SMALL SATELLITE MISSIONS SYMPOSIUM (B4)
Design and Technology for Nano-Sats and Cube-Sats (6B)

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SYSTEMS ENGINEERING, OPERATIONS AND PAYLOAD INTERFACING IN CUBE-SATS

Abstract

Cube-Sats provide a considerable challenge to systems engineering, with minimal power and mass constraints being carefully managed to provide maximum scientific gain. This paper outlines the particular considerations and difficulties in the systems engineering requirements of the "LunchSat project", a Cube-Sat mission currently being designed by members of the graduate scheme at EADS Astrium UK. Comparisons to the systems engineering solutions implemented in other Cube-Sat missions are also drawn.

One challenge of the systems engineering of the LunchSat described here involves the successful overseeing of concurrent and inter-dependent design and analysis work in varying subsystems. The co-investigation of multiple and significantly differing attitude control systems in particular strongly drives the interfacing to other systems, including thermal analysis and payload operation. Uncertainty in the solar cell capabilities are another factor, which limit the understanding of the potential operation of power-hungry subsystems such as communications. In addition to internal interfacing within the project, focus is given to the challenge of producing comprehensive payload interfacing requirements to potential external suppliers. The definition of an accurate but flexible interface during a stage where many subsystems are still undergoing rapid and significant development has been one of the major recent undertakings of the systems engineering team.

The related problem of operations under these subsystem constraints is also presented. The development of the project without a clear definition of the available launch options requires careful planning and contingency to enable successful operation of the satellite in various orbits and attitudes with little or no technical changes to the LunchSat design. The steps taken in this field are described, with reference to the systems engineering decisions made to implement this flexibility.

Following the descriptions of these technical activities, an overview of the upcoming challenges for the LunchSat systems engineering is presented with reference to the envisaged solutions. Finally, a mention is made of the benefits gained from this systems engineering work in terms of both professional development and application to larger space craft.