

**Commercialization**

# ESRIC Start-up Support Programme



**Lari CUJKO**

*ESRIC Start-up Support Programme Lead*

**XXIII Meeting**

**June 6, 2023**

Session 2: Economic Considerations and Business Cases

Colorado School of Mines  
Golden, Colorado USA

## ESRIC 4 main pillars



### RESEARCH

Ambitious, mission-driven **Research, Innovation and Applications**, world-class scientists and state-of-the-art facilities unique in Europe are key to success. ESRIC supports the space resources sector by undertaking industry-relevant R&D, by training the next generation of space resources innovators and by developing pathways to implementation.



### KNOWLEDGE

New research leads to new insights. New legislation opens new avenues. New technology creates new possibilities. Sharing and generating **new knowledge** encourages an open and collaborative environment, one in which new ideas can thrive and businesses emerge.



### COMMERCIALIZATION

ESRIC supports commercial initiatives in space resources. We host the world's unique **Start-up Support Programme** exclusively dedicated to space resources. We enable technology transfer between space and non-space industries and encourage public-private partnerships and **new commercial initiatives**.

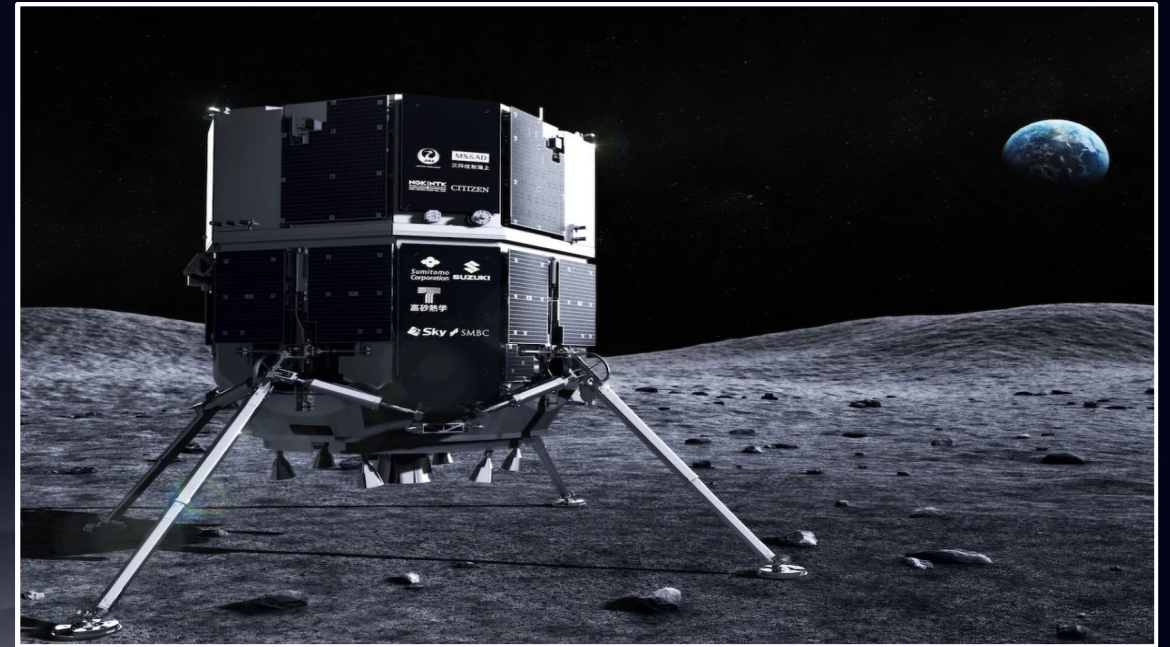


### COMMUNITY

ESRIC connects people and businesses, ideas and funding, ambitions and challenges by creating an open, collaborative environment in which the space resources community can enjoy the free exchange of ideas as they grow together.

## Space (Resources) Commercialization

- **W**hy ?
- **S**ciences
- **E**xploration, Knowledge
- **V**alue (Commercial) ?



June 2023

# Future Lunar Economy

## Space Mining

Mining and processing the lunar surface

## Space Manufacturing

Manufacturing for lunar robotic products

## Space Tourism

Low, mid earth orbit, Lunar and Martian tourism

## Space Health

Analysis of effects on “space people” – DNA

## Space Astronomy

Deep Space Research and Telescopes

## Space Water

Lunar water processing (Poles)

## Space Living

Moon Habitat on/under Lunar surface

## Space Communications

Improved remote sensing activities

## Space Power-Fuels

Solar Power exploitation and photovoltaic panels

## Space Robotics

Autonomous rovers (assembly and ISRU)

