

Space Resources in Luxembourg: Growing and Supporting European Expertise

Kathryn Hadler
Director, ESRIC

What is new in Europe?



EXPLORE 2040

THE EUROPEAN EXPLORATION STRATEGY

In 2024, ESA published its new exploration strategy

An implementation plan is expected to follow



What is new in Europe?

Contributions to the lunar surface architecture and technology demonstration missions will increase the scientific output and prepare for the next phases of lunar exploration. Habitation, including life support, power systems, medical support systems, mobility, mapping and surface characterisation together with communications and navigation means are critical capabilities for expeditions lasting more than a few days. Longer stays and increased robotic surface mobility will enable wider lunar surface and subsurface characterisation which will help to assess the potential for using lunar resources to support long-term astronauts stays and thus extended lunar exploration, which directly feeds into human exploration of Mars. A responsible and efficient use of local resources, including in-situ waste management and recycling, will be a prominent feature and a differentiating factor of a sustainable exploration by Europe.

The follow-up Explore2040 strategy implementation roadmap and derived engineering and programmatic considerations will provide a top-down prioritisation. Some key areas will be:

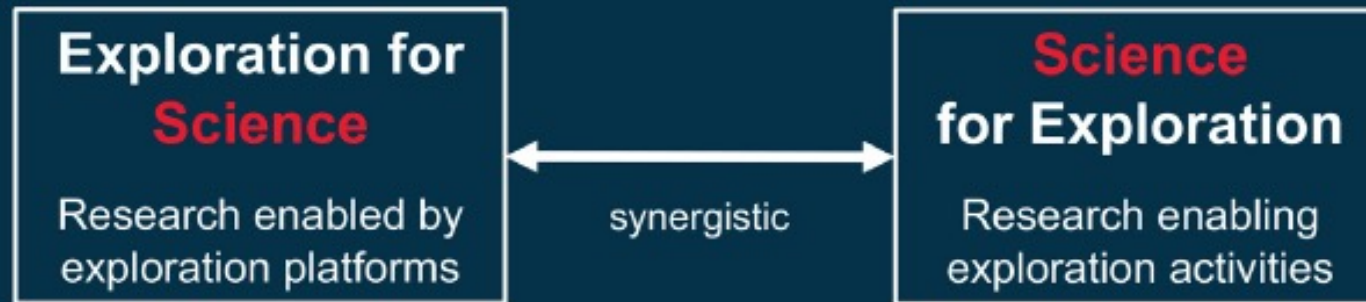
- de-risking crew survival, maximising crew mental/physical health, crew support and performance (e.g., counter-measures to address adverse effects such as radiation or the absence of gravity, advanced medical and life support, waste management and recycling, virtual presence and AI embedded in all aspects of the spacecraft subsystems and human support);
- understanding new locations and their environments, how these environments will affect human activities, and how human and robotic activities affect these environments (e.g., surface mapping, radiation, dust, impactors, atmospheres and exospheres);
- searching for potential resources at the Moon and Mars and understanding their potential to support sustained exploration (e.g., water ice, volatiles, metals, and other materials).

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World-class centred on European uniqueness

Preparing for and de-risking future missions

Ground-based preparatory R&D

Key cross-cutting fundamental and applied research topics, with down to Earth applications

Mental and physical health & safety, life support systems in isolated environments, waste & recycling, energy efficiency, mobility and transport, AI applied to challenging environments.

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The 6 Pillars of the ESA ISRU Initiative

