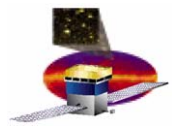**Gamma-ray Large Area Space Telescope**

GLAST Large Area Telescope

Instrument Flight Software
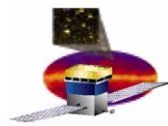
LAT Monthly
Mar 30, 2006

Dick Horn

Final FQT Closure Plan - Overview

- **Currently 0-6-6: 149 of 183 requirements**
  - **Several bugs driven out during commissioning effort on the LAT**
  - **Still several issues being worked that are likely FSW bugs**
  - **After bugs fixed this will give us the core FSW to support shipment to NRL**

- **Impacts to Release 0-7-0 Target For Formal FQT - 173 of 183 requirements**
  - **Swain/Russell/Maldonado largely supporting commissioning effort**
  - **Although progress made on planned added functions: GRB response, Gamma, CNO, Cosmic filters need to complete unit test and test script development**
  - **Low risk to defer to delta-FQT, will discuss more at TRR**

- **Release 1-0-0 target for delta-FQT - 183 of 183 requirements**
  - **ECD: POST NRL Ship, Need science closure**
  - **Added function: GRB detection, data compression**
  - **New scripts: GRB detection, FSWSTD → 57/57 total scripts**
  - **Additional requirements verified**
    - **5.3.10.2 LAT GRB Detection**
    - **5.3.10.2.1 GRB Location Accuracy**
    - **5.3.10.2.2 Modification of GRB Criteria**
    - **5.3.11.3.3 Process Attitude Data**
    - **5.3.11.5 LAT Closeout to GBM**
    - **5.4.1 System of Units**
    - **5.4.2.1 LAT Coordinate System**
    - **5.4.2.2 Observatory Coordinates**
    - **5.4.2.3 Celestial Coordinate System**
   - **5.4.3 Resource Margin**

Summary of FSW Current Status

Current Status	Liens	Impact/Risk
• **Core Software Complete** Core functionality to complete all calibration and system test requirements	• **Minor Bugs/Fixes via Commissioning Effort**	• **Complete bug fixes as minimum entrance criteria** **ECD : 4/7/06**
• **GRB Interface Functionality** • **CNO/Alignment Filters** Initial functionality complete	• **VSC Support for LAT GRB commands** • **Complete Unit Testing** •**Test-bed Environment For Filter Tests**	• **Commissioning effort given higher priority** • **Low risk to defer to Δ-FQT if required**
• **GRB Detection Algorithm** • **Software Standards** Deferred to post shipment to NRL	• **GRB Detection Algorithm Requirements ECD 1 May 06** •**Verification of Software standards awaiting final code base**	• **No risk to LAT functionality or schedule** • **Current code base meets software standards** • **Target Δ-FQT complete prior to TVAC (June 06)**
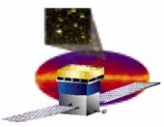
Schedule

30 March :   Test Readiness Review (TRR)
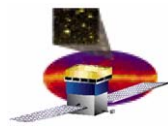10 April :   Close all required action items
7 April :   Target FSW build
1-10 April :   Script Dry Runs/Closure
11-14 April :   FQT
17 April :   Post Test Review (PTR) –
1 May :   GRB Detection Algorithm Requirements
1 June :   Build V1-0-0 for $\triangle$-FQT
 8 - 9 June : $\triangle$-FQT
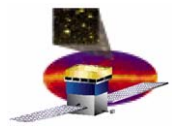
Test Stand Fidelity

- **The FSW test program has been very successful in driving out FSW system errors for the vast majority of FSW functions, However,**

  – **Commissioning effort on LAT has exposed some FSW errors that were not caught in unit or FSW system test**

  – **These errors are largely related to gaps in test environment**

- **We have started the process of understanding the gaps**

  – **Near term: To understand how to better use the capabilities we have**

  – **Long term: To look for ways to enhance our ground test capability to support on-orbit FSW maintenance**

