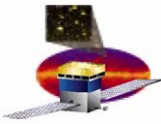


## **GLAST Large Area Telescope Instrument Science Operations Center**

**Commanding, Health and Safety**

**Rob Cameron  
Stanford Linear Accelerator Center  
ISOC Manager**

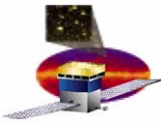
**rac@slac.stanford.edu  
650-926-2989**



# Outline

---

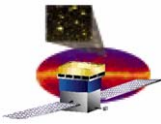
- ❑ Overview of CHS
- ❑ GLAST ground system test support
- ❑ Development activities
- ❑ CHS software releases
- ❑ Operating Procedure Development
- ❑ Operations Networks and Security
- ❑ CHS resource requirements
  - Staffing
  - Operations Facility
  - M&S



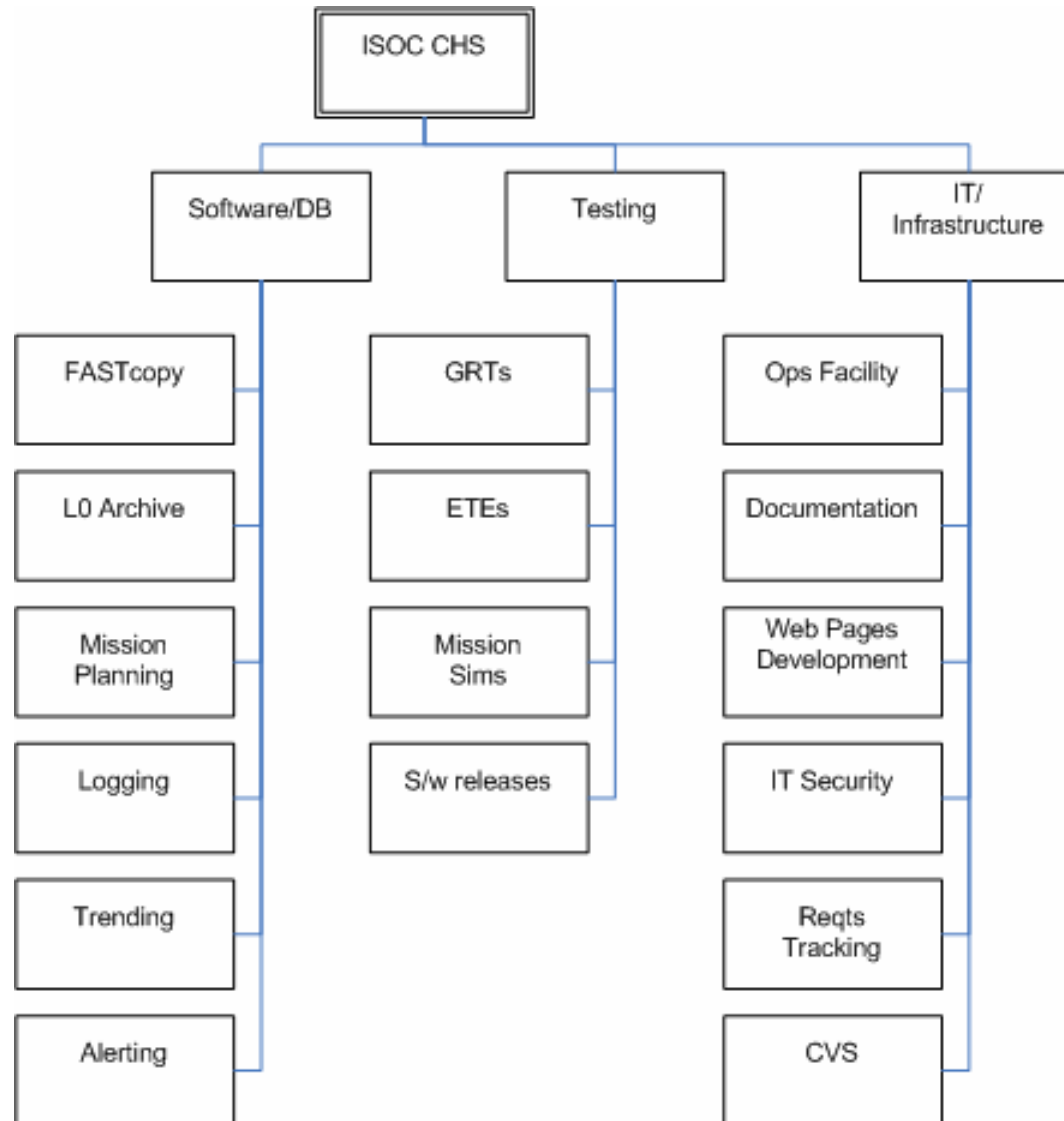
# Commanding, Health and Safety

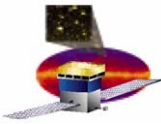
---

- ❑ **The Commanding, Health and Safety (CHS) team is responsible for:**
  - **LAT mission planning support**
  - **generation and validation of LAT commands**
  - **passing LAT commands to the GSSC**
  - **verifying commands were correctly executed**
  - **receiving Level 0 data from the MOC**
  - **logging and archiving of all commands and Level 0 data**
  - **monitoring the health and safety of the instrument**
  - **continuous knowledge of the configuration of the LAT**



