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PROGRESS CARGO VEHICLES USED FOR SPACE EXPERIMENTS

Abstract

Russian Progress cargo vehicles have been used for space station programs since 1978. When primary tasks are accomplished, basic systems of cargo vehicles often have unspent resources that would make feasible the autonomous 2-3 month long flight. It would be reasonable to use these resources for research programs.

Satellite Launch upon Undocking and Departure from ISS It is rational to transfer Progress to a higher orbit for launching satellites. The satellite is placed inside a launch container. When Progress undocks and transfers to a required orbit, the satellite is launched.

The satellite could have large dimensions or deployed elements that go into operational state under operators' control. So it is proposed to place a folded satellite inside Progress. When Progress docked to the ISS, the satellite is brought inside the station and later installed outside Progress by cosmonauts during EVA.

Truss System for Upper-Air Study Progress could support upper-air studies at the altitude of 100-160 km. Progress could accommodate a probe equipped with scientific hardware, a probe jettison device and a truss connecting the probe with Progress. Probe's aerodynamic stabilization along with the force directed towards the Earth provides reliable deployment of the truss. Gradual decline of Progress orbit would make upper-air studies feasible for a long time without propellant to be consumed.

Microgravity Experiments aboard Progress There is no crew and life support system aboard Progress, so the cargo vehicle has lower micro g-loads than the ones aboard the ISS RS. That makes favorable environment for micro g-loads experiments. Space experiment hardware could be placed inside Progress prior to undocking. When the experiment is accomplished, the vehicle redocks to the ISS to return the experiment hardware. Progress passive attitude modes are the most favorable for micro g-loads space experiments.

In-Flight Testing of Equipment, Procedures and Systems The testing of systems and procedures for rendezvous and docking with uncooperated vehicles is a relevant task. As there are a lot of spacecraft in orbits (particularly, in GEO), and it is necessary to remove those that are out of the service. To address this topical issue, the equipment and procedures for rendezvous with uncooperated vehicles as well as robotic systems to capture spacecraft need to be developed.