GLAST Large Area Telescope:
Cost/Schedule Review
June 30, 2004
AntiCoincidence Detector (ACD) Subsystem
WBS: 4.1.6

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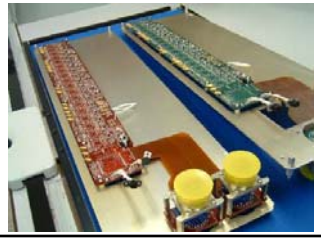
Recent Accomplishments

- **Electronics**
  - **All 16 flight FREE boards have been operated successfully; half have completed full functional test.**
  - **HVBS Production Line resumed operation**
- **PMTs**
  - **Re-arranged tube placement to remove "worst" tubes found in glass inspection**
- **Mechanical Structure**
  - **Match drilling of Base Frame Assembly and GRID completed.**

Recent Accomplishments - Electronic Component Status

ITEM	Quantity Required Flight (Spare)	Assembly Complete	Functional Testing	Conformal Coating	Thermal Testing	Ready for next assembly
Front End Electronics Boards 	12 (4)	16	8	7	7	5
High Voltage Bias Supply 	24 (6)	30	30	20	12	8
Photomultiplier Tube Assembly 	196 (40)	71	60	29	0	0

Near Term Milestones

Milestone Description	Date	New Date	Status/Notes
Complete Flight HVBS	6/30/04		All 30 are assembled. Ready for assembly into Electronics Chassis
Complete Flight FREE Boards	6/30/04		All 16 are assembled. 5 ready for assembly into flight electronics chassis.
Complete PMT Assembly	January, 2004	6/30/04	71 assembled. Issues with plastic screws and glass flaws resolved, but defective coax and a crack in a ceramic capacitor require rework.
Complete Qualification Unit Electronics Chassis Assembly	5/20/04	7/14/04	Mechanical parts, FREE Boards, and HVBS are ready. 29 PMTs ready next week. Need to finish up EGSE testing and software so that the chassis can be tested.
Mechanical Subsystem delivered to I&T	5/17/04	6/1/04	Complete!
Complete Flight Mechanical Drawings	September	7/15/04	All part drawings complete. Two assembly drawings remain. Designers have been focused on revisions.
Complete Fab of Clear Fiber Cables	August	6/25/04	All parts have been received and tooling is set up. Will complete first cable this week.
Complete Fab of Flight TDAs	November	6/20/04	All TDAs have been fabricated, 16 require wrapping. Lead technician at Fermi Lab is out with serious illness. Workaround plan in development. 96 TDAs received. Remainder to be completed by 6/20/04.

Interdependencies

1. EGSE/G3 – Ongoing development with I&T and Electronics groups.
   - Third EGSE/G3 was received on 6/21. Testing ongoing.
   - Still awaiting software updates for software rate counters.
   - Current sensor/voltage drop issue has been resolved.
2. Grid to Base Frame match drilling –COMPLETE!
3. Delivery of ACD Calibration Unit or subset to LAT I&T –The same electronics chassis being used for G3 commissioning will be used for the calibration unit. Delivery of calibration unit will occur some time after this testing. Two more G3s coming.
4. ICD – Rich Bielawski is helping track a set of needed changes.
5. Instrumentation (temperature sensors and accelerometers) changes – worked issues with LAT Systems – now resolved.
6. Unanticipated requirement for HVBS to operate at 24V - resolved.

Open Design Issues

- **OPEN: Outline drawing that defines some interfaces with LAT is still not complete (blanket attachment, grounding, cable tie-downs, optical survey mounts). Action Plan: Work with LAT mechanical design team to resolve open issues. Status: Unchanged from last month**

Issues that have impacted schedule

- **Interfaces**
  - HVBS requirement to operate at 24 V - RESOLVED
  - Current measurement and voltage drops for 3.3V line - RESOLVED
  - Temperature sensor and accelerometer placement and wiring – RESOLVED
  - Incomplete EGSE software, particularly software rate counters – UNRESOLVED
- **Parts**
  - Discovered defective coax on phototubes. New coax received, but rework required. RESOLVED
  - Discovered cracks in ceramic capacitors on the Resistor Networks. Problem found on 8 of first 10 RNs to be assembled. The remainder have been inspected and appear to be okay. ONGOING
  - Discovered Platinum Resistive Thermo units were defective (contaminated, could not be soldered). Expect replacements at the end of this week. These parts were specified by LAT so other subsystems should be notified of issue. ONGOING
- **Personnel**
  - Serious illness of key technician at Fermilab has delayed final tile detector shipment. Workaround – we do wrapping.

