



Next Steps in Exploring Deep Space: Synergies and Roadmap for Moon-Mars Exploration

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The broad outline for, and the science strategy within, the IAA cosmic study on the Next Steps in Exploring Deep Space will be described. The study provides a vision for the scientific exploration of space by humans in the first half of the 21st Century. The guiding principles of the study are to address questions of broad public and scientific interest, determine the goals for exploring the solar system, and derive the destinations and an implementing architecture. The outcome is a systematic plan for continuous exploration of space, flexible in destinations, affordable without large budget increases, and sustainable with a progressive set of exciting goals to maintain public interest. The approach to deriving the science goals will be described and the resulting exploration objectives at each of the four destinations in the architecture: Sun-Earth Lagrangian Point L2, the Moon, Near-Earth Objects and Mars.

There are large synergies between Moon and Mars exploration. This starts with areas of scientific investigations: clues on the formation and evolution of rocky planets, accretion and bombardment in the inner solar system, comparative planetology processes (tectonic, volcanic, impact cratering, volatile delivery).

The synergy includes joint areas of instrumentation: Remote sensing miniaturised instruments; Surface geophysical and geochemistry package; Instrument deployment and robotic arm, nano-rover, sampling, drilling; Sample finder and collector.

There are also common technologies in robotic exploration: Mecha-electronics-sensors; Tele control, telepresence, virtual reality; Regional mobility rover; Autonomy and Navigation; Artificially intelligent robots.

We compare Moon-Mars system aspects related to In-Situ Utilisation of resources; Establishment of permanent robotic infrastructure, Environmental protection aspects; Life sciences laboratories; Support to human exploration.

Finally, we discuss possible roadmaps for exploration, starting with the Moon-Mars missions for the coming decade.