Mechanical Systems
Mechanical / Thermal Hardware
September 2005 Status

Marc Campell, Subsystem Manager
Grid Qual Static Load Test

- **Hardware**
  - Grid Box #2 assembly is complete

- **Pre-Test (SLAC activities)**
  - Test Interface Plate (TIP) Assembly complete less strain gage application which will be done at NTS now
  - Used & returned Spectrum’s Interface template
  - Shipped Grid Box Assy to NTS on 10/5
  - TRR held on 10/13
Grid Qual Static Load Test (cont)

- Test (NTS activity)
  - Received large baseplate
  - Checked out all of the load frame configurations
  - Erected tent over our test area
  - Started programming data acquisition channels
  - Setting up for proof test of the load frame for Load Case 1 (highest loads)
  - Installation of Grid & Flexure Strain Gages is 85% complete
  - Overtime has been authorized to maintain schedule
Grid Qual Static Load Test Schedule

<table>
<thead>
<tr>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
<th>Prec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixture Fabrication</td>
<td>30 days</td>
<td>Mon 9/12/05</td>
<td>Fri 10/21/05</td>
<td></td>
</tr>
<tr>
<td>Hydraulic Actuator Preparation</td>
<td>20 days</td>
<td>Mon 9/13/05</td>
<td>Fri 10/14/05</td>
<td></td>
</tr>
<tr>
<td>Instrumentation Preparation</td>
<td>20 days</td>
<td>Mon 9/13/05</td>
<td>Fri 10/14/05</td>
<td></td>
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<tr>
<td>Test Article Delivery</td>
<td>0 days</td>
<td>Fri 10/7/05</td>
<td>Fri 10/7/05</td>
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<tr>
<td>Receiving inspection &amp; start SG</td>
<td>1 day</td>
<td>Wed 10/12/05</td>
<td>Wed 10/12/05</td>
<td>10/7</td>
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<tr>
<td>Generate Test Procedure</td>
<td>10 days</td>
<td>Mon 10/3/05</td>
<td>Fri 10/14/05</td>
<td></td>
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<tr>
<td>Approve/Update Test Procedure</td>
<td>5 days</td>
<td>Mon 10/17/05</td>
<td>Fri 10/21/05</td>
<td>10/7</td>
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<tr>
<td>B1 Building Test Area Preparation</td>
<td>8 days</td>
<td>Mon 10/10/05</td>
<td>Wed 10/19/05</td>
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<tr>
<td>Strain Gauge Installation</td>
<td>8 days</td>
<td>Wed 10/12/05</td>
<td>Fri 10/21/05</td>
<td>10/7</td>
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<tr>
<td>Ship Grid Tit Table to NTS</td>
<td>3 days</td>
<td>Tue 10/13/05</td>
<td>Thu 10/20/05</td>
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<tr>
<td>TRR Via Telephone</td>
<td>0 days</td>
<td>Thu 10/13/05</td>
<td>Thu 10/13/05</td>
<td>10/7</td>
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<td>Test Fixture Delivery</td>
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<td>Thu 10/20/05</td>
<td>Thu 10/20/05</td>
<td></td>
</tr>
<tr>
<td>Fixture/Actuator/Instrumentation</td>
<td>11.25 days</td>
<td>Thu 10/20/05</td>
<td>Fri 11/4/05</td>
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<tr>
<td>Integration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct delta T/R</td>
<td>0 days</td>
<td>Fri 11/4/05</td>
<td>Fri 11/4/05</td>
<td>11/4</td>
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<tr>
<td>Test Conduct</td>
<td>14.5 days</td>
<td>Fri 11/4/05</td>
<td>Mon 11/28/05</td>
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<tr>
<td>Shipping preps</td>
<td>4.25 days</td>
<td>Mon 11/28/05</td>
<td>Fri 12/2/05</td>
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<tr>
<td>Test Report</td>
<td>10 days</td>
<td>Mon 11/23/05</td>
<td>Mon 12/12/05</td>
<td>30</td>
</tr>
</tbody>
</table>
Drawing Release Plan

