

TWO PIONEERS FLEW AROUND THE WORLD IN A SOLAR AIRPLANE TO PROMOTE CLEAN TECHNOLOGIES

The founders and pilots

By pushing back the boundaries of the possible, going into the unknown and taking on a project deemed unfeasible by industry experts, Bertrand Piccard and André Borschberg wanted to support concrete actions for sustainability and show that the world can be run on clean technologies.

Bertrand Piccard – Initiator and Chairman: a medical doctor, explorer and lecturer, achieved the first ever non-stop round-the-world balloon flight. Initiator of Solar Impulse, he brought together the partners to fund this project. Linking science with adventure to promote clean technologies, he develops the project's philosophy and outlines its symbolic and political reach.

André Borschberg – CEO and Co-Founder: an engineer by education and an entrepreneur, André Borschberg has solid experience in creating and managing companies, as well as in flying. His passion for aviation and his interest in innovative solutions have led him to develop the strategy to design and build the Solar Impulse airplanes and to organize the flight missions.

The first Round-The-World Solar Flight

Taking turns in the single-seater 3.8m³ cockpit, Bertrand Piccard and André Borschberg flew Si2 around the world in 23 days, 43'041 km and 17 legs, crossing Asia, the Pacific Ocean, the USA, the Atlantic Ocean, the Mediterranean Sea and the Middle East. This landing in Abu Dhabi on 26 July 2016 with Bertrand Piccard at the controls brought full circle the historic circumnavigation that began on 9 March 2015 when Si2 set off from Abu Dhabi piloted by André Borschberg.

A total of 19 world records were set or are still pending by the World Air Sports Federation (FAI), in particular when André Borschberg accomplished the pioneering first of flying five consecutive days and nights over the Pacific Ocean from Japan to Hawaii in the longest duration a solo airplane of any kind has ever flown and when Bertrand Piccard achieved the historic first crossing of the Atlantic Ocean in a solar airplane.

The vision

Solar Impulse started off with Bertrand Piccard's vision of building an airplane capable of flying night and day without using any fuel, propelled solely by solar energy. The aim of the project was to develop a symbol which would attractively promote a pioneering and innovative spirit, particularly in the field of renewable energy and clean technologies.

Solar Impulse's goal was to demonstrate that clean technologies, such as the ones used on the Solar Impulse airplane, have the potential to change lives, societies and future markets in an unprecedented way. Solutions exist to run the world on clean technologies.

"If an airplane can fly day and night without fuel, everybody could use these same technologies on the ground to halve our world's energy consumption, save natural resources and improve our quality of life. Our hope is to motivate everyone to reduce their dependence on fossil fuels in their daily lives and encourage concrete actions for sustainability," Bertrand Piccard.

Key milestones of the project:

- **1999:** Bertrand Piccard's vision
- **2003:** EPFL Feasibility study led by André Borschberg
- **2004-2009:** start-up financing, design and construction of Solar Impulse 1
- **2010:** first ever solar-powered day and night flight (André Borschberg)
- **2011:** special guest at Paris-le-Bourget International Air Show
- **2012:** first intercontinental solar flight across the Mediterranean to Morocco (Bertrand Piccard)
- **2013:** Across America Mission from San Francisco to New York City
- **2014:** Solar Impulse 2 maiden flight
- **9 March 2015:** departure for the first Round-The-World Solar Flight from Abu Dhabi (André Borschberg)
- **26 July 2016:** completion of the first Round-The-World Solar Flight from Abu Dhabi (Bertrand Piccard)

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The development and design

To translate Bertrand Piccard's vision into reality, it took more than ten years of calculations, simulations, construction and testing by a technical team brought together and led by André Borschberg. As a result, the [Solar Impulse 2 – a genuine flying laboratory and concentration of clean technologies](#) – flew around the world with no fuel. To take up the challenge of achieving the first Round-The-World Solar Flight, each link in the propulsion chain, from the solar cells to the propellers, had to be optimized.

- Single-seater aircraft made of carbon fiber
- Unpressurised and unheated cockpit of 3.8m³ / 134ft³
- Wing span: 72m / 236ft (larger than a Boeing 747: 68m / 223ft)
- Length: 25 m / 82ft
- Weight (empty): 2300kg / 5100lb (equals an empty family car)
- Cruising Speed: 45-55km/h / 28-34mph (25-30 KIAS (Knots-Indicated Air Speed) at sea level))
- Max. Altitude: 8'500m / 28'000ft (Flight Level: 280)
- 17,248 solar cells built into the wings that power the four batteries (38.5kWh per battery) that in turn power the four electric engines (13.5kW / 17.5hp each) and the propellers
- The propulsion system is 93% efficient i.e. only 7% energy loss compared to a car that loses 70%

“From the beginning, we knew that the plane would require a large wingspan to reduce drag and a large surface to insert enough solar cells and produce sufficient energy whilst at the same time have an ultra-light structure to save a maximum amount of energy and fly throughout the night on batteries. The aircraft structure uses the most advanced technologies and has stimulated scientific research in the fields of composite structures, lightweight materials, electric propulsion and methods for managing and storing energy,” André Borschberg.

