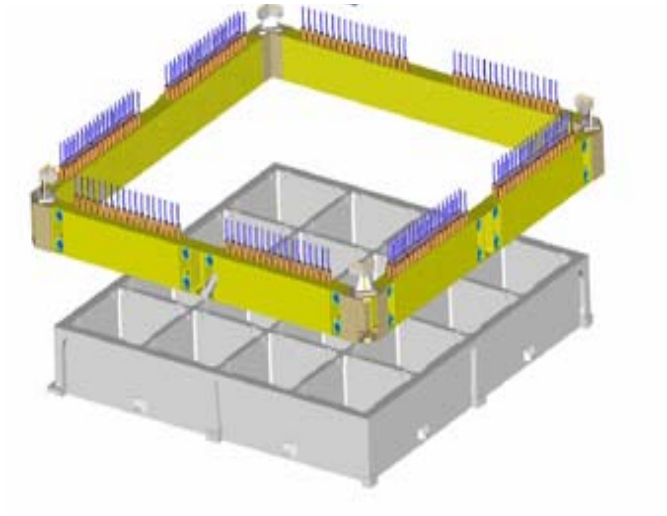
LAT Grid – Mechanical/Thermal Interface to LAT

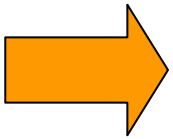
Mounting the Electronics Chassis into the Base Frame Assembly forms the BEA

