IAF SPACE SYSTEMS SYMPOSIUM (D1)
Lessons Learned in Space Systems (7)

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LIFE CYCLE OF THE VZLUSAT-2 EO SATELLITE: LESSONS LEARNED AND TECHNICAL SOLUTIONS

Abstract

The presentation describes the life cycle of the VZLUSAT-2 satellite from the beginning of the design phase to the successful completion of all mission objectives after two years of operation in space. VZLUSAT-2 is a technology research CubeSat satellite with a size of 3U for in-orbit demonstration of Earth observation with high GSD with its own COTS camera payload and an experimental AOCS system. Additionally, as hosted payloads, RGB detector, X-ray camera, and volatile vapor detector are placed on the satellite.

The construction of the satellite began in 2019 and was completed within 9 months. During development, several critical moments occurred, which will be presented as lessons learned. These included problems with long lead time of reaction wheels and undocumented in-rush current properties of the S-band communication subsystem. The satellite was scheduled for launch on SpaceX's Transporter-1 launch. However, due to reasons that will be presented, the launch was delayed to Transporter-2 and ultimately to the exchange of two launch providers. Eventually, the satellite was successfully launched on Transporter-3 on January 13, 2022, as a payload of D-Orbit's ION-SCV. The changes in launches and launch providers brought not only legal change requirements but also technical issues. Successful remanifestation among providers within days will be presented along with associated suitable technical solutions.

As a D-Orbit is Satellite Carrier Vehicle, VZLUSAT-2 left inside ION-SCV for two weeks after launch. According to plan, after CubeSat deployment the commissioning of individual subsystems was successfully carried out. During commissioning the issue with Ground Station surroundings interference was overcome and the lessons learned will be presented. Due to rapid development, the AOCS system was equipped only with SW drivers for all sensors and actuators and B-dot detumbling algorithm. Control algorithms were planned to be uploaded only in orbit in the form of uPython scripts. This was successful after several development cycles based on flight experience needed to complete the AOCS development. Nevertheless,

residual magnetic field limitations led to reaction wheel saturation within several minutes. Currently it is possible to take any pictures of Earth with a resolution of around 30 meters GSD, with a lower duty cycle. The system operates reliably and long-term, which will be evidenced by images of the same ground locations after between years of operation.