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SPACE PROPULSION SYMPOSIUM (C4)
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GROUND TESTING OF LOW-THRUST SELF-PRESSURIZED HYBRID MOTOR

Abstract

Research of the Hybrid Propulsion Team at the University of Brasilia (UnB) covers the questions of design, manufacturing and testing of the hybrid rocket motors. With the support of the Space Agency of Brazil, the project of the 1kN motor development started in 2013, which is connected with SARA reentry system for the scientific missions at low gravity conditions. The hybrid motor design project duration of three years was split into two main actions. First action is the theoretical research and design of the test motor, subsystems, planning of experiments and measurements, projecting and construction of the test facility, manufacturing of the propulsion system and ignition system qualification. Second phase is about the assembling of the motor on the bench, design modifications, experimental research of the processes in the propulsion system, including tests in cold and low pressure conditions, decisions of the modification of the motor, building and testing of the flight model. Currently, the first phase of the project is completed successfully. Very important part in the project development took the design of the test bench and planning of the experiments, which is able to fulfill the questions of motor characteristics and statistical properties of its operation. The projected horizontal test stand for the motor of 3kN maximum thrust gives the possibility of accurate measurements of axial forces for the SARA motor, and to have support of sensors mounted in the feeding system, combustion chamber and the nozzle. Safety of propellants storage, test preparation procedures, test execution considered during in the design of the test facility. That is why questions of the automatic ignition, control of the propulsion process, safety protocols are key points of the new test system. During the design phase of the testbench questions connected with frequency analysis, mechanical and combustion stability were taken into the consideration. The concept, schematic of the bench, its realization are currently finished and will be presented in the paper, as well as tests of its conjugated operation with the hybrid propulsion system. Received data show the advantages and limitations of the designed test system. The proof of the presented concepts made with use of the measurement equipment with short response time.