# CHS Activities - Breakdown

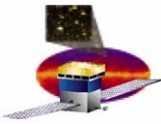




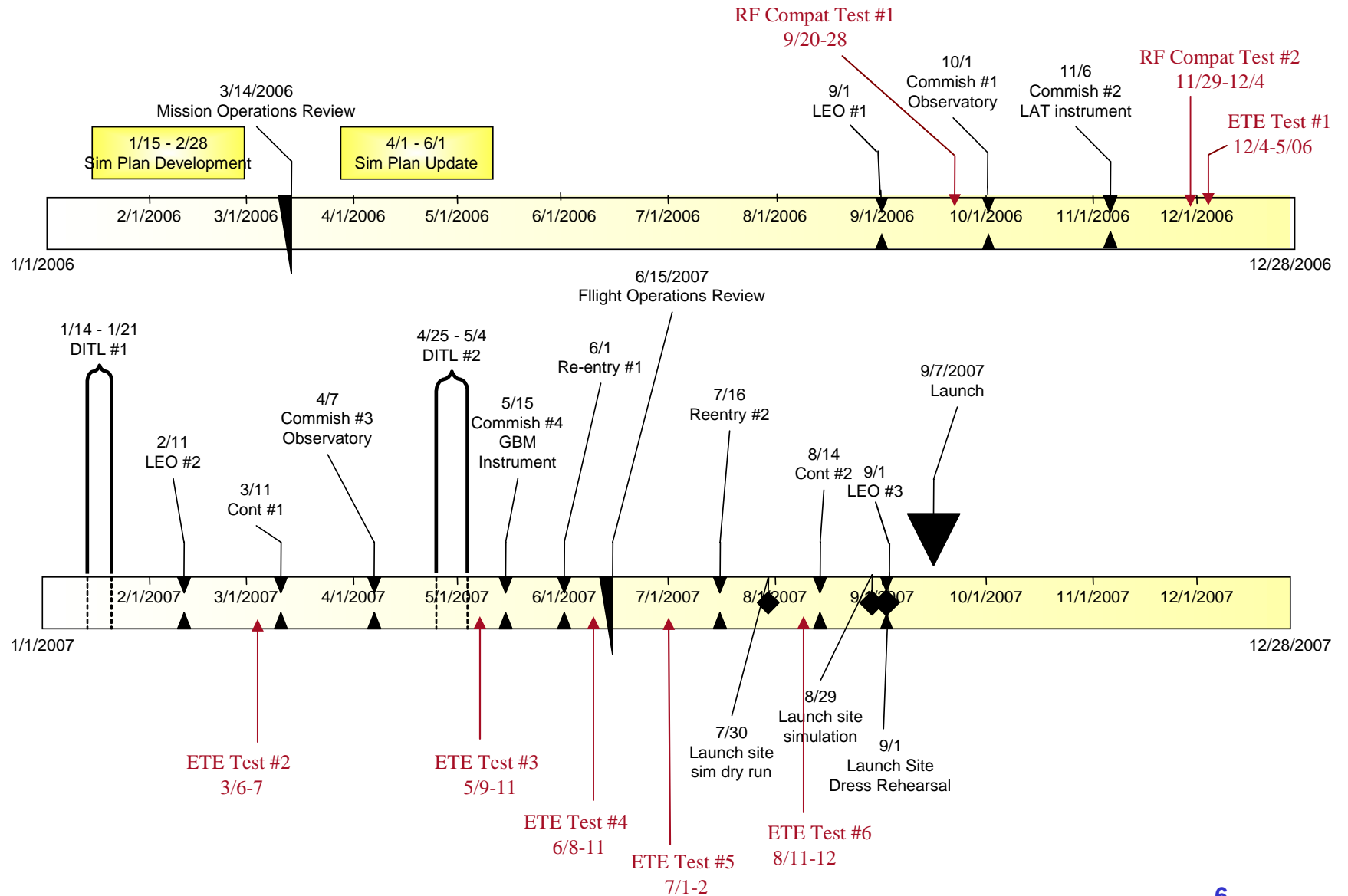
# GLAST Ground System Test Support

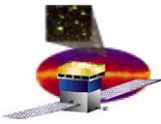
---

- ❑ **Participation in 5 Ground Readiness Tests**
  - **Test of Individual interfaces and products between GS elements**
  - **June 2005 – Dec 2006**
  - **2 GRTs successfully completed to date**
- ❑ **Participation in 6 End-to-End Tests**
  - **Complete GS system exercises with GLAST Observatory**
  - **Dec 2006 – Aug 2007**
- ❑ **Mission Simulations**
  - **Team training using Observatory+Instrument simulators**
  - **Start in Sept 2006**



# Simulation and Mission Test Schedule

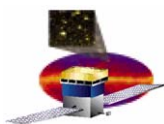




# CHS Development Activities

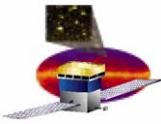
---

- ❑ **CHS Software development tied to GS testing schedule**
  - **Software release schedule driven by GRT and ETE schedule**
- ❑ **ISOC Operations Data Products tested/debugged during GRTs**
- ❑ **LAT Operating Procedures**
  - **NASA requires Narrative Procedures in prescribed format**
  - **66 NPs identified to date**
  - **ISOC/CHS is working with NASA Instrument Operations Engineer to develop and test STOL PROCs from Narrative Procedures**
- ❑ **CHS Participation in LAT I&T at SLAC**
  - **ISOC/CHS provides transport and archiving of data from SLAC cleanroom**
    - **FASTcopy-based transport**
    - **Provides experience with LAT data formats**
    - **Exercises ISOC Level0 data handling**
    - **Offloads effort from I&T**
- ❑ **CHS Participation in LAT I&T at NRL**
  - **Data transport and archiving, similar to SLAC**
- ❑ **Observatory I&T at GD/Spectrum Astro Space Systems**
  - **ISOC provided EGSE h/w and s/w**
  - **Performs telemetry data filtering and format conversion to support ITAR restrictions**
- ❑ **Pre-launch activity at Titusville/KSC**
  - **TBD, probably similar to ISOC-provided EGSE support at GD/SASS**



