GLAST Large Area Telescope:

Project Status

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rev. C
GLAST MISSION SUMMARY

• 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: May 2007
• Launch Vehicle: Delta 2920H-10
• Launch Site: Kennedy Space Center
OBSERVATORY LAYOUT

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

- LAT
- LAT Radiator
- Optical Bench and Skirt Assembly
- 3 Star Trackers and SIRU
- Hydrazine Propellant Tank
- GBM NaI Detectors (x12)
- 3 Panel Solar Array
- GBM BGO Detector (x2)
- S-Band Antennas
- Ku-Band Antenna
- GBM Power Supply Box
- GBM Data Processing Unit
- Single Axis S/A Drive
- 125 Ahr Battery

Launch Config.
Instrument Structure

- Anti Coincidence Detector -- GSFC
- 16 Tracker Modules – Italy & UCSC
- Grid -- SLAC
- 16 Calorimeter Modules – NRL & France and Sweden
- Electronics Modules -- SLAC
- Radiators -- SLAC
- Integration and Test -- SLAC

Mass  3000 Kg
Power  650 Watts
LAT Underside Structure

- Global trigger
- ACD Signal Unit
- Spacecraft Interface Unit (2x)
- Empty boxes for heat conduction (5x)
- Tower Power Supply (16x)
- Tower Electronics Module (16x)
- Event Processing Unit (3x)
- Power Distribution Unit
Master Schedule

• LAT complete and tested December 2005
  – To NRL for environmental testing

• Delivery to Observatory Integration March 2006
  – Mate with spacecraft and GBM and test

• Launch May 2007 TBR
  – Kennedy Space Flight Center

SIRTF Launch on a Delta II Heavy
Rebaseline Plan

- Rebaseline proposal is for $24.6M with $21.8M in FY05
- Capital Equipment Project is capped at $45M (currently $42M)
  - On-going operating funds are limited to $5M per year
  - Previously $6.3M for FY06
- Cost plus commitments January 31 on DOE funds are $39.6M.
- Office of Science requested that the project identify specific activities which are funded by DOE alone and stay within the $45M cap
  - This proposal identifies the fabrication of flight electronics boxes, system engineering & project controls for these activities
  - The period of performance will be the remainder of FY05
- The DOE $3M plus the $17M from NASA gives an additional $20M in funding for the LAT for FY05
  - The work in the rebaseline has been descoped to reduce FY05 costs by $1.8M
Instrument Status – Overview

- Two Tracker flight towers at SLAC
  - Need to demonstrate production rate in Italy
- Five flight Calorimeters at SLAC
- Two flight Tower Electronic Modules and Power Supplies at SLAC
- Grid in I&T
- Instrument simulator shipped to Spectrum Astro
- Cost and schedule issues dominated by vendor performance
  - Lockheed Martin Thermal control system
  - Teledyne MCM Production
  - Parlex Tracker cables and pitch adapters
  - General Technologies TEM and TEM PS fabrication
- I&T of the instrument is just starting
  - Need to demonstrate integration and test rate
Tracker Status

INFN Italy
University of California at Santa Cruz
Stanford Linear Accelerator Center
Tracker Status

- Two flight towers at SLAC
- Details at the Tracker talk by Persis Drell

Tower A in I&T at SLAC
Calorimeter

Naval Research Laboratory
IN2P3 France, Sweden
Calorimeter status

- CsI Crystals – Complete
  - Swedish Consortium delivered high quality crystals.

- Crystal Detector Element (CDE) Manufacturing - Complete
  - Swales Aerospace has provided high quality CDEs on schedule and well under budget. Great job!

- Composite Structures - Complete
  - French hardware contribution completed. IN2P3 / LLR Ecole Polytechnique has done an excellent job in supporting LAT.

- Analog Front End Electronics (AFEE)
  - All boards have been manufactured and tested
  - Last 8 boards are currently in conformal coating.

- PreElectronic Modules (PEMs)
  - 16 PEMs have been assembled and tested. 2 more will be built for ground testing.

