

REPORT OF THE OCTOBER 20, 2014 SOFIA USERS GROUP (SUG)

1.0 INTRODUCTION

The sixth meeting of the SOFIA Users Group (SUG) took place on October 20, 2014 at the SOFIA Science Center, Building N232, Conference Room 103, NASA Ames Research Center, Moffett Field, CA. The SUG is charged with providing input to the SOFIA Project by a representative sample of the scientific community of users and potential users. The SOFIA Users Group Charter and the agenda for the October 20, 2014 meeting and the SUG membership may be viewed and downloaded on the internet at:

http://www.sofia.usra.edu/Science/advisorygroups/sug/SUG_006/index.html

Members attending the October 20, 2014 meeting were Lee Armus, John Bally, Imke de Pater, Jochen Eisloffel (by speaker phone), Bob Gehrz, (Chair), Matt Greenhouse, Urs Graf, Al Harper, and Luke Keller (by speaker phone).

The SUG thanks the SOFIA Project personnel involved in supporting the meeting and preparing the informative presentations.

2.0 OVERVIEW OF THE STATUS AND PROGRESS OF THE SOFIA PROJECT

The SUG found that commendable progress has been made on many fronts since the April 28, 2013 SUG 5 Meeting. We are especially pleased to hear that satisfactory progress is being made on inspecting and refurbishing the SOFIA aircraft at Lufthansa Technik in Germany during the heavy maintenance visit (HMV), and that science flights are expected to begin again in late November. It appears that adequate funding will be available for the coming fiscal year and we are hopeful that stable funding can be secured to enable the Project to be well placed for a Senior Review during 2018. The Project has received a critical report from the General Accounting Office, and the Project's response indicates that they understand where they must improve to serve the astronomy community effectively.

The Project has taken clear steps to improve the level to which data products are processed prior to delivery to the user community. The science center has set specific standards for timely delivery of Level-3 data products to the users with the range of 0.5 – 2.5 months depending on science instrument. We commend the Project for committing to this standard (E. Young presentation chart 21). However, we note that the project management team must ensure adequacy of resources, schedule management, and schedule performance tracking on the pipeline development work in order for the EY Chart 21 capability to be realized.

Although the above management aspect was not presented during the meeting, it was noted that the current Level 1 requirements for SOFIA may prioritize realization of annual flight hours over realized observatory science productivity. We strongly recommend that the NASA HQ SOFIA Program Scientist work to ensure that the Level 2 Project has written authority, in this fiscal year, to balance personnel and other resource allocations so that competing demands, such as flight hour capability and data reduction software development, can be optimized for maximum observatory science capability.

Efforts to investigate and mitigate the high FLITECAM thermal background at the longer wavelengths in FLIPPO mode have been partially successful and additional work is ongoing. We are encouraged to see that work to eliminate the bottleneck in the delivery of level 3 data from these instruments is now beginning to bear fruit. The FORCAST and FLITECAM grism analysis pipeline finally seems to be in hand. The auto pipelines (L2) for FORCAST are now operating. Finally, we believe that the Project has defined a viable outreach program that will renew its communication of the capabilities and successes of SOFIA to the scientific community.

3.0 AREAS OF EFFORT SUPPORTED AND ENCOURAGED BY THE SUG

We are pleased to hear that the SMO is engaged in the following activities and we look forward to hearing about progress at the next meeting (SUG 7):

- Investigation of plans to improve funding for General Investigator (GI) Projects. We believe that one proximate cause of GIs' failure to produce science papers is lack of support for data analysis.
- Further work to unstop the level 3 data bottleneck, another cause of low GI science production, is still being heavily emphasized. We applaud the Project's stated commitment to provide Level 3 products for all SOFIA observations.
- New deployment opportunities continue to be investigated. We encourage the Project to consider northern deployments and southern deployments straight south from Palmdale that might reach objects of opportunity with a return fuel stop in South/Central America.
- We understand that the Project is discussing strategies to maximize the SOFIA science output and encourage that this effort be continued.
- Dryden is discussing ways to trade flight hours against support for GI programs, and we encourage that these discussions continue.
- We understand that efforts are being continued to understand how to lower FLIPPO mode background, and encourage the Project to fly FLITECAM naked at least once as part of this effort.

