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Relative Navigation Requirements for Automatic Rendezvous and Capture Systems

by

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ABSTRACT

This paper will discuss in detail the relative navigation system requirements and sensor trade-offs for Automatic Rendezvous and Capture.

Rendezvous navigation filter development will be discussed in the context of navigation performance requirements for a "Phase One" AR&C system capability. Navigation system architectures and the resulting relative navigation performance for both cooperative and uncooperative target vehicles will be assessed. Relative navigation performance using rendezvous radar, star tracker, radiometric, laser and GPS navigation sensors during appropriate phases of the trajectory will be presented. The effect of relative navigation performance on the Integrated AR&C system performance will be addressed. Linear covariance and deterministic simulation results will be used.

Evaluation of relative navigation and IGN&C system performance for several representative relative approach profiles will be presented in order to demonstrate the full range of system capabilities.

The material in this paper is the result of Draper Laboratory involvement with NASA Johnson Space Center in the development of flight proven IGN&C rendezvous systems for Apollo, Skylab and Shuttle. The performance data has been obtained from linear covariance and deterministic analysis simulations. These simulations have also been used to support flight techniques development, definition of performance bounds for flight rules, system performance capability assessment, and to provide signature data for flight software verification.

A summary of the sensor requirements and recommendations for AR&C system capabilities for several programs requiring AR&C will be presented.

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