

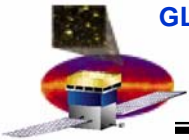
LAT Manager's Meeting

30 June 2004

LAT Analysis Status

Martin Nordby

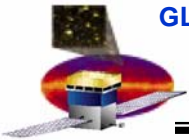
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Structural Analysis: Completed Tasks

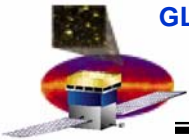
- **LAT System Level**
 - Major update to environmental spec complete – in review cycle. All subsystems have been informed (JK, SAI)
 - LAT Instrumentation plan complete (accelerometer count, type and locations) (ER, JK)
 - LAT Acoustic Analysis complete (SAI)
 - LAT thermal distortion model, mapping from SINDA, and preliminary results report complete (MO, JK)
- **LAT Subsystem Level**
 - **TKR Subsystem**
 - TKR Redesign Structural Analysis nearing completion, with only one cable clip analysis outstanding.
 - Support of EM Static Test
 - Facility setup at INFN and information transfer from Hytec to SLAC/INFN (JK,MM)
 - Pre-test analysis with simplified load cases and easy pass/fail criteria (JK)
 - Supported pre-test activities and successful TRR (JK)
 - Supported static test execution (MM)
 - Successful Test! (joint slippage was within expected tolerances)

*Performed by: JK=John Ku; MO=Mike Opie; ER=Eric Roulo; YI=Youssef Ismail; MM=Mark Molini; SAI=Swales



Structural Analysis: Completed Tasks (continued)

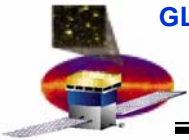
- **LAT Subsystem Level (Continued)**
 - **TKR Subsystem (Continued)**
 - **Support of EM Vibration Test**
 - Pre-test analysis with reformulation of loads and random vibration manual notch (MO, ER)
 - Supported pre-test activities and successful TRR (MO, ER)
 - Supported dynamics test execution (MO, ER)
 - Successful Test! (excellent pre- and post-test correlation, indicating a solid joint)
 - Supported miscellaneous NCR/MRB activities (e.g. stress corrosion cracking, material selection, last minute design changes, etc.)
 - **EBOX Subsystem**
 - CAL/TEM Standoff analyzed – deemed sufficiently strong for CAL and EBOX testing (ER)
 - Completed review of original EBOX analysis – deemed conservative (SAI, JK, ER)
 - **Grid Subsystem**
 - Support of XLAT analysis activities (JK, MO)
 - Preliminary Grid Static Test Plan complete (JK, YI)
 - Grid #2 machining error (gouge in bay) analysis complete (Swales, JK)



Structural Analysis: Current Tasks In-process

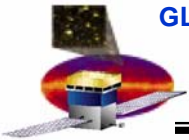
- **LAT System Level**
 - **LAT Dynamics Plan is well underway.**
 - A draft has been completed and is currently being reviewed between SLAC and GSFC (JK, SAI)
ECD=July-04
 - **LAT Acoustic Test Plan pending**
 - Analysis complete (SAI)
 - Discussing with GSFC whether a SC simulator during LAT Acoustic testing is required (SAI, JK)
ECD=Aug-04
 - **LAT Vibration Test Plan pending**
 - Preliminary analysis complete (ER, JK)
 - Final analysis pending agreement on LAT Dynamics plan (ER) ECD=Sep-04
 - **LAT Thermal Distortion Analysis**
 - Preliminary analysis complete (MO)
 - Final analysis and reporting of results pending further discussion (MO) ECD=Oct-04
 - **MGSE for Integration Analysis**
 - Analysis complete (ER, MO)
 - Report pending (ER) ECD=July-04
 - **Shipping Container Analysis**
 - Preliminary analysis complete (YI)
 - Needs to be performed with new parameters (SAI), ECD=Nov-04

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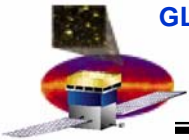
Structural Analysis: Current Tasks In-process (continued)

- **LAT Subsystem Level**
 - **TKR Subsystem**
 - Completion of cable clip analysis will close out all new hardware design analysis (SAI, JK) ECD=Jun-04
 - Continued support of TKR TWR A testing, as-needed (MO, ER) ECD=July/Aug-04
 - Continued support of TKR NCR disposition, as-needed (e.g. bias circuit delam) (JK) ECD=Ongoing
 - Analysis of TKR Shipping container and other MGSE (JK, MO). ECD=July-04
 - **EBOX Subsystem**
 - Re-analyze EBOX for new design and loads (SAI). ECD=Aug-04
 - Develop EBOX test plan/procedure (SAI). ECD=Aug-04
 - Test EBOXs (JK,ER) ECD=Sep-04?
 - **Grid Subsystem**
 - Grid Static Testing (for strength and stiffness survey, performed by SAI). ECD=Sep-04
 - Grid Static Test plans/procedures/STE (SAI). ECD=Nov-04
 - Test Grid (JK, SAI) ECD=Feb-05
 - Support RAD and XLAT issues, as needed (JK) ECD=Ongoing