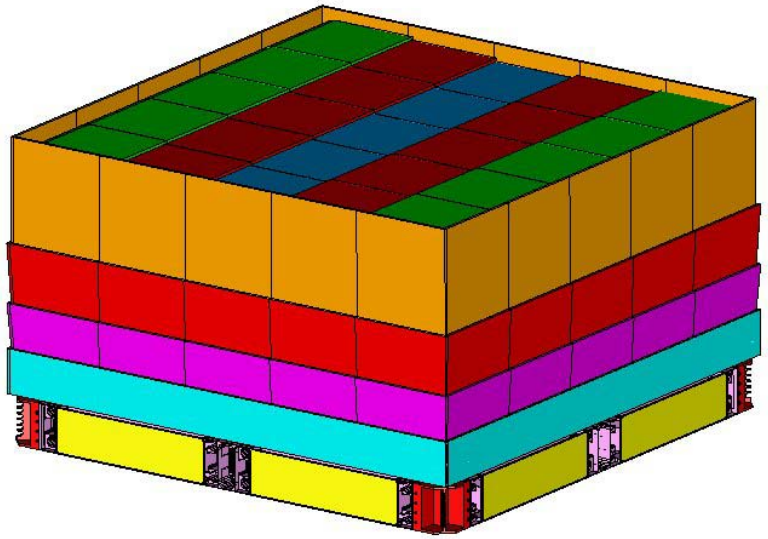
ACD I&T Overview - Assembly

Tile Shell Assembly (TSA), Base Electronics Assembly (BEA), and ACD





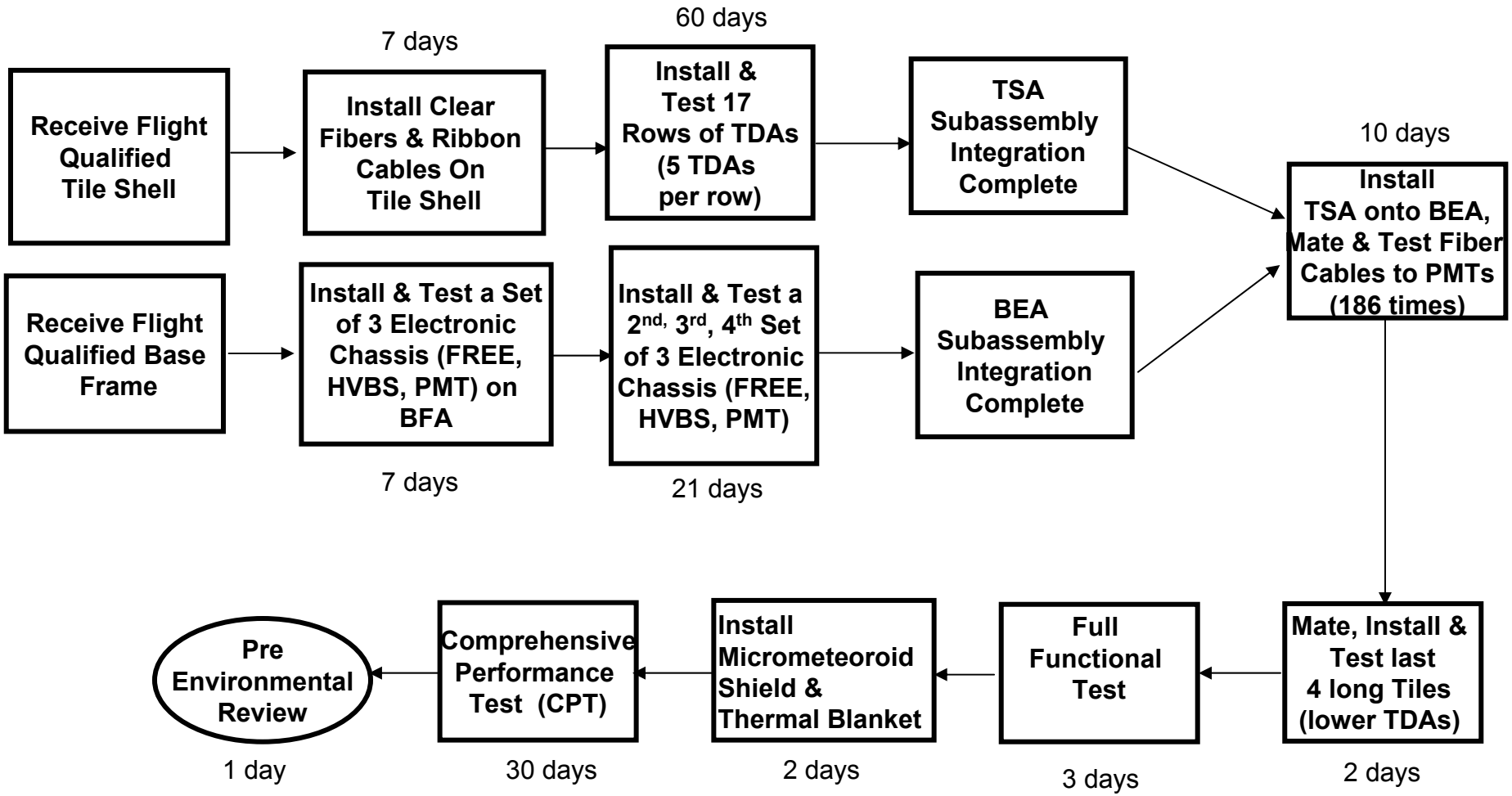




Mounting the TSA onto the BEA forms the complete ACD

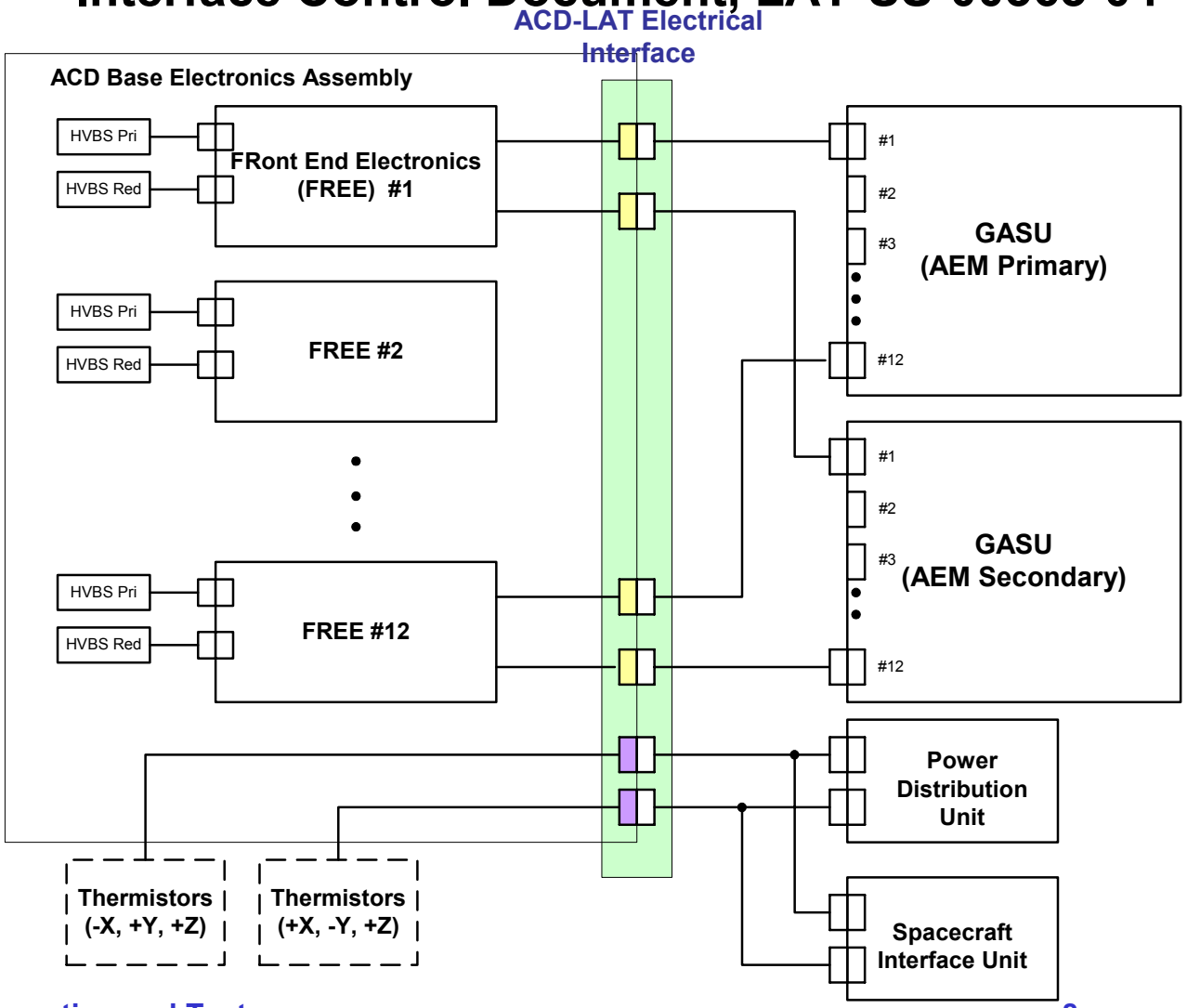
ACD I&T Assembly/Integration Flow

- **Major activities in I&T flow have been defined (LAT-TD-00430-D1)**



ACD-LAT Electrical Interface

Interface Control Document, LAT-SS-00363-04



ACD-LAT Electrical Integration

Electrical integration consists of the following for each connector:

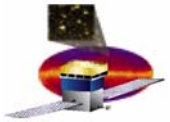
- With all instrument power removed, install connector savers on the component (also on the harness if space allows).
- Install Break-Out Box (BOB), with all jumpers removed, between the component and the harness;
- Perform an isolation/continuity check.
- Supply power to the component and perform an open-circuit voltage check. Remove power from the component.
- If connector supplies power, perform Initial Power Turn-On (IPTO). Remove power from the component.
- Install jumpers, reapply power, and verify connector performance;
- Perform functional test (with BOBs installed)
- Remove all BOBs and re-mate the harness to all the connectors.
- Re-run the functional test.

