IAF SPACE PROPULSION SYMPOSIUM (C4)
Propulsion System (1) (1)

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QUALIFICATION APPROACH FOR MODIFICATIONS OF LIQUID PROPULSION SYSTEMS

Abstract

The Qualification of Liquid Propulsion Systems is costly and complex, involving in particular heavy and long hardware testing. This is why it is fundamental to optimize the Qualification logic, in order to perform the just needed activities to assure that all requirements are respected. In many cases, the Propulsion system to be qualified is an evolution of an existing one, either for performance improvement, reduction of cost, reliability enhancement or for a new application on a new launcher. The purpose of the paper is to analyse, on the basis of real examples, the way to tailor the Qualification standard rules, in such cases.

A methodological approach is presented, based on a specific technical impact analysis, allowing defining the most adequate risk mitigation logic. Possibilities to reduce the testing effort are also discussed, in particular through test hardening options. Different types of modifications are considered to show the diversity of tailoring possibilities. This will be illustrated by real examples of modifications such as: 1) The adaptation of the Ariane 4 HM7 engine to propel the cryogenic upper stage of Ariane 5 2) Thrust increase of the current Vulcain 2 engine in order to improve the performances of the Ariane 5 cryogenic main stage 3) Change of classical manufacturing processes to 3D printing for cost reduction of some parts.