GLAST Large Area Telescope: GLAST Large Area Telescope: I & T Input to Monthly Technical/Cost/Schedule Review 10/29/03

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Last Month’s Accomplishments

- Rebaselining mostly done.
- Initiated LAT transportation vibe analysis.
- Completed seismic analysis of Van De Graaff.
- Detailed assembly procedure for TKR and CAL, TEM, TEMPS into single bay.
- Detailed disassembly procedure for CAL from single bay tower.
- A midterm report of the EM operations was made at the Tuesday Engineering Meeting.
- EM Van De Graaff data taking completed as planned.
- Deintegrated EM tower, shipped EM CAL back to NRL on schedule, and mounted EM mini-tower in TRK test stand with TEM and TEMPS.
- Helped ELX group check out GTRC TOT code using EM mini-tower with special TEM that had TOT code imbedded.
- Supported TKR Interface Design Review.
- Release of LATTE 1.9
  - Improved configuration snapshots- FITS data file header- Event data distribution- Single event display- Trigger rate and associated data corruption debugging- Online development- EM lessons learned discussions and implications for Online- Misc. subsystem support
**EM Test Flow**

**Stand-alone TKR Mini-Tower tests**
- **AUG 20-26**
  - Receive TKR mini-tower at SLAC
  - TKR Mini-tower Post Ship Test

**Stand-alone CAL tests**
- **AUG 6-8**
  - Receive CAL Module at SLAC from NRL
  - CAL Module Post-Ship Test (in shipping container)

**Stand-alone EM Grid tests**
- **OCT 6-8**
  - Receive EM Grid
  - EM Grid Inspection/Test

**Stand-alone TKR Mechanical Model tests**
- **OCT 6-8**
  - Receive EM TKR Mechanical Tower
  - Mechanical TKR Inspection/Test

**Integration and Test 3**

**Receive EM TKR Mechanical Tower**
- **OCT 17**
  - Fit Check w/ Mech TKR, CAL, and EM GRID

**Install Mech. TKR into EM Grid**
- **OCT 6 - 8**
  - Install Mech. TKR into EM Grid

**OCT 17**

**Van de Graaff data taking**
- **OCT 6 - 8**
  - Van de Graaff data taking

**Install CAL Module in EM Single Bay**
- **SEP 27 - OCT 12**
  - Single Bay Electrical Performance Tests

**SEP 2-17 (individual test)**
- **SEP 2-17 (integrated script development)**
- **SEP 19-26 (integrated test)**

**Cosmic ray data taking**
- **SEP 19-26 (integrated test)**

**Flight Software Development**
- **SEP 26 TEM-PS Test**

**SEP 26 TEM-PS Test**
- **SEP 26 TEM-PS Test**

**EM CAL Shipped to NRL and on dock**
- **OCT 13 TEM-PS Test**

**EM CAL Returns to SLAC**
- **JAN 2003**

**4.1.9 - Integration and Test**
GLAST LAT Project Technical/Cost/Schedule Review 10/29/03

I&T Timeline

I&T Support Activities
- Aug 21, 2003
  - 9/1: LAT Assy Plan
  - 10/1: LAT Survey Plan
  - 11/1: LAT Plan
  - 12/1: LAT Plan
  - 2/1: Composite Design
  - 3/1: Systems Design
  - 4/1: LAT Assembly

GSE Preparation Activities
- Aug 21, 2003
  - EGSE
    - 9/1: EGSE Acceptance
    - 10/1: EGSE Acceptance
    - 11/1: EGSE Acceptance
    - 12/1: EGSE Acceptance
  - MGSE
    - 9/1: MGSE Acceptance
    - 10/1: MGSE Acceptance
    - 11/1: MGSE Acceptance
    - 12/1: MGSE Acceptance

LAT Planning & Procedure Activities
- Aug 21, 2003
  - 9/1: LAT Planning
  - 10/1: LAT Planning
  - 11/1: LAT Planning
  - 12/1: LAT Planning
  - 1/1: LAT Planning
  - 2/1: LAT Planning
  - 3/1: LAT Planning
  - 4/1: LAT Planning

Subsystem, Component & Development Tests
- Sep 30, 2003
  - 9/1: EM Tower Test
  - 10/1: EM Cal Tests