Test Stand Environments

Functionality	Testbed	Uber Teststand	Multi-crate + Dalek	VSC, lat-elf15,20	Mini-LAT
GASU (P/R)	yes	yes	yes	no	yes
PDU (P/R)	yes	yes	no	no	no
SIU (flight crate or VME crate)	flight	flight	VME	flight	VME
EPU (# of crates, flight or VME)	2, flight	2, flight	2, VME	no	1, VME
TEM (# of TEMs available)	16	no	1	0	1
Heater Control Boxes (P/R)	yes	no	no	no	no
ACD FREE P/R (# out of 12)	2	0	2	0	2
TKR Front End Registers	no	no	yes (full)	no	yes (partial)
CAL Front Ends Registers	no	no	yes (full)	no	yes
Tracker strips	no	no	no	no	yes (partial)
Calorimeter logs	no	no	no	no	yes
ACD tiles	no	no	no	no	yes (partial)
VSC (sci, discr, 1553, 850IO) P/R	yes	yes	yes	yes	yes
VSC 468IO Board (S/C meas temps)	no	no	no	no	no
RBPU	yes	no	no	no	no
UBPU	no	no	no	no	no
Front End Simulators	yes	no	no	no	no
FSW build (autoboots from ee0)*	yes	yes	no	no	no

Test Stand Functional Capabilities

Hardware	Functionality Provided	Testbed	Uber Teststand	Multi-crate + Dalek	VSC, lat-elf15,20	Mini-LAT
16-tower DAQ (TEM/PDU/GASU/SIU/EPU/HCB/VSC/FES)	LAT/SC interface, 1553, Power On/Off, file upload, memory read/write, SIU reset, Boot telemetry, LHK, VSC telemetry, science modes, thermal control, LAT Configuration (LATC), datataking (filter), power consumption, current transients, input impedance, T&DF data transport errors	X				
Flightlike Dataflow system (PDU/GASU/SIU/EPU/VSC)	SC-LAT 1553 interface, file upload, memory read/write, SIU reset, boot telemetry, LHK, science modes, thermal control, configuration, datataking, T&DF data transport errors	X	X			
Dataflow system (GASU/SIU/EPU/VSC)	LAT Configuration (LATC), datataking, T&DF data transport errors	X	X	X		X
SIU (flightlike) + VSC	1553, file upload, mem read/write, SIU reset, boot telemetry	X	X		X	
ACD FREE	Charge-injection calibration, LAT Configuration (LATC)	X		X		X
TKR/CAL Front End Registers *	Charge-injection alibration, LAT Configuration (LATC)			X		X
Tracker strips/Calorimeter Logs/ACD tiles *	Charge-injection calibration, LAT Configuration (LATC), muon runs and general datataking, T&DF data transport errors					X
FSW build (autoboots from ee0)**	Autobooting	X	X		X	

An X means the teststand provides the functionality shown.

All teststands support both the primary and redundant sides of the LAT, except with respect to the SIU. Only primary SIUs are available on teststands.

* Mini-LAT has full Cal EM but does not contain a full set of front-ends or a full tower's worth of strips and tiles

** B0-6-6 is loaded into the SIB EEPROMs on the testbed and uber. For all teststands, it is possible to load B0-6-6 using serial/ethernet
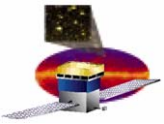
Current Summary

- **Core FSW functionality is well represented in a system environment on test bed**
  - **DAQ interaction and supporting FSW has been flawless on the LAT as a result (e.g. processor communications)**
- **Minor shortfalls exist in full interaction with sensors and front end registers due to limited availability of front -end components**
  - **FES provides science data inputs but falls short of real life interaction with front end**
  - **Need to use single tower representations and scale test scenario to full LAT**
  - **Has led to a small number of system issues (e.g. charge Injection functionality)**
- **Based on the lesson's learned to date**
  - **Once debugged the front end interaction should remain stable, i.e. not be a subject of significant FSW maintenance**
  - **Enhancements to housekeeping telemetry to add key register error states would improve both LAT and test bed insight (In work now)**
  - **More thought required post system test to assess cost/benefit of further test bed enhancements for FSW maintenance**
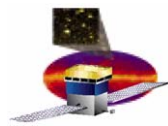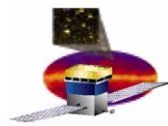
Script Status (1)

Test Script (in priority and planned execution order)	Test Procedure Document (LAT-TD)	Formal Dry Run Against Specified Release
FSW Initialization		
FSWINI_001: SIU primary boot	7132	0-6-1
FSWINI_002: Boot self-test	7133	0-6-1
FSWINI_003: Multiple boot images	7134	0-6-1
FSWINI_004: SIU hardware reboot in response to signal on the discrete lines	7135	0-6-1
FSWINI_005: EPU primary boot	7136	0-6-1
FSWINI_006: Reset source	7137	0-6-1
FSWINI_007: Storage and retrieval of system errors during SIU primary boot	7138	0-6-1
FSWINI_008: Storage and retrieval of system errors during EPU primary boot	7139	0-6-1
FSWINI_009: SIU boot status on discrete lines and SIU boot housekeeping telemetry	7140	0-6-6*
FSWINI_010: SIU and EPU secondary boot	7141	0-6-1
FSWINI_011: SIU and EPU secondary boot error mitigation	7142	0-6-1
FSWINI_012: SEU protection	7143	0-6-1
FSWINI_013: Memory scrubbing	7144	0-6-1
FSWINI_014: Watchdog management during boot	7145	0-6-1
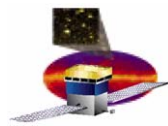
Script Status (2)

