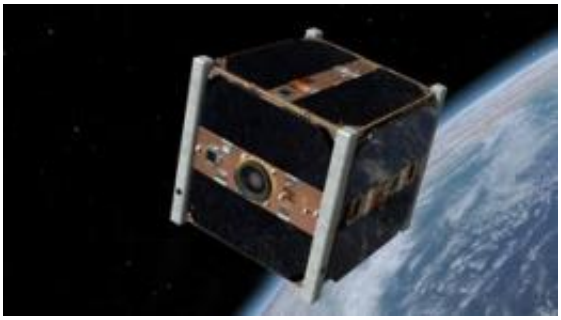
# Twenty-two thousand trips around the planet

October 21 2013, by Sarah Perrin



Credit: 2013 EPFL

Four years after its launch, Swisscube, the small satellite developed by EPFL's Space Center, is still in operation. Some of the technological choices made and considered audacious at the time have yielded valuable lessons for building future spacecraft.

The mission was supposed to last three months to one year, but now, four years later, Swisscube is still orbiting the Earth. This small Cubesat-type satellite, measuring just 10cm by 10cm and entirely designed in Switzerland, was launched on September 23, 2009. After more than 22,000 trips around the planet, all its functions are still operational. Only one of its six solar sensors has been irreversibly damaged.

The satellite's mission was to photograph "air glow," a photoluminescence phenomenon that occurs in the upper atmosphere and is caused by the interaction between solar radiation and oxygen

molecules. In four years, some 250 images were produced. Even though these data are not precise enough to be studied scientifically, the Swiss space community still considers Swisscube a success.

"Its goal was above all educational," says Muriel Richard, an engineer at the Swiss Space Center and Swisscube project manager. "It allowed nearly 200 students from EPFL and the Universities of Applied Science to learn about space technology. And today, it's still valuable for current students as an extraordinary experimentation platform, with which we can, for example, check movements and altitude or test ground-based algorithms."

## Put to the test

The fact that it's lasted this long proves that the satellite is robust. It confirms the wisdom of certain technological choices that were made; at the time they seemed audacious, but now, in hindsight, they have proven innovative and full of lessons that can be drawn upon for the construction of future spacecraft. For example, it was decided that instead of components that were certified space-quality, standard electronic components would be used; they were thus much less expensive, such as mobile phone batteries bundled into a thermally controlled, waterproof housing. An innovative system of copper mountings was developed that both secured the solar cells to the external walls, ensuring stowage during the violent shakings of launch.

"The first week is decisive," explains Richard. "If the satellite gets through it without a hitch, it's because it was truly well built, and there's a high likelihood that it will operate for years to come." Once the satellite reaches space, the electronics on board are seriously put to the test. To start with, vibrations experienced during the launch will reveal even the slightest error in soldering. The materials also undergo temperature variations that can range from -50 to 70 degrees Celsius.

Solar radiation and the flow of solar particles can also easily damage systems that are insufficiently protected. And then there's always the chance of collision with the ever-increasing amount of space debris orbiting the Earth.

## Set your calendar for 2018

In fact, Swisscube has narrowly avoided impact several times. As soon as it was launched, it was quickly caught up in the train of debris created by the February 2009 collision between the commercial satellite Iridium-33 the Russian satellite Cosmos-2251. More recently, on September 11, 2013, US Air Force alerted the Swiss Space Center that its Cubesat passed less than 75 meters away from one of the 15,000 pieces of space debris more than 10cm in diameter that have been identified and are monitored from the ground by the U.S.. But it appears that Swisscube's time has not yet come. Barring an unforeseen event, Swisscube's demise has been programmed for 2018. It will be the first object captured and destroyed by CleanSpace One, the space debris clean-up satellite currently under development at the Space Center.

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