GLAST USERS' COMMITTEE MEETING OF OCTOBER 22-23, 2003

Comments Collated by David Band

1) Purpose

The GLAST Users' Committee met for the first time October 22-23, 2003, at Goddard Space Flight Center. At this meeting members of the GLAST mission presented the mission's science goals and plans to serve the user community. Members of the Users' Committee reacted to these plans both during the meeting and in comments sent in afterwards. In this document I first summarize these comments, and then present the written comments topically. In many cases I present relevant additional information.

2) Summary

The general consensus of the Committee was that our planning for supporting the user community is remarkably mature for three years before launch, although concern was voiced about implementing these plans. Also, the committee appreciated the thorough presentations.

Usually the data policy is the most contentious issue that a Users' Committee addresses. There was little disagreement with the fundamental policy that after the first year the data are essentially open to all scientists. Alan Marscher advocated restricting the data to scientists who justify their access to the data by writing an abstract about their intended use of the data; he worries that there are scientists who will analyze public data based on the ideas in posted proposal abstracts. This concept was considered at one time but dropped. Since we anticipate that survey mode will predominate, data accumulated early in the mission will be similar to later data, and therefore restricting the data to "qualified investigators" should be for the entire mission. To analyze a source an investigator will need the LAT data from a good fraction of the sky, and with a few sources the investigator will need access to the entire database. To implement Marscher's proposed approach the qualified investigator policy would require the LAT data be closed to the general public for the entire mission. Paul Hertz stated that this would be contrary to NASA policy.

Much discussion was aroused by the question of whether an honor statement should state that the projects (i.e., the ideas) of accepted proposals are proprietary. The consensus appears to be that while such a statement has merit, it would be unenforceable and difficult to apply, and therefore should be not be adopted. This is similar to the recommendation of the GLAST Science Working Group. Reshmi Mukherjee suggests that since the data will not be proprietary, and the honor statement is unworkable, the abstracts should be proprietary for one year.

Committee members were concerned about the instrument teams' workload during the first year; beyond calibrating the LAT, the LAT instrument team is expected to produce a preliminary point source catalog midway through the first year in support of the second round of GI proposals. Dave Bertsch and Reshmi Mukherjee were particularly concerned about the small number of GIs during the first year skimming the cream off the LAT observations while the instrument team struggles with understanding their instrument. Bertsch advocates canceling the first GI cycle, and lengthening Phase 1 during which the data are proprietary; Mukherjee and Rene Ong also suggested canceling the first GI cycle. Note that there will probably be Cycle 1 proposals that will not request access to LAT data. The committee favored a plan in which Phase 1 GIs collaborate with the instrument teams, if appropriate; the level of support the GIs will provide should be a criterion for deciding among proposals. This issue will require further discussion at the next meeting.

The Committee was generally satisfied with the conception of the GI program. Mark Strickman was concerned with funding-only proposals for the analysis of non-proprietary data: what if someone else performs the research before the successful GI? Note that *CGRO*'s GI support of BATSE research was almost exclusively funding-only. Currently one year-only Key Projects are envisioned, and the only difference in the treatment of regular and Key Project will be the size of the grant. Roger Brissenden advocates making such projects multi-year.

Many committee members felt strongly that the size of the average GI grant will be too small, perhaps by a factor of two! The comments indicated that the GI program should be better funded rather than decreasing the number of accepted proposals to increase the average grant size. However, the sense at NASA Headquarters is that any additional funding over that already in the budget is most unlikely. A better approach would be to coordinate with the DOE, which also will be providing substantial funding during the operations period.

At the meeting many committee members questioned the assumption that survey mode will generally be the most efficient observing mode and will therefore predominate in Phase 2. In his comments Olaf Reimer supports this assumption. If this assumption is incorrect then we may need to limit the pointed observations for operational reasons. If this assumption is correct, the NRA should state and explain the preference for survey mode. The proposal cover sheet should include a box for the proposers to accept survey mode observations instead of pointed observations. We had not prepared a presentation on our studies comparing survey and pointed mode for the first meeting, but will draft a white paper on the issue, and report to the committee at a future meeting.

