FINAL REPORT FROM THE SPITZER SCIENCE USER PANEL
MEETING OCTOBER 21-22, 2005
Michael Skrutskie, chair

The SUP met October 21/22 at the SSC. This meeting occurs 2.2 years following launch with an estimated 3.3 years remaining in the cryogenic mission. The observatory is operating at near peak efficiency with all systems still functioning on their first string of redundancy. Through careful engineering and planning SSC continues to squeeze additional hours from spacecraft calibration and overhead for return to the science pool. In the second year of the mission SSC anticipated scheduling 6500 hours of science observing time but in the end delivered 6925. Careful management of observatory temperature, particularly the execution of "warm" MIPS campaigns promises to extend the cryogenic mission and thus add additional net hours of science time.

The Spitzer data archive is stable and functional with users accessing 250GBy weekly from the archive. Software updates are appearing at regular intervals and are being applied to the archived data. The BCD and post-BCD products have matured to the point that, with a few exceptions, scientifically mature data products are populating the archive. Resources devoted to development and validation of user post-BCD software are increasing along with efforts to maintain these packages across popular software platforms. The GO program is now well established with Cycle 2 observations being routinely scheduled and the Cycle 3 call for proposals pending (now issued). Spitzer press releases not only appear regularly, but also are picked up as leading stories in the popular press highlighting not just the quantity, but the quality, of the Spitzer public affairs effort and scientific output. Overall the SSC continues to serve the user community well at all levels.

Specific SUP issues:

1) Informing users of data features and potential traps

As SSC data products become more refined, and thus as users become more comfortable with BCD and post-BCD products representing nearly "science ready" results, it becomes vitally important the users are made aware of limitations of the data, particularly any quirks or potential traps (for example the 14 μm "teardrop" in IRS low resolution data, or the "lost light" problem in the long-wavelength IRAC channels). Currently, workshops provide an effective, but limited, means of reaching users with this information. The SUP urges the SSC to make information about data "caveats" readily and visibly accessible, ideally at a single web location, and confront users with the
availability of this information whenever possible.
The existing instrument and general observers mailing lists should be kept active and updated regarding these issues. SSC might consider adding successful proposers to instrument mailing lists automatically based on AOR.

2) IRS and extended sources

A polling of users prior to this meeting yielded several comments

regarding difficulties in the reduction and calibration of IRS data where the targets were extended sources. Discussion of this particular issue at the SUP meeting further illuminated the potentially intractable nature of the IRS extended source data reduction. We are left with members of the user community describing themselves as "at sea" and "with no idea what to do" while facing a data reduction issue that SSC regards as being of the greatest difficulty. This issue thus straddles the borderline between algorithm research and user support and, although users can dream of receiving a turnkey package from SSC that will solve the problem, the truth is that progress will come from active analysis within and communication between the user and SSC communities. Since no closed solution to the problem will be forthcoming either overnight or possibly into the indefinite future, the SUP urges SSC to take steps to

a) make as much fundamental calibration data which addresses this particular issue available to users.

b) encourage active discussion amongst users with this genre of data with the aim of engaging users, who would otherwise prefer to be passive, in the pursuit of mitigating/ understanding the issues involved.

c) discourage submission of these proposals or at least make proposers fully aware of the difficulties which will lie ahead (possibly by encouraging contact with active users of this mode). Users reporting to the SUP noted that they felt they were not forewarned of the difficulties that they encountered and that they would have designed their observing strategies/target selection differently to avoid the worst of the extended source issues.

3) NVO compatibility of the data archive

Although IRSA will ultimately have responsibility for integrating the Spitzer archive with the activities of the National Virtual Observatory, it was not clear to the SUP that the active population of the archive, both by the SSC and with Legacy data products, is fully accounting for its future digestion by NVO. The SUP requests that SSC address this concern at its next meeting.

