

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems Verification and In-Flight Experimentation (6)

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SMALL AUTONOMOUS WINGED AEROSHAPE TRADE-OFF THROUGH MISSION AND SYSTEM
GUIDELINES

Abstract

Considering the recent successful flights of the European VEGA launcher and the approaching of IXV re-entry flight, it appears to be the right time to set up the foundations for achieving the target, in a longer timeframe, of a fully reusable spaceplane. Standing on the shoulders of VEGA as launcher and IXV as technology needs, a small scale autonomous winged vehicle with maneuvering and conventional runway landing capabilities is currently under investigation as a step forward in hypersonic and re-entry systems. As far as every feasibility study is concerned, the winged aeroshape shall be defined through a trade-off analysis involving different vehicle architectures able to perform the whole re-entry flight. The present paper reports on this design effort taking into account not only the aerodynamic performances of the vehicle but also system and sub-systems constraints, such as structure, mechanisms, thermal protection system and etc., with main focus being on mass saving and complexity reduction. To this end several low order methods and more detailed numerical analysis are considered in the design phase and discussed in the paper. In order to satisfy system requirements, the aeroshapes' aerodynamic performances have been compared in the three different flight regimes (hypersonic, transonic and subsonic at landing conditions) to assess the most promising one, thus helping system design authorities find the most promising vehicle architecture. Also trim, stability and control capabilities have been taken into account and discussed. In conclusion, mechanical, thermal and system configurations have been analyzed and a final baseline is proposed.