Mechanical Systems
Mechanical / Thermal Hardware
December 2004 Status

Marc Campell, Subsystem Manager
Accomplishments during December.

- Missing feature was added to grid – this allowed temperature sensor wiring in the X axis purge grooves to pass under the Y axis heat pipes (more later).
- The 5th Top Flange Heat Pipes was bonded into Grid.
- Lockheed progress reported earlier.
## 3 Month Milestones Jan - Mar

<table>
<thead>
<tr>
<th>Milestone Description</th>
<th>Original Date</th>
<th>Current Date</th>
<th>Major Reqmts to Achieve Milestone</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Grid Box Base Assy ops</td>
<td>07/22/04</td>
<td>02/04/05</td>
<td>bake-out</td>
<td>2/4/2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>bond temperature sensors</td>
<td>2/4/2005</td>
</tr>
<tr>
<td>Grid Heat Pipe bond process Qual</td>
<td>02/24/04</td>
<td>11/15/04</td>
<td>write test report</td>
<td>ECD 12/10/2004</td>
</tr>
<tr>
<td>Design Heater Control Box</td>
<td>08/19/04</td>
<td>11/12/04</td>
<td>release drawings</td>
<td>complete</td>
</tr>
<tr>
<td>Fabricate Heater Control Box</td>
<td>10/28/04</td>
<td></td>
<td>procurement cycle</td>
<td>in process. Stay clear issue being worked</td>
</tr>
<tr>
<td>Test Heater Control Box</td>
<td>12/13/04</td>
<td>02/18/05</td>
<td>release drawings of using assemblies</td>
<td>activity started</td>
</tr>
<tr>
<td>Order TCS electronics components</td>
<td>01/30/04</td>
<td>12/17/04</td>
<td>LM procured TCS components</td>
<td>all parts on hand</td>
</tr>
<tr>
<td>Order TCS flight hardware Heaters, thermostats &amp; thermistors</td>
<td>12/19/03</td>
<td>12/30/04</td>
<td>Grid thermostats</td>
<td>Qual test complete report in review at GSFC</td>
</tr>
<tr>
<td>Receive Grid #2, EMI skirts, details</td>
<td>11/15/04</td>
<td>04/02/05</td>
<td>EMI skirts &amp; details</td>
<td>complete</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grid final machining &amp; inspection</td>
<td>ECD 3/2/05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grid plating</td>
<td>reqmt deleted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>grid box machining &amp; hardware installation</td>
<td>ECD 3/30/05</td>
</tr>
<tr>
<td>Grid #2 Static Load Qual Test</td>
<td>12/16/04</td>
<td>05/02/05</td>
<td>Load case analysis</td>
<td>prelim eval complete</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>in-house vs out-house analysis</td>
<td>ECD 2/17</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SOW, RFP &amp; vendor selection</td>
<td>Feb</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MGSE &amp; test fixture design</td>
<td>Mar</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MGSE &amp; test fixture fab</td>
<td>Mar</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Test Readiness Review</td>
<td>Apr</td>
</tr>
<tr>
<td>Receive X-LAT plate</td>
<td>12/09/04</td>
<td>03/31/05</td>
<td>Complete X-LAT heat pipe fab</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Complete X-LAT plate assy</td>
<td>Feb</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Complete Thermal Vac testing</td>
<td>Mar</td>
</tr>
</tbody>
</table>
Drawing Release Plan

• 57 of 81 (70%) drawings released
  – 18 MLI drawings have been added to MECH drawing list
  – 4 unreleased parts not needed until I&T operations
    • In check

• Known drawing revisions
  – Feb – 2 planned
    • X-LAT (ready for release) & Radiator IDD’s
      – Investigating potential interference between X-LAT cooling tube exit point and proposed Spacecraft MLI attachment
Concerns

- Lockheed Martin - X-LAT plate & Radiator delivery schedule
  - See LM presentation
Concerns (cont)

