

43rd STUDENT CONFERENCE (E2)  
Student Team Competition (3-V.4)

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THE DESIGN AND ORGANIZATIONAL APPROACH FOR A STUDENT-BUILT HYBRID  
SOUNDING ROCKET**Abstract**

This paper presents the final design for the University of Toronto Aerospace Team's (UTAT) sounding rocket, Eos, as well as the team's organizational and outreach initiatives. The rocket was designed for the 8th Intercollegiate Rocket Engineering Competition to reach an apogee of 3km while carrying a 4.5kg payload. In its first year of activity, the UTAT's rocketry division was able to design, build, test, and successfully launch the Eos rocket.

Eos is powered by a hybrid rocket engine using a mixture of paraffin wax and aluminum as fuel with nitrous oxide as the oxidizer. This was selected for its high performance, ease in construction, and most importantly its inherent safety. The external structure that houses the various systems was fabricated using an advanced spread tow carbon, fibreglass, and foam composite. Many of the overall system components, including structural members, aerodynamics, engine, and flight performance were simulated through both in-house and commercially available software packages. Numerous ground tests were performed prior to launch in order to validate these predictions. This paper will detail the design of Eos, with particular emphasis on the advanced propulsion and composite structure.

The success of this project was made possible through UTAT's multi-divisional organizational structure and its 10 years of experience in engineering design. Historically focused in the area of aeronautics, UTAT pools resources and skills from its four divisions - rocketry, unmanned aerial vehicles, powered flight, and unpowered flight - in order to better the team as a whole. UTAT's breadth of projects of varying difficulty, and its efficient organizational structure allows the engagement of over 200 individuals ranging from first year undergraduates to doctoral students. In addition to the details of the rocket design, this paper will highlight the key benefits and difficulties encountered in operating a large multi-divisional organization in the hopes that other University teams will be able to benefit from this approach.

Another substantial portion of UTAT is outreach, which aims to motivate and educate aspiring engineering students. This is done through various campus and community events, as well as educational programs. For example UTAT is involved with the Da Vinci Engineering Enrichment Program (DEEP), the Canadian Aeronautics and Space Institute (CASI) quarterly meetings, “Go Eng Girl”, and frequently speaks at local secondary schools to promote aerospace. This paper will briefly overview the outreach initiatives of UTAT, including the impact that UTAT has made in the aerospace community.