SOFIA Basic Science

Call for Proposals

This document and all other information pertaining to Basic Science with SOFIA may be found at http://www.sofia.usra.edu/Science/proposals/basic_science.

1. SOFIA Basic Science Program Description

1.1. Introduction:

The Stratospheric Observatory for Infrared Astronomy (SOFIA) is pleased to invite proposals for “Basic Science” observations, which are expected to take place in early 2011, in a 2-3 month interval within the time period of March 1 through August 31.

A total of 15 science flights are planned during the Basic Science period, using either the mid-infrared camera FORCAST[1] or the heterodyne spectrometer GREAT[2]. Of the Basic Science flights, 20% will be reserved for and allocated by the German Aerospace Center (Deutsches Zentrum für Luft und Raumfahrt; DLR). This Call for Proposals solicits proposals for the remaining 80% (12 flights, up to approximately 75 hours observing time), using either the FORCAST or GREAT instrument. It is being issued on behalf of NASA by the Universities Space Research Association (USRA). Funding to support the selected applicants will also be issued through USRA.

The call is open to all qualified astronomers, including non-US researchers, except for astronomers currently affiliated with German institutions. Astronomers with a German professional affiliation must participate through the DLR led Basic Science program. Only researchers with a US affiliation are eligible to receive financial support through this solicitation.

The Basic Science phase will have limited total duration, as well as limited planning resources available, as it occurs during observatory development and commissioning. All scientifically well-justified proposals will be considered. Preference will be given to substantial investigations that demonstrate significant scientific impact from SOFIA observations. The observations under the Basic Science Call for Proposals are considered shared risk.

[1] Faint Object infraRed Camera for the SOFIA Telescope, see http://www.sofia.usra.edu/Science/instruments/instruments_forcast.html
[2] German REceiver for Astronomy at Terahertz frequencies, see http://www.sofia.usra.edu/Science/instruments/instruments_great.html

1.2. The SOFIA Project

The SOFIA project is a joint project of NASA and DLR. SOFIA Science Mission Operations (SMO) is the organization responsible for the scientific operation of the observatory. It is operated by USRA under contract to NASA and is primarily located at the NASA Ames Research Center. The Deutsches SOFIA Institut (DSI), located at the University of Stuttgart, is the primary interface between SOFIA and the German astronomical community. The SOFIA aircraft development is managed by the NASA Dryden Flight Research Center. The aircraft itself is located at the Dryden Airborne Operations Facility (DAOF) at the Palmdale regional airport.

SOFIA has a 2.7m telescope, housed in a Boeing 747-SP aircraft. The airborne observatory will fly at altitudes between 35,000 and 45,000 feet. These altitudes will place it above 99.8% of the obscuring atmospheric H_2O vapor. The observatory operates in the 0.3-1600 μm wavelength region, with a focus on the mid and far infrared portions of the spectrum (5-650 μm). There are eight first generation instruments for SOFIA, which will provide imaging and spectroscopic capabilities that can be used for a wide range of scientific investigations. These instruments will come on-line over the next several years. Descriptions of the instruments can be found at http://www.sofia.usra.edu/Science/instruments/.
A number of science cases (Design Reference Mission Case Studies) can be found at http://www.sofia.usra.edu/Science/science_cases/ .
An overview of SOFIA is given in the SPIE paper #7012-62 (Gehrz & Becklin 2008), which can be accessed at
http://www.sofia.usra.edu/Science/proposals/basic_science/SPIE_Gehrz_and_Becklin.pdf

1.3. Available Instruments and Observing Modes

For Basic Science observations, the two instruments available will be FORCAST and GREAT. Not all of the planned observation modes of those instruments will be available during this period. The sections below describe the available modes. Details are given in the FORCAST and GREAT web pages linked from the Basic Science pages on the SOFIA web site.

1.3.1. FORCAST modes supported in Basic Science

For FORCAST, the science modes consist of observing strategies and filter choices. The supported science modes for Basic Science are:

Observing strategies:

1. Two position chop and nod (C2N)
2. Two position chop and nod with dither (C2ND)
3. Mosaic mode mapping (MOSMAP)

Filters:

For the Short Wavelength Camera (SWC):
5.4, 6.3, 6.6, 7.7, 8.6, 11.1, 11.3, 19.7, 24.2 µm

For the Long Wavelength Camera (LWC):
31.5, 33.7, 35.1, 38.8 µm

The GRISM modes of FORCAST are not offered in this proposal call.

Dichroic:
For Early Science, FORCAST can be used in a single channel mode or dual channel mode. Dual channel mode uses a dichroic to split the incident light towards the short and long wavelength arrays simultaneously. One of the following short wavelength filters: 11.1, 11.3, 19.7 or 24.2 µm, can be used at the same time as any of the long wavelength filters. All filters can be used in the single channel mode, allowing for increased sensitivity.

1.3.2. GREAT modes supported in Basic Science

For GREAT the science modes consist of observing strategies, receiver band and backend choices. The supported science modes for Basic Science are:

Observing strategies:

1. Position switching (PSW)
2. Beam switching (BSW)
3. On-the-fly mapping (in PSW or BSW mode)

Receiver bands:

Band L #1 & Band L #2 will be operated simultaneously. Both have instantaneous bandwidths of 720 MHz. Different frequencies can be set in each band. Both backends (two for each band) record data simultaneously. The frequency ranges of the two receiver bands are:

Band L #1: 1.25 THz - 1.5 THz

Band L #2: 1.82 THz - 1.92 THz

Backends:

Two array-Acousto-Optical Spectrometers (AOS):
4 GHZ bandwidth and 1 MHz resolution

Two Chirp-Transform-Spectrometer (CTS) spectrometers:
220 MHz bandwidth and 47 kHz resolution

The developmental Mid-Frequency band (2.4 – 2.7 THz) will not be available via this proposal call.