Both Mark Strickman and Roger Brissenden advocate that dedicated calibration observations should be scheduled periodically. At the meeting Strickman pointed out the importance of calibration observations, especially after LAT components fail, but also for normal observations as well. Note that the LAT has a special mode where the onboard filtering of non-astrophysical photons is turned off for short periods of time, allowing a

better understanding of what is being filtered out. Running in this mode periodically is planned.

Roger Brissenden also advocates setting aside ~5% of the observing time as Director's Discretionary Time. This has been valuable for HST and Chandra.

The committee was impressed by the early definition and development of a single analysis environment, although members are concerned about its successful completion. There is a general understanding that analyzing LAT data is a difficult problem, and therefore good LAT-specific tools are essential. Many committee members want to beta-test the tools. Clearly a more comprehensive report should be made at a future committee meeting.

Roger Brissenden suggested that we survey the users regarding their preferred operating system. Currently only Windows and Linux will be supported, although we assume that once the tools work on Linux, we can easily port them to any Unix platform.

Rene Ong was concerned about the number and choice of sources that will be monitored. The Science Working group decided that the LAT team (which will perform this monitoring, at least during the first year) should not be overly burdened by a large list. More details on the monitoring program will be presented at a future committee meeting. Ong was also concerned that multiwavelength observations are not being adequately addressed. Dave Thompson is the liason with the AGN observer community, while Steve Thorsett is responsible for organizing the radio pulsar community's determination of pulsar ephemeredes. Swift will have fostered ground observations of burst afterglows; note that the GLAST and Swift mission teams overlap. We will report on GLAST's connection to multiwavelength observations at a future meeting.

Jim Ling advocated a GBM sky survey using occultation steps, as was done by BATSE. The GBM funding is insufficient for such a survey, but GI program funding could be proposed.

Finally, Roger Brissenden addressed various issues in the development of GLAST's ground system. I have forwarded these suggestions to the Ground System/Operations Manager.

3) Action Items

The following are issues that were raised in the comments or during the meeting. In some cases there appears to be a consensus, but such a consensus should be ratified at a future Users' Committee meeting.

a) Should the 'qualified investigator' concept be revived?
b) Should there be an honor statement regarding accepted GI projects?
c) Should Phase 1 be lengthened?

d) Should Phase 1 GI projects analyzing LAT data be eliminated?
e) What are the expectations of Phase 1 GIs analyzing LAT data?
f) Should funding-only GI projects be funded if someone else performs the research before the successful GI?
g) Should Key Projects be multi-year?
h) Should additional funding for the GI program be requested?
i) If the GI program budget is fixed, should the number of accepted proposals decrease to increase the grant size?
j) How should the GI program be coordinated with DOE's support of data analysis?
k) Summarize studies comparing efficacy of survey and pointed observation modes in a 'white paper.'
l) Should guidelines be established as to the fraction of the observing time which can be pointed?
m) Should proposers be allowed to request that their proposal be considered with survey mode substituted for pointed observations?
n) Develop a plan for dedicated calibration observations.
o) Should there be Director's Discretionary Time? If so, how much?
p) How are decisions made about changing observing constants such as the length of the autonomous repoint after a burst?
q) Develop a plan to familiarize the Users' Committee with the analysis tools through demonstrations and beta testing.
r) How will the correct operation of the data processing pipelines be verified?
s) Survey the user community for preferred analysis platforms.
t) The reading of GLAST FITS files should be tested with different software libraries (e.g., the IDL FITS library).
u) Should a GBM sky survey be supported, and if so, how?
v) Should the decisions of the yearly timeline committee be solely technical, or should it have the power to drop proposals that do not fit into the timeline?
w) Presentations at future Users' Committee meetings:
    i) Results of survey vs. pointed observation modes study.
    ii) Detailed description of analysis environment.
    iii) Details of source monitoring program.
    iv) Connection to multiwavelength observations.

4) Comments

The written comments are presented topically, with the committee member identified at the beginning of his comments.

General Assessment

Mark Strickman—As an overall comment, it seems to me that the GLAST program is well ahead of the curve in terms of development of data handling software and procedures, both pipeline processing and user analysis systems. The fact that the program is having a relatively comprehensive data challenge more than three years before

launch, and that the data challenge includes science analysis in addition to pipeline processing, is particularly impressive.