# CHS Software Releases Driven by GS Tests

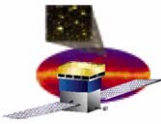
Release #	Date	GSFC test support	Incremental Capabilities
1.0	3-Jun-05	GRT 2	<ul style="list-style-type: none"> <li>receive real time HK, Diag, Alert packets from MOC</li> <li>receive level 0 HK, Diag, Alert packets from MOC</li> <li>provide basic mission planning</li> </ul>
1.1	29-Sep-05	(none)	(following release 1.1, involvement of the IOCs in GRT4 was removed; 1.1 had no major new capabilities, but was an up-to-date version of the dev SW)
1.2	16-Nov-05	GRT 3	<ul style="list-style-type: none"> <li>receive level 0 science data from MOC</li> <li>remove duplicate packets</li> <li>ingest new orbital and mission planning products</li> </ul>
1.3	15-Feb-06	Engineering tests only	<ul style="list-style-type: none"> <li>mission planning database elements integrated</li> <li>EU convert L0 data</li> <li>calculate derived parameters from L0 data</li> <li>limit check L0 and derived parameters</li> <li>logging (APIs in place and used in ISOC apps + webapp for browsing log)</li> </ul>
1.4	19-Apr-06	Engineering tests only	<ul style="list-style-type: none"> <li>process level 0 science data into level 1 data products LS-002 &amp; LS-005</li> <li>provide level 1 data products to GSSC</li> <li>mission planning GUI</li> <li>calculate derived low-rate science counter parameters from L0 data</li> <li>trending</li> <li>realtime data fed into L0 raw archive and trending</li> </ul>
2.0	14-Jun-06	GRT 5	<ul style="list-style-type: none"> <li>process level 0 science data into level 1 &amp; 2 data products</li> <li>provide level 1 and 2 data products to GSSC</li> <li>integrated mission planning capability</li> <li>LAT configuration tracking &amp; management</li> </ul>
2.1	10-Aug-06	GRT 6	<ul style="list-style-type: none"> <li>(adds contingency capabilities)</li> <li>refinements to mission planning and LAT config tracking &amp; management</li> <li>anomaly tracking &amp; notification system (automatic notification for 24/7 operation)</li> <li>generate reports</li> <li>exercise MOC's trending app &amp; remote ITOS display pages</li> </ul>
3.0	20-Sep-06	GRT 7, ETEs 1-2	<ul style="list-style-type: none"> <li>(clean up and regression testing of all previously released capabilities)</li> <li>refinements to mission planning and LAT config tracking &amp; management</li> </ul>
4.0	7-Feb-07	ETEs 3-6, Mission Sims	<ul style="list-style-type: none"> <li>refinements to mission planning and LAT config tracking &amp; management</li> <li>GUI enhancements</li> <li>bug fixes</li> </ul>



# ISOC Operations Data Products

---

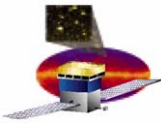
- **From MOC** (GLAST-GS-ICD-0002)
  - ✓ Level 0 (science, HK, diagnostic & alerts)
  - ✓ Real-time data
  - ✓ Integrated Observatory Timeline
  - As-Flown Timeline
  - ✓ TDRSS Ephemerides
  - ✓ GLAST Ephemerides
  - ✓ Requested TDRSS Contact Schedule
  - TDRSS Forecast Schedule
  - ✓ LAT South Atlantic Anomaly Report
  - ✓ Eclipse Entry and Exit Report
  - ✓ Project Database
  - ToO Notification
  - ✓ MOC Command Log
  - MOC File Transfer Log
  - Anomaly Report
  - MOC Status Report
  - Trending Tool Access
  - Remote Real-Time Telemetry Monitoring
  - ✓ File Retransmission Request
- **From GSSC** (GLAST-GS-ICD-0002)
  - ✓ Preliminary Science Timeline
  - ✓ File Retransmission Request
- **From LISOC** (GLAST-GS-ICD-0002)
  - ✓ LAT Science Timeline
  - ✓ Instrument Flight Software Load
  - ✓ PROC Request
  - South Atlantic Anomaly Definition Update
  - Anomaly Report
  - Instrument Procedures
  - ✓ Project Database Update
  - Status Report
  - Data Retransmission Request
  - ✓ File Retransmission Request