1.4. Basic Science Schedule

While the details are dependent on the overall SOFIA schedule, the nominal schedule for the Basic Science observing program is as follows:

January 5, 2009	Special Session at the AAS Long Beach meeting introducing the Basic Science Call for Proposals.
January 30, 2009	Release of draft Call for Proposals.
February 27, 2009	User comments on draft Call for Proposal due.
April 19, 2010	**Release final Call for Proposals**
	Proposal ingest opened.
	Observing window for Basic Science defined.
	Accessible telescope elevation range defined
July 2, 2010	Proposal Submission deadline.
October, 2010	Proposal Selections Announced.
April-June 2011	Nominal Basic Science Flights Window.

1.5. General Guidelines and Policies

The Basic Science observations will be undertaken as a collaborative effort between selected science proposers from the astronomical community, the Science Instrument teams and the SOFIA Science Mission Operations (SMO). The observations will be selected through a peer review competition (Sec. 1.1; 1.9). During these early stages of observatory operation and instrument characterization, the active participation of the Science Instrument teams in data acquisition, reduction and analysis will be crucial. Therefore, the instrument PI will be designated co-I on all accepted programs using that instrument.

Basic Science is intended to demonstrate that SOFIA is ready to perform scientific observations and is capable of supporting significant observing programs, consistent with the constrained observing conditions expected. The goal is to acquire high scientific value observations.

The Basic Science Team will consist of the selected proposal teams, the Science Instrument PIs (designated as program co-I(s)). Additional Science Instrument team members may be added to each selected proposal team based on negotiations between the proposal PI and the Science Instrument PI(s), facilitated by the SMO director.

1.5.1 Proposal Process

The SOFIA Basic Science proposal process will consist of two steps. In phase 1 a science justification, a feasibility analysis for the proposed program and a high level description of the proposed targets and observations will be required. This phase 1 proposal will form the basis of the peer review and proposal selection by USRA. Proposals that are awarded observing time based on the evaluation process described in Section 1.9 will subsequently be required to submit Phase 2 observation specifications following guidelines provided by the SOFIA Science Mission Operations. These submissions will provide the SOFIA Science Mission Operations and instrument PIs with the detailed definition of each observation to be executed for the program. In addition, proposers affiliated with U.S. institutions will be invited to submit a budget, based on funding guidelines provided by USRA.

SOFIA Basic Science phase 1 proposals shall be prepared and submitted via the SOFIA Proposal Tool (http://dcs.sofia.usra.edu/proposalDevelopment/installSPT) [3] which is a Java based application. The prospective proposer must download SPT to a local computer. The proposal shall consist of standard formatted information filled in via the SPT form fields (such as proposer information, scientific category, instrument, target and exposure information) and a text file, to be uploaded in .pdf format described below (section 2.1.2). SPT is available for most commonly used platforms, including Mac OS X, Windows and linux (http://dcs.sofia.usra.edu/proposalDevelopment/installSPT/index.jsp)

An outline of the proposal preparation process can be found in section 2.

1.5.2. Who May Propose

Participation in the US lead SOFIA Basic Science Program is open to scientists from all categories of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit institutions, NASA Centers, and other Government agencies. German organizations, however, must participate through the DLR led program.

Each SOFIA Basic Science proposal must identify a single Principal Investigator (PI) who assumes responsibility for the conduct of the scientific investigation. Proposal Co-Investigators must have well defined roles in the investigation, which will be evaluated as part of the proposal review process. Following selection by the SMO Director, the SOFIA Science Mission Operations will communicate formally only with the PI (or a person designated by the PI) of each proposal, except for funding issues where communications will be primarily with the institutional Sponsored Research Office (or equivalent). It is the responsibility of the PI (or designee) to provide the SOFIA project, in a timely manner, any information necessary for implementing observations, and also to respond to any questions concerning observational constraints or configurations.

[3] In large parts based on the STScI Astronomers' Proposal Tool (APT)

1.5.3. Late Proposals

Consistent with USRA and NASA policy, a late proposal may be considered only if it is judged to be in the best interests of the project and US Government. However, a proposal submitted after the published deadline is unlikely to be considered of uniquely greater value to USRA and NASA than the proposals that are submitted on time. A proposal will be considered to have been submitted on time only if all necessary components have been received by the published deadline. Finally, note that processing delays at the proposer's home institution, the method of shipment of the proposal, or Internet delays, do not excuse the late submission of a proposal.

1.6. Data rights and distribution

All scientifically meaningful raw data obtained during the Basic Science phase will be made available to the SOFIA Science Mission Operations in standard FITS format, with header information and appropriate FITS keywords conforming to the SOFIA FITS keyword dictionary. This delivery does not include documentation or analysis tools. The data will be made available to the proposal PIs as soon as is feasible after each flight. It is expected that the raw data will be available to the Proposal PI, , through the SOFIA archive, within 24^h of the end of each flight. The proposal and Science Instrument PIs shall jointly notify the SMO director of which data sets are to be labeled to be "scientifically not meaningful", as soon as possible after each flight, but no later than one month after receiving the data.

Raw data will be validated by the SOFIA Science Mission Operations staff and, when appropriate, the Instrument PI prior to archive ingestion. Each dataset will be assigned a 'Data Quality' code. These data will be accessible to the general community after a proprietary period of six months. While the goal is the prompt reduction and analysis of Early Science Data, general community support for data analysis from the Science Instrument teams may be limited during this period.

Any reduced and calibrated data products shall be delivered to the SOFIA archive and will be made available to the community three months after archive ingestion, and no longer than nine months following the archival of the associated raw data.

1.7. Targets for Observations

All scientifically valid observations may be proposed for, with the exception of those duplicating the ones in the "Reserved Observations Catalog" lists, designated by the FORCAST and GREAT science teams.

