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FAST RENDEZVOUS PROFILES' EVOLUTION: FROM THE ISS TO THE LUNAR STATION

Abstract

Recently “fast” rendezvous profiles trend is observed in manned spaceflight domain. Since 2012 docking of 25 Russian vehicles (15 of them were Soyuz crewed vehicles) have been accomplished using 6-hour and 4-orbit rendezvous profile. Successful practicing of this approach made a two-orbit rendezvous possible to be prepared and accomplished for the Progress vehicle in 2018 and this will make Soyuz faster rendezvous possible in 2020. The fast rendezvous profile will bring the crew vehicle to docking point in just 3 hours after the insertion into orbit. Furthermore in future an ultrafast (one-orbit) rendezvous profile is considered as well. Crew comfort on their way to the ISS is just a small piece of advantages of the fast rendezvous profile which will make two-launch scenario possible to use for missions to a Lunar station (LS). Since two-launch scenario considers separate launches of the crew vehicle and the booster, this allows arranging an effective traffic towards the Moon using launchers (LVs) of lower capacity. Launches at different times will allow the crew vehicle to wait for a successful launch of the booster while being docked to the orbital station (OS), and that will give much higher reliability of the two-launch scenario. In future two-launch scenarios which include visiting an orbital station could be applied for reusable spacecraft transit from the OS to the LS and back. Fast rendezvous is especially favorable for two-launch scenarios because of the booster limited lifetime if fueled with low-boiling propellant components. The paper reviews evolution of the fast rendezvous profiles which were initially used in the ISS program for further utilization of this experience for development of rendezvous concepts in two-launch scenarios for missions to a Lunar station.