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OUTERNET: THE DEVELOPMENT OF 1U CUBESAT PLATFORMS TO ENABLE LOW-COST GLOBAL DATA PROVISION

Abstract

The Outernet constellation aims to revolutionize telecommunications provision by offering a low-cost, mass-producible alternative to traditional infrastructure.

Traditional telecommunications platforms typically have a mass of the order of a few tonnes, cost several million dollars and take a number of years to develop. Therefore, the development of 1U CubeSats with the ability to distribute information across a constellation and subsequently transmit it to receivers is not trivial. Some of the challenges of the Outernet CubeSats are: power generation, volume, high duty cycle operation and satellite batch production techniques.

To overcome these challenges, the platforms will incorporate a number of state-of-the-art Clyde Space subsystems. Power will be provided by a bespoke version of the standard 1U solar panels consisting of body mounted and deployable panels to maximise power generation. These solar panels will also host coarse sun sensors, capable of providing illumination information, along with temperature sensors. Power conditioning will be performed using an off-the-shelf next-generation Clyde Space electric power system with an integrated 20Wh battery. Outernet platforms will also include the newly developed on-board computer which will carry out all platform and mission control and management and will provide the on-board storage necessary for payload operations. The attitude determination and control system will be the Clyde Space motherboard with standard on-board sensors and will interface to the solar panel embedded magnetorquers, coarse and fine sun sensors. A modified VHF/UHF transceiver (VUTRX) will be the primary transceiver for telecommand, telemetry, and payload data. The VUTRX will provide a VHF uplink and UHF downlink at nominal rates of 9600bps using modified CCSDS packets and a resilient broadcast protocol. The bespoke 1U CubeSat structure has also been designed with the necessary interface and aperture cut-outs to satisfy the Outernet subsystem requirements.

The Outernet IOD mission will allow understanding of the platform from subsystem level to full operation (provision of data to the fixed Earth station and pick up by a simple receiver at a different location) to extrapolate the expected performance of a future full Outernet constellation. The completeness of the received data, the effect of missing packets and the end to end reliability will be assessed. This paper provides an overview of the ambitious Outernet IOD mission where Clyde Space will push the boundaries of platform development to enable Outernet to pursue its goal of offering a near continuous broadcast of humanitarian data to those most in need.