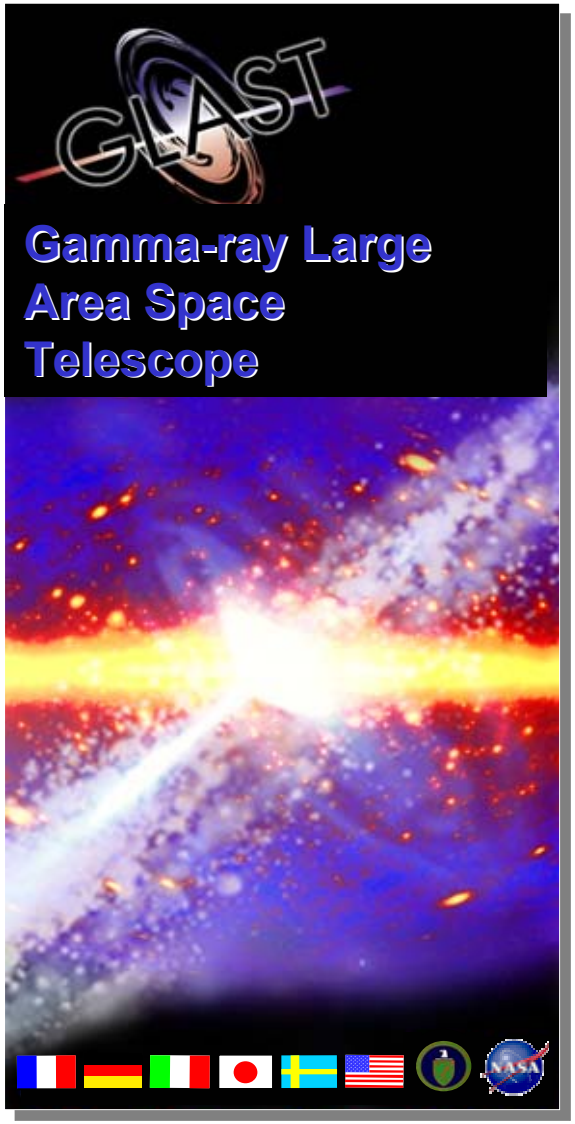


GLAST Large Area Telescope:

Performance & Safety Assurance

Darren Marsh
Stanford Linear Accelerator Center
Performance & Safety Assurance Manager

