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STUDENT PROJECT OF A SMALL RE-ENTRY VEHICLE FOR DELIVERING SCIENTIFIC CARGOES FROM ORBITAL STATIONS

Abstract

The article presents a project of a small re-entry vehicle (SRV) aimed at prompt delivery of cargoes of various types, for example of biological nature, from the orbital stations. This system should permit to transport cargoes from orbit on demand, irrespective to the existing traffic. With its relatively small dimensions and mass, the SRV can be delivered to the orbital station with a supply vehicle and stored there

until required. The SRV is being developed by the student team of Youth Space Centre of Bauman Moscow State Technical University. The team consists of the following groups: general design, aerodynamic analysis, propulsion, thermal control, autorotation effect study, and testing. The SRV consists of two main parts: a re-entry capsule and a thermostatically controlled landing device inside it. The last one maintains the required temperature regime for the payload. The general design team developed a re-entry capsule which represents a stiffened shell with a thermal-protective coating. The form and thermal shield of the capsule are based on preliminary descent dynamics and thermal analysis. The SRV is to be detached from an orbital station via a CubeSat-like P-POD. The propulsion group substantiated the choice of cold gas engine for SRV de-orbiting. Based on the assessment of aerodynamic parameters of the capsule, a method of descent control was proposed using the flaps in the dense atmosphere. Once SRV decelerates down to subsonic velocity, the landing device is pulled out of the capsule by a braking chute. The autorotation effect of a multirotor assembly, proposed by the group, is a new approach for velocity damping. It makes possible to adjust the angle of blades in order to increase the efficiency of the propellers. Autorotation and controlled descent improve maneuverability of the landing device and also contribute to the accuracy of the SRV landing. The device uses "pull-up landing". This helps to obtain the velocity values that can be extinguished by the landing legs. Now, the students are creating a mock-up of the subsonic landing device to check the developed mathematical model during the drop tests.