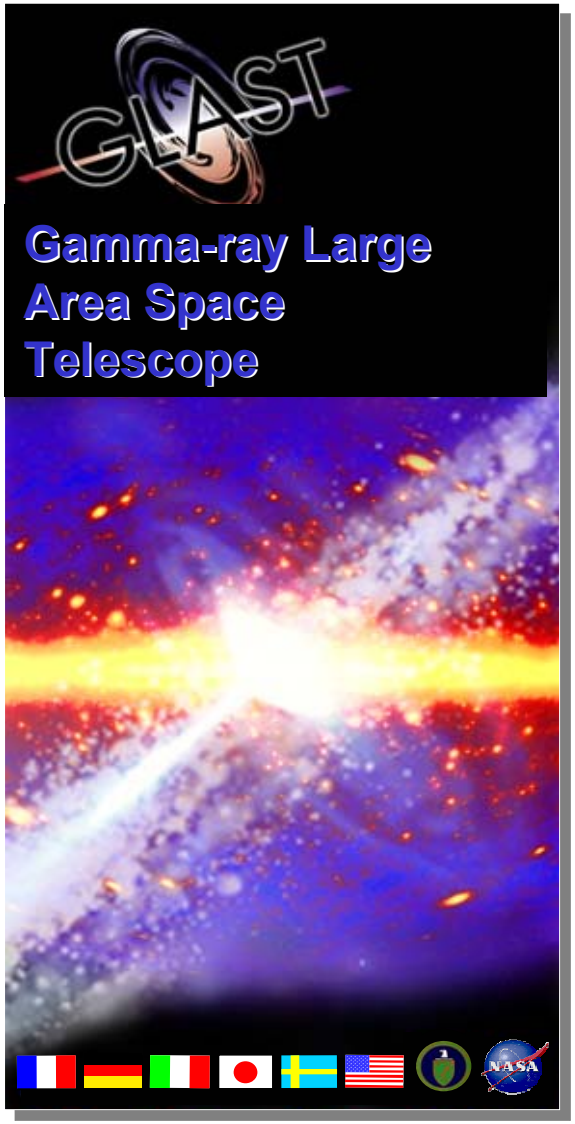

GLAST Large Area Telescope:

Electronics, Data Acquisition & Flight Software W.B.S 4.1.7

October Status 10-29-03

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Last Month's Accomplishment, PDU

- Power Distribution Unit
  - Function
    - Switches power to TEM's, GASU, EPU crates
    - Digitizes temperatures to be used for thermal control
  - Status
    - Engineering Module exists,
    - Difference to flight: need to incorporate
      - some small fixes
      - replace Thermistor input sense circuits with RTD's where needed, waiting for final decisions by Lockheed
      - Replace 28V to 3.3V/2.5V converter for ACTEL with circuit used on Tower Power Supply (does power-sequencing as required, see GIDEP Alert by ACTEL)
    - Flight Schematic completion waiting for above
    - Need more documentation
    - Have enclosure with PDU DAQ board
  - Last Month
    - worked on more tests/debugging of firmware code, more testing of PDU, still working on incorporating the redundant PDU DAQ board in the prim/red PDU box
    - engineer produced schematic of cabling harness inside PDU, will be used eventually by assembly company to assemble PDU
    - also worked on conceptual design of test-box for flight acceptance testing
    - All active components were ordered (R's and C's left)
  - Concern
    - no technical concern, schedule looks ok, driven by need for test-bed and ISIS delivery, not LAT flight hardware delivery