4) Long term planning

The end of the Spitzer cryogenic mission is still over 3 years away, but close enough that post-cryogenic mission plans will influence the strategy for larger programs as early as Cycle 3 and certainly in Cycle 4. The SUP understands that SSC is already planning for these late-term issues, but wishes to underscore

1) the importance of establishing plans for finalizing the configuration of the Spitzer archive and plans for supporting archival research in the post-cryogenic era.

2) the need to keep the user community well informed and involved in the proposing/planning process for an IRAC Band 1/2 post-cryogenic mission.

5) Pipeline metrics and validation data

The BCD and post-BCD pipelines are producing refined data products of high quality. Although these products can be further improved, at some point the gains become marginal. It was not clear to the SUP that there existed a set of performance specifications or objectives that could be used to gauge the need for allocating resources to the continued development of the various pipelines. In addition, since system features and quirks often arise and drive software development such specifications for each pipeline should be accompanied by an actively-updated publically-available list of open issues remaining to be addressed.

The SUP also suggests that SSC maintain a public archive of the validation data which were used to characterize the performance of each pipeline release. Some users would like to have a quantitative basis to judge how each new software release improves upon its predecessor. The pipeline history files should not only list specific changes to the pipeline but, where appropriate, the effect/improvement that a given modification was to have addressed.

6) Source extractions.

The previous SUP report noted "the original expectation that BCD products would contain source extractions has yet to be realized. The ability to extract sources from Spitzer images continues to be a lagging feature of the post-BCD suite, and significant benefits would accrue from users being able to consistently extract source fluxes with a validated piece of post-BCD software." The SUP discussed the issue of source extraction and of providing source extractions as a post-BCD product again at this meeting. Although SSC reported progress in validating the output of the APEX source extractor so that source extractions could soon be included as a post-BCD product, SSC management expressed significant reservation concerning the implications of including SSC-generated source extractions in data products and asserted a strong preference for not doing so. SSC expressed the concern that source lists produced by SSC could be viewed as "catalogs" by the users - especially if introduced now in mid-mission. From that perspective, such lists would have to be highly reliable and complete and would require a robust characterization of the "catalog's" properties. The resources for such extensive characterization of the source list properties are not available. Reluctantly, the SUP must agree that, in some sense, the opportunity for releasing source extractions with image data has been missed - the delivery of source lists being more benign if they had been considered a "reference" data file associated with post-BCD data from early in the mission. This agreement with SSC's position on the matter, however, does not mean that the development and characterization of source extraction tools at SSC should receive lower priority. If anything it places the burden on SSC to provide the well-characterized easily-used post-BCD source extraction software so that users can take responsibility for generating reliable source lists on their own.

7) Theory/Archival proposal funding

SSC has suggested reducing the proportion of funding allocated to the archive/theory programs to 5% from its current 10% level. The SUP feels strongly that funding for archive/theory should not decrease. The richness of Spitzer archival data, not to mention its value to exploiting the remainder of the cryogenic mission should not be discounted. Similarly, theoretical modeling of appropriate astrophysical systems also guides the focus of future proposals. SSC appropriately emphasizes the need to devote a significant portion of the available funds to primary scientific analysis of observations as they occur. The SUP feels, however, that halving the current theory/archive work for a relatively small proportional gain in funding other activities is not appropriate.

8) Lack of EPO funding

In response to budget reductions in the last year SSC no longer can support an EPO component to GO proposals. The SUP supported this decision in its last report as the most palatable of several budget reduction choices. Nevertheless, the SUP still recognizes the importance of public outreach and the fundamental obligation the Spitzer community has to share the intellectual wealth of the Spitzer program with the general public which has funded the enterprise. When possible, SSC should encourage and facilitate GO and GTO interaction with the public even in the absence of explicit funding for this activity for observers. Such actions could include

- a letter from the SSC director underscoring the value of GO public outreach and, given the current state of funding for EPO, encouraging "volunteerism" within the community to compensate for the lack of funding.

- packaging and advertisement of downloadable 8"x11" public-oriented fact sheets (along with existing press release images) which highlight Spitzer science and Spitzer results and could be printed by a GO to support an outreach visit.

