

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Launch Services, Missions, Operations, and Facilities (2)

Author: Mr. Jean Oswald
Centre National d'Etudes Spatiales (CNES), France

Mrs. Kanthéa Kheng
Centre National d'Etudes Spatiales (CNES), France

Mr. PINEAU LEONARD
CNES, France

Mr. JEAN-MARC BAHU
CNES, France

ECONOMIC ANALYSIS OF A SEMI REUSABLE LAUNCHER FOR EUROPE.

Abstract

Europe will soon realize the maiden flight of Ariane 6 which will replace the Ariane 5 historic battle horse. Great improvements have been performed to reduce the launch cost of Ariane 6 especially thanks to simplifications of the industrial organization and enhancement of production tools. Nevertheless, additional launch cost reduction has to be targeted. In the frame of the development of the next generation of Ariane launchers, the conditions for which semi reusable concept of a future launcher has an economical interest are investigated.

Two main system drivers have to be considered:

-The mastering of the recovery of the launcher parts which are going up to orbit is really disruptive and only the recovery of non orbital part of a launcher is considered.

-The Vertical Take Off Vertical Landing system (VTVL) is the concept which seems the most promising up to now compare to other reusability strategies.

In that case, semi-reusability consists of launches mixing newly produced stages and recovered and refurbished stages for both expandable and "recovered" missions. An economical modeling of the recurrent cost of a future semi reusable launcher has been developed with a set of hypothesis which will be presented. It is mainly based on two stages launcher with a first stage which can be reused. The fix and variable costs are defined at a macroscopic level for the different parts of the launch vehicle production and life cycle of the rocket depending on whether a recovery when it is successful followed by a refurbishment is undertaken or not. The different steps which are identified are: production, operation, recovery, refurbishment and storage. The satellites market is an input and its fluctuations are taken into account. The limits and resulting criteria of this model will be highlighted by testing the various identified parameters and comparing the resulting launch cost to a reference launch cost deduced from the same launcher but only produce for an expandable use.

Finally, the benefit of having a launch strategy which involves semi reusability will be addressed. In addition several developments in Europe such as the low cost throttleable reusable Prométhée Liquid Oxygen and Methane engine, the key reusable technologies demonstrator Callisto and the reusable first stage demonstrator Themis develop in the frame of the Ariane Works initiative are underway. The

relevance of the semi reusability strategy with these maturing activities Prométhéus, Callisto and Themis will be presented.