GLAST Large Area Telescope:
Performance & Safety Assurance

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Outline

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Mechanical Subsystem – Grid Status

• Final machining operations on Grid prior to plating and alodining have been completed
• MRB was held 8/16 with Mechanical Subsystems, System Engineering, I&T and QA to review Grid dimensional nonconformances found during final dimensional inspection (NCR #147)
  – Discrepancies on Tracker, Calorimeter, and ACD interfaces were dispositioned “conditional” use as is. Additional inspection and analysis will be performed.
  – Spacecraft interface dimensions will be verified using LAT/Spacecraft interface tool after spacecraft mount bushings are installed in Grid following plating
  – EMI interfaces will be fit checked after plating, and EMI mounting holes can be enlarged as required
  – Radiator mount bracket interfaces will be shimmed to accommodate Grid squareness discrepancy
• MRB concurred to proceed with Grid alodining and plating
• Alodining completed 8/23 at Sanford Metal Processing (Menlo Park, CA)
• Grid shipped to Platron (Hayward, CA) for selective Ni plating per AMS 2451/1
• Grid will return to Tapemation after plating for helicoil and bushing installation, EMI shield fit checks, RMB shimming, Spacecraft interface dimension verification and closure of NCR #147
Mechanical Subsystem – Grid Status (Con’t.)
Tracker Subsystem QA Activities

- Completed tasks
  - Inspections of MGSE and flight hardware for tower assembly activities
    - Interface hardware
    - Lifting fixture
    - Vibration fixture
    - Inner shipping container
    - Cable-holding frame
    - Cable-fixation corner brackets
  - Pre-Production Readiness Review performed for tower assembly

- Issues
  - Bias Circuit Bonding Failure
    - Kapton bias circuits bonded to the tracker trays fail under T/V testing at 55C
      - Tiger Team currently in Italy to propose plan of action
Tracker Subsystem QA Issues

- Flex cable coupon failures
  - Coupon evaluation results received from GSFC show failures on 5 Parlex flight flex cables
    - 1 coupon had internal annular rings missing and separations between barrel plating and internal layers
    - 4 other coupons had separations between barrel plating and internal layers
  - LAT Team visited Parlex last Friday to discuss failures
  - Parlex and LAT personnel were at GSFC today to review sample preparation procedures and coupon results
- Novacap HV capacitors on MCMs fail the mil-spec leakage current requirement
  - Lifetime testing at GSFC and MCM experience indicate minimal risk
  - Plan is to use existing capacitors on boards and cut in new production of capacitors when available
  - Documentation of test results, conclusions and disposition required to close issue
- MCM Workmanship issues (pealing of conformal coating, bubbles, and solder and solder on connector leads)
  - Additional investigation, inspections and analysis required
Tracker Subsystem QA Issues (Con’t.)

• Charge injection read-back errors at +60C
  • MRB held on May 28th – Additional tests and analysis performed by Tracker team that isolate the error to be internal to the GTRC chip
    – Traced to GTRC timing margins, which were found to be sensitive to clock duty factor
    – Follow-up MRB required to address analysis
• Pitch adaptor trace cracking
  – Traces on the MCM pitch adaptor show cracking in the nickel at the bend region; some cracks result in open traces
  – Qualification of “revised” pitch adaptors design (no nickel or gold plating in bond area) not successful; second design iteration complete
  – Design review to take place prior to moving to production
• MCM board shorts
  – 6 MCMs have developed internal board shorts
  – Investigation and analysis is underway
Tracker QA Concerns

- LAT Tracker and QA resources are focused on addressing “problems of the moment”
  - Delays in addressing open Tracker NCRs
    - A total of 35 INFN & SLAC Tracker NCRs are open
    - 17 NCRs have been opened within the past 30 days
    - 8 NCRs have been open over 30 days
    - 6 NCRs have been open over 60 days
    - 4 NCRs have been open over 90 days
- LAT SLAC Tracker Quality Engineer is retiring requiring reassignment of responsibilities
DAQ Subsystem - Part Status

- Tower Electronics Module (TEM) EEE parts inspection and acceptance
  - 36 of 39 part types received to date
    - DPA samples from 3 part types submitted to GSFC for evaluation passed (7 TEM part types require DPA)
    - 28 part types approved for “flight use”
- Tower Electronics Module Power Supply (TEM-PS) parts inspection and acceptance
  - 73 of 76 part types received to date
    - DPA samples from 8 part types submitted to GSFC for evaluation passed (13 TEM-PS part types require DPA)
    - 66 part types approved for “flight use”
- TEM & TEM-PS part issues and concerns:
  - Replacement Novacap capacitors have not been received
  - Two capacitor types were not surge tested by supplier. Parts sent to GSFC for surge testing
  - Bake-out of Cristek connectors required (interface seals were not pre-baked prior to connector assembly)
  - FPGA reliability issue outstanding
  - Determination of parts (mechanical) on hand is still in progress by DAQ Production; status of part inspections are reviewed regularly
  - Number of recent design iterations on PWBs. Subsequent testing of CCA resulted in BOM revisions.
TEM Enclosure Status

