Mechanical Systems
Mechanical / Thermal Hardware
August 2004 Status

Marc Campell, Subsystem Manager
Accomplishments

- Accomplishments during Sept.
  - Grid #1 Nickel plating complete
  - Grid #2 finish machining 80% complete
  - LM has delivered the Top Flange and Downspout heat pipes to B/33
    - They had been delivered in place at LM
    - Grid TCS instrumentation quantities & locations finalized
  - Received Grid Box tilt table for B/33 assembly work
Grid #1 Brush Nickel Plating

Masked

Plated
Grid #2 In Process
Tapemation Status

- All detail parts complete
- Final operations ready to start

Milestones
- Plating complete 9/30 (took 5 weeks, 2 were planned)
- Grid Box Machining complete 10/12
- Final hardware installation 10/18
- Clean, inspect pre-ship review 10/20
- Package & Ship to SLAC 10/21
## 3 Month Milestones Sep - Nov

<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>10/21/04</td>
<td>Grid plating &amp; grid box machining</td>
<td></td>
</tr>
<tr>
<td>Complete Grid Box Base Assy ops</td>
<td>07/22/04</td>
<td>11/12/04</td>
<td>All parts + MGSE in house</td>
<td>Complete</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Procedures in place</td>
<td>in review</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Hold MRR</td>
<td></td>
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<tr>
<td>Release Grid Box Assy Procedures</td>
<td>04/15/04</td>
<td>10/16/04</td>
<td></td>
<td>ECD 10/14/04</td>
</tr>
<tr>
<td>Procure Grid Assembly MGSE</td>
<td>05/17/04</td>
<td>09/14/04</td>
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<td>in work</td>
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<tr>
<td>Grid Heat Pipe bond process Qual</td>
<td>02/24/04</td>
<td>10/15/04</td>
<td></td>
<td>last sample in process</td>
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<tr>
<td>Design Heater Control Box</td>
<td>08/19/04</td>
<td>10/19/04</td>
<td></td>
<td>in work</td>
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<tr>
<td>Fabricate Heater Control Box</td>
<td>10/28/04</td>
<td></td>
<td></td>
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<tr>
<td>Test Heater Control Box</td>
<td>12/13/04</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Order TCS electronics components</td>
<td>01/30/04</td>
<td></td>
<td></td>
<td>activity started</td>
</tr>
<tr>
<td>Order TCS flight hardware Heaters, thermostats &amp; thermistors</td>
<td>12/19/03</td>
<td>10/30/04</td>
<td>LM procured TCS components</td>
<td>parts on order</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grid thermostats</td>
<td>parts in house now</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Qual test pending</td>
<td></td>
</tr>
<tr>
<td>Receive Grid #2, EMI skirts, details</td>
<td>11/15/04</td>
<td></td>
<td>Grid plating &amp; grid box machining</td>
<td></td>
</tr>
<tr>
<td>Receive X-LAT plate</td>
<td>12/09/04</td>
<td>01/15/05</td>
<td>Complete X-LAT heat pipe fab</td>
<td>50% complete</td>
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<tr>
<td></td>
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<td></td>
<td>Complete X-LAT plate assy</td>
<td></td>
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<td></td>
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<td></td>
<td>Complete Thermal Vac testing</td>
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Drawing Release Plan

- 54 of 61 (90%) drawings released
  - Unreleased parts not needed until I&T operations
  - Start work on these in Oct

- Known drawing revisions
  - Sep – 2 planned
    - Grid as built - in sign off
    - Grid box machining – in sign off
  - Oct – 2 planned
    - X-LAT & Radiator IDD’s,
Concerns

- Grid to I&T delivery date – schedule continues to compress.
- 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
  - Ramp up in manufacturing progress is slower than expected
  - LM is reviewing their cost at completion
Open Flight Design Issues

- TCS – location of Grid thermistors, fly away instrumentation and associated wiring needs to be finalized (top assembly drawing)
  - Locations determined – wire routing in work
  - Grid thermostats will operate at 35V & 1A; 42V failure mode
  - Qualification testing of parts underway
    - ~15,000 of 30,000 cycles completed

- 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
    - 1st draft due 10/29
Open Flight Design Issues (cont)

• **Radiator wiring nomenclature (new)**
  – The temp sensors going to the Spacecraft are labeled #1 - 6 but they go to VCHPs #0 - 5.
  – Likewise the primary & redundant heater leads from the Heater Control Box to the reservoir heaters are labeled #1 - 6, but go to reservoirs #0 - 5.
  – This means that heater #1 & temp sensor #1 are on VCHP 0. This will surely cause confusion down the line.

• **2 options**
  – **fix the wiring nomenclature**
    • Affects labeling on several harness drawing
    • May affect PDU & SIU connector labeling on drawings
    • Affects Spacecraft ICD & labeling on Spacecraft harness drawing
    • Affects Instrumentation plan
  – **Or – change the VCHP numbering from 0 – 5 to 1 – 6 to match current drawing**
    • Affects LAT numbering document and other
    • Affects Radiator IDD
    • May affect Flight Software
    • Will contradict with existing thermal analyses and models
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
- Radiator level EMI test was deleted
  - Engineering test of coupon started
  - Coupon passes up to ~80Mhz
  - LM will present results
- X-LAT MLI blanket billowing will violate stay clear
- Radiator MLI blanket and wiring violates stay clear
  - Working issue with LM & Spectrum Astro
  - S/C to LAT MLI design options in work with Spectrum Astro
- 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
# 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>In work</td>
<td>Sep 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>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>Comp</td>
</tr>
<tr>
<td>Radiator Acoustic</td>
<td>at LMMS</td>
<td>Mar 05</td>
</tr>
<tr>
<td>Radiator Thermal Vacuum</td>
<td>at LMMS</td>
<td>May 05</td>
</tr>
<tr>
<td>TCS-Radiator Thermal Balance</td>
<td>Scope is changing. Need to define requirements</td>
<td>May 05</td>
</tr>
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PMCS

• Mech Sys (SLAC only) current period schedule variance -$104K
  – Procurement of TCS hardware
  – Delivery of Grid #2

• Mech Sys (SLAC only) cum schedule variance -$504K
  – Driven by late receipt of Grid #1, Grid #2 and TCS hardware
  – Delivery of Grid #1 in Oct and Grid #2 in Dec will remove ~ half of this
Program Threats

• Top threats to maintaining schedule
  – Grid delivery from Tapemation
  – Highly compressed, success oriented schedule
  – LM X-LAT & Radiator delivery have no float and LM manufacturing not maintaining schedule
  – Grid Box will be pathfinder for Flight hardware operations in B33

• Top threats to staying within cost
  – Staying on schedule
  – LM staying on schedule
  – Interdependencies with DAQ for fab, assy & test of TCS