# Operating Procedure Development

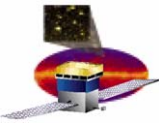
---

Procedures	Need Date
Conduct physics observations	ETE1
Dwell telemetry, configure task messaging, configure command confirmation	ETE1
File upload and file management	ETE2
Calibration data collection run	ETE2
SIU and EPU memory dump/write	ETE2
ToO observation	ETE3
LAT turn on/off	ETE3
Set bias voltages	ETE4
Configure LHK, mode control settings	ETE4
Enable and disable science counters	ETE4
Thermal Control commanding	ETE4
Contingency file upload	ETE5
CPU reboot	ETE5
Miscellaneous contingency operations	ETE5

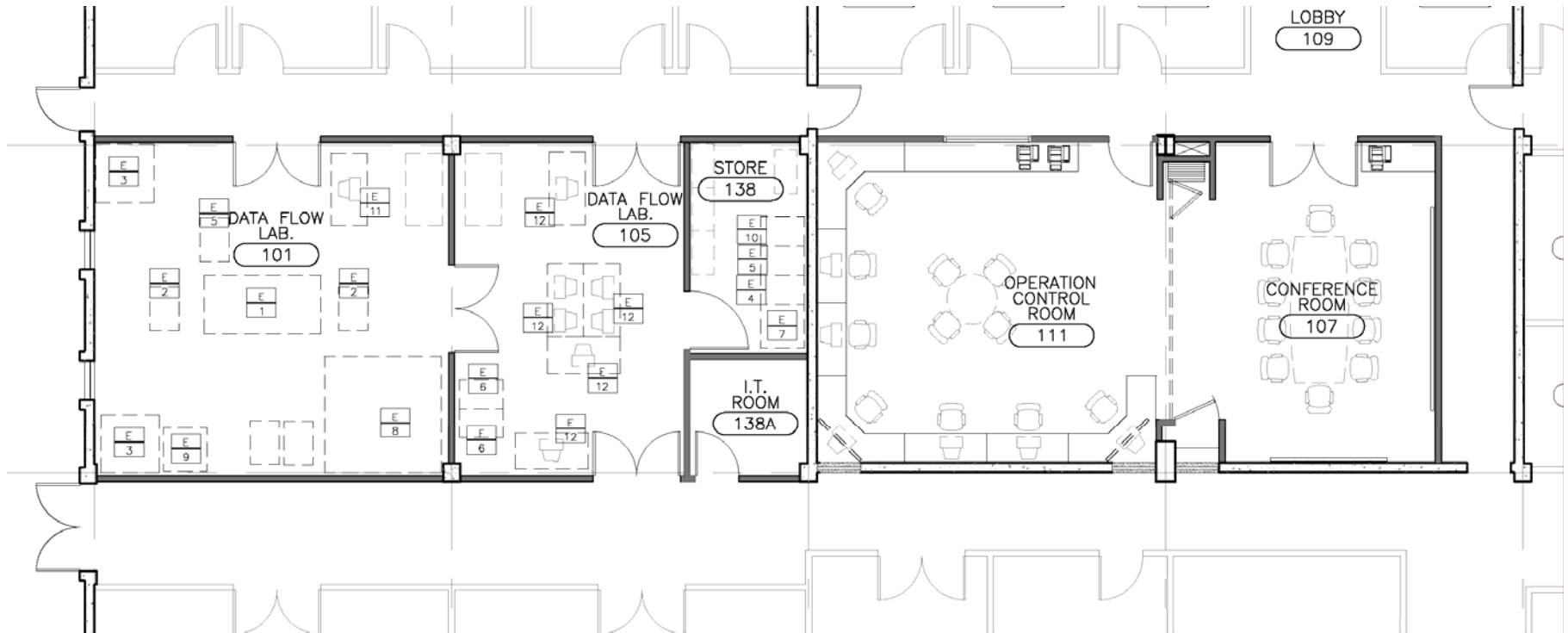


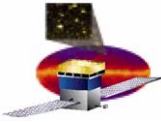
# Document Status

Document Title	LATDocs #	Last Update	Comment
LAT Performance Specification – Level II(B)	LAT-SS-00010	12/10/01	
LAT IOC Performance Specification – Level II(B)	LAT-SS-00015	9/15/04	
LAT ISOC Operations Plan	LAT-SS-01378	7/14/04	Update in work
LAT ISOC Management Plan	LAT-MD-04443	7/8/04	
LAT ISOC Verification and Validation Plan	LAT-SS-02513	Draft	
ISOC Configuration Management Plan	LAT-MD-04835	Draft	
LAT Science Verification and Calibration Plan	LAT-MD-00446	8/20/04	
LAT SAS Level III Requirements	LAT-SS-00020	1/7/02	
LAT ISOC Level III Requirements	LAT-SS-00021	8/3/04	Update in work
LAT Instrument Operations Handbook	LAT-TD-07944	Draft	
ISOC Test Plan	LAT-MD-05150	Draft	
Flight Software User Guide	LAT-TD-07665	1/5/06	
FSW-ISOC ICD	LAT-SS-05141	10/31/05	Update in work
ISOC Software Architecture	LAT-TD-04778	Draft	

