I&T Pre Preliminary Design Review, October 2, 2001



I&T&C Organization Chart





Operations Coordination Mission

- Ensure orderly transition to IOC and nominal LAT operations on-orbit
- Leverage EGSE development to minimize IOC cost
- Capture LAT engineering knowledge and retain in operations team
- Validate and verify flight operations procedures, command & telemetry database, calibration procedures, and IOC software/hardware prior to delivery
- Maximize use of I&T opportunities to train instrument operators and science observers



Approach

- Inject operations requirements into I&T.
 - verification of procedures, databases, instrument modes, and ground system interfaces
- IOC participation in I&T planning, procedure development, and operations.
 - IOC participants in I&T working groups
 - IOC support for I&T tasks
- Time-phased sharing of operations personnel.
 - IOC support for I&T tasks
 - I&T migration to IOC support



Work Breakdown Structure

There is significant overlap in functional requirements between the I&T and IOC. This is reflected in the IOC work breakdown structure with areas of overlap shown in red.

WBS	Task	Responsibility	WBS	Task	Responsibility
4.1.B	Instrument Operations Center	Williams	4.1.B.6	LAT Performance Verification	Lauben
4.1.B.1	Project Management	Williams	4.1.B.6.1	Performance Verification Test Planning	
4.1.B.1.1	Project Administration		4.1.B.6.2	Analysis Software	
4.1.B.1.2	Meetings & Reviews		4.1.B.6.3	Display Software	
4.1.B.1.3	Logistics Management		4.1.B.6.4	LAT Calibration Support	
4.1.B.1.4	Travel		4.1.B.6.5	LAT Simulator	
4.1.B.1.5	Project Support		4.1.B.7	LAT Integration & Test	TBD1
4.1.B.2	Performance Assurance	TBD1	4.1.B.7.1	Qualification Unit Test Support	
4.1.B.2.1	IOC Performance Assurance		4.1.B.7.2	Flight Unit Test Support	
4.1.B.2.2	IOC Verification		4.1.B.7.3	LAT I&T Travel	
4.1.B.3	Mission & Operations Planning	Williams	4.1.B.8	Mission Systems Integration & Test	TBD1
4.1.B.3.1	Operations Concept Development		4.1.B.8.1	Observatory Testing	
4.1.B.3.2	Integration & Test Planning		4.1.B.8.2	Ground Systems Testing	
4.1.B.3.3	Mission Operations Planning		4.1.B.8.3	Training Simulations	
4.1.B.4	LAT Operations Facility	TBD2	4.1.B.8.4	Launch & Early Operations Support	
4.1.B.4.1	System Conceptual Design		4.1.B.8.5	MSI&T Travel	
4.1.B.4.2	Data Acquisition S/W Development		4.1.B.9	Mission Operations & Data Analysis	Williams
4.1.B.4.3	Operations Software Development		4.1.B.9.1	MO&DA Management	
4.1.B.4.4	Command & Telemetry Development		4.1.B.9.2	Science Operations	
4.1.B.4.5	LOF System Development		4.1.B.9.3	LAT Operations	
4.1.B.4.6	EGSE Coordination		4.1.B.9.4	LOF Systems Support	
4.1.B.5	LOF Test	TBD1	4.1.B.9.5	LAT Simulator	
4.1.B.5.1	Test Planning		4.1.B.9.6	LAT Engineering Support	
4.1.B.5.2	Test Development				
4.1.B.5.3	Verification Testing				
4.1.B.5.4	LOF Interfact Tests				
4.1.B.5.5	LOF I&T Travel				



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Evolutionary IOC Development



Evolutionary development and verification of IOC functions, software, and hardware. EGSE is used to prototype IOC functions during I&T.



LAT Large Area Telescope **Ground Support Equipment** GSE Instrument Operations Center IOC LOF **Operations Facility** SAS **Science Analysis Software Science Data Production** SDP S/C **Spacecraft** MOC **Mission Operations Center** SSC **Science Support Center**



LAT Operations Facility Functions

- Instrument Control & Operation
 Status & condition monitoring, limit checking, procedure development, command generation, trending, logging.
- Level 0 LAT Data Processing
 - Data acquisition & management, archiving, data distribution, data quality verification.
- Operations Uploads

Flight software updates, command sequences, parameter tables.

Test & Calibration

Mode control, procedure development, on-orbit calibration scheduling, implementation, and data acquisition, systems analysis.

Instrument Operations

Planning & scheduling, procedure development, upload validation and verification, anomaly resolution.

Communication Support

LAT IOC interfaces to MOC, GN, SSC, SAS.

• Operations Environment Maintenance

LOF maintenance and upgrade, LAT Testbed maintenance, Database maintenance, crew resource management, documentation.



Mission Operations Functions









IOC Development & Test



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Instrument Operations Coordination



IOC Revised Milestones

•	IOCIOC Requirements Review	05/03/01
•	IOC Peer Design Review	08/17/01
•	IOC Pre PDR	10/5/01
•	LAT Instrument PDR (TBR)	1/15/02
•	LAT Instrument CDR (TBR)	08/05/02
•	IOC CDR (TBR)	12/03
•	Development Model	03/04
•	IOC S/W Release 1, Environmental Test Database	05/04
•	IOC S/W Release 2, Observatory Integration Database	01/05
•	Operations Model	04/05
•	LAT Ops Facility Validation & Verification Complete	06/05
•	Ground Systems Compatibility Test (TBR)	07/05
•	IOC S/W Release 3	09/05
•	Mission Sequence Test (TBR)	10/05
•	Operations Sims Begin	10/05
•	Flight Database Release	11/05
•	IOC S/W Release 4	01/06
•	End-to-end Test (TBR)	01/06
•	Launch	03/06
•	LAT Checkout Complete	L+60d



Instrument Operations Interfaces

- LAT Online Manager R. Claus
 - Operations hardware and software, display definitions, command procedures, databases.
- LAT Environmental Test Manager M. Lovellette
 - Procedure validation and verification, operator training, database validation and verification, test support opportunities.
- Particle Test Manager G. Godfrey
 - Calibration procedures, displays, test support opportunities.
- Calibration & Verification Manager E. do Couto e Silva
 - Calibration displays, analysis, data quality metrics, instrument performance metrics, calibration database.
- Other interfaces
 - Science Analysis Software R. Dubois
 - Flight Software JJ Russell
 - Calorimeter N. Johnson
 - ACD D. Thompson
 - TKR TBD



IOC Development Staaffing

Instrument Ops Coordination resources provided by IOC.

Manager - S. Williams

Technical management, reporting, mission planning, concept and requirements development, command & telemetry database, operations procedures and documentation, crew resource management.

Scientist - D. Lauben

LAT performance verification, calibration support, analysis and display prototyping, science planning and operations tools, LAT Testbed support, SSC interface (instrument scheduling), SAS interface.

Engineer - TBD2, mid-FY03

LOF development, operations S/W development, distributed monitoring, procedure and upload verification & validation, LAT Testbed.

Engineer - TBD1, FY04

Verification and QA support, test planning, command & telemetry database, operations procedures and documentation, MOC interface, I&T Coordination.

Programmer - TBD3, FY04

Computer systems management, data processing S/W, operations S/W, FSW interface, GN interface, LAT testbed support.



IOC Needs / I&T Deliverables

- Online System prototype
- Ground system I/F test opportunities
- Operations training opportunities
- Instrument mode, operations procedures V&V
- Command procedures, command and telemetry database, low level calibration V&V
- Performance metrics
- Sample data
- Calibrated & Verified Flight LAT