GLAST Large Area Telescope: Project Overview

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Objective: Larger field of view (FOV), higher sensitivity, and broader energy detection range than any previously flown gamma-ray mission.

- Mission Duration: 5 yrs (10 yr Goal)
- Orbit: 565 km Circular, <28.5° Inclination
- Launch Date: Fall 2007
- Launch Vehicle: Delta 2920H-10
- Launch Site: Kennedy Space Center
Observatory Layout

+Z (Yaw)
+Y (Pitch)
+X (Roll)

GBM BGO Detector (x2)
Large Area Telescope
LAT Radiator

3 Panel Solar Array
Optical Bench and Skirt Assembly
3 Star Trackers and SIRU

GBM NaI Detectors (x12)
Hydrazine Propellant Tank

GBM Power Supply Box
GBM Data Processing Unit

S-Band Antennas
Ku-Band Antenna

Launch Config.

Launch Config.

Project Overview
Presentation 1 of 12
**Instrument Design: 4x4 modular array**

**Si Tracker**
- pitch = 228 µm
- 880,000 channels
- 18 X-Y layers of silicon with tungsten foil converters
  - (12 layers × 2.8% \(X_0\))
  - (4 layers × 19% \(X_0\))
  - (2 layers)

**CsI Calorimeter**
- Hodoscopic array
- 8.4 \(X_0\)
- 8 × 12 bars of CsI
- 2.0 × 2.7 × 32.6 cm

**Anti-Coincidence Detector**
- Segmented scintillator tiles
- 0.9997 efficiency

**Mechanical Sys. (inc. Grid & Thermal Radiators)**

**Electronics, Data Acquisition, & Flight Software**

**LAT measures direction and energy of incoming gamma rays**

**Project Overview**
Presentation 1 of 12
LAT Status

- LAT is at NRL
  - Completed CPT before and after shipment
- Unit level and instrument level testing have reduced the risk of an undiscovered anomaly with the hardware to an acceptable level
- Unit level, FQT, and instrument testing of the flight software have validated the software to be adequately stable to conduct the environmental test
- The mechanical GSE for shipment and environmental test is ready, proof tested, and used successfully for path finding
- The electrical ground support systems are operational
  - Used in the test program at SLAC
  - Is in use testing the LAT
  - The network connectivity between NRL and SLAC for data analysis is operating
LAT Status – 2

- The LAT has been powered and under test for 981 hours since testing with flight software began. 636 hours of those hours have been logged since in the final flight configuration
  - Over 300 million triggers have been logged since running with flight software
- Whenever the instrument is on it can track cosmic rays
  - Produces data sets that are analyzed for detector performance and science data integrity
- Liens
  - The event filter and gamma ray burst detection were not included in the FSW FQT. These will be tested in a delta FQT.
  - Less than 50 NCRs remain open.
Master Schedule

- LAT complete and tested  May 2006
  - To Naval Research Laboratory for environmental testing

- Delivery to Observatory Integration  September 2006
  - Mate with spacecraft and GBM and test

- Launch  September 2007
  - Kennedy Space Center

Spitzer Launch on a Delta II Rocket
# Project History

## GLAST - The History

<table>
<thead>
<tr>
<th>Event</th>
<th>Start</th>
</tr>
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<tbody>
<tr>
<td>First International GLAST Meeting</td>
<td>August-94</td>
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<tr>
<td>GLAST Mission Concept Study</td>
<td>March-95</td>
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<tr>
<td>GLAST NASA SR&amp;T Program</td>
<td>February-96</td>
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<td>1st GLAST Beam Test - ESA, prototype CsI Calorimeter</td>
<td>July-96</td>
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<tr>
<td>2nd GLAST Beam Test - ESA, prototype TKR, CAL, &amp; ACD</td>
<td>October-97</td>
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<tr>
<td>GLAST Advanced Technology Development Program</td>
<td>August-97</td>
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<tr>
<td>ATD Beam Test Prototype - ESA Beams</td>
<td>December-99</td>
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<td>GLAST Mission Proposal to NASA</td>
<td>November-99</td>
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<td>GLAST Mission Selection</td>
<td>February-00</td>
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<tr>
<td>ATD Balloon Flight</td>
<td>August-01</td>
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<td>Preliminary Design Review</td>
<td>January-02</td>
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<tr>
<td>Critical Design Review</td>
<td>May-03</td>
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<tr>
<td>First Flight Tracker and CAL Modules Installed in GRID</td>
<td>April-05</td>
</tr>
<tr>
<td>All 16 towers and Anticoincidence Detector installed on LAT</td>
<td>November-05</td>
</tr>
<tr>
<td>All flight DAQ modules installed on LAT</td>
<td>February-06</td>
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Sensors

ACD before installation of Micrometeoroid Shield

1 of 16 Calorimeter modules

1 of 16 Tracker modules
Sensor testing at each stage of integration

2 Towers on 4/11/2005

4 Towers on 5/19/2005

6 Towers on 6/13/2005

8 Towers on 8/4/2005
LAT before installing the ACD
LAT with ACD and protective cover
Data Acquisition System (-Z)
-Z with the Cross LAT plate installed
LAT Test Flow

System Commissioning/ System Test → Shipment
5/11/06

Offload & Set-up LAT → CPT
5 days

CPT → Sine Vibe
5 days
9 days

PER
5/25/06

Sine Vibe → Install Radiators
2 days

EMI/EMC Test
11 days

Acoustic Test
7 days

Shipment → System Commissioning/ System Test
5/16/06

5 days

Pre TV → T- Bal → T- Cycle
8 days
40 days

CPT
3 days

Remove Radiators
2 days

Weight & CG
2 days

Pack and Ship
2 days
9/15/06

PSR
9/13/06

NOTE: Durations for moving and setup have been incorporated into the total duration for the test.
Pathfinder at NRL
Pathfinder at NRL
2nd Grid mounted on Spacecraft Flexures

Spacecraft interface flexures

LAT Test Interface Plate
LAT on Shipping Container Base
Next Steps

- 2006 – Complete and test instrument and hand off to NASA
- 2007 – Support observatory testing and establish instrument ground systems including the ISOC at SLAC
- 2008 – Begin science with an all sky survey
- 2009 through 2017 – Continue discovery-based science
Conclusion

- The LAT is complete and tested.
  - Risk of significant anomalies has been reduced to an acceptable level
- Preparations for environmental test are complete and verified
- The LAT has completed a CPT after arriving at NRL
- The systems and procedures are in place to conduct the environmental test
- The staff is available and trained to do the test
  - Were involved in the testing at SLAC
  - Were involved in the path finding at NRL
  - NRL personnel will operate the facilities
- The LAT project is ready to conduct the environmental test