

22nd IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)

Space Technology and System Management Practices and Tools (3)

Author: Mr. Sai Tarun Prabhu Bandemegala
Politecnico di Torino - Thales Alenia Space Italia, Italy, sai.bandemegala@polito.itEVALUATION OF LIFE CYCLE COST STRATEGIES: A CASE STUDY FOR PLANETARY
HABITATS**Abstract**

The establishment of permanent habitats on planetary surfaces, particularly the Moon and Mars, represents a significant leap in human exploration efforts. However, accurately predicting the life cycle costs of such long-term projects remains a challenge due to the complex interplay of investment, operational, environmental, societal, design, and development costs. Numerous cost estimation models and softwares currently in use incorporate aspects of life cycle cost methodologies to assess the cost of developing, deploying, and operating advanced life support systems for long-duration space missions. Yet, they have not been able to account for the investment, maintenance, societal, and technological advancement costs. This paper considers the various cost dimensions to provide insights into effective financial planning and management to evaluate life cycle cost strategies for planetary habitats through a case study using the existing models from NASA and ESA. This would include the equivalent system mass (ESM) and its iterations, as well as the Advanced Life Support System Evaluator (ALiSSE). In addition, this paper also investigates the influence of the cost categories represented by user, environmental and social costs, that are declined and adapted to specific expenses related to cycle paths that can further improve the current methodologies. The outcomes of this case study will show the benefits and limitations of the cost models currently used, along with suggestions on integrating other aspects of costs to provide stakeholders, policymakers, and project managers with a comprehensive understanding of the financial implications and trade-offs associated with establishing permanent habitats on the Moon, Mars, and beyond.