PROTECTION OF THE GROUND/BOARD INTERFACES FOR THE THEMIS DEMONSTRATOR AND ITS DERIVED LAUNCHER

Lorenza Trilles[1], Michal Kurela[2], Henry Kong[3], Jérôme Vila[4]

[1]*ESTACA Student, ArianeWorks Intern, CNES, Paris, France*
[2]*Directorate of Space Transportation, CNES, Paris, France*
[3]*Directorate of Space Transportation, CNES, Paris, France*
[4]*MaiaSpace, Paris, France*
lorenza.trilles@estaca.eu, https://www.estaca.fr/

Abstract: ArianeWorks was born from the joint efforts of both ArianeGroup and CNES to create an innovation platform pushing forward rocket reusability in Europe. ArianeWorks is mainly working on a project named Themis: a reusable 1st stage launcher demonstrator fueled with liquid oxygen and methane, that shall explore a flight domain representative of a notional future rocket stage. After three years accelerating Themis, ArianeWorks completed its mission mid of 2022. However, Themis' legacy sparked a new project envy for the engineers who worked on this demonstrator. They evaluated the concept of a two-stage launcher using Themis as its reusable first stage.

The first stage is not the only reusable element of the launch: the launch pad and every system needed to support launch operation must be reusable as well. Among those systems are the launch table and the ground/board interfaces for both the first and second stage. These include umbilicals and their connectors, which need to perform "last minute disconnection" at lift-off before withstanding the thermal and acoustic environment created by the launcher's engine. The umbilicals are cables and/or hoses that supply required consumables to the launcher. An umbilical can supply for example cryogenic liquids, fluids, data or electrical power.

One of the main criteria to design the mechanical protection system that ArianeWorks prioritized was the non-use of any commands after ignition, favoring passive systems to limit design complexity and turn-around operations in between launches.

Also, a criteria for the second stage is that all connections should be done at ground level. As the umbilical connection is a complex operation, the umbilical connections done at ground level are more reliable than those done on an aerial work platform. This reliability can avoid some cases of aborted launches.

This paper will address early concept work performed on these subsystems for a hypothetical application on a two-stage rocket.