Last Month's Accomplishment, GASU

- GASU
  - Function: global trigger, event builder, command-response unit, ACD control/monitoring/data-readout (all on one GASU DAQ PC board)
  - Status:
    - Hardware Engineering Module exists
    - Difference to flight:
      - need to incorporate some small fixes
      - replace 8 programmable ACTEL FPGA's with 8 flight one-time programmable (different pin-out)
      - replace commercial SRAM with flight SRAM (different pin-out)
      - Move some board connectors once internal cabling is finalized
    - Flight Schematic being updated for above (Joszef)
    - Need more documentation
    - Need to finalize internal wiring paths
    - Have enclosure with GASU board (but not all wiring, need wiring diagrams)
  - Last Month
    - Continued writing ACD EM section firmware
    - Wrote Trigger section firmware, started debugging on board, most critical since overall trigger latency is impacted by number of cycles taken in GEM (global trigger module)
    - Command-Response Unit section was debugged
    - Event Builder section code was reassigned to Eric Sisken (SLAC)
    - All active components ordered (or waiting for budget release)
  - Concern:
    - Schedule, not for flight, but for test-bed, ISIS, and ACD EGSE test-setup delivery
      - (2 engineers working on GASU were redirected to help TKR GTRC effort)
    - Trigger Latency (may be ok, but need verification what the final numbers are and compare to measurements of efficiency numbers of tracker)
    - Wiring inside GASU needs attention

Last Month's Accomplishment, GASU Power Supply

- GASU Power Supply
  - Function: Generate power for GASU DAQ board and ACD front-end electronics from 28V
  - Last month
    - Modified original supply to use circuit from Tower Power Supply (MAX724)
    - Difference to flight:
      - none
    - Flight Schematic final
    - In layout
    - All active components ordered (or waiting for budget release)
  - Concern:
    - none

Last Month's Accomplishment, TEM

- **Tower Electronics Module**
  - Function: control/readout/monitoring of TKR and CAL sub-system
  - Status:
    - Continue testing, still works including ASIC's
    - Schematic and layout is final
    - Difference to flight: none
    - Have enclosure with TEM integrated
  - Last month
    - Working on flight acceptance test scripts
    - Finalizing bid package/drawings for fabrication/assembly of qual/flight model
    - Started work on performance test/thermal cycle/vibration/TV test procedure documents
    - All active components and connectors ordered (or waiting for budget release)
  - Concern:
    - Schedule for flight: receipt of EEE components for TEM assembly

Last Month's Accomplishment, DAQ ASICs

- TEM Tracker Cable Controller ASIC (GTCC1)
- TEM Calorimeter Cable Controller ASIC (GCCC1)
- GLAST LVDS Translator Chip ASIC (GLTC2)
  - Status
    - Flight production is in packaging at ASAT (T25D wafers)
    - SEL/SEU testing done
    - Total Ionizing Dose testing is waiting for more packaged dies from lot
  - Last month
    - Started working on test board for dynamic burn-in
    - Fabricated board for performance/function test
    - Working on detailed screening documents for the 3 DAQ ASIC's
  - Concern:
    - None, unless flaw is detected while more testing is going on

Last Month's Accomplishment, TPS

- Tower Power Supply
  - Function: supply voltages to TKR, CAL sub-system and to TEM from 28V
  - Status:
    - Engineering module still in testing
    - Schematic of board looks final, incorporated small changes compared to last board
      - Fixed connector foot-print
      - Added Zener protection diode at TKR and CAL HV output
      - Added inverter in synch circuit
    - Need documentation, drawing package for flight RFP
  - Last month
    - Tests of engineering module on Cal/TKR engineering tower
    - Performance tests on bench
    - Modified schematic
    - Modified enclosure for TPS on order (EM1 model needed some changes due to final design of TPS board, cooling details)
    - All active components and inductors ordered (no transformers needed)
  - Concern:
    - Schedule for flight

Last Month's Accomplishment, SIU/EPU (1)

- EPU and SIU cCPI crate the same except
  - RAD750 boot code different
  - Storage Interface Card loaded different (no MIL1553 components loaded on board)
  - Status combined
- cCPI crate comprises
  - Enclosure
  - Backplane
  - LAT Communication Board (LCB)
  - Storage Interface Board (SIB)
  - Crate Power Supply Board (CPS)
  - Wiring

Last Month's Accomplishment, SIU/EPU (2)

