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THE SPACE STATION DESIGN WORKSHOP AS A PLATFORM FOR STUDENTS TO DEVELOP A LARGE-SCALE HUMAN SPACEFLIGHT MISSION CONCEPT

Abstract

The Space Station Design Workshop (SSDW) is an intensive, one week-long workshop that brings together students from all over the world to develop space station concepts collaboratively. Each year's SSDW task is an independent challenge, resulting in diverse missions and respective designs. However, with technological advancements over the years, such as In-Situ Resource Utilization (ISRU) and In-Space Manufacturing and Assembly (ISMA), the workload during a workshop became very high, and the outcomes lacked depth due to the breadth of the topics. To address this issue, a more continuous approach is now being tested and implemented. The goal remains to foster innovative concepts that push the boundaries of space mission design.

This paper describes the shift of the SSDW from isolated annual challenges towards a multi-year, large-scale space mission concept. The objective is to establish a structured framework where each year's work can build upon previous progress, allowing continuous development and refinement. The goal is to contribute to the broader task of solar system exploration, with a focus on transforming the Moon, Mars, and their surroundings into habitable environments for humans.

The implementation of this multi-year approach requires well-defined requirements and constraints by the workshop organizers. Each year's task must integrate seamlessly with the existing framework, allowing subsequent teams to expand upon earlier work without major revisions. A modular approach is essential, meaning each workshop develops a complete concept with opportunities for extension. Each iteration remains self-sufficient while allowing further development without redesigns. This enables the space station to grow. Each team builds on past results while maintaining flexibility for innovation. This methodology ensures that SSDW participants can effectively contribute to a long-term vision while maintaining coherence across multiple years.

The workshop in August 2025 demonstrated the feasibility of the aforementioned mission development approach. This initial phase establishes a foundation for the following years by defining core mission parameters and documenting the results. Additionally, it provides insights into the preparation and transition processes for subsequent years. This paper outlines the new concept development process, highlighting the educational and technical challenges encountered. By analyzing lessons learned from the first iteration, the paper provides insights for structuring future SSDW workshops to contribute to advancing space mission design methodologies.