The SOFIA airborne observatory has landed in Hamburg

28 June 2014

The Stratospheric Observatory for Infrared Astronomy (SOFIA), a modified Boeing 747SP, is a joint project of the US Space Agency, NASA, and the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR). It is normally stationed at NASA's Armstrong Flight Research Center in California, but at 08:44 CEST on Saturday, 28 June 2014, it landed at Hamburg Airport. From now until the beginning of November, both the aircraft and its telescope will be undergoing extensive maintenance at the Hamburg facilities of Lufthansa Technik. "This is how DLR will fulfil part of its 20 percent contribution towards the operating costs of the observatory," explains Alois Himmes, the SOFIA Project Manager at DLR.

DLR and NASA have selected Lufthansa Technik for the overhaul of the aircraft because they have the world's longest and most extensive experience with maintaining aircraft of this type. "There were 45 Boeing 747SPs built, 18 of which are still in use. Boeing itself, however, no longer supports this aircraft type," Himmes adds. US-based companies with a license for extensive maintenance and repair do not have comparable experience. The previous US operators of this aircraft, Pan Am, who brought the aircraft into service as 'Clipper Lindbergh' in 1977, and United Airlines, who purchased the plane in 1986, also no longer perform maintenance on this type of aircraft, and, as they are no longer operating the 747SP, they have let their licenses lapse. The 747SP – 'SP' stands for 'Special Performance' – has a much shorter fuselage but the same power; these aircraft can therefore fly significantly higher than other versions, at altitudes of up to between 12 and 14 kilometres.

Observatory can detect infrared radiation and study how stars are formed

Now, the old 'Jumbo' performs pioneering work again; SOFIA is a globally unique airborne observatory, which, since 2010, has made around 90 scientific flights to study, among other things, the development of galaxies and how stars and planetary systems are formed from molecular and dust clouds.

Installed in the fuselage is a 17-ton telescope, developed in Germany and commissioned by the DLR Space Administration, with a mirror diameter of 2.7 metres. A total of six scientific instruments are currently in use, including the GREAT spectrometer and FIFI-LS, which are operated by German scientists. "In contrast to space observatories, continuously improved or even newly developed instruments can be used and the latest technology can be implemented on SOFIA. This airborne observatory performs almost like a space observatory, but it returns to Earth after each flight," Himmes elaborates. Because SOFIA flies in the stratosphere, above the water vapour in the atmosphere, it can observe infrared radiation with virtually no losses. Ground-based telescopes are not able to measure this radiation from space, as the water vapour blocks most of the infrared radiation.

Looking to the future, Eddie Zavala, SOFIA Program Manager at NASA says: "On May 29, 2014, we formally completed the development phase and NASA declared SOFIA fully operational. After the overhaul here in Hamburg, SOFIA will be resuming operations in 2015 with approximately 100 planned observation flights per year for many years to come and it will be a unique scientific tool for infrared astronomers."

The telescope will also be maintained

The German SOFIA Institute (Deutsche SOFIA Institut; DSI) at the University of Stuttgart has been charged with the coordination of the DLR operating contribution. While the aircraft is undergoing its overhaul in Hamburg, DSI personnel will take the opportunity to also perform thorough maintenance on the telescope. "We will replace worn parts and improve its

functionality," says DSI Director Thomas Keilig. "We certainly look forward to a fruitful cooperation with our Lufthansa Technik colleagues." Although the aircraft is on the ground, the scientific work will not stop; 18 July 2014 is the deadline for applications for astronomical observation time during the third science cycle, scheduled to begin in March 2015. In parallel, the data from science flights conducted in 2013 are being evaluated and submitted for publication. The results from the first observation cycle in 2011 have already been extensively published.

Numerous special features

For Lufthansa Technik, this task is somewhat unusual: "Because SOFIA is not a commercial airliner, but an airborne observatory, there are special operations involved, as well as routine procedures," says Sven Hatje, the Project Manager responsible for the SOFIA overhaul programme. In five phases – arrival, inspection, modification, installation and acceptance – the engineers will place SOFIA 'under the microscope' over the coming months. The specifications of the aircraft also influence its treatment in the maintenance facility: "We must, for example, first lift SOFIA to a height of six metres to replace the landing gear. The rear of the aircraft is, with its weight of 48 tons, too heavy for conventional lifting methods. This is why we will have to jack SOFIA up with five instead of three lifters. For this, we have to obtain a special permit." In addition, the research aircraft not only has modified cockpit electronics and very extensive additional electronic systems, but also – and this is really unique – a roughly four by six metre door in the fuselage, which opens when the telescope is performing observations.

