

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems Technologies (5)

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TECHNOLOGICAL DEMONSTRATOR FOR REUSABLE LAUNCHERS

Abstract

Reusable launchers have been studied under CNES contracts for more than 30 years, with early concepts such as STS-2000 or Oriflamme, more recently with very significant efforts devoted to Liquid Fly Back Boosters as with the Barguzin project led with Tsniimash, TSTO with the Everest concept studied by the French industry or the RFS Reusable First Stage concept of a large first stage associated to a cryotechnic second stage. These studies, summarized in the first part of the paper, have enabled CNES to identify clearly the technological requirements associated to reusability, as well as cost efficiency through detailed Non Recurring Costs and Mission Costs.

In parallel, CNES has set in place a development logic for sub-systems and equipment based on Demonstrators, hardware test benches enabling maturation of technologies up to a TRL such that a real development can be decided with limited risks. This philosophy has been applied so far on a large number of cases, such as TPTech and TPX for Hydrogen turbo pump, GGPX as demonstrator of innovative Gas Generator, HX demonstrator of modern cryotechnic upper stage with a dozen of different objectives (Thermal Protection, 20K Helium storage, measurements...).

This virtuous approach, "learn as you test", is currently applied in the phased approach towards a small reusable stage acting both as technology enabler and first stage of a micro launch vehicle aiming at launching payloads in the range of 250 kg to LEO or 120 kg to high SSO. The selected technologies are such that they open the road for further larger developments such as reusable boosters for an evolution of Ariane 6, or main reusable stage for a further generation of heavy launcher dubbed Ariane 7.

The paper describes the logic behind this project, together with the demonstration objectives set for the various sub-systems as well as operations. The corresponding trade-off is presented, dealing with the numerous possible configurations, leading to the preferred configuration for which the main technical features are presented. The maturation plan and definition of the sub-systems demonstrators are presented, with the description of the first phases of the project.