

HUMAN SPACE ENDEAVOURS SYMPOSIUM (B3)
How Can We Best Apply Our Experience to Future Human Missions? (2)

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USAGE OF PRE-FLIGHT DATA IN SHORT RENDEZVOUS MISSION OF SOYUZ-TMA
SPACECRAFT

Abstract

Reduction of flight duration after insertion till docking to the ISS is considered. Modern human spacecraft have to dock to the ISS at random initial phase angles, therefore rendezvous mission of the Soyuz-TMA and, until recently, of the Space Shuttle to the ISS took about two days. The long stay of a crew in the limited habitation volume of the Soyuz-TMA spacecraft before docking to the ISS is one of the most strained parts of the flight and naturally cosmonauts wish to dock to the ISS as soon as possible. In the previous studies it was shown that the current capabilities of the Soyuz-TMA spacecraft could provide transition to the short four-orbit rendezvous mission. However, the analysis of the cosmonauts' work day in such a mission shows that it is too long and that is why it is necessary to find a way to reduce the flight duration of Soyuz-TMA before docking. In traditional rendezvous profile the calculation of burns begins only after determination of the actual insertion orbit. The paper describes an approach when prior to the flight we calculate the burns based on the nominal insertion pre-flight data and fire them as soon as the spacecraft reaches the insertion orbit. Compared to the four-orbit profile this approach decreases the duration of the rendezvous by one orbit. Fuel consumption for the nominal and emergency cases is defined by statistical simulation of the proposed short rendezvous mission. Possible contingencies pertinent to this profile are described. The first test of the short rendezvous profile is planned for the Progress cargo vehicle flight to the ISS in 2012.