- 70 of 73 (96%) drawings released
  - 3 MLI drawings (in check)
- Known drawing revisions
Concerns

Lockheed Martin – open items

• The following work is still being performed at LM at no cost to SLAC:
• A second interim paperwork sell was held to close out open paper except for the items below.
  – 3rd & final sell is pending
• X-LAT plate lifting fixture has been reworked (welds repaired) and is in inspection. It will be proof loaded on Monday, inspected and shipped to SLAC on Wed. 11/2. (Complete)
• Radiator flight MLI blankets are complete. Paperwork is being closed and these will ship to SLAC on Wed. 11/2.
• Radiator 2 pt lift sling in proof test. ECD for ship to SLAC is also 11/2.

Lockheed Martin – financial

• LM has billed through July and only $185k remains on contract value for Aug. & Sept. activities including T/Vac testing
Open Flight Design Issues

• Radiator integration sequence
  – Coupon testing of repeated make & break of joint has been tested. Results were inconclusive due to test facility problems.
  – Test will be repeated at NTS
  – Disassembly facilitated by use of mold release agent

• Radiator vibration requirements
  – Sine vibration testing will not be performed at LM
    • Test options under investigation
# MECH Qualification Program

<table>
<thead>
<tr>
<th>Qual Test</th>
<th>Status</th>
<th>ECD</th>
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<tbody>
<tr>
<td>Grid-Top Flange Heat Pipe bond process qual</td>
<td>Complete. Report released</td>
<td>Comp</td>
</tr>
<tr>
<td>Grid Box Assy Static Load test</td>
<td>Planning in work. Perform on Grid #2</td>
<td>Nov 05</td>
</tr>
<tr>
<td>X-LAT Plate Thermal Vac test</td>
<td>Complete less MRB on final results</td>
<td>Comp</td>
</tr>
<tr>
<td>Radiator Variable Conductance Heat Pipe new extrusion</td>
<td>Passed burst test, heat capacity test after charging</td>
<td>Comp</td>
</tr>
<tr>
<td>Radiator Acoustic</td>
<td>at LMMS</td>
<td>Comp</td>
</tr>
<tr>
<td>Radiator Thermal Vacuum</td>
<td>at LMMS</td>
<td>Comp</td>
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<tr>
<td>TCS-Radiator Thermal Balance</td>
<td>at LMMS</td>
<td>Comp</td>
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<tr>
<td>Radiator Sine Vibration</td>
<td>Test alternatives in work</td>
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<tr>
<td>Radiator Heat Pipe Thermal Joint</td>
<td>Continue coupon tests at NTS</td>
<td>Dec 05</td>
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</table>
Radiator Sine Vibe Test Approach

Requirement

2. The primary objective of the high-level sine vibration test is to exercise the radiator interfaces to 1.25 x CLA. The dynamic response of the radiator in its test configuration should be verified in the pretest analysis. If the provided sine vibration input spectrum does not produce adequate reaction forces, the vibration spectrum in the low frequency band should be increased to compensate.

Approach

• Analysis shows that the interface loads normal to the panel (Y-axis) were enveloped by the Acoustic test
• Acoustic test had a flight-like Radiator Mount Brackets
• Propose performing static load test to address the in-plane (X and Z axis) loading requirement
Static Load Test Proposal

- Radiators would be mounted to flight like interfaces on the Acoustic test fixture
- Load fixtures would mount to handling inserts on the X sides of the panel
- Panel is sequentially loaded in +X, -X, +Z and –Z directions (or pull at –Z corner to produce shear load and moment at RMB interface) TBR
- X loads are approximately 200 lbs
- Z loads are approximately 200 lbs
- Handling insert coupons were tested in shear and B basis capability is 800 lbs TBR (just need to verify)
GLAST LAT Project

