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SAPIENZA S5LAB STUDENT DRIVEN SMALL-SCALE SPACE MISSIONS AND EXPERIMENTS

Abstract

The rising number of concepts for small size space payloads, e.g. space station experiments, nano- or pico-satellites and stratospheric experiments, is widening the users number for such payloads to virtually all the people in the world, as per the so-called "New Space Economy".

In this framework, the involvement of students at the early stages of their academic careers into development of space payloads is beneficial on multiple points of view. As an example, students have the chance to face and solve "real-life" problems and to gain their soft skills (e.g. team working skills or basic manufacturing and coding capabilities). Moreover, students learn how to face success and failure of their small missions and how to improve processes for their future.

At Sapienza Space Systems and Space Surveillance Laboratory (S5Lab), a group of around 50 students is developing small-scale missions since 2014. Four CubeSats have been launched with the support of ASI and other institutions, while a fifth CubeSat will be launched in mid-2022 on the maiden Vega-C launch. Three stratospheric payloads manufactured by S5Lab have been successfully launched from the Esrange Space Center in Sweden, through the REXUS/BEXUS and HEMERA international programmes. The new perspectives of payload development, besides continuing to manufacture CubeSats (through the selection of a new 2-Unit mission to be launched in 2023) and stratospheric experiments (through a new participation in REXUS/BEXUS) include the possibility of developing a student-led analog mission simulating lunar lava tube operations, and the chance to study and develop prototypes for innovative launcher navigation systems and suborbital experiments.

The main lessons learned obtained by the years of development with students deals with reaching a certain continuity of payload manufacturing, from a "one-shot" concept in the early years to a better knowledge management for launch opportunities potentially obtainable every year. Other lessons learned are dealing with the correct time and year of involvement of the students, and with manpower management when the involved students are volunteering for joining the teams.

This paper will deal with the experience in payload and missions development at Sapienza S5Lab. After an introduction over the present, past and future space missions, the main lessons learned from how to turn these projects into success stories of students involvement will be presented. The future perspectives for reaching a more stable continuity of launch opportunities and payloads development with a wider knowledge management among students will be discussed.