- CAL Modules
  - 12 modules have been completely assembled.
  - 7 of these have completed all environmental testing and calibration
  - 5 of these have been delivered to LAT I&T at SLAC.
Calorimeter Assembly Flow and Build Status

- **Dual PIN Diodes**
  - Total: 4800
  - Required for flight: 3072

- **CsI Crystals**
  - Total: 1755
  - Required for flight: 1536

- **Crystal Detector Element (CDE) Assembly**
  - Total: 1755
  - Required for flight: 1536

- **Mechanical Structure**
  - Total: 18
  - Required for flight: 16

- **Front-End Electronics**
  - Total: 64
  - Required for flight: 64

- **PreElectronics Module (PEM)**
  - Total: 16
  - Required for flight: 16

- **Module Assembly & Test**
  - Delivered to LAT I&T: 5 modules
  - Total needed: 7 out of 16
CAL Module Testing

7 Completed Modules in CAL Clean Tent

- 106 & 107 ready to ship
- 108 & 109 ready for TVAC
- 110 calibration w/ cosmic muons
- 111 & 112 post vibration performance testing.
# CAL Module Deliveries

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<tr>
<th>Month</th>
<th>FM Range</th>
<th>Status</th>
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<td>FM 101</td>
<td>✔️</td>
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<tr>
<td>January '05</td>
<td>FM 102 - 105</td>
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<td>February '05</td>
<td>FM 106 - 107</td>
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<td>March '05</td>
<td>FM 108 - 110</td>
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<td>April '05</td>
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<td>May '05</td>
<td>FM 115 - 116</td>
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Anti-Coincidence Detector

Goddard Space Flight Center
Femilab
Anti-Coincidence Detector status

- Completed installation of 2nd side row Tile Detector Assemblies. This brings the total number of installed TDAs to 65. Remaining 24 TDAs are installed after integration of the Electronics Chassis.

- Completed a performance simulation using “as built” gaps between detectors and “as measured” performance data for the flight detector chain (Tile Detector Assemblies and fiber cables). The ACD efficiency requirement of 0.9997 was met!

- PMT assembly progressing well. Issues with quality and delivery rate of mechanical housings has impacted final completion date for the PMT assemblies, however all flight PMT assemblies will be completed by the end of February, 2005.
Significant Accomplishments in January

- Completed the assembly and functional testing of the first and second Electronics Chassis. The first Electronics Chassis has completed vibration testing and is in thermal vacuum testing.

- Completed Thermal Vacuum testing of the Qual/Spare Electronics Chassis. Twelve thermal cycles were completed.
## Electronics Chassis Completion Dates

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<thead>
<tr>
<th>Electronics Chassis</th>
<th>Assembly</th>
<th>EMI/EMC</th>
<th>Vibration</th>
<th>Thermal Vac.</th>
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<tbody>
<tr>
<td>Qualification / Flight Spare</td>
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<td>Qualification (completed)</td>
<td>Qualification (completed)</td>
<td>12 cycles (completed)</td>
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<td>Complete</td>
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<td>2/26/05</td>
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<td>#3</td>
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<td>3/4/05</td>
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<td>#4</td>
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<td>#6</td>
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<td>#7</td>
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<td>#8</td>
<td>3/2/05</td>
<td>N/A</td>
<td>3/11/05</td>
<td>Descoped</td>
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</table>

Base Electronics Assembly (1)

Electronics Chassis (8) (4 double + 4 single)
# Electronic Component Status

<table>
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<tr>
<th>ITEM</th>
<th>Quantity Required Flight (Spare)</th>
<th>Assembly Complete</th>
<th>Functional Testing</th>
<th>Conformal Coating</th>
<th>Thermal Testing</th>
<th>Ready for next assembly</th>
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<tr>
<td>Front End Electronics Boards</td>
<td>12 (4) Done</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
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<td>High Voltage Bias Supply</td>
<td>24 (6) Done</td>
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<td>30</td>
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<tr>
<td>Photomultiplier Tube Assembly</td>
<td>196 (40)</td>
<td>162</td>
<td>108</td>
<td>108</td>
<td>147</td>
<td>108</td>
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</table>
Data Acquisition System