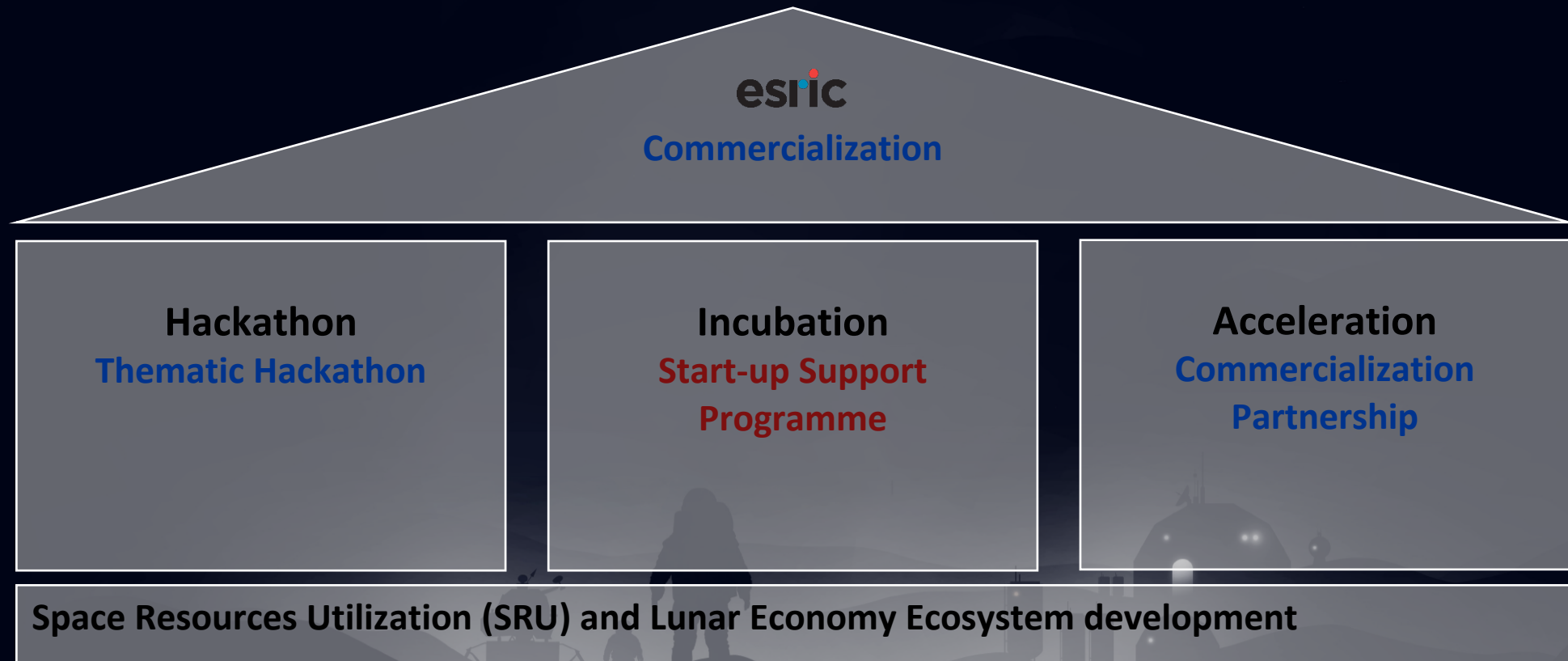




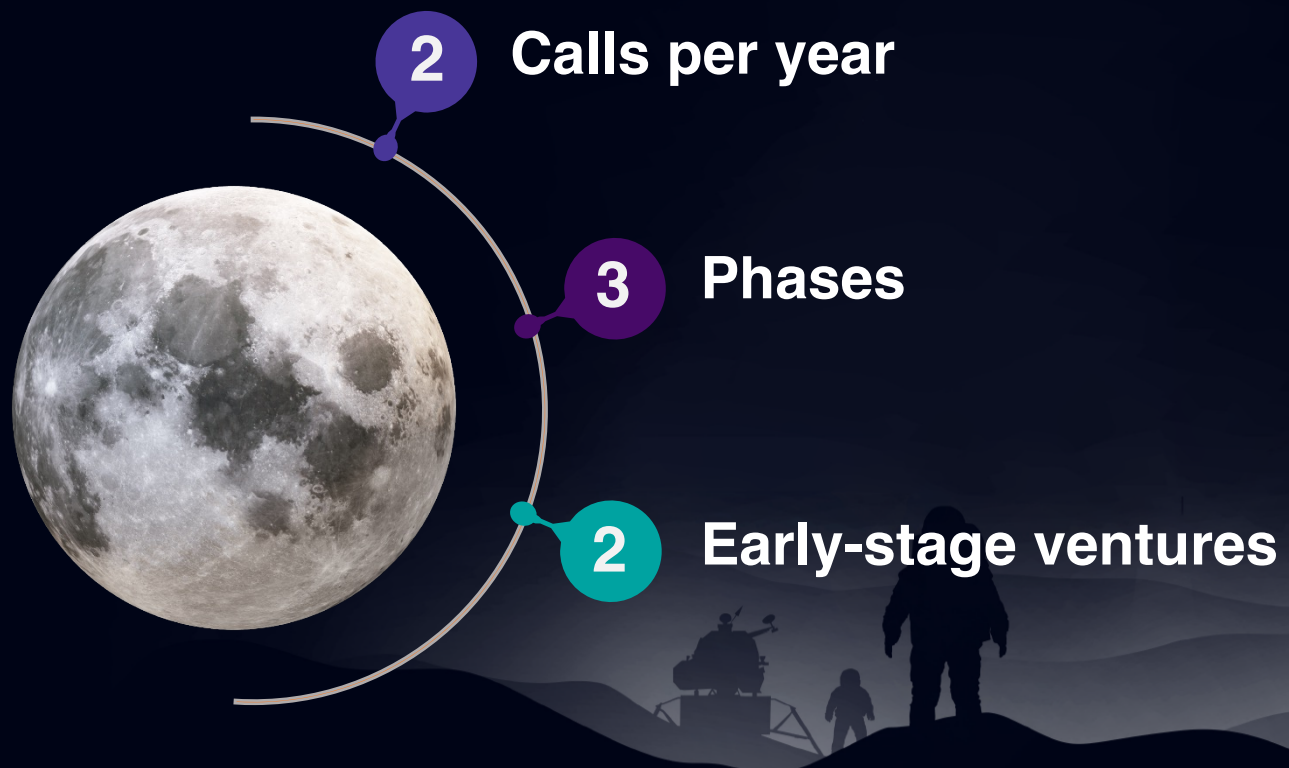
## Space Economics

- **1 Tn\$** Morgan Stanley's Space Team estimates that the roughly \$350 billion global space industry could surge to over **\$1 trillion** by **2040**
- **142 Bn€** PwC's "Lunar Market Assessment" predicts a market trend to surpass a value of **€142 billion** by **2040**
- **464 Bn\$** Euroconsult estimates the "Value of Space Economy" at **\$464 billion** in **2022** despite several unforeseen investment concerns

## ESRIC Commercialization



## Start-up Support Programme



- 1 call / semester

- Phase 1: Remote (3 months)
- Phase 2: On-site (up to 24 months)
- Phase 3: On-site ( up to 36 months)

