492074 S29-54 ABS ONLY

CATEGORY 4 - OPERATIONS

146697 N93-21436

Operator-Assisted Planning and Execution of Proximity Operations Subject to Operational Constraints

by Arthur J. Grunwald and Stephen R. Ellis, Ames

P. 1

Future multi-vehicle operations will involve multiple scenarios that will require a planning tool for the rapid, interactive creation of fuel-efficient trajectories. The planning process must deal with higher-order, non-linear processes involving dynamics that are often counter-intuitive. The optimization of resulting trajectories can be difficult to envision. An interactive proximity operations planning system is being developed to provide the operator with easily interpreted visual feedback of trajectories and constraints. This system is hosted on an IRIS 4D graphics platform and utilizes the Clohessy-Wiltshire equations. An inverse dynamics algorithm is used to remove non-linearities while the trajectory maneuvers are decoupled and separated in a geometric spreadsheet. The operator has direct control of the position and time of trajectory waypoints to achieve the desired end conditions. Graphics provide the operator with visualization of satisfying operational constraints such as structural clearance, plume impingement, approach velocity limits, and arrival or departure corridors. Primer vector theory is combined with graphical presentation to improve operator understanding of suggested automated system solutions and to allow the operator to review, edit, or provide corrective action to the trajectory plan.

S30-18 ABS ONLY

Collision Avoidance for CTV: Requirements and Capabilities

by Thomas Nosek,TRW
Presented by Ken Rourke, TRW

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Collision avoidance must be ensured during CTV operations near the space station. The design of the Collision Avoidance Maneuver (CAM) will involve analysis of CTV failure modes during rendezvous and proximity operations as well as analysis of possible problems external to the CTV, but that would require CTV to execute a CAM. In considering the requirements and design of the CAM for the CTV, the CAM design for the Orbital Maneuvering Vehicle (OMV) is a useful reference point from which some lessons can be learned and many CTV design options can be set forth

One design choice, the degree of integration of the CAM with the CTV's primary avionics, will greatly impact the CTV's CAM options. Also, staged CAM options at successive hold distances and times provide options for fault recovery without prematurely terminating the mission.

Questions and issues: Is a dissimilar backup computer required (in spacecraft)? Some people would like to remove the fifth "watchdog" computer unless or until it is shown to be necessary by some requirement or calculation.

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MMU Applications for Automated Rendezvous and Capture

by Ed Whitsett, NASA, JSC

146699

P. 3

The Manned Maneuvering Unit (MMU) is a proven free flying platform that can operate in a piloted or unpiloted mode. The MMU is a possible candidate for an on orbit AR&C demonstration. A pilot can transition the system between manual and automated modes, then monitor the automated system for safety.