GLAST Large Area Telescope

WBS 4.1.B
Instrument Science Operations Center
Monthly Status Review
1 Sept 2004

Rob Cameron
rac@slac.stanford.edu
650-926-2989
July/August Accomplishments: Overview

- Completed successful CDR and GSDR reviews
- RFAs being addressed
- Refined Functional Organization and Architecture
- Staffing: new hires; future hires
- ISOC Level 2 and 3 Requirements in review and tracing
- ISOC Design and Development
  - Scoping of ISOC software: new development vs. re-use
  - Software and network architectures refined
  - Software development schedule
- Operations Planning
ISOC Reviews and RFAs

- ISOC Peer Review: 2 March 2004
- ISOC CDR: 4 August 2004
- GLAST GSDR: 18-19 August 2004

- CDR: very successful review
  - 8 RFAs and 8 Recommendations received
  - 4 RFA responses submitted for review
  - Responses for remaining RFAs to be submitted by mid-September
  - Recommendations: 7 completed, 1 in work

- GSDR: very successful review
  - Awaiting final list of RFAs
  - No ISOC-specific RFAs
  - Ground-system RFAs will be applied to ISOC as needed: command encryption; validation of L&EO ops procedures.
## CDR RFA Status

<table>
<thead>
<tr>
<th>Section</th>
<th>RFA Title</th>
<th>Requestor</th>
<th>Actionee</th>
<th>ECD/Comments</th>
<th>Sent to Originator for Review</th>
<th>Submitted to Chairpersons</th>
<th>Closed</th>
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<tbody>
<tr>
<td>1</td>
<td>ISOC Documentation Tree</td>
<td>E. Andrews</td>
<td>L. Bator</td>
<td>Response submitted</td>
<td>8/12/04</td>
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<td>2</td>
<td>Requirements Traceability Tool</td>
<td>E. Andrews</td>
<td>B. Craig</td>
<td>Response submitted</td>
<td>8/27/04</td>
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<td>3.1</td>
<td>Add ISOC Architecture Diagram</td>
<td>E. Andrews</td>
<td>B. Craig</td>
<td>Response submitted</td>
<td>8/16/04</td>
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<td>3.4</td>
<td>ISOC Requirements &amp; Testing (Overall)</td>
<td>E. Andrews</td>
<td>J. Martin</td>
<td>9/15/04</td>
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<td>4.2</td>
<td>SAA Handling Approach</td>
<td>N. Johnson</td>
<td>L. Bator</td>
<td>Response submitted</td>
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<td>4.2</td>
<td>Launch Critical Support Pan</td>
<td>M. Rackley</td>
<td>S. Culp</td>
<td>9/15/04</td>
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<td>4.2</td>
<td>Red/Yellow Limit Philosophy</td>
<td>J. Leibee</td>
<td>L. Bator</td>
<td>9/10/04</td>
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<td>8</td>
<td>SAS Verification Approach</td>
<td>M. Rackley</td>
<td>J. Martin</td>
<td>9/10/04</td>
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## CDR Recommendation Status

<table>
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<tr>
<th>Section</th>
<th>Recommendation Title</th>
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<th>Actionee</th>
<th>ECD/Comments</th>
<th>Completed</th>
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<tr>
<td>2</td>
<td>Handling Data Gaps</td>
<td>M. Rackley</td>
<td>S. Culp</td>
<td>8/13/04</td>
<td>8/10/04</td>
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<td>2</td>
<td>Requirements Verification Methods</td>
<td>E. Andrews</td>
<td>J. Martin</td>
<td>Changes completed</td>
<td>8/9/04</td>
</tr>
<tr>
<td>2</td>
<td>Handling LAT Alerts</td>
<td>M. Rackley</td>
<td>L. Bator</td>
<td>Answered at Ops TIM</td>
<td>8/5/04</td>
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<td>2</td>
<td>Requirements Specification Tree Enhancements</td>
<td>M. Rackley</td>
<td>L. Bator</td>
<td>Handled by RFA (documentation tree)</td>
<td>8/12/04</td>
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<td>3.1</td>
<td>Corrections to Interface Diagrams</td>
<td>M. Rackley</td>
<td>L. Bator</td>
<td>Corrections made</td>
<td>8/9/04</td>
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<tr>
<td>3.3</td>
<td>Transitioning SVAC I&amp;T Tools to ISOC</td>
<td>M. Rackley</td>
<td>B. Craig</td>
<td>GSDR Presentation</td>
<td>8/19/04</td>
</tr>
<tr>
<td>6</td>
<td>SAS WBS/Subsystem Consistency</td>
<td>E. Andrews</td>
<td>B. Craig</td>
<td>J. Martin</td>
<td>9/3/04</td>
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<tr>
<td>n/a</td>
<td>FSW Test Team - Selection Process</td>
<td>B. Atwood</td>
<td>B. Craig</td>
<td>Search underway</td>
<td>8/20/04</td>
</tr>
</tbody>
</table>
Refined ISOC Organization