- Space Resources Utilization
- Terrestrial & Space Applications



## Target Audience: Dual challenges

- **Technology providers:** Having existing market applications being **Terrestrial** or **Space**



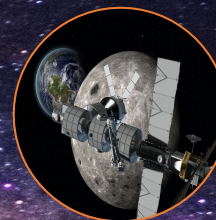
### TERRESTRIAL

- Mining
- Agriculture
- 3D Printing
- Marine
- Other



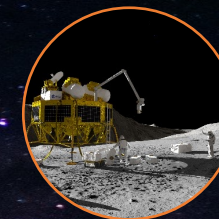
### SPACE

- LEO / MEO / GEO
- Satcom services
- Earth Observation
- Space Debris use
- Other



### CIS-LUNAR

- Communications
- Infrastructure
- ISRU Applications
- Transportation
- Other



### LUNAR & OTHER

- Infrastructure
- Exploration & Prospection
- Mining & Extraction
- Refining & Processing
- Manufacturing & Supply
- Power
- Transportation

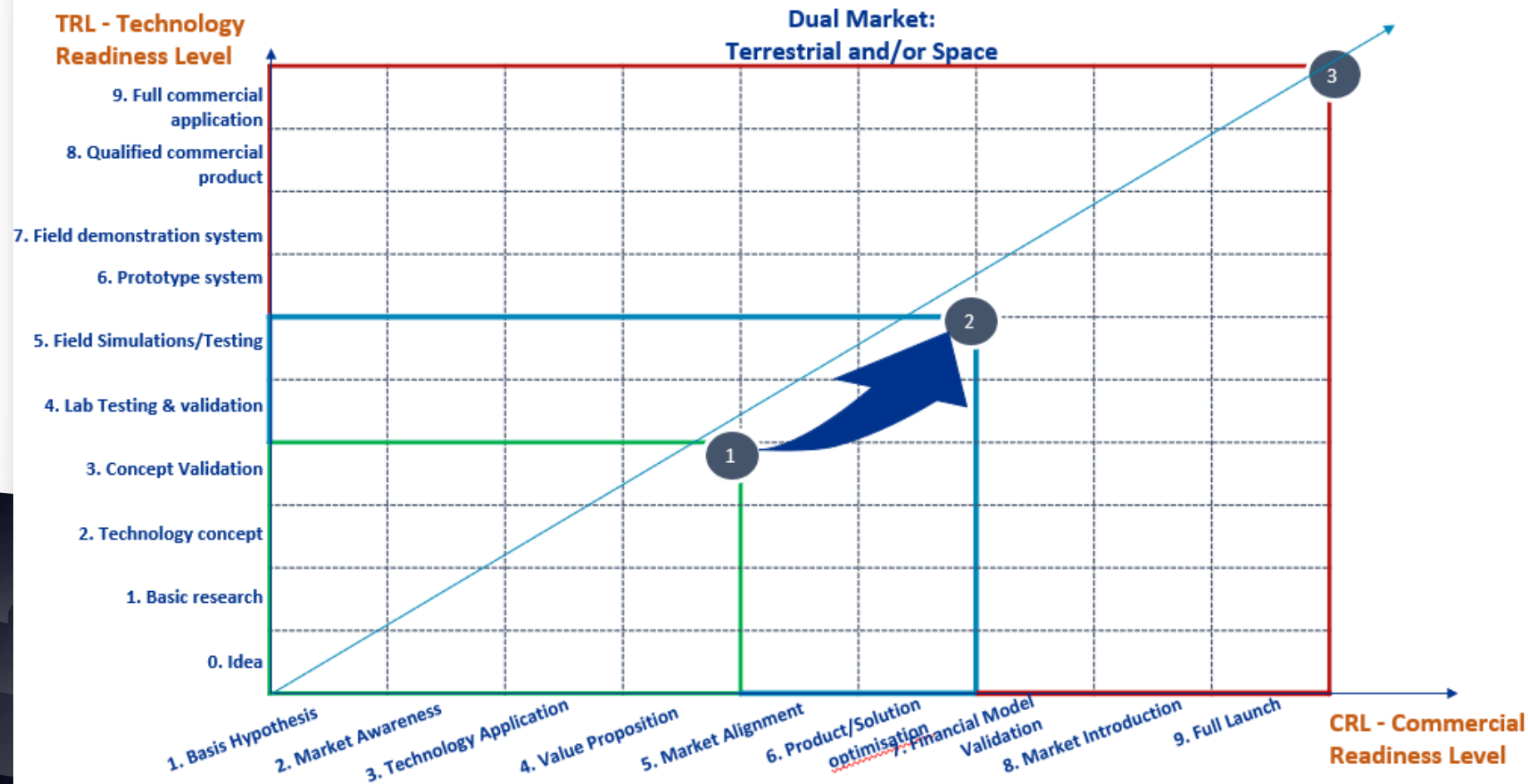


## TRL and CRL

Consolidate  
technological  
proposal into a  
Technology  
Business Solution

What do you need to  
proof & start your  
Project

Who are the  
Targeted  
Customers / End  
users



## Three phases



## 1. Anisoprint *ISRU 3D Printing*



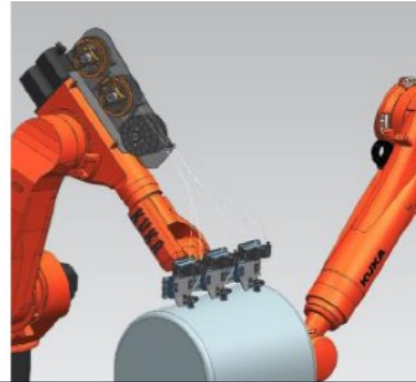
el)

