LAT Monthly Status Review

27 January 2005

Design Integration and Analysis

Martin Nordby  John Ku  Jack Goodman
Subsystem Design Support Status

• **Mechanical systems**
  – Making final modifications to Connector Panels to reflect latest Instrumentation Plan release (ECD: 2/4)
  – Waiting final modifications to Grid assembly drawing to reflect heater change

• **DAQ**
  – Thermal Shunt: completed and released
  – Cable Ways: part drawings completed and released. Assembly held waiting stress analysis (ECD: 2/15)
  – Harness Interface Box (HIB): completed and released
  – Internal cables: all drawings completed and released over the past 2 months.
  – Internal fly-away instrumentation cabling: 3 cables had been released, but have since required revision, and are in-work now (ECD: 2/4)
  – External fly-away instrumentation cables: working cable routing now, with drawings to follow (ECD: 2/22)

• **I&T**
  – Just started LAT Configuration Assembly drawings to document flight hardware with M-GSE
    • Single-Bay drawing in the works (ECD: 2/5)
    • Developing list of other drawings needed (ECD: 2/2)

• **MLI**
  – Met with Spectrum and GSFC thermal, design, and system engineers to work through LAT, SC, and interface MLI design and stayclears
  – Arrived and consensus on integrated MLI design that met SC, LAT, and integration needs
  – Working MLI design details now. Spectrum working on stayclear growth with GBM
LAT Top Assembly Drawings Status

- LAT-DS-02559-01 CAL-TEM-PS Module Assembly
  - Complete and approved
  - No known liens on this assembly

- LAT-DS-02560-01 LAT Tower Assembly
  - Complete and approved
  - Known liens:
    - TKR flex cable mounting to Grid: method in-work by TKR (ECD: )
    - Grid Box Base Assembly drawing in revision for minor mod’s (ECD: )

- LAT-DS-02561-01 Cable Installation Kit
  - This shows routing of all internal LAT cables
  - Modeling and bill of materials is nearly complete (ECD: 2/2)
  - First draft of drawing ECD: 2/11

- LAT-DS-02561-01 LAT Tower and Electronics Assembly
  - Model still in-work
  - Draft of drawing is underway in rough form (ECD: 2/25 for draft, late March for final)
  - Known issues still needing work:
    - Connector Panels in revision—expect incorporation of final design by 2/11
    - Fly-away accelerometer locations and mounting not quite final—plan to close this at a meeting this Friday, with model completion by 2/11
    - Assembly notes and detailed bill-of-material review still needed (ECD: 2/18)
LAT Top Assembly Drawings Status (cont.)

• LAT-DS-02563-01 LAT Instrument Assembly
  – Model is still in-work
  – Draft of drawing not started
  – Known issues still needing work:
    • Instrumentation and their cabling need finalization (ECD: 2/18)
    • MLI Blanket Bar design and analysis still in-work (ECD: 2/11, pending Spectrum, GSFC OK)
    • Heat Pipe mounting hardware design still in-work (ECD: 2/25)
    • Notes and detailed bill-of-material review still needed (ECD: 3/15)

• LAT-DS-01624-01 LAT Assembly
  – Model in-work
  – Known issues still needing work:
    • MLI blanket design still in conceptual stage (ECD: early March, pending GSFC, Spectrum OK)
    • Radiator as-built design needs to be incorporated (ECD: )
Interface Drawings

- LAT-DS-00040-12  LAT Instrument Stayclear
  - Revised to incorporate stayclear changes agreed-to at meeting in Phoenix on 1/12
  - Draft/model sent to GSFC and Spectrum for review
- LAT-DS-00309-04  ACD-LAT IDD
  - Remaining work
    - ACD-LAT cable hold-down points need to be added (as already agreed to by ACD and LAT)
  - Release of this is held pending release of LAT-DS-00040-12
- LAT-DS-00233-07  CAL-LAT IDD
  - Released 12/9/2004 with no known leins
- LAT-DS-00851-03  TKR-LAT IDD
  - Released 11/10/2004 with no known leins
Integration and Test Planning

