The 22nd Spitzer Users Panel meeting occurred November 13/14, 2008. During the first day of the meeting the SUP attended the Spitzer Cryogenic Mission Closeout Review. Two members of the Users Panel (Carpenter, Skrutskie) served as members of the closeout review committee. The remaining SUP members participated as observers at the one-day closeout review. The second day of the meeting was SUP-only and covered topics that were more focused on user issues not already addressed at the closeout review.

The SSC is at an interesting crossroads. The cryogenic mission is ending in April 2009. The warm Spitzer mission begins at that point (although preparations and the proposal process have been in the works for some time) and archiving and long-term support for the vast data accumulated by the cryogenic mission is taking center stage. All of these activities take place during a period when the natural denouement of the successful mission is leading to steadily reduced staffing levels in an environment that can encourage the departure of key individuals with great expertise. Simply put, the situation is challenging, and the SUP has consistently been impressed with how the SSC team has risen to that challenge with effective planning and enthusiasm to develop a future course of action that serves both the Center, and ultimately the long term interests of the scientific community, exceptionally well. Inevitably there will be surprises - key departures, unexpected changes in scope of task - that may disrupt this best laid plan, but it has been the SUP's observation that the management and staff comprise one of the most clever and resilient organizations around. Responding to such surprises requires well-established priorities, and the SUP independently arrived at a prioritization for the future that paralleled the suggestions made by the cryogenic mission closeout reviewers. Leading that list is the need to establish a lasting and usable archive of the cryogenic mission data and its underlying documentation that will enable continued effective use of the products well after the SSC has left the scene. The closeout review addressed specific prioritizations in detail and SSCs level of planning and preparedness for accomplishing these goals. This Users Panel report will leave much of that discussion to the closeout review summary.

Advertising the Transition

Ultimately, IRSA becomes the keeper of the Spitzer Archive and future user support will be IRSA-based. The SUP feels that it is important to begin conditioning the user community for this transition as soon as possible. Distributing the transition plan in a visible and accessible manner will be an important first step in raising community awareness. At the same time, the development of the archive is being driven, in part, by a set of use cases compiled over the last

year. These use cases should be made available to the user community in an equally accessible fashion and community use case input should be solicited in order to assure that the baseline for archive development fully accommodates the most critical user needs. The primary portal for communication with the community is via the SSC website. Given the plans to hire a web designer/consultant specifically to support user interface to the archive, the SUP suggests placing some priority on getting this person in place as soon as possible.

Looking forward to the Warm Mission

Before delving into the issues associated with the long term data archive the SUP would like to recognize the efficiency and effectiveness of warm mission planning to date. With fewer than 6 months until the likely depletion of cryogen, the SSC is on track to begin a rich program of warm mission characterization and science. Despite having the complement of instruments on Spitzer decline from three to essentially one-half, the response to the warm mission exploration science call was an extraordinary demonstration of the continuing science potential of Spitzer in its warm configuration. Nearly 800 co-investigators participated in oversubscribing the exploration science opportunity by a factor of four. This healthy interest bodes well for the 2 year warm-mission extension approved by NASA and underscores the value of considering an extension of Spitzer operations to its communications-limited lifetime.

As the cold mission winds down the SSC should be sensitive to users with approved programs who will not receive their allocated observing time. The nature of Spitzer visibility windows means that even now programs that will never execute can be identified. These observers will appreciate prompt notification of the demise of their programs rather than being left to wonder until the cryogen runs out.

Heritage archive issues

The Spitzer Heritage Archive will be the ultimate repository for Spitzer data. As with the warm mission planning exercise, the conceptual development of the Heritage Archive has received considerable attention and is at an advanced stage. The SUP in its discussions made the following observations:

The source code for the instrument data pipelines should be archived as a record of exactly what was done to the raw data to produce the archive data products. There is no expectation that future generations should be able to compile and execute the code. In fact, the interaction between the code and databases at SSC make

reproducing the pipelines themselves a virtual impossibility. Archiving the code, however, does permit one to examine specific implementations of algorithms to determine exactly what calculation was applied at a particular point in the pipeline reduction.

The validation plans for the archive data products, particularly the efficacy of the final round of re-processing, are not explicitly defined at present. The SSC should outline a validation plan to assure the final archived product meet the expectations of the final re-processing. The final reprocessing(s) of the data should not deliver their results too close in time to the final population of the archive in order to assure sufficient time for validation. Along these lines, one area of descope in the final archive plan would be to scale back the re-processing activity. The SSC should distinguish between essential reprocessing and reprocessing that provides incremental improvement in the final data products. All three instrument teams identified possible means to descope the final processing with minor impact on the final results.

The SSC should distinguish between essential reprocessing and reprocessing that incrementally improves, say, the final photometric precision. All three instrument teams identified possible means 1of descoping the reprocessing with minor impact on the final results.

The SSC should consider whether, in addition to the preserved archive documentation, it can provide closeout journal papers summarizing the state of and accomplishments of the mission and its instruments at the end of cryogenic operations. Of particular importance would be documenting "lessons learned" that have been fundamental to the Spitzer experience and would be of lasting value to future missions.

The archive content/format should not be dependent on the expectation that the Virtual Observatory will someday exist and deliver interoperability between Spitzer archival data and other astronomical datasets. Design of the metadata content for the archive should presume that users may have to assume more of the burden of database interoperability that would be delivered in a VO scenario.