PROM IS



## LARGE-SCALE INDUSTRIAL (development)

PROM PT



## Adventus Interstellar

Ultra-Low-Cost Space Deployment Services

## 2. Adventus Interstellar *Interplanetary lander*



## SSP1 - 2022



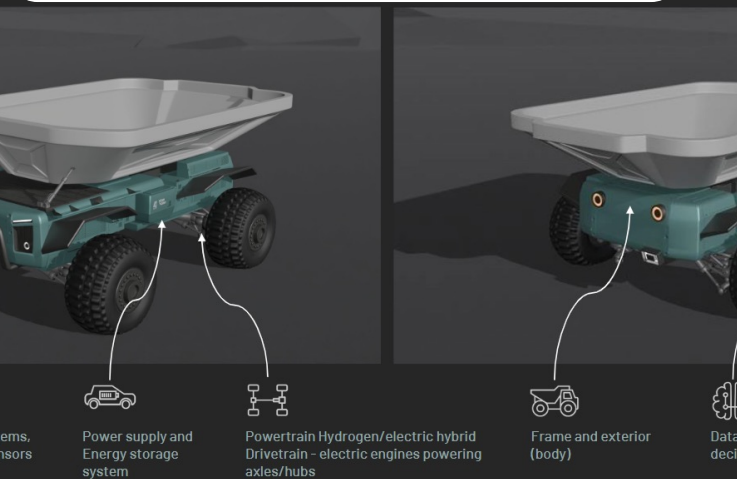
## 3. Astroport Space *Lunar Landing Pad*



## 5. Orbital Recycling *Metal extraction from Debris*

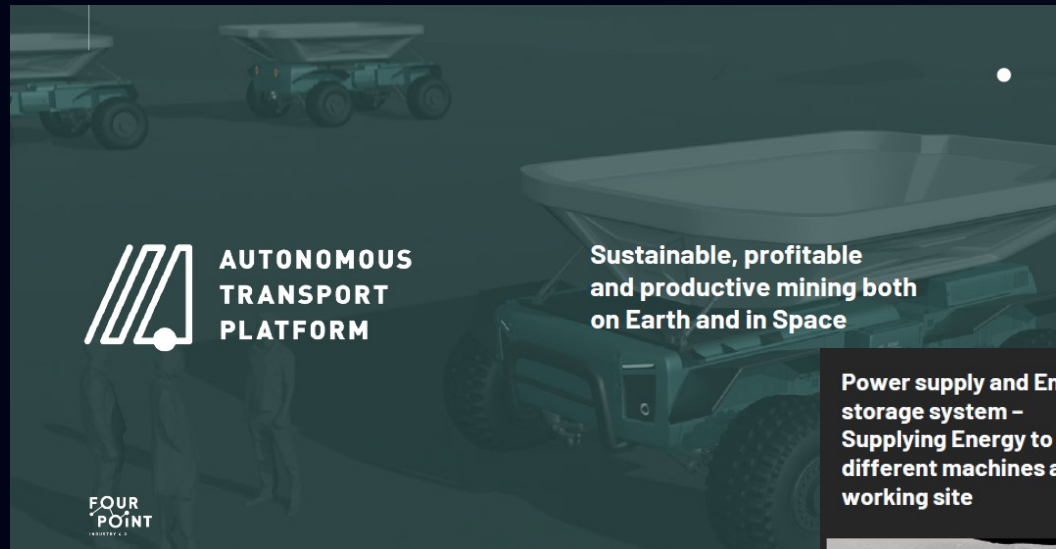


## 4. Four Point Space *Autonomous Transport Platform*





## SSP1 - First Cohort (2022)



- ATP - **A**utonomous **T**ransport **P**latform
- Operations on **E**arth and **S**pace
- Web-based application RSOM (**R**emote **S**ensing for **O**pencast **M**ines)
- **S**pace **S**ystems for **A**utonomous **C**onveyance

**Power supply and Energy  
storage system –  
Supplying Energy to  
different machines across  
working site**



Lunar battery carrier with  
robotic arm - 550kg +  
1000kg load

**Regolith cartridge carrier  
(Astroport solution)**



Lunar container carrier in  
cooperation with Astroport  
(4x containers + robotic  
arm) - 1000kg + 1700kg load

**Combination of battery  
extender and payload  
carriers**



Lunar container carrier in  
cooperation with Astroport  
(4x containers + robotic  
arm) eighth shelves for  
batteries - 1000kg +  
22000kg load