Stanford Linear Accelerator Center
Data Acquisition System status

- TEM-TPS
  - Three Flight Tower-Electronics Modules/Tower Power Supplies
    - Fully assembled
    - Thermal-cycled
    - Vibration tested (one of them to qualification levels)
    - One finished thermal-vacuum testing
  - Balance of 19 TEM/TPS in surface-mount assembly
- Flight GASU & PDU
  - Design/documentation complete
  - Enclosures fabricated
  - Assembly contract awarded
  - Assembly process started
- Flight SIU/EPU
  - Design/documentation complete
  - Enclosures fabricated
  - Assembly contract to be awarded
- Flight Harness
  - Design/documentation complete
  - Assembly contract awarded
  - Kitting of parts in progress
After TEM and TPS are tested individually, the two modules are mated and the TEM/TPS package is tested.
Outlook

- **TEM/TPS**
  - 2/16/05 First TEM/TPS to I&T
  - 2/23/05 Second TEM/TPS to I&T
  - 4/1/05 Third TEM/TPS to I&T
  - 4/22/05 Fourth TEM/TPS to I&T
    - One week lag between delivery of consecutive TEM/TPS
  - 7/26/05 Last TEM/TPS to I&T

- **PDU**
  - 7/1/05 Flight PDU to I&T

- **GASU**
  - 7/15/05 Flight GASU to I&T

- **SIU/EPU**
  - 8/19/05 First SIU/EPU to I&T
  - 9/1/05 Last (5th) SIU/EPU to I&T
Thermal / Mechanical System

Stanford Linear Accelerator Center
Lockheed/Martin
Thermal / Mechanical System status

- **Grid**
  - Bonding of the Grid Top Flange Heat Pipes complete.
  - Bonding of Grid Thermistors 50% complete.
- **Lockheed Martin**
  - Received X-LAT plate (detail) from Vendor.
  - End Item Data Review successfully held for X-LAT Heat Pipes.
    - Ready to bond into next assembly.
  - X-LAT tool try has been completed.
    - Some minor modifications required to improve functionality of the tool. In work.
  - Radiator panels potting of inserts and spools is 25% complete.
  - Radiator panel repair techniques (for honeycomb bonding) have been developed and demonstrated. Ready to implement on flight units.
Grid Heat Pipe Bonding
X-LAT Heat Pipes
## Plan Forward

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<tr>
<th>Milestone</th>
<th>Feb-05</th>
<th>Mar-05</th>
<th>Apr-05</th>
<th>May-05</th>
<th>Jun-05</th>
<th>Jul-05</th>
<th>Aug-05</th>
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<td>Grid 1 to I&amp;T</td>
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<td></td>
<td></td>
<td>15-Feb</td>
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<tr>
<td>Grid 2 deliv to SLAC</td>
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<td>15-Apr</td>
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<td>Qual Static Load Test</td>
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<td>Mech Qual Report</td>
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<td></td>
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<td>15-Jun</td>
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<tr>
<td>X-LAT Fab complete</td>
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<td>17-Mar</td>
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<tr>
<td>X-LAT Test</td>
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<td>13-Apr</td>
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<tr>
<td>X-LAT ship to SLAC</td>
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<td></td>
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<td>20-Apr</td>
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<tr>
<td>Radiator Fab</td>
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<td></td>
<td>30-Mar</td>
<td></td>
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<tr>
<td>Rad Vibe &amp; Acoustic Test</td>
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<td></td>
<td>23-May</td>
<td></td>
<td></td>
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<tr>
<td>Rad T/Vac &amp; Balance Test</td>
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<td></td>
<td></td>
<td>5-Jul</td>
<td></td>
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<tr>
<td>Rad Ship to SLAC</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>22-Jul</td>
<td></td>
</tr>
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</table>
Integration and Test

Stanford Linear Accelerator Center Collaboration
Integration & Test Status

• Five (5) flight calorimeters and one (1) flight tracker have been received and bench tested.
  – Validated the calorimeter and tracker test benches and workstations for subsystem receiving tests.
• Thermal control system (TCS) components integrated into the flight grid.
  – Procedures for Grid handling, heat pipe bonding and installation of thermocouples and thermistors released and executed.
• Detailed integration procedures have been developed and documented for each subsystem component.
  – Integration procedures have been dry run with engineering model hardware to validate safe hardware handling.
• Comprehensive Performance Test (CPT) software suites have been coded and validated for tower component testing and data taking.
  – Electrical ground support equipment (EGSE), workstations and test scripts have been validated with subsystem engineering model components.
  – This software has been used to accept 5 flight calorimeters and the flight tracker.
Integration & Test Status (2)

