GLAST Large Area Telescope:

ISOC Subsystems
WBS: 4.1.B

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Review History

- IOC Peer Design Review  August 2001
- LAT PDR/Baseline Review  January 2002
- Delta PDR/Baseline Review  July 2002
- LAT CDR/CD3  May 2003
- ISOC Peer Review  March 2004
Significant Changes Since Last Lehman Review?

- GLAST Ground System Operation management team in place
- Completed element peer reviews:
  - GLAST Science Support Center Peer Review
  - Mission Operations Center Peer Review
  - Instrument Science Operations Center Peer Review
- A Working Group was formed to review the Instrument Operations Center (IOC) implementation plan
  - Formulation of the Science Operations Group within ISOC
- Rebaselined the ISOC budget
- Bill Craig is acting ISOC manager
Mission Block Diagram – ISOC View

- **TDRS**
- **GLAST**
- **Mission Operations Center (MOC)**
- **GLAST Burst Monitor (GBM) IOC**
- **GRB Coordinates Network (GCN)**
- **GLAST Science Support Center (GSSC)**
- **LAT Collaboration**
- **LAT ISOC**
- **LOF**
- **SOG**
- **SAS**

- **Primary White Sands Complex**
- **Backup USN, Wallops**

- **Alerts Raw Data**
- **Commands Instrument Uploads**
- **Raw Data**

- **Level 0 and RT HK Data**
- **Level 1 and Level 2 Data Analysis Tools**
- **Refined Alerts**
- **Schedules and Commanding**

* test, early orbit, and backup only
ISOC Mission

• Primary Mission
  – Science
    • Acquisition, Analysis, Calibration, etc...

• Secondary Mission
  – Review and maintain LAT Instrument health and safety
    • Review and trend health and safety telemetry
    • Provide necessary support for contingency operations
      – Immediate health and safety operations are handled at the GLSAT-MOC
  – Configure and maintain the flight data bases
    • Command, telemetry, and calibration
  – Instrument command generation and validation
  – Archive Level 0 telemetry packets and higher-level products
To Meet The Mission

- An Ad Hoc Working Group was formed to review the Instrument Operations Center (IOC) implementation plan
- Members of the Working Group are: S. Digel (chair), E. do Couto e Silva, R. Dubois, P. Nolan, H. Tajima (with participation from S. Ritz, instrument scientist)
- Charge to the working by the Project PI
  - Examine the plans to date for the IOC and, in particular, assess the adequacy of the IOC plan for serving the science needs of the collaboration.
  - Develop an operational picture/description that illustrates the role of each IOC element and the relationships between the elements.
  - Develop a strawman staffing plan that identifies needed full-time (and part-time) scientists, engineers, technicians, etc. Consideration should be given to how I&T activities will eventually phase out and the IOC will become fully operational.
  - Examine examples from other space astrophysics missions (e.g. CGRO/EGRET, SWIFT, Chandra, RXTE, SOHO/MDI., etc.) to understand the “lessons learned” and apply them in the context of GLAST
Major Findings from Working Group

• Identified the need for a Science Operations Group within ISOC to support the instrument activities

• Established a preliminary staffing plan/road map for formulating and staffing the ISOC

• Identified the roles and responsibilities for the three major components of the ISOC
ISOC Functional Architecture

Mission Operations Center

LAT Instrument Science Operations Center (ISOC)

GLAST Science Support Center

Level 0 Data

Level 1, Level 2 (e.g., updated trans. alerts)

Data Processing

Response Functions

Operations & Commanding

Monitoring & Diagnostics

Instrument Optimization

Calibrations

Flight Software

Health & Safety

LAT ISOC Steering Committee

SAS

LAT Science Analysis

Document: LAT-PR-XXXXX

Section ISOC 9

Data Transfer

Reports and Information

Support Functions Through Deliverables

Advisory and/or Revision Role
ISOC Elements Description

• LAT Operations Facility (LOF)
  – Responsible for day-to-day operations of the LAT instrument and facility
  – Generate and coordinate commanding plans for the LAT instrument

• Science Operations Group (SOG)
  – Supports LAT instrument calibration activities
  – Performs LAT instrument activity planning, trending & performance analysis and anomaly investigation
  – Perform sustaining engineering for the LAT instrument

• Science Analysis Software (SAS)
  – Performs higher level data processing (Level 1 & 2) using Level 0 data provided by MOC, and provides data products to the GSSC
  – Archives and distributes science data products (for LAT collaborations)
ISOC Design Approach

- ISOC design approach is to use as much as possible of the software and tools developed by Electronics, I&T and SAS
  - Many of the ISOC physicist and engineers are matrixed with other LAT subsystem to gain experience

- LOF
  - ISOC ground software and operational tools will be developed and derived in coordination with I&T efforts
  - Command and telemetry database will be developed in coordination with I&T efforts
  - LOF team will include technicians, engineers and programmers who were involved with I&T throughout the instrument integration and testing

- SOG
  - Draw from Science Verification Analysis and Calibration (SVAC) pre-launch efforts
  - Use analysis tools, instrument simulation, and processing pipeline developed by SAS
  - Use or develop additional operational tools from tools used for I&T
  - SOG personnel will include scientists and programmers who were involved with I&T

- SAS
  - Experienced scientists and programmers who have developed the data processing, simulation/reconstruction, science tools and databases in support of Data Challenges and I&T
ISOC Peer Review (3/2/04) Summary

• Charge for the review
  – Requirements properly address the principal function of the center
  – ISOC design maturity, qualification and verification planning near CDR level
  – Open design issues and appropriate closure plans
  – Are the design, planning, and formulation of the ISOC properly defined?

• Review was focused on the operation aspect of ISOC

• 20 Request For Action/Recommendations
  – Concern areas are:
    • Staffing profile
    • ISOC organization
  – No significant technical finding or recommendation
Major ISOC Release & Review Dates

- ISOC Detail Design Review  
  August 4 2004
- LOF SW Release 1  
  March 15, 2005  
  Support GRT #2
- LOF SW Release 2  
  October 14, 2005  
  Support GRT #5
- Mission Operations Review  
  October 18, 2005
- Operation Readiness Review  
  December 15, 2006
- Launch  
  February 2007
ISOC Critical Path

- Develop Procurement Specs: 7/30/04 / -96
- IOC CDR: 8/4/04 / -64
- ISOC S/W Release 1: 3/15/05 / -203
- Ground Readiness Test #2: 4/1/05 / 0
- CD-4 Review: 7/14/05 / 0
- System Dev 1st set: 7/20/05 / -98
- Procedures & Documentation 2nd set: 9/30/05 / 0
- ISOC S/W Release 2: 10/14/05 / -34
- Ground Readiness Test #5: 11/15/05 / 0
- Operational Model Complete: 1/20/06 / 0
- LAT Ops Facility Validation & Verification Complete: 6/2/06 / 0
- Mission Simulations Complete: 9/15/06 / 0
- System Operation 2nd set: 9/29/06 / 0
- Launch: 2/28/07 / -40
- Completion Dates/Variance to Baseline
Approved
Cost Changes Since Rebaseline

- No significant changes from rebaseline

(k$)

4.1.B Baseline, November 03 $326

Changes:
Stanford Benefits Rate Increase $2

4.1.B Baseline, February 04 $328
Road Map to ISOC Detail Design Review

- Establish agreements between the subsystems and ISOC for transitioning the necessary tools and staffing
  - Between I&T and IOSC
  - Between SAS and ISOC
  - Between Electronics and ISOC
- Increase LOF staff
- Address all RFAs/Recommendations from the Peer Review