**Moon Hauler**



Lunar with open dumper -  
1750kg + 5000kg load

**Extra: Earth Hauler**



Terrestrial with open  
dumper - 5000kg +  
20000kg load



## SSP1 - First Cohort (2022)



Marek Wilgucki

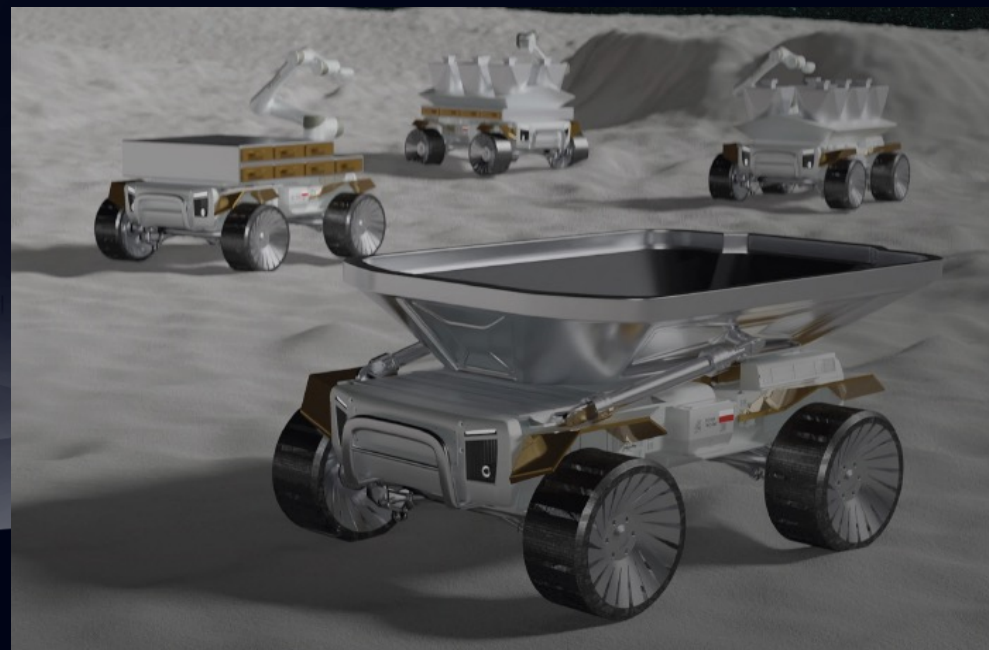


Miłosz Małachowski

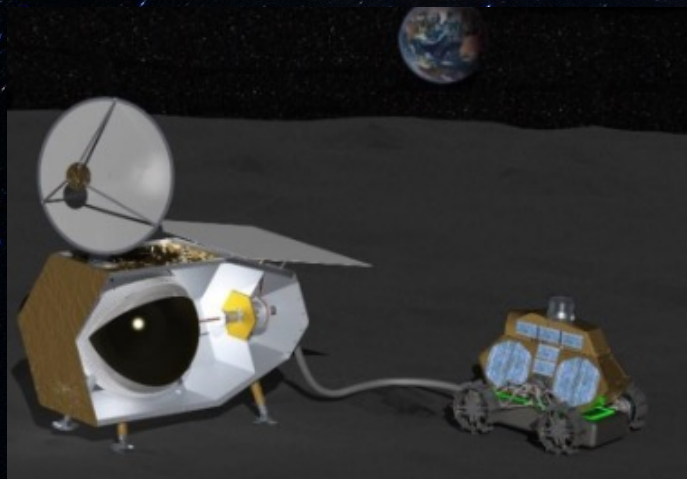


Oskar Fryckowski

- Four Point Space activities in Luxembourg (03 2023)
- Local SME supports
- Commercial Partnerships with Terrestrial industrials



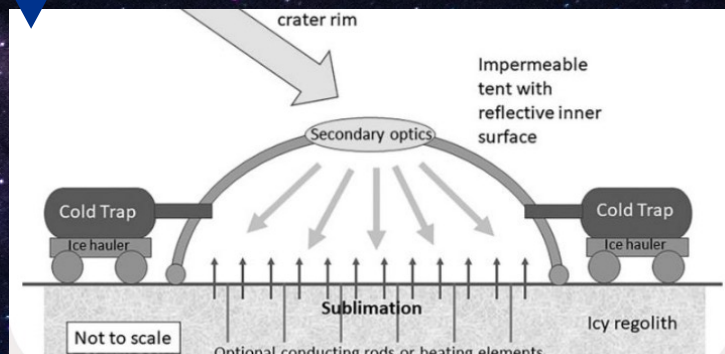




**1. Lunar Outpost**  
*Thermal Energy Provider*



**4. Terra Luna Resources**  
*Water Purification*



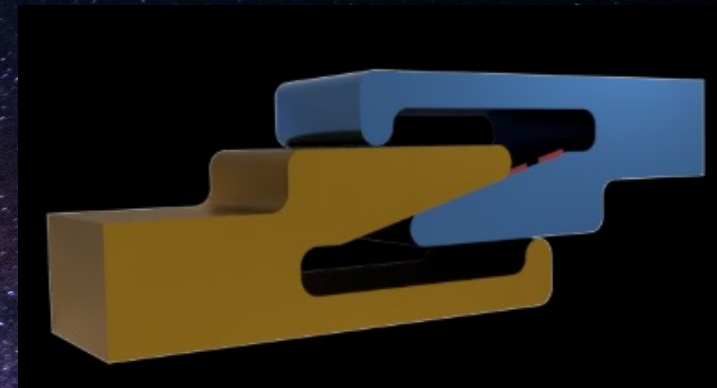
**SSP2 - 2023**



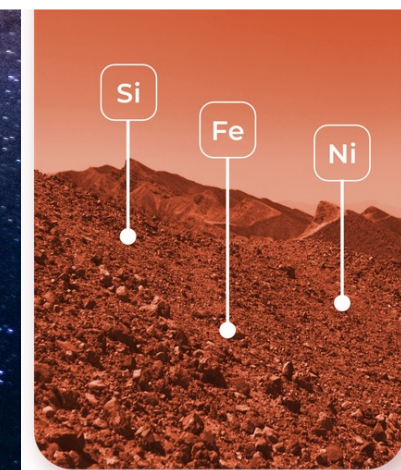
**3. Orbital Assembly**  
*In-space Waste Recycling*