ISOC Manager
R Cameron

Database
Documentation

Commanding, H&S
- Timeline Planning
- Command Generation
- Command V&V
- Health & Safety
- Configuration Tracking

FSW
- Code Maintenance
- Code V&V
- Testbed Maintenance

Performance V&O
- Calibration
- Performance Trending
- Standard Source Monitoring
- IRF Generation

Science Products
- Level 1
  - CRs, gammas, diagnostics
- Level 2
  - Transients, GRBs
- Pipeline Operation

Science Analysis Tools
- Simulation
- Pipeline Tools
- Calibration Tools
- Reconstruction & Event Classif.
- Transient Source Analysis

Documentation

Timeline Planning
Command Generation
Command V&V
Health & Safety
Configuration Tracking
ISOC Staffing

- ISOC staffing is ramping up

- New Hires:
  - Jim Lemon, Database developer, 2 August
  - Lee Steele, Technical writer, 23 July
  - Rob Cameron, ISOC Manager, 16 August

- Future hires:
  - Software developers: 2004, early 2005
  - Test Planner/Engineer: 2004

- Planning underway for merge of FSW, SVAC groups into ISOC
ISOC Staffing Plan

- Projected staffing profile to be revisited and revised

- Includes SWG/SAC scientists

**ISOC Staffing by Job Function**

<table>
<thead>
<tr>
<th>FTE</th>
<th>Support</th>
<th>Scientist</th>
<th>Technician</th>
<th>Software</th>
<th>Engineering</th>
<th>Management</th>
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Months since March 04
ISOC Requirements – Review and Tracing

- Level 2 and 3 requirements in review, preparing for signoff
- Level 2 and Level 3 moved to Doors
  - Includes SS-00015, SS-00020 (SAS), SS-00021
  - Will leverage LAT’s use of Doors for the Instrument
- Have completed first round of traceability
  - L2 to GSRD
  - L3 to L2
- Refinements to both levels and to traceability over next few weeks
- Plan to include testing
  - test procedures and results
Scoping of ISOC Software

- L3 Requirements mapped to software resources
- Each requirement was identified as:
  1. Procedural (non-software) 42
  2. Existing software (commercial or other well-established software -- i.e. implementation Done!) 277
  3. Under development by SAS (mostly done, refer to SAS for status) 39
  4. To be developed by others (I&T, FSW, ITOS) 21
  5. Remaining new development 88

  total 467

- Some requirements map to multiple categories or SW tools, so total exceeds total number of L3 Rqts (379)
## ISOC Software: to be developed

<table>
<thead>
<tr>
<th>Tool Name</th>
<th>Description</th>
<th># Level 3 Reqts</th>
<th>% of Reqts</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>PLOTTOOL</td>
<td>plotting</td>
<td>28</td>
<td>6.0%</td>
<td>combination of existing tools (e.g. ROOT, HippoDraw, JAS, IDL) &amp; new dev</td>
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<tr>
<td>TRENDTOOL</td>
<td>trending</td>
<td>16</td>
<td>3.4%</td>
<td>combination of IDL, DTAS (used by MOC), and/or TAPS (GSFC)</td>
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<tr>
<td>PLANTOOL</td>
<td>mission planning</td>
<td>6</td>
<td>1.3%</td>
<td>generate timeline and commands for LAT operation</td>
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<tr>
<td>CONSTRAINT TOOL</td>
<td>check command sequences against constraints</td>
<td>12</td>
<td>2.6%</td>
<td></td>
</tr>
<tr>
<td>DB</td>
<td>database definition and implementation</td>
<td>10</td>
<td>2.1%</td>
<td>partially done by SAS, I&amp;T, FSW - coordinating dev with SAS, I&amp;T, FSW, SCS</td>
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<tr>
<td>DBIN</td>
<td>ingest ISOC data</td>
<td>7</td>
<td>1.5%</td>
<td></td>
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<tr>
<td>WEBTOOL</td>
<td>provide web access to data products</td>
<td>9</td>
<td>1.9%</td>
<td></td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>88</strong></td>
<td><strong>18.8%</strong></td>
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</table>
Software Design: Primary Data Flows