marsh@slac.stanford.edu

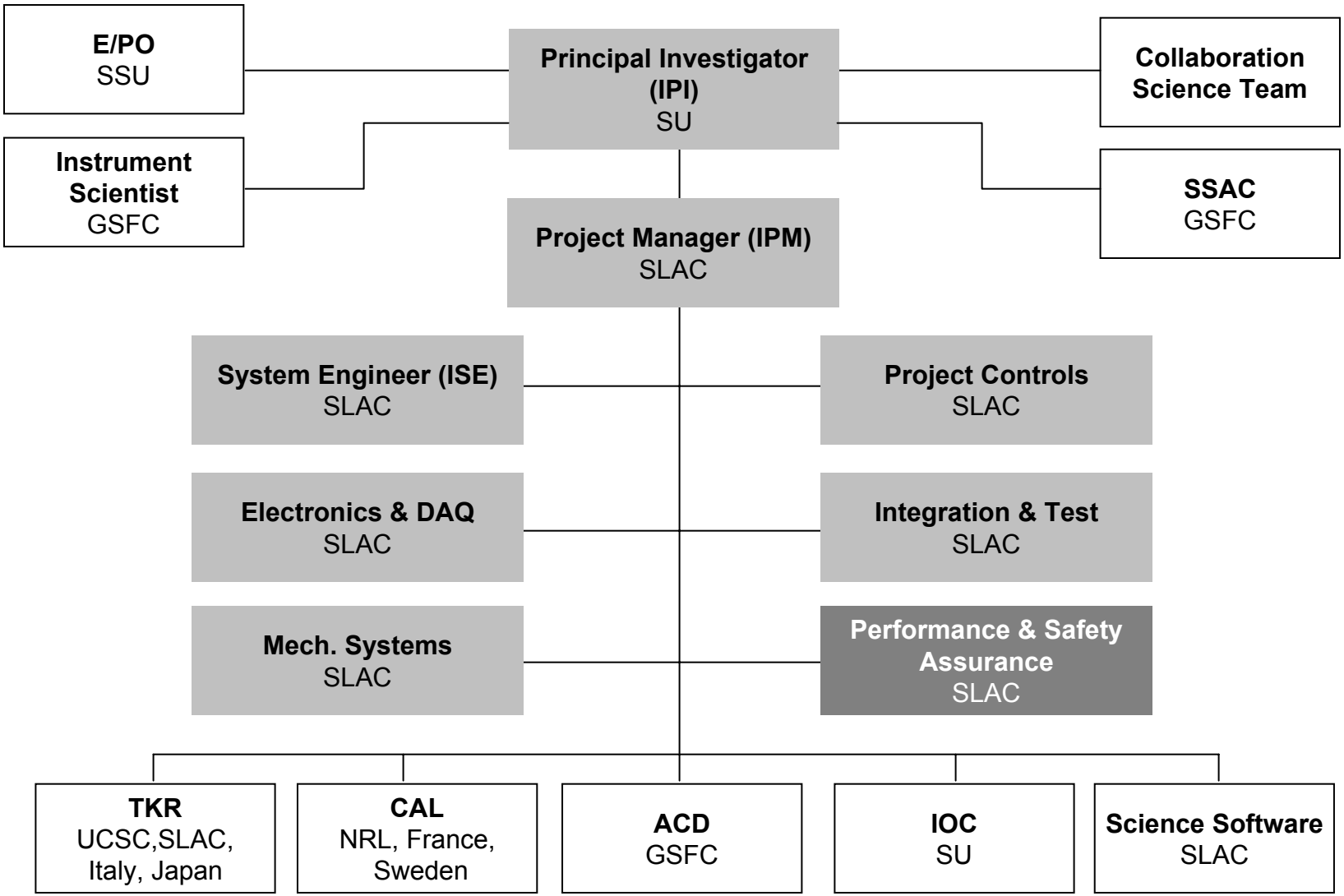
Outline

- Introduction
- Organization
- Requirements
- Quality Assurance Summary
- Fabrication Controls
- EEE Parts and Packaging Program
- Materials & Processes Program
- System Safety

Introduction

- **Performance & Safety Assurance is a program consisting of:**
  - Quality Assurance
    - Hardware
    - Software
  - Systems Safety
  - EEE Parts Program
  - Materials & Processes Program
  - Contamination Control
  - Reliability & Risk Management Program
  - Design Verification
  - Technical Reviews