• The mechanical ground support equipment (MGSE) for integration to a single grid is tested and ready to go.
  – Tracker lift fixture
  – Metrology bay
  – Single grid bay

• The MGSE for LAT instrument integration in the grid has been assembled, and is being proof tested.
  – The Large Area Telescope (LAT) integration stand facilitates safe, ergonomic mechanical assembly of the instrument with moveable personnel access platforms (PAP).
I&T Accomplishments

- Preparation of flight grid for TCS integration
- Flight Tracker in the Cleanroom at SLAC
- LAT Integration stand with PAP
- Flight Calorimeter in the shipping container base
## I&T Plan

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Complete</th>
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</thead>
<tbody>
<tr>
<td>Integration and test of Tower A in the single tower test stand</td>
<td>2/18/05</td>
</tr>
<tr>
<td>Tower A integration into the flight grid</td>
<td>2/25/05</td>
</tr>
<tr>
<td>Completion of two tower test in the flight grid</td>
<td>4/30/05</td>
</tr>
<tr>
<td>Integration and test of remaining towers</td>
<td>9/15/05</td>
</tr>
<tr>
<td>LAT System Level Test</td>
<td>11/1/05</td>
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<tr>
<td>Environmental Testing at NRL</td>
<td>3/1/06</td>
</tr>
</tbody>
</table>
Instrument Science Operating Center

Stanford Linear Accelerator Center
Instrument Science Operating Center status

• Management
  – **Building 210** is now being used for ISOC staff and operations offices; first 2 development workstations have been installed in ISOC development lab in 210
  – Continued planning equipment needs for ISOC operations area: computers, servers, UPS, networking, firewalls
  – Long-term facility space: exploring options in new Kavli building at SLAC, or building 84 at SLAC

• Design and Development Activities
  – ISOC Data Flow reviews, used to resolve issues between ISOC designs and other LAT planning
    • Internal ISOC review completed for data flow designs
    • "External" reviews with SLAC staff completed:
      – Mission Planning, L0 File Ingest, L0 Data Processing, Logging, Instrument Configuration Control
  • Remaining external reviews:
    – L1 & L2 Data Processing, L1 & L2 Transmission to GSSC, Telemetry Monitoring, Trending
ISOC Future Project Activities

- **Continued ISOC Support for LAT Project**
  - Coordination of LAT ground operations activities
  - Archiving and processing of LAT data collected in I&T
  - Continued FSW support and maintenance after delivery
  - Transfer of I&T experience to flight ops preparation
  - Participate in GLAST Ground System testing

- **Support transition of LAT from development to operations basis**
  - Maintain FSW, data processing pipeline and tools, LAT calibrations
  - Support LAT mission planning, commanding and monitoring
  - Support LAT Data Challenges

- **ISOC 2005 Milestones**
  - ISOC software release 1: 28 April 2005
  - Ground Readiness Test 2: 16 June 2005
  - Ground Readiness Test 3: 15 August 2005
  - ISOC software release 2: 15 September 2005
  - Ground Readiness Test 4: 1 November 2005
Science Analysis Software

Stanford Linear Accelerator Center
GLAST Collaboration
Science Analysis Software status

- **Flight Integration Support**
  - Processing Pipeline is functioning
  - Sim/recon has been in place for some time
    - Iterating on features and keeping up with Online data formats
    - New TkrRecon and CalRecon requested prior to integration
  - Calibration code in use
    - Still some ongoing development underway on Tkr ToT
- **User Workbook going great guns**
  - More polishing on the New User introduction
- **Preparing for DC2**
  - Targeted for July
  - One month of photon signal (cf 6 days for DC1)
  - Aggressive schedule of upgrades for Tkr/CalRecons (almost done) prior to new round of background rejection and instrument performance analysis
  - Trying to involve the ISOC and GBM this time
  - Science tools development going well
    - Hope to have catalogue analysis in place
- **System tests now taking prime role in QA**
  - Hundreds of plots generated per code release; shapes auto-compared to standards to spot anomalies
SAS Displays

