IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Upper Stages, Space Transfer, Entry & Landing Systems (3)

Author: Mr. Jorge Cardín Vigal
SENER Aeroespacial, Spain

DEVELOPMENT AND EXECUTION OF A SCALED DOWN FLIGHT TEST CAMPAIGN FOR THE SPACERIDER PROGRAMME

Abstract

The Space Rider (SR) programme aims to provide Europe with a reusable system that enables routine access to low Earth orbit. The Re-entry Module (RM) consists of a lifting body that, starting from orbital coasting, performs a controlled hypersonic re-entry, transonic flight and a final precision approach and landing under parafoil. The SR RM is developed by Thales Alenia Space Italy for the European Space Agency. Sener Aerospace is the design authority for the RM Guidance, Navigation and Control (GNC) algorithms and developer of the Parafoil GNC (PGNC). The RM GNC module is currently in the middle of the formal verification process. To support such activities, a series of flight tests are planned to characterize the real dynamics of the system and test the PGNC algorithms. The flights are split in three campaigns with increased representativity of the final system: a Scaled-Down Flight Campaign (SDFT) using a modified 150-250kg paramotor; a full-scale Drop Test (DT) campaign with a mock-up system that reproduce the real mass of the system; and a final System Drop Test (SysDT) that will use the complete flight model. The execution of the SDFT campaign serves as a de-risking activity for the full-scale systems allowing to perform several flights and tests at a fraction of the cost and time. The main goals of the SDFT are: evaluate the dynamics of the parafoil-payload system and identify any potential unmodeled behaviour, assess the PGNC in-flight performance and landing accuracy, and test the robustness of the system against external perturbations. The scaled flights will also help maturing the tools and procedures developed to characterize the full-scale vehicle response and update the mathematical models used in the formal model in the loop verification campaign. The SDFT vehicle, internally referred to as Starling, is a COTS paramotor adapted to reproduce the dynamics of the full-scale system. The vehicle will take-off from ground, perform a remotely controlled ascent and perform several tests during the descent phase both in manual or autonomous configurations. This paper presents the development, characterization, and performance of the SDFT system together with the test campaign definition and main findings.