

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Sustainable Approaches and Impact of Space Transportation Solutions on Earth + Space Environment  
and on General Safety (9-D6.2)

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UPPER-ATMOSPHERIC IMPACT INCLUSION IN LCA FOR SPACE

**Abstract**

ESA since 2011 leads the application of life cycle assessment (LCA) into space missions, from various satellite applications to launch segments. Space industry is the only one to have a direct effect in the upper-atmospheric layers, particularly space-transportation projects. However, current LCA methodologies and impact indicator are limited in emissions to water, land and troposphere. The reason behind is that the scientific and data gaps (such as metal particles behaviour and soot characterization) blocked the assessment of impact on stratospheric and mesospheric layers. ESA organised a workshop in January 2024 to gather the multi-disciplinary community involved in the topic. This paper comes from the outcome of the coordinated work and proposes an extension of LCA methodology to include upper-atmospheric impact due to space transportation's emissions during launch, atmospheric disposal and re-entry.