

SPACE SYSTEMS SYMPOSIUM (D1)  
Space Systems Architectures (2)

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A NEW ERA FOR REUSABLE SPACE SYSTEMS

**Abstract**

Beginning back in the 1970's NASA put considerable effort into developing reusable space access systems. The partially reusable Space Shuttle, which first flew in 1981 and was decommissioned in 2011, represented the clear apogee of these efforts even though a number of programs to advanced beyond Space Shuttle capabilities were attempted. These include the very ambitious fully reusable, single stage to orbit National Aerospace Plane (NASP) in the early 1990's which never progressed beyond subsystem development, and the Reusable Launch Vehicle (RLV) program which produced the single stage to orbit X-33 Venture Star vehicle which was canceled in 2000 when significant difficulties arose during full-scale development. One vehicle that came out of the RLV program did succeed and is now operational for the US Air Force, the X-37 reusable spacecraft. However since the decommissioning of the Space Shuttle, NASA has switched its focus to large, expendable space transportation systems with the Space Launch System (SLS) and the expendable Orion capsule being the principle space transportation development programs for the agency.

With NASA turning its attention to expendable space transportation systems, the commercial space industry has now taken the lead in developing a variety of reusable space transportation systems and elements. These include the SpaceX Falcon-9 launch vehicle with its recoverable first stage and its reusable Dragon capsule, the reusable New Shepard sub-orbital rocket being developed by Blue Origin and their proposed New Glenn orbital launch system, the reusable ACES upper stage being pursued by United Launch Alliance and their proposed Vulcan launch system, and reusable space habitats being developed by Bigelow Aerospace.

This paper will explore the current status and future impact of these new reusable space systems being developed by the commercial space industry, as well as their potential effect on the future of space exploration and development.