Structural Analysis: Conclusions

- **General increase in responsibility, but project-wise humps are over (hopefully)**
 - **Structural Analysis group has taken on additional responsibilities, now being responsible for**
 - LAT System Level Structure
 - TKR Subsystem Structure (new)
 - EBOX Subsystem Structure (new)
 - Grid Subsystem Structure
 - **Very few design analysis tasks remain, i.e. design analysis phase is essentially closed**
- **Testing preparations are proceeding along at a good pace**
 - **Test levels have all been defined in the LAT environmental Spec and have been reported to all subsystems**
 - **Test plans, STE analysis, have started to take shape, but so far, only the TKR test plan has been completed. This is the next hurdle to overcome.**
 - **Need to mesh rough schedule with project schedules and goals**
- **Manpower is not anticipated to be an issue**
 - **Manpower is currently tight, but manageable. Current full time support staff includes John Ku, Mike Opie, Eric Roulo, Chris Fransen (SAI), and Ichung Weng (SAI). Additional surge support is available within SLAC and GSFC/Swales.**
 - **Surge period should be receding, especially with successful dynamics testing of the EM TKR**
 - **Current team is working well together (changes in GSFC side have improved communication flow tremendously, as well as allowed for more autonomous existence) and represents a very good mix of experience in stress, dynamics, analysis, and testing**



Thermal Engineering Activities – Completed 1/2

1. Design Engineering and Support

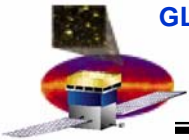
- Environmental Specification, Section 11 reviewed

2. LAT Level Thermal Analysis and Tests

- Temperature input to STOP Analysis
- LAT Thermal Vacuum Testing, 8-10/05
 - * Held first Technical Interchange Meeting, NRL 6/2/04
- Thermal-Vacuum Test Plan: initiated review
- Concurrence with LM/GSFC on integrated thermal math model changes for Ver. 6
- Influence of using Grid ground HEX during LAT TVAC testing

3. Subsystem Support and Oversight

- Correlated calorimeter submodel – reviewed and ready to be integrated into Ver. 6
- Tracker EM Tower Thermal Vacuum Balance tests
 - * Correlated tracker submodel ready to be integrated into Ver. 6
- Electronic box stack test – ΔT across box/X-LAT plate higher than predicted but total ΔT agrees with predictions
- Electronic Box Detailed Thermal Analyses
 - * TEM and TPS completed, within specs
 - * SIU/EPU completed, Qual. spec. exceeded, Acceptance level – no exceedance expected.



Thermal Engineering Activities – Completed 2/2

4. LAT Thermal Control System

- Flight Software reviewed, modifications added
- Discussions with DAQ group (Haller, Nelson) to supply flight DAQ/EGSE to be used in LM radiator acceptance tests
- GRID thermostats and heaters ordered
- X-LAT plate ground heat exchanger concept and detailed design completed

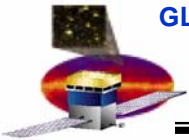
5. Lockheed-Martin Thermal Control System Hardware

- X-LAT plate test plan; draft in review

NASA Review of LAT Instrument Performance Verification Plan

Thermal RFA #2 still open

Thermal RFA #62 & #68 closed – change in Environmental Spec.



Thermal Engineering Activities – Current 1/2

1. Design Engineering and Support

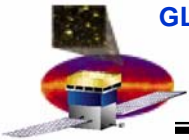
- Environmental Specification – change to Tracker Acceptance Level Tests (35oC to 40oC)
- Qualification Plan, reviewed thermal profile – no changes
- Initiated MLI design activities

2. LAT Level Thermal Analysis and Tests

- Grid geometric model
- EMI skirt addition
- S/C actual solar array
- Cullimore & Ring (SINDA) heat pipe subroutine in evaluation (vs LM proprietary)

3. Subsystem Support and Oversight

- ACD TVAC test issues clarified
- Tracker Tower A TVAC tests
 - * Test Plan and Test Procedures in preparation
 - * Thermal Math Model being used for predictions of test thermal profile
 - * Test orientation/setup for towers defined, MGSE for Tower A being fabricated; tests currently planned to start 19 July.



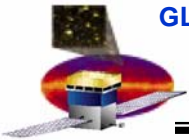
Thermal Engineering Activities – Current 2/2

4. LAT Thermal Control System

- Development tests for VCHP assembly/disassembly procedure, re: single use vs reuse of heat transfer adhesive at triple joint
- Update *LAT Test Thermal Requirements* –TD-00997
- Grid top flange heat exchanger conceptualized, finalized after TD-00997 updated

5. Lockheed Martin Thermal Control System Hardware

- TCS software algorithm in review
- Radiator thermal math model, TVAC test configuration
- Radiator Acceptance Test Plan
 - *Overall testing concepts agreed by LM,SLAC and NASA/GSFC
- X-LAT Plate test procedures in preparation
- Grid top flange heat exchanger detailed design in progress



Thermal Engineering Activities - Planned

- 1. Design Engineering and Support**
 - Define MLI interface to ACD, S/C and radiators
 - Detailed design and fabricate MLI blankets

- 2. LAT Level Thermal Analysis and Tests**
 - Thermal Math Model, Ver. 6.1, reduced node
 - Thermal Math Model, Ver. 6.2, LAT TVAC test configuration
 - Correlate integrated Thermal Math Model after LAT TVAC tests
 - 200 Node Launch Vehicle Thermal Math Model

- 3. Subsystem Support and Oversight**
 - Flight Tracker Nos.1-16, thermal vacuum test configuration concept finished; detailed designs for MGSE to start in August

- 4. LAT Thermal Control System**
 - Verified in LAT TVAC tests, 8-10/05

- 5. Lockheed Martin Thermal Control System Hardware**
 - X-LAT Plate Test Plan final version
 - X-LAT Plate Test Procedures
 - Radiator TVAC Test Plan, TVAC Test Procedure