Concerns – How to achieve zero schedule variance

- Looking at ways to make up time by carefully selecting tests that can be delayed until the next higher level of assembly, however this would increase risk.
- The sheer number of schedule-killing problems has overwhelmed our ability to find enough work-arounds
- Even if our current CCB actions are approved, we have no resources to make up lost schedule time.

ACD Schedule Variances

- 4.1.6 – ACD Subsystem (-$448K cum, +$171 current)
- 4.1.6.3 - TSA Schedule Variances (-$9K cum, +$12K current)
  - Procedures and TDA Assembly and Test
- 4.1.6.4 BEA Schedule Variances (-$311K cum, +$82K current)
  - ($10K) – HVBS (HV Capacitor & voltage change)
  - ($291K) – PMTs & Resistor Networks (PMT glass, signal wire issue, cracked capacitor, capacitor life test issue, ultem screws)
  - ($4K) – FREE Board (ASIC Delay)
- 4.1.6.6 Mech Qual and Cal Unit ($0K cum, +$104K current)
  - As noted last month SV is gone this month
- 4.1.6.7 ACD I&T (-$102K cum, -$9K current)
  - ($102K) – Getting started late, but we have begun! Many issues, mainly PMTs and PRTs, hampering progress.
- 4.1.6.B GSE (-$20K cum, -$18K current)
  - ($20K) – Shipping container work being pushed out to reduce current manpower.

ACD Cost Variances

- 4.1.6.1 ACD Project Management/Sys Eng/Science (+$378K cum, +$3K current period)
  - (+$267K) - Labor support lower than planned due to lower than planned science simulations and test support ($173K), systems engineering being covered by GLAST Project ($29K), Science Support lag in accruals ($65K)
  - (+$118K) MPS lower than planned
- 4.1.6.2 Safety and Mission Assurance (+$50K cum, -$16K current period)
  - Cross utilizing support with the GLAST project. Staffing was not sufficient in this area. We have added a QA person.
- 4.1.6.3 Tile Shell Assembly (-$335K cum, -$183K current period)
  - (-$108K) - Labor higher than planned to complete drawings, schedule variance, and labor charged to .3 instead of .6 ($34K)
  - (-$231K) – Materials, higher than planned for materials and parts costs, material testing, and late drawing completion.

ACD Cost Variances

- 4.1.6.4 Base Electronics Assembly (-$802K cum, -$166K current month)
  - (-$265K) Labor: Mechanical design and analysis on the base frame. $50K for earned value method (performed work, but can not take full credit for it yet)
  - (-$492K) M&S – (-$92K) Parts screening, parts purchases, (-$261K) FREE, HVBS, PMT, and Resistor Network work performed, but have not received credit for work done, (-$139K) electronics assembly and test
  - (-$46K) SLAC ASIC charges.
- 4.1.6.5 MS/TB (-$27K cum, -$44K current month)
  - (-$27K) – Design of MMS and Thermal Blanket.
- 4.1.6.6 ACD Mech Qual and Cal Unit (+$152K cum, +$60K current month)
  - (+$112K) - $34K labor charged to 4.1.6.3 and $78K is a underrun
- 4.1.6.7 I&T (+$30K cum, +$31K current month)
  - (+$30K) - 50/50 earned value
- 4.1.6.B Ground Support Equipment (+$243K cum, -$26K current month)
  - (+$153K) – Labor. Costs lagging by $100K and expect an underrun of $53K.
  - (+$88K) – Materials. Not billed for work completed

Threats to Schedule and Cost

1. GASU/G3 EGSE
2. PMT Assembly
3. Electronics assembly and test

Zero Schedule Variance Actions

- **Total ACD SV = $619K**
- **Approximately ½ ($300K) of ACD schedule variance is due to PMTs, so we need to get this work completed. Making good progress, have run into several issues, but we are getting close to reaching full production.**
- **Another $100K is for electronics assembly. Need to resolve voltage change and get EGSE operating to eliminate this variance.**
- **Another $100K is for mechanical qualification. This work is done so it will go away next month.**
- **Another $100K is for I&T. Due to schedule delays this one would be difficult to zero out. It would require a CCB action to change our scheduled delivery date.**