**2. Aurora-Connect**  
*GDPPC - Connectors*

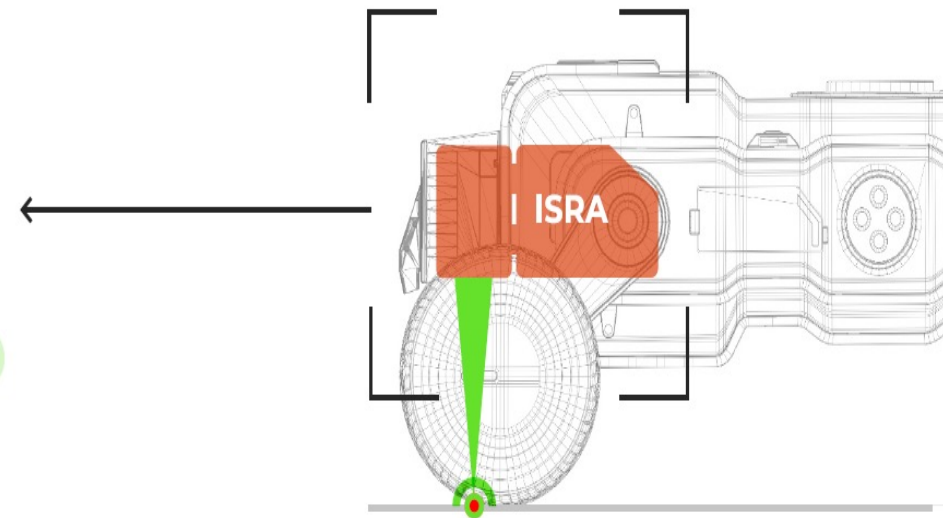
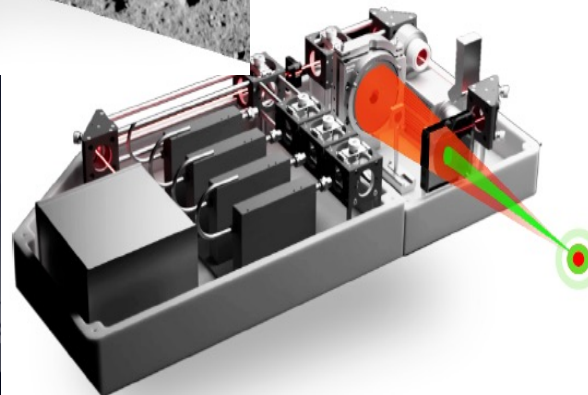
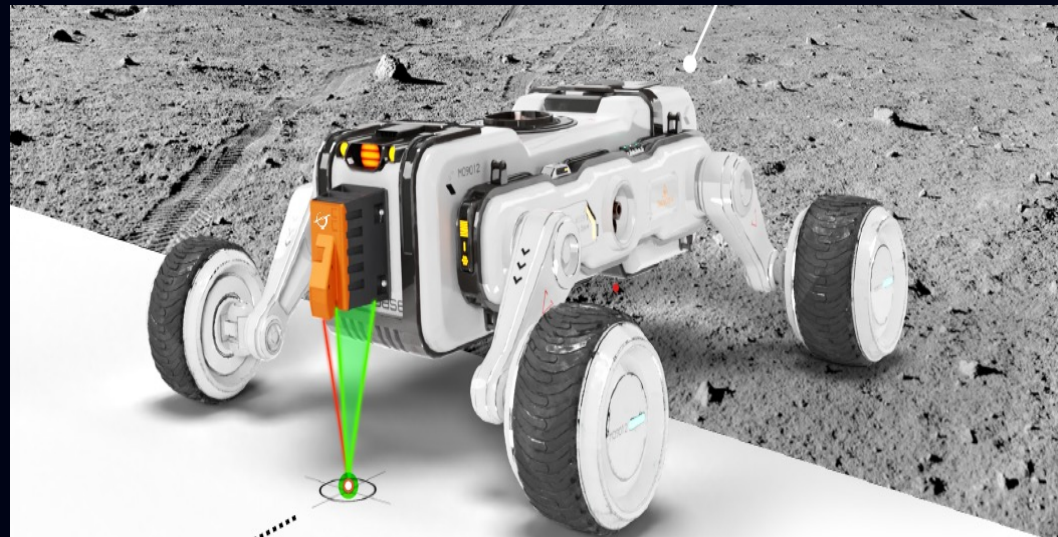


**5. Lightigo Space**  
*Optics and materials analysis*





## SSP2 – S1 2023



- Resources Prospecting & Materials Characterization
- ISRA – In-Situ Resource Analyser
- Laser spectroscopy payload for lunar exploration
- LIBS – Laser-Induced Breakdown Spectroscopy

## SSP2 – S1 2023

- Lightigo Space activities in Luxembourg (09 2023)
- Local SME supports
- Commercial Partnerships with Terrestrial industrials



