

17th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)

Interactive Presentations - 17th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE
EXPLORATION AND DEVELOPMENT (IP)

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INCORPORATING SUSTAINABILITY INTO PLANNED LUNAR MISSIONS: BUILDING BLOCKS FOR LUNAR SETTLEMENT THROUGH LUNAR SUSTAINABILITY GOALS

Abstract

Future lunar surface and gateway missions are being proposed and supported by a range of actors, namely commercial companies, national space agencies, academics, and non-governmental organizations. In many instances, these actors have published their own mission strategies and phases for developing a lunar settlement. While these plans differ in their timelines and end objectives, they share a building blocks approach that transitions from robotic investigation, to establishment of infrastructure and habitats, arrival of humans, long-term missions, and eventually an established human settlement. Although the literature provides broad evaluation of the technical, scientific, and international requirements for achieving these plans, it contains significant gaps in evaluating the sustainability of these proposals. These issues are important because future lunar activity will likely rely on international, cooperative, sustainable strategies, rather than past unilateral, geopolitically driven, short-term strategies. To address these insufficiencies, this paper reviews a variety of roadmaps and establishes a consolidated five-phase summary of these roadmaps, with details for the infrastructure, human factors, political, and economic prerequisites, to outline the gaps in sustainability evaluation. These gaps are then organized into Lunar Sustainability Goals, which can be integrated into planned lunar surface missions. These fifteen goals, developed in line with the United Nations Sustainable Development Goals (SDGs), the Committee on the Peaceful Uses of Outer Space (COPUOS) Long Term Sustainability of Outer Space Guidelines, and in consultation with external advisors, are: (1) Open Access, (2) Peaceful Purposes, (3) Diversity and Opportunity, (4) International Cooperation, (5) Education and Outreach, (6) Environmental Protection, (7) Heritage Protection, (8) Health and Safety, (9) Sustainable Transportation, (10) Standardization, (11) Space Debris Prevention, (12) Zero Waste, (13) Sustainable Energy, (14) Sustainable In-Situ Resource Utilization, and (15) Earth Applications. Ultimately, these goals, along with their accompanying targets and drivers, help frame future mission plans in terms of an internationally cooperative, building blocks approach to lunar settlement.