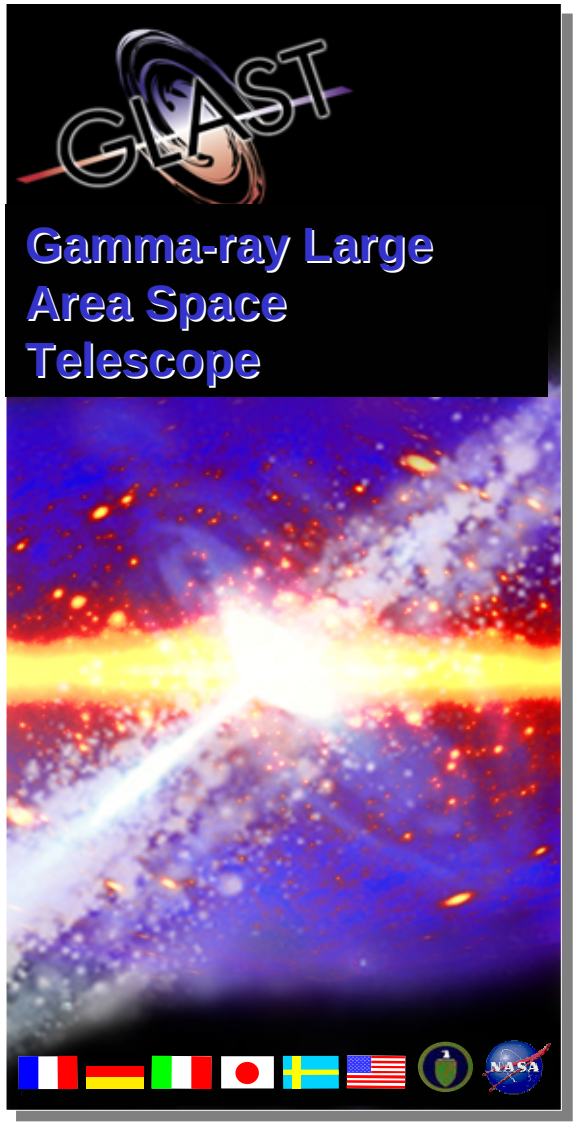


# GLAST Large Area Telescope:

## I&T Integration Kickoff Meeting
## Online

## March 9th, 2004

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# GASU support

- **Trigger interface**
  - The trigger interface API is described in "LAT-TD-???? GASU based teststands and the ACD v1.0 - First public draft". 1/3 of the Online group's resources are fully devoted to implementing this API, migrating LATTE to its use and testing it. As of February 18, 2004, much of the implementation work is currently complete. LATTE migration and testing is still to be done.
- **ACD script migration**
  - As part of the testing of the Trigger interface, we plan to convert a version of the ACD scripts to the new triggering technique, supplied by the ACD EGSE group. This process will also provide examples for the ACD group to work from for future scripts.
- **EBF package update**
  - The EBF package is used to parse event data, typically read from data files or the LATTE event data stream. This package is exported to SAS and others for use in reading data files for analysis. With the arrival of the GASU, the event format will change due to the addition of a contribution to the event from the GEM (trigger information).
    Since both GASU-based teststands and mini-GLT based teststands will exist at the same time, the EBF package has to support event data formats generated by both types of teststand. In addition, the EBF package must support prior event data formats so that already existing event data files can continue to be processed.
    The EBF package is provided in two forms: The first is as a library against which C++ code is built and the second is as a library against which Python code is run. The Python interface is implemented using a third party package called SIP. SIP has recently undergone an API change. The old API is still supported but will go away at some point.
    As of February 18, 2004, much of the implementation of the new format support is complete. What remains to be done is the support of the previous event format and implementation of the Python interface. A choice must be made whether to upgrade to the new SIP API or stay with the old one, realizing that the migration to the new interface will have to happen at some point. An analysis must still be made to determine how difficult the migration will be.

