

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

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ALTAIR SEMI-REUSABLE AIR-LAUNCH SYSTEM – LESSONS LEARNED FROM SYSTEM DESIGN
AND FLIGHT EXPERIMENTS**Abstract**

This paper presents the final design results of the H2020 ALTAIR project, focused on a cost-effective launch system for small satellites up to 150 kg in SSO, including the lessons learned from the flight experiment campaign using the small scale demonstrator EOLE. The 4-year H2020 ALTAIR project, performed by a Consortium of 8 Partners from 6 countries and Coordinated by ONERA, aims at demonstrating the economic and technical viability of an innovative air launch system in order to pave the way for a future available, reliable and competitive European launch service for the access to space of small satellites. The ALTAIR concept (acronym for Air Launch space Transportation using an Automated aircraft and an Innovative Rocket) revolves arounds an innovative launch vehicle and an innovative ground segment, all of them designed towards the objective of cost-effectiveness. The vehicle part can be described as a semi-reusable air-launch system made of a reusable automated carrier designed specifically for the launch mission and an expendable launcher using hybrid propulsion for the two main stages and monopropellant H2O2 liquid propulsion for the upper stages. The first part of this paper presents the consolidated design of the ALTAIR system (carrier, launcher and ground segment), obtained during the 3-year design process made of 3 subsequent design loops, with a particular focus on the lessons learned. The second part of the paper is devoted to the flight experiment program, which is the main focus of the 4th and last year of the ALTAIR project, and which should be completed by the time of the paper submission. Their goal is to validate in representative flight conditions key technologies developed in the project, including the

launcher avionics and the release system and procedure. ALTAIR flight experiments are performed using the existing small scale EOLE demonstrator (developed under ONERA's project management for the CNES PERSEUS project), equipped with a small-scale version of the release system and carrying an inert rocket mock-up with avionics and sensors. The ALTAIR flight experiment program, starting with captive flights (with the rocket mock-up attached) performed on the French St. Yan airfield, culminates with a flight test that is fully representative of the ALTAIR reusable carrier's mission, including the release of the rocket mock-up, performed at the Guyana Space Center (CSG) in French Guyana.