All archived data analysis tools should include a demonstration/baseline dataset that can be used to verify the software is operating properly. Such a validation dataset will be particularly useful for tier 2 software which will not be maintained or modified once initially archived. Users will likely

need to modify tier 2 software as the platforms on which they run (e.g. IDL) evolve over time and must have the opportunity to verify that these routines produce valid results after modification.

SUP members have expressed an interest in serving as beta-testers as the Heritage Archive matures.

Archival user support (i.e. funding)

The SUP has been vociferous in the past concerning the depth of unmined scientific content in the Spitzer archive. As Spitzer enters the archival science era, documentation and advertisement of this archival content will be critical to obtaining funding to support archival data analysis. The SSC could take two immediate steps to promote the archive in a way that will garner increased future support for users. First, the SSC should highlight of order ten well-regarded refereed papers that have based their results on archival data. To some extent these papers represent specific use cases and illustrate the depth of the archive. At the same time, the SSC should undertake an accounting of refereed papers that use archival content. The STScI has been quite effective in advertising the case for the value of the Hubble Legacy Archive via tracking of the increasing fraction of publications that originate from the HST archive. Although it may cost some personnel resources to undertake this activity, this investment will have direct return to the user community and to the ultimate volume of science that is extracted from Spitzer data via the direct promotion of the archival science endeavor.

NASA's is supporting Spitzer archival analysis by including Spitzer archival research in the ADP program for the first time. This year ADP is likely to enjoy a $3M increase in available support to bring its base to $15M. Spitzer proposals are likely to compete exceptionally well in the ADP environment and may garner substantially more than the $3M augmentation. At the same time, this transition occurs at at time when Spitzer observers enjoy $30M annually in user support. These observers are primed to exploit archival opportunities, particularly when the "live" opportunities of the cryogenic mission are no longer available. The SUP suspects that the ADP opportunity will be substantially oversubscribed as a result. Extreme subscription leads to self-regulation. If NASA is not quick to respond to strong/overwhelming Spitzer user interest in the first ADP opportunity with further augmentation, interest in Spitzer archival research will be squelched and scientific opportunity will be lost. On a related note, the user community has also inquired as to whether the NASA Theory program would welcome Spitzer-related proposals. The SUP's understanding is that the theory program will also be open

to Spitzer proposals.

Source lists

The SUP has long advocated the importance of source extractions accompanying archival image data. The generation of a source list from IRAC and MIPS 24um imagery is of fundamental importance in enabling and encouraging the long term use of the mission's data. Source extractions are the key to interoperability of the Spitzer data with other archived datasets. Database explorers are more likely to be drawn into the analysis of the Spitzer image datasets if queries on general astronomical source databases reveal the presence of Spitzer sources. The SSC has made substantial progress toward delivering IRAC and MIPS24 source extractions, and the SSC plans a future review to make a final decision on whether to provide a source list as part of the mission archival materials. The delivery of the source list requirements is scheduled for mid-January with the decision-making review scheduled only two months later in mid-March. The SUP is concerned that there may not be sufficient time to validate the source list pipeline given the short interval and that the go/no-go decision may be shortchanged by the compressed timeline. The SSC should consider whether sufficient time is available to deliver a fair characterization of the source generation pipeline by the mid-March review.

The SSC pointed out that previous reviewers of the source list concept requested an analysis of the science enabled by the existence of source lists, possibly as a pre-requisite for deciding that a source list would be of fundamental worth. The SUP wishes to emphasize that intrinsic science enabled by database queries on the source list is secondary to the simple accounting that Spitzer observed a source and estimated a flux at a given location on the sky. Even if one is not able to generate journal quality science based on intrinsic source list queries, the existence of the source entries themselves is of greater importance. Although possibly counter-intuitive, intrinsic science value should not be considered a deciding factor in producing a source table.

Artifacts/caveats pages

The instrument artifacts web pages have developed into excellent (and primary) resources for instrument users. Keeping these pages current by incorporating the latest instrument/data quirks should remain a high priority. In that spirit, the pages for all three instruments are in need of an update. At the same time, these pages should be maintained at a location that it is nearly inevitable that users must

traverse them on their way to manipulating and interpreting instrument data.

Data workshops

One of the most effective and appreciated SSC activities has been data workshops, offered on average twice per year, that permit users of Spitzer data the opportunity for hands-on, in-person training with the SSC-supported data analysis tools. These workshops will be an inevitable casualty of the decline of funding and staffing as the SSC enters the warm mission era. Nevertheless, there will still be a need for new (and seasoned) users to become versed in data reduction and analysis techniques. The SUP encourages the SSC user support group to consider ways to use the accessibility provided by, for example, network video interfaces to, where possible and practical within the resource constraints, 1) archive the content of the demonstrations and step-by-step walk-throughs of the data analysis tools. 2) provide "remote" data workshop activities where outside users can join an interactive video session at a pre-scheduled time for discussion about a particular data analysis tool.

The Heritage Archive and Public Outreach

The SSC has established a rich history of providing public access to its discoveries. The functionality of the Heritage Archive, particularly the ease of access to data and simple manipulation of FITS images, provides another opportunity to engage the broader public, particularly the amateur community craving for opportunities to participate in professional-level data mining. While developing and advertising the Heritage Archive the SSC should consider means of incorporating the amateur community in the use of the archive.