Basic Science observations will be performed during an approximately two to three month period, expected to fall in the first half of 2011. To allow for development contingencies, this call solicits observations of targets with SOFIA availability for a observing window within a 6 month period that commences on 1 March 2011 (see also Section 1.1). The potential investigator should consult the SOFIA Visibility Tool to check on target availability during the Basic Science period. The Visibility Tool can be found at: http://dcs.sofia.usra.edu/observationPlanning/visibilityToolMain.jsp . Because Basic Science flight operations will be conducted from the Dryden Aircraft Operations Facility, no targets in the declination range -36 degrees to -90 degrees will be considered.

1.7.1. Reserved Observations

As part of the instrument development contract, the instrument teams were awarded a limited amount of Guaranteed Time Observing (GTO). The teams have chosen to exercise this allocation at a later stage. To protect the interests of the instrument development teams, the SOFIA project has allowed the Basic Science instrument teams to set aside a limited number of targets and associated exposure times as "Reserved Observations". These reserved observations may not be proposed to be reproduced in Basic Science – including by any member of the instrument teams.

A Reserved Observation consists of the combination of position on the sky, instrument observing mode, and length of observation. "Instrument observing mode" encompasses the basic scientific intent of the observation by specifying, for example, the wavelength range for FORCAST or the frequency of observation for GREAT.

The Reserved Observation Catalogs (ROC) for the two instruments are independent of each other. The initial Reserved Observation list only applies to Basic Science, and the Instrument PIs will have the opportunity to revise the Reserved Observation Catalog prior to subsequent proposal calls.

Observation requests for a target in the ROC will require a strong scientific justification and may only be proposed for scientific applications that clearly cannot be accomplished with the Reserved Observations. The justification for such a duplication must be clearly addressed in the proposal. Any such proposals must, at a minimum, aim to achieve a signal-to-noise ratio of twice that expected from the Reserved Observation.

1.7.2. FORCAST and GREAT Reserved Observations

The FORCAST and GREAT Reserved Observations Catalogs can be found in appendix A. The FORCAST and GREAT ROCs are independent and hence a target in the FORCAST-only ROC may be proposed for GREAT observations and vice versa without the limitations in exposure time discussed above.

1.8. Proposal Evaluation and Selection Process

Proposals submitted to USRA in response to this opportunity will be evaluated in a competitive peer review conducted by SOFIA Science Mission Operations and led by the SOFIA Science Mission Operations Chief Science Advisor. The peer review panel, including its chair, will be recruited from the astronomical community and be subject to the standard NASA procedures and rules.

Based on the results of the peer review, the SOFIA Chief Science Advisor will develop a recommendation for the total program to be submitted to the SMO director, who will make the final proposal selection.

The following factors will be used in evaluating proposals for the SOFIA Basic Science Program.

1. The overall scientific merit of the proposed investigation.
2. The suitability of using the SOFIA observatory and data products for the proposed investigation.
3. The feasibility of accomplishing the objectives of the investigation given the early stage in the characterization of the observatory and instruments.
4. The degree to which the investigation uses SOFIA's unique capabilities.
5. The competence and relevant experience of the Principal Investigator and any collaborators to carry the investigation to a successful conclusion.

The scientific review panels will be given an assessment of the technical feasibility of each proposal as determined by the SOFIA Science Mission Operations. After acceptance of an observing program by SMO, successful proposers must provide the required inputs to detailed observing plans for submission to the SOFIA Science Mission Operations. Instructions for completing these inputs will be distributed to the selected PIs.

The SOFIA project reserves the right to select only a portion of a proposer's investigation, in which case the PI of the proposal will be given the opportunity to accept or decline the implementation of the partial selection.

As noted in section 1.4, the final schedule for the Basic Science flights is contingent on satisfactory results from upcoming observatory in-flight performance tests.

The scientific review panels will be asked to evaluate the proposed observations based on the above criteria, irrespective of the exact visibility window (within the overall six month period). Proposal selection by the SMO Director will be made on the basis of results from the peer review process and the alignment of target availability with the conclusive timing of the nominal two-month window. Under the contingency of significant schedule slip, highly ranked proposals with targets that fall outside of the nominal two-month observing window, but within the overall six month period, will be held in reserve. As the Basic Science scheduled is finalized, issues related to target availability will be reviewed and a final observing list selected by the SMO director.

At the discretion of the SMO director, an appropriate over-subscription of the available flight times may be accepted via the peer review process with an associated prioritization, which will allow for contingencies in flight planning. The implementation of the observing prioritization and target selection will be approved by the SMO director.

1.9. Funding for US-based Investigators

Limited funds for awards under this solicitation are expected to be available to investigators at U.S. institutions subject to the annual NASA budget cycle. Successful proposers at U.S. institutions, including U.S. Co-Investigators on successful non-U.S. proposals, will be eligible for funding. It is expected that the Basic Science General Investigator support will be consistent with other NASA-sponsored observing programs. However, budgets should not be submitted with research proposals submitted in response to this call. Instead, the selected investigators will receive a funding guideline from USRA based on the scope of the approved observing program and the available budget for the SOFIA Basic Science program. A budget summary and narrative description of how these funds will be used must be submitted after the receipt of the guideline. The deadline for budget submittal will be announced after the proposal selection and included in the funding guidelines document. An institutional signature will be required when a budget is submitted.

Due to the uncertain nature of the Basic Science schedule, disbursement of research grants will take place only after the successful completion of the first observing flight. Limited expenses for such items as travel to the observing flights may, upon request and with appropriate justification, be covered directly by USRA.

