

Roadmap for Future Lunar Science and Exploration

B.H. FOING¹ and ILEWG PANEL MEMBERS ¹ILEWG c/o Chief Scientist, ESA ESTEC SCI-SR

After the results of Muses-A/Hiten, Clementine and Lunar Prospector last decade that changed our views of the Moon, a series of missions to explore the Moon are currently planned, continuing de facto an International Lunar Exploration programme. The ESA SMART-1 mission has been launched in fall 2003 and arrived at the end 2004, to be followed by the Japanese Selene, Lunar-A, India's Chandrayaan-1, China's Chang'e 1, and US Lunar Reconnaissance Orbiter and Moonrise South-Pole Aitken Basin sample return mission.

We discuss strategies for future lunar exploration. This includes open science questions about comparative planetology, the origin of the Earth –Moon system, the early evolution of life, the planetary environment and the existence of in-situ resources necessary to support human presence. We discuss 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.

We discuss 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 and synergies for Moon-Mars exploration, starting with the missions for the coming decade, and building effectively on joint technology developments.

Keywords: Moon; planetary; science; exploration; technology; utilization; international