Procedures are based on standard Goddard electrical integration approach.

Performance Verification Plan

ACD-PLAN-000050–D5, LAT ACD Subsystem - ACD Verification Plan

- **Purpose and Scope**
  - Provide means to verify ACD Performance, Functional & Environmental requirements
  - Flow requirements for LAT Instrument Performance, Functional & Environmental test
  - Track level of verification: Components, Subassemblies, & Subsystem
  - Identify method of verification: Test, Analysis, Inspection, & Similarity
- **Performance Verification Matrix**
  - Easily track and verify each ACD requirement
  - Details each requirement's verification level, method and origin



ACD Test Requirements

Electrical

Electrical Interface
- Isolation /Continuity Checks
- Open Circuit Voltage Checks
-Initial Power Turn-On

Aliveness

Limited Functional

Full Functional

Comprehensive Performance

Mechanical

Static Load

Sine Sweep Vibration (Modal Survey)

Sine Vibration, 3 Axis

Random Vibration

Acoustic

Mass Properties

Environmental

Thermal Vacuum

Thermal Balance

EMI/EMC

ACD-PLAN-000050–D5, LAT ACD Subsystem - ACD Verification Plan

ACD Environmental Testing

Environmental Testing already performed on Qualification Subassemblies, consisting of shell section, flexures, tiles, waveshifting fibers, optical connector, clear fibers, and photomultiplier tubes with resistor network in housing:

- ACD-PLAN-000032, LAT-ACD Tile Detector Test Vibration Test Plan
- ACD-PROC-000068, TDA-PMT-Resistor Network End-to-End Thermal-Vacuum Test Procedure

Functional testing for these environmental tests used these procedures:

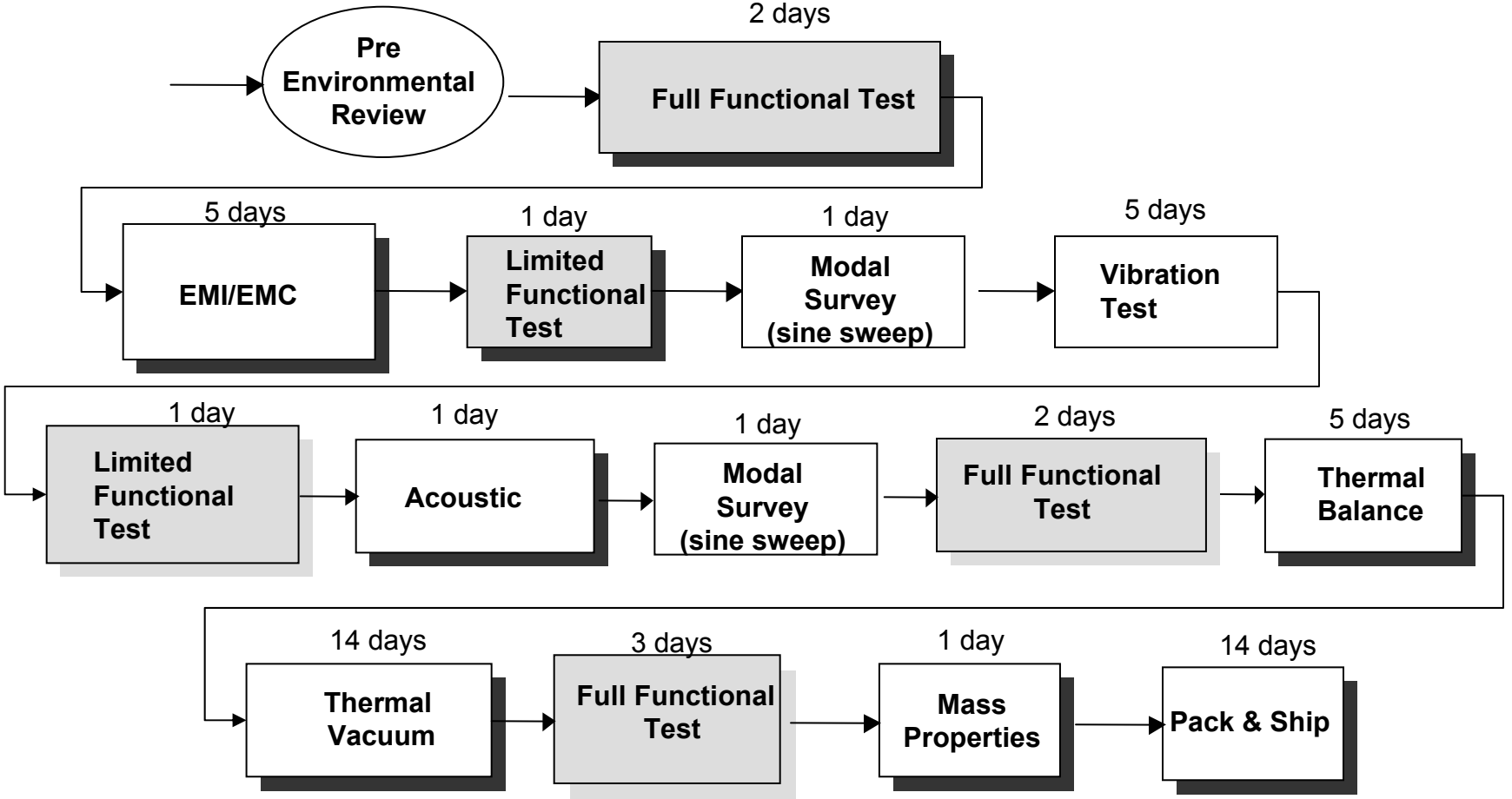
- Tile Detector Assembly (TDA) Test B Procedure
- Tile Detector Assembly (TDA) Test A Procedure

