Potential Regions of Scientific and Operational Interest for a Future European Lunar Infrastructure: A High-Level Summary of the Community Perspective

Disclaimer: This report synthesizes high-level themes emerging from the submissions to the "Call for Evidence: Potential Regions of Scientific and Operational Interest for a Future European Lunar Infrastructure" and a subsequent workshop. This document does not aim to attribute individual proposals in detail, in order to respect the original contributors and the unpublished nature of the submitted material.

Returning to the lunar surface has become a central goal of space exploration, supporting scientific research objectives while advancing technologies, infrastructure, and resource assessments for sustained robotic and human operations. Looking towards 2040, ESA's Explore 2040 vision highlights the development of a European infrastructure to enable sustained access to and operations on the lunar surface, designed to work in synergy with international human and robotic exploration efforts (ESA Strategy 2040; The European Exploration Strategy: Explore2040). In support of Explore2040, ESA issued a *Call for Evidence* in June 2025, inviting the European and international lunar science and exploration communities to identify candidate regions of interest that could enable frontier science, support sustainable exploration, and prepare future activities on the Moon. The notional concept envisions an initial robotic infrastructure at a nearside primary location with Earth visibility, established during the 2030s (ESA Strategy 2040). Contributors were asked to assess scientific impact, technical feasibility, environmental considerations, and the added value of a long-term infrastructure relative to short-duration missions in alignment with ESA's exploration priorities (ESA Strategy 2040).

The community contributed 33 submissions covering 26 different regions, including nearside, farside, and polar locations, although the primary focus was on nearside sites consistent with the initial infrastructure concept.

Drivers for location identification were found to be:

- Access to regions with high geological diversity to enable fundamental scientific investigations into the origin, evolution, and current environment of the Moon.

- Access to regions containing diverse resources to facilitate the systematic sampling and in-situ assessment of their utilisation potential.
- Proximity to subsurface features that might be used as shelter, such as pits and lava tubes, to enable habitation and environmental studies.
- Scalability to allow rapid high-impact science return from the earliest missions, with substantial potential for longer term science return.
- Consideration of the possible impacts of a location on crew health, including psychological health.

The nearside Procellarum KREEP Terrane (PKT), characterized by elevated potassium (K), rare earth elements (REE), and phosphorus (P), stands out for its unique scientific and strategic value, with diverse geology and in-situ resource utilization potential, and would therefore be favourable for a long-term lunar infrastructure. Outside the PKT, strategic regions are located on the limb between the nearside and farside, which could act as strategic access points for the development of capabilities targeting the farside.

Farside regions are scientifically compelling in particular as quiet locations for radioastronomy. This might be considered as a longer-term option for a lunar infrastructure applying knowledge gained from experience on the near side.

Polar regions provide a compelling exploration environment due to favourable lighting conditions for energy generation, as well as the inferred presence of ice as a resource and associated scientific opportunities. However, major uncertainties on the resource potential of local ice and volatiles remain, which should be addressed by prospecting missions before planning infrastructure development in this region.

References:

ESA Strategy 2040 (2005). ESA Publications.
https://esamultimedia.esa.int/docs/corporate/ESA_Strategy_2040_InDepth.pdf

The European Exploration Strategy: Explore 2040 (2025). ESA Directorate of Human and Robotic Exploration.
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