

IAF SPACE SYSTEMS SYMPOSIUM (D1)
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REUSABILITY POTENTIAL OF SPACECRAFT SOLAR PANELS

Abstract

Sustainability is a major subject for society and industries. Circularity seems to be the next step in this development. Regarding the space industry, implementing sustainability poses different challenges, and many pieces of knowledge and technologies are still missing: to capture a spacecraft in space, the infrastructure to process it, the policy on sustainable space, etc. Nevertheless, those are arriving with risking taking and non-traditional satellite development and management method as Lean satellites. The space community must foresee the requirements to reuse a spacecraft after its end of life. It should answer questions such as how can one reuse a spacecraft? Is it even possible? Can the space industry use findings from other industries to implement reusability? For example, can we implement solar panels' end-of-life processes used on Earth in space?

This paper will study the reusability of solar panels since they are a common part of most satellites and are composed of rare materials. The capability to reuse them in space might be a first step for space circularity since it will maximize the value of a spacecraft mission to its customer by giving value to something considered nowadays as debris. The concept of reusing spacecraft solar panels can be integrated into a Lean satellite project. Nonetheless, reusing solar panels in space requires understanding their degradation due to the space environment, investigating the applicability of Earth solar panels end of life processes in space, and their potential performances after those processes. It requires also to design solar panels to be reused either by making them easier to be reprocessed or by making them transferable from one spacecraft to another spacecraft. Some missions such as the Hubble Space Telescope, i.e., HST, mission present reusability characteristics in their design. HST was designed to be maintained in space and its solar panels were replaced twice by astronauts during the time of the space shuttle.

This paper aims to investigate the reusability potential of spacecraft solar panels by first describing their function, their designs, and their degradation in the space environment. Following this, the different solar panel end-of-life processes available on Earth will be presented. Their applicability to aged spacecraft solar panels and feasibility in space are discussed. Then, the two servicing missions of the Hubble Space Telescope where the solar panels were replaced are described and lessons learned from those are presented. Finally, the reusability potential of solar panels in space is discussed.