Supporting the development and de-risking of ISRU technologies

Stimulating the creation of Space Resources-enabled markets

Nurturing the growth of the Space Resources community

**Pillar 1: Ground-based Research Facilities
& technology de-risking**

TECHNOLOGY DE-RISKING

Pillar 6: In-Situ Demonstrators

**Pillar 2: Prospecting & Data
Modelling**

COMMUNITY ENGAGEMENT

Pillar 3: Space Resources Challenge

**Pillar 4: Business
Incubation, Acceleration &
Modelling**

Pillar 5: Community Events

MARKET DE-RISKING

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MARKET DE-RISKING

Facilities and Labs at ESRIC

In partnership with ESA



Beneficiation Zone



O₂ Extraction Zone



Purification Zone

EXISTING FACILITIES



DTVC
2.2m diameter
Expected in 2026



Ground-Based Pilot Plant
Based on O₂ from regolith
Design study ongoing

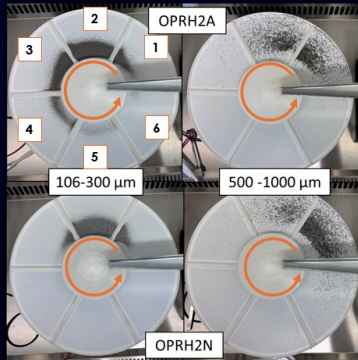
FUTURE FACILITIES

Research

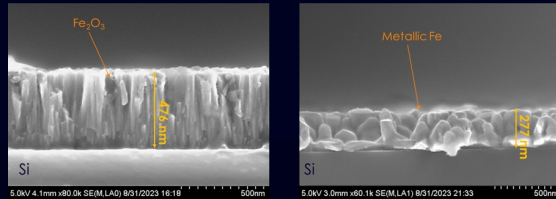
7 PhD Students
7 postdoctoral researchers
5 experienced researchers
3 engineers



Size classification



Plasma H reduction



H reduction: 1 kg scale



Water purification
and capture

Vacuum
Temperature
Swing
Adsorption



Regolith handling
and beneficiation

Oxygen and
Metals Production

Molten salt electrolysis

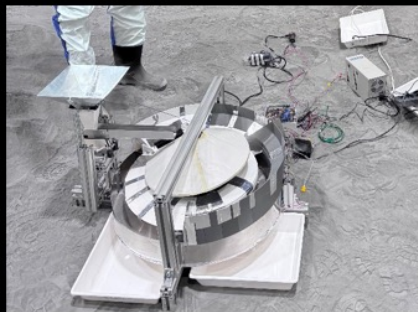
Metal production & use

Salt reclamation

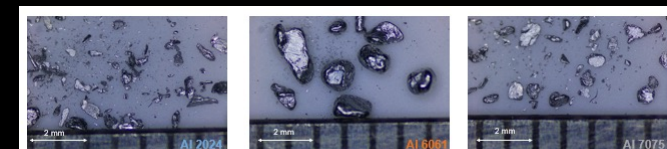
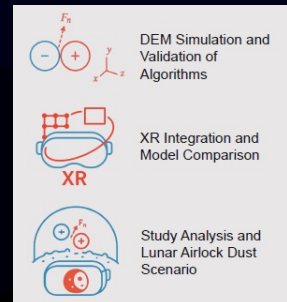
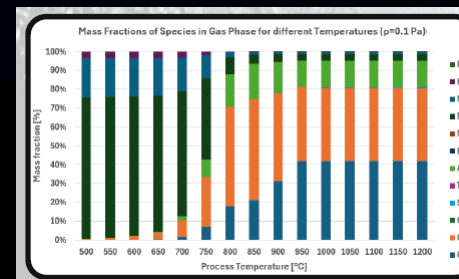
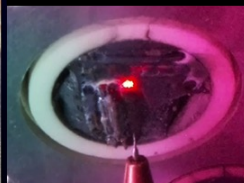
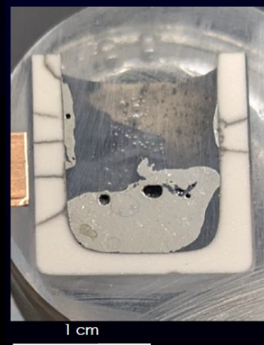
Dust modelling

Designing for
the
Environment

Hardware recycling



Size classification
(field trial)