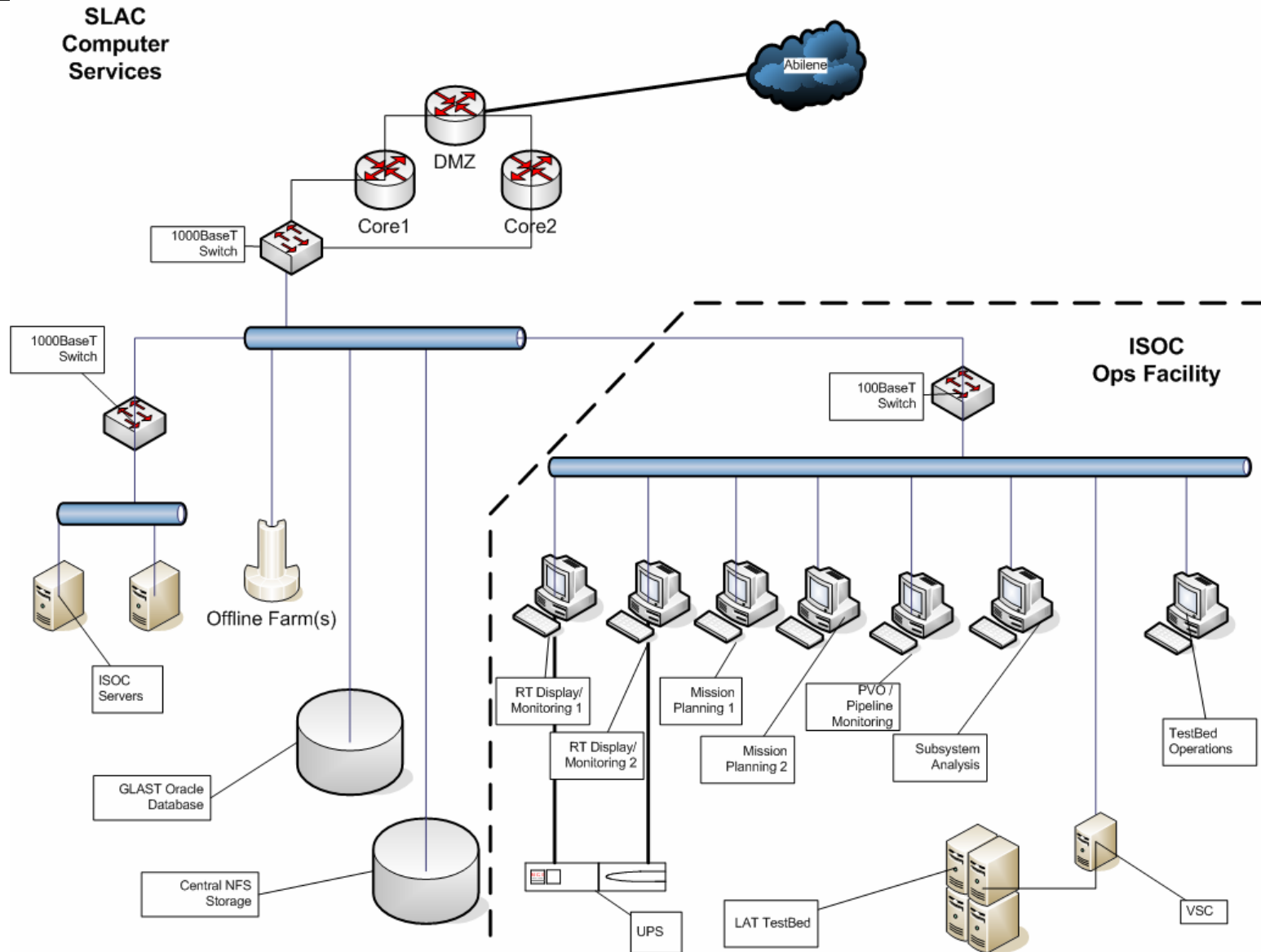


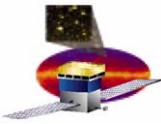
# LAT Operations Facility at SLAC





# ISOC Operations Network at SLAC

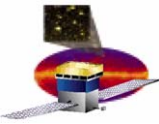




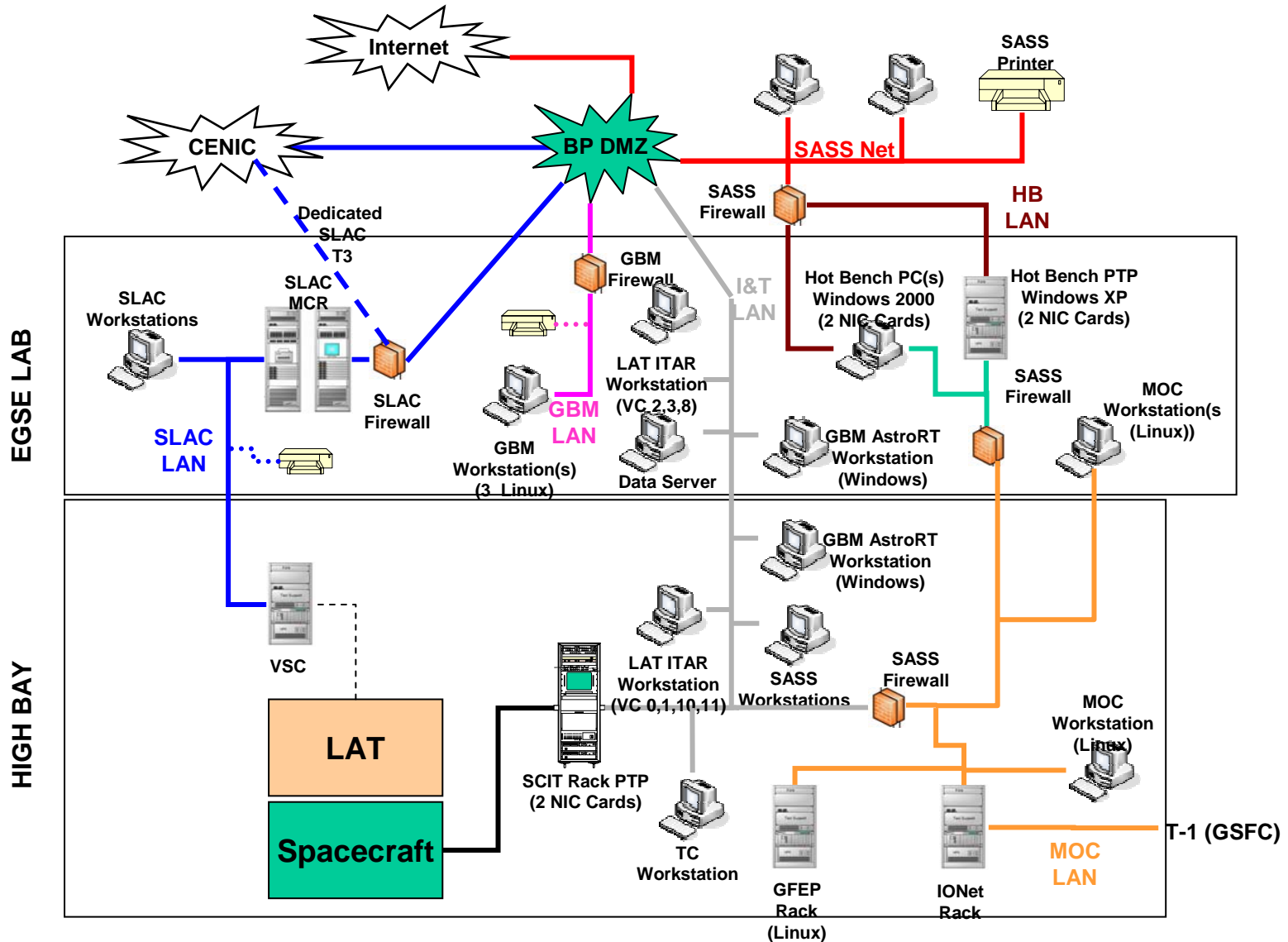
# Operations Security

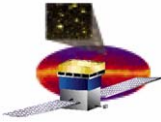
---

- ❑ Implementing subnet for ISOC operations facility
- ❑ Locked door physical security for operations facility
- ❑ ISOC FASTcopy on secure servers in SCCS
- ❑ ISOC at GD/SASS
  - ISOC will support filtering of GLAST test data on
  - Only pass LAT data off GD/SASS I&T LAN
- ❑ ISOC at NASA/GSFC MOC
  - Access to ITOS computers on open IONET
  - LAT-provided computers on CNE network
- ❑ ITAR considerations
  - LAT is in public domain
  - Spacecraft information is ITAR-restricted