1.10. Proposer Participation in Observations

Because the SOFIA observatory will still be in formal development during the Basic Science phase, the project needs to minimize the complexity of operations, and hence the number of persons on the airplane, to essential personnel. The Basic Science observations will be performed as collaborations between the selected proposers, the SOFIA Science Mission Operations and the instrument teams. Of the very limited number of "astronomer slots" available for the Basic Science flights, one (1) slot has been allocated for the selected proposal PI. The remaining slots will be required for the instrument team and support personnel. At the discretion of the instrument team PI, and with concurrence from the SMO director, the program PI and instrument team may choose to reallocate additional "astronomer slots" from the instrument team to the proposal PI. Even if observations for more than one GI program are planned in a given flight only one seat is available. Therefore GIs who wish to be considered for an opportunity to fly should state this in their proposal.

1.11. Outreach

1.11.1 Education and Public Outreach

The SOFIA project encourages researchers to include an Education and Public Outreach (EPO) component in their program. Selected proposals will be offered several options to participate in SOFIA related EPO activities, with educational resources and funding support available from the SOFIA project. These options include:

1) The SOFIA project will link the PI to educator(s) in their area and send materials and funding to help them do local outreach such as classroom visits, field trips, etc., modeled after the ASP's Project ASTRO

2) In cases where the PI already has active or specific proposals for EPO, the SOFIA project will provide support to their program, contingent on mutual agreement of support type and funding level.

1.11.2 Press Releases and Presentations

Press releases associated with SOFIA observations during Basic Science will be jointly released by NASA and the DLR and will require coordination with both NASA and the DLR before release. The SOFIA Science Mission Operations E&PO officer and his German/DSI E&PO counterpart will coordinate the press release process. Other relevant press releases by participating organizations (including PI institutions) must be coordinated with the SOFIA project, NASA and DLR. Other presentation material based on the Basic Science observations can be generated by any member of the Basic Science Team and will be considered part of the team's collective set of material. Any member of the team may use these materials (e.g., in public science talks or conference proceedings).

2. Proposal Preparation and Submission

2.1. Proposal Preparation

Each Basic Science proposal must be prepared using the SOFIA Proposal Tool (SPT). The proposal information is directly entered, while text sections including the scientific justification and feasibility analysis should be in PDF files, uploaded via SPT[4].

Proposals must be written in English. The length of each section of the proposal should not exceed the page limits indicated in Section 2.1.2, using single-spaced 8.5x11 inch or A4 format with 1 inch (2.5 cm) margins. Proposals must be printed to the PDF files with a font size no smaller than 11 points (about 6 characters per cm). Reviewers will only be provided the portion of each proposal that complies with the page limits.

For the convenience of those wishing to typeset the proposal text using LaTeX, simple template and style files are available at the SOFIA Basic Science web page. A similarly simple MSWord template is also available. The use of these files is **not** required.

The abstract provided using the Proposal Information form is limited to 300 words (see Section 2.1.2).

[4] http://dcs.sofia.usra.edu/proposalDevelopment/installSPT/index.jsp

2.1.1 The SOFIA Proposal Tool (SPT)

The SOFIA Proposal Tool (SPT) provides the user with a simple form-based interface for preparing a proposal and for electronic submission to the SOFIA Science Mission Operations. After downloading the appropriate package[4] and following the install instructions, the user starts a new proposal by launching the SPT application. The proposer then fills out the necessary form fields including proposer information, abstract, instrument(s), and target lists. The Science and Technical Justification is prepared in a separate text editor (e.g. MS Word, LaTeX, etc...) and saved as a PDF file. Using SPT, the proposer then identifies this PDF file on a local disk for attachment to the proposal summary information. When the proposal is complete, the user submits all the complete proposal directly to the SOFIA Science Mission Operations using SPT and a unique identifier is returned for later reference. Proposals that have been submitted to the SMO can be ***resubmitted*** using SPT at any time up to the proposal deadline (note that old versions are not retained).

Please note that the concepts of "Blackout Periods", or "Long Term Observation" are not supported in Basic Science and should not be used in the SPT form. Similarly, Target of Opportunity observations are not supported for Basic Science.

2.1.2 Proposal Text Sections (To be uploaded as a single .pdf file)

Proposal Sections – The uploaded .pdf file must contain the following Sections and be addressed in the order indicated for each proposed observing program. The page length limits are indicated.

1. **Scientific Justification (up to 3 pages)** - Describe the scientific objectives of the proposed investigation, clearly stating the goals and their significance to astronomy, and why SOFIA data are essential to the investigation. The page limit includes all text, figures and tables. A separate page for references only is allowed.

2. **Feasibility (up to 1 page)** - The proposed program must justify the requested exposure time for each target, noting the target visibility assessment, required signal-to-noise ratio (S/N) and spectral resolution, expected flux, and any other information relevant to the observation (e.g., wavelength region of interest, spectral flux distribution, emission line intensities). This section forms the basis for assessment of the technical feasibility of the proposed observations. Describe the basis for and accuracy of the flux estimates. This section should also contain justifications for special calibration procedures, if applicable (Section 3.2.2).

3. **Principal Investigator and Co-Investigator Biographical and Publication Data (1 page for the PI with one additional page for co-Is)**. A short biographical sketch for the PI should be provided and include a list of the most recent refereed publications relevant to the scientific proposal. Short biographical data (~1 paragraph each), including their roles in the proposed project, should be provided for the Co-I's

2.1.3. Exposure time estimates

Estimates of instrument sensitivities can be made using the SOFIA Instrument Time Estimator (SITE)[5], a web-based tool that provides total integration time or S/N given instrument, filter(s), source type (point, extended, emission line) and water vapor overburden. Algorithms and assumptions used are given in the help link on the page. At the current time, for the Basic Science instruments only FORCAST is covered by SITE.