Contacts

Elisabeth Mittelbach
German Aerospace Center (DLR)
Communications, Space Administration
Tel.: +49 228 447-385
Fax: +49 228 447-386
Elisabeth.Mittelbach@dlr.de

Heinz-Theo Hammes
German Aerospace Center (DLR)
Space Administration, Space Science
Tel.: +49 228 447-377
Fax: +49 228 447-745
Heinz.Hammes@dlr.de

SOFIA landing in Hamburg

SOFIA, the DLR / NASA Stratospheric Observatory for Infrared Astronomy, landed at Hamburg Airport on 28 June 2014 at 08:44 CEST. Until mid-November, the Boeing 747SP is being overhauled by Lufthansa Technik AG. The scientists and engineers of the German Sofia

Institute (DSI) will use this time to modify the 17-ton telescope housed in the fuselage of the aircraft.

Credit: Lufthansa Technik AG/ Jan Brandes.

SOFIA in front of one of the hangars at Lufthansa Technik

DLR and NASA have selected Lufthansa Technik for the overhaul of the aircraft because they have the world's longest and most extensive experience with maintaining aircraft of this type.

Credit: Lufthansa Technik AG/ Jan Brandes.

SOFIA arriving at Lufthansa Technik in Hamburg

In five phases – arrival, inspection, modification, installation and acceptance – the engineers will place SOFIA 'under the microscope' over the coming months.

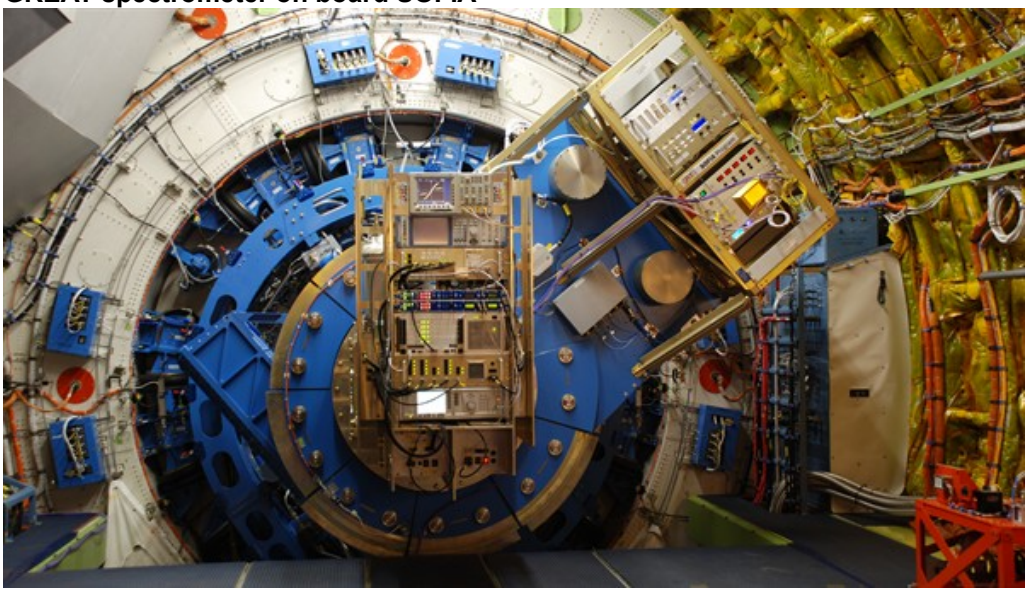
Credit: Lufthansa Technik AG/ Jan Brandes.

SOFIA airborne observatory

SOFIA provides researchers with the best opportunities to observe exoplanets more accurately at different wavelengths in order to determine the composition of their atmospheres.

Credit: NASA/C. Thomas.

GREAT spectrometer on board SOFIA



The GREAT far-infrared spectrometer (the vertical structure in the foreground) is mounted to the telescope counterweight flange inside the pressurised cabin. During observations, GREAT rotates ±20 degrees from the vertical, while the telescope (invisible on the far side) and its counterweight (seen here in blue at an angle of 45 degrees) move between roughly 25 and 65 degrees from the vertical.

Credit: GREAT-Team (R. Güsten).

Made in Germany: the 2.5-metre infrared telescope in the fuselage of the Boeing 747SP

SOFIA during test observations of the night sky in March 2008. The opening in the fuselage of the converted Boeing 747SP provides a glimpse of the 2.5-metre infrared telescope, built in Germany.

Credit: NASA.

Contact details for image and video enquiries as well as information regarding DLR's terms of use can be found on the DLR portal imprint.