

# Aerospace Europe Conference 2023

## Joint 10<sup>th</sup> EUCASS – 9<sup>th</sup> CEAS Conference

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Abstract #XXX

Preferred Topics: REUSYS

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Type: Oral

Status of corresponding author: Regular

For student corresponding author: student member of one of the following:

3AF / AAAR / AIAE / AIDAA / CzAeS / DGLR / FTF / NVvL / PSAA / RAeS / SVFW / EUROAVIA

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### Title

## A liquid reusable strap-on booster system discussion for future European launch vehicles

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### Abstract

To guarantee independent access to space, to keep up with the worldwide competitive commercial market and to reduce the environmental impact of spaceflight, Europe continuously improves its launch vehicle technologies. Two major aspects on the vehicles design side with potential to contribute towards those topics are eco-friendly propellants and system reusability. Beside well-established technologies regarding liquid main and upper stages, liquid propulsion technologies for strap-on boosters have no applications in Europe since Ariane 4. This paper discusses a liquid reusable strap-on booster for a future launch-vehicle concept benchmarked against an equivalent solid strap-on booster launch vehicle system design. Therefore, a reference vehicle, equipped with solid strap-on boosters, is established to fulfill certain aspects of current European space transportation needs. Those solid boosters are subsequently replaced by a liquid LOX/LCH<sub>4</sub> reusable alternative. Both launch vehicle concepts are compared and evaluated from perspective of current R&D activities, environmental impacts and future needs. Further key aspects of the discussion are current European space transportation developments including but not limited to PROMETHEUS, European Mini-Launcher ecosystem and reusability efforts such as THEMIS, CALLISTO and RETALT. Concluding, a summary and an outlook of consecutive activities is provided.