Innovative Reusable Horizontal Takeoff/Horizontal Landing (HTHL), Two-Stage-To-Orbit (TSTO) Spaceplane

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Abstract

Suborbital to LEO space launch vehicles aren't meeting the cost, reliability and responsiveness of GSTD (Global Space Transportation and Delivery) needs which is causing capability gaps both commercially and nationally. The Exodus Space Corporation is developing the AstroClipper, a family of innovative Horizontal Takeoff/Horizontal Landing (HTHL) Two-Stage-To-Orbit (TSTO) fully reusable spaceplanes with the potential to provide the next-generation level of robust and cost-effective launch and landing service capabilities. This effort could well represent a generational leap forward in responsive, reliable, and economical access from sub-orbital to Low Earth Orbit (LEO), well beyond the latest innovations coming out of the commercial launch vehicle sector today.

Patented Design

This innovative launch system concept is the result of several years of evolving conceptual design. All Exodus spaceplanes will employ a unique and patented (US patent #8528853 B2) horizontal-in-line two-stage configuration that integrates booster and orbiter stages into a single aerodynamically-optimized blended wing body, taking maximum advantage of aerodynamic lift and of atmospheric oxygen to efficiently reach orbit. The lifting body shape enables a high lift-to-drag ratio, high fuel capacity, and reduced weight structures, while enabling horizontal take-off operations from a wide variety of spaceports and airports around the world. The orbiter effectively functions as a nose cone to the larger booster stage minimizing frontal area drag. The booster's airbreathing engines reduce onboard oxidizer mass, significantly reducing Gross Take-Off Weight while helping provide a first stage high altitude, supersonic transition from jet propulsion to rocket propulsion

Proven Technologies

These vehicles will take advantage of current and emerging technologies including additive manufacturing methods, non-cryogenic rocket engines, state-of-the art fuel efficient jet engines, and data-driven artificial intelligence (AI) platform systems. No exotic, unproven technologies, such as combined cycle engines, lie in its critical path. The spaceplane will launch and land horizontally from commercial and military space/airports around the world. The versatility of the system will offer an unprecedented range of mission capability operating from any suitable runway able to handle large aircraft. The geographic flexibility of possible launch sites will promote efficient access to the widest variety of orbital inclinations ranging from polar to equatorial while reducing ground support associated with vertical launch systems and not constraining launch operations to only locations with complex and fixed launch pads and towers.

Conclusions

The AstroClipper can be configured to support diverse missions of interest to both military and commercial users from sub-orbital to LEO. Mission types within its scope include point to point transportation, mass satellite deployment and retrieval, on-orbit satellite servicing, space debris collection, space-based R&D, crew and cargo transport, space tourism, hypersonic R&D, and other emerging markets.

Figure Insert: Exodus AstroClipper Design Concept. Enabling the Next Order of Magnitude Reduction in Launch Costs