

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

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## DESIGN PHILOSOPHY FOR OTV OPERATING ON CRYOGENIC PROPELLANT COMPONENTS

**Abstract**

The paper summarizes a design philosophy established in designing hydrocarbon and hydrogen orbit-to-orbit transportation vehicles (OTV), procedural concept defining OTV shape. The OTV design specifics are to use cryogenic propellant components (O<sub>2</sub>+H<sub>2</sub>, O<sub>2</sub>+RP-1) and select the injection scenario, i.e. one-launch or two-launch scenario with docking in a low-earth orbit, use a gravity-assist maneuver near the Moon. Both the first and second specific features place definite requirements on the OTV shape, their operation in space environment, and particularly impose operational constraints. This design philosophy forms the basis for developing OTV under the Moon and circumlunar space exploration program, including Lagrangian points in the Earth-Moon system L1 and L2. The development of hydrocarbon and hydrogen OTV is carried out by using great groundwork laid under the Sea Launch and Energia-Buran programs.