MRB on SLAC NCR 241, 248
Failed Cable Coupons

Dave Nelson
January 4, 2005
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Description of the nonconformance

- The main issue is coupon failures with separation between barrel plating and internal layers.
- Secondary issues is cleanliness and handling.
  - These issues have been addressed
NCR 241

• Excessive amount of air bubbles in the acrylic adhesive.
  – Determined not to be a structural problem.

• Dirty flex cables (finger prints, potting material, ink, debris)
  – After testing is completed the product is re-cleaned and inspected 100%
NCR 241 (Cont)

• Micro section exhibited separation
  – Thermal cycle & post electrical tests OK
• Damaged socket rims on Omnetic connectors, J2-J10.
  – SLAC performed a pull test on the worst case sockets, results sockets held position at a 20 grams pull.
NCR 241 (Cont)

- All eight cables exhibit molding separation from the housing (Cristek connector's)
  - No structural problem, This is OK.
- All eight cables exhibit foreign material on the outside of sockets of the omnnectics connector.
  - Cleaned. No electrical or mechanical issues.
1. Description of Non-Conformance NCR 248

- Item: Flex cable LAT-DS-02379 and LAT-DS-00724
- Nonconformance: Coupon tests show separations between barrel plating and internal layers
- Tower A cable flight set has 1 cable with two bad coupons
NCR 248

• 1. Excessive amount of air bubbles in the acrylic adhesive / bonding material in between the flex cable and Omnetics connectors ref: J2 -J10
  – Air bubbles determined to not be a problem

• LAT-DS-02377, C0-017 Failed micro-section evaluation ref: EC No. 50123
  – Thermal cycle & post electrical tests OK
NCR 248 (Cont)

• All eight cables exhibit damaged or deformed socket rims (ominetics connectors)
  – SLAC performed a pull test on the worst case sockets, results sockets held position at a 20 grams pull.

• All eight cables exhibit molding separation from the housing (Cristek connector 's)
  – No structural problem, This is OK.
NCR 248 (Cont)

- All eight cables exhibit foreign material on the outside of sockets of the omnnectics connector.
  - Cleaned. No electrical or mechanical issues.
- Exposed solder pads location thermistors C3
  - pads exposed will not affect the product
NCR 248 (Cont)

• micro-sections failed evaluation, coupons failed evaluation
  – Performed over stress & additional testing.
    • Next slide.
2. Overstress Analysis & Additional Testing

• All cables are fully functionally tested as described in LAT-PS-04643

• Two flex cables were subjected to thermal cycles to evaluate tolerance against thermal cycles and failure modes
  – Test Cable 1: Cable with bad coupon
    • Thermal cycle 1 – 21: -50C to 125 C
      – One via failure on retest after ~ 16 cycles
    • Thermal cycle 22 – 41: -35C to 55 C
  – Test Cable 2: Cable with good coupon
    • Thermal cycle 1 – 25: -50C to 125 C
    • Thermal cycle 26 – 100: -35C to 55 C
Coupon Testing
Goddard (Diane Kolos)

• In process coupons were sent to Goddard. Comparisons are made with & without water blasting holes. The four in process steps are:
  – After drill no plasma
  – After plasma, no micro etch
  – After micro etch no deposition
  – After deposition
Specimen 3P
Post-Plasma, No Water Blast

Note debris only on one outer foil.
Specimen 3P
Post-Plasma, No Water Blast

Debris (organic)

Outer Foil at bottom of Image on slide 1.

Debris (contains F)

Inner Foil Near Top of Image
Specimen 4P
Post-Plasma, Post-Water Blast

(Little or no Fluorine-bearing Debris)

Inner Foil, near top of image in slide 3.  Outer foil, near top of image in slide 3
Specimen 5M
Post-Microetch, No Water Blast

Material in depression contains S and Na (in addition to Cl)

Plaques of organic contamination

Inner Foil, near top of image in slide 5.

Outer Foil, near top of image in slide 5.
Specimen 6M
Post-Microetch, Post-Water Blast

Copper surfaces have extensive chlorine contamination (not visible in this image, see slide 9).
Specimen 6M
Post-Microetch, Post-Water Blast

Inner Foil, near top of image in slide 7.

Higher magnification view showing cubic, chlorine bearing crystals on surface.
3. Suspected Root Cause

- Suspected root cause of coupon and micro section failures is contaminants in via holes before plating.
4. Impacts to Inventory

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<th>DS-02378</th>
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NCRs Tower A & B

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|               |          |          |          |          |          |          |          |          |
|               | passed   |          |          |          |          |          |          |          |
|               | failed   |          |          |          |          |          |          |          |
| Tower A       |          |          |          |          |          |          |          |          |
| ASSY S/N      | 16       | 003      | 004      | 004      | 008      | 007      | 011      | 003      |
| FLEX S/N      | 0044     | 0053     | 0044     | 0019     | 0046     | 0035     | 0064     | 0105     |
| Status/Loc    | NCR 241  | NCR 241  | NCR241*  | NCR 241  | NCR 241  | NCR 241  | NCR 241  | NCR 241  |
|               |          |          |          |          |          |          |          |          |
| Tower B       |          |          |          |          |          |          |          |          |
| ASSY S/N      | 17       | 004      | 005      | 009      | 003      | 010      | 010      |
| FLEX S/N      | 0040     | 0051     | 0042     | 0017     | 0045     | 0020     | 0052     | 108      |
5. Corrective Action

- Panels are water blasted to clean out via holes in panels before plating.
6. Effectiveness of Corrective Action

• Two coupons were tested at Goddard.
  – One coupon was protected from the water blast process
  – Second coupon had the water blasting treatment.
  – Both coupons passed.
    • The expectation was for the non-water blasted coupon to fail.
  – Goddard will finish testing more in process by 1/7/05
7. Recommended Disposition

• Tower A: Use as is
• Tower B: Install flight set (pre water blast process) with
  – 1 cable has 2 bad coupons
  – 2 cables have 1 bad and 1 good coupons
  – Leave NCR open until after environmental test
• Tower 1: Install flight set (pre water blast process) with all good coupons
• Tower 2 and beyond: Install flight set with all good coupons
  – Mixture of pre- and post- process change