Mechanical Systems
Mechanical / Thermal Hardware
May 2004 Status

Marc Campell, Subsystem Manager
Accomplishments during June

- Base Frame Assy – Grid Match Drilling Complete
- Grid #2 MRR held – Tapemation given OK to proceed
- Started Grid #2 machining
- Grid #1 progressing (next chart)
- 3 way (Downspout, X-LAT & Radiator) heat pipe thermal joint trials 90% complete
- Radiator installation trials 50% complete
  - Demonstrated ability to torque up fasteners within thermal adhesive pot life
- LM released all X-LAT flight drawings
- Thermal Control System E-box prototyping started
Tapemation Status

- Grid +Z & -Z surfaces machined flat per blueprint
- Grid side features put in
- Shear plate match machining completed
- CAL interface in process (896 inserts)

- Workarounds in process or under evaluation
  - Modifying Grid Box Machining requirements & moving final inspection of EMI skirts assembled on Grid to SLAC puts delivery date at 9/15
  - Plan to reduce Grid inspection to 1 week is in work (tentatively agreed upon by Tapemation) puts delivery date at 9/8
  - Meeting with brush nickel vendor (Platron) to reduce plating times
Tapemation Status (con’t)

Milestones

• Spacecraft interface drilling – target 7/7
• Machining complete (CAL & Tracker interfaces) 7/19
• Grid inspection complete 8/2
• Ship to plating vendors (alodine & brush nickel) 8/3
• Plating complete 8/23
• Grid Box Machining complete 9/3
• Final hardware installation 9/11
• Clean, inspect pre-ship review 9/13
• Ship to SLAC 9/15, possibly 9/8
Grid #1 Shear Plates Matched Machined
Base Frame Assy – Grid Match Drilling
3 way Heat Pipe Thermal Joint
Radiator Installation Trials
Light at End of Tunnel
## 3 Month Milestones June - August

<table>
<thead>
<tr>
<th>Milestone Description</th>
<th>Original Date</th>
<th>Current Date</th>
<th>Major Reqmnts to Achieve Milestone</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive Grid #1, EMI skirts, details</td>
<td>03/30/04</td>
<td>09/08/04</td>
<td>Grid inspection</td>
<td>Inspection plan in workECD 7/6/04</td>
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<td></td>
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<td></td>
<td>resolve grid plating issues</td>
<td>meeting with vendor</td>
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<tr>
<td>Grid #1-BFA match drilling</td>
<td>01/27/04</td>
<td>06/15/04</td>
<td>complete</td>
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<tr>
<td>Grid #1-S/C interface drilling</td>
<td>7/7/2004</td>
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<td>Release procedure</td>
<td>in release cycle</td>
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<tr>
<td>Grid #2 OK to proceed</td>
<td>03/01/04</td>
<td>06/11/04</td>
<td>complete</td>
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<tr>
<td>Grid #2 start machining</td>
<td>03/01/04</td>
<td>06/30/04</td>
<td>started</td>
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<tr>
<td>Release Grid Box Assy Procedures</td>
<td>04/15/04</td>
<td>07/16/04</td>
<td>Need to hire ME</td>
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<tr>
<td>Procure Grid Assembly MGSE</td>
<td>05/17/04</td>
<td>07/14/04</td>
<td>finalize design</td>
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<td>Grid Heat Pipe bond process Qual</td>
<td>02/24/04</td>
<td>07/16/04</td>
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<td>manpower priorities</td>
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<tr>
<td>Radiator Integration Demo</td>
<td>02/19/04</td>
<td>07/02/04</td>
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<tr>
<td>Design Heater Control Box</td>
<td>08/19/04</td>
<td>08/19/04</td>
<td>in work</td>
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<tr>
<td>Order TCS electronics components</td>
<td>01/30/04</td>
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<td>activity started</td>
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<tr>
<td>Order TCS flight hardware</td>
<td>12/19/03</td>
<td>06/30/04</td>
<td>Update of LAT instrumentation plan</td>
<td>Spreadsheet updated</td>
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<td>Heaters, thermostats &amp; thermistors</td>
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<td>Get LM RTD's, thermistors &amp; heaters approved &amp; on EEE parts list</td>
<td>complete</td>
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<td>parts on order</td>
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<td>LM procured TCS components</td>
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<td>ordered</td>
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<td>Grid heaters</td>
<td>parts in house now</td>
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<td>Qual test pending</td>
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<td>Grid thermostats</td>
<td>received</td>
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<td>MECH thermistors</td>
<td>ELEC - PO</td>
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<td>LAT level?</td>
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Drawing Release Plan