- explicit mention of public outreach in the in the Call for Proposals both as general encouragement and as an optional item to be cited in the "Status of Existing Observing Programs" section of a proposal.

National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

Response to SUP-16 report

Gordon K. Squires
Spitzer Science Center

Spitzer Space Telescope
SUP-17
May 2-3, 2006
Pasadena, CA

National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

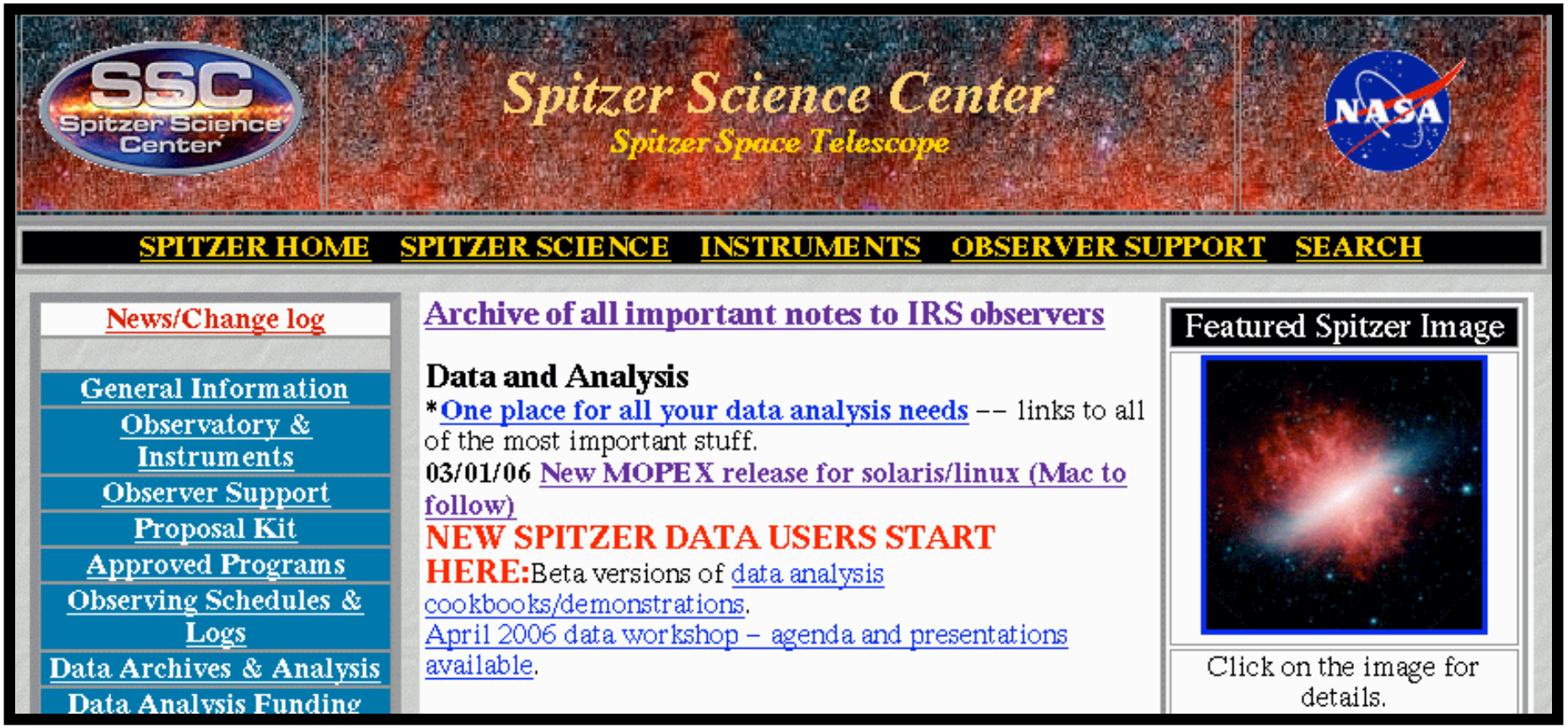
1. Informing users of data features and potential traps

a) "The SUP urges the SSC to make information about data "caveats" readily and visibly accessible, ideally at a single web location, and confront users with the availability of this information whenever possible."

