

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Emerging Space Ventures, including Space Logistics and Space Safety for Sustainability (9-D6.2)

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COMPARISON OF THE ENVIRONMENTAL IMPACT OF PRODUCTION AND LAUNCH
EMISSIONS OF DIFFERENT COMMON LAUNCHER ARCHITECTURES

Abstract

Space travel is at a turning point in its history. In 2022, more space objects were launched into space than ever before. The announced number of satellites for constellations will require an unprecedented transport capacity. At the same time, humanity is faced with the challenge of converting its activities to sustainable operations. Against this background, the question arises as to how space activities can be carried out in an environmentally friendly manner.

This paper aims to contribute to this by examining the environmental impacts of stage production and launch emissions using typical mission scenarios. Common payload capacities are defined for target orbits in order to be able to compare the environmental impacts. Subsequently, different launcher system architectures are developed for the defined orbits. These differ in their staging as well as the propellant system used. In the next step, the subsystem masses and volumes are determined on the basis of a generic design. Using generic environmental indicators, the overall impact of production is calculated.

The environmental indicators are based on the analysis of the Ariane 6 LCA study conducted by ArianeGroup. Individual values were determined for each subsystem.

Finally, the analysis is used to evaluate and compare different propellant systems and launcher system architectures in terms of their environmental impact from production and launch. This is done based on the two functional units per ton payload and depending on one launch into the target orbit.

The work is intended to contribute to making space transport greener to shed light on the influence of propellant choice and stage architecture in terms of environmental impact.