Static Load Test Test Configuration

Frame Simulating the S/C Bus

Struts 4x

-Y Radiator

Flight like brackets from SLAC (dye penetration tests run with no issues found)

Pedestal not available

Frame would be bolted to I beams on floor

Loads

+Y Radiator

Loads

+Z

X

Y
Test Approach (Cont)

Requirement 1

1. The Radiators shall be capable of full operational performance after exposure to the sinusoidal vibrations loads due to the launch environment shown in Table 11a. This is specified in the IRD requirement, which reiterates Goddard Space Flight Center (GSFC) policy that sine vibration testing is performed only up to 50 Hz. Notching of the test levels shown is allowed to avoid over-testing of the structures.

Approach

• Waiver would be required for this requirement
Requirement

3. In order to address any vulnerability to the MECO high frequency (110 Hz – 120 Hz) event, the LAT and all subsystems will conduct a low-level sine sweep test to identify all resonant frequencies up to 200 Hz. This low-level sine sweep spectrum for the LAT and all subsystems is shown in Table 11b.

Approach

• Analyzing Acoustic test data including tap testing to determine if modes can be identified.
  – Preliminary check looks promising
  – Also need damping (Q) factor
• If modes were not identified then need to investigate test approach
  – Modify tap test?
  – Modal test?
  – Note Radiators are not installed during LAT level vibration testing
• Waiver required to explain how the data was arrived at if not by sine sweep?
Next Steps

• Agree on test approach
  – Received comments back on chart package
  – Set up telecon to discuss open issues
• Arthur Scholz will detail out Static Load Test implementation
• Conduct TRR
• Process required waivers
Cost/Schedule Reports for
4.1.8 Mechanical Systems
Presentation
September 2005 Month End
Level 3 Milestone Count
Level 3 Milestone List
Milestone Variance Explanation

• None
### Cost Report

#### 4.1.8 MECHANICAL SYSTEMS

<table>
<thead>
<tr>
<th>Reporting Category</th>
<th>Cost Incurred/Hours Worked During Month</th>
<th>Estimated Cost/Hours to Complete OCT05</th>
<th>Estimated Final Cost/Hours</th>
<th>Unfilled Orders Outstanding</th>
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<tr>
<td></td>
<td>Actual</td>
<td>Planned</td>
<td>Actual</td>
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<tr>
<td>4.1.8.1 MANAGEMENT</td>
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<td>4.1.8.2 RELIABILITY &amp; QUALITY ASSURANCE</td>
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<td>4.1.8.5 THERMAL CONTROL SYSTEM (SLAC)</td>
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<td>79</td>
<td>798</td>
<td>929</td>
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<td>4.1.8.6 RADS, HEATPIPES, THERM TEST, X-LAT (LM)</td>
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<td>594</td>
<td>7,498</td>
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<td>4.1.8.7 GRID</td>
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<td>640</td>
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<tr>
<td>4.1.8.8 FABRICATION, ASSEMBLY, AND TEST</td>
<td>15</td>
<td>3</td>
<td>669</td>
<td>947</td>
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<td>4.1.8.9 LAT I&amp;T SUPPORT</td>
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<td>4.1.8.A MISSION I&amp;T SUPPORT</td>
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<tr>
<td><strong>CAPW[3] Totals:</strong></td>
<td><strong>615</strong></td>
<td><strong>755</strong></td>
<td><strong>17,119</strong></td>
<td><strong>17,406</strong></td>
</tr>
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</table>
Cost Variance Explanation

- Why overrun/underrun?
  - LM has overrun their contract

- What will be done to correct?
  - Additional $540K funding approved
FTE Variance Explanation

• Why overrun/underrun?
  – Underrun due to Grid Static Load Test and Heater Control Box fab being late

• What is the impact?
  – No LAT impact from SLT
  – Heater control boxes being tracked by ELEC