IAF SPACE SYSTEMS SYMPOSIUM (D1)
Innovative Systems toward Future Architectures (1)

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ENABLING A SPACE CIRCULAR ECONOMY BY 2050

Abstract

As part of the Zero Debris Approach for Space for a sustainable and safe space environment by 2050, ESA is encouraging the implementation of a 'circular economy' in space that ensures long-term orbital sustainability through an ecosystem of in-orbit servicing, in-orbit assembly, in-orbit manufacturing, and eventually in-orbit recycling. The implementation of a Space Circular Economy could play an important role in guaranteeing the sustainability of the orbits, maximising the usage of space assets (reduction of costs) and protecting the Earth's environment by limiting the exploitation of raw materials on-ground and lowering the number of satellites launches and re-entries.

Following input from industry and academic stakeholders in the European space industry, ESA laid out its vision for a space circular economy in a white paper in 2023. As well as noting the potential of the space circular economy, this white paper identified technical, commercial, and regulatory challenges facing the establishment of a circular economy in space. As well as demanding innovative systems and mission architectures, making the space circular economy a reality will require a commercial case to be developed as well as a legal and regulatory framework established that supports a wider range of in-orbit services.

This paper summarises the challenges and opportunities of the space circular economy as seen by ESA, and provides an overview of past, present, and future ESA activities that will collectively address these challenges and make the most of these opportunities. These studies recognise the capabilities and aspirations of European industry to work towards a circular space economy and will help ESA build consensus around the steps required to build the circular space economy.