



Sun rising

Is this the most revolutionary aircraft of modern times? Is it the dawn of a new aviation horizon? After the successful test flight of Solar Impulse 2, it certainly seems that way

BY CHRISTOPHER HOUNSFIELD



Solar Impulse 2, the revolutionary single-seater solar-powered aircraft, successfully completed its maiden flight on June 2, 2014, from its base in Switzerland.

For 2 hours and 17 minutes, test pilot Markus Scherdel was the first to test the aircraft's performance. The initial test results have not been released, but the team has said that all results are in line with its calculations and simulations. There will now be several other flights taking place in the coming months in order for the experimental machine to attain certification before its 35,000km circumnavigation of the globe. To produce an aircraft that will take off

and fly autonomously day and night, propelled only by solar energy, was an amazing challenge. It required the optimization of new kinds of technology and a drastic reduction in energy consumption. Solar Impulse's 80 engineers and technicians, under the leadership of Solar Impulse co-founder, CEO and pilot André Borschberg, have had to apply highly innovative technological solutions.

While Solar Impulse is not the first solar aircraft project, it's by far the most ambitious. With its successful 26-hour night flight last year, Solar Impulse 1 became the first aircraft ever to come close to perpetual flight.

It has taken a total of 12 years of calculations, simulations, construction and testing to arrive at the launch of Solar Impulse 2, the second aircraft, and the one set to fly around the world.

"Solar Impulse 2 incorporates a vast amount of new technology to render it more efficient, reliable and in particular better adapted to long flights. It is the first aircraft to have almost unlimited endurance," highlights Borschberg.

The engineers led by Borschberg reduced the weight of the entire structure proportionately. Every gram added had to be deducted somewhere else, to make room for enough batteries and to provide a cockpit in which a pilot can live for a week. A monitoring system constantly checks the functioning of the autopilot and detects any anomaly or transgression of safe limits. A man-machine interface provides the pilot with a sensory alert if the bank angle goes beyond 5°.

Pilot:

Markus Scherdel

FLIGHT

Flight duration:

2 hours 17 minutes

Highest altitude reached:

1,670m (5,500ft)

Average ground speed:

55.6km/h (30kts)

Solar Impulse 2 is set to accomplish what no other aircraft has ever achieved: flying without fuel with only one pilot for five consecutive days and nights over oceans from one continent to another. This is the challenge for which the aircraft has been built. To do this, it has four brushless, sensorless motors, each generating 17.4hp (13.5kw), mounted below the wings, and fitted with a reduction gear limiting the rotation speed of a 4m diameter, two-bladed propeller to 525rev/min. The entire system is a record-breaking 94% energy-efficient.

The single-seater solar aircraft is made of lightweight carbon fiber, and has a huge wingspan of 72m (236ft) for its total weight of just 2,300kg (5,000 lb), producing what the team proudly describes as an aerodynamic performance and energy efficiency greater than anything to date. There is a 3.8m³ cockpit, every detail of which has been designed for a pilot to live in for a week. However, for the sake of maximum energy efficiency, the cabin is not pressurized or heated, a further endurance challenge for the pilot, who is to fly around the world drawing power only from the sun. ■

TECHNICAL INNOVATION

- 17,248 monocrystalline silicon cells, each 135µm thick, mounted on the wings, fuselage and horizontal tailplane, providing the best compromise between lightness, flexibility and efficiency (23%)
- Airframe made of composite materials (carbon fiber and honeycomb sandwich)
- Upper wing surface covered by a skin consisting of encapsulated solar cells, and the lower surface by a high-strength, flexible skin
- 140 carbon fiber ribs spaced at 50cm intervals give the wing its aerodynamic cross-section and also maintain its rigidity
- Stimulating innovation in the field of sheets of carbon, which now weigh 25g/m² – just one-third the weight of a sheet of printer paper