SOFIA, the Stratospheric Observatory for Infrared Astronomy
Hands-on Access to the Far Infrared Sky

First light early science by mid-2009

The Stratospheric Observatory for Infrared (IR) Astronomy (SOFIA) is a unique general-purpose airborne observatory designed to operate in the lower stratosphere to altitudes as high as 45,000 feet and above 99.8% of Earth's obscuring atmospheric water vapor. SOFIA's capabilities enable great science that will complement and extend past, present and future IR telescopes in wavelength range, angular and spectral resolution, and observing flexibility. A joint project between NASA and the German space agency DLR, the German-built 2.5 meter telescope flies aboard a US modified Boeing 747-SP aircraft that is equipped to provide astronomers, educators and journalists a unique opportunity to engage in the challenges and excitement of real time data collection, processing and discovery.

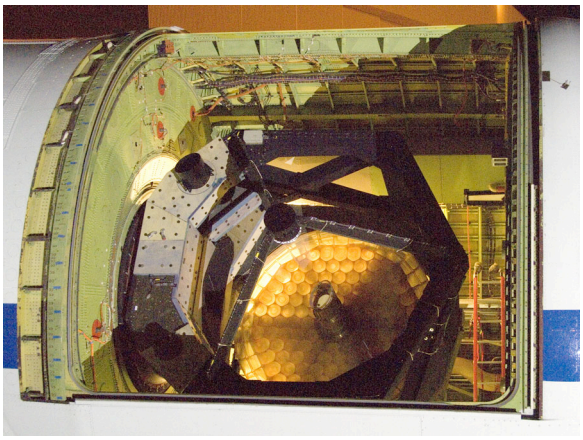
A great strength of SOFIA is the enormous breadth of its capabilities and the flexibility with which those capabilities can be modified and improved to take advantage of advances in technology. SOFIA offers:

- A 2.5-meter effective-diameter optical-quality telescope for diffraction-limited imaging beyond 25 µm, thus giving the sharpest view of the sky provided by any current or developmental IR telescope operating in the 30 to 60 µm region;
- Wavelength coverage from 0.3 µm to 1.6 mm and high resolution spectroscopy (R to 10^5) at wavelengths between 5 and 150 µm;
- An 8 arcmin FOV allowing use of very large detector arrays;
- Ready observer access to the telescope allowing instruments to be repaired in flight and changed between flights;
- A low-risk ability to incorporate new science-enabling instrument technologies and to create a whole "new" observatory several times during the lifetime of the facility;
- Opportunity for continuous training of instrumentalists to develop and test the next generation of instrumentation for both suborbital and space applications;
- Mobility, which allows access to the entire sky and a vastly increased number of stellar occultation events;
- Unique opportunities for educators and journalists to participate first-hand in exciting astronomical observations

These capabilities will enable a wide range of science investigations over SOFIA's 20-year operational lifetime. SOFIA's nine first-light science instruments are described in the table below. Facility instruments are maintained and operated by the SOFIA science staff for the general science community. Their pipeline-reduced data will be archived. PI instruments are maintained and operated by PI teams at their home institutions.

SOFIA Instrument	Description	Built by	λ range (µm) spectral res ($\lambda_0/\Delta\lambda$)	Pre-ship Review
FORCAST	Faint Object InfraRed CAmera for the SOFIA Telescope Facility Instrument - Mid IR Camera and Grism Spectrometer	Cornell	5 - 40 R ~ 200	Feb, 2009
GREAT	German Receiver for Astronomy at Terahertz Frequencies PI Instrument - Heterodyne Spectrometer	MPIfR, KOSMA DLR-WS	60 - 200 R = 10^6 - 10^8	Mar, 2009
FIFI LS	Field Imaging Far-Infrared Line Spectrometer PI Instrument w/ facility-like capabilities - Imaging Grating Spectrometer	MPE, Garching	42 - 210 R = 1500 - 3000	Oct, 2009
FLITECAM	First Light Infrared Test Experiment CAMera Facility Instrument - Near IR Test Camera and Grism Spectrometer	UCLA	1 - 5 R~1300	Feb, 2010
HIPO	High-speed Imaging Photometer for Occultation Special PI Instrument	Lowell Obs.	.3 - 1.1	Mar, 2010
HAWC	High-resolution Airborne Wideband Camera Facility Instrument - Far Infrared Bolometer Camera	Univ of Chicago	50 - 240	Mar, 2011
CASIMIR	CAltech Submillimeter Interstellar Medium Investigations Receiver PI Instrument - Heterodyne Spectrometer	Caltech	200 - 600 R = 3x10^4 - 4x10^5	Sep, 2011
EXES	Echelon-Cross-Echelle Spectrograph PI Instrument - Echelon Spectrometer	Univ of Texas	5 - 28 R = 10^5, 10^4, or 3000	Sep, 2011
SAFIRE	Submillimeter And Far InfraRed Experiment PI Instrument - Imaging Fabry-Perot Bolometer array spectrometer	GSFC	145 - 655 R = 1000 - 1800	May, 2012

See http://www.sofia.usra.edu for more information.