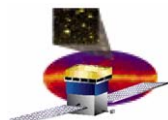| Test Script (in priority and planned execution order)	Test Procedure Document (LAT-TD)	Formal Dry Run Against Specified Release
Command Functional		
CMDFNC_001: Soft reset	6995	0-6-1
CMDFNC_003: 1553 interface and command functional verification	7164	0-6-1
Narrowband Telemetry Verification		
NBTLMV_001: Housekeeping and low-rate science	7129	0-6-1
NBTLMV_002: Diagnostic telemetry	7130	0-6-1
NBTLMV_003: ACD HSK anomaly response and alert telemetry	7160	0-6-1
Configuration (nominal)		
SIUCFG_001: LAT subsystem data collection	7051	0-6-1
SIUCFG_002: LAT subsystem configuration	7052	0-6-1
File Management		
FILMGT_001: File management	7158	0-6-1

Script Status (3)

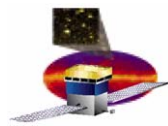| Test Script (in priority and planned execution order)	Test Procedure Document (LAT-TD)	Formal Dry Run Against Specified Release
Operational Modes		
OPMODE_001: Mode control	7161	0-6-1
Front-End Calibration (Charge Injection)		
FECALB_001: TOT measurements	7152	0-6-6
FECALB_002: TKR Threshold and charge scans	7153	0-6-6
FECALB_003: TKR Trigger check	7154	0-6-6
FECALB_004: ACD CI	7155	0-6-6
FECALB_005: CAL CI	7156	0-6-6
Event Performance Monitoring		
EVTPMO_001: Deadtime	7054	0-6-6
EVTPMO_002: VETO rates from GEM	7055	0-6-6
EVTPMO_003: L1 Trigger Rates	7056	0-6-6
EVTPMO_004: Monitor CNO Rates	7057	0-6-6
Filter		
EVTFIL_001: Interface from the Event Builder	7112	0-6-1+
EVTFIL_002: Rates and capacity	7113	0-6-1+
EVTFIL_003: Reprogramming	7114	0-6-1+
EVTFIL_004: Filter bypass	7115	0-6-1+

Script Status (4)

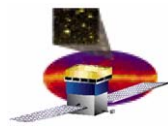| Test Script (in priority and planned execution order)	Test Procedure Document (LAT-TD)	Formal Dry Run Against Specified Release
Wideband Telemetry Verification		
WBTLMV_001: Science data format and volume	7157	0-6-6*
Memory Management		
MEMMGT_001: Memory managment	6994	0-6-1
MEMMGT_002: Memory load data	7159	0-6-6*
Time Processing		
TIMPRC_001: Time Services	7053	0-6-1

Script Status (5)

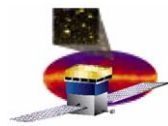| Test Script (in priority and planned execution order)	Test Procedure Document (LAT-TD)	Formal Dry Run Against Specified Release
Interface formats		
IPCFNC_001: Inter-processor communications	7050	0-6-1
VSGIFV_001: Discrete Signal interfaces	7163	0-6-6*
Thermal		
THRMCS_001(2): Thermal control system	7162	0-6-6
THRMCS_002(1): Thermal control system - Heater Algorithm		0-6-6

Script Status (6)

Test Script (in priority and planned execution order)	Test Procedure Document (LAT-TD)	Formal Dry Run Against Specified Release
Diagnostic functions		
DCMODE_001: ACD Diagnostics and Calibration	7126	
DCMODE_002: CAL Diagnostics and Calibration	7127	
DCMODE_003: TKR Diagnostics and Calibration	7128	0-6-6*
DCMODE_004:	7128	
GRB		
GRBPRC_001: delta		
GRBPRC_002		
GRBREQ_001		
GRBREQ_003		
GRBREQ_004		
GRBREQ_005		
FSW Standards		
FSWSTD_001: Units		
FSWSTD_002: Coordinate Systems		
FSWSTD_003: Resource Margin		

JIRA Metrics

JIRA Metrics as of 29 March 2006

Open Issues

 1 – Critical/Blocker
10 - Major
18 - Minor
18 - Trivial/Deferred