SYMPOSIUM ON INTEGRATED APPLICATIONS (B5)
Tools and Technology in Support of Integrated Applications (1)

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DOWNSTREAM APPLICATIONS DRIVING CUBESAT TECHNOLOGY DEVELOPMENT

Abstract

This paper provides an overview of how downstream applications have driven technology advancement at Clyde Space Ltd, over recent years, to develop platforms to house state-of-the-art payloads and create the next-generation of CubeSat missions. Available power has always been considered a limitation of CubeSats. For example, missions such as: cloud profiling and rain monitoring using radar; and atmospheric, aerosol and vegetation measurements using lidar have in the past been thought to be infeasible using CubeSats due to the high power requirements. However, the development of efficient deployable solar panels is now making these kind of missions, requiring high power, feasible.

The growing commercial use of CubeSats has also created a demand for more reliable, longer duration missions in order to maximise the profitability. This requirement has driven the need for both reliable CubeSat subsystems and micro-propulsion systems to extend mission lifetime. While redundancy and high reliability are difficult to implement in CubeSats, by the same means as larger spacecraft due to the fundamental limitation in size, design optimisation can provide high system reliability. For example, the newly developed Clyde Space on-board computer (OBC) uses magnetic RAM (unique for a CubeSat OBC) to ensure data storage during loss of power and robustness to radiation events such as single event upsets as it is not susceptible to ionization. The need for longer duration missions has also driven the development of the Pulsed Plasma Thruster for CubeSat Applications (PPTCUP) to perform atmospheric drag compensation in Low Earth Orbit (LEO) and is capable of extending the mission lifetime by up to 200

These subsystem developments mean Clyde Space are developing some of the most capable CubeSat missions possible. These include PICASSO – which uses a hyperspectral imager to determine ozone distribution in the stratosphere, temperature profile in the mesosphere and electronic plasma characterization in the ionosphere and; SeaHawk - which uses an ocean colour sensor to provide ocean colour data of at least equal quality to sensors on traditional larger platforms.

This paper will also provide an insight into market demands for future CubeSat applications and the subsequent developments in CubeSat technology required to meet these objectives.