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ALTERNATIVE PYROTECHNIC COMPOSITION FOR REUSABLE PYROMECHANISMS

Abstract

Facing always more challenging objectives the Space market calls for ever lighter, cost effective, easy handling and versatile solutions. This trend is reflected in the European launcher roadmap which encompasses the development of technological bricks for future reusable launchers.

Capitalizing on the long-proven advantages of pyrotechnics (high energy density in a reduced space, unmatched reliability over time and milliseconds functioning time), Pyroalliance presents a concept of reusable pyrotechnic actuator addressing the market of future reusable launchers. Such actuator can be envisaged for various functions like deployment of landing feet, deployment of grid fins as well as for damping or separation solutions. Compared to traditional "one shot" actuators, the concept enables the reuse of the main parts of the actuator. Depending of the launcher architecture it offers an advantageous trade-off compared to electrical or pneumatic actuators which involve the use of heavy batteries, respectively sophisticated pressure distribution networks.

The R&D activities are carried out in collaboration with the French Space Agency CNES. Their objectives are:

- To demonstrate the cleanness of the combustion particles of the envisaged pyrotechnic composition so as to enable the reuse of the mechanical parts of the actuator
- To demonstrate the ability of the related pyrotechnic composition to motorize such mechanical actuator
- Based on those results, to prototype and test a reusable pyrotechnic actuator

Our solution is based on pyrotechnic composition from the automotive security industry, originally developed for airbag inflators (hence very reliable). The extremely low temperature (<1400 K) of the exhaust gas is consistent with a reuse function. The architecture is based on two independent devices: a pyrotechnic gas generator and a mechanical actuator. The actuator is fixed behind the gas generator and offers an easy refurbishment process.

The main advantages of the reusable pyrotechnic actuator are Reusability, Compact technology, Reliability, Availability, Ease of integration and Cost-efficiency.

In this paper, authors will present the detailed advantages of the concept, the status of R&D activities performed through prototyping and testing since 2021.

Keywords: Reusable, Thermal pyrotechnic composition, Pyrotechnic actuators