

24th IAA SYMPOSIUM ON HUMAN EXPLORATION OF THE SOLAR SYSTEM (A5)  
Human Exploration of the Moon and Cislunar Space (1)

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DOMI INTER ASTRA - A CASE STUDY FOR THE DEVELOPMENT OF A NEAR-TERM  
PERMANENT LUNAR SETTLEMENT

**Abstract**

Permanent human settlements outside of low-earth orbit face technical and psycho-social challenges for the crew members and programmatic risks around funding and operating these missions, without clear public support and international involvement. A concept for the construction and operation of a lunar settlement named "*Domi Inter Astra*" (DIA), near the Shackleton Crater, was developed to identify gaps in current technologies, economies, and societal and management structures, and to understand the

feasibility of a near-term permanent settlement crewed by international researchers and tourists. This project was created by a team under the Space Generation Advisory Council's auspices and a follow-on to our First Place-design in the Moon Base Design Contest by The Moon Society.

Technologies for infrastructure, life support/environment control, and robotics were selected using high-level trade studies to balance resource requirements, safety, reliability, operability, and maintainability of the base over a long (20+ year) operating life with 10-30 inhabitants. Technology roadmaps were developed for gaps in existing technologies, considering opportunities with ISRU and methods of closing the environment control and life support system loops.

As human exploration missions extend further into the solar system, relationships between crew members and tourists, their living environment, and terrestrial mission control centres must accommodate a larger range of human factors for long-term sustainability. Design choices in the settlement's architecture and social operations were made to meet the crew's psychological needs and behaviours while maintaining technical and economic viability.

Large scale space exploration projects must mitigate both public interest and funding risks throughout their life cycle. High-level economic roadmaps are introduced to diversify revenue streams throughout the settlement's design, deployment, and operation, prioritizing early returns and applications back on Earth to minimize risk. Funding opportunities that evolve with the base design and functionality over time are identified for long-term economic sustainability. A polycentric model for international collaboration is explored to promote interest from current space-leading countries while providing opportunities for emerging space nations.

The DIA lunar settlement case study showcases the interrelation between engineering, economics, architecture, social and management scopes. It also presents gaps that should be filled in the near-term to allow for a permanent lunar settlement to be built. This case study can help international and public-private partnerships to develop human space exploration capabilities further.