Rene Ong—Taking a broad perspective, it appears that the core topics that are of concern to the user community are being well addressed. Clearly, some of the plans are not fully formulated (and some are not even in the development stage), but the key thing is that the overall plans look sound, the major issues have been identified, and the work to address these issues is starting. The major concern associated with the overall picture is one of the timetable - some of the milestones appear to be quite difficult to achieve (more on this later).

Roger Brissenden—The GLAST Program is doing the right things in preparing for science operations and user support. I was impressed by the technical depth of the team, the ownership showed by presenters and by the material presented. Given the role of the Science teams in operations the integration of the GSSC and IOCs is especially important. The Program is aware of the criticality of this interface and management should continue to pay close attention to this. The plans for the GI program, processing, archiving and data analysis software are generally mature for this stage of the mission's development, and are clearly based on experience with other missions and lessons learned. I reviewed the PDMP (draft version 14, 10/10/03) and have no major comments. Overall the plan look sound for this stage and it appears ready for an initial draft submission. The Program may choose to incorporate some changes to the PDMP based on the User Committee feedback. The team is likely to have a challenge implementing all the plans described given their resources and so prioritization will be required.

Reshmi Mukherjee—Although there are still many open issues, the GLAST team is clearly taking the right approach in getting ready for science operations and GI support. Getting input from a Users Comm. at this early stage is important. It is a great idea to solicit feedback from other science users via the users committee members.

Data Policy—General

Rene Ong—This is obviously a bit of sticky issue because of the nature of GLAST and the historical way in which data rights have been associated with specific sources or regions of the sky. Although I applaud the general sentiment of the "strawman" proposal for data rights, as presented by J. Ormes (namely the "Honor System" or "Hippocratic Oath"), I believe that such a policy will be difficult to explain and rather impossible to enforce or monitor. Thus, I personally support a completely open policy with NO data rights whatsoever. For a rather unique instrument like GLAST, this will probably be the only way to go.

Mark Strickman—As I understand it, the biggest general issue to come out of the meeting involves the "unproprietary" nature of the GLAST data. On reflection, I wonder if we are overreacting to this issue. By making the data publicly available from the outset, we are implicitly saying "make whatever (scientific) use of this resource that you want." That given, it's not clear to me that the whole issue of "protection of ideas" is as

large a problem as first thought. Whereas any system will have its abusers, most abuse in our field probably involves access to data that the investigator should not have. Most astronomers would rather apply their own ideas to what the data mean rather than copying someone else's. Their goal is to get their ideas out in the public domain with their names on them. Whereas a GI proposer should have some expectation that no one else will plagiarize his work, in this environment he does not have any guarantee that no one else will either a) independently come up with the same idea or b) develop a competing idea using the same data. And proving otherwise would be almost impossible. So I propose that we don't worry too hard about it. Maybe this scenario is naïve, but I think it is supportable. No matter what scheme we use (honor system, signing a release, etc) we cannot guarantee that there won't be abuse. However I suspect the number of incidents will be small enough that they shouldn't necessarily drive the whole system.

Alan Marscher—I feel strongly that GLAST should adopt a policy similar to that of NRAO and other observatories: people who want access to the data should be required to write an abstract that is reviewed for conflicts with regularly approved programs. Otherwise, if someone doesn't need money, they can go the lazy route: don't submit a proposal, just comb through the titles and abstracts of approved programs, steal the ideas, fetch the data, and publish ahead of the GI. I'm not worried so much about US scientists employed at research institutes and universities, but more about foreigners who may have a lot of time and no qualms about stealing other people's ideas. I know that we've had a lot of problems in the past with foreign students who thought it was acceptable to copy a published paper, put their name on it, and hand it in for credit, on the grounds that they understood the paper. In any case, the most precious commodity in science is a clever or robust idea, and those whose ideas succeed a proposal competition should be allowed to work on it at the appropriate pace. I don't care whether there is a proprietary period, but I'd like to see a quasi-proprietary period when only investigators with non-conflicting projects are allowed access to the data.