- LAT Integration Sequence (LAT-MD-00676-03)
  - The order in which bays are integrated has been modified and reviewed over the past month
  - Document revised and reviewed at LAT Engineering meetings
  - Ready for release
- Environmental test planning
  - Resurrecting Environmental Test Sequence document to clarify and codify test sequence and logistics
  - Working with I&T to identify long-lead issues and resolve them
  - Started working test planning strategy regarding:
    - Personnel interfaces between SLAC and NRL—with I&T and NRL involvement
    - MGSE, EGSE, and test definition lists for all tests—working with test engineers on this
    - Test configurations—identifying drawings needed and information that is lacking
    - Other logistics issues
Design Integration: Issues and Concerns

• Timely release of assembly drawings
  – This is the only mechanism for catching hardware that drops through the cracks between subsystems
  – ECD for these drawings from I&T is for integration, not for hardware procurement for this “lost” hardware
  – Working with Systems Engineering and I&T to develop system for tracking parts needs and availability

• Integration configuration drawings
  – We just started working these, but behind on this
  – LAT has a mix of MGSE and flight hardware during integration, little of which has been well-documented
  – For the better-understood procedures, like integrating a CAL, there is little risk in not having these drawings
  – For more complex, cross-bay and LAT-wide procedures, these drawings will be more important
Structural Analysis: Accomplishments

- LAT System Level
  - Supported FMEA review of LAT and Subsystems
  - Continued LAT Static test plan development
    - New direction to streamline tests further
    - Informally presented to GSFC Mechanical Systems and deemed feasible, but official review in future needed
  - LAT Instrumentation plan with accelerometer count completed
    - Final locations and routing pending one more design/analysis iteration
  - Completed MLI support frame sizing analysis
    - Final design pending one more design/analysis iteration

- LAT Subsystem Level
  - TKR Subsystem
    - TKR Flight Design
      - Supported TWR A/B Vibration Testing
      - Supported resolution of various production questions and issues
    - TKR Additional Studies
      - Supported data review of bottom tray static testing
      - Supported tiger team with some pitch adapter analysis
      - Cross-sectional differential CTE analysis — credible theory but collateral events are difficult to predict
      - Moisture expansion survey — credible but not enough data
      - MCM macro stress analysis — not credible, i.e. no correlation with observations
  - Mechanical Subsystem
    - Re-analyzed RMB for counterbored holes for MGSE access – margins all adequate
    - Evaluated RAD structural insert repair – LMCO’s repair is acceptable
    - Radiator L4 Spec in release cycle
    - Supported RAD thermal isolator material selection
  - EBOX Subsystem
    - Supported TEM/TPS Qualification and Acceptance Testing
      - Supported TRR and action item closure
      - Supported dry run at Wyle Labs
      - Co-Authored Test Procedure with EBOX group
    - Supported EBOX shipping container evaluation
Structural Analysis: Near-term Milestones and Status

- LAT System Level
  - Complete MLI Support bracket analysis – one more design/analysis iteration anticipated – ECD = 1/28/05
  - Integrate correlated ACD model into LATv10.09 – ECD = 2/11/05
  - LAT Static Testing: develop detailed plans and predictions based on new direction given by SLAC mgmt (Streamlined testing of only required components; all else qualified by analysis, per GEVS-SE) – ECD = 2/18/05

- LAT Dynamics Testing
  - Evaluate low freq acoustic loads into LAT in two configurations – ECD = 2/18/05
  - Determine accelerometer locations for middle interface, i.e. to monitor the interface between TPS and Special Boxes – ECD = 2/18/05
  - Release LAT Dynamics Test Plan – ECD = 3/4/05
  - Finalize accelerometer locations and cable routing – one more design/analysis iteration anticipated – ECD = 3/16/05
  - Update LAT vibration test predictions – ECD = 5/1/05
  - Coordinate with I&T and NRL for LAT environmental testing – ECD = 7/05

