

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Future Space Transportation Systems (4)

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ARIANE CLASS SYSTEM VEHICLE STUDIES LEADING TO PROPULSION AND REUSABILITY  
DEMONSTRATIONS

**Abstract**

Ariane 6 first production batch is about to be ordered, and the launcher will be the next European work-horse for the 2020 decade in particular on the commercial market, allowing to divide by a factor of 2 the launch cost with respect to Ariane 5 current launcher. Nevertheless, the fast evolving Space landscape (emerging needs, renewed competition) leads rocket industry to be more and more cost effective, flexible and responsive. Consequently, Ariane mid and long term future is being actively prepared already from now on, by identifying and maturing relevant technologies.

At least 2 technologies are pre-identified as being promising, that are low cost LOX-Hydrocarbon propulsion, and first stage reusability, for which dedicated technology demonstrations are decided or initiated (including the so-called “Prométhée” engine). In order to derive those technology maturation needs and requirements, launch system architecture studies are being performed at CNES Launcher Directorate, on various concepts of notional target vehicles.

These studies are based on preliminary objectives for a future launch system, that are mainly driven by further launch cost cut, together with improved launch service flexibility. Future market scenarios, as well as launcher design guidelines inherited from experience and past studies, are considered.

For what concern LOX-Hydrocarbon propulsion, LOX-Methane propulsion is compared to LOX-Kerosene to select the most appropriate liquid propulsion candidate, to be considered with the LOX-LH2 reference of the current Ariane fleet.

In the area of reusability, an exploitation scheme is being worked out in line with the European particular market context, allowing to avoid some of the drawbacks of reusability in low volume economy, i.e. production rate collapse effect against reusability savings. Also several concepts of recovering the lower stage (or part of it) are considered and studied.

Then several notional launcher concepts are elaborated in relation to a set of propulsion candidates, evaluated in term of performance, exploitation strategy, production rate of the different stages/engines and finally the launch costs elements. In order to consolidate some of the concepts, dedicated technical points are addressed such as the launch pad, the safety constraint of the trajectory, the re-entry phase.

The results of these system vehicle studies are a set of technical and economical requirements for the technology demonstrations in the area of propulsion and reusability.

This study is performed in the frame of CNES Future Projects Program.