  - Only LAT-related data comes to SLAC
  - GLAST GS elements use ITOS (ITAR-restricted) operations platform
  - Controlled access to ITAR-restricted items



# ISOC Workstations at GD/SASS





# CHS Resource Requirements Summary

---

- **Current Staffing**
  - 5 FTEs: 3 SLAC term staff + 2 contractors
    - 1 Operations Engineer
    - 1 Test lead + 0.5 test support
    - 2.5 Software developers
- **Future steady-state staffing plan (post-launch)**
  - 5 FTEs: SLAC staff with NASA/space experience
    - Operations Lead/Engineer
    - Operations support scientist (alternate lead)
    - Software developer
    - 2 Operators (can multi-task, for s/w support or sysadmin)
    - 0.5 network support / sysadmin
  - Objective is to have 2 people capable of supporting any operations task
- **Interim Computer room**
  - 1 office for placement of ITOS workstations (ITAR restricted s/w), until Ops facility available
- **Computer hardware, software**
  - Operations control-room buildout scheduled for 2006
    - 7 workstations + local sub-network support
    - Other control room hardware: printers, copier, fax, UPS, A/V, etc.
    - Furniture provided in SLAC Infrastructure project
    - COTS software: SatTrack for mission planning support
  - 2 workstations for GD/SASS I&T
  - Laptops/desktops for L&EO, placed MOC on NASA CNE network
- **Telecom: cellphone/PDAs for essential ops staff**
- **Travel**
  - 2006: I&T support at NRL
  - 2006: ITOS workstation setup and support at GD/SASS
  - 2006/2007: Mission Simulations support at NASA/GSFC
  - 2006/2007: Face-to-face operations TIMs