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The hunt for debris in outer space

Switzerland is at the very forefront of international research on outer space. It is now demonstrating its penchant for tidiness by becoming a debris hunter in outer space. The Zimmerwald Observatory has commissioned three new telescopes for this task.

SIMON GSTEIGER

The two domes that stand on concrete pillars in Zimmerwald in the canton of Berne look like part of the set for a science fiction movie. You might think you were on the Moon or Mars were it not for the luscious green Zimmerwald meadows, the neighbouring farm, the hum of a tractor and the Alps in the background. The canton and University of Berne have recently equipped and expanded the nearby Zimmerwald Observatory. There are now three new telescopes in both domed buildings. Scientists are using them to scour outer space for debris.

This is an urgent requirement, according to Thomas Schildknecht, Director of the Zimmerwald Observatory: "It's hard to imagine how much damage these fragments can cause." They move at a speed of over 7.5 kilometres a second. "That's almost ten times faster than a bullet," he says. At that speed even the smallest pieces release as much energy as the explosion of a hand grenade upon impact. An es-

timated 30,000 objects are circling Earth, and these are just the larger ones.

Permanent monitoring

One of the new instruments consists of two wide-field telescopes. They have an extensive field of vision and are used to permanently monitor debris in the geostationary ring. This ring is at an altitude of 36,000 kilometres, where weather and communications satellites orbit. "The telescopes allow us to see when something is moving against the backdrop of the stars. We then log what's in motion," explains the Zimmerwald Director. Various recordings enable an object's orbit to be calculated. This helps to establish whether it is a previously identified or newly discovered object.

"The amount of debris has reached a critical point and cannot continue to increase," points out Schildknecht. The problem can be tackled at source once it is clear where the objects are

"It's become crowded up there"

Whereas it was just a few dozen satellites at the start of the history of space travel, there are now over 1,300 of them circling Earth's orbit. "It's become quite crowded up there in recent years," reveals Thomas Schildknecht, Director of the Zimmerwald Observatory. It is not so much the active artificial celestial bodies that pose a problem but rather those which have exceeded their lifespan, such as decommissioned satellites, fuel tanks and panels. Space debris is increasingly presenting issues for space travel. The orbits of around 30,000 such objects have now been identified. They also represent a threat to manned spacecraft. Anyone planning a mission in outer space is best advised to coordinate the operation with great precision. The organisations behind such launches rely on data logs indicating the orbits of debris fragments. (SG)

coming from. They are often remnants of satellites or rockets, but sometimes also fragments of insulation panels. "The developers of spacecraft have to be notified so that they can modify construction methods," he says.

Debris ends up in "cemetery"

A preventative approach is one solution. However, if the amount of debris in outer space continues to rise, other strategies will be required. One possibility is robots able to gather debris. Such collection robots are nevertheless controversial due to the risk of them being misused for military purposes. "Just imagine reconnaissance satellites being sabotaged," says Schildknecht. Above a certain distance

The two new domed buildings at the Zimmerwald Observatory are equipped with three telescopes.





from Earth it is also extremely difficult to steer objects so that they burn up in the atmosphere. Instead they are sent into a zone even further away from Earth, which is something akin to a cemetery in outer space. "There is no future in this method though," says Schildknecht. "Who knows what we might need the space out there for one day."

India needs data from Berne

The University of Berne has a tradition of research into debris in outer space. Schildknecht explains that this field was still regarded as the domain of "freaks" at the end of the 1980s. Those who worked in it gained a reputation for tarnishing the image of their own discipline. Schildknecht adds: "Space exploration had enjoyed an impeccable reputation until that point. Then people started highlighting the nega-

tive impact on the space near Earth." This field is becoming increasingly important today, he says. "We are fortunate in Berne because not only can we hunt for debris but we also have the capability to calculate orbits. That's an almost unique combination."

Schildknecht and his team are frequently in touch with the European Space Agency and colleagues in Russia. And if India wants to launch communications satellites into outer space, its agencies use the data from the University of Berne to prevent any collisions with fragments of debris.

The Zimmerwald Observatory invests heavily. In 2013, it spent 700,000 Swiss francs on a new dome and telescope. The two latest domed buildings cost the canton of Berne 820,000 francs. Around the same amount was spent on the new telescopes, the cost of which was largely met by the Swiss National Science Foundation and the

Thomas Schildknecht, Director of the Zimmerwald Observatory, in front of the telescope that can locate small pieces of debris in outer space.

Photos: Adrian Moser

University. How can such high spending over a short space of time be justified? Schildknecht says, "Berne is at the very forefront of space exploration. To remain there requires state-of-the-art technology and equipment."

SIMON GSTEIGER IS A FREELANCE JOURNALIST
IN BERNE

Flagship in space exploration

The Zimmerwald Observatory in the canton of Berne is a Swiss flagship in the field of space research. Switzerland has many other such facilities though. The Swiss Astronomy Society lists 46 observatories. In addition, there are also research institutes at various traditional universities and universities of applied sciences, such as those in Geneva and Zurich. The observatories perform various tasks. While the team in Zimmerwald hunts for debris in outer space, the observatory in Geneva conducts research into planets outside our solar system. Astronomers working at the Eschenberg Observatory in Winterthur measure the position of asteroids near Earth. Their measurements provide data for calculating the orbits of celestial bodies and help to estimate potential impact risk to Earth.

(SG)