For GREAT, best estimate sensitivities and a brief tutorial on heterodyne sensitivity estimates are available at the Basic Science web site (http://www.sofia.usra.edu/Science/proposals/basic_science/great_tutorial.pdf).

Because this call for proposals is being issued prior to in flight commissioning, the sensitivities of the instruments are somewhat uncertain.

2.1.3. Sky availability during Basic Science

The sky availability for SOFIA observations, particularly during Early Science, is constrained by several factors, including the need to return to the DAOF at the end of a flight. Other restrictions include that of allowed airspace, maximum radius of about 400 nautical miles and avoidance of paths over the Pacific Ocean.

The instantaneous pointing of the telescope, relative to the aircraft, is restricted to ±3˚ cross-elevation (on the left hand side of the plane) and elevations between 15 and 75 degrees (20 and 60 degrees unvignetted). The available telescope elevation depends on the flight testing (envelope expansion) that has been completed at the time of Basic Science and might be less than the nominal range.

The SOFIA Visibility Tool (VT)[6] provides the capability to estimate what date, time, and aircraft heading are required to observe an astronomical target from a given point on the earth's surface. The tool distinguishes between unvignetted and vignetted observations, includes easy selection of common SOFIA takeoff locations, can simultaneously plot up to sixteen sources, and shows sunrise and sunset times on the plots. VT is useful for determining whether or not a particular source will be available to observe during the Basic Science period. For Basic Science, only flights out of the DAOF (Palmdale) will be available.

In terms of potential target selection, we note that due to the requirements of flight planning, targets in parts of the sky complementary to highly sought regions will likely be sought to provide efficient flight plans. Depending on the exact dates and time of flights relatively large areas of the sky are available, but due to flight restrictions. only objects north of Dec.≈-36˚ are likely to be observable in Basic Science. The 400 nautical miles radius limitation corresponds to flight legs up to about 1.5h.

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[5] http://dcs.sofia.usra.edu/proposalDevelopment/SITE

[6] http://dcs.sofia.usra.edu/observationPlanning/visibilityToolMain.jsp

Basic Science proposers are not expected to lay out flight plans or perform detailed visibility analysis for their proposals. Flight planning will be done by the SOFIA Science Mission Operations staff and the instrument teams, with input from the selected science PIs.

2.2. Proposal Submittal

Proposals must be submitted using the SPT application. Upon successful upload, the system will generate an automatic message acknowledging the submittal.

Once the forms in SPT have been filled out and the proposal text attached, the proposal is ready for submission to the SOFIA Science Mission Operations. Before submission, the proposer should verify that all required form fields have been filled in by pressing the "Errors and Warnings" button on the SPT tool bar (there is also an "errors and warnings" indicator at the bottom right of the SPT tool that shows status at all times). The resulting "Diagnostic Report" will indicate if there are any fields missing. Once all fields have been filled in, the diagnostic report should be empty and a green check mark will appear in "errors and warnings" indicator at the lower right hand corner of the SPT window. The proposer should save the proposal to the local desktop at this point.

To submit the proposal to the SOFIA Science Mission Operations, simply hit the "Submit" button in the SPT tool bar, enter any "Submission Comments" in the text box provided, and then press the "Submit Phase 1" button. If any required fields are missing, the proposal will not be submitted; the proposer should go back and run the Errors and Warnings check again (see previous paragraph). If there are no errors and warnings, a pop-up window will appear indicating that the proposal has been assigned a unique identifier (Proposal ID) and has been successfully received by the SOFIA Science Mission Operations. In the Submission Window, the submission log should now show the Proposal ID and the date and time of submission. In addition, a confirmation email will also be sent to the proposer using the address provided in the proposal.

Proposals can be resubmitted to the SOFIA Science Mission Operations at any time before the proposal due date. Note that a resubmitted proposal **replaces** all previously submitted versions (i.e. there is no version management, the SOFIA Science Mission Operations only keeps the latest proposal submission from each proposer). To change and resubmit a proposal, the proposer should start SPT, select "Open" or "Open Recent" from the "File" menu, and choose the local copy of the proposal to be updated. The Proposal ID should be shown in both the "Node Tree" at the left hand side of the SPT window, and in the Window Title itself. Once changes are made, the proposer should check the proposal for errors and warnings as described above and then hit the "Submit" button. After entering any comments, the proposer would then press the "Resubmit Phase 1" button. A pop-up window will appear indicating that the proposal has been received and the submission log should now show the date and time of the re-submission. Once again, a confirmation email will be sent to the proposer using the address provided in the proposal.

3. Observations and Data

3.1. Flight Planning & Target Prioritization

Flight planning will not be part of the Basic Science proposals. Upon ranking by the peer review panel and selection by the SMO director, a prioritized target pool will be provided to the SOFIA Science Mission Operations, which will produce flight plans in consultation with the instrument teams and science PIs. The effort will be carried out under the scientific direction of the SMO director.

As noted in Section 1.8 an appropriate over-subscription of the available flight times may be accepted via the peer review process with an associated prioritization. Since the Basic Science program is constrained to a set number of flights, and due to this over-subscription or due to unexpected contingencies, not all accepted targets are guaranteed to be observed. Unobserved targets will not be retained for future observing cycles.

3.2. Data Processing, Calibration and Distribution

3.2.1 Data Processing, Archiving and Distribution

All scientifically meaningful raw data obtained during the Basic Science phase will be archived by the Observatory in standard FITS format, with header information and appropriate FITS keywords conforming to the SOFIA FITS keyword dictionary. The proposal and Science Instrument PIs shall jointly notify the SMO director of which data sets are to be labeled to be "scientifically not meaningful", as soon as possible after each flight, but no later than 1 months after receiving the data. These data will be accessible to the general community after a proprietary period of 6 months, counting from the time of archival.

