Building a European Lunar Capability with the European Large Logistic Lander

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In the context of an accelerated lunar exploration agenda on international level, ESA is engaging in studies to enable European roles in the near and mid-term which can support the international community. While near-term opportunities exist in "boots-on-the-ground" human lunar return in the frame of the NASA Artemis programme and commercial (CLPS) robotic landers, ESA continues to prepare the next step in sustainability with the European Large Logistic Lander (EL3).

Returning to the Moon not only yields fundamentally important science opportunities for our understanding of the Solar System but also allows us to test hardware and operational procedures for the exploration and utilization of space beyond Low Earth Orbit (LEO). EL3 will be a sustainable programme that will allow a diversity of missions for the science community. Whilst EL3 is intended to be a generalised lander capable of delivering a wide variety of cargo, such as science experiments, crew supplies, or unpressurised rovers, the most studied mission to date is a sample return package comprised of a return stage and a rover. EL3 Sample Return will land on the lunar surface, demonstrate surface operations, and return ∼15 kg of samples to the lunar Gateway and back to Earth by the astronauts aboard Orion. Hence, the mission will begin a robotic pathway toward sustainable human exploration of the Moon and beyond.

To achieve this, some of the key objectives include: (1) Create opportunities for science, particularly sample return, which has been highlighted as a key aspect of ESA's lunar science strategy; (2) Gain scientific and exploration knowledge by scouting for potential resources; (3) Create opportunities to demonstrate and test technologies and operational procedures for future Mars missions; (4) Preparing for more sustainable human lunar missions by implementing, demonstrating, and certifying technology elements for vehicle reusability, mobility, and night survival.

EL3 Sample Return will consist of the EL3 cargo lander, an interface element housing a 330 kg rover, and a Lunar Ascent Element (LAE) that will return the samples to the lunar Gateway. The rover will be designed for driving more than 100 km at relatively high speed and surviving the lunar night. Whilst mostly operated by ground control on Earth, the rover could also be partly tele-operated by astronauts aboard the Gateway. Once landed on the lunar surface, the rover will immediately collect a contingency sample and will then collect additional samples along a ∼35 km long traverse. The rover will carry a suite of scientific instruments that will allow the
comprehensive study of the sampling locations, providing the context of the samples, as well as the geology along the traverse. After depositing the samples into the LAE, the rover will embark on a 100+ km traverse along which it will take further in-situ measurements over the course of a year or more.

In summary, the goals of the EL3 programme will be to support international crewed lunar activities, develop and fly the technologies necessary to build Europe's lunar capability, and serve the needs of the lunar science community.