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THE FUTURE OF FULLY REUSABLE SPACE LAUNCHERS IN EUROPE

Abstract

In the recent years an exponential improvement of reusable space launchers has been witnessed and promoted by several companies and institutions. These new and rapid developments are leading the humanity to a new era where Moon and Mars will start not only to be explored but also colonised, with missions like ARTEMIS, Chang'e, Slim or Chandrayaan. Moreover, some private companies are offering space trips and it is said that intercontinental future trips will experiment a significant trip reduction thanks to reusable space launchers.

Immersed in this new technological paradigm is where the topic of this paper gathers strength. Several current challenges in terms of system and mission level will not only be discussed, but also potentially solved by the proposition of multidisciplinary solutions based on building blocks, which is a method based on applying either existing technologies or modifications on them to face the problems that fully reusable space launchers will lead to. These challenges have been addressed by ESA as a part of their initiative REVOLUTE, which aims to success on obtaining a fully reusable launch vehicle.

Sener is leading one of the consortiums that is analysing and defining the future family of European reusable launchers, addressing the following main technological challenges:

- Ground segment facilities and operations.
- Launch vehicle structural indexes.
- Proposal of a fully reusable upper stage.
- Exploring the implementation of aerospike engines.
- Landing strategies, sub-systems, and support equipment.
- Implementing an Autonomous Flight Termination Unit.
- Assessing CONOPS and missions.
- Cost and schedules analyses to guarantee the benefit.

All these efforts aim to provide a functional conceptual solution aligned with the following user requirements:

- Preliminary definition of an optimised European family of reusable launch vehicles that covers Vega and Ariane markets.
- Provide interface and performance specifications based on common building blocks. Giving more importance to the reusable building blocks and their need of further developments.
- Conclude with a preliminary design and development roadmap stressing the risks, defining the technological maturation, and identifying the common building blocks still under definition.
- Propose a new operating model, based on efficient institutional-industrial relationships for cost-efficient and shorter contract obtentions and flight operations.

In conclusion, this paper main purpose is to satisfy all these demanding and technologically challenging topics through the presentation of space launcher systems conceptual solutions and enabling ESA as a worldwide competitive agency with the potential to execute complex and resource demanding missions with efficiency, high pace and at low cost.