

SPACE DEBRIS SYMPOSIUM (A6)

Poster Session (P)

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DEVELOPMENT AND IN-ORBIT VERIFICATION OF DEPLOYABLE SAIL STRUCTURES FOR
DEBRIS MITIGATION WITH A CUBESAT**Abstract**

The FH Aachen University of Applied Sciences has developed and launched his first CubeSat, named COMPASS-1, in 2008 into a polar sun synchronous 630km orbit. After 4 years of successful operation, the power management unit failed in April 2012 and the satellite went out of function. Now, COMPASS-1 is space debris, which will de-orbit only slowly within the next 10 years. According to the international "Space Debris Mitigation Guidelines", new satellite designs shall be equipped with a fast descent and removal out of orbit. For this new requirement, several strategies are discussed in the community. The upcoming CubeSat of the University is designed as a carrier system for miniaturized payloads. For the first application of this triple CubeSat (100 x 100 x 340.5 mm), named COMPASS-2 or according the application DragSail-CubeSat, two payloads were selected to demonstrate the possibility for deploying larger sail structures from a triple CubeSat. The first payload is a further developed drag sail that was originally designed by the student group Space Sailors, who demonstrated the sail on a sounding rocket in 2013. After the deployment of the sail, the drag on the satellite will increase drastically and lead to a faster de-orbiting. Demonstrating this in orbit will be one step forward to validate the drag sail strategy for small and medium LEO satellites to ensure a fast and save way to dispose defunct satellites from orbit. In this paper, the mechanism for our pyramid-shaped "DragSail" is presented. It is based on bi-stable metal ribbons, thus there are no motors needed. The sail itself is a thin aluminum-covered polyimide foil. Supported by the German Aerospace Center the sail is build with the required reinforcements for the load introduction and a packaging and deployment strategy was developed. The second payload is the mechanism for the deployment of thin film solar cell areas. This mechanism is also based on bi-stable metal ribbon and will deploy symmetrically a 2 m boom covered by thin film solar cells, which will increase the naturally small CubeSat power budget. The required technologies are currently under development at the University of Applied Sciences' Astronautical Laboratory and are supported by the German Federal Ministry of Education and Research. According to the current development schedule, the DragSail-CubeSat will be finished in mid-2015, ready for flight together with other CubeSats on the European Union Research Project QB50.