Data reduction during Basic Science will be the joint responsibility of the proposal and instrument PIs. Any reduced and calibrated data products shall be delivered to the SOFIA Archive in standard FITS format and will be made available to the community three months after Archive ingestion. The detailed requirements of this data delivery may be negotiated with the SMO director.

Approval to deviate from these archiving requirements may be granted by the SMO director.

Raw data will be distributed to the Basic Science teams remotely via the SOFIA Science Archive (encrypted http), or locally via direct data transfer or by removable media, as agreed by the teams and the SOFIA Science Mission Operations.

Both raw and reduced data will be made available to the community, after the proprietary period, through the SOFIA Science Archive

The data deliveries to the SOFIA Science Archive do not include documentation or analysis tools. The data release will make clear the limitation on community support by the Science Instrument teams during the Early Science period.

3.2.2 Calibration

Because this Call for Proposal is being issued prior to the initiation of SOFIA science flights, the data calibration is currently uncertain and will be developed primarily by the instrument teams in collaboration with the SOFIA Science Mission Operations staff.

It is expected that the photometric calibration for FORCAST during Basic Science will be no worse than 20%.

The absolute photometric accuracy of GREAT, during Basic Science is expected to be no worse than 20%.

Basic Science proposals do not need to include time for calibration target observations. Calibration observations will be allocated as general overhead and will be obtained at a Basic Science wide level. Proposers wishing to implement specific calibration strategies may propose to do so, but must identify the specific calibration target observations to accomplish these goals and explicitly request the observing time to accomplish these observations. The calibration strategies and targets will be evaluated in the technical and science reviews, and if recommended by the review process will be treated as part of the proposal.

4. Contacts and Further information

For further information about the Basic Science Call for Proposals, or help in preparing proposals, please see the "information for Researchers" section of the SOFIA web site, or contact the SOFIA help desk at sofia_help@sofia.usra.edu.

Questions about the SOFIA General Investigator program can be directed to the SOFIA Science Operations Manager, Dr. B-G Andersson (bg@sofia.usra.edu), or SOFIA User Support Scientist Dr. Ravi Sankrit (rsankrit@sofia.usra.edu).

For further information about the SOFIA Science project, please contact the above, or the Science Mission Operations Director, Dr. Erick T. Young (eyoung@sofia.usra.edu)

Appendix A1.

FORCAST Basic Science
Reserved Observations Catalog (ROC)*

Science Group	Object Name	RA (J2000)	Dec (J2000)	SWC Filter [µm]	LWC Filter [µm]	Total Time [h]
Debris disks	Alpha Lyr	18:36:56.34	+37.1:47:01.3	19.7	31.4	8.05
	Alpha Lyr	18:36:56.34	+37.1:47:01.3	24.2	37.1	13.66
	Fomalhaut	22:57:39.05	-29:37:20.1	19.7	31.4	0.94
	Fomalhaut	22:57:39.05	-29:37:20.1	24.2	37.1	1.17
	HD 141569	15:47:20.2	-03:46:12	6.3	-	0.25
	HD 141569	15:47:20.2	-03:46:12	7.7	-	0.25
	HD 141569	15:47:20.2	-03:46:12	8.6	-	0.25
	HD 141569	15:47:20.2	-03:46:12	11.1	37.1	0.25
	HD 141569	15:47:20.2	-03:46:12	11.3	37.1	0.25
Galactic Center	Sag A West, Arches, filaments	17:45:50.5	-28:49:28	19.7	31.4	0.65
	Sag A West, Arches, filaments	17:45:50.5	-28:49:28	24.2	37.1	1.10
	"Pistol" star, Sickle region	17:46:15.3	-28:50:04	19.7	31.4	0.07
	"Pistol" star, Sickle region	17:46:15.3	-28:50:04	24.2	37.1	0.15
Extra-galactic	NGC 253	00:47:33.13	-25:17:17.8	5.4	-	0.50
	NGC 253	00:47:33.13	-25:17:17.8	6.3	-	0.50
	NGC 253	00:47:33.13	-25:17:17.8	6.6	-	0.50
	NGC 253	00:47:33.13	-25:17:17.8	7.7	-	0.50
	NGC 253	00:47:33.13	-25:17:17.8	8.6	-	0.50
	NGC 253	00:47:33.13	-25:17:17.8	11.1	-	0.50
	NGC 253	00:47:33.13	-25:17:17.8	11.3	-	0.50
	NGC 253	00:47:33.13	-25:17:17.8	19.7	31.4	0.50
	NGC 253	00:47:33.13	-25:17:17.8	24.2	37.1	0.50
	M82	09:55:52.2	+69:40:47	5.4	-	0.50
	M82	09:55:52.2	+69:40:47	6.3	-	0.50
	M82	09:55:52.2	+69:40:47	6.6	-	0.50
	M82	09:55:52.2	+69:40:47	7.7	-	0.50

