

SPACE PROPULSION SYMPOSIUM (C4)
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DEVELOPMENT OF SMALL SOLID ROCKET BOOSTERS FOR THE ILR-33 SOUNDING ROCKET

Abstract

This paper gives an overview of the development of a 6000 Newton-class solid rocket motor for sub-orbital applications. The design configuration and results of interior ballistics calculations are given. The initial use of the motor as the main propulsion system of the H1 experimental in-flight test platform, within the Polish Small Sounding Rocket Program, is presented. Comparisons of theoretical and experimental performance are shown. Both on-ground and in-flight tests are discussed. A novel composite-case manufacturing technology, which enabled to reach high propellant mass fractions, was validated and significant cost-reductions were achieved. This paper focuses on the process of adapting the design for use as the booster stage of the ILR-33 sounding rocket, under development at the Institute of Aviation in Warsaw, Poland. Parallel use of two of the flight-proven rocket motors along the main stage is planned. The process of adapting the rocket motor for booster application consists of stage integration, aerothermodynamics and reliability analyses. The separation mechanism and environmental impact are also discussed within this paper. Detailed performance analysis with focus on propellant grain geometry is provided. The evolution of the design since the first flights of the H1 rocket is covered and modifications of the manufacturing process are described. Problematics of simultaneous ignition of two motors and their non-identical performance are discussed. Further applications and potential future developments are outlined. The work presented is based on initial work done by the Rocketry Group of the Warsaw University of Technology Students' Space Association. The large scale continuation of the Polish Small Sounding Rocket Program at the Institute of Aviation proves the value of the outcomes of the initial educational project.