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Future Space Transportation Systems Verification and In-Flight Experimentation (6)

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IN-FLIGHT AND GROUND TESTS OF AN INEXPENSIVE SUBORBITAL PERUN ROCKET AND ITS GREEN HYBRID ROCKET ENGINE IN PREPARATION FOR THE FIRST FULL SCALE FLIGHT IN 2022.

Abstract

PERUN is a reusable suborbital rocket being developed by a Polish company SpaceForest, which main goal is to deliver 50 kg of scientific and commercial payloads to altitudes of up to 150 km. To reduce the cost of launching payloads to suborbital trajectories PERUN will be launched from a mobile platform and will be entirely reusable. This paper describes two major milestones achieved in the development process of PERUN, which first suborbital flight should take place in late 2022. The first major milestone was achieved in January 2020, when a 1:1 model of PERUN made its first supersonic flight, reached the altitude of 9.5 km and was successfully recovered. In this test the technology demonstrator was launched from a fully complete mobile tower and was equipped with parachutes and avionics that will be used in the final version of the rocket. The second major milestone was achieved in January 2021, when a full static test of PERUN main engine, called SF-1000, was completed. The engine reached a total impulse of 1200 kNs with a peak thrust of 42 kN and average thrust of 30 kN over the entire burn that lasted over 40 s. Post-test data analysis revealed that the average engine specific impulse was 212 s, exceeding initial expectations. The results, gathered experience and outline of both tests are presented in this paper. It is

also shown how these results shaped the plans for future tests in 2021 and 2022.