

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems (4)

Author: Dr. Martin Sippel

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, Martin.Sippel@dlr.de

Mr. Jascha Wilken

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Institute of Space Systems, Germany,
jascha.wilken@dlr.de

Mr. Steffen Callsen

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Institute of Space Systems, Germany,
Steffen.Callsen@gmail.com

Mr. Leonid Bussler

DLR (German Aerospace Center), Germany, Leonid.Bussler@dlr.de

TOWARDS THE NEXT STEP: SPACELINER 8 PRE-DEFINITION

Abstract

The SpaceLiner fully reusable launcher and ultra-high-speed rocket-propelled passenger transport is in conceptual design phase. The key premise behind the original concept inception is that the SpaceLiner ultimately has the potential to enable sustainable low-cost space transportation to orbit while at the same time revolutionizing ultra-long-distance travel between different points on Earth. The number of rocket-launches per year should be strongly raised and hence manufacturing and operating cost of launcher hardware should dramatically shrink [1].

DLR's SpaceLiner concept is similar in certain aspects to the idea of multiple-mission reusable launch vehicles which are to serve quite diverse missions by similar vehicles. Another typical example in this category is the SpaceX StarshipSuperHeavy [1, 2, 3]. Many parallels can be identified between these concepts but also significant differences in architecture and mission profile [2]. The systematic comparison with Starship but also with European proposals like SUSIE is fruitful in further refinement of the SpaceLiner.

The ongoing concept evolution is addressing system aspects of the next configuration release 8. The space transportation role of the SpaceLiner concept as a TSTO-launcher is further refined and suitable precursor steps with reusable booster but expendable upper stages have been investigated [3]. The winged, reusable upper stage, almost untouched since 2016 [1] is moving now in the focus of promising redesign options described in this paper.

The SpaceLiner cabin integration is an important aspect to be addressed as well as the feasibility of performing multiple missions compliant with noise and sonic-boom constraints. The systematic assessment of different critical separation cases revealed that the aerodynamic unstable design of the capsule (SLC) is not acceptable [3] and needs to be redesigned for SpaceLiner 8. Further, the nose section of a future SLC should include part of the separation motors and thus help improving stability of the emergency-case separation maneuvers.

[1] Sippel, M., Trivailo, O., Bussler, L., Lipp, S., Kaltenhäuser, S.; Molina, R.: Evolution of the SpaceLiner towards a Reusable TSTO-Launcher, IAC-16-D2.4.03, September 2016

[2] Callsen, S.; Wilken, J.; Stappert, S.; Sippel, M: Feasible options for point-to-point passenger transport with rocket propelled reusable launch vehicles, IAC-22-D2.4.7, 73rd International Astronautical Congress (IAC), Paris, September 2022

[3] Sippel, M., Stappert, S., Bayrak, Y.M.; Bussler, L., Callsen, S.: Systematic Assessment of SpaceLiner Passenger Cabin Emergency Separation Using Multi-Body Simulations, 2nd HiSST-conference,

