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The men exploring aviation's final frontier

Two Swiss pilots are attempting to change the future of flying in a plane powered by the Sun. We talk to the pioneers

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For most people, this would be a recipe for torture: you are strapped into a tight space for five days and nights. You are unable to move or sleep for more than 20 minutes at a time. Nod off for longer and you die in a plane crash.

But for Bertrand Piccard, a Swiss aeronautical pioneer, this nightmare will be a dream come true. It will be the culmination of an epic venture that has consumed him for a decade. He plans to take off and fly around the world in an aircraft powered only by sunlight.

Some time next month the *Solar Impulse*, Piccard's giant gossamer-winged machine, will lift off on the first of its brief test hops at Dübendorf, a military base near Zurich. Then, a year or so later, Piccard, 57, and André Borschberg, 51, his partner, hope to go down in history as pioneers of perpetual flight.

A quest like this would normally be dismissed as crackpot. But Piccard has managed to raise some £80 million of sponsorship because he has credentials. In 1999, with Brian Jones of Britain, he beat Richard Branson, the late Steve Fossett and others in the race to make the first non-stop flight around the world in a balloon.

Piccard's family also belongs to history. His grandfather Auguste was the first man to reach the stratosphere in a balloon. His father Jacques was the first to reach the deepest ocean trenches, discovering sealife that no one knew existed. "To boldly go where no man has gone", *Star Trek*-style, is a family habit. That is why the commander of the second-generation *Starship Enterprise* was given the name Jean-Luc Picard. Before that, in the 1940s, the Belgian Hergé used Auguste, the scientist-adventurer, as the model for Professor Calculus in his *Tintin* stories.

Bertrand Piccard, a wiry man with a slightly manic glint in his eye, may be a little crazy, so it helps that he is also a psychiatrist. "I always did the two things: a lot of aviation at the same time as medicine," he says after showing me his "bird", a huge, skeletal, ultralight craft with wings almost as long as those of a jumbo jet.

"What interested me was the level of alertness and concentration that you need to fly hang gliders," he says, talking of the 1970s. The *Solar Impulse* has a spiritual goal, he adds. "It is a logical extension of my role as a doctor. The project is about improving the quality of life. We are talking about respect for the environment, not in an idealistic way. We are saying the technology exists, let's use it for a better world."

Being a shrink also enables Piccard to perform self-hypnosis to endure days piloting without sleep. "It's like a tool for managing your body. You go into a state of dissociation, like being asleep, but your mind is aware of what is going on outside," he says.

In theory, the human being is the only limit to the *Solar Impulse*. The technical challenge is colossal, and aerial electric transport is still decades away. But experimental machines have flown on solar power since the 1970s and robot planes have stayed up at night on batteries. Piccard's project is different because a pilot — meaning extra weight — will be aboard the electric-powered plane as it flies for days.

The *Solar Impulse* will have only a rudimentary autopilot. The human version reaches the limit of sleep deprivation at about five days so Piccard and Borschberg plan to alternate. Every five days the pilot will land and hand over to the other

one. They hope to circle the globe in three or four weeks, pulled along at a puny 40mph by four propellers.

Both Piccard and Borschberg have already “flown” a 25-hour non-stop stretch in the simulator at Dübendorf. They managed to stay alert, helped by a vibrating system in their flight suits that wake the pilot if he sleeps more than a few minutes and lets a wing drop. The controls in the tiny cockpit, like that of a glider, are heavy. A lot of force is needed to push and pull the vast aileron and elevator surfaces. If the pilot is doing his job right, muscles will not be needed because he and the autopilot will be keeping the wings as level as possible. Anything beyond a mild bank could send the machine out of control.

The prototype, *HB-SIA*, sits near by, dismantled with its huge wing running the length of the closely guarded hangar. The secrecy — they will not permit photographs — reminds me of past visits to the “skunk works” experimental plane projects in the Mojave desert in California.

The cockpit panel is simple, not much more than that of a modern motor glider. But a glance at the wonderful contraption is also reminder that the *Solar Impulse* is a leap back to the future. With its lattice construction of carbon fibre, the spindly fuselage looks like a super-stretched version of the monoplane in which Louis Blériot flew the Channel in 1909. The ribbed, ultra-long wings, coated by their 12,000 electricity-generating solar cells, may be high-tech but they also look like something that the Wright brothers might have invented.

Borschberg, the engineer and manager of the project, explains that *Solar Impulse* is blazing an unknown trail, like the Wrights’ *1903 Flyer*. The tension will be great when the Swiss *“Flyer”* first rises from the Dübendorf runway with a German test pilot at the controls. “This is a very particular plane. Its wings are loaded five to seven times less than a glider’s,” Borschberg says. “It’s all about going to the limit of lightness. It is a plane with very little energy at its disposal. Everything is being done to conserve it.”

To understand, it helps to compare other transport. Their plane has the 200ft wingspan of a 260-tonne Airbus, yet it weighs only 1.6 tonnes, the same as a medium car. Its propellers provide only the total power of a motorscooter. A quarter of the weight comes from the lithium polymer batteries that will be charged as it soaks up the sunrays through the day.

