

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

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STUDY ON FAULT SCHEMES DURING THE PROCESS OF SWITCHING TO AUTONOMOUS
CONTROL IN RENDEZVOUS AND DOCKING

Abstract

Spacecraft rendezvous and docking flight is divided into remote guiding phase and autonomous control phase. After remote guiding phase ends, chaser is normally moving with a speed below target. Switching from remote guiding phase to autonomous control phase is critical and complicated. Normally, when it is within relative distance, chaser will build stable relative navigation, on-board computer will calculate orbital transfer parameters, control engine will maneuver at planned starting point of autonomous control, then chaser is guided to the holding point which is behind target. If it cannot switch to autonomous control as planned, chaser will continue moving forward freely and arrive in front of target. As a result, the following flight scheme has to be changed and additional time and fuel have to be used. There are three schemes in cope with the faults during the process of switching to autonomous control. Scheme I: chaser continues moving forward freely until it moves one more circle and comes back to the orbit before switching to autonomous control. This is normally not applied since it takes too much time. Scheme II: chaser lifts up and phases. Chaser comes back to the orbit before switching to autonomous control when the phase meets the requirement. This scheme can meet the requirement, but chaser will be maneuvered several times and the fuel will be consumed. The flight plan will also be delayed. This paper emphasizes on Scheme III. When chaser cannot switch to autonomous control, it will be maneuvered twice so that it is guided behind target and they are at the same orbit attitude. They can keep the relative distance since they are in the same orbit. The fault of autonomous measurement and control can be fixed during this process. Then chaser will switch to autonomous control again. This scheme barely affects the follow-up plan, but some risks have to be taken. The scheme has to be designed as follows: a. Choose the timing of maneuver. Chaser should not be maneuvered too late, or chaser will move to the front of target and fail to transfer to the orbit behind target. b. Maneuver twice under some accuracy requirements. The error after maneuver has to meet safety requirements. Chaser should not enter clearance area of target. c. Security measures. If another fault occurs during the process, security measures must be activated to evacuate chaser so that the collision is avoided.