GALACTIC HOUSEKEEPING

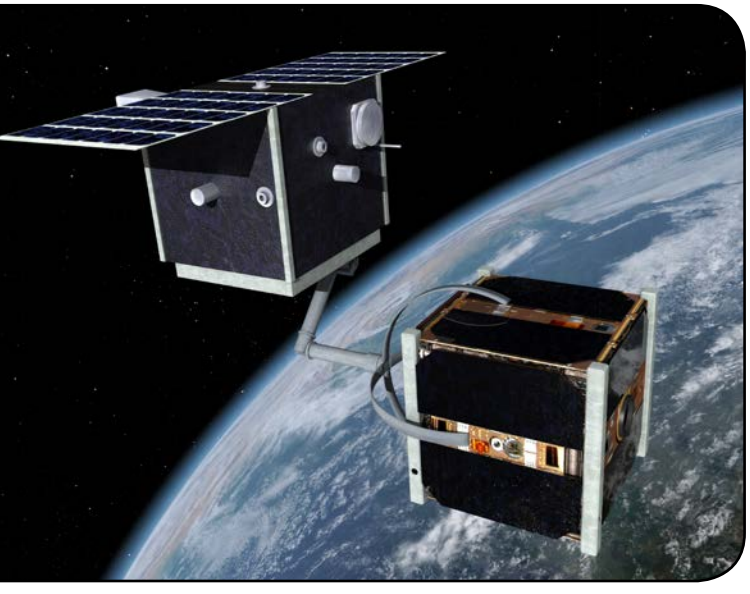
Swiss Space Systems Project Aims to Clean Up Earth's Orbit

With the constant push for sustainable and environmentally friendly procedures on Earth, you'd think we'd apply the same rules high above it. Space junk, also known as "space debris" or "space waste," is the collection of old satellites and multi-stage rocket parts that are floating around Earth's orbit like an intergalactic scrap yard. Our planet's various space programs have launched more than 7,000 crafts into the geosynchronous and low-earth orbits through the years. It's starting to get extremely crowded up there.

On October 21, 2013, a European Space Agency satellite reentered the earth's atmosphere when it ran out of fuel. While most of the 1,110 kg satellite disintegrated, an estimated 25 percent of the wreckage reached the Earth's surface. "The one-tonne Gravity Field and Steady-State Ocean Circulation Explorer (GOCE) satellite is only a small fraction of the 100 – 150 tonnes of man-made space objects that re-enter Earth's atmosphere annually," said Heiner Klinkrad, head of ESA's Space Debris Office. "In the 56 years of space flight, some 15,000 tonnes of man-made space objects have reentered the atmosphere without causing a single human injury to date."

With 122+ new space crafts scheduled to launch each year, one has to wonder if those odds will get increasingly worse in the not so distant future.

Swiss Space Systems (S3), headquartered in Payerne, Switzerland, is involved in the CleanSpace One mission to remove the thousands of bits of jettisoned rocket and satellite components orbiting the Earth. The plan is to grab hold of a piece of space junk (for example an out of commission Swiss nanosatellite) and thrust it into the atmosphere, where it will burn up. The engineering know-how necessary to navigate and seize this man-made junk is amazing.



The project will develop a new launch method where a small shuttle rides piggyback atop an A300 jetliner. When the plane reaches cruising altitude, this Suborbital Reusable Shuttle (SOAR) lights its engines and takes off upwards. When it reaches an altitude of 80 km, it ejects a vessel, which after reaching an altitude of 700 km, releases the satellite into Earth's orbit. Both the Airbus and the shuttle are reusable and use standard fuels, making the system very cost effective.

The goal of this three-phase process is to make space more accessible and to make sure that this doesn't end up putting even more space debris in Earth's orbit. S3 will ensure that all the elements in the chain, including the satellites, are equipped with their own reentry systems. CleanSpace One is set to launch in 2018 and will be the first satellite launched into orbit using this method. Although the satellite design is slightly different than originally planned (it's bigger and will weigh about 30 kg), the rest of the design is on track. Scientists have tested many technologies that could potentially be integrated into the satellite in the future.

Finally, as part of a partnership with the European Space Agency, researchers are developing many key technologies targeting space debris propulsion, navigation and reconnaissance systems and, above all, a device that can anchor itself to pieces of debris. ETH Zurich and the Swiss Universities of Applied Science are participating in this as well. They are counting on integrating their developments into the CleanSpace One project.

"You can't democratize space access without having a responsible attitude," says Pascal Jaussi, CEO of Swiss Space Systems. "If we don't deal with the problem of orbiting space debris and its accumulation, future generations' access to space will be compromised."

For more information on the CleanSpace One project, visit *www.s-3.ch*. **PTE**