

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Upper Stages, Space Transfer, Entry and Landing Systems (3)

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ORIGIN AND EVOLUTION OF ORION SERVICE MODULE PROPULSION FROM ESAS TO  
INITIATION OF PRELIMINARY DESIGN

**Abstract**

The Orion Crew Exploration Vehicle will serve as the next generation human space transportation for the United States. The design evolution of the Orion vehicle has been significant since the inception of the Exploration System Architecture Study (ESAS) through establishment of a point of departure to initiate preliminary design. Several design cycles and iterations were conducted within NASA, through NASA sponsored Phase I studies, and under the Orion prime contract. The evolution of the Service Module Propulsion System has been an integral part of the Orion design evolution. Major refinements include changes in propellant, system configuration and system operational characteristics to result in propulsion that will meet the demanding requirements of long- term lunar exploration and near term for travel to the International Space Station.

The results of the trade studies and design synthesis activities will be conveyed along with a system description and rationale for the major design choices leading to the point of departure configuration. Driving design requirements will be discussed and options for meeting the requirements that were assessed will be stated. Several factors integral to NASA objectives are documented including the influence of risk, cost, operations, development, test and verification. The overall purpose is to provide a ready reference and compendium of the most influential steps in the early definition and design of this challenging propulsion system.