

SPACE SYSTEMS SYMPOSIUM (D1)
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ENVIRONMENTAL IMPACT ASSESSMENT -
THE APPLICATION OF THE LCA METHODOLOGY FOR SPACE MISSIONS AT ESA**Abstract**

Global environmental challenges are receiving growing public awareness and as a consequence new and upcoming legislative measures address these demands. In the space sector, environmental issues have only recently started to come under closer consideration. Yet through the risks of supply chain disruptions and the increasing environmental awareness of costumers, client operators, employees, and stakeholders the sector has to face these new challenges. Being aware of its unique position towards the European space industry, ESA is proactively promoting awareness and striving to achieve a deep understanding of environmental impact assessment by means of an objective, technical, and scientific approach.

The most recognised and most widely used methodology for analysing the environmental impact of products is the ISO standardised Life Cycle Assessment (LCA) methodology. LCA is based on a quantitative exhaustive accounting of all the substances that are consumed or rejected into the environment along the entire life cycle of a product or service and an assessment of their quantifiable environmental impacts through a multi-criteria approach. In the frame of its Clean Space initiative, ESA has utilised this tool to assess the environmental impact of the European family of launchers and four different European space missions. Since LCA is mostly used for mass produced items, specific distinctions and challenges of applying this methodology to space missions have to be considered.

Based on these results, ESA aims to use LCA to understand the complete life cycle of a space mission, quantify its environmental impacts, and monitor and prevent potential disruption risks. Through the identification of hot spots, potential mitigation actions can be suggested. Furthermore, by establishing a common framework ESA aims to promote eco-design in future space missions. This framework shall include dedicated databases and tools for space activities, including a tool to be implemented in ESA's Concurrent Design Facility (CDF) to asses and compare the environmental impact of preliminary design choices.

With the input of specific studies, LCA will additionally be used as a platform for future technology trade-offs and will also support the evaluation of the overall impact of future technologies on the environmental costs of space projects.

These activities are used as major input for the roadmap of the Eco-design branch (branch-1) of ESA's Clean Space initiative.

By pioneering the use of LCA in the space sector, ESA tries to turn a threat into opportunity, guaranteeing the future of space activities by protecting our environment.