• 58 of 64 (91%) drawings released
• 5 new parts (shims, misc. details) required for Grid Box & I&T assembly operations were added to plan
• Remaining hardware is needed for MECH assembly operations in Sept
• Known drawing revisions
  – July – 15 planned (X-LAT & Radiator IDD’s, Grid Box Machining, EMI skirts)
Concerns

• Grid to I&T delivery date – schedule continues to compress.
• Grid Box Assy Static Load test will be performed on Grid #2 after start of I&T on fight unit. This increases risk.
• Grid thermal control components & Downspout Heat Pipe to Grid thermal joint are not verified until LAT T/Vac test. Difficult to access these components at this level (remove Radiators & ACD).
• X-LAT plate & Radiator delivery schedule have no float remaining due to late starts and manufacturing has just begun
Open Flight Design Issues

• TCS – location of Grid heaters, thermostats, RTD’s and associated wiring needs to be finalized (top assembly drawing)
  – Grid thermostats will operate at 35V & 1A; 42V failure mode
  – Qualification testing of parts will be performed
  – Watching PRT contamination issue discovered by ACD; LM is buying same part for Radiator

• TCS validation vs. LM modified Radiator Thermal Vacuum & Balance plans
  – TCS test requirements being developed with Tom McCarthy
  – TCS risk assessment and Qual test plan requested by GSFC

• Define GBA Static Load test requirements & plans
  – Interface loads developed
  – Detailed load cases & STE being developed
  – Plan to hire Mechanical Engineer for this task
Open Flight Design Issues (cont)

• Radiator integration sequence
  – Grid modified to allow installation using pure translation
  – Wet joint trials underway. Disassembly a concern
• Radiator level EMI test was deleted
  – Engineering test at this level has been quoted by LM
• X-LAT plate needs 0.5” radius is some locations that may violate 00040 drawing stay clears near S/C interface – Closed - smaller radius OK, waiver will be submitted for very minor envelope encroachment
• X-LAT MLI blanket billowing will violate stay clear
• Radiator MLI blanket violates stay clear
• LM will use -6dB pre & post acoustic tests to verify Radiator instead of low level sine sweep
  – Low level sine sweep to 150 Hz may be required anyway to address Delta II concern
  – Investigating twang or tap tests on Radiator as alternate
  – Radiator very stiff in Z axis (direction of Delta II mode)
### 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>Ready to go</td>
<td>July 04</td>
</tr>
<tr>
<td>Grid Box Assy Static Load test</td>
<td>Planning in work. Perform on Grid #2</td>
<td>Feb 05</td>
</tr>
<tr>
<td>Grid Box Assy Thermal Cycle test</td>
<td>Plan to delete test</td>
<td></td>
</tr>
<tr>
<td>X-LAT Plate Thermal Vac test</td>
<td>at LMMS</td>
<td>Nov 04</td>
</tr>
<tr>
<td>Radiator Variable Conductance Heat Pipe new extrusion</td>
<td>Passed burst test, heat capacity test after charging</td>
<td>July 04</td>
</tr>
<tr>
<td>Radiator Acoustic</td>
<td>at LMMS</td>
<td>Nov 04</td>
</tr>
<tr>
<td>Radiator Thermal Vacuum</td>
<td>at LMMS</td>
<td>Mar 05</td>
</tr>
<tr>
<td>TCS-Radiator Thermal Balance</td>
<td>Scope is changing. Need to define requirements</td>
<td>Mar 05</td>
</tr>
</tbody>
</table>
PMCS

- Lockheed Martin current period cost variance -$223K and
- Lockheed Martin cum cost variance -$163K
  - Due to over accrual input into system
  - Will correct next month

- Mech Sys (SLAC only) current period schedule variance -$83K and
- Mech Sys (SLAC only) cum schedule variance -$133K
  - Driven mainly by TCS prototyping late start (did start in June) and late procurement of assembly fixtures (details being finalized with vendor – order in early July)
Program Threats

- Top threats to maintaining schedule
  - Grid delivery from Tapemation
  - Grid design & fabrication are occurring concurrently
  - Highly compressed, success oriented schedule
  - LM X-LAT & Radiator delivery have no float and manufacturing has just begun
  - Grid Box will be pathfinder for Flight hardware operations in B33

- Top threats to staying within cost
  - Staying on schedule
  - Grid design changes and cost of work arounds to improve schedule
  - Interdependencies with DAQ for fab, assy & test of TCS