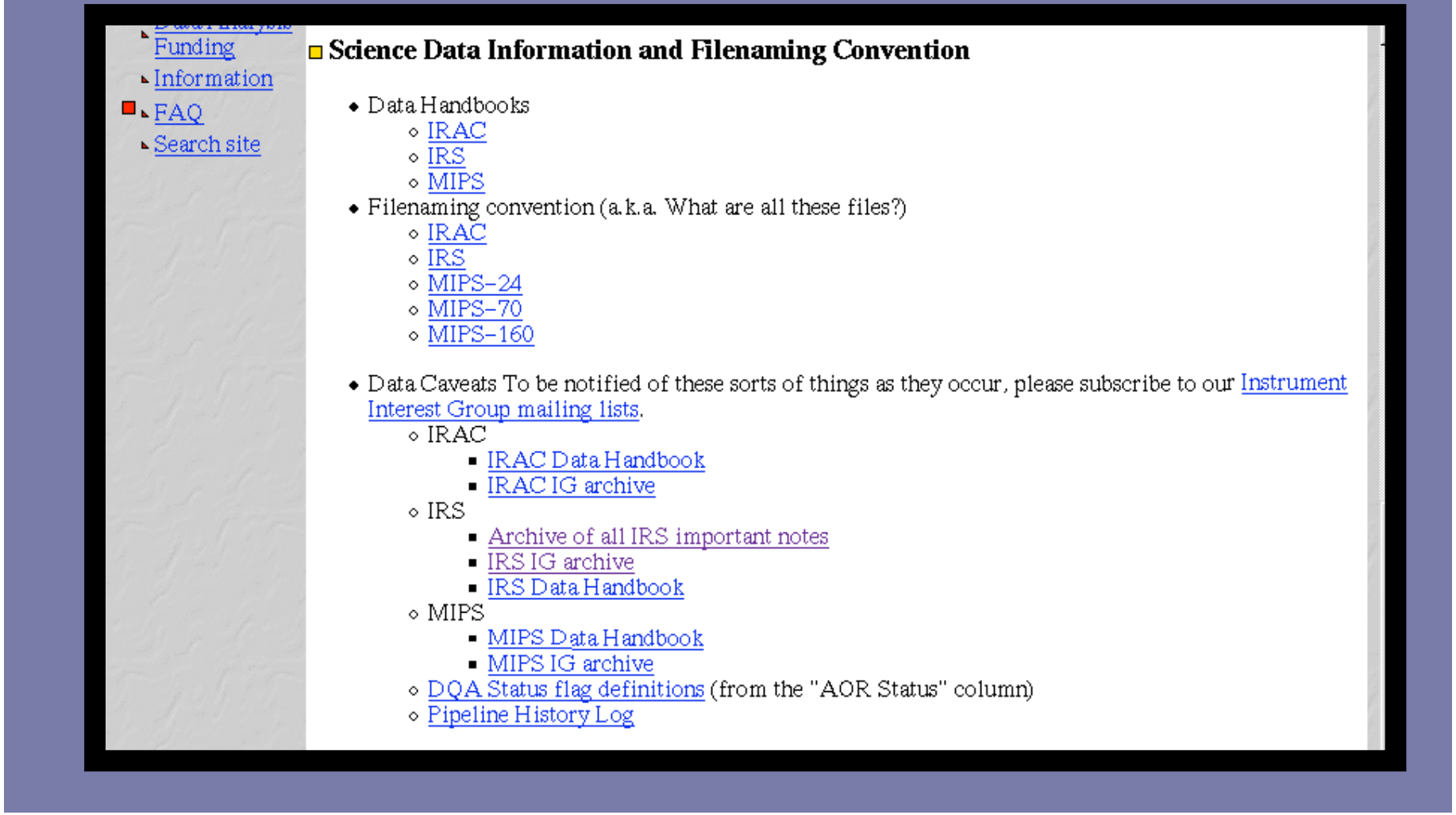
- We have taken several steps to attempt to enable this useful suggestion from the SUP:
  - The top link off of the SSC astronomers' homepage leads to information relevant to IRS ("Archive of all important notes to IRS observers"). The very latest understanding of IRS data is posted here, as well as links to the IRS interest group mailing list, and the data handbook.
  - The second link on the SSC astronomers' homepage is "Data Analysis: One place for all of your data analysis needs." On this page, we have added a section for "Data caveats". Also, we've added links to the data handbooks and instrument interest group mailing lists.
  - The data handbooks are updated every ~6 months, with software releases.
  - Section 7.3.4 of the Spitzer Observer's Manual also discusses known data caveats.