At night, the plane will stay aloft, drawing on the batteries and the energy that is stored in altitude. Gravity will help power it as it descends, like a glider, from its day cruising height of 25,000ft to about 5,000ft. When the sun comes up, it will start its slow climb back. The pilot has oxygen for use above 12,000ft and the cockpit temperature will not drop much below freezing.

Piccard and Borschberg are sure that the idea will work if their team can route them through ideal weather as they fly west-east roughly around the Equator. That means avoiding headwinds, clouds, rain or ice — a tall order. The pair, who are backed by a staff of 70, say that they are taking existing technology to the extreme to prove a point. “We are doing the first stage,” says Borschberg, who has lost 21lb from his 6ft frame to lighten the load. “The Wright brothers predicted that it would be impossible for an aircraft ever to cross the Atlantic. Yet [Charles] Lindbergh did it 20 years later.”

They often cite Lindbergh, the young barnstormer who flew non-stop from Long Island to Paris in 1927. His single-seater *Spirit of Saint Louis* was so loaded with fuel that it had no forward visibility. Lindbergh even cut the edges from his charts to lighten the load. Everyone supposed that the only way of crossing the ocean would be to become a pilot, yet a couple of decades later airliners were doing it.

In 1927, Lindbergh that said fighting off sleep was torture on his 33-hour flight. When he nodded off, he forced himself awake by changing altitude and blasting himself with cold air. At one stage, he skimmed the ocean with only a few feet of altitude to sharpen his exhausted mind. When he landed in Paris, he had gone 55 hours without real sleep. With their five-day stretches, Piccard and Borschberg are entering unknown territory. Their models are the skippers on single-handed ocean yacht races who take micro-naps to stay at the helm most of the time.

“We are aiming for polyphasic sleep methods like the yachtsmen,” Borschberg says. “You have to know how you react to lack of sleep and train yourself according to your pattern. You take brief naps at night-time, waking up every few minutes to check the status of the plane.”

A system will wake the pilot when the autopilot cannot handle the aircraft. This will be necessary because the *Solar Impulse* does not have enough power for electronics to make more than minor corrections to its flight. The human pilot will be needed at every 20 minutes at least to keep the plane straight and level.

The pair do not plan to take medication to stay alert but they will train themselves to live on less food to reduce the energy needed for digestion. “Aviation has made the world dream for 100 years,” Piccard says. “It has to go on doing this, but the conquest now will be the environment. For the moment, we are at the limit of the possible, but we are showing what the world can do if it has the courage. We want to show that renewable energy is not about limits, that it can stir passion, that the technology can be sexy.”

Piccard, the visionary of the pair, talks of his pride as a pioneer. “It was really something when I went to the Smithsonian Museum in Washington and saw my balloon beside the *Apollo 11* capsule and Lindbergh’s and the Wrights’ planes.” It was after landing his *Breitling Orbiter* balloon in Egypt in 1999 that he came up with the *Solar* dream. The balloon had to

burn tonnes of propane gas to stay aloft as it circled the world. Surely the flight could be done with no pollution, he thought.

A robot plane could do the job more simply, he says, but the human pilot is all-important. “No one cared much when they put probes on the Moon. They paid attention when Neil Armstrong got there. It has to be a human adventure to create public enthusiasm.” This will be helped by internet links to Piccard’s machine as it putters its way around the globe. “There will be a webcam on the pilot, but with a minute’s lag so he a take a piss in private,” he says.

S*olar Impulse* has stirred the interest of corporate sponsors, including Solvay, the Belgian chemical giant, and Omega watches. The pair hope soon to raise the total to €100 million. The latest ploy is an offer to the public to sponsor individual solar cells. They are also getting technical help from the European Space Agency and EADS, the aerospace group that owns Airbus. Their latest supporter is the International Air Transport Association, which has committed itself to zerocarbon airliners by 2050.

What is it about the Swiss that sends them chasing after flying records, I asked Borschberg? Only a year ago, his friend and fellow former Swiss airforce pilot Yves Rossy made the news when he strapped a winged-rocket pack to his back and became the first human jet to fly the Channel. “Switzerland is known only for things such as its banks, but we are rather good at finding new solutions, such as winning the America’s Cup for yachting,” he says. “The Piccards have been pioneers for three generations. It’s a little-known territory that is part of the Swiss character.”

If everything works, Piccard and Borschberg will make ever-lengthening flights from about the middle of next year, first crossing Europe, then the Mediterranean and eventually the Atlantic. They will replace *HB-SIA* (Swiss aircraft carry the HB registration) with a slightly larger version and hope to tackle the global mission in 2012.

Piccard, in the meantime, keeps his pilot’s hand in by commuting from his home at Lausanne to Dübendorf in a Grumman light plane. He mused over his scheme as we flew back alone together across Switzerland at the end of the day. Bouncing through the Alpine air in the Grumman, I wondered how he could face five days and sleepless nights alone in a plane with even more cramped space.

“It will be comfortable and it will be great,” he says. He talks of his family and his three teenage daughters. Did they plan a life of adventure? “My grandfather and father were pioneers. My children may go into the law or politics or charity. That is what pioneering will be about in the 21st century,” he says. We pushed the little Grumman Tiger into its hangar after a tricky cross-wind landing and Piccard drove off into the rush-hour traffic.