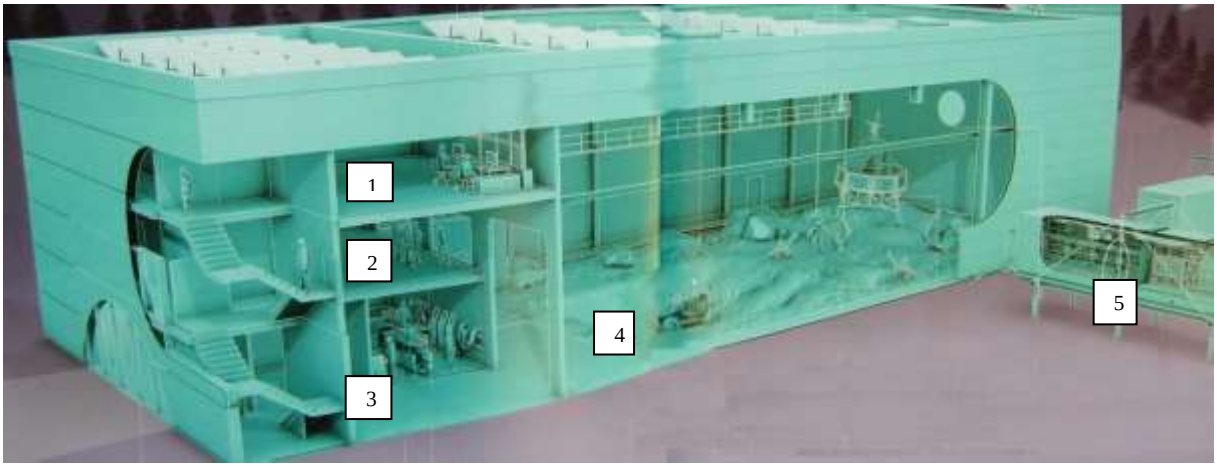
The Moon on Earth

The German Aerospace Center (DLR) and the European Space Agency (ESA) are jointly establishing a fundamental facility for the preparation of future human and robotic missions to the Moon at DLR's Cologne site. With its unique infrastructure and the seamless integration into the campus, LUNA will enable complex simulations for lunar surface activities of astronauts and robotic systems.



The above drawing shows the major elements of the LUNA Moon analog facility, which is under construction as a joint cooperation between the German Aerospace Center (DLR) and the European Space Agency (ESA) in preparation of the European participation in the international Artemis Lunar-Gateway program. LUNA will support Moon activities sustainably from Germany, advance innovation and technologies in the region and worldwide

1 *XR Laboratory*: eXtended Reality technologies are playing an increasing role in simulations, preparatory activities and training for space missions. An XR development and digital production studio is planned for this purpose.

2 *Visitor Area*: LUNA is designed to inspire. Here, visitors have a direct view of the lunar surface and can admire a real Moon rock.

3 *Preparation Rooms*: A workshop, experiment preparation rooms, a gas laboratory and alunar dust laboratory are also part of the facility.

4 *Lunar Surface Hall*: The regolith surface is the centerpiece of LUNA. The basaltic simulant EAC-1A obtained from a nearby location simulates the lunar dust.
The simulation area contains a *Deep Floor Area* (foreground, left). The regolith has a depth of 3 m and provides various slopes for sample taking, drilling, processing the lunar soil or for crater simulation.
In addition a *Rover, Lander,* and *Suspension System* is provided (right hand side). The Rover will be used for robotic tests and validation activities. future ESA Argonaut Lander replica will be used for handling and interaction testing on the Moon surface. The Suspension System will be used to support astronauts in spacesuits in such a way they can move around as if they where actually on the lunar surface experiencing lunar gravity.
A *Sun Simulator* (upper right hand corner) will create the very special lighting conditions on the Moon

5 *Eden LUNA Greenhouse* (foreground) and *Habitat* (attached to the rear): The Greenhouse provides an almost closed life-support system in which vertical plant growth is being tested. It includes a robotic arm controlled by AI. It will assist with tasks that have to be performed during the cultivation process.

Additional external modules and partnerships (Moon station, energy module, greenhouse, medical facilities, etc.) allow for the construction and investigation of complex Moon surface elements and their operations, including autonomous systems, system synergies and closed loopThe attached Habitat will be designed as a prototype Moon base to provide secluded shelter for the astronauts without leaving the simulation area.

Integration of all systems enables a comprehensive, versatile utilization and scientific research from the beginning and extending well beyond the initial years.

The LUNA analog training facility at DLR, Cologne

Possible integrated training scenario

Much like the international Space Station ISS, future exploration of Moon and Mars is an international endeavor that will be realized in cooperation of many partners. Germany and ESA are jointly contributing strategically with the various institutes and faculties of DLR, the European Astronaut Centre (EAC) in Cologne and the German Space Operations Center (GSOC) in Oberpfaffenhofen, inclusive the secure ground communications network.

The outer shell of the LUNA hall is now finished. In the coming weeks and months, the interior of the facility will be prepared for use. For this purpose, measuring devices will be installed, microbiological samples will be taken and the regolith dust will then be spread.
Image credit: DLR/ESA
Reference:
Tom Uhlig on Facebook, June 30, 2024

References

[1] DLR Magazine No. 174 – March 2024
[2] ESA flyer 2023-09-07_LUNA-One-pager_EN.pdf (luna-analog-facility.de)