SSC homepage

The top 2 links on the astronomers' homepage lead to extensive information on "data caveats":



SSC Data Analysis webpage



Funding
Information
FAQ
Search site

Science Data Information and Filenaming Convention

- Data Handbooks
  - IRAC
  - IRS
  - MIPS
- Filenaming convention (a.k.a. What are all these files?)
  - IRAC
  - IRS
  - MIPS-24
  - MIPS-70
  - MIPS-160
- Data Caveats To be notified of these sorts of things as they occur, please subscribe to our Instrument Interest Group mailing lists.
  - IRAC
    - IRAC Data Handbook
    - IRAC IG archive
  - IRS
    - Archive of all IRS important notes
    - IRS IG archive
    - IRS Data Handbook
  - MIPS
    - MIPS Data Handbook
    - MIPS IG archive
  - DQA Status flag definitions (from the "AOR Status" column)
  - Pipeline History Log

1. Informing users of data features and potential traps (con't)

b) *"The existing instrument and general observers mailing lists should be kept active and updated regarding these issues."*

- Agreed. For "minor" issues, a note is sent to the instrument interest groups mailing lists (and we have noted this on the "data caveats" area of the data analysis webpage). Also, all notes are logged on the interest group webpages, for any to read, at any time.
- If the problem is serious, we notify either *all* of our observers, or all observers affected.
- Mailings, with the latest news, are issued monthly to the interest groups.

c) *"SSC might consider adding successful proposers to instrument mailing lists automatically based on AOR."*

- We have considered this, but have not implemented this suggestion. We feel that it is not appropriate for us to generate any more unsolicited email. However, for serious problems, all observers will be notified. We will encourage all observers to subscribe to the interest group mailing lists; a note to this effect will be included occassionally in our emails to all observers.

2. IRS and Extended Sources

"Since no closed solution to the problem will be forthcoming either overnight or possibly into the indefinite future, the SUP urges SSC to take steps to:

a) make as much fundamental calibration data which addresses this particular issue available to users.

- All stellar data used to calculate slit losses are public and released after every campaign. We are working to specifically identify these observations in the observing log, posted on our webpages.
- We will provide examples of extended vs point source calibration effects using SINGS data (see Armus's IRS presentation to the SUP). There will be a special webpage with this information.
- The best observing practises webpage was updated and we have created a special webpage set-up with tips on designing spectral maps. Both were in-place well before the GO-3 deadline. See:

  http://ssc.spitzer.caltech.edu/irs/documents/specmap_bop/

b) encourage active discussion amongst users with this genre of data with the aim of engaging users, who would otherwise prefer to be passive, in the pursuit of mitigating/ understanding the issues involved."

- The venue for such interactions exists within the IRS interest group forum.
- We have also been proactive, partially in response to the SUP's suggestion, in making as much information available as possible on the webpages noted above.
- We will occasionally encourage subscription to the interest group, in our emails to all observers.

2. IRS and Extended Sources (con't)

b) *Discourage submission of these proposals or at least make proposers fully aware of the difficulties which will lie ahead (possibly by encouraging contact with active users of this mode). Users reporting to the SUP noted that they felt they were not forewarned of the difficulties that they encountered and that they would have designed their observing strategies/target selection differently to avoid the worst of the extended source issues."*

- We are not discouraging sensible proposals to observe extended sources. However, we hope that by making the top entry on our homepage "Archive of all important notes to IRS observers", we have appropriately flagged an area where diligent proposers will be made aware of this issue. We have updated our "best observing practises" webpages, and the SOM, as well.
- In the program modification phase, we will remind successful proposers to consider these effects, and iterate with Science User Support as necessary to develop sound observing programs.