LAT ISOC

MOC
- Level 0 Data, LAT Alerts, Integrated Observ. Timeline, Spacecraft Timeline, As-Flown Timeline, Flight Dynamics Products, SC Incident Reports, PDB updates

Receive & Archive
- Level 0 Sci Data

Science Data Analysis Pipeline
- Level 1&2 Sci Data Products

Archive & Send
- Level 1&2 Sci Data Products, LAT Timeline

GSSC
- Contingency: LAT Instrument Commands, LAT Instrument Loads, LAT Incident Reports, LAT T&C Database Updates

GSSC

Receive & Archive
- Level 0 Hkpg Data, LAT Alerts

Integrated Observ. Timeline, Spacecraft Timeline, As-Flown Timeline, Flight Dynamics Products

LAT Timeline

Mission Planning
- Commands to Verify
- Tested OK

LAT Test Bed
- Alerts, Logs, Process status, File status

All data into ISOC, and products out

Anomaly Tracking & Notification System

Alerts, Logs, Process status, File status

Database

Web Access

MOC
- LAT ISOC Alerts, Logs, Process status, File status

Receive & Archive
- All data into ISOC, and products out

GSSC
- Archive & Send

Level 1&2 Sci Data Products, LAT Timeline
Software Design: Telemetry Processing

Science Data Analysis Pipeline

- Calibration Trending
  - Calib. DB
- Level 1 processing
  - Recon-struction
  - System-level Monitor
- Level 2 processing
  - Transient Search/GRB Refinement

LAT ISOC

- Archive & Send
  - GINO & FastCopy/DTS
- Level 1 & 2 data products

MOC

- Receive & Archive
  - GINO & FastCopy/DTS
- Level 0 Calibration
  - Level 0 sci & hkpg telemetry, LAT Alerts
- Level 0 science telemetry
  - Subsystem-level monitor
- Level 0 hkpg telemetry
  - Monitor hkpg parameters
  - Monitor Trends
- Realtime Level 0 hkpg telemetry (during contacts), LAT Alerts
  - Monitor hkpg parameters
  - Monitor Data
  - ITOS
  - Subsystem-level monitor
  - Text & Stripchart displays (optional)

GINO & FastCopy/DTS

- System-level Monitor
- Level 2 processing
  - GIN & FastCopy/DTS
  - Level 1 & 2 data products

ITOS

- Monitor hkpg parameters
  - Monitor Trends
  - STOL Config monitor scripts

FASAT

- Anomaly Tracking & Notification System
  - Database
  - Appear & email message

GCN

- Transient Search/GRB Refinement

GSSC

- Reports, Log entries, Data Products received and sent
  - Beeper / email message

- Beeper / email message

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ISOC Software Release Schedule

- New software architecture in place, centralizing all software releases; eliminating the various separate software release schedule as in the PDR schedule
- The schedule has been coordinated with GSFC Ground System plans
  - ISOC Software Release 1 (April 1, 2005)
    - Support Ground Readiness Test (GRT) 2 and 3
  - ISOC Software Release 2 (August 15, 2005)
    - Support GRT 4 and 5
  - ISOC Software Release 3 (December 15, 2005)
    - Support End-to-End 1, ETE 2, ETE 3, GRT 6, GRT 7, and Mission Sim
  - ISOC Software Release 4 (July 25, 2006)
    - Support remaining ETE’s 4, 5, and 6
# ISOC Development Schedule

