

IAF SPACE PROPULSION SYMPOSIUM (C4)
Solid and Hybrid Propulsion (1) (3)

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SYNTHESIS OF THE DEVELOPMENT OF THE P120C SRM NOZZLE FOR ARIANE 6 AND
VEGA-C AND WAY FORWARD FOR P120C+ NEEDS

Abstract

The P120C Solid Rocket Motor project was kicked-off during the Ministerial Council in November 2014. It aims at providing the next generation of European Expandable Launchers, namely Ariane 6 and Vega-C, with a new low cost generation of SRM. Since then, the activities performed lead to succeed in two steps of the P120C nozzle Ground Qualification, firstly passed mid-2019 for VEGA-C Launcher System need and secondly, a complementary qualification step beginning of 2021 for Ariane 6 need. 3 full scale SRM Static Firing Tests (SFT) namely DM, QM1 and QM2, were fired respectively mid-2018, beginning 2019 and fall-2020 in this time frame. Since this last development milestone, mass production is ongoing to face launch production manifest. The two flight models VEGA C and Ariane A62 will be launched in 2022 achieving the development phase imitated in 2015. In the first part of this paper we will synthesize an overview of the design selected by ArianeGroup for the P120C nozzle, the materials, processes and new lean production lines mandatory to cope with the first challenge of an ambitious cost objective. In order to improve the performance of the Ariane A64 Launcher, the opportunity to increase the length of the SRM P120C to allow the casting of additional propellant, up to roughly 157t has been identified as a solution improving by 10%. The decision on the development of the development and qualification of this P120C design evolution (dubbed "P120C+") is currently planned at the next ESA Council at Ministerial level scheduled in 2022. The P120C+ development would be taking advantage of the industrial organization and of the technologies, facilities and hardware developed and used in the Ariane 6 and Vega C programs, in particular through the heritage of P120C qualification and exploitation. The paper will focus on the complementary nozzle development foreseen and the associated new nozzle design to answer to motor performances requirement. Taking the opportunity of this new design and driven by recurring cost reduction, it has been decided to embark two main evolutions consisting to introduce shims manufactured with contour weaving process and to simplify the nozzle nose design. Indeed, it is proposed to modify the design with a simplification of the nozzle assembly by merging the Nose and Nose Cap parts in one single part. Currently, the nozzle nose is a specific part in Carbon-Carbon material (Sepcarb® Naxéco®-PyC). In the new design Nose Cap in 2D wound Carbon-phenolic material will be elongated next to the throat part, with a slight modification of the existing interface. Concerning shims, the objective is to move from a technology TFP/RTM (Textile Fiber Placement / Resin Transfert Molding) to a Contour Weaving Process/RTM. Contour Weaving process leads on shaped automatic weaving meanwhile TFP/RTM yet remains on more manual processes. The associated investments consists in the adaptation of the complete production tool to the new P120C+ definition. Considering the very challenging objective of achieving qualification in 2024 for delivery of the first flight units in 2025, the development activities are supposed to start already in 2022 so as to prepare in due time the motor elements for manufacturing the SRM test article (QM3) to be tested on ground. This paper will present in its second part, the way forward relative to P120C+ nozzle evolution.