4.0 AREAS OF CONCERN

The following areas of concern need to be addressed by the Project and plans for their resolution reported to the SUG in the Project's response to this report:

- We are concerned that the Project does not have enough full-time staff to obtain and maintain satisfactory flow of level 3 data for all of the science instruments (SIs). In order to demonstrate the power of the observatory it is absolutely crucial to provide fast and reliable data processing. Seeing how hard the Project has to fight to keep pace with the observations produced so far, it is doubtful that the currently available manpower is sufficient to cope with the higher flight rates and the increasing number of different science instruments and observing modes.
- We are very pleased to see significant progress in telluric correction and flux calibration for the FLIGHTCAM and FORCAST Grism spectroscopy data reduction pipelines. We suggest continued systematic observations of sources used for calibration of

spectroscopic data. Science programs that depend on good flux calibration will continue to need bright calibration sources observed on the same flight (and preferably close in altitude as noted in Bill Vacca's presentation) as the program objects. This plan should include continued cross-calibration of spectroscopic flux calibrator stars, since many of the brightest mid-IR standards are also variable in the mid-IR. We suggest that standard star observations be considered science data for programs that require a good flux calibration. The wavelength calibrations also require investment of flight time. The details of the wave calibrations mid-IR grism mode are most likely a function of source position in the slits. This will require observation and characterization to see if wavelength calibration corrections can be established for the data reduction pipelines. The best solution would of course be to do wavelength calibration for each source observed, but in practice this is very difficult because the only wavelength calibration features easily available are telluric lines, which are not necessarily high-contrast (especially in the cross-dispersed grism modes) at high altitudes. We suggest that the Project continue developing a clear policy describing whether (and/or under what conditions) acquisition of the data needed for spectrophotometric flux calibration is an observatory or an observer responsibility.

- Project management rigor (e.g., schedule planning, schedule performance tracking, resource sufficiency, and flow-down of accountability below the SOFIA project manager) on the data reduction software development activity appeared not to be fully in place. We feel that this rigor is needed to ensure that the EY Chart 21 objectives are realized.
- We believe it would be a mistake to start a one year data release clock on a GI's level 2 data before the level 3 data is put into the archive. The one-year release clock should only be started when the level 3 data are available. Already, grism results show that level 2 data have been out for almost a year before level 3 has been released, leading to a situation where users of the archive can attempt to scoop GIs with data they don't understand how to analyze properly.
- The Project should consider raising Director's Discretionary Time (DDT) from 7% to 15% to facilitate the conduct of high-risk, high-yield projects.
- The Project needs to develop a solicitation process for rapid acquisition of new science instruments. The prior AO solicitation was not that process. We would like the Project to better convey their thinking in this area and the options that are being considered. We note that one viable approach may be a multistep process involving 1) solicitation of a proposed science capability and notional design concept, 2) a development phase to conduct preliminary design activities that are supported by SOFIA engineering, and 3) a down-select of instrument projects for implementation.
- The Project needs to relax the level-one requirement on water vapor and re-state it in terms of line intensities. In view of the difficulties in calibrating the absolute water vapor column versus the line intensity measured using the Water Vapor Meter (WVM), the requirement to produce absolute water vapor columns is not useful to gauge the performance of the WVM. It should, therefore, be replaced by WVM performance requirements like e.g. accuracy of the determined water line emission temperature and stability requirements like e.g. an Allan variance minimum time. All science instruments – in particular the ones that can resolve atmospheric water absorption lines – should collaborate to cross-calibrate WVM data and infrared data with the goal of developing

reliable algorithms for correcting SOFIA instrumental data for the effects of variable water vapor absorption.

- Regarding large programs, the future AO's should say that the Project "will entertain (or consider)" them rather than say "we intend to select" one or more.
- The committee strongly endorses the approach of optimizing science impact above all other metrics. The Project should think creatively beyond both current and former practice and be encouraged to consider any changes needed to achieve that goal.

Respectfully submitted on behalf of the SOFIA Users Group,

A handwritten signature in black ink, appearing to read "R. Gehrz", with a long, sweeping horizontal stroke extending to the right.

Robert D. Gehrz, Chair

November 24, 2014