| Phase / Milestone           | Aug 04 | Sep 04 | Oct 04 | Nov 04 | Dec 04 | Jan 05 | Feb 05 | Mar 05 | Apr 05 | May 05 | Jun 05 | Jul 05 | Aug 05 | Sep 05 | Oct 05 | Nov 05 | Dec 05 | Jan 06 | Feb 06 | Mar 06 | Apr 06 | May 06 | Jun 06 | Jul 06 | Aug 06 | Sep 06 | Oct 06 | Nov 06 | Dec 06 |
|-----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| ISOC CDR                    |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| GSDR                        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| ITOS setup/configuration    |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| ISOC Verif. with Test Bed  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Diagnostic Tool Dev        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Mission Planning Dev       |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| DB/Web/E-logbook Dev       |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Plotting/Trending Dev      |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| ISOC Demos                 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| ISOC Simulation Testing    |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| ISOC SW Releases           |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Ground Readiness Tests     |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| End-to-End Tests           |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Environmental tests at NRL|        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| ISOC testing at NRL        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| ISOC takes over LAT operation|        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| ISOC used to I/F with LAT (front-door only) |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Mission Simulations        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Launch                     |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| SW Dev Slack Times         |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
Continuing to finalize details of operations timeline and commanding process with GSSC and MOC through

- Weekly GOWG meetings
- Ops TIMs. Latest on August 5
- Operations Data Products ICD (492-MOC-009)
- Operations Agreement

LAT operations planning documented in ISOC Operations Plan (LAT-SS-01378)
Cost & Schedule Status

- ISOC effort is off project
- Development schedule produced from software scoping
- Overall staffing and resources being scoped to allow smooth transition of SAS, SVAC and FSW groups into ISOC
Backup Slides
# ISOC Risk Status

<table>
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<tr>
<th>Number</th>
<th>Date</th>
<th>Rank</th>
<th>Originator</th>
<th>Description</th>
<th>Mitigation</th>
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<tbody>
<tr>
<td>ISOC-0001</td>
<td>5/15/04</td>
<td>1</td>
<td>B. Craig</td>
<td>ISOC lacks accepted architecture and plan for software implementation.</td>
<td>Trade study between possible front ends to be completed by 6/15/04. Hires into s/w architecture position. Successful CDR retires risk</td>
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<tr>
<td>ISOC-0002</td>
<td>5/15/04</td>
<td>3</td>
<td>B. Craig</td>
<td>Slow response to PDR RFAs</td>
<td>Schedule and track RFA’s weekly. 3 remain as of 8/02</td>
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<tr>
<td>ISOC-0004</td>
<td>5/21/04</td>
<td>4</td>
<td>B. Craig</td>
<td>No facility location identified for ISOC</td>
<td>Long-term solution identified, short term space to be requested from SLAC management.</td>
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</table>
## ISOC Risk Status (2)

<table>
<thead>
<tr>
<th>Number</th>
<th>Date</th>
<th>Rank</th>
<th>Originator</th>
<th>Description</th>
<th>Mitigation</th>
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<tr>
<td>ISOC-0005</td>
<td>5/21/04</td>
<td>2</td>
<td>B. Craig</td>
<td>No requirements levied on I&amp;T and FIt S/W subsystems</td>
<td>Mechanism in place with I&amp;T and FSW Final disposition after joint requirements review.</td>
</tr>
<tr>
<td>ISOC-0006</td>
<td>5/21/04</td>
<td>1</td>
<td>B. Craig</td>
<td>ISOC will be unable to hold schedule due to staffing delays and unscoped work</td>
<td>Definition of work plan follows architecture development. Additional support supplied as requested but need to balance new hires vs transfers from other subsystems.</td>
</tr>
</tbody>
</table>
Issues and Concerns

- Frontloaded software support needed.
  - Need to limit hires to account for expected transfers from other subsystems.

- Database architecture not as well developed as we would like
  - Need to deliver I&T databases soon while retaining an overall structure that makes sense for the ISOC

- Requirement completeness,
  - risk of missing requirements, mitigation in work (DOORS and full requirement review)

- Many software elements need to interoperate smoothly
  - Early testing reduces problem, and certainly easier than writing the code anew