4.1.9 - Integration and Test

LAT Working Schedule
### Key Milestone for Next 3 Months

<table>
<thead>
<tr>
<th>Milestone Description</th>
<th>Original Date</th>
<th>Current Date</th>
<th>Major Requirements to Achieve Milestone</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I&amp;T PMCS Rebaseline</td>
<td>10/03/02</td>
<td>10/31/02</td>
<td>Need replan subsystem delivery dates for final I&amp;T schedule.</td>
<td>Begin replan assuming hardware availability dates per Rebaseline Review presented 7/31/03</td>
</tr>
<tr>
<td>Bldg 33 Upgrades (except for humidity)</td>
<td>09/01/03</td>
<td>11/26/03</td>
<td>Earthquake new cabinets, more furniture, all phones installed, permanent Liquid Nitrogen System operational, Clinton flight hardware Stores complete (fire and earthquake)</td>
<td>Van De Graaff Seismic analysis done. Simple chaining to floor required. Completed in next two weeks. SLAC safety committee presentation for LNS Thursday.</td>
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<tr>
<td>Single Tower EGSE Configuration including CAL and TKR Production scripts</td>
<td>09/30/03</td>
<td>10/30/03</td>
<td>Final LATTE scripts for TKR and CAL production. Support for CAL GSI beam test</td>
<td>Plan in place with TKR and CAL to synchronize scripts with I&amp;T for final delivery.</td>
</tr>
<tr>
<td>I&amp;T training mockup complete and ready for use</td>
<td>01/03/04</td>
<td>01/03/04</td>
<td>All I&amp;T mechanical &amp; electrical techs on board and ready to train.</td>
<td>Plan to use (TBR) injected molded plastic parts to the CAD model in the 1x4 grid augmented by 4x4 footprint hardware. Also using ELX software test bed</td>
</tr>
<tr>
<td>MGSE conceptual design for transportation container complete</td>
<td>11/30/03</td>
<td>11/30/04</td>
<td>Preliminary design, vibe analysis, impact on LAT in flight complete</td>
<td>Need as input for decision on airplane test.</td>
</tr>
<tr>
<td>ACD tent work</td>
<td>01/30/04</td>
<td>01/30/04</td>
<td>Investigate using previously used BaBar enclosures</td>
<td>Need for ACD 9/1/04</td>
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<tr>
<td>Multi-FREE Board EGSE</td>
<td>01/30/04</td>
<td>01/30/04</td>
<td>GASU delivered with software to I&amp;T 12/30/03. Complete LATTE multi FREE Board support to ACD.</td>
<td></td>
</tr>
<tr>
<td>ACD EM Tower Tiles and Electronics</td>
<td>2/17/04</td>
<td></td>
<td>ACD to deliver tiles, photo-tubes, freeboards for use with single tower + GASU. I&amp;T to produce mechanical support and EGSE scripts.</td>
<td>Key delivery to obsolete Calibration unit milestone date</td>
</tr>
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</table>
## 4.1.9 - Integration and Test

### EGSE Road Map

#### Activity Description

<table>
<thead>
<tr>
<th>Activity ID</th>
<th>Activity Description</th>
<th>Orig Dur</th>
<th>Early Start</th>
<th>Early Finish</th>
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<tbody>
<tr>
<td>91020963</td>
<td>EGSE Definition Document</td>
<td>41</td>
<td>01OCT03*</td>
<td>26NOV03*</td>
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<tr>
<td>91020953</td>
<td>Twr Integration EGSE Dev &amp; Support - Part 1</td>
<td>51</td>
<td>01OCT03*</td>
<td>12DEC03*</td>
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<tr>
<td>91025221</td>
<td>ND: EGSE TEM/TEM PS/CTS w/FE Elec #1 for Dev</td>
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<td>15DEC03</td>
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<tr>
<td>9102522A</td>
<td>ND: EGSE TEM/TEM PS/CTS w/FE Elec #2 for Dev</td>
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<td>91025231</td>
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<td>91020954</td>
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<td>91020951</td>
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<tr>
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<td>20APR04*</td>
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<tr>
<td>91025223</td>
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<td>156</td>
<td>21APR04</td>
<td>01DEC04*</td>
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<td>91025222</td>
<td>ND: Final EGSE for Sys Test incl S/C Sim, FSW</td>
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<td>16AUG04*</td>
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<td>910205227</td>
<td>EGSE Ready for System Test</td>
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<td>910205225</td>
<td>LAT EGSE System Test Support</td>
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<td>910205226</td>
<td>AV: LATTE Delivery from I&amp;T to IOC</td>
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### EGSE from ELX to I&T Level 3 Milestones (rebaseline plan)