Experience gained with these tests is being used to write the full ACD Environmental Test procedures

All Environmental Testing will be carried out in Goddard testing facilities used for many previous instruments and spacecraft.

Environmental Test Flow

- **Setup test outlines are consistent with 568-PG-8700.1.1 Rev A**



Performance Tests

LAT-TD-01112-D1, ACD Functional Test Plans (Comprehensive Performance Test)

- **Aliveness Test (AT)**

  Functional test that turns on the ACD in a nominal state and verifies basic operation of all channels

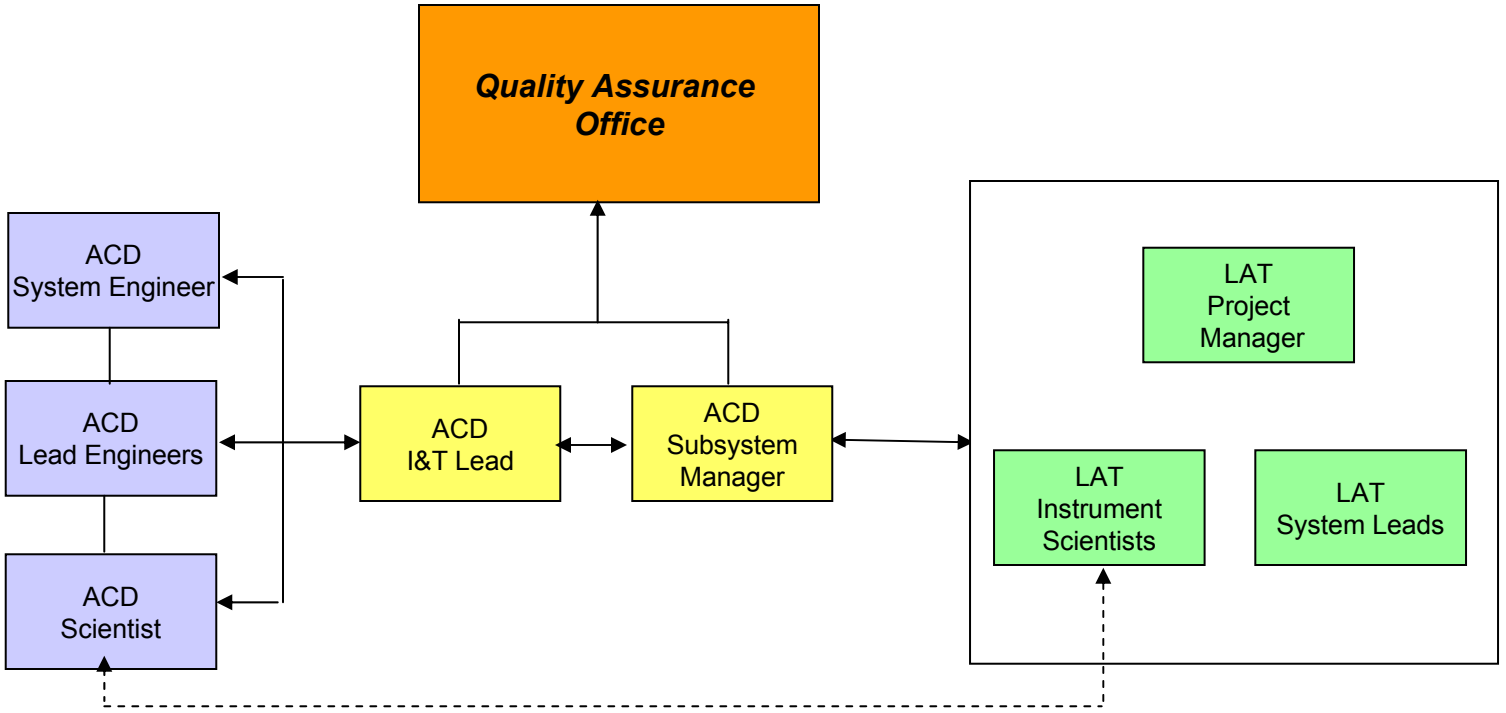
- **Functional Tests**
  - Limited Functional Test (LFT) - Test all major functions of the ACD system
  - Full Functional Test (FFT) - Test all functions of the ACD system except a complete measurement of all the ACD tile efficiencies

- **Comprehensive Performance Test (CPT)**

  Test all functions of the ACD system and includes a complete measurement of all the ACD tile efficiencies. Requires rotation of ACD into three different orientations.

ACD Level I&T Communication

- **The I&T Lead is the point of contact for all daily activities, and works in conjunction with the entire ACD Team**



Daily operation inputs will be flowed from System, Leads, and Scientist to I&T Lead for scheduling & coordination of activities. Minor anomalies are to be resolved at this Level.

Higher level anomalies that are affecting Science, Lat instrument or other subsystems will be flowed up to the LAT Project System Leads & LAT Instrument Scientists for resolution, then back through ACD Subsystem Manager to ACD I&T Lead for implementation

Key I&T Schedule

▪ Flight Hardware starts to arrive for I&T	September 03
▪ TSA assembly complete	December 03
▪ BEA assembly complete	March 04
▪ ACD Integration Complete	March 04
▪ Environmental Test Starts	May 04
▪ Ship ACD to SLAC	Aug 04

Issues/Concerns

- Need commitment from Goddard for Test Conductor support

- Readiness of LAT Test Stand delivery to support ACD I&T (ACD/LAT Electronics – Testing Interface Document, LAT-TD-01205, Draft)

Summary

ACD Element	Progress to Date	Status
MGSE	Modifying existing hardware	Will be ready when needed
EGSE test scripts	Scripts outlined, GARC test script written.	Partially dependent on new interface hardware from LAT Electronics, due in April.
Assembly plan	Detailed outline	Will be ready when needed.
Functional testing plans	Functional tests for phototubes and tile detectors ready. Comprehensive Performance Test in review	Building larger tests from individual component tests already completed.
Verification plans	Verification plan in signoff; Environmental tests in draft	Building larger tests from subassembly tests.