_	M82	09:55:52.2	+69:40:47	8.6	-	0.50
_	M82	09:55:52.2	+69:40:47	11.1	-	0.50
_	M82	09:55:52.2	+69:40:47	11.3	-	0.50
_	M82	09:55:52.2	+69:40:47	19.7	31.4	0.50
_	M82	09:55:52.2	+69:40:47	24.2	37.1	0.50
_	NGC 4038/9	12:01:52	-18:52:02.9	19.7	31.4	1.50
_	NGC 4038/9	12:01:52	-18:52:02.9	24.2	37.1	1.50
_	M51	13:29:52.37	+47:11:40.8	19.7	31.4	2.00
_	M51	13:29:52.37	+47:11:40.8	24.2	37.1	2.00
_	NGC1068	02:42:40.83	-00:00:48.4	5.4	-	0.50
_	NGC1068	02:42:40.83	-00:00:48.4	6.3	-	0.50
_	NGC1068	02:42:40.83	-00:00:48.4	6.6	-	0.50
_	NGC1068	02:42:40.83	-00:00:48.4	7.7	-	0.50
_	NGC1068	02:42:40.83	-00:00:48.4	8.6	-	0.50
_	NGC1068	02:42:40.83	-00:00:48.4	11.1	-	0.50
_	NGC1068	02:42:40.83	-00:00:48.4	11.3	-	0.50
_	NGC1068	02:42:40.83	-00:00:48.4	19.7	31.4	0.33
_	NGC1068	02:42:40.83	-00:00:48.4	24.2	37.1	0.33
_	Arp 299	11:28:32.8	+58:34:45	5.4	-	0.50
_	Arp 299	11:28:32.8	+58:34:45	6.3	-	0.50
_	Arp 299	11:28:32.8	+58:34:45	6.6	-	0.50
_	Arp 299	11:28:32.8	+58:34:45	7.7	-	0.50
_	Arp 299	11:28:32.8	+58:34:45	8.6	-	0.50
_	Arp 299	11:28:32.8	+58:34:45	11.1	-	0.50
_	Arp 299	11:28:32.8	+58:34:45	11.3	-	0.50
_	Arp 299	11:28:32.8	+58:34:45	19.7	31.4	1.00
_	Arp 299	11:28:32.8	+58:34:45	24.2	37.1	1.00
HII / PDR	M16	18:18:51.5	13:49:30	6.3	-	0.04
_	M16	18:18:51.5	13:49:30	6.6	-	0.15
_	M16	18:18:51.5	13:49:30	7.7	-	0.02
_	M16	18:18:51.5	13:49:30	8.6	-	0.04
_	M16	18:18:51.5	13:49:30	11.1	31.4	0.19
_	M16	18:18:51.5	13:49:30	11.3	33.5	0.55
_	M16	18:18:51.5	13:49:30	19.7	34.8	0.21
_	M16	18:18:51.5	13:49:30	24.2	37.1	0.32
_	M17	18:20:26	-16:10:36	6.3	-	0.08
_	M17	18:20:26	-16:10:36	6.6	-	0.08
_	M17	18:20:26	-16:10:36	7.7	-	0.09
_	M17	18:20:26	-16:10:36	8.6	-	0.05
_	M17	18:20:26	-16:10:36	11.1	31.4	0.06
_	M17	18:20:26	-16:10:36	11.3	33.5	0.16
_	M17	18:20:26	-16:10:36	19.7	34.8	0.06

_	M17	18:20:26	-16:10:36	24.2	37.1	0.08
_	S106	20:27:27	37:22:48	5.4	-	0.07
_	S106	20:27:27	37:22:48	6.6	-	0.49
_	S106	20:27:27	37:22:48	7.7	-	0.02
_	S106	20:27:27	37:22:48	8.6	-	0.02
_	S106	20:27:27	37:22:48	11.1	31.4	0.04
_	S106	20:27:27	37:22:48	11.3	33.5	0.13
_	S106	20:27:27	37:22:48	19.7	34.8	0.10
_	S106	20:27:27	37:22:48	24.2	37.1	0.19
_	Orion BNKL, Trapezium, Bar	05:35:16.0	-05::23:17	5.4	-	0.40
_	Orion BNKL, Trapezium, Bar	05:35:16.0	-05::23:17	6.3	-	0.40
_	Orion BNKL, Trapezium, Bar	05:35:16.0	-05::23:17	6.6	-	0.40
_	Orion BNKL, Trapezium, Bar	05:35:16.0	-05::23:17	7.7	-	0.40
_	Orion BNKL, Trapezium, Bar	05:35:16.0	-05::23:17	8.6	-	0.40
_	Orion BNKL, Trapezium, Bar	05:35:16.0	-05::23:17	11.1	31.4	0.40
_	Orion BNKL, Trapezium, Bar	05:35:16.0	-05::23:17	11.3	33.5	0.40
_	Orion BNKL, Trapezium, Bar	05:35:16.0	-05::23:17	19.7	34.8	0.40
_	Orion BNKL, Trapezium, Bar	05:35:16.0	-05::23:17	24.2	37.1	0.40
_	Orion Nebula "Deep"	05:35:16.0	-05::23:17	5.4	-	0.17
_	Orion Nebula "Deep"	05:35:16.0	-05::23:17	6.3	-	0.17
_	Orion Nebula "Deep"	05:35:16.0	-05::23:17	6.6	-	0.17
_	Orion Nebula "Deep"	05:35:16.0	-05::23:17	7.7	-	0.17
_	Orion Nebula "Deep"	05:35:16.0	-05::23:17	8.6	-	0.17
_	Orion Nebula "Deep"	05:35:16.0	-05::23:17	11.1	31.4	0.17
_	Orion Nebula "Deep"	05:35:16.0	-05::23:17	11.3	33.5	0.17
_	Orion Nebula "Deep"	05:35:16.0	-05::23:17	19.7	34.8	0.17