Clean technology solutions

When Solar Impulse was initiated in 2003, the aviation industry thought that a flight around the world powered by solar energy was infeasible. Therefore Bertrand Piccard and André Borschberg searched for the necessary knowledge elsewhere. It's thanks to a diversified team with a positive outlook and a wide network of partnerships that Solar Impulse has been able to develop technologies that give solutions capable of meeting many of the many challenges facing our society today. Indeed, the energy efficient solutions developed by Solar Impulse can already be used in electrical networks, houses, cars as well as IT equipment and household appliances.

“All the technologies developed with our partners, such as electrical motors with 97% efficiency, LED lamps for public/private lightening system, extremely efficient insulation foam that can reduce energy consumption for houses, light materials, high energy density batteries and ultra-thin solar cells, can be used on the ground to contribute to a cleaner and more sustainable world,” Bertrand Piccard.

“Just imagine your energy reserves increasing during flight! To make this dream a reality, we had to make maximum use of every single watt supplied by the sun, storing any surplus in our batteries. We tracked down every possible source of energy efficiency,” André Borschberg.

The Piccard family heritage

[Solar Impulse continues in the long tradition of the Piccard family](#) – three generations of Swiss pioneers: Auguste, Jacques and Bertrand – having featured scientific exploration and protection of the environment from the skies to the ocean abyss.

“All my education was about pioneering, with the stories of my grandfather being the first person to explore the stratosphere and to see the curvature of the Earth, and my father diving with his Bathyscaphe to the deepest place under the sea, in the Marianna Trench. I was deeply inspired by my family, from whom I learned about the spirit of exploration, curiosity and perseverance,” Bertrand Piccard.

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Advocacy

Through Solar impulse, [Bertrand Piccard also actively promotes the use of new modern clean technologies as an opportunity for change](#) seeking to influence decisions and bring progress within political, economic, and social systems and institutions. His message conveys a visionary approach: solving climate change is not an expensive problem, but rather a unique opportunity for profit and job creation. Climate change, and in particular CO2 emissions, are mainly caused by inefficient energy sources. If those outdated technologies were to be replaced with modern technologies, such as the ones used on the Solar Impulse 2 aircraft, the energy consumption of the world, and therefore the CO2 emissions, could divide by two.

“If an airplane can fly day and night without fuel, everybody can use these same technologies on the ground to halve our world’s energy consumption, save natural resources and improve our quality of life. Solar Impulse is a perfect example to illustrate that solving climate change is a profitable opportunity, not an expensive problem, and that it is possible today to bridge ecology and economy,” Bertrand Piccard.

The International Committee for Clean Technologies (ICCT)

Beyond achieving the first Round-The-World Solar Flight, Solar Impulse will continue its efforts to demonstrate that concrete energy efficient solutions can solve many of the challenges facing global society today through the creating the International Committee for Clean Technologies (ICCT). Created in the form of a non-governmental organization (NGO), the Committee is intended to regroup the main global actors in the field of clean technologies to bring independent and credible guidance on energy policy to governments and corporations alike.

As one of the direct legacies of the Solar Impulse project, it will initially be backed by the Solar Impulse Foundation. Building on the [#futureisclean initiative](#) launched ahead of COP21 – of which H.S.H. Prince Albert II of Monaco, Richard Branson and Kofi Annan are patrons – the NGO’s mission will be to act as a common voice for the close to 400 global organizations that have joined forces to promote concrete solutions for a clean future.

“We have flown 40’000 kilometers without fuel, but there is still a lot to be done to encourage a worldwide implementation of clean technologies and to motivate everyone to reduce their dependence on fossil fuels in their daily lives, hence the creation of the International Committee for Clean Technologies.” Bertrand Piccard.

High endurance solar aircraft

Solar Impulse has demonstrated that we can reach perpetual flight using the sun as continued source of energy. By designing and building Si1 and Si2 the team of engineers has developed a unique understanding not only of the development of modern clean technologies but also of the challenges related to their implementation. In addition, being the first to make solar powered airplanes fly across the world in many different countries and airspaces, Solar Impulse has also gained global and significant operational experience as well as expertise in weather and route planning.

The goal is now to leverage the skills, expertise and technology gained over the past decade in the fields of electric propulsion and solar energy and to launch new innovative and disruptive projects. Among others, the team of engineers is already working on unmanned and high endurance solar powered electric aircrafts that could fly in high altitude for months, offering services that could provide exponential added value and complement the work being done by satellites today in a flexible and sustainable way.

“Solar Impulse is of course very well positioned to contribute to the next generations of manned or unmanned electric aircrafts. By capitalizing on the engineering skills and expertise gained over the past decade, we will continue to work to encourage concrete innovations and disruptive solutions.” André Borschberg.

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