Roger Brissenden—The present plan for Phase 1 (survey data) is for 1 year of proprietary rights for the Instrument teams plus data rights for 12 GI's who will be selected through peer review. All data will be public after the first year (a full survey of the sky). Phase 2 will have all data released immediately and ask that GI's follow an honor system in analyzing their data with respect to the ideas proposed by other GIs. This is effectively a pseudo proprietary system and given that DOE will not require the people they are funding to follow any kind of proprietary system, appears problematic to implement. An alternate approach would be to treat data as available to all without any implied restrictions. The GI program would then primarily become a way of distributing funding, and for capturing the best science ideas for pointing the satellite (i.e., science that survey mode will not achieve). I would advise either developing a full proprietary rights approach or completely abandoning it. Given the difficulty in creating individual data sets (because of the survey mode and large FOV) the latter seems the best approach.

Olaf Reimer—Nearly everybody has expressed an opinion here, the LAT team does have one, NASA and DOE have their policy, it's a persistent issue at the GLAST SWG meetings and now the User's Committee steps into this. At a certain point we're repeating

thoughts already thought and concerns already discussed. The requirements of the GI program, the NASA and DOE data right policy and the complexity of the analysis of data from a wide FoV instrument give sufficient, however partly controversial constraints. In order to prevent ever-continuing discussions we might review and compare the different approaches to a common data policy in a schematic way, followed by exclusions of combinations that won't work, do not appeal—to say a rejection process instead of discussion what might suit the requirements. The concept of the qualified investigators, GI rights go certainly along with such scheme.

Reshmi Mukherjee—[T]he data should be really "free" and accessible to all. If the data is really public, I do not see how one can implement abstract writing to have access to the data. I understand Alan Marscher's point about protecting scientific ideas, but realistically, I don't see how one would implement it. One would still write proposals, and a good proposal would be "rewarded" with GI funding, but once the data is public, it should be accessible to all. Perhaps a way out would be to not make the abstracts public for a 1-year period (sort of a proprietary period for abstracts)! That way one would protect the scientific idea of the successful proposal, but not restrict data access. I feel data access should be unconditional, if the data is truly free.

Data Policy—First Year

Dave Bertsch—Although I am supposed to represent the users, I think my biggest concern had to do with the situation of the Team in and near the end of the first year. As I see it, they will have to deal with glitches in software and data manipulation, possibly reprocessing, instrument performance issues, etc. and then in only about 3 or 4 months they will be under pressure to have some sort of press results, pictures, etc. and at about the same time to produce a catalog and maps of tentative identifications. The Team is large, but I'll bet much of the initial pressure will fall on the shoulders of a relatively small group who understand the instrument and data system the best. Then in about another month, they will have to prepare proposals. At about 9 months, there will be heavy pressure to publish the results up to that point since the data will soon be public. The data in the last 2 or 3 months will become public so soon that for most purposes, their proprietary rights will not mean much.

For starters, I would recommend that the release of the first year's data be made after 15 months and that initially from that point, data be released with a latency of 3 months with the goal of reducing that interval gradually to eventually the current one day.

I do not see much benefit of the 10 or so GI's in the first year insofar as the Team support is concerned, even if they are expected to perform a service. Most of the experienced gamma ray people are already on the Team, and they will not be able to propose. These 10 will have an unusual opportunity to have a part of the most choice sources and studies. Granted, they will likely publish their results with members of the Team, but I would guess that that number would only be small. In addition, the Team should be able to muster internal support at any level that could be expected of the GI's. Theoretical work might be a welcome addition to the Team once they begin getting solid results, although

there are probably many theoreticians already on the Team. Finally, I think there is the possibility that the User community would view any of the 10 GI's as specially favored and certainly they will be in a very advantageous position for the first real round of GI participation.

Do we really want a GI program in the first year? At the very least, if there is to be a selection of GI's during the first year, the competition should be open to Team members as well (for funding and perhaps frequent travel or relocation reasons).