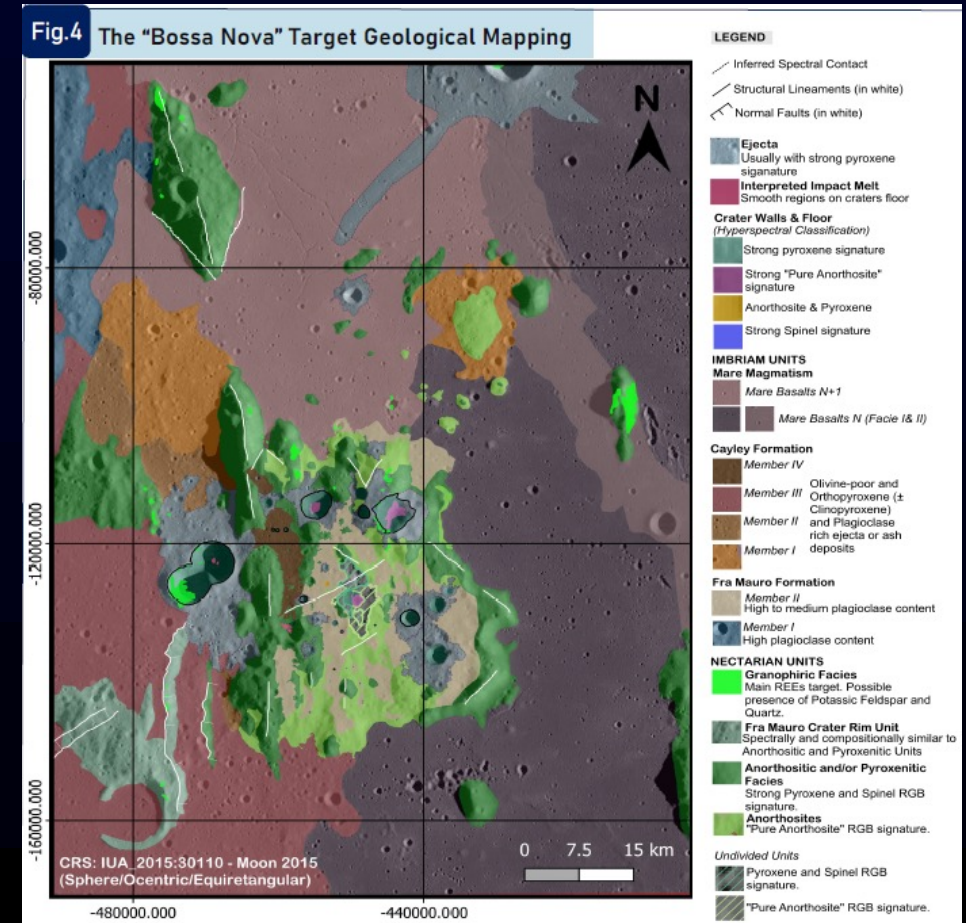
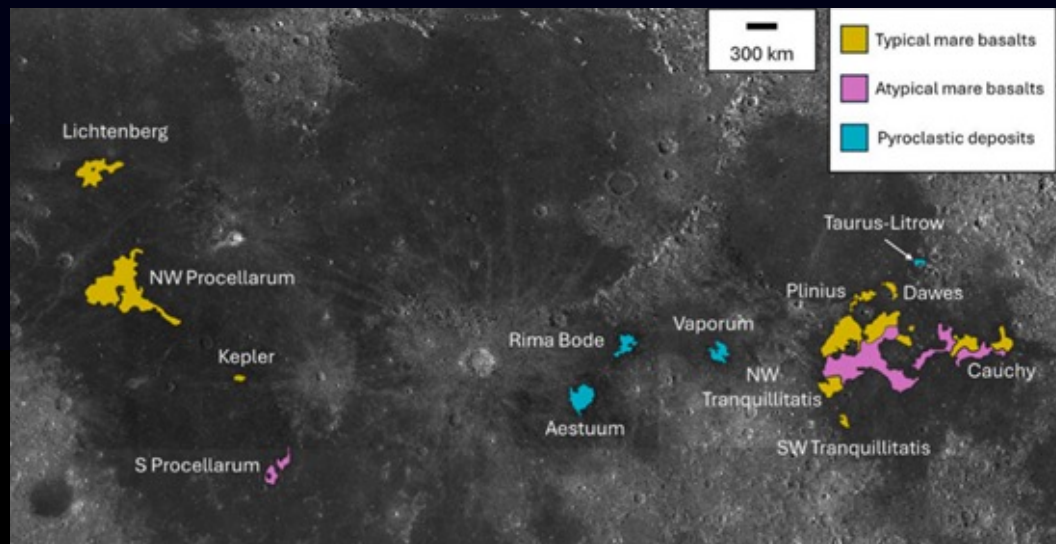


