50th STUDENT CONFERENCE (E2)
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STRATOS IV: DEVELOPMENT OF A STUDENT SOUNDING ROCKET CAPABLE OF LAUNCHING TO 100 KM ALTITUDE

Abstract

In September 2019 the Stratos IV team started with the aim of concluding the Student Space Race by launching a rocket fully designed and built by students to over 100 km altitude. This meant increasing the performance of the Stratos III rocket by 25% in a single year with a team consisting of 75 students. To achieve this, a novel team structure aiming to significantly accelerate technical innovation was implemented, resulting in several ground-breaking innovations. Moreover, a new approach to partnerships ensured attraction of non-traditional companies into a space project.

To ensure meeting the aggressive project timeline of one year, a so-called matrix team structure was implemented. The team is organised between subteams oriented on different specialisations such as structures and electronics, and subsystem focused section teams headed by a system owner, e.g. the recovery bay, with engineers from different disciplines. This fluent communication across the entirety of the team eased the traditional challenge of interface management and system ownership. Team cohesion and knowledge management was further enhanced with monthly full team meetings and weekly subteam meetings and section work sessions. The unique and challenging aspects of launching a student rocket to space were leveraged for project outreach and media coverage. These resulted in a significant increase in project funding and project engagement.

The Stratos IV sounding rocket made a giant leap forward for student rocketry through several new technical innovations featured on the vehicle. Considerable weight savings were achieved through a 50% lighter 3D-printed titanium nozzle and a carbon composite combustion chamber, withstanding the 3000 °C combustion temperature. The engine bay, where the combustion chamber interfaces with the oxidiser tank, was entirely redesigned to allow for increased rigidity and accessibility. The recovery system employs a new hot gas mortar system that reduces overall system complexity. The in-house developed flight computer can accommodate up to four external payloads and features an advanced flight termination system (FTS) compliant with Range Commanders Council (RCC) specifications. Moreover, it controls the propulsion and recovery systems, and handles live data telemetry. A nitrous oxide monopropellant roll control thruster system was developed to counteract the inertial roll coupling encountered on Stratos III.

Stratos IV highlights the power of student rocketry through technical innovation and new team struc-

tures. It has allowed the team to complete the first student rocket that can reach space with very little development resources and an aggressive project timeline.