# Hardware monitoring system

- In LATTE releases up until now, the hardware monitoring system is tightly coupled with the Run Control system. In this situation, the system issues register commands to the hardware via a commanding client/server. This impacts system performance, both CPU-wise as well as network bandwidth-wise. Additionally, whenever the Run Control system isn't running, the hardware isn't being monitored. This is not acceptable when working with flight parts.
- To make a system that constantly monitors the hardware whenever it is powered up, a process must be running on the host computer whenever it is powered up. This process must be started when the host boots. The system must be independent of Run Control and other processes running on the host. To achieve this, a housekeeping server running on the VxWorks SBC and a corresponding housekeeping client running on the host computer is envisaged.
- The FSW group has described a design for a housekeeping system in a document called LAT Housekeeping (no LAT-TD-XXXXX assigned). To meet the July deadline, I&T will need to have (perhaps a degenerate portion, e.g., 1 tower, of) the system implemented in the April to May timeframe in order to meet the V&V phase of the plan. The Online department expects that the FSW group will supply the server portion of the system and the appropriate packet decoding tools. The Online department will provide the client side that allows:
  - conversion to engineering units
  - trending
  - logging
  - limit checking
  - alarm handling
  - alert generation
- The client will repeatedly try to establish a connection to the server whenever one doesn't exist. Whenever the VxWorks crate is powered off, the client will be polling for a connection. As soon as VxWorks boots, the server will start and the connection will be established. At that point the hardware will be monitored.

# Power-up sequence

- The Power-up sequence is controlled by the PDU. Flight Software will provide the software to interact with the PDU upon a start-sequence command from LATTE. LATTE will report sequencing failures. The work involved on the LATTE side is not expected to be a big deal. However, the requirements on FSW need some investigation.

# Event prescaling in VxWorks

- LATTE, as a DAQ system, is performance limited by network bandwidth constraints. The LAT instrument is required handle an average L1 trigger rate of 10 KHz. This rate is greatly reduced to allow data transmission to the ground through on-board filtering. There is no requirement to sustain collection of a 10 KHz event rate from the LAT. None the less, an average 10 KHz trigger rate must be demonstrated and tested to ensure that the electronics responds correctly and within the tolerable error rate. Without having the completed flight software available, this can be achieved by not passing every event to LATTE.
- Currently, the LATTE system supports the ability to transmit all the data from the VxWorks SBC or only the data containing errors, to the Run Control system. In the first case, deadtime will be introduced (trigger rate reduced) when the system saturates. In the second case, the trigger rate is allowed to increase arbitrarily providing that the error events don't saturate the system. The disadvantage of this second case is that it doesn't allow for monitoring the quality of the data passing through the system. It is therefore prudent to introduce a way of prescaling the transmitted events so that spot checking is possible.
- Another method to improve event data throughput is to implement event batching, described below in section 7.3.

# Subsystem scripts

- Subsystems are expected to provide their scripts to the Online group prior to the V&V phase of the plan. At least a couple of months are required to complete V&V, so this implies that subsystem scripts are ready in the April time frame. Scripts are expected from:
  - ELX
  - CAL
  - TKR
  - ACD
  - I&T
- The scripts are outlined in "LAT-TD-02834, GLAT LAT I&T Testing Requirements Document". The I&T scripts are to be provided by the Online department. These constitute the "system" tests that cover inter-subsystem interactions.
- Prior to release, the Online department will ensure that the scripts conform to I&T rules so that uniformity of the operator interface is maintained, the correct output files are produced, etc.

# Security against unauthorized software changes

- The Online department will implement techniques for ensuring that no deviances from released software can be run against flight hardware. LATTE currently recognizes when changes to the core software have been made and records that information in the run reports generated with each test. This will be extended to cover the released scripts. In addition, a command line option to Run Control will provide the ability to disable features of the system, such as loading arbitrary scripts and bringing up some GUIs. Permissions will be set up on the testing computer such that operators log into a captive account in which they will not be able to modify any files, including the batch file that launches Run Control.
- Making this entirely bullet proof may be a difficult task, especially in a culture in which this sort of thing is like presenting a red flag in front a bull. However, detecting and recording that a breach has is not that difficult and is largely in place already.

# Security against operator complacency

- Operators will be required to sign off on any inputs they provide to the system by giving their private password. This still needs to be implemented.

# Operator training

- Once the system has more or less settled to its final form, an operator training program will be set up. This is to avoid key steps from being omitted, as happened during EM-1.

# Building 33 EGSE room 102 set-up

- We plan to set up the EGSE room in building 33 with two computers and four LCD screens. One computer will be the machine from which the tests are carried out. It will run Run Control and the test scripts. Its two screens will display the Run Control GUI, the HippoDraw GUI for visualizing data collected by the scripts and the electronic logbook. The other machine will be an observer computer that receives data from the data taking machine for opportunistic display, e.g. GOSED, the single event display. It will also be used to display the hardware monitoring system data.
- Details of this still need to be worked out.