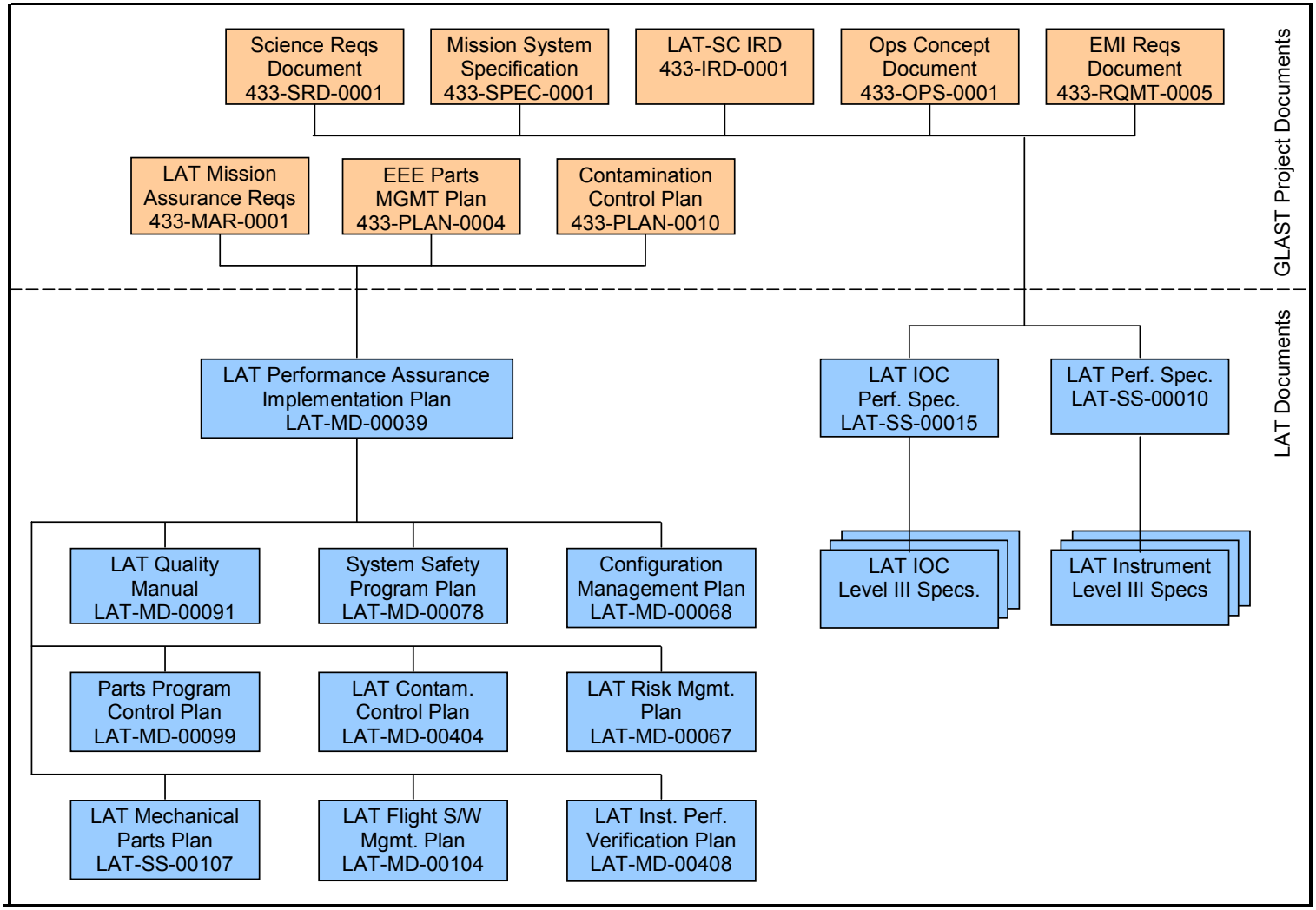
LAT Organization



Performance Assurance Functional Responsibilities

FUNCTIONAL ELEMENT	INSTITUTIONS (LEAD)
Hardware Quality	SLAC (Marsh), GSFC (Huber), NRL (Virmani)
Flight Software Assurance	SLAC (Russell)
Reliability Engineering & Risk Management	SLAC (Thurston)
EEE Parts Program	NRL (Virmani)
Materials & Processes Program	SLAC (Nordby)
Instrument Design Verification	
- Design Verification Planning	SLAC (Thurston)
- Analytical Design Verification	SLAC (Thurston)
- Functional Design Verification	SLAC (Bloom)
Systems Safety	SLAC (O'Neill)
Contamination Control	SLAC (Thurston)

Performance & Safety Assurance Requirements



Performance & Safety Assurance Requirements (Con't)

- Goddard Space Flight Center (GSFC) Office of System Safety and Mission Assurance (OSSMA) performed a survey of the LAT Program April 3-4, 2001
  - The goal of the survey was to evaluate the status of the LAT Safety & Mission Assurance Program and give GSFC and LAT personnel the opportunity to discuss Safety & Mission Assurance documentation
  - The SLAC survey did not result in any "Findings", there were nine "Observations" and two "Commendations"
- GSFC will perform a Safety and Mission Assurance Re-Survey prior to CDR to ensure related plans, processes, and procedures are being followed by LAT personnel

