**The Strathclyde Space Systems Database: A New Life Cycle Sustainability Assessment Tool for the Design of Next Generation Green Space Systems**

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1. **Introduction**

The use of Life Cycle Assessment (LCA) is currently being pursued by the European Space Agency (ESA) to allow decision-makers within the space industry to minimise environmental impacts and define new optimality criteria for space systems [1]. However, with Life Cycle Sustainability Assessment (LCSA) being predicted as the future of LCA [2], moving towards space-based LCSA is a logical next step for the space industry. This paper will present the methodology used in an open-source LCSA platform called the Strathclyde Space Systems Database (SSSD) under development at the University of Strathclyde for the design of space missions, outlining the integration of social and economic aspects with environmental LCA.

1. **Materials and methods**

The SSSD has been built to conform to international ISO Standards 14040/14044 as well as the ESA Space system LCA guidelines. For LCA, a tier-style approach was adopted in order to come to a detailed assessment ranging from mission level to individual activity level for the space, ground and launch segments across each phase of a space mission. A range of midpoint indicators from a variety of sources were used for the impact assessment categories to give a full spectrum of relevant environment results relating to a typical space mission. Social processes were built based on the Sustainable Development Goals and the United Nations Environment Programme and Society of Environmental Toxicology and Chemistry guidelines on Social LCA (SLCA) across 5 different stakeholder categories. These stakeholder categories are based on an evaluation scheme used by an intervention and associated severity risk score to allow a social score for each Stakeholder Category to be reached. The Life Cycle Costing (LCC) aspects were built into the environmental processes by splitting monetary flows into costs and revenues across a variety of cost categories for the space, launch and ground segment. As each category within SLCA and LCC use common units (score and money), each assessment has the ability to come to a single score and be included as impact categories within LCA.

1. **Results and discussion**

An example of life cycle sustainability results achieved using the SSSD will be presented for a variety of space systems/components using the SSSD. These results will then be tested for the viable integration within the concurrent design process and with other design tools at the University of Strathclyde to assist with the ecodesign of space missions. This will be conducted at the Concurrent and Collaborative Design Studio at the University of Strathclyde.

1. **Conclusion**

It is hoped that the SSSD will be released publically by mid-to-late 2019 where it will contribute to the global sustainability agenda by allowing the space industry to become more accountable and responsible for their operations. The tool will therefore assist decision-makers in choosing sustainable technologies and products that are not only cost-efficient, eco-efficient and socially responsible, but also ones that can easily justify and evidence their sustainability.

1. **References**

[1] Pedersen, A.L. Ecodesign: Reducing Impacts. Guest Lecture. Delft University of Technology. 13 February 2018.

[2] Guinée J.B., Heijungs R., Huppes G., Zamagni A., Masoni P., Buonamici R., Ekvall T., Rydberg T. Life cycle assessment: past, present, and future. Environ. Sci. Technol. 2011, 45, 90−96, 2011.