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Author: Mr. Adam Okninski
Institute of Aviation, Poland

Mr. Bartosz Bartkowiak
Warsaw University of Technology (WUT), Poland
Mr. Paweł Nowakowski
Warsaw University of Technology (WUT), Poland
Ms. Joanna Zaborowska
Warsaw University of Technology (WUT), Poland
Mr. Damian Kaniewski
Warsaw University of Technology (WUT), Poland
Mr. Blazej Marciniak
Warsaw University of Technology (WUT), Poland
Mr. Jan Matyszewski
Warsaw University of Technology (WUT), Poland
Dr. Jan Kindracki
Warsaw University of Technology (WUT), Poland
Prof. Piotr Wolanski
Polish Academy of Sciences, Poland

LOW-COST SOLID ROCKET MOTOR DEVELOPMENT

Abstract

This paper gives an overview of the development of solid rocket motors of the Polish Small Sounding Rocket Program. The team efforts enabled manufacturing of high performance rocket motors using low-cost, mainly off-the-shelf, technologies. This paper presents the design and optimization methodologies. A description of software developed during the project is contained. Structural and interior ballistics optimization techniques are described. Optimization focused on adapting the rocket thrust curve to specific mission requirements is also discussed. Technical equipment and background is presented. This paper introduces a technology of producing low-cost composite structure solid propellant rocket motors without expensive filament winding machinery. All of the main parts of the motors are presented. Performance simulations and firing results of sub-scale rocket motors of thrusts between 500 and 5000 Newtons are given. Flight operation data is also presented and analyzed. Finally, a detailed comparison of similar size rocket motors is shown, proving an efficient and economic design. The ultimate aim is to build larger rocket motors enabling intensive suborbital experimentation and preparing the developed design for launcher operation. This work is based on results of the joint project of the Space Technology Department of the Institute of Aviation and the Division of Aircraft Engines of the Institute of Heat Engineering of Warsaw University of Technology (WUT) with a key role played by members of the Students' Rocketry Group of the WUT Students' Space Association.