- Enclosure (cPCI crate)
  - Received one, looks ok (fit-checked backplane, boards)
  - Additional ones for test-bed on order
- Custom Backplane
  - Backplane received/loaded, is in testing with LCB, awaits software, SIB card, BAE750
- LCB (Control/event interface from processor to LAT)
  - PMC card code was debugged further
    - EM1 version without command slave function (that part is needed when EPU's are added: not EM1, not EM2, but FU model)
  - cCPI version was further debugged (configuration part), still needs command/event path debugging
  - cCPI version schematic of board is being updated to include modifications from debugging
  - Need documentation, drawing package for flight RFP
- SIB (MIL1553 interface to Spacecraft, EEPROM storage for code, control circuit for VCHP heaters) (Done at Silver Engineering via NRL)
  - Reviewed document of flight SIB
  - Progress in layout
  - Worked on getting EEE approved, ordered several electronic components for flight, more to go
- CPS (Generate crate supplies (5V/3.3V) from 28V)
  - Debugged module, tested with backplane and LCB, all ok
  - Waiting until all boards including BAE750, SIB are integrated before flight fabrication

Last Month's Accomplishment, Misc

- LAT Point-to-point cables ("Harness")
  - Worked on cable assembly drawings
  - Started to add cable-ways on test-bed so one can fit cables
    - Need to make sure that it is ok with installation sequence during I&T
    - Need to finalize fly-away sensors and cabling since they live in same space
- Heater Control Box
  - Started schematic of Heater Control Box circuit

Last Month's Accomplishment, Simulator

- **Function:**
  - Simulates TKR and/or Calorimeter front-end electronics on test-bed, connects to TEM like subsystem and to PC (latter for downloading data-patterns)
- **Last month:**
  - Debugged TKR and CAL firmware code in simulator
  - Created list of modifications to update schematic before making 32 boards
  - Started to look at ACD simulator part

Last Month's Accomplishment, EGSE

- **Function:**
  - Provides test-setups for CAL, TKR, ACD, DAQ HW & SW effort
- **Last month:**
  - Ordered (to arrive at a total of 60 test-stands)
    - VME crates
    - VME single-board computers
    - VME SLAC custom transition board (boards and components)
    - Custom PCI Mezzanine Card (PMC) LCB's (boards and components)
    - Connectors for cables
    - TEM enclosures
    - Tower Power Supply enclosures
    - TEM printer-circuit boards
    - TEM components
    - 28V-power supplies
- **To do:**
  - Ordering Tower Power Supply boards and components
  - Test all LCB, transistion, TEM's, TPS's and integrate/test each system
  - Documentation of EGSE
- **Concern: man-power**

Last Month's Accomplishments, FSW (1)

- Customers for EM1, EM2, Flight Unit builds (each one has assortment of SW packages to be designed/tested)
  - EM1 (single-tower, single CPU):
    - for engineering tower -> I&T
      - Status: was used to take data (without problems in regards to flight software part, drivers)
    - EGSE test-stands
      - VME communication card based
        - » Being used for many months
      - PMC-version of LCB (plugs into PCI bus slot on VME processor in test-stands, replaces Com Card)
        - » Software driver exists, debugging in process (delayed due to hardware delay)
  - EM2: (multi-tower, single CPU)
    - For instrument simulator to be delivered to spacecraft vendor
      - Although not multi-tower, need EM2 functinality since GASU and PDU are part of ISIS
    - For ACD test-stand
      - Some EM2 functionality since need GASU to connect to multiple ACD front-end FREE cards

FSW LTX

- LTX (Package LTX)
  - Actively being used in the field
    - Boot code unit tests (NRL)
    - LCB driver code (SLAC)
    - LAT configuration
  - Bugs and usability features identified and a fixed as a result
  - User education also provided

  - To Do
    - Package is stable, anticipating only
      - Feature upgrades
      - Bug fixes