Rene Ong—The overall mission profile looks good. The general strategy of scanning as the greatly preferred mode of operation is very well motivated. The major concern associated with the timetable comes from the great time pressure on the instrument teams and the GSSC, especially in the early days after launch. In particular, it may not be viable to expect the LAT team to produce an initial sky map, exposure charts and so forth in time to support the GI proposals in Phase 2. (I believe that we determined that this map would be required only 3 months after launch!). I am not sure what solution or alternative to suggest.

I did have some issue with the way in which the Phase 1 GI program is conceived. In the first year of the mission, many of the most exciting discoveries will be made and I worry about the presence of a small, select group of GI's having a somewhat exclusive crack at the early data. There are two issues here: 1) if the instrument team members are so occupied with data processing issues (calibrations, sky maps, sensitivity estimates, etc.) so as to be less involved in science analysis, it could be that a rather small group of individuals will come to dominate the early, exciting science output (and in some sense take credit for these discoveries at the expense of the instrument builders), 2) the procedure to select a rather small group of GI's will be difficult - both to ensure fairness and to ensure broad representation in a variety of communities. If this procedure does not work well (or there is any feeling in the community that it was not completely fair), then there would be resentment toward the whole GI program. I would personally favor the entire first year to be the proprietary data for the instrument team and the ID scientists. Then after this first year, the entire community will all be on an equal footing to get access to the data. Right now, a few selected members of the outside community will get special treatment. As it stands now, the rationale for having a select group of outsiders in the first year and the procedures for selecting this group are not well documented.

Reshmi Mukherjee—I have a different viewpoint now than I did before I went into the meeting. After sitting through the GUC meeting, and reading the minutes, I am starting to think that the idea of a select group of GIs having access to the cream of the data the first year may not be so fair, after all. This needs more thought and discussion, and we should perhaps talk about it again at the next GUC meeting. Perhaps, abolish this first year group of 12 select GIs and make the data accessible to the instrument team only?

GI Program

Rene Ong—The general parameters and expectations for the GI program seem quite sound. The scale of the number of investigators and the typical support expected during Phase 2 seems sensible and appropriate. Smaller awards would not be worthwhile and larger average award sizes would result in too few awards.

Mark Strickman—In addition, and for a number of other reasons, the AO will have to be unusually carefully crafted. I think that the users committee should be involved in the process. If we make our intentions clear in the AO, everything else is much easier. Often, when reading an AO the proposer tries to interpret the intent behind every word and nuance: "Just what is NASA trying to say here?" For this mission, I think we should try to avoid this and be very clear with what NASA is trying to say. This is not the place to try to pass information "under the table" with subcontexts.

A related data rights issue concerns the following scenario: I write a successful GI proposal to get funded to do a particular experiment (no pointed observations involved). But before I can get around to doing the work, someone else comes up with the same idea independently and publishes the results. What do I do with my funding? I'm not sure what the right answer is to this (although I'm pretty sure that "give it back" is the wrong answer), but I think the AO has to address this issue. Perhaps we should allow broader proposals that do not require specific experiments to be listed. Within these broad topic-oriented proposals, there would be room for a number of specific investigations. The scope is controlled by the amount of money awarded. If one investigation is done elsewhere, there are more to do within the scope of the proposal. In reality, this is how things work now, to some extent, but unofficially. This is, perhaps, more difficult to peer review, but it would allow GI s more leeway to deal with the huge amount of data at their disposal. Nothing says that multiple awards for the same broad topic could not be made, as well. I realize that nothing forbids this approach now, but I think that a shift in instructions to review committees is probably required to make this sort of proposal competitive.

Roger Brissenden—There is a need to decide if Key Projects can be multi-year, if they imply that time is reserved from the observing schedule for future years, and if funding can be provided over year boundaries. I would encourage 2 or 3-year projects.

The Program should consider defining standard modes for instrument use. The standard modes should be available for users to propose and be documented accordingly in the NRA and user manual. The planning for data processing, calibration planning and proposal tools should take the standard modes into account.

Funding of GI Program

Jim Ling—The budget of $6M per year is about a factor of 2 lower than that for Chandra. I agree with Anne Kinney's assessment that $50k per GI grant is really not sufficient to do effective GI gamma-ray data analysis work.