3. NVO compatibility of the data archive

a) *"… it was not clear to the SUP that the active population of the archive, both by the SSC and with Legacy data products, is fully accounting for its future digestion by NVO. The SUP requests that SSC address this concern at its next meeting."*

- There was a presentation at this meeting on this topic (Lacy, archive).
- IRSA is a central participant on NVO development, and is the final repository of the Spitzer archive.
  - IRSA is already registered with the NVO as a database.
  - The final Spitzer archive is under development, with extensive input from IRSA.
  - Metadata for IRSA use is currently written to the Spitzer database.
- Note that, currently, both the Spitzer archive and the NVO standards are evolving.
- Anticipate that reasonable effort will be required to meet the eventual NVO standard:
  - Were able to support NVO queries to the Spitzer archive for a few months. Use VO tables internally for some services.
  - Currently need help from NVO to update our interface software to new NVO protocols and reregister the Spitzer archive.
  - Original NVO interface took one of our developers ~half a day to write at NVO summer school. Sending another this year.

4. Long term planning

"The SUP understands that SSC is already planning for these late-term issues, but wishes to underscore:

a) the importance of establishing plans for finalizing the configuration of the Spitzer archive and plans for supporting archival research in the post-cryogenic era.

- The SSC is actively engaged in finalizing the configuration of the Spitzer archive, and the ultimate transition to IRSA. With extensive input from IRSA, we have generated metadata tables which are compatible with their infrastructure (see Lacy's archive presentation).
- On the latter point, a major component of the post-cryo era planning is with respect to supporting archival research. This is covered in a presentation by Helou on Wednesday morning.

b) the need to keep the user community well informed and involved in the proposing/planning process for an IRAC Band 1/2 post-cryogenic mission."

– Agreed. At this time, our interface for community input is from the SUP. We have prepared an initial presentation for NASA HQ, which will start the discussion of post-cryogenic mission plans.

– A presentation on our long term plans will be made at the "Making the Most of the Great Observatories" meeting in May 2006.

– We will continue to inform the community in our annual call for proposals cycle, documentation, and participation at major scientific meetings (e.g., AAS, etc).

5. Pipeline metrics and validation data

a) *"It was not clear to the SUP that there existed a set of performance specifications or objectives that could be used to gauge the need for allocating resources to the continued development of the various pipelines."*

- There were prelaunch requirements for SSC generated data products, and those have been substantially met.
- Since launch, we have actively addressing artifacts that became evident in-flight, with input from all of our observers (including the SUP). Substantial, obvious improvements have been made (most recently with IRS data).
- However, we do appreciate that we are at a point in the mission where a new cycle of planning needs to begin:
  - Find a balance between pipeline development, development of enhanced data products and tools, and identification of known issues to be addressed as we progress towards a final processing of all of the data.
  - We will be in position to elucidate concrete steps by SUP-18.
- We are also sensitive to the need to have the capability to support evolving instrument behavior during the mission, and the capability to address lower level artifacts in the data, that were masked by higher order effects (now corrected) or not addressed until the resources become available.

5. Pipeline metrics and validation data (con't)

b) *"In addition, since system features and quirks often arise and drive software development such specifications for each pipeline should be accompanied by an actively-updated publicly-available list of open issues remaining to be addressed."*

- As part of our planning for the rest of the mission, including identifying known issues to be addressed in the pipelines, as well as priorities for enhanced data products and pBCD tools, we are accumulating such a list. We will be in position to present a more concrete long-term plan for SUP-18.
- Some of the items targeted for future development is presented in the MIPS data handbook, (section 4.3.3). We will work to make all such information available as our planning progresses.