HealPix sky pixellation studies

System tests

GLAST LAT Project DOE Rebaseline Review, February 18, 2005

SVAC Pipeline Status
Timeline – Long term

2005

→ Flight Int at SLAC

+ support of NRL, Spectrum activities

2006

Final pipeline & data server →

2007

DC2

DC3

DC3: essentially final pre-launch versions of

- pipeline
- data server
- event simulation and reconstruction
- Science Analysis tools
- ISOC-like operation as a test

Based on iterations from DC1,2 and Flight Int
December End PMCS Results
Budget, Cost, Funding, Performance

![Graph showing budget, cost, funding, and performance metrics over fiscal years.](image)
### Performance Analysis

<table>
<thead>
<tr>
<th>WBS</th>
<th>Description</th>
<th>BAC</th>
<th>BCWS</th>
<th>BCWP</th>
<th>ACWP</th>
<th>SV $</th>
<th>CV $</th>
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<th>%BCWP</th>
<th>%ACWP</th>
<th>SPI</th>
<th>CPI</th>
<th>CPI_Fcst</th>
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<td>116,715</td>
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<td>↓</td>
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<td>↓</td>
<td>0.921</td>
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<td>↔</td>
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<td>93.10</td>
<td>93.10</td>
<td>91.39</td>
<td>↔</td>
<td>↑</td>
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<td>1.019</td>
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<td>2,115</td>
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<td>86.37</td>
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<td>209</td>
<td>83.61</td>
<td>83.61</td>
<td>76.69</td>
<td>↔</td>
<td>↔</td>
<td>1.000</td>
<td>1.090</td>
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<td>0</td>
<td>100.00</td>
<td>100.00</td>
<td>99.98</td>
<td>↔</td>
<td>↔</td>
<td>1.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>

### LEGEND

- **BAC**: Budget At Complete
- **BCWS**: Budgeted Cost of Work Scheduled (to date)
- **BCWP**: Budgeted Cost of Work Performed (to date)
- **ACWP**: Actual Cost of Work Performed (to date)
- **SV $**: Schedule Variance = BCWP - BCWS
- **CV $**: Cost Variance = BCWP - ACWP
- **% BCWS**: Percent Scheduled = BCWS/BAC
- **% BCWP**: Percent Complete = BCWP/BAC
- **% ACWP**: Percent Spent = ACWP/BAC
- **SPI**: Schedule Performance Index = BCWP/BCWS
- **CPI**: Cost Performance Index = BCWP/ACWP

**CPI and SPI Change Thresholds**

- **Worse than 0.85**
- **Between 0.95 and 1.10**
- **Between 0.85 and 0.95**
- **Better than 1.10**
### Variance Analysis

**OTHER PROD**
Element: 4.1  Name: LAT

Bull's-eye Chart - As of: DEC 04

- BEHIND SCHEDULE, UNDER COST
- AHEAD OF SCHEDULE, UNDER COST
- BEHIND SCHEDULE, OVER COST
- AHEAD OF SCHEDULE, OVER COST

<table>
<thead>
<tr>
<th>CV % CUM Percent of Dollars</th>
<th>SV % CUM Percent of Dollars</th>
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</thead>
<tbody>
<tr>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>-2.0</td>
<td>-2.0</td>
</tr>
<tr>
<td>-4.0</td>
<td>-4.0</td>
</tr>
<tr>
<td>-6.0</td>
<td>-6.0</td>
</tr>
<tr>
<td>-8.0</td>
<td>-8.0</td>
</tr>
</tbody>
</table>

-0.0  -2.0  -4.0  -6.0  0.0  2.0  4.0  6.0  8.0
### CV and SV Chart

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<tr>
<th></th>
<th>JAN04</th>
<th>FEB04</th>
<th>MAR04</th>
<th>APR04</th>
<th>MAY04</th>
<th>JUN04</th>
<th>JUL04</th>
<th>AUG04</th>
<th>SEP04</th>
<th>OCT04</th>
<th>NOV04</th>
<th>DEC04</th>
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<tbody>
<tr>
<td>BCWS</td>
<td>77,394</td>
<td>81,916</td>
<td>87,277</td>
<td>91,518</td>
<td>96,621</td>
<td>103,131</td>
<td>107,062</td>
<td>111,988</td>
<td>115,928</td>
<td>119,051</td>
<td>121,471</td>
<td>123,269</td>
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<td>BCWP</td>
<td>76,574</td>
<td>80,742</td>
<td>84,687</td>
<td>88,243</td>
<td>93,063</td>
<td>97,784</td>
<td>101,746</td>
<td>106,092</td>
<td>109,429</td>
<td>111,850</td>
<td>114,323</td>
<td>116,715</td>
</tr>
<tr>
<td>ACWP</td>
<td>74,989</td>
<td>78,460</td>
<td>83,184</td>
<td>87,264</td>
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<td>101,567</td>
<td>106,275</td>
<td>110,961</td>
<td>114,903</td>
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<td>CV</td>
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<td>1,503</td>
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<td>-5,348</td>
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<td>-5,895</td>
<td>-6,499</td>
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</table>
LAT Schedule

