

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Upper Stages, Space Transfer, Entry and Landing Systems (3)

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SYSTEM COSTS REDUCTION DRIVEN BY INNOVATIVE SOLUTIONS - THE CASE OF A SMALL
UPPER STAGE LIQUID ROCKET DEVELOPMENT

Abstract

This paper addresses the up to date status of a small Upper Stage Liquid Rocket development, intended to have a simple but initial flight tested system configuration, which will be the basic reference design solution for future components and system performance improvements and, also, to incorporate navigation and guidance functionalities. Its design was driven by local technological feasibility and cost reduction, resulting in locally innovative solutions at both component and system levels. A description of the Upper Stage Liquid Rocket base configuration is presented, including its Pressurized Feeding System and a 5 kN thrust Engine with Ethanol and Liquid Oxygen as propellant pair. Simple electronics for event sequence command generation, for power supply storage and distribution were developed. To reduce costs, the electronic equipment and the pressurized feeding system design were based on industrial and automotive components class type. The telemetry and telecommand equipment for flight interruption were based on Commercial Off The Shelf (COTS). The Upper Stage Liquid Rocket under development is characterized by a singular technological cooperation between a research institute and a small private enterprise. The Project Management methodology, Product Assurance organization and Project Work Breakdown Structure, which contributes to the project success, are discussed. The Development and Verification Plan as well Integration and Test Plan to assure safety realization of functional firing test are presented. The functional and environmental qualification tests results at components, equipment and system levels, including a system hot fire test in the test bench are summarized. Finally, it is introduced the flight experiment that is on the schedule, having the small Upper Stage Liquid Rocket as a payload of a sounding rocket.