Roger Brissenden—The GI budget is $6M allowing for an expected grant of $50K for 100 programs and $1M for a Fellows program, annual peer review and grant administration. The $50K grant size is comparable to Chandra grants however inflation should be taken into account since the grants are not awarded until 2008 (assuming a 2/07 launch). For example, $50K for 100 programs ($5M), a fellows program for 6 scientists selected 2 per year for 3 years ($100K per Fellow ramping to a steady state of $600K/yr after the first 3 years), a DDT program of $250K (5% of $5M), peer review costs of $150/year and 3 FTE for administering the grants ($450K total) yields a profile of $6.06M, $6.25M, $6.45M, $6.45M etc in FY03 dollars (the ramp being due to increase of 2 Fellows per year for the first 3 years). Adjusting for 3.5% inflation yields a profile of $7.2M, $7.7M, $8.2M, $8.5M etc for a program starting in FY08.

Alan Marscher—Inflation since the CGRO times suggests that the average grant size for GI programs be around $100K, which implies $10M times (no. programs/100) + GLAST fellows program + grant admin costs. So, I would say something like $15M would be appropriate. Anything less would hurt. It takes a lot to keep a group going, and most gamma-ray observers are not faculty with academic-year salary paid. Rather, a substantial portion of a research associate's salary should be figured in, plus travel, etc., and overhead.

Dedicated GLAST Project Observations

Mark Strickman—Unrelated to data rights, I think it's important to emphasize the need for dedicated instrument performance/calibration pointings every so often (2 wks/yr?). Peter seems to agree with this. Based on the CGRO experience, I think they should not be competed, but taken off the top.

Roger Brissenden—Director's Discretionary Time (DDT) time (e.g., at the 5% level) has been used successfully with other missions such as Chandra, and Hubble for either TOO's or for science that may not be approved by a peer review due to risk but may be very high return. The Program should consider the merits of including a Director's Discretionary Time component as part of the GLAST Guest Investigator Program. A possible allocation could be 5% time and funds.

The Program is planning a series of initial calibration observations during the first 60 days of the mission. A block of time should be allocated for each cycle to perform follow-up calibration observations and take engineering data to ensure that the Observatory calibration is maintained. The calibration program should be published prior to each NRA and the calibration data made available in a standard form. The length of time required should be determined through simulations and consultation with the LAT and GBM teams.

Balance of Observing Types

Roger Brissenden—Phase 2 observing will be driven by the peer review and will include a balance of survey and pointed observations. Targets of Opportunity (TOO) will also be accepted and are likely to be pointed observations. Survey mode is attractive since it creates a uniform large field of view data set with multiple science uses. Pointed observations may have high science return but will disrupt the survey mode and dwell on a single celestial location for an extended time. TOO observations will require an interruption of the planned schedule. The peer review will assess the science merit of proposals, however given the impact of the observing type on the overall mission return, the peer review needs some way to trade the science against the observing type. The Program should simulate GO proposal inputs for various mixes of pointed, TOO and survey and see the impact on the scheduling and efficiency. This will result in better insight into the planning process (and ops response to TOOs) and provide guidelines for conducting the peer review, including possible guidelines for the fraction of time or number of the different types of observations.

Olaf Reimer—I've seen at least one presentation including exposure calculations for pointing and scanning mode—and it appears to me that pointed observations [are] of no advantage except for the requirement to have a best possible statistics in a minimal but continuous interval of observation time, e.g.. for studying short-time transients or weak PSR/msPSR timing and for coordinated multifrequency campaigns. However, the gain is not overwhelming and this requirement is rather a *re*pointing followed by scanning mode with the ToO in a privileged position for continuing in scanning ("wobble/rocking") mode. The User's Committee might invite a speaker with a presentation on this topic for final clarification.

Analysis Software

Rene Ong—I was very impressed with the attention that has gone into the top-down planning of the GSSC and to the fact that many of the key elements are already being work on now. I wonder if the overall manpower allotment will be sufficient (but perhaps this is more constrained by $$ than anything else). I agree that it makes little sense to have a large analysis engine for the outside user community - having access to the data and analysis tools available will allow individual users to do analysis at their home institutions. The way in which the GSSC will interact and collaborate with the IOC's is clearly of high importance because of the key role in which the IOC's play in developing the science tools and instrument response functions. From the outside at least, it appears that the GSSC and IOC's are interacting well and have strong overlap with people geographically placed to improve communication and interchange.