TKR A
2/4/05

TKR 14
9/2/05

ACD
6/9/05

CAL A
12/08/04

CAL
5/2/05

DAQ
8/2/05

TEM/PS A
2/17/05

TEM/PS
7/26/05

X-LAT
4/20/05

GRID
Assembly
12/21/04

Install Twrs A&B
8 wks

2 Tower CPT
3 wks

Install Twrs 1-13
13 wks

Install Tower 14
1 wk

Install Glob Items
4 wks

System Test
9 wks

Ship LAT
1 wk

Enviro Test
12 wks

LAT RFI

Observ. Integration

Launch 2007

FSW Complete
6/3/05

FSW Formal Test
06/24/05

Feb '05
Project Rebaseline
### Status of FY05 Rebaseline

<table>
<thead>
<tr>
<th>Item</th>
<th>Oct-04 Baseline</th>
<th>Preliminary Baseline</th>
<th>Difference</th>
<th>Reduction</th>
<th>Reduction Description</th>
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<tbody>
<tr>
<td>4.1.1 Instrument Management</td>
<td>16,911</td>
<td>17,650</td>
<td>739</td>
<td>247</td>
<td>Reduce staff by 3 people</td>
</tr>
<tr>
<td>4.1.2 System Engineering</td>
<td>7,047</td>
<td>7,618</td>
<td>571</td>
<td>150</td>
<td>Reduce staff by 1 person</td>
</tr>
<tr>
<td>4.1.4 Tracker</td>
<td>16,573</td>
<td>21,229</td>
<td>4,656</td>
<td>(672)</td>
<td>Last 2 towers non-flight Stop 2nd cable vendor Tile etching a GSFC cost</td>
</tr>
<tr>
<td>4.1.5 Calorimeter</td>
<td>22,022</td>
<td>22,593</td>
<td>571</td>
<td>667</td>
<td>No environ test for 15,16</td>
</tr>
<tr>
<td>4.1.6 Anticoincidence Detector</td>
<td>15,595</td>
<td>17,241</td>
<td>1,646</td>
<td>100</td>
<td>Reduced testing, TV and EMI</td>
</tr>
<tr>
<td>4.1.7 Electronics, Data Acquisition, Flight Software</td>
<td>22,055</td>
<td>28,893</td>
<td>6,838</td>
<td>(169)</td>
<td>Eliminate GASU, SIU PDU, EPU spares</td>
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<tr>
<td>4.1.8 Mechanical Systems</td>
<td>14,179</td>
<td>15,936</td>
<td>1,757</td>
<td>4</td>
<td>Reduce staff</td>
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<tr>
<td>4.1.9 Integration &amp; Test</td>
<td>7,764</td>
<td>9,274</td>
<td>1,510</td>
<td>527</td>
<td>Reduce staff Reduce VdG testing</td>
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<tr>
<td>4.1.A Performance &amp; Safety Assurance</td>
<td>2,935</td>
<td>3,844</td>
<td>909</td>
<td>50</td>
<td>Staff roll off</td>
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<td>4.1.B Instrument Science Operations Center</td>
<td>328</td>
<td>336</td>
<td>8</td>
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<td>4.1.C Education &amp; Public Outreach</td>
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<td>2,684</td>
<td>235</td>
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<td>4.1.D Science Analysis Software</td>
<td>3,019</td>
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<td>(3)</td>
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<td>4.1 Budget at Completion</td>
<td>$132,202</td>
<td>$151,695</td>
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<tr>
<td>4.1 Contingency</td>
<td>$3,783</td>
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<tr>
<td>4.1 Total Estimated Cost</td>
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Components of the DOE closeout project

