GLAST Large Area Telescope:

Electronics, Data Acquisition & Flight Software Overview

W.B.S 4.1.7

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Outline

• Overview
• Requirements
• Status
• Past Review Recommendations
• WBS Interfaces
• Organization
• Summary Schedule
• Schedule Milestones
• Cost Plan
Subsystem Overview

[Diagram showing the subsystem overview with various components such as L1, SIU, LAT COMM, Event Builder, Level 1 Data, Reconfigurable Software Filters, Processor Farm, and LAT Heaters.]
Subsystem Overview (con’t)

16 Tower Electronics Modules
- DAQ electronics module (DAQ-EM)
- Power-supplies for tower electronics

5 Event-Processor Units (4 + 1 Reserve)
- Eventbuilder
- Event processing CPU

Global-Trigger/ACD-EM/Signal-Distribution Unit*

Spacecraft Interface Unit*
- Spacecraft interface, control & data
- LAT control CPU
- LAT command and data interface

Power-Distribution Unit (PDU)*
- Spacecraft interface, power
- LAT power distribution
- LAT health monitoring

* Primary & Secondary Units shown in one chassis
Requirements Documents

- Level III Requirements
  - LAT-SS-019 Level III Trigger & Dataflow Requirements
  - LAT-SS-136 Level III Power System Requirements
- Level IV Requirements
  - LAT-SS-284 Level IV Trigger Requirements
  - LAT-SS-285 Level IV Dataflow Requirements
  - LAT-SS-399 Level IV Flight Software Requirements
  - LAT-SS-183 Level IV Power Supply Requirements
- Other Requirements documents
  - 433-IRD Spacecraft Interface Requirements
  - LAT-SS-00010 LAT Instrument Performance Specifications
Electronics, DAQ & FSW Status

• Balloon-flight effort ended
• Requirement documents created
• Electronics system design completed
  – Final partitioning of functions into locations at bottom of LAT
  – Interface to all other sub-systems defined
• Data formats within LAT (most important on Tower Electronics Module) defined
• Buffer depths on TEM simulated
• Tower Electronics DAQ Module prototype fabricated and in test
• Conceptual Design of most units documented
• Ground-Support Equipment card designed, fabricated, and in use
• System test with EGSE test-stand, TEM, and Calorimeter Front-end electronics under way.
• Processor choice baselined
• Wooden 1:1 model of LAT with electronics boxes built
• FEMA created
Electronics, DAQ & FSW Status (con’t)

• Balloon Flight
  – Validated many elements of Flight Software Management Plan
    • Code development life cycle
    • Code building/distribution
    • Inline documentation generation

• Dataflow Analysis
  – Performed discrete event simulation
  – Designed/documented compact/efficient event format
    • More compact (nearly a factor of two smaller)
    • More “navigable” (easier for filter to read/process/span)

• Filter Analysis
  – Generated MC events
  – Processed events using trial algorithms (continuing effort)
    • Characterizing timing performance
    • Characterizing efficiency/purity

• Hardware and software development on schedule
Subsystem WBS Interfaces

- 4.1.5.6/7 CAL
- 4.1.4.3.3 /4.2 TKR
- 4.1.6.4 ACD
- 4.1.7 Electronics, DAQ & FSW
- 4.1.7.6 Power System
- 4.1.8.5 Thermal Control
- 4.1.8.7 Heat-Pipes

M: Mechanical
E: Electrical
T: Thermal
### Key Level III Milestones

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
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<tr>
<td>Electronics &amp; DAQ Subsystem Requirements Review</td>
<td>04/25/01</td>
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<tr>
<td>Electronics &amp; DAQ Pre-PDR</td>
<td>08/16/01</td>
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<tr>
<td>Tracker Elex - TEM System Test</td>
<td>02/07/02</td>
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<tr>
<td>Calorimeter Elex - TEM System Test</td>
<td>04/12/02</td>
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<td>EGSE EM1 Release Available</td>
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<tr>
<td>ACD Elex - TEM System Test</td>
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<td>Engineering Model 2 TEM to I&amp;T</td>
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<tr>
<td>Engineering Model 2 System Test (HW &amp; SW)</td>
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<td>First Flight TEM to I&amp;T</td>
<td>10/29/03</td>
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<td>Full 16-Tower EM2 Test</td>
<td>11/15/03</td>
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<tr>
<td>Flight GASU/EPU/SIU/PDU/Harness to I&amp;T</td>
<td>04/26/04</td>
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</table>
## Summary Schedule

### Key Milestones
- Electronics System Design
- Dataflow Electronics (TEMs + Proc Farm)
- Spacecraft Interface Unit
- Power Conditioning
- Enclosures
- Cable Harness
- Qualification Units
- Flight Units
- Flight Software: EM1
- Flight Software: EM2
- Flight Software: Qualification Unit
- EGSE & Operations

### Timeline

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<thead>
<tr>
<th>Year</th>
<th>FY01</th>
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<th>FY03</th>
<th>FY04</th>
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### Project:
- **GLAST LAT Project**
- **SLAC Internal Review, April 16-18, 2002**

**417 Electronics**
Electronics Cost & Commitments

$M, Then Year Dollars

FY00 FY01 FY02 FY03 FY04 FY05

ACWP Actual Commit BCWS BCWS + Planned Commit
Electronics Cost Type

![Bar chart showing electronics cost type for different fiscal years FY00 to FY05. The chart categorizes costs into labor, M & S (no travel), and travel. Costs are measured in millions of dollars.]
## Key Level IV Milestones

<table>
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<th>Milestone</th>
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<tr>
<td>Flight Software EM1, Complete Architecture</td>
<td>04/15/02</td>
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<tr>
<td>Global Trigger EM1 Available</td>
<td>05/15/02</td>
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<tr>
<td>Event Builder EM1 Available</td>
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<td>Front-End Simulator Available</td>
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<td>Spacecraft Interface Card Available</td>
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<tr>
<td>Global Trigger EM2 Available</td>
<td>01/31/03</td>
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<td>Event Builder EM2 Available</td>
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<tr>
<td>Housekeeping Card EM2 Available</td>
<td>05/02/03</td>
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<tr>
<td>Multi-CPU Toolbox Flight-Software Complete</td>
<td>05/13/03</td>
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