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SPACE SUSTAINABILITY: ENVIRONMENTAL IMPACT OF REUSABLE SPACE HARDWARE AND
IN-SPACE ASSEMBLY, MANUFACTURING, AND REMANUFACTURING.**Abstract**

The constant increase of rocket launches to deliver satellites and other cargo into Earth orbits and beyond is raising concerns about the environmental impact of rocket emissions. At the same time, driven by technological advancements, the reuse of space hardware becomes feasible. The technology needed for in-space spacecraft assembly, manufacturing, and remanufacturing is in development and can become an alternative to spacecraft production on Earth. The production of components and parts for spacecraft and payloads seems to be a viable option within the next decade. Literature on reusability and re-manufacturability of spacecraft or their parts and components is limited but approaches in other industries can be used as starting points. The aim of this paper is therefore to advance knowledge on the environmental impact of reusable space hardware and in-space re-manufacturing. A literature search on the components that can be reused or re-manufactured in space is complemented by interviewing experts with knowledge in product development, life cycle assessments, environmental impact assessments, circular economy principles, eco-design, or remanufacturing in heavy-machinery or equipment and automotive industries. In addition, case-studies on the reusability and re-manufacturability of components are reviewed. With this, the possible reusable mass that is already in space and the resulting number of launches that can be saved will be estimated or calculated if appropriate/attainable. Aside the reduction of cost, the benefits for space sustainability and environmental protection will be considered.