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L.A.R.S. - MOBILE GROUND STATION FOR CUBESAT OPERATIONS

Abstract

The DLR Institute of Space Systems in Bremen, Germany, presents a mobile ground station for CubeSat/SmallSat operations which completely fits inside a 20 ft shipping container. The ground station operates in the VHF/UHF amateur radio frequency bands (144-146 MHz and 430-440 MHz) and is prepared for S band (2400-2450 MHz). Moreover, the ground station is remote controllable via a VPN network connection.

Many of the CubeSat and SmallSat operators in the academic field suffer from the fact that the ground station operations for TT&C of their satellites is often quite challenging to maintain for the duration of a mission. Besides the operational costs for acquiring and maintaining of the equipment, a suitable spot for the antennas has to be identified, cables have to be routed to the radio room and the system demands regular maintenance. During the operations, it binds a lot of well-trained man power, and also student fluctuation can further strain the available resources. Our experience shows, that in an academic environment it is sometimes difficult to ensure reliable satellite operations during a complete mission.

Also, in Central Europe there are fewer (approximately 2-3 per day) high elevation passes for polar LEO orbits achievable. Locating a ground station closer to the polar regions will increase the number of passes significantly (e.g. more than 12 passes per day in Inuvik/Canada) and therefore guarantees longer and more frequent contact to the satellites.

Since our ground station is easily transportable by trailer or vessel, it can be moved to nearly any location where electric power and internet connection is available. The antenna system has no moving parts, which could be potentially vulnerable to harsh and freezing conditions, this also keeps the maintenance efforts low. The container itself features a good thermal insulation as well as a heating and a data logging system for the housekeeping. In the past months, continuous upgrades with other project related systems were added, such as receivers for AIS (Automatic Identification System), ADS-B (Automatic Dependent Surveillance), and WSPR (Weak Signal Propagation Reporter).

Currently, the ground station is located for testing purposes at the Jade Weser Airport in Wilhelmshaven, Germany. Tests with different Small- and CubeSats have demonstrated promising results of great performance with high sensitivity in reception, even at low elevations. In the near future it is planned to move the station to a northern location (Greenland) to achieve optimal contact opportunities for polar satellite orbits.