SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
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# LEEM ROCKOON PROJECT: DEVELOPING A HIGH ALTITUDE PLATFORM

**Abstract**

The association LEEM (Laboratory for Space and Microgravity Research) from Aerospace Engineering at Technical University of Madrid (UPM) is designing a Rockoon, a solid propellent rocket with its launching pad carried into the upper atmosphere with a stratospheric balloon. This has the benefit of a better performance of the rocket to reach a higher altitude due to the lower density of the air during its flight. Our current step in this project is to test all the systems that will enhance a future mission reaching the border of the space at 100 km.

One of the main challenges at altitudes above 30 km high is to achieve the ignition of the solid-propellent rocket motor, due to the lack of pressure and low temperatures. Low densities have also an effect on the control of the rocket trajectory making necessary an active system. The main structure besides must be designed taking account of the stability needs of the rocket. The development has been planned in several stages and, as of today, we have accomplished 3 launches with different objectives and we are currently planning the fourth one. In addition to the launches, the development comprises several ground test on the ignition systems, on-flight structure and electronics. This last subsystem imposes hard requirements on the thermal conditions inside the rocket and balloon bay, requiring a detailed study of the thermal behaviour of the embedded electronics. The main recovery system is based on a GPS module using the GSM mobile network and a complementary RF telemetry subsystem with high gain antennas, being able to establish at least a 40km-range datalink, all supported by a ground segment under progress. All this work has been mentored by the Electronics Laboratory at the UPM.

The contributions of this paper are the design and operation of a Rockoon mission. This paper will present all the results from the ground tests and Rockoon launches, including the last launch planned this summer. It will be also presented the design to launch a Rockoon up to 100 km, using SoA technologies.