Quality Assurance Summary

- Review of design specifications
- Support subsystem, system, and Instrument design reviews
- Monitor procurement controls
- Fabrication control system
- Training and certification of personnel
- Review test plans and procedures
- Test and inspection of hardware
- Nonconformance reporting and resolution
- Support hardware qualification activities
- Conduct surveys and perform audits
- Software assurance

Fabrication Controls

- Items maintain identity by drawing number or serial number
- Processes specified by documented work instructions, procedures or quality plans
- Material Review Board action required for non-conforming material
- Contamination control
- Controlled storage for assemblies in fabrication
- Calibration and QA monitoring of critical tooling, jigs, and fixtures
- Fabrication processes continually monitored

EEE Parts and Packaging Program

- LAT EEE Parts Program Control Plan, LAT-MD-00099, has been implemented for the LAT
  - The LAT Parts Control Board (PCB) will control the management, selection, and standardization of EEE Parts
  - The PCB will be responsible for the generation and maintenance of a Program Approved Parts List (PAPL) and for assuring every part on the PAPL meets the requirements of the program
- Grade 2 parts will be utilized per GSFC-311-INST-001 which govern the selection, screening, and qualification processes
- To the maximum extent possible, parts are selected from the NASA Parts Selection List (NPSL) and derated in accordance with GSFC PPL-21
- Stress analysis will be performed to compare against the nominal stress derating criteria

EEE Parts and Packaging Program (Con't)

- Initial parts activities are focusing on Photo Multiplier Tubes (PMT's), Application Specific Integrated Circuits (ASIC's), Analog-Digital Converter (ADC), Digital-Analog Converter (DAC), etc.
  - Procurements strategies are being identified and implemented
- Printed wiring board coupons will be evaluated prior to flight assembly
- NASA Workmanship Standards will be utilized in the manufacturing, assembly, and quality control of electronic system

Materials & Processes Program

- The LAT Materials & Process Program will adhere to the LAT Mechanical Parts Plan, LAT-SS-00107
- Conventional and compliant materials with flight heritage will be chosen to avoid costly and time consuming testing of unproven materials & processes
- When non-conventional or non-compliant materials are considered for use or when off-the-shelf items for which there is no flight history or clear identification of materials are considered, LAT engineers will thoroughly investigate the material prior to its incorporation
- The LAT has established a Mechanical Parts Review Board for materials usage and disposition on out-of spec materials, material failures, out-of date items, and limited-life items

Contamination Control

- **The LAT Contamination Control Program will be governed by the LAT Contamination Control Plan, LAT-MD-00404**
  - **LAT assembly and integration activities will take place in an appropriately clean environment consistent with LAT/GLAST requirements including the use of cleanroom garments and equipment**
  - **Surface cleanliness of flight hardware to be verified with white light/black light visual inspections, tape lifts, particle fallout samples and/or NVR solvent rinses/swabs**
  - **Materials used in flight hardware shall meet outgassing requirements as specified in the LAT Contamination Control Plan**
  - **Required thermal vacuum testing of flight hardware shall be performed and outgassing rates shall be monitored to achieve required maximum outgassing levels**