<table>
<thead>
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<th>Activity Description</th>
<th>Start</th>
<th>Finish</th>
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<tr>
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<tr>
<td>ND: EGSE Development Hardware/FSW First Delivery</td>
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<td>02FEB04*</td>
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<td>ND: EGSE TEM/TEM PS/CTS #1 for Bldg 33</td>
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<tr>
<td>ND: EGSE TEM/TEM PS/CTS #2 for Bldg 33</td>
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<td>02FEB04*</td>
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<tr>
<td>ND: EGSE TEM/TEM PS/CTS with GASU for Bldg 33</td>
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<tr>
<td>ND: Final EGSE for Sys Test incl. S/C Sim, FSW</td>
<td>15DEC03</td>
<td>01SEP04*</td>
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</tbody>
</table>
Summary of Issues and Concerns

- Time frame and effort needed for rebaselining.
  - Should be complete by Friday, but needed additional personnel have not been included.

- Need for electronics technician to be under I&T control – currently under electronics and not shown in PMCS. Under projected schedule I&T needs to start hiring to prepare for flight integration before the end of this year.
  - This issue is currently under management discussion

- Finalization of all LAT test plan requirements is not complete.
  - An agreement with Systems on appropriate dates has been reached (next chart)

- There is concern if the current MGSE design allows adequate access during integration.
  - A regular meeting has been set up between I&T, System and Design Engineering to discuss these concerns.
  - Trade study MGSE for tooling and access during tower integration.
  - This regular meeting will also address the assembly plan and the MGSE designs for Environmental Testing

- A complete EGSE plan needs to be finalized now that the LAT has accepted a SIUS is not the entire solution. EGSE definition Document needs to be completed.
Agreement I&T and System Engineering on completion dates:

- LAT I&T - Assembly Plan - 12/03
- LAT Comprehensive Performance Plan - 6/04
- LAT Limited Performance Plan - 6/04
- LAT Operational Performance Tests - 3/04
- LAT Instrumentation Plan - Update 1/04
- LAT Survey Plan - 12/03
- LAT Dynamics Test Plan - First Release 12/03, Final 3/04
- LAT Thermal Test Plan - First Release 12/03, Final 3/04
- LAT EMI/EMC Test Plan - First Release 3/04
Status/Closure of action items

- No action items from last months review meeting
- RFA closure required.
Open Design/Engineering model/ manufacturing issues and closure plan for them

- Work out sharing of EM CAL between CAL and I&T from October 15 until flight integration begins. We expect ~50/50 sharing in this time period.

- Fit check of TKR Mechanical model needs to be done with CAL EM and 1x4 grid as early as possible. TKR Mechanical model delivery is now expected in early January. Need CAL EM back in early January to make fit check. Preliminary plan from Bloom/Borden in review.

- Plan for completion multi tower EGSE that uses GASU is in flux depending on GASU availability. Need date for completion of multi tower EGSE is Dec/Jan for ACD use. Need final plan. I&T milestone delivery requirements from ELX are shown above.
Status of Subsystem’s Parts List and qualification program

- EGSE EM-1 qualification in progress in EM program. EM-1 used for production of flight TKR and CAL units.
- Final multi tower EGSE qualification needs to use software test bed. Qualification required for use by ACD in Dec/Jan. For more details of the EGSE qualification plan see, LAT-MD-01533 draft. More details required.
- MGSE qualification plan discussed in I&T MGSE Development Plan, LAT-MD-01262 draft.
Significant Cost/Schedule Variances

• Cumulative Cost and Schedule Variance
  – Cumulative Cost Variance: +106k$ (+4%)
  – Cumulative Schedule Variance: -310k$ (-11%)
    • 218k$ is in MGSE
    • 65k$ is in IFCT

• September Cost and Schedule Variance
  – September Cost Variance: +65k$ (+48%)
  – September Schedule Variance: -106k$ (-38%)
    • 86k$ of the Sept. schedule variance was anticipated as the baseline MGSE plan has not been replanned to reflect the expected later MGSE deliveries. This variance to be mitigated by the upcoming rebaselining effort.
Threats to Maintaining Cost/Schedule

- Delay in implementation of 3 month schedule extension has left our MGSE schedule exposed to a very large schedule variance over the past 3 months, getting bigger as PMCS reprogramming is delayed longer. This is expected to be mitigated by the upcoming rebaselining effort. We should not see big increases in the future.

- I&T test plan depends on future delivery of SE level test plans and committee reports. We have plan from SE for deliveries, but final content is currently in flux.

- Spacecraft interface detail uncertainty.
  - Environmental test fixtures.
  - EGSE interface.
  - MGSE handling fixtures.

- Delivery of flight hardware to I&T may be late.