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SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Small Launchers: Concepts and Operations (7)

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L3AR – A NEW AIR LAUNCH CONCEPT USING A DEDICATED AUTOMATIC CARRIER

Abstract

Since 2005, CNES and ONERA have been studying innovative solutions for the air launch of a small launcher capable of delivering a small payload (10-150 kg) into Low Earth Orbit. This paper is focused on the latest air launch concept derived from these studies, called L3AR (French acronym for "Air Launch using a Reusable Automated Carrier"). L3AR is currently the reference air-launch concept in the CNES-led PERSEUS project, which is a dedicated to nanolauncher technologies and innovation, with participation of university and engineering schools. The unique feature of L3AR as an air launch concept is to be an alternate solution to both classical approaches using a piloted aircraft (leading to cost and potential security issues) and more ambitious approaches using an Unmanned Vehicle System (UVS), which are unnecessarily complex for the sole air launch mission. Unlike previous CNES/ONERA air launch concepts using a Unmanned Vehicle Systems (e.g. DEDALUS family concepts), L3AR relies on a carrier which is designed as simply as possible for the air launch mission, with operations procedures similar to classical ground-based launch systems, thus avoiding all the complexity and regulations issues of Unmanned Vehicle Systems. In the first section of the paper, we review past CNES/ONERA air launch activities performed in the frame of the PERSEUS project and highlight the lessons learned, which have led eventually to the current L3AR concept. We also show the originality of the L3AR concept through a bibliographical review of recent air launch work. In the second part of the paper, we present the results of recent works focused on a variant called L3AR-Bellerophon, which has been designed with the objective to get an interesting compromise between the complexity of the carrier and the complexity of the launcher. The Bellerophon launcher, first studied by GAREF, is an innovative launcher architecture whose aerodynamic characteristics allow a moderate pull-up maneuver after release, thus relieving the flight path angle requirements for the carrier. Finally, we present the current status of the L3AR project and associated activities in the frame of the PERSEUS project.