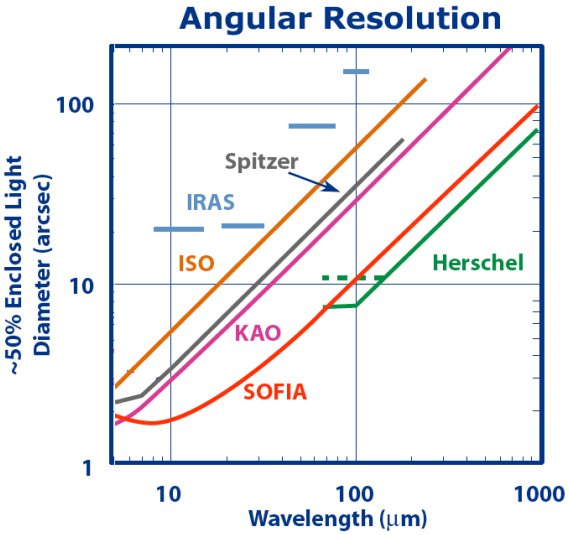


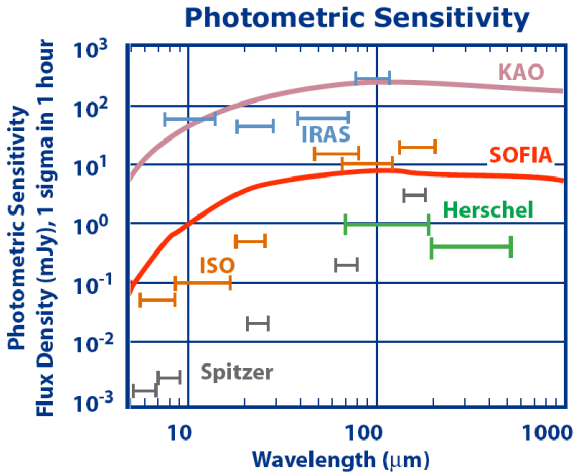
SOFIA observations will support NASA's Cosmic Origins astrophysics theme. The mid- and far-IR wavelength regions are key to studying the dusty universe. SOFIA science emphasizes four major themes:

- Our solar system and other planetary systems
- The interstellar medium: the material we came from
- Star and planet formation
- Nearby galaxies and the galactic center

SOFIA science will complement and exploit the availability of data from other existing facilities such as Spitzer, SMA, and ASTRO-F and future facilities such as WISE, Herschel, ALMA, and JWST.

Herschel and SOFIA will now start science operations at approximately the same time, in mid-2009. For the years of overlap, SOFIA will be the only program with a 25-to-60 µm capability and the only program with high-resolution spectroscopy in the 60-to-150 µm region. When cryogens are depleted aboard Herschel in 2011, SOFIA will be the only NASA mission for many years in the 25 to 600 µm region. With somewhat less sensitivity, SOFIA will provide an important observational follow-up of Herschel discoveries. SOFIA will also offer unique capabilities through advanced instrumentation with technologies for polarization, heterodyne arrays, and heterodyne spectroscopy of new molecular lines such as the ground state of molecular hydrogen and other interesting astrophysical lines.





The SOFIA telescope has been installed on the aircraft, and system integration is nearly complete. The aircraft successfully completed closed-door flight testing in January, 2008. Subsequent end-to-end ground tests of the telescope on the sky have been successful. The primary mirror was removed in late April and will be aluminized at NASA Ames in the summer of 2008. Open door flight testing will begin in early 2009 with first-light early science operations to begin in mid-2009. General observing and basic science flights will begin in 2010.

The first Call for Short Science to demonstrate telescope operation will be issued in June, 2008 followed by a call for early, more extended Basic Science in December, 2008. When fully operational in 2014, SOFIA will make more than 120 scientific flights per year in support of approximately 50 investigation teams per year.

SOFIA is poised to provide community-wide opportunities for forefront science, invaluable hands-on experience for young researchers, and an extensive and unique education and public outreach program. With observing flexibility and the ability to deploy new and updated instruments, the observatory will make important contributions towards understanding a variety of astrophysical problems well into the 21st century.

The Dryden Aircraft Operations Facility in Palmdale, CA is the home port of *Clipper Lindbergh*, the SOFIA aircraft. The plane will occasionally operate from other bases world-wide, including the southern hemisphere. The SOFIA Science and Mission Operations Center is located at NASA Ames Research Center in Moffett Field, CA. The Universities Space Research Association (USRA) and the Deutsches SOFIA Institut (DSI) in Stuttgart, Germany manage science and mission operations for NASA and DLR.