# Release mechanism for subsystem test scripts to I&T

- **The subsystem scripts will be configuration controlled with cvs and released to the IFCT department computers for I&T testing by trained operators. The configuration control system and release process are already in place since similar techniques are used for LATTE itself.**

# Electronic logbook

- An electronic logbook has been developed that uses the SLAC Oracle database. It is web-based and was used during the EM-1. A standalone version based on a MySQL database and Online's GUI tool Qt is currently being implemented. This allows electronic logbook use without there having to be a network connection to the central database. The standalone logbook works together with Run Control to be able to display the results from tests together with operator comments in real time. At any time later, the contents of the database can be exported to a file and then imported into the central database, thus providing the complete record of testing activity back at the ranch.

# OPUS and the paper trail

- OPUS is a tool provided by the SAS group for automating tasks. The Online department intends to use it for moving run-associated files off of the staging area on the testing computer to the official archive and for loading run information into the central log book. SAS and/or SVAC will use it to process the test data.

# Validation and Verification

- The validation and verification process will require a fair bit of time to explore the various situations that LATTE may find itself in. During EM-0 we spent 6 weeks to 2 months discovering all sorts of issues with both hardware and software. The system has grown since then, but so has our familiarity with it. In addition, there are currently many more users of the system that help us shake the system out. Therefore, a rough guess at the time to do the V&V process is two to three months.

# Documentation

- Documentation has been lacking due to the Online departments efforts to provide subsystems with the features they need to do their jobs. We have redoubled our efforts to add to the documentation by inserting Doxygen comments into the code (describes the API) and adding to the Online System User's Guide (no LAT number assigned, yet). Much more work is to be done.

# Bonus work

- **This section describes work that would be nice to get into the Flight Qualified release.**
  - **Test suites**
    - A test suite is a set of test scripts or other suites that can be run under the control of LATTE. A suite invokes scripts or other suites sequentially. Given that suites can invoke other suites, the concept of nested scripts is provided.
    - The implementation of test suites was done as an afterthought and in a hurry to support CAL. This code really needs to be revisited to verify that it meets all the requirements and to improve its implementation. The Finite State Machine should be used to sequence the steps of each individual test in the suite. Functionality must be provided to allow aborting of any or all of the tests in the suite.
  - **Event display**
    - The event display tool the Online department has available now (GOSED) displays event data for only one tower. Diagnostic and error data from the tower contributions are not yet provided. The ACD is only beginning to be supported. The GEM (trigger) contribution is currently not yet displayable, mostly because of section 6.1.3 above not being completed. It is quite likely that some form of ACD display will be ready by July.
  - **Event batching**
    - Batching up events into larger packets will make those packets more efficiently transmittable over the Local Area Network between the VxWorks SBC and the host computer. This would allow higher rates of event data to be logged, although not an average rate of 10 KHz of realistically sized events (10 KHz * 2 Kbytes/event * 8 bits/byte = 160 Mbits/sec which is greater than the 100 Mbit/sec network links we have available. Gigabit Ethernet might be an option but would cost much more work. Secondly there are CPU constraints and disk write rates to consider.). Implementing a batching algorithm should not be too terribly difficult (shoulda done it to start with), but may have some repercussions downstream (the Run Control system). The EBF package to parse data already supports it. Since batching is not a requirement for hardware check-out, this item is listed as a bonus.

# Background work

- **This section describes background work that must go on despite the preparation and maintenance of a Flight Qualified release. It may well mean that the Online group will be forced to prepare and maintain a separate release branch to support these activities. This is a condition that we would like to avoid due to the confusion that is likely to result. Maintaining multiple releases is nasty business.**
  - **ELX support**
    - The Electronics group will be releasing new hardware in the coming months. The Online department will need to support interface additions so that the parts can be tested.
  - **FSW support**
    - The Flight Software group will be releasing new software in the coming months. They will also be informing the Online group of format and protocol changes that LATTE will need to support. As well, as we move closer to the flight interface, LATTE will need to be able to communicate with the SIU through the SIIS. This work is by and large orthogonal to the preparation for testing in Building 33, but will take time from the Online department's resources.
  - **ACD, CAL and TKR support**
    - ACD, CAL and TKR will continue to demand bug fixes and features to be added to LATTE until they get into flight hardware production. The Online department will need to support these requests.