Paper ID: 33443
oral
student

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

Author: Mr. Bertrand Bocquet
ESTACA, France

Ms. Justine Tenil
France
Mr. Pierre GABRIELLI
ESTACA, France
Mr. Baptiste BARRE
ESTACA, France
Mr. François ANDRUSYSZYN
ESTACA, France
Ms. Armelle Frenea-Schmidt
France
Mr. Corentin Miton
ESTACA, France
Mr. Pierre MORIN
ESTACA, France
Mr. Alexandre Saint-Alme
ESTACA, France
Mr. Bastien Burrallo
ESTACA, France
Mr. PEERIS ARNOULD
France
Mr. Valentin RAMAJO
ESTACA, France

MATRIOCHKA SPACE PROJECT D2S5

Abstract

The heavy cost of a launch is motivating industrialists to develop reusable solutions for launchers' first stages or main engine. Matriochka is a bi-stage experimental rocket created by students from the ESTACA; a leading space engineering school (France). At the ESTACA Space Odyssey (ESO), our project is challenging because Matriochka has a reusable first stage and the second stage is considered as a payload which imposes flexibility and adaptability. Payload separation is reached by propulsion sub-system which is called the "Heat Jettisoning".

Re-usability implies adaptability. First of all, the "Heat Jettisoning" enables to have a mechanical interface only constrained by the free place in the launcher. This interface is almost independent of the payload geometry. Secondly, the launcher's ailerons are movable so if the payload changes the global centre of mass, the ailerons' position can be adjusted to correct stability. Eventually electronic sub-system is totally independent in order to avoid compatibility problems between payload's and launcher's electronic.

Flight and ground safeguard is the top priority for operations and launch. We handled safety by favouring simplicity in every step. This is why "Heat Jettisoning" system was designed because it "only"

pushes the second stage. Consequently it has just one system with a mastered technology which decreased the number of potential failures. Simplicity made us practising well-known technologies with high TRL as well as a step-by-step validation. This approach was enforced by dependability and heat studies on jettisoning system.

Security rules are demanding. French experimental rockets are usually made for a single flight that is why Matriochka is a kind of pioneer. Moreover we need to protect the structure which is the most valuable part of the launcher. Therefore a parachute will slow down the launcher after the payload jettisoning. The know-how acquired from previous projects will enable us to safely recover our launcher. Besides, only a few parts are consumable items. They are designed to be low cost and easily manufactured. We aim to reach a full return to flight readiness within one month at a price lower as 10

Mastering cost- and time-efficiency for re-launch are the objectives of Matriochka! Dependability is a day-to-day challenge while innovative choices have been made in order to adapt to as many as possible payloads.