**Pavel**  
Scientific director



**Marek**  
Business director



**Jan**  
Optical engineer



**Patrik**  
HW and SW engineer



**Jozef**  
Scientific supervision

**June 2023**

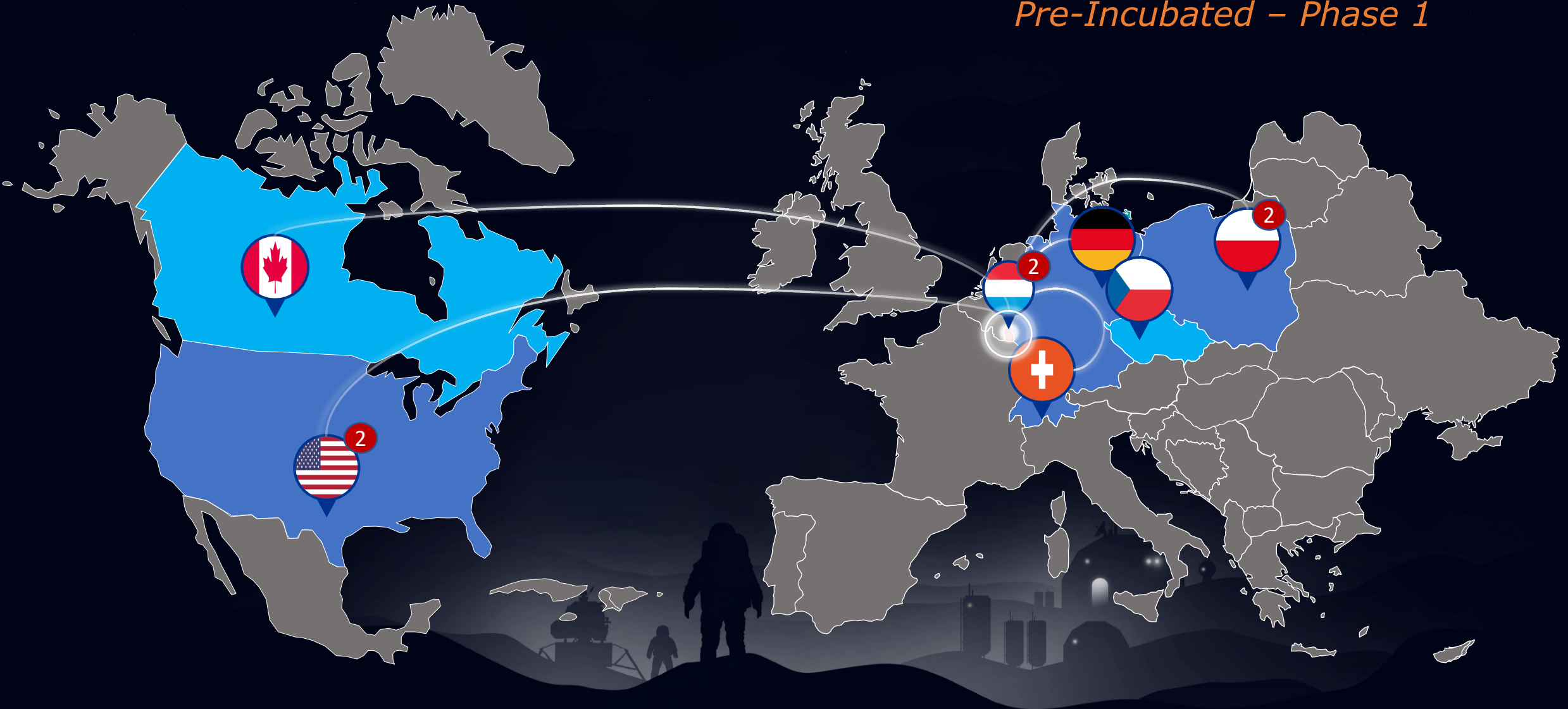


# Worldwide Incubation Programme



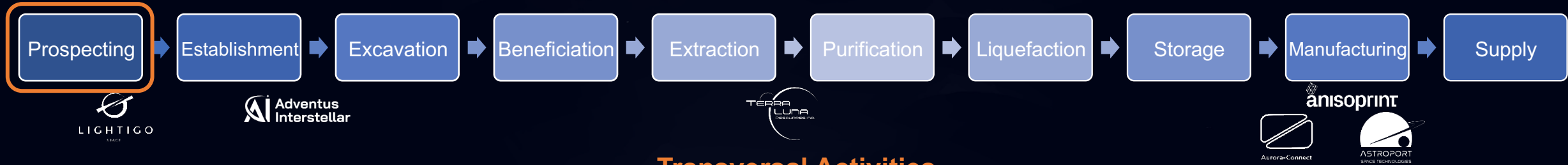
June 2023

## Pre-Incubated – Phase 1



June 2023

## Primary Activities



## Transversal Activities

(Autonomous) Transportation

FOUR POINT

Waste Management/Recycling

Orbit Recycling  
Wertstoff aus dem All

ORBITAL  
ASSEMBLY

Communication & System Navigation

Robotic Systems

FOUR POINT

Lunar Outpost™

Energy & Power

Lunar Outpost™

## Call for Applications

Space Resources Utilization (SRU)

<5 years Incorporation

Entrepreneurial & Innovative  
consolidated teams

Mid-term sustainable business

Apply to ESRIC SSP

Business in Luxembourg (Phase 2)



June 2023



## Commercial Gateway toward the Moon



Up to **two** years of business **incubation** at ESRIC



**Legal** and **IPR** Advice



**Workshops** and **Trainings**



**Technical support** from leading experts from ESA and ESRIC



Access to business partners  
**capabilities**, **Labs** and **networks**



**€200 000 funding** for product and IP development \*




**Business support** from leading experts from ESA and ESRIC



Fundraising **guidance** and opportunities



# ESA's Commercialization Network

 **Φ LAB NETWORK**  
(coming soon)

ESA-wide coverage in multiple Member States

Ground-breaking research, driving commercial technologies

For PhDs and researches



**BUSINES INCUBATION**

**25** Centres  
>80 locations

**200** new startups p/y


**1250** startups selected



**TECHNOLOGY BROKERS**

**7** Technology Brokers

**404** Technology Transfers



**PARTNERSHIPS**

For Entrepreneurs, Corporates, Institutes, and Business Schools

Supports startups, alumni and newcomers

Connecting to current & future decisionmakers





Cornelis J.J. Eldering  
Head of ESA BIC & Φ-LabNet Office (CIP-CB)  
ESA Commercialisation Department



ESA UNCLASSIFIED – For ESA Official Use Only



THE EUROPEAN SPACE AGENCY

## Welcome to the European Space Resources Innovation Centre

Unique of its kind, ESRI aims to become the internationally recognised centre of expertise for scientific, technical, business and economic aspects related to the use of space resources for human and robotic exploration, as well as for a future in-space economy.

ESRIC partners with public and private international players in the field in order to create a hub of excellence for space resources in Europe.

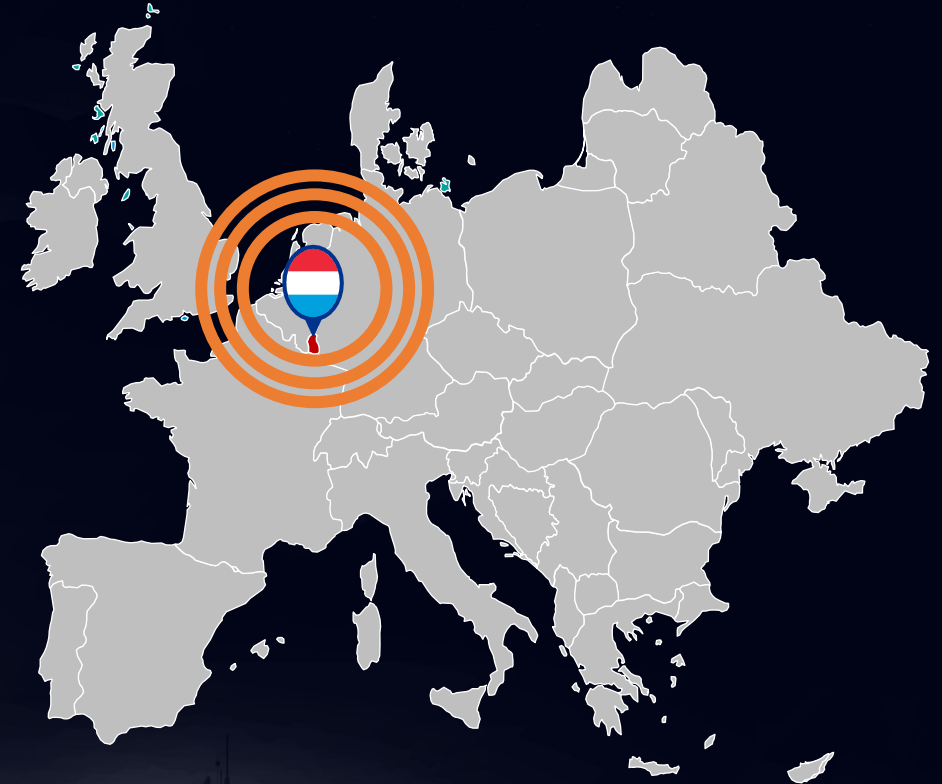
ESRIC's activities are based on four main pillars: space resources research and development; support for economic activities; knowledge management and community management.

