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STRATHCUBE: A STUDENT CUBESAT THAT ENCOURAGES THE SUSTAINABLE USAGE OF SPACE

Abstract

The 'NewSpace' revolution has led to more launch opportunities and cheaper off-the-shelf components. As a consequence, the rate at which objects are being launched into orbit has significantly increased. A large proportion of these new objects are due to satellite mega-constellations, and concern is growing over the congestion of the space environment. However, a positive associated with the democratisation of space is that CubeSats, a standardised nanosatellite, are becoming increasingly technically capable. STRATHcube is a student-led CubeSat in development at the University of Strathclyde that seeks to mitigate the problem of space debris with two novel technology demonstrations: in-orbit space debris tracking and measuring fragmentation during re-entry. This paper will present the design of the CubeSat and the learning experience of the student team. A trade-off analysis was conducted to determine the optimum configuration of the CubeSat in terms of viability and scientific value. A broad range of configuration options with different payload capabilities and properties were initially considered. By completing a high-level design for each option, a baseline and a more technically ambitious choice were selected. A detailed design process was then able to be undertaken for the CubeSat subsystems, in parallel with the design of the payloads and their experiments. As the first student CubeSat development at the University, strategies such as interactive workshops were used to give undergraduate students practical experience of designing and building a space mission. The challenges associated with developing STRATHcube in parallel with two ambitious experiments will be assessed, particularly given the student-led nature of the project. From the trade-off analysis and detailed design process, it was determined that the CubeSat's primary payload will use passive bi-static radar technology to demonstrate in-orbit space debris tracking,

which could eventually decrease the minimum size of debris currently able to be catalogued. A secondary payload that will gather data on the spacecraft's fragmentation during re-entry was determined as feasible but posed significant challenges for the design of several subsystems. The results of a survey measuring the success of the methods used to train the students involved in the project are presented. It is hoped that the CubeSat's design will enable it to contribute to space debris mitigation and encourage the sustainable usage of space.