- TEM Enclosures
  - Source inspection performed June 18 at vendor facility
    - Reviewed plating operations at plating vendor
  - 21 lids and bases received at SLAC
    - 5 of the enclosure bases returned to vendor for replacement due to plating irregularities
      - 5 replacement bases to be delivered from vendor this week
  - 100% dimensional inspection on 2 bases and 2 lids
    - Fit check on one base and lid by QA revealed slight “oil canning” distortion of base
      - Additional evaluation revealed out of tolerance flatness condition on bases and lids
      - Flatness profiles were measured on bases to determine how much distortion circuit boards will experience when installed into bases
      - Measured base distortion is within the allowed 0.5% bow and twist requirement for TEM PWB
**DAQ ASICS Inspection & Test Status**

- GLTC3 – 645 each (GASU); GTCC1 – 881 each (TEM); GCCC1 – 824 each (TEM)
  - Screening and Qualification Plan, LAT-TD-02656, released and approved
    - Visual inspection and serialization completed
    - Thermal cycling completed
      - GTCC1 and GCCC1 have completed thermal cycling 4/2/04
      - GLTC3 requires thermal cycling
    - Electrical testing and burn-in performed at SLAC in Building 33 (LAT I&T Facility)
      - Initial Electrical Test at 25C
        - GTCC1 – 224 of 231 accepted
        - GCCC1 – 112 of 139 accepted
      - Dynamic Burn in for 168 hrs. at 85C
        - GTCC1 – 224 of 244 accepted
        - GCCC1 – 112 of 112 accepted
      - Electrical Test post burn in at 25C
      - GTCC1 – 224 of 224 accepted (Enough GTCC1s for 28 TEMs)
      - GCCC1 – 112 of 112 accepted (Enough GCCC1s for 28 TEMs)
  - Radiation testing (TID) to be performed in Italy
    - 9 ASICs from each ASICs type to be sent to Italy
  - Qualification testing will be performed at GSFC
    - 52 ASICs from each ASICs type need to be provided to GSFC
  - DPA evaluation performed on all three ASICs and passed
Flight Software QA Activities

- Software Quality Engineering oversight necessary at this stage of flight software life-cycle
  - LAT Performance Assurance provided recommendation to LAT Project Management to supplement flight software activities with Software Quality Engineer
    - LAT Performance Assurance identified individual to support this function and in-process of establishing contract
- EEPROM reliability issue on the RAD750 and SIB
  - EEPROM can experience a failure mode that affects all the bits in the 128 bytes of a page of memory
  - NCR No. 149 was generated to capture this issue
    - Mitigation strategies are presently being formulated
LAT QA Audit Activities

• Facility Readiness Review (SLAC I&T Facility – Building 33) was performed by LAT QA on May 19th & 24th
  – Facility Readiness Review performed to evaluate readiness of facility to receive, store, assemble and test flight hardware
    • 4 findings and 22 observations were identified and documented
      – 4 findings and 14 observations have been closed to date
• Status of LAT responses to GSFC Audit recommendations
  – Responses to all 26 observations were provided to Lead Auditor March 4th
  – 25 of the responses have been closed by the Audit Team
  – One response required additional information be submitted related to MAR deliverables
    • LAT Project Controls and Performance Assurance updated the MAR Deliverables Matrix in April and it is currently with LAT Project Management for review
Issues and Concerns

- Incoming inspection & documentation backlog has accumulated
  - QA inspector has been on long-term medical leave
    - QA has lost two excellent short-term replacements due to Purchasing cycle time to execute contract
  - Presently QA is not a bottleneck but inspections performed on “just-in-time” basis based on priorities
  - QA does not have visibility into part application for those parts in bonded stores
    - No Mechanical Subsystem TCS parts have gone through incoming inspection
      - Plan to meet with subsystem to determine priorities and work with Production Group to get parts identified
  - Few DAQ SIB, GASU, Harness and PDU part inspections have been performed
  - Still struggling with getting “critical path” parts to QA in timely manner
    - Resources required to address documentation and quality problems of components/parts exasperates issue
      - QA has over 70 documents in the queue to review
Cost Variance Analysis

- Cumulative CV = $139K (Last month $149K)
  - Management = $48K
  - Quality Assurance = $89K
    - Majority of variance due to delayed processing of subcontractor invoices. Actual expenditures in line with planning.
  - Records Management = $-3K
  - Training = $5K
  - Systems Safety = $0K