

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

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SUSTAINABILITY PRINCIPLES FOR SPACE OPERATIONS ACROSS THE CENTURY

Abstract

Sustainability is a key factor in the future of space exploration, as well as in the future of life on Earth. Sustainability in this regard, can be defined as; ensuring that outer space will continue to be used for exploration, innovation, and to the benefit of all humanity and the Earth, now and in the future. As space becomes more crowded with man-made debris, and as Earth becomes more polluted as a result of spacecraft production and emissions, the question arises: What can we do to make spaceflight more sustainable? Prioritizing sustainability in spacecraft and mission design is key to the future of spaceflight, as it considers the effects that space exploration has on the Earth and our environment.

In this study, we will analyze different aspects of NASA's Juno mission, while highlighting how such a mission can be made more sustainable using current technology. Twelve years ago, the Juno probe was launched with the goal of studying the atmospheric composition, strong magnetic fields, and immense gravity of the biggest planet in our solar system – Jupiter. While the Juno mission has been successful in many aspects, we hope to re-evaluate this mission with sustainability as a main priority. This investigation considers the most important factors of the original mission – key mission goals, engineering aspects, science instrumentation, ethics and policy, budgeting, and timeline – evaluating it from the top-down to assess the ways in which it could have been more viable economically, environmentally, and scientifically. We also consider the direct and indirect impacts that spacecraft, their fuel, and the materials used to build them have on the Earth, and the carbon emissions that they create. Recommendations from our study can be used as learnings for designing more sustainable space exploration missions in the coming decades.

This study will investigate the ways that we perceive sustainability within the space sector, with the hope of initiating a discussion on long-term sustainability in space mission planning and execution. Our group consists of young professionals and students from the Space Exploration Project Group (SEPG) in the Space Generation Advisory Council (SGAC). Please note that this abstract is submitted under the supervision of SEPG SGAC.