_	Orion Nebula "Deep"	05:35:16.0	-05::23:17	24.2	37.1	0.17
Galactic	HV Tau	04:38:35.311	+26:10:38.49	5.4	-	0.01
Star formation	HV Tau	04:38:35.311	+26:10:38.49	8.6	-	0.01
_	HV Tau	04:38:35.311	+26:10:38.49	11.1	31.4	0.01
_	HV Tau	04:38:35.311	+26:10:38.49	19.7	34.8	0.03
_	HV Tau	04:38:35.311	+26:10:38.49	24.2	37.1	0.05
_	DK Tau	04:30:44.243	+26:01:24.79	5.4	-	0.01
_	DK Tau	04:30:44.243	+26:01:24.79	8.6	-	0.01
_	DK Tau	04:30:44.243	+26:01:24.79	11.1	31.4	0.01
_	DK Tau	04:30:44.243	+26:01:24.79	19.7	34.8	0.01
_	DK Tau	04:30:44.243	+26:01:24.79	24.2	37.1	0.01
_	IT Tau	04:33:54.708	+26:13:27.70	5.4	-	0.01
_	IT Tau	04:33:54.708	+26:13:27.70	8.6	-	0.01
_	IT Tau	04:33:54.708	+26:13:27.70	11.1	31.4	0.01
_	IT Tau	04:33:54.708	+26:13:27.70	19.7	34.8	0.03
_	IT Tau	04:33:54.708	+26:13:27.70	24.2	37.1	0.05
_	HK Tau	04:31:50.576	+24:24:17.84	5.4	-	0.01
_	HK Tau	04:31:50.576	+24:24:17.84	8.6	-	0.01
_	HK Tau	04:31:50.576	+24:24:17.84	11.1	31.4	0.01
_	HK Tau	04:31:50.576	+24:24:17.84	19.7	34.8	0.01
_	HK Tau	04:31:50.576	+24:24:17.84	24.2	37.1	0.01
_	GG Tau B	04:32:30.326	+17 31 40.67	5.4	-	0.01
_	GG Tau B	04:32:30.326	+17 31 40.67	8.6	-	0.01
_	GG Tau B	04:32:30.326	+17 31 40.67	11.1	31.4	0.01
_	GG Tau B	04:32:30.326	+17 31 40.67	19.7	34.8	1.02
_	GG Tau B	04:32:30.326	+17 31 40.67	24.2	37.1	1.93
_	FX Tau	04:30:29.617	+24:26:45.04	5.4	-	0.01
_	FX Tau	04:30:29.617	+24:26:45.04	8.6	-	0.01
_	FX Tau	04:30:29.617	+24:26:45.04	11.1	31.4	0.01
_	FX Tau	04:30:29.617	+24:26:45.04	19.7	34.8	0.06
_	FX Tau	04:30:29.617	+24:26:45.04	24.2	37.1	0.12
_	FQ Tau	04:19:12.798	+28:29:33.01	5.4	-	0.01
_	FQ Tau	04:19:12.798	+28:29:33.01	8.6	-	0.01
_	FQ Tau	04:19:12.798	+28:29:33.01	11.1	31.4	0.01
_	FQ Tau	04:19:12.798	+28:29:33.01	19.7	34.8	1.02
_	FQ Tau	04:19:12.798	+28:29:33.01	24.2	37.1	1.93
_	FV Tau	04:26:53.502	+26:06:54.06	5.4	-	0.01
_	FV Tau	04:26:53.502	+26:06:54.06	8.6	-	0.01
_	FV Tau	04:26:53.502	+26:06:54.06	11.1	31.4	0.01
_	FV Tau	04:26:53.502	+26:06:54.06	19.7	34.8	0.01

_	FV Tau	04:26:53.502	+26:06:54.06	24.2	37.1	0.01
_	Haro 6-28	04:35:56.837	+22:54:36.22	5.4	-	0.01
_	Haro 6-28	04:35:56.837	+22:54:36.22	8.6	-	0.01
_	Haro 6-28	04:35:56.837	+22:54:36.22	11.1	31.4	0.01
_	Haro 6-28	04:35:56.837	+22:54:36.22	19.7	34.8	0.26
_	Haro 6-28	04:35:56.837	+22:54:36.22	24.2	37.1	0.48
_	UZ Tau	04:32:42.962	+25:52:31.09	5.4	-	0.01
_	UZ Tau	04:32:42.962	+25:52:31.09	8.6	-	0.01
_	UZ Tau	04:32:42.962	+25:52:31.09	11.1	31.4	0.01
_	UZ Tau	04:32:42.962	+25:52:31.09	19.7	34.8	0.01
_	UZ Tau	04:32:42.962	+25:52:31.09	24.2	37.1	0.01
_	GH Tau	04:33:06.216	+24:09:33.72	5.4	-	0.01
_	GH Tau	04:33:06.216	+24:09:33.72	8.6	-	0.01
_	GH Tau	04:33:06.216	+24:09:33.72	11.1	31.4	0.01
_	GH Tau	04:33:06.216	+24:09:33.72	19.7	34.8	0.03
_	GH Tau	04:33:06.216	+24:09:33.72	24.2	37.1	0.05
_	NGC 2024	05:41:43	-01:50:30	5.4	-	0.09
_	NGC 2024	05:41:43	-01:50:30	8.6	-	0.76
_	NGC 2024	05:41:43	-01:50:30	11.1	31.4	0.80
_	NGC 2024	05:41:43	-01:50:30	19.7	34.8	0.65
_	NGC 2024	05:41:43	-01:50:30	24.2	37.1	1.24
_	Serpens	18:30:00.0	01:15:00	5.4	-	0.11
_	Serpens	18:30:00.0	01:15:00	8.6	-	1.00
_	Serpens	18:30:00.0	01:15:00	11.1	31.4	0.14
_	Serpens	18:30:00.0	01:15:00	19.7	34.8	0.21
_	Serpens	18:30:00.0	01:15:00	24.2	37.1	0.41
_	L988-e	21:03:58	50:14:38	5.4	-	0.09
_	L988-e	21:03:58	50:14:38	8.6	-	0.76
_	L988-e	21:03:58	50:14:38	11.1	31.4	0.11
_	L988-e	21:03:58	50:14:38	19.7	34.8	0.16
_	L988-e	21:03:58	50:14:38	24.2	37.1	0.31

* This table is a summary of the full ROC, which is available, as a .pdf file, at the Basic Science web site.

Deleted: Appendix A1. FORCAST Reserved Observations Catalog.

Appendix A2. GREAT Reserved Observations Catalog.