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GREEN PROPULSION AND NEW GENERATION SPACE LAUNCHERS: HYDROGEN PEROXIDE GROUND SYSTEMS FOR VEGA-E RACS

Abstract

Nowadays the renewed interest arising for the aerospace field is strictly blended with the increasing demand for the reduction of environmental impacts pertaining space vehicles manufacturing processes and operations.

Consequently, new generation space launchers are gradually searching suitable substitute propellants to the most adopted toxic substances, such as Hydrazine. **Hydrogen Peroxide** (H2O2) represents one of the most promising liquid propellants for these purposes, being able to generate high-temperature, non-harmful gases upon catalytic or thermal decomposition. However, despite being characterized by attractive "green" characteristics, Hydrogen Peroxide is a strong oxidizer and represents a very complex substance when taking into consideration storage, handling and operations. Indeed, even very small traces of impurities, as much as exposure to light and heat, may behave as catalysts for the decomposition process, leading to the formation of hot gases. Within the current landscape of European launchers at the **Centre Spatiale Guyanese** (CSG), **Vega-E** represents the first vehicle of medium-small size, under development by AVIO as Design Authority and ESA as Qualification Authority, planning to adopt Hydrogen Peroxide as a propellant for its **Roll and Attitude Control System** (RACS).

Therefore, a renewed ground system is in development with respect to existing Vega/Vega-C architectures dealing with Hydrazine, in order to manage Hydrogen Peroxide temporary storage and all the operations related to propellant handling and loading/unloading activities.

The preliminary architecture for Vega-E RACS **ground segment** has been designed referring to existing processes already implemented within the ZLV (Zone de Lancement Vega) combined with specific studies on H2O2 behavior during operations. Main focus was addressed on the driving force to transfer the propellant from ground to flight tanks, on emergency management systems in case of unexpected decomposition phenomena and on decontamination processes for a safe reutilization.

The preliminary architecture will undergo further consolidations according to next Vega-E project milestones scheduled during 2024.