

APB-S; AURORA PLASMA BRAKE - SMALL

A LIGHTWEIGHT DEORBITING SYSTEM FOR LEO CUBESATS

APB is capable of deorbiting nano- and microsatellites from orbits with periapsis of up to 1000 km. Designed especially for a CubeSat, the system has minimal mass and volume to provide the deorbiting capability with minimal budget.

The APB modules consist of a microtether, a deployment system and required control electronics.

For satellites of bigger sizes, please refer to the APB-M and APB-L, the SmallSat plasma brake units suitable for us in satellites up to 1000 kg in mass.

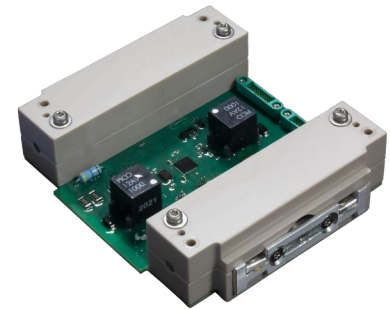


Figure 1 Dual redundant plasma brake unit of the AuroraSat-1

SCIENCE BEHIND THE TECHNOLOGY

A plasma brake uses Coulomb drag to interact with the upper atmosphere plasma, slowing down a spacecraft. The power requirements are minimal compared to the drag created. The time to deorbit depends on the initial orbit, satellite mass, tether length and voltage. You can read more [here](#).

MODULAR STRUCTURE FOR CUSTOM REQUIREMENTS

The APB-S can be fitted with a microtether in the range of 100 to 500 meters. An automatic de-orbiting functionality is also available, deorbiting the satellite even in situations where everything except the power system has failed. The APB-M and APB-L are available also with independent power systems, for fully autonomous deorbiting even when the satellite power system has failed. Aurora will recommend the best variant and suitable tether length based on customer requirements. The next page shows some example deorbit cases.

SAFETY

The plasma brake is inherently safe and reliable due to its simplicity. It is also safe for other satellites due to the use of the $\varnothing 50 \mu\text{m}$ (or smaller) microtether; even if it hits another satellite, it only leaves a mark few micrometers deep, equal to the daily micrometeoroid bombardment present in LEO.

For more details about the plasma brake safety, a separate Microtether Safety Document is available along with simulation results via e-mail request through sales@aurorapt.fi.

SPECS

	CubeSats 1-10 kg	Microsatellites of 10-30+ kg
Power	0.25 – 1 W	1 – 4 W
Tether length	100-300 m	300 – 1000 m
Thrust	Up to 100 nN / m	Up to 100 nN / m
Mass	< 200 g	< 500 g
Form	40 x 40 x 100 mm	60 x 60 x 100 mm
Availability	Starting 2020-Q4	Starting 2021-Q2
Lead time in 2021	6 months	8 months

Simulations

Below are shown an example simulation for a 3U CubeSat starting from several altitudes, comparing the aerodynamic deorbiting to plasma brake deorbiting. The bottom plot shows the comparison of the actual drag forces at different altitudes.