## Research

Research is at the heart of ESRI's mission to build a future in-space economy. ESRI's world-class labs and testing facilities attract talent and expertise from around the globe to undertake pioneering R&D, here in Luxembourg.

## Commercialization

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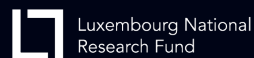


**Call for Applications (SSP3) - Open until 30 June 2023**

**June 2023**



# ESRIC research network



## Sustainable ISRU

1. Regolith beneficiation
2. Process optimisation
3. Recycling of end-of-life equipment
4. Environmental impact and legacy



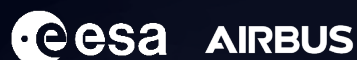
5. Geology and geospatial characterization of lunar resources
6. Plasma-enhanced hydrogen reduction of regolith
7. Plasma treatment of regolith for manufacturing
8. Resource-efficient optimization of reversible fuel cells
9. Additive manufacturing with processed regolith



10. Purification of oxygen and water



11. Fluidized-bed hydrogen reduction of ilmenite
12. FFC molten salt electrolysis

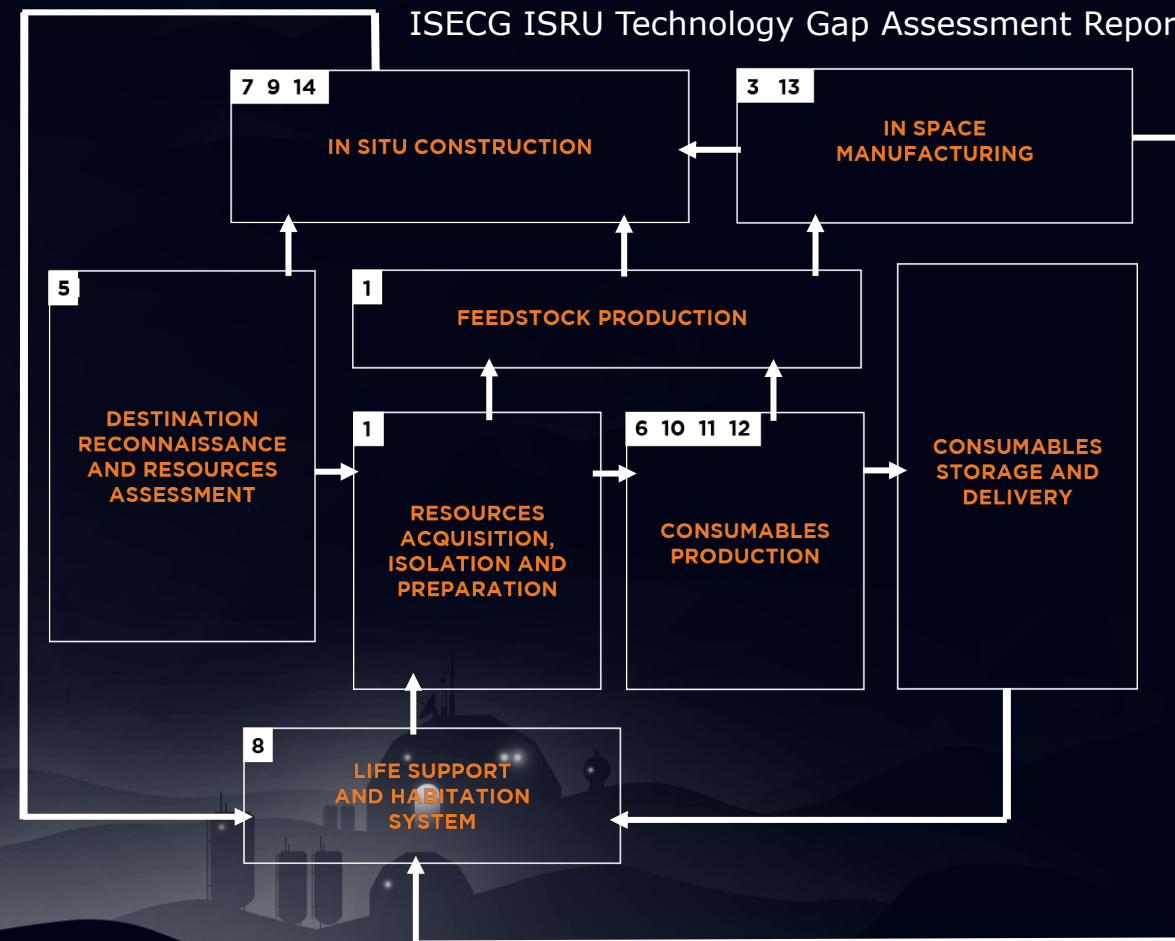


13. Metal recovery from oxygen production for 3D printing



14. Microwave sintering of regolith

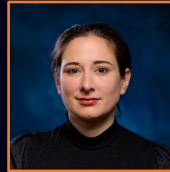
## ISECG ISRU Technology Gap Assessment Report



June 2023



## ESRIC Experts (Research & Innovation Lab)



And more

## Partners



## Stakeholders

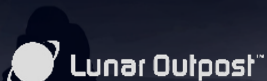


LUXEMBOURG  
SPACE AGENCY

