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IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

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MOON EXPLORATION – PART 1

Abstract

The Moon has become the focal point of renewed global interest in space exploration, serving as a critical stepping stone for future missions beyond Earth. This session will provide an overview of current and upcoming lunar missions, covering orbital and surface exploration, robotic and human activities, and scientific research aimed at utilizing lunar resources and preparing for future deep-space exploration.

Orbital and Robotic Surface Missions Lunar orbiters and robotic landers play a vital role in mapping the Moon's surface, analyzing its composition, and scouting potential landing sites for human missions. Key missions include:

NASA's Lunar Reconnaissance Orbiter (LRO): Providing detailed surface maps and identifying water ice deposits. India's Chandrayaan-3: Successfully landing on the Moon's south pole, advancing lunar surface research. China's Chang'e Program: Conducting sample return missions and paving the way for future lunar bases. Private and Commercial Missions: Companies like Astrobotic and Intuitive Machines are developing lunar landers to deliver payloads for scientific and commercial purposes. Human Exploration and Lunar Habitats With the Artemis program, NASA and its international partners are planning to return humans to the Moon, aiming to establish a sustainable lunar presence.

Artemis I, II, and III: A series of missions leading to human landings on the Moon's south pole, where water ice can be used for life support and fuel production. Lunar Gateway: A planned space station in lunar orbit to serve as a hub for future deep-space missions. Lunar Surface Habitats: Concepts for habitats using in-situ resource utilization (ISRU), such as 3D printing structures from lunar regolith. Life Sciences and Resource Utilization Understanding the effects of lunar gravity and radiation on human health is crucial for long-term space missions. Studies include:

Biological and medical experiments to assess astronaut health in reduced gravity. Lunar agriculture research to develop self-sustaining food systems. Mining lunar resources, including water ice for fuel production and oxygen extraction. Preparatory Activities for Solar System Exploration The Moon serves as a testbed for technologies required for Mars and beyond. From advanced propulsion systems to closed-loop life support, lunar exploration will drive innovations critical for humanity's expansion into the solar system.

As international and commercial collaboration grows, the Moon will serve as a proving ground for sustainable space exploration, unlocking new possibilities for scientific discovery and human settlement beyond Earth.