• Grid to I&T delivery date – schedule continues to compress.
  – 2 big delays in delivery to I&T
  – Requirement to bake out adhesive used to bond heat pipes in order to meet outgassing requirements
    • Oven identified for this work in Oct
    • After SLAC injury incident, internal review revealed multiple deficiencies that had to be corrected before oven could be used. Still not online.
    • Developed work around plan to address these issues.
    • Plan to demonstrate ability to control grid temperatures on grid mass simulator (alum plates)
  – Rework of Grid for missing feature
    • Tooling developed and fabricated
    • Rework technique demonstrated on 1 x 4 Grid
Grid Rework Completed
Open Flight Design Issues

- Requirements for Grid survival heaters & thermostats being revised to raise minimum Tracker temperatures
  - MRB has approved modification to these parts
  - Existing Qual is valid for new thermostats with higher set point and slightly higher current for 30,000 cycles
  - New thermostat has a much higher duty cycle in Safe mode. Is 30,000 cycles satisfactory?
- TCS validation vs. LM modified Radiator Thermal Vacuum & Balance plans
  - TCS test requirements being developed with Tom McCarthy
  - ~3 additional TCS cases proposed
  - Cost & schedule impacts will be evaluated
  - TCS risk assessment and Qual test plan requested by GSFC
- Define GBA Static Load test requirements & plans
  - Detailed load cases & STE being developed
    - Stress has performed another iteration on the load cases
    - Loads have gone down and many cases are now Qual by analysis and other test cases will be combined
Open Flight Design Issues (cont)

- Radiator integration sequence
  - Coupon testing of repeated make & break of joint in process
  - Disassembly facilitated by use of mold release agent
- X-LAT MLI blanket billowing does not violate stay clear (Closed)
- Radiator MLI blanket and wiring violates stay clear
  - S/C to LAT MLI design options in work with Spectrum Astro
    - Working group meeting held in Jan
- Radiator vibration requirements
  - Current proposal is pre & post low level sine sweep, sine vibe and Acoustic testing
  - Working with GSFC & LM to minimize & finalize requirements
  - Preliminary design of vibration test fixture complete.
  - Design concepts for Acoustic test fixture are next
  - Effort on hold
# MECH Qualification Program

<table>
<thead>
<tr>
<th>Qual Test</th>
<th>Status</th>
<th>ECD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid-Top Flange Heat Pipe bond process qual</td>
<td>Complete report in work.</td>
<td>Dec 04</td>
</tr>
<tr>
<td>Grid Box Assy Static Load test</td>
<td>Planning in work. Perform on Grid #2</td>
<td>Mar 05</td>
</tr>
<tr>
<td>X-LAT Plate Thermal Vac test</td>
<td>at LMMS</td>
<td>Mar 05</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>TBD*</td>
</tr>
<tr>
<td>Radiator Thermal Vacuum</td>
<td>at LMMS</td>
<td>TBD*</td>
</tr>
<tr>
<td>TCS-Radiator Thermal Balance</td>
<td>Scope is changing. Need to define requirements</td>
<td>TBD*</td>
</tr>
</tbody>
</table>

*LM test program on hold pending funding resolution
PMCS

- Mech Sys (SLAC only) cum schedule variance -$727K
  - Driven by late receipt of Grid #2, TCS hardware and Static Load Test did not start.
  - Will decrease each month as these are worked off

- Mech Sys (LM only) current cost variance -$317K, and
- Mech Sys (LM only) cum cost variance -$1,246K
  - LM is behind schedule and not on their headcount profile
  - LM has provided a spending profile for Jan – Mar to take them up to $7.5M
  - Investigating other testing options for Radiator and X-LAT plate
Program Threats

- Top threats to maintaining schedule
  - Grid Box is a pathfinder for Flight hardware operations in B33
  - Highly compressed, success oriented schedule
  - LM X-LAT & Radiator delivery have no float and LM manufacturing is not maintaining their schedule

- Top threats to staying within cost
  - LM staying on schedule
  - LM maintaining headcount profile, esp. planned roll-off
  - SLAC staying on schedule
  - Interdependencies with DAQ for fab, assy & test of TCS