Mechanical Systems
Mechanical / Thermal Hardware
April 2004 Status

Marc Campell, Subsystem Manager
Accomplishments during May

- Tapemation has completed machining all bays and Tracker cable chaseways on Flight Grid #1
- Released 3 drawings per plan
  - Including Rev 04 of Grid drawing
- Completed bending the Variable Conductance Heat Pipes for the Radiators
- Completed X-LAT cooling pipe design/layout
- Held X-LAT Manufacturing Readiness Review
<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>X-LAT Plate MRR</td>
<td>5/27/04</td>
<td>8/31/04</td>
<td>Close MRR action items</td>
<td>Revised Grid plating requirements to pull in date</td>
</tr>
<tr>
<td>Receive Grid #1, EMI skirts, details</td>
<td>3/30/04</td>
<td>8/31/04</td>
<td>Stop changing the design</td>
<td>TRK mods &amp; wing mods for Radiator installation proposed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>resolve grid plating issues</td>
<td>Is the logest task in the flow investigating modifying or deleting reqmts</td>
</tr>
<tr>
<td>Grid #1-BFA match drilling</td>
<td>1/27/04</td>
<td>6/09/04</td>
<td>BFA and Grid available</td>
<td>early June window</td>
</tr>
<tr>
<td>Grid #2 OK to proceed</td>
<td>3/01/04</td>
<td>6/15/04</td>
<td>Sufficient progress on Grid #1</td>
<td>Final draft in review</td>
</tr>
<tr>
<td>Grid #2 start machining</td>
<td>3/01/04</td>
<td>6/15/04</td>
<td>Sufficient progress on Grid #1</td>
<td></td>
</tr>
<tr>
<td>Grid Heat Pipe bond process Qual</td>
<td>2/24/04</td>
<td>6/30/04</td>
<td>manpower priorities</td>
<td></td>
</tr>
<tr>
<td>Radiator Integration Demo</td>
<td>2/19/04</td>
<td>6/15/04</td>
<td></td>
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<tr>
<td>Grid Assembly MGSE Design</td>
<td>2/04/04</td>
<td>6/30/04</td>
<td>release Top Assy dwgs</td>
<td>in work - drafts available</td>
</tr>
<tr>
<td>Order TCS electronics components</td>
<td>1/30/04</td>
<td></td>
<td></td>
<td>activity started</td>
</tr>
<tr>
<td>Order TCS flight hardware</td>
<td>12/19/03</td>
<td>6/30/04</td>
<td>Update of LAT instrumentation plan</td>
<td>Spreadsheet updated</td>
</tr>
<tr>
<td>Heaters, thermostats &amp; thermistors</td>
<td>12/19/03</td>
<td>6/30/04</td>
<td>Get LM RTD's, thermistors &amp; heaters approved &amp; on EEE parts list</td>
<td>need to add new thermistor with longer leads</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grid heaters</td>
<td>ordered</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grid thermostats</td>
<td>parts due in house now</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MECH thermistors</td>
<td>35 &amp; 42 V issue</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other Subsystem thermistors</td>
<td>ELEC - PO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LM procured TCS components</td>
<td>LAT level?</td>
</tr>
</tbody>
</table>
Tapemation Status

- Completed machining bays & chaseways
  - 5+ Mdays lost due to SNK machine failure
- Grid flatness checked
  - Flat within .018” & there is .022” extra material to clean up part
- Workarounds in process or under evaluation
  - Current plan would deliver Grid to SLAC on 9/28
  - Modifying Grid Box Machining requirements, plating requirements & deleting a final inspection of EMI skirts assembled on Grid pulls delivery date forward to ~8/31 depending on final plating requirements
- Other tall poles
  - Plating 1 to 3 weeks
  - Deburring & polishing of Grid to get surface finish = 10 Mdays
  - Inspection of Grid 12 Mdays
    - Have not received Tapemation’s inspection plan
Milestones

• BFA (ACD) match drilling 6/9
  – Pulling this task forward to meet ACD window adds 1 day to Grid schedule
• Spacecraft interface drilling – as available prior to plating
• Machining complete (ready to plate) 6/30
• Grid inspection complete 7/19
• Plating complete 8/3
• Grid Box Machining complete 8/17
• Final hardware installation 8/23
• Clean, inspect pre-ship review 8/30
• Ship to SLAC 8/31
Drawing Release Plan

- 56 of 59 (95%) drawings released
- Remaining hardware is needed for MECH assembly operations in May
  - April – 10 released (9 planned)
  - May – 3 released (2 planned)
  - June – 4 planned
- ~6 new parts (shims, misc. details) required for Grid Box & I&T assembly operations will be added to plan next month
- Known drawing revisions
  - April - 1 revised (Grid)
  - May – 3 revised (Grid)
  - June – 9 planned (X-LAT & Radiator IDD’s, Grid Box Machining, EMI skirts)
Concerns

- **Tapemation Grid #1 delivery schedule**
  - Difficult to press vendor as we keep making design changes
- **Grid to I&T delivery date** – schedule continues to compress.
- **Coordination of MECH assembly plans and LAT I&T integration plans.**
  - Late delivery of Grid to SLAC drives whether work will be performed prior to or after delivery to I&T
  - I&T will loan technicians to perform Mech operations
- **Tapemation Grid #2 delivery schedule**
  - Start of Grid #2 on hold until we complete Grid #1 machining
  - Tapemation proposing some changes to machining operations
- **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

• Grid-TRK interface definition CLOSED
  – Bushings into grid are back
• TCS – location of Grid heaters, thermostats, RTD’s and associated wiring needs to be finalized (top assembly drawing)
  – Grid thermostats are rated to 30V & 2A for 200,000 cycles
  – Planned operation at 35V & 1A; 42V failure mode
  – Telecon with GSFC (PCB), SLAC & TI held
  – Considering Qualification testing of parts
  – Only thermostat available with 3 deg on-off differential (power concern)
  – Honeywell has qualified parts to these voltages & current, but larger temperature range
  – Possible power impact, cost & schedule impacts need to be compared to qualifying TI parts
• 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)

• TCS validation vs. LM modified Radiator Thermal Vacuum & Balance plans
  – What are TCS test requirements?
  – TCS risk assessment and Qual test plan requested by GSFC

• 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

• Radiator heater wire sizing (26 vs. 24 gage)

• X-LAT plate needs 0.5” radius is some locations that may violate 00040 drawing stay clears near S/C interface

• X-LAT MLI blanket billowing will violate stay clear

• Radiator MLI blanket violates stay clear

• LM proposed -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
## 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>Ready to go</td>
<td>June 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>June 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>
Current Cost Variance

- Mech Systems +$181K
  - Took credit for late procurement of TCS hardware
- Lockheed Martin +$220K
  - March accrual (750K) was zeroed out and the April accrual (590K) went in = $160K
  - Remaining $60K LM is under running their projected plan (late starts)

Current Schedule Variance

- Mech Systems +$195K
  - Took credit for late procurement of TCS hardware
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