Command & Telemetry Database

- Three Pieces
  - Utility to capture the information
  - The information itself
  - Software to respond to telecommand / generate telemetry
- Utility
  - Prototyped a version allowing entry into a 'neutral' database
    - Can export in a variety of formats
      - ITOS
      - FSW version
      - Etc
    - Test version in ITOS format sent to NRL to try on the SIIS
- Information
  - Two extensives documents defining Telecommands/Telemetry for
    - File System / Memory Dumps / Task Status / Memory Usage
    - Critical Housekeeping information
- Software
  - Critical Housekeeping gathering/reporting in design phase
- To Do
  - Move utility from prototype to production quality code
  - Implement critical housekeeping code

LAT Configuration

- Software now exists to (Packages XLX, LATC)
  - Specify (in human readable form) a configuration, host side
  - Convert to an compressed, uploadable format, host side
  - Receive the compressed, uploadable format, embedded
  - Load the reexpanded configuration into the LAT
    - Complete path exists for the TEM
- Baseline version of the software tagged and released for use

- To Do
  - Add PDU & GDAB stuff; CRU, AEM, trigger configuration
  - Define internal LAT startup procedure
    - Power-on sequencing
    - Redundant path selection

LCB Driver/Hardware

- LCB advanced on 2 fronts
  - Hardware testing (covered previously)
  - Driver code
- LCB Driver Code (Package – LCB, formerly LIOX)
  - Created extensive suite of unit tests, cast into LTX form
  - Poll mode version of the driver, design begins
    - This is needed to boot the EPUs
  - GNAT reorganized (command/response code)
    - Anticipating the transition from COMM I/O → LCB as the physical communications layer
  - Retrofitted to use MSG facility to report errors

- To Do
  - Poll version of the driver
  - Complete the LCB code

GDAB Driver/Hardware

- GDAB (GASU stuff) advanced on 2 fronts Hardware
  - Driver code
- Hardware (Package TPG)
  - Provided a package to do Test Pattern Generation
    - For use by hardware engineers
      - We have an obligation to educate them on its use
- Driver Code (Package GDAB)
  - Converted code to
    - Use MSG facility for error reporting
    - Use LCB as the physical transport (from COMM IO)
    - LTX for unit testing

- To Do
  - Hardware test program

MISCELLEANEOUS

- Thermal Control System (Package TCS)
  - Problem scoped
    - Lockheed algorithm reviewed and understood
  - Draft of design document written,
    - Release to Lockheed for comment
  - To Do – Interaction with Lockheed, begin coding
- Front-End Simulator (Package FES)
  - TKR board capable of being
    - Downloaded
    - Delivering events
  - CAL/ACD Data Format Designed
    - Allows design of firmware to go forward
  - Board level configuration software designed & implemented
  - To Do – Continue firmware testing; adding components to system
- Boot Code
  - On-board use of EEPROM improved
  - Explored various software/hardware interactions
  - To Do, mature the code

Tool Set Upgrades

- Upgrading our tool set (thanks to new hire Kim Lo, with APW)
  - Transition to VxWorks 5.5 completed
  - Upgraded our underlying build tool (CMT) to latest version
    - Necessitated upgrading our wrapper on it (CMX)
  - Upgraded our code documentation tool (DOXYGEN)

Additional Tasks in next 3 Months

- Design Internal LAT Software Communication Protocols
  - Communication task-to-task and CPU-to-CPU
- Framework (mode control)
  - What commands can be sent in various modes
- EM1 packages have been tested, but no formalized reports
  - EM1 packages were extensively tested before delivery to I&T
  - Need to decide whether to assemble reports
    - EM1 is somewhat obsolete, but EM2 review may expect test reports
- Detailed Unit testing of EM2 packages (uses EM1 packages)
- Design Software watchdog
- Support test-bed effort with software

Key Miles Stones (1)

