NASAfacts

SOFIA - NASA's Stratospheric Observatory for Infrared Astronomy

Over a blanket of snow covering California's southern Sierra Nevada mountains, NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA) flies with the sliding door over its telescope cavity fully open. (NASA / Jim Ross)

NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA) is the world's largest airborne astronomical observatory, complementing NASA's space telescopes as well as major Earth-based telescopes.

SOFIA features a German-built far-infrared telescope with an effective diameter of 100-inches (2.5 meters). The telescope weighs 19 tons (38,000 pounds) and is mounted in the rear fuselage of a highly modified Boeing 747SP aircraft.

Unparalleled astronomical science capabilities

Flying at altitudes of between 39,000 to 45,000 feet (12 – 14 kilometers) and above 99 percent of the water vapor in the atmosphere, SOFIA facilitates observations that are unobtainable from telescopes on the ground. Because SOFIA can fly virtually anywhere in the world, change instruments between flights, and implement new capabilities, it provides greater adaptability than any space-based telescope.

Preliminary scientific operations with the observatory began in 2010, providing astronomers with early access to the visible, infrared and sub-millimeter wavelength bands with optimized performance in the mid-infrared to sub-millimeter range.

"First light," the first time the telescope collected astronomical data, was achieved on May 25, 2010. Infrared light from the red supergiant star Antares, emitted more than 550 years ago, was observed by SOFIA using a camera called the Faint Object Infra-Red Camera for the SOFIA Telescope, or FORCAST, developed by Cornell University.

SOFIA made its first official science flight on Nov. 30, 2010. The FORCAST instrument collected data on a number of celestial targets including Comet Hartley, the star-forming nebulae Messier 42 in the Orion constellation and massive clouds of interstellar gas and dust in which hundreds of stars are forming such as W3 IRS5 and Sharpless 140.

SOFIA also has observed the occultation of a star by the dwarf planet Pluto. During this short-lived event, the planet crossed in front of the star. The resulting dip in the brightness of the star allowed astronomers to determine the structure of Pluto's atmosphere. SOFIA had to fly thousands of miles to catch this very rare event at an otherwise empty spot over the eastern Pacific. Without the deployment capabilities of SOFIA, these observations could not have occurred.

These and other forthcoming data will help astronomers answer many fundamental questions about the

creation and evolution of the universe. By using SOFIA, scientists hope to better understand how stars and planets are formed, how organic materials necessary for life form and evolve in space, and how the black hole at the center of our Milky Way galaxy influences its surroundings.

Technology Development

SOFIA is also a cutting-edge laboratory for the development and testing of astronomical instrumentation and detector technology by scientists at NASA centers, universities and colleges across the country. Its seven first-generation instruments, including cameras, spectrographs and a high-speed photometer, together with its future-generation instruments, will enable a wide variety of astronomical science observations. Once validated, the technologies developed will also be useful in future space missions. Applications in ground-based astronomy are also expected.

SOFIA's ability to return to Earth after each flight enables frequent opportunities for upgrading and installing new science instruments, permitting ongoing development of new astronomical technology throughout its lifetime.

Education and Public Outreach

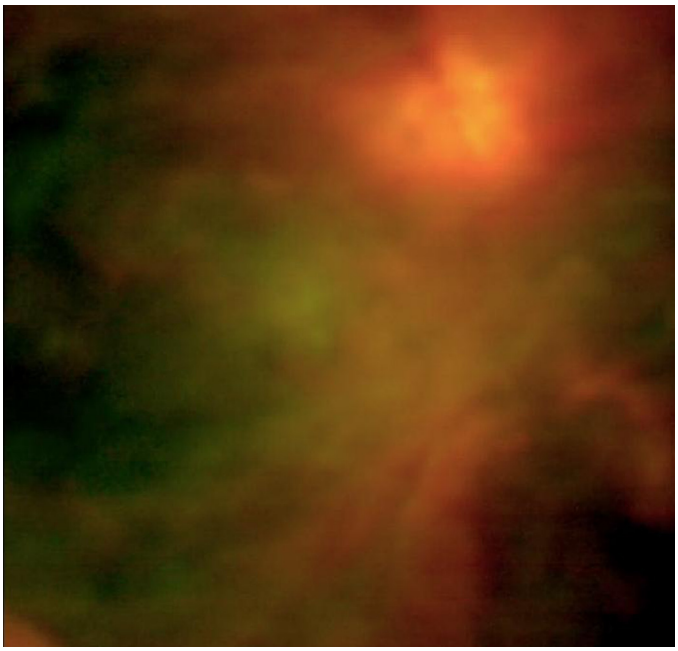
The SOFIA education and outreach program is designed to help enhance science, technology, engineering and mathematics (STEM) education in U.S. and German communities.

SOFIA's Airborne Astronomy Ambassadors program gives middle- and high-school teachers and science museum educators hands-on experience in scientific and astronomical research as they work with scientists during missions on the flying observatory. This program enabled eight teachers to fly on SOFIA in 2011, with another 26 U.S. educators selected to fly in 2012 and 2013. Educators take what they learn during their SOFIA training and flights back to their classroom and their communities to improve curricula and generate interest in STEM-related courses and careers.

Training is also provided for undergraduate and graduate-level scientists, engineers and technologists by enabling their participation in the design and development of instruments, as well as the execution and analysis of astronomical observations made using the SOFIA telescope.

Development Status

Sustained science operations are scheduled to begin in late 2014. Leading up to that milestone, SOFIA will undergo alternating periods of science flights and long-term development of the observatory, including installation of upgraded software and hardware control systems, commissioning of science instruments, avionics



The Orion star-formation complex was taken by the SOFIA telescope using the FORCAST mid-infrared camera. (NASA/SOFIA/USRA/FORCAST Team)

modernization and routine maintenance of the aircraft. The completion of these tasks will result in sustained use of the observatory for many years to come, enabling infrared astronomy of the highest caliber.

SOFIA continues the legacy of prominent planetary scientist Gerard Kuiper, who championed airborne astronomy in 1968 using a 12-inch telescope aimed through a window of a converted Learjet. His work led to the development of NASA's Kuiper Airborne Observatory, a modified C-141 aircraft incorporating a 36-inch reflecting telescope that flew from 1974 to 1995. During its 21-year lifetime, the Kuiper Observatory focused on solar system, galactic and extra-galactic astronomy, and was used in the discovery of the rings of Uranus, a ring of star formation around the nucleus of the Milky Way, luminous infrared galaxies, complex organic molecules in space, and water in comets. SOFIA will continue the legacy begun by Gerard Kuiper well into the 21st Century.

The SOFIA is a joint program of NASA and the German Aerospace Center (DLR - Deutsches Zentrum für Luft- und Raumfahrt). The program is managed at NASA's Dryden Aircraft Operations Facility in Palmdale, Calif., where the aircraft is based. NASA's Ames Research Center at Moffett Field, Calif., manages the SOFIA science and mission operations in cooperation with the Universities Space Research Association in Columbia, Md., and the Deutsches SOFIA Institut in Stuttgart, Germany.

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