

SPACE OPERATIONS SYMPOSIUM (B6)
Human Spaceflight Operations Concepts (1)

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SPACE STATION OVERALL MISSION PLANNING: PLANNING MODEL, SIMULATION
FRAMEWORK AND PRELIMINARY RESULTS**Abstract**

Space station overall mission planning is essential to improve the utilization capability, to minimize life-cycle operations costs, and to ensure that the space station program is available and affordable. The Space Station overall mission planning is a complex problem firstly because it involves tasks such as on-orbit experiments and utilization arrangements, crew rotation and manned vehicle visiting schemes, logistics and maintenance supply lists and cargo vehicle visiting strategy, and space station flying orbit plan. Second, the elements and processes during a space station operation scenario are also complicated. The spacecraft could be launch vehicle, cargo vehicle, manned vehicle or space station cabin. The supply resources could be propellant, spares, crew daily consumables and science equipments, and the possible flight process could be one segment of launch, orbital maneuver, rendezvous and docking, and align flying of space station and visiting vehicles. A lot of studies have been done on space station mission planning. However, few of them focused on overall mission planning. This study proposes a proper model and an effective operation scenario simulation framework for space station overall mission planning. Subsequently the planning model and the simulation framework will be applied to plan, validate and evaluate the space station operation scenario. The present study consists of four main parts as follows: Firstly, based on the China space station project, the space station overall mission planning problem is described in a decomposition approach, and the planning model is formulated. Secondly, considering the complex operation scenario, the object-oriented method is adopted to design the operation scenario simulation object model, and the various objects are generalized into two aspects: operation elements and operation processes. Thirdly, the operation scenario simulation framework is built based on the discrete events simulation model, which is suitable for top-level planning problems. The performance indexes regarding feasibility and effectiveness for evaluating the operation scenario are proposed. Finally, in order to demonstrate and validate the proposed planning model and simulation framework, the preliminary results of overall mission planning for a five-year space station operation scenario are presented, which include propellant consumption, number of visiting vehicles, and days of crew on board.