- LAT Thermal Distortion Analysis
  - Final analysis and reporting of results pending further discussion – ECD = 4/1/05

- MGSE for Integration Analysis: augment MGSE analysis with additional I&T requests, as required – ECD = Continuing

- Shipping Container Analysis report – ECD = 4/1/05

D = Flight Design
I = Integration Prep
T = LAT Test Prep
Structural Analysis: Near-term Milestones and Status and Summary of Issues and Concerns

• LAT Subsystem Level
  – TKR Subsystem
    • Work on plan to support Tracker Vibration acceptance tests in Italy – ECD = 2/4/05
    • Other analysis support – ECD = Ongoing
  – E-BOX Subsystem
    • Complete TEM/TPS Vibration test support – ECD = 2/9/05
      – 1 Qual Units, 2 Acceptance Units, and test report
    • Support Special Box Vibration test analysis and planning (mesh with EBOX schedules)
    • Evaluate EBOX loads/accels when LAT is subjected to sine input – ECD = 2/18/05
    • Analyze cable support tray design – ECD = 2/18/05
  – Grid Subsystem
    • Finish helicoil and bare thread pull-out tests and derive B-basis allowables – ECD = 2/25/05
    • Grid Static Test procedures/STE – ECD = 3/18/05
    • Static Test Grid – ECD = 4/15/05
    • Shear plate qualification test report – ECD = 4/15/05
    • Proof Test Spectrum provided flexures – ECD = 5/6/05
    • Support RAD and X-LAT issues, as needed

• Summary of Issues and Concerns
  – Manpower to support testing (Integrated LAT, TKR, EBOX, Mechanical) in addition to “walk-in work” will require tight and creative planning

[D] = Flight Design
[I] = Integration Prep
[T] = LAT Test Prep
Thermal Engineering: Flight Hardware Design and Analysis

• New TKR requirement to maintain coldest point of TKR above –15 degC
  – Assessed impact of this change to LAT thermal systems
  – Hardware impacted only during survival mode
    • New Grid thermostats (primary and redundant)—higher set-points needed to keep TKR above -15 degC
    • New Grid Make-Up heaters—larger heaters required to handle bigger heat leak
    • No change for radiator thermostats
    • Radiator anti-freeze heaters require less power—because of versatile design, no new heaters are required
    • New orbit-average and maximum total heater power are still within LAT IRD requirements
  – Procedural change required to limit Radiator Interface Temperature (RIT) low-temperature operation so no interference with survival heaters
  – Only remaining action is to update LAT Environmental Spec and TCS Spec

• MLI Blankets
  – Held interface meeting with GD Spectrum mechanical and thermal teams to arrive at consensus of LAT, SC, and interface MLI blanketing
    • Arrived at consensus on blanket design concepts to simplify all aspects of blanketing
    • Working LAT side of detailed design now
    • Expect completion of detailed blanket layouts by mid-February
  – Supporting Design Integration to resolve stayclear violations of Radiator MLI
Thermal Engineering: LAT Test Planning

- LAT Thermal Vacuum Test Plan
  - Currently being revised—very rough draft sent out for limited preliminary review
  - Expect cleaner rough draft for general distribution by mid-February
  - ECD for release of this revision, late February

- LAT Thermal Vacuum Test Math Model
  - In preparation with bulk of work finished
  - ECD is end of February

- LAT Test Thermal Requirements document
  - In second revision, but delayed
  - This is required for planning M-GSE cooling for LAT integration tests
  - ECD is mid-February for clean draft out for review
Thermal Engineering: LAT Subsystem Support

- **Tracker**
  - Acceptance Thermal Vacuum Test procedures have been reviewed and released
  - Tower B Acceptance Thermal Vacuum Testing
    - Alenia facility pathfinder test in progress
    - Starting one week late because of Alenia problems
    - Pathfinder test has shortened schedule to recover time for tower test
    - Expect to finish tower test first week in February