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FROM TECHNOLOGY DEMONSTRATION TO A 5 KN SPACE PROPELLANT ENGINE FAMILY - SPE-BERTA

Abstract

Introduction: Thruster and engines operating with storable propellants have been part of ArianeGroup's product portfolio since decades. The spectrum covers the 0.5 N to 60 kN thrust range using mono-propellant as well as bi-propellant combinations to serve different applications; e.g. satellites, platforms and launcher stages. Overall expertise for these thrusters and engines is available covering engineering, manufacturing and integration up to hot-fire testing and in-flight analysis. In the past decade, activities for engines in the 5 kN class were mainly grouped around technology maturation programs with ESA's Future Launcher Preparatory Program (FLPP) occupying a central role in this context. This demonstrator program is a strong basis for two development axes currently being followed-up within ArianeGroup and its partners: the Storable Propellant Engine (SPE) for Ariane 6's future KickStage ASTRIS as well as a throttlable version dubbed SPE-T for exploration missions. Both versions are derived from findings of FLPP's demonstrator concept BERTA (Bi-Ergoler RaumTransportAntrieb) which is operated with classical hypergolic and storable propellants. In addition to these classical propellants the transition towards combinations of Alternative/Green propellants is prepared by dedicated activities. Here the use of ecologically friendly substances will significantly reduce the operational demands all along the life cycle and thus offer a price reduction potential – while profiting from continuous production and flight heritage gained by the SPE family downscaled from AESTUS. However, the unbeatable level of performance and reliability obtained by the classical storable propellants is to be considered in this discussion, as well.

Discussion: The paper will present the current status of the development and qualification phases of the two Storable Propellant Engines in development: SPE and SPE-T, both being based on BERTA technology. The discussion will start with the basic set of key requirements given by the envisaged applications. The corresponding design concepts will be presented, followed by an overview of respective development steps and results. Finally, the transition towards Alternative/Green propellants for engines of the 5 kN thrust class is described from ArianeGroup's perspective.

Conclusion: This paper covers the journey from technology maturation and demonstration towards development which will end up in a fully qualified SPE engine family of the 5 kN thrust class - ready to boost space vehicles to fulfill their missions. Additionally, an outlook into the next generation of the SPE family is given making use of Alternative/Green propellants in order to have an eco-friendly version available.