5. Pipeline metrics and validation data (con't)

c) *"The SUP also suggests that SSC maintain a public archive of the validation data which were used to characterize the performance of each pipeline release."*

- A formal evaluation process, with supporting documentation, for every software release is beyond the SSC's resource capability.
- Pipeline improvements address a substantially different set of problems with every software release cycle, and validation data is chosen to address the problem at-hand. Often this data is proprietary and hence can not be immediately made publically available.
- We will attempt to provide illustrative examples of data processed with successive software releases, to assist observers quantitatively understanding improvements made.

d) *"The pipeline history files should not only list specific changes to the pipeline but, where appropriate, the effect/improvement that a given modification was to have addressed."*

- We are attempting to quantify improvements as much as possible, and the ISTs have presented some of this during this meeting. The list of implemented pipeline changes is maintained at:

  http://ssc.spitzer.caltech.edu/archanaly/plhistory/

  and we will add quantitative measures to this area as best as we can.

We encourage all observers, if there is any doubt about the status or utility of their data, to contact the helpdesk, or attend a data analysis workshop.

6. Source extractions

a) *"Reluctantly, the SUP must agree that, in some sense, the opportunity for releasing source extractions with image data has been missed - the delivery of source lists being more benign if they had been considered a "reference" data file associated with post-BCD data from early in the mission. This agreement with SSC's position on the matter, however, does not mean that the development and characterization of source extraction tools at SSC should receive lower priority. If anything it places the burden on SSC to provide the well-characterized easily-used post-BCD source extraction software so that users can take responsibility for generating reliable source lists on their own."*

- For extragalactic MIPS data, MOPEX has been successfully used for PRF fitted photometry.
  - See XFLS 24um data (Fadda et al. 2006, ApJ, accepted astroph/0603488);
  - XFLS 70um data (Frayer et al. 2006, ApJ, 131, 250);
  - 24um data: Makovoz & Marleau, 2005, PASP, 117, 1113, "Point Source extraction with MOPEX"

- MOPEX has also been successfully used for point source detection in IRAC data
  - galactic center, Stolovy, Ramirez et al
  - SMC data, J. Simon et al. 2006.

- For broader applications, the SSC is testing MOPEX's performance (reliability, completeness) as follows:
  - Reliability: the IRAC deep calibration field (observed in every campaign)
  - Completeness: GFLS, XFLS and Pleiades fields; varying galactic latitutes, crowding and exposure coverage. Place simulated sources into bcd images and extract.

7. Theory/Archival proposal funding

a) *"SSC has suggested reducing the proportion of funding allocated to the archive/theory programs to 5% from its current 10% level. The SUP feels strongly that funding for archive/theory should not decrease."*

– In cycle 3, we did not decrease advertised archive/theory funding, as per the SUP's recommendation.

8. Lack of EPO funding

"When possible, SSC should encourage and facilitate GO and GTO interaction with the public even in the absence of explicit funding for this activity for observers. Such actions could include:

a) a letter from the SSC director underscoring the value of GO public outreach and, given the current state of funding for EPO, encouraging "volunteerism" within the community to compensate for the lack of funding.

- We will occasionally include a statement to this effect in our emails to all observers.

b) packaging and advertisement of downloadable 8"x11" public-oriented fact sheets (along with existing press release images) which highlight Spitzer science and Spitzer results and could be printed by a GO to support an outreach visit.

- We have updated several webpages and made this sort of material available:
  - http://ssc.spitzer.caltech.edu/documents/speakers/
  - http://www.spitzer.caltech.edu/features/downloads.shtml
  - http://coolcosmos.ipac.caltech.edu/resources/paper_products/index.html

c) explicit mention of public outreach in the in the Call for Proposals both as general encouragement and as an optional item to be cited in the "Status of Existing Observing Programs" section of a proposal."

- The current funding situation and the impacts on EPO/public outreach was specifically mentioned in Call for Proposals (section 12). Proposers/observers were encouraged to to pursue EPO activities, and the resources of the SSC were highlighted as being available to those interested.