Milestone ID	Milestone Description	Current Date	new	Major Reqmnts to Achieve Milestone
7E45000610	LCB: (LAT Comm Board) EM (PMC Card)	11/14/2003	ok	Assemble and test first of 60 LCB cards for EGSE
7E45000630	LCB: (LAT Comm Board) EM (cPCI Card)	12/16/2003	ok	Assemble and test first of cPCI LCB
7E20008480	PDU: EM (non-flight FPGA)	11/14/2003	12/14/03	Finish VHDL code, debug, test with DAQ
7E52000670	SIB: Storage Interface Board EM (cPCI Card)	12/3/2003	ok	Finish Layout, Procure parts, fabricate PCBs, assemble, ready to test.
7E47200040	CBP: Crate Backplane EM	9/9/2003	done	Finish Layout, procure parts, fabricate PCBs, assemble, ready to test.
1M1001390	GEM h/w driver, final vers - to I&T Online	11/14/2003	Delayed 12/14 (need Huffer)	
7EN93B3110	FSW: EM1 Formal Test Complete	1/5/2004	ok	Finish all drivers and SW layer to I&T for single tower, single CPU
7EN94D0000	FSW: EM2 Peer Review	tbd		
	Power Supply Peer Review	9/22/2003	done	Finalize design, fab/load High-voltage prototype, produce docs
7E20001070	TEM: Pre-qual (w/ ASICs, all flight, exc. board mat'l, & ACTELs)	11/17/2003	done	Complete test of TEM w/ ASICs & Subsystem Electronics.
7E433E0000	TEM: EM2 to TKR	1/12/2004	ok	Packaging of ASICs
7E43320120	TEM: EM2 to CAL	11/17/2003	12/17, need ASIC's	Packaging of ASICs
7E65000200	TEM PS: Prequal	11/17/2003	Design done	Finalize design, fab/load , test
7EC2000040	GASU: EM	3/19/2004	ok	Running w/ AEM, GLT, Eventbuilder, Comand-Response Unit.
7EN94C3030	GASU: FSW Commanding (EM2)	12/15/2003	ok	FSW to control/readout GASU (more packages, Commanding is reference)
7E66000150	GASU PS: EM2 Available	2/4/2004	ok	
1M7941150	EGSE EM2 Release - to I&T	10/15/2003	check	

Key Miles Stones (2)

Milestone ID	Milestone Description	Date		Major Reqmnts to Achieve Milestone
7EA0000310	EGSE TEM (w/ ASICs) test-stands ready (with EM1 FSW)	11/17/2003	12/17, need ASCIs, enclosures	Order parts (CPU/VME crate/TEM's/TEM PS/Transition Boards/LCB's/cables/PC's/28-V supplies/TEM enclosures/TEM-PS enclosures and test modules/system. Depends on TEM ASICs and CPU delivery.
1M19500400	CU S/C Simulator - to I&T Online	2/2/2004	ok	
	Complete Order of All Components	November	ok	Order FU parts for TEM, LAT Com Card, Data CPU Backplane, GLT Electronics, SC Com Card, Event Builder PCB, Power Condioning Cards, and SIU Backplane.
7E74000150	Finalize All Enclosures	1/6/2004	ok	Procure parts for EM1. Complete Mechanical/Thermal Analysis of all Enclosures.
	Complete Mini-tower test support	10/15/2003	ok	

Manpower

- **Last Month:**
  - 3 new engineers started for FSW
    - 1 tools, 1 writing code, 1 documentation
  - Selected and added 2 technical writers
    - Writing test-procedures
- **To do:**
  - Investigate additional EGSE man-power needed to support hardware and software effort
  - Investigate additional manpower for software system testing (not unit-testing since that task was taken over by existing staff by adding 3 engineers above and reallocating tasks). However the question is funding

Schedule/Budget

- Total budget: $16,672
- Work Scheduled up to date: $7,580
- Work Performed: $7,142
- Actuals: $7,790
- Schedule Variance $438k
  - Mainly because test-bed actuals (600k) were due last month, but only started to order components for test-bed
- Cost Variance: -$648k
  - Mainly because BAE required 30% down payment ($550k), in PCMS only planned to have actuals at delivery