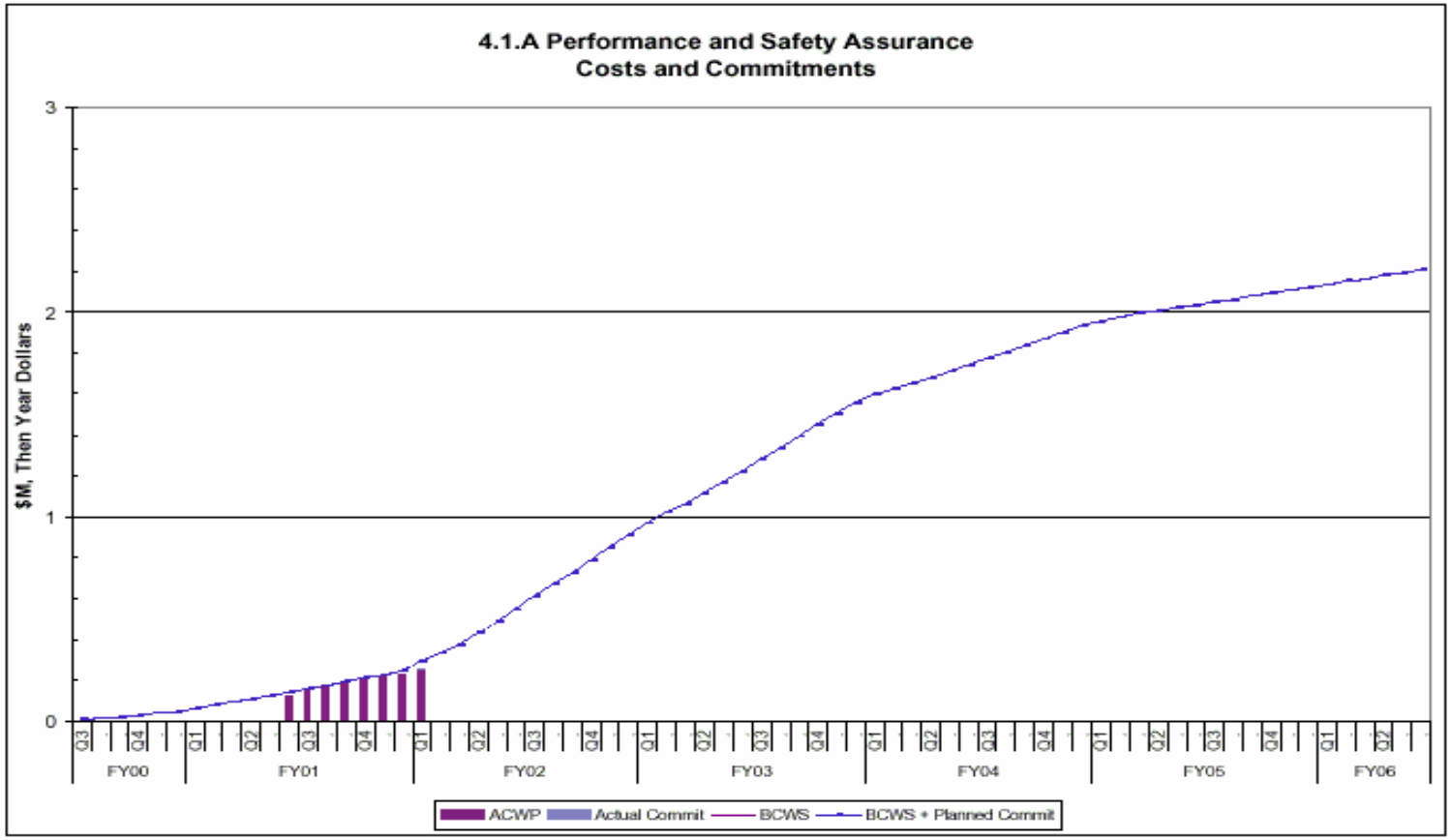
System Safety Program

- Comply EWR 127-1, Eastern and Western Range Safety Requirements
- Established and implemented System Safety Program Plan (SSPP), LAT-MD-00078
- Perform Preliminary Hazard Analysis (PHA)
- Perform Operations and Support Hazard Analysis (O&SHA)
- Maintain Hazard Control Verification Log
- Develop Safety Assessment Report (SAR)
- Provide input to Ground Operations Plan (GOP)
- Develop Safety Noncompliance Reports as required

Hazards Summary

- **LAT Preliminary Hazard Analysis, LAT-MD-00366, identifies safety critical areas, assesses risk, and establishes requisite hazard controls**
  - **Identified Hazards:**
    - **Structural Failure**
    - **Rupture of heat pipes**
    - **Hazardous Material**
    - **Electrostatic Discharge**
    - **Electromagnetic interference**
    - **Electrical**

Performance & Safety Assurance Cost & Commitments



Performance & Safety Assurance Cost Profile