

HUMAN SPACE ENDEAVOURS SYMPOSIUM (B3)
New Technologies, Processes and Operating Modes Enabling Future Human Missions (7)

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PROBLEMS OF TRANSPORT CARGO VEHICLE FLIGHT CONTROL WHEN RESEARCHES ARE
PERFORMED IN ITS FREE FLIGHT

Abstract

Russian Progress transport cargo vehicles (TCVs) have successfully worked in different space station programs since 1978. At present time, they play the important role in the International Space Station (ISS) project with the Progress M-M vehicle modification. Main tasks performed by the TCV in the station program are the following: refueling of the station, delivery of consumables and equipment, station attitude control and orbit correction maneuver execution, waste removal. At the same time, the cargo vehicle basic systems still have unused resources when the vehicle finishes its work with the station. It makes sense to use these resources when possible to perform researches in free flight of TCV after departure from the ISS. The fields of research can be determined not only on the base of vehicle capabilities as a research platform but also taking into account society needs. Possible fields could be the following: - In-flight tests and validation of various equipment in the interests of other spacecraft; - Execution of experiments on the Earth remote sensing; - Microgravity research; - Launch of small satellites from the Progress vehicle after undocking from the station and being considerably far from the ISS, etc. Specific features of the Progress TCV flight control when researches are performed in free flight of the vehicle are related to the following: - The need to control several transport vehicles simultaneously as the other transport vehicles continue to work with the ISS; - The necessity to develop and execute new operations and specific modes for research with additional requirements and constraints to be considered in flight control; - The demand to optimize mission plan when various experiments are executed; - Though researches are performed in free flight of the TCV it is necessary to integrate them correctly into the ISS mission plan, as it is required to reserve certain fuel amount for experiments support, to plan crew participation for equipment or satellite mounting and checks before the TCV undocking from the station, in some cases to plan second docking to the station to get research results from the TCV, etc. The paper presents detailed consideration of the TCV flight control problems when various experiments are fulfilled on the vehicle and the methods of their solution. Problems of TCV mission planning and integration into the ISS mission plan are analyzed on the base of lessons learned during experiments already performed on the Progress vehicles.