

# SOFIA Science Instrument Development – Quick Look Guide

## General SOFIA information:

The NASA/DLR Stratospheric Observatory For Infrared Astronomy (SOFIA) Program consists of a German-built 2.7-meter telescope mounted in a Boeing 747-SP aircraft supplied and modified by NASA. Flying at altitudes up to 45,000-feet, SOFIA observes from above more than 99 percent of Earth's atmospheric water vapor, thereby opening windows to the universe not available from the ground. Additional general information on SOFIA may be found at <http://sofia.usra.edu> and [https://www.nasa.gov/mission\\_pages/SOFIA/index.html](https://www.nasa.gov/mission_pages/SOFIA/index.html).

## SOFIA Science Instruments (SIs):

Capabilities of the present SIs can be found in the SOFIA Instruments Guide available in the SOFIA Science Instrument Development Library, and at <https://www.sofia.usra.edu/science/instruments>

**EXES:** Echelon-Cross-Echelle Spectrograph

**FIFI-LS:** Field Imaging Far-Infrared Line Spectrometer

**FLITECAM: (Retired 2018)** First Light Infrared Test Experiment CAMERA

**FORCAST:** Faint Object InfraRed CAMERA for the SOFIA Telescope

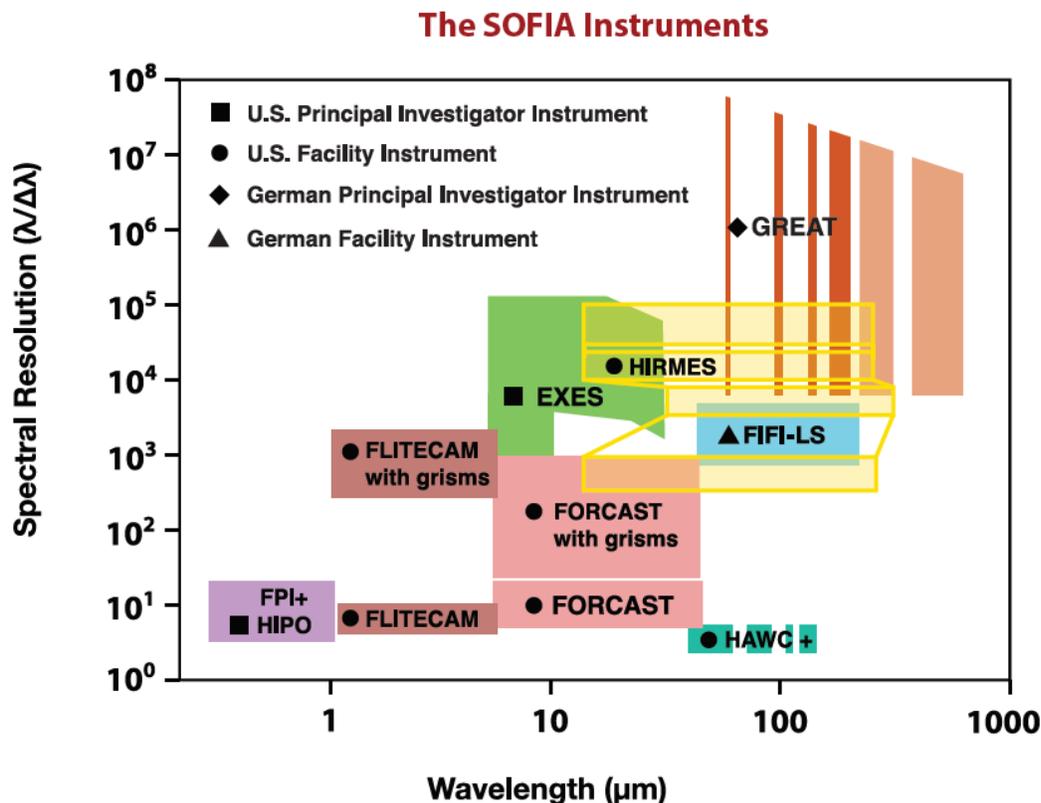
**FPI+:** Focal Plane Imager Plus

**GREAT:** German REceiver for Astronomy at Terahertz Frequencies

**HAWC+:** High-resolution Airborne Wideband Camera Plus

**HIPO: (Retired 2018)** High-speed Imaging Photometer for Occultations

**HIRMES (Available in 2019):** High Resolution Mid-Infrared Spectrometer



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## Key Documents for the Science Instrument Developer:

There are several key documents listed below that should be referenced when developing proposals. These can all be found in the SOFIA Science Instrument Development Library at <https://www.sofia.usra.edu/science/instrument-call>

1. **Science Instrument Developers' Handbook** (SCI-AR-HBK-OP03-2000): describes how to develop a science instrument (SI) for the SOFIA Program.
2. **SOFIA Science Instrument System Specification** (SOF-AR-SPE-SE01-2028): contains the design requirements for airworthiness, safety, mission assurance, and quality assurance for Science Instruments, and requires compliance with interface control documents (ICDs).
3. **Interface Control Documents** (ICDs): contain the requirements for how the SI will interface with the aircraft, telescope, data and control systems, and the laboratory facilities. A list of applicable ICDs can be found in section 5.3 of the *Science Instrument Developers' Handbook* (SCI-AR-HBK-OP03-2000).

## Tips from previous SI Developers and SOFIA Program:

Efforts have been made and are ongoing to make the instrument development process easier. Listed below are tips from previous SI developers and the SOFIA Program that may help make the SI development easier.

1. Unlike ground based instruments, SIs developed for SOFIA must obtain an Airworthiness Certification (i.e. SI failure cannot damage the TA, aircraft, or harm personnel). If the SI developer can demonstrate/prove containment is maintained in the event a cryostat internal failure occurs, the failure becomes a mission assurance issue, as opposed to an airworthiness one, and some environmental testing can be avoided during SI production.
2. Requirements listed in the *SOFIA Science Instrument Systems Specification* (SOF-AR-SPE-SE01-2028) are classified as Airworthiness (AW), Ground Safety (GS) or Mission Assurance (MA). Unlike the AW and GS requirements, the MA requirements may be negotiable. Keep in mind there may be cost and schedule impacts to the SOFIA program if you are unable to meet these requirements. If you are proposing an SI that promises to conduct amazing science but cannot meet some of these MA requirements, you are encouraged to initiate negotiations with the SOFIA Program as early as possible.
3. SI Developers that elect to use the closed-cycle cryocooler system onboard the aircraft in lieu of expendable liquid cryogen reservoir(s) in their instrument design, can avoid some or all of the following requirements: 3.5.3.1 through 3.5.3.3.1, 3.8.1 and Appendix C within the *SOFIA Science Instrument Systems Specification* (SOF-AR-SPE-SE01-2028).
4. Refer to Appendix A.1, in the *Science Instrument Developers' Handbook* (SCI-AR-HBK-OP03-2000), for the list of deliverables items expected from the SI developer and Appendix A.2 for documentation delivery timeline.

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5. The SI developer is expected to follow NASA project lifecycle and quality assurance processes; this should be taken into consideration in your proposals. Refer to the *Science Instrument Developers' Handbook* (SCI-AR-HBK-OP03-2000) for details.
6. Be sure to adequately reflect the amount of support required between the Commissioning Review and Acceptance Review, to account for any modifications to the instrument that may be required during the commissioning period.
7. SI developers should negotiate with the SOFIA program, for the type and number of hardware spares (e.g. motors) to be provided.

## Getting Started:

1. Review existing instrument capabilities.
2. Determine if you plan to propose a modification to an existing instrument or an entirely new instrument.
3. Review the Key Documents for the Science Instrument Developer for NASA processes, review milestones, QA measures, and deliverables.
4. Format the proposal according to the stylistic requirements described in the 2017 *NASA Guidebook for Proposers* <https://www.hq.nasa.gov/office/procurement/nraguidebook/>
5. Focus on the legacy science you will be contributing to the SOFIA program and the scientific community, when developing your proposal. [http://www.sofia.usra.edu/Science/science\\_cases/](http://www.sofia.usra.edu/Science/science_cases/)
6. Submit your proposal