The many challenges associated with analysis of data from an instrument like GLAST, which is both wide FOV, but low count rate (for a particular source), were well presented. It's clear that the LAT team, which has the most challenging task associated with analysis, is very far along in developing the tools and techniques to reduce the complex data. The general structure of the analysis effort, along with the required

software to be produced, seems to be sound. One issue that appears to be still in the early stages is that of the database. This will need to get ramped up on a moderately quick timetable so that the team (and some outside users) can get familiarity with the meta-data well before the launch.

Jim Ling—It is critical to have a detailed plan, functional flow diagram and schedule for the development of the data analysis tools for various LAT analysis (point source, burst and diffuse emission etc) and GBM (localization, spectra and time profile) in the next few years and have them ready before launch in 2007. The User Committee should monitor closely their progress, and should expect a report from both the PI teams and SSC on this at the next meeting.

Mark Strickman—I've been involved with the GLAST software development effort for several years and, at the onset, I had serious concerns that the difference in cultures between the NASA and DOE user communities would present a serious problem. In particular, I was afraid that appropriate user software (from an astronomical user standpoint, that is) would not be made available. I'm glad to say that this has not been the case. Seth Digel, Jim Chiang, Pat Nolan and the other astronomers at SLAC and Stanford, plus David Band and his staff at the GSSC have done an excellent job of making sure that the astronomical user community will be comfortable with the systems they are given. I'll be very curious to see if the high energy particle community will also use these systems.

Roger Brissenden—Linux and Windows have been chosen as the two platforms for support of user analysis software. The Program should identify an appropriate time to perform an initial survey of user platforms in use with sufficient lead time to port to other platforms if needed.

Olaf Reimer—What the Users Committee might have missed yet is that the range of possible investigations is already very wide spread (as are the requirements on the science tools to achieve different tasks) and the usage of various data levels to do so. Perhaps most of the potential users really don't want to look into level 0 data because they have neither the resources nor the knowledge to work at level 0 data (similar to EGRET: Who looked into the spark chamber track reconstructions apart of instrument team members?)—a range of potential scientific tasks and necessary data access/tool readiness etc. is something we might consider to talk about as well. (call it "scientific case studies and consequences").

Reshmi Mukherjee—I think making the EGRET data available for people to test GLAST software is a great idea. I whole-heartedly support it. How much additional work is needed to make the EGRET data compatible with the GLAST software?

Testing the Analysis Software

Jim Ling—When these tools are ready sometime before the launch, it would be useful that either the PI teams or the SSC personnel to provide a life demonstration to the User

Committee, and perhaps even allow a hands-on validation by the committee members, acting on behalf of the potential GI community, on how to use these tools.

For the first 12 GIs to be selected during phase 1, it would be highly beneficial to the community if some of these GIs could help participating in the "beta" testing of the analysis tools on behalf of the community.

Roger Brissenden—The Program should schedule a milestone for the User Committee (as representatives of the User Community) to perform a beta test activity with the analysis tools to allow early feedback to the developers.

Data Flow

Rene Ong—We heard a good summary of how the raw data from the GLAST satellite will be transferred to the ground and how the basic low and high level data products will be generated. The idea that the two instrument operations centers (LIOC and GIOC) play key roles in the flow and reduction of data is a good one. In a relatively complex, wide aperture instrument such as GLAST, the instrument teams are by far in the best position to develop and test the low-level analysis tools. The procedures by which the data get analyzed and the timetable for the product availability seem acceptable. (For example, the one day latency in producing the Level 1/2 data by the LIOC seems quite reasonable).

Source Monitoring

Rene Ong—I did have some questions concerning the statement that the LAT would monitor the light curves (and spectra) for "20 bright sources" and that the information regarding transient behavior for these sources would be disseminated on a regular basis.
1. Why is the list limited to 20 sources? Why not just automate a procedure for a flexible system in which many additional sources can be added (where the analysis is done, plots made, etc. without human intervention)?
2. How often will the source fluxes and spectra be updated and how will users access these updates?

