

43rd STUDENT CONFERENCE (E2)
Educational Pico and Nano Satellites (4)

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UNIVERSITY DESIGN AND BUILD AUSROC LIQUID FUELED ROCKET SYSTEM

Abstract

This paper outlines the Australian Space Research Institute (ASRI) and RMIT University joint development of two liquid fuel launch vehicle systems designed and built by a University team. The team of thirty university students from aerospace, mechanical and computer systems degrees is unique in that it is wholly student lead and managed.

AUSROC 2.5 is a single stage, high altitude sounding rocket of 450kg launch mass which has passed fuel tank pressurisation testing and the ablative-cooled, 35kN thrust (ISP 230s at sea level) motor, which utilizes Tridyne technology, is scheduled for performance testing in September 2013. The simple aluminium demonstrator is designed to carry a 10kg payload to a height of at least 20km. The paper presents the technical design challenges faced by the student team in realizing their design into hardware and testing.

AUSROC nano is a three stage nano-satellite launch vehicle designed to place a payload of maximum 10 kg into circular low earth orbit with an altitude of at least 250 km; while maintaining minimum launch cost. Design has been completed of a liquid bipropellant pressure-fed engine and performance sizing; attitude control system using 2-DOF gimbals, fairing and inter stage structural analysis, and stage separation mechanism utilizing pyrotechnics. CAD designs of the stages and system are finalized as baseline and are currently being integrated for prototype fabrication and testing. Both projects are expected to launch from the Woomera rocket testing range.

Student work for AUSROC projects contributes to the formative assessment towards each student's academic degree and facilitates student centred project based learning. The students in AUSROC have achieved a high level of external conference publications compared to non AUSROC students. The quality of the space education program is peer reviewed on an annual basis by ASRI at the conclusion of each academic year.