<table>
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<tr>
<th>Subsystem</th>
<th>Cost (K$)</th>
<th>Conting. %</th>
<th>Conting. (K$)</th>
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<tr>
<td>4.1.1.2 Project Controls</td>
<td>$498</td>
<td>10%</td>
<td>$50</td>
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<tr>
<td>4.1.2 System Engineering</td>
<td>$884</td>
<td>10%</td>
<td>$88</td>
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<tr>
<td>4.1.7 Electronics DAQ</td>
<td>$3,058</td>
<td>25%</td>
<td>$764</td>
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<td>4.1.7.1 Management</td>
<td>273</td>
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<td>4.1.7.4.3.4 TEMs</td>
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<td>4.1.7.4.5.4 LCB</td>
<td>186</td>
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<tr>
<td>4.1.7.4.4.4 &amp; 4.1.7.4.8.4 GASU</td>
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<td>4.1.7.4.9 Test Bed</td>
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<td>4.1.7.5 SIU</td>
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<td>4.1.7.6 Power Conditioning</td>
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<td>4.1.7.A EGSE</td>
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<td>4.1.7.C I&amp;T Support</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$4,440</strong></td>
<td><strong>20%</strong></td>
<td><strong>$903</strong></td>
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<tr>
<td><strong>Total w/ Contingency</strong></td>
<td><strong>$5,342</strong></td>
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## DOE funding

### Fiscal Years

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<th></th>
<th>FY00</th>
<th>FY01</th>
<th>FY02</th>
<th>FY03</th>
<th>FY04</th>
<th>FY05</th>
<th>FY06</th>
<th>FY07</th>
<th>FY08</th>
<th>FY09</th>
<th>Total</th>
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<tr>
<td>DOE Project</td>
<td>3,000</td>
<td>5,689</td>
<td>8,080</td>
<td>8,910</td>
<td>7,900</td>
<td>8,421</td>
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<td>42,000</td>
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<tr>
<td><strong>Current</strong></td>
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<tr>
<td>DOE Project Funding</td>
<td>3,000</td>
<td>5,689</td>
<td>8,080</td>
<td>8,910</td>
<td>7,900</td>
<td>11,421</td>
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<tr>
<td>DOE Ops</td>
<td>1,317</td>
<td>1,934</td>
<td>2,892</td>
<td>2,939</td>
<td>4,300</td>
<td>5,579</td>
<td>8,737</td>
<td>7,600</td>
<td>7,074</td>
<td>7,321</td>
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<tr>
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<td></td>
</tr>
<tr>
<td>DOE Funding Ops</td>
<td>1,317</td>
<td>1,934</td>
<td>2,892</td>
<td>2,939</td>
<td>4,300</td>
<td>3,602</td>
<td>5,000</td>
<td>5,000</td>
<td>4,464</td>
<td>4,620</td>
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<td>2,521</td>
<td>2,610</td>
<td>2,701</td>
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<td>7,424</td>
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<td>-760</td>
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</table>

### Total Needs for 06
- 19.3
- Take out the .7 Other Gls
  - 0.7
- Ttl Needs
  - 18.6

### Funding
- NASA
  - 9.4
- NASA Rebaseline
  - 2.8
- DOE Funding
  - 5.0
- Ttl Funding
  - 17.2

### Funding - Needs
- (1.4)
Status of GLAST Mission office rebaseline

- Current LAT plan based on a NASA planning number of $17M additional funds for FY05
- DOE funding for FY06 reduced from $6.3M to $5.0M
- NASA funding for FY06 increased from $9.4M to $12.2M
  - $2.8M increase from the rebaseline proposal
- This leaves a $1.3M gap relative to the rebaseline proposal
- NASA management is investigating descope options
  - The configuration being investigated is:
    - 16 Calorimeters
    - 12 Tracker towers
    - Remaining instrument per the current baseline
      - Saves approximately 1 month of schedule
      - Mission management making presentation to Anne Kinney on February 24
Summary

- The flight instrument is coming together
- The primary challenge is to execute the end game on schedule
- The major technical issues are behind us
  - Examples of all the flight components exist and have been tested
- This is a complex instrument and a challenge to integrate and test
  - I&T is just beginning