IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Interactive Presentations - IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (IP)

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WAYS OF IMPROVEMENT OF SUBORBITAL LAUNCH VEHICLES

Abstract

The work is devoted to an important problem of expansion of capabilities of suborbital launch vehicles (SOLV), including increase of the altitude of launch of the payload up to low-earth orbits. The range of implementations of SOLVs is rather wide. Their use as geophysical rockets is related to the study of the Earth's gravitational and magnetic fields and to astrophysics. As meteorological rockets, they are used for studying (measuring) structural parameters of the atmosphere, in particular, the ozone layer, various phenomena in the atmosphere substantially influencing the weather of the planet for improvement of existing models and formation of long-term weather forecasts. SOLVs are used as flying test stands for working-out perspective systems for rocket-and-space technology, including control, communication and navigation systems, reentry, parachute and landing systems for Earth and other planets. A separate field of applications of SOLVs is experiments in microgravity conditions. These rockets, depending on their flight altitude, provide the quality of microgravity of 0,001g to 0,0001g during 200 to 300 seconds or more and a choice of parameters of the trajectory, in particular, the angle of deflection from the vertical line. It should be noted that for certain applications, including biology, pharmacy, hydrodynamics, material studies, crystal growing, etc., the longitudinal g-forces should be limited to 5g, which imposes limitations on the choice of the design parameters of the SOLV and its propulsion system, and their modes of operation. In 2018 and 2019, flight tests of sample rockets with the lift altitude up to 10,000 m were carried out. The tests completely confirmed their ability to be used as launchers of CanSat payload. This became a foundation for development of a two-stage rocket with flight altitude of 40 km. The flight test is scheduled for the first half of 2021. In preparation to the test, successful stand tests of the rocket engine operating on a mixed solid propellant have been carried out. Further on, development of SOLVs with the flight altitude up to 700-800 km and payload up to 50 kg for launching payload into the LEO. These rockets will be similar to Maxus and SS-520 rockets.