(a) Shredded space grade Al alloys (microscope)

Prospecting

Prospecting is now a focus area of ESA's exploration strategy

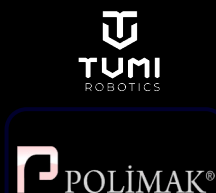
We are working with ESA to develop a concept based on a Space Resources Reference Model to identify and specify data gaps



Supporting the Commercial Sector

We host a Business Incubator

The ESRIC Start-up Support Programme is the first worldwide incubation programme entirely dedicated to space resources utilization, in partnership with ESA



And a Business Accelerator

The Space Resources Accelerator is part of ESA's BSGN Accelerator programme.

- Scout and support projects from scale-ups based in ESA Member States
- Based on a 50% ESA co-funding model
- The aim is to support projects that can reach the Moon

FIBRECOAT
high-performance materials
Series A



ORBITFAB
in-orbit refueling
Series A



MAANA ELECTRIC
solar power generation
Seed



SPACE POWER
power beaming
Pre-Seed



ORBITAL MATTER
additive manufacturing
Pre-Seed



VOLTA
Space Technologies
power beaming
Seed



COMMUNITY ACTIVITIES

ESA & ESRI Space Resources Challenge

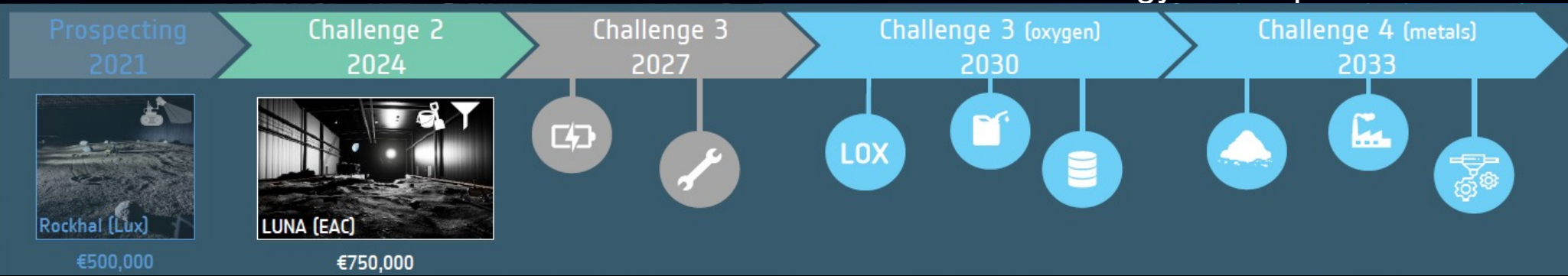
Innovation-driving challenges

Challenge 1 (2021-2022)

- Theme: Remote prospecting on the Moon
- Field trial: Luxembourg
- Prize: 500k EUR technology development contract with ESA and ESRI

Challenge 2 (2024-2025)

- Theme: Lunar excavation and beneficiations
- Field trial: LUNA
- Prizes:
 - 500k EUR technology development contract with ESA
 - 250k EUR technology development contract with LSA



COMMUNITY ACTIVITIES

Space Resources Week



2025

470 participants on-site

250 participants online

9 tech demonstrations

2 parallel sessions

12 partners

190 speakers

60 posters

**LUXEMBOURG
SPACE
RESOURCES
WEEK 2025
19-21 MAY**

Thank you!

www.esric.lu

Get in touch!
contact@esric.lu



esric

European Space Resources Innovation Centre

Our mission is to support human and robotic space exploration and contribute to the development of a sustainable in-space economy through pioneering research, commercial innovation, and by building a vibrant, global space resources community.