

PEGASUS – a review of in-orbit operation and obtained results

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Abstract:

The QB50 project is an international project with the goal of sending an extended number of nanosatellites, a.k.a. CubeSats, into the Thermosphere. The scientific goal of this mission is to monitor over a period of up to nine months the prevailing conditions in this rather unknown part of Earth's atmosphere. Each of the CubeSats will be equipped with one of three possible scientific instruments: (i) a set of Langmuir probes, (ii) atomic oxygen measurement device, (iii) ion/neutral mass spectrometer.

In 2017, 36 nanosatellites were launched in the framework of QB50. The first batch included 28 CubeSats deployed from the ISS in April 2017, followed by a second batch of eight satellites two months later on the 23rd of June by means of the Indian launcher PSLV. One of the eight satellites from the second batch was the Austrian CubeSat PEGASUS.

PEGASUS is equipped with the Langmuir probe instrument from the University of Oslo. Beside of its scientific mission, the satellite serves as a test bed for several subsystems which were developed by the PEGASUS team including

- A TT&C board with two redundant transceivers and corresponding controllers combined on one board. Both transceiver-controllers can be operated independently in the same or different frequencies, with the same or different RX or TX frequencies.
- Multifunctional structure elements: beside of its mechanical tasks, the structural elements of PEGASUS serve also as a bus system, house the magnetotorquers for the ADCS and serve as solar cell array. This allows a very compact design and avoids (nearly) completely the use of cables inside the satellite.

In addition to the in-space technology, also a ground station network and a dedicated PEGASUS datacentre has been developed. The ground stations (in total four ground stations distributed in Austria) are interconnected but can operate independent from each other to ensure uninterrupted operation of at least 1 ground station at any time during the mission. All data received by any of the four ground stations are send to and collected by a dedicated data server. This server features also an interface for radio amateurs who can upload beacons and data they managed to receive.

PEGASUS has performed very well since in orbit and the PEGASUS team was able to download a large amount of house-keeping data, as well as scientific data. The present paper provides a summary of the in-orbit measurement and the lessons learned.