GBM Monitoring of the Sky

Jim Ling—The value of continuous all sky monitoring of gamma-ray sources using the earth occultation technique have been well demonstrated by the BATSE experiment. Such a capability can be also made available by the GBM experiment (shown in Meegan's charts), but is not currently included as part of their baseline objectives. I would encourage that the GBM team and the GLAST Project to take another closer look at this capability, and assess its sensitivity compared to that of BATSE, and present the results to the GLAST SWG and perhaps also to the User Committee. If the science outputs and potential discoveries obtained by all sky monitoring of gamma-ray sources using the earth occultation technique are highly valuable, perhaps it would be worthwhile to formally implement this science as part of the baseline objectives of the GBM experiment.

Multiwavelength Campaigns

Rene Ong—The one important issue that was not covered in our meeting is that of multi-wavelength support and coordination. Obviously, to get the best science out of GLAST will require good coordination between the gamma-ray community (both in space and on the ground), the broader astronomical community at longer wavelengths from radio to X-ray, and the high-energy physics community. Perhaps this is not precisely a matter for the GLAST User's Committee, but it would be good to understand what sort of planning is happening in this regard. Right now, I believe that the individual instrument teams (through their Science Working Groups and IDS's) are developing the links and connections to other wavebands and other instruments (or at least, this appears to be what's happening with the LAT Collaboration). This procedure seems a bit ad hoc, and some questions naturally arise. For example, could the GSSC and/or Users' Committee, play a role in developing the parameters and overall guidelines for multi-wavelength campaigns between team members and outside users? During the Phase 2 of the GI program, how will new, exciting transient sources be identified and how will the information from these sources be disseminated widely? (For bursts and well known AGN, this information will obviously come out very quickly, but what about an EGRET UNID source that starts to flare and isn't on anyone's list of "top 50" sources?). Finally, there are a variety of analyses that one could imagine that will require use of the Level 0 data (e.g. very energetic events in which the energy calibration is suspect, very inclined tracks, etc.). Currently, it is suggested that an outside user wishing to work with the low level data develop a collaboration with the relevant instrument team members. But there do not appear to be any guidelines about how to form this collaboration and what requirements (if any) are placed on the instrument teams. It would be good to flesh this out a bit. In the context of the high-energy physics community, access to the low-level data is of high importance.

Ground System Development

Roger Brissenden—Operations Processes. The Program should develop a set of detailed operations processes (or threads) that involve the multiple ground elements. These should include the prime operations thread (proposal receipt, mission planning, command generation, uplink, downlink, processing, archiving and data distribution), anomaly response (spacecraft – including safemode, and Science Instruments), calibration, flight software updates (s/c and LAT), and other threads that involve the MOC, GSSC, IOC and user interfaces. Exercises and data flow tests should be conducted to prepare for operations and verify the processes. The Data Challenges are a good example of this, but should be extended systematically through the end-to-end system. Consider a day in the life test for the spacecraft with command loads driven by example proposals and resulting in processed and archived data. Particular emphasis should be placed on processes involving the IOCs.

Role of MOC and IOC in I&T. The Program should ensure significant participation of the MOC and IOC teams in the Observatory I&T. For example, consider scheduling testing from the remote facilities during Observatory I&T to execute all LAT and GBM

flight procedures, verify data base compatibility and upload a LAT flight software patch. Contingency responses should also be exercised (e.g., safe mode recovery). These tests are also important for team training. It's clear that good planning along these lines has begun however the challenge will be to ensure systematic coverage of cases and that the tests survive in tact as the schedule progresses. These tests should be key gates. In designing cases, think "Real Operations".

Transition from Development to Operations Organizations. The Program should develop a plan for transition from the development to the operations organizations as early as feasible. This is important for GLAST given the roles of the Science Instrument teams (IOC) in operations (planning, commands, TOOs, SOH monitoring) and science user support (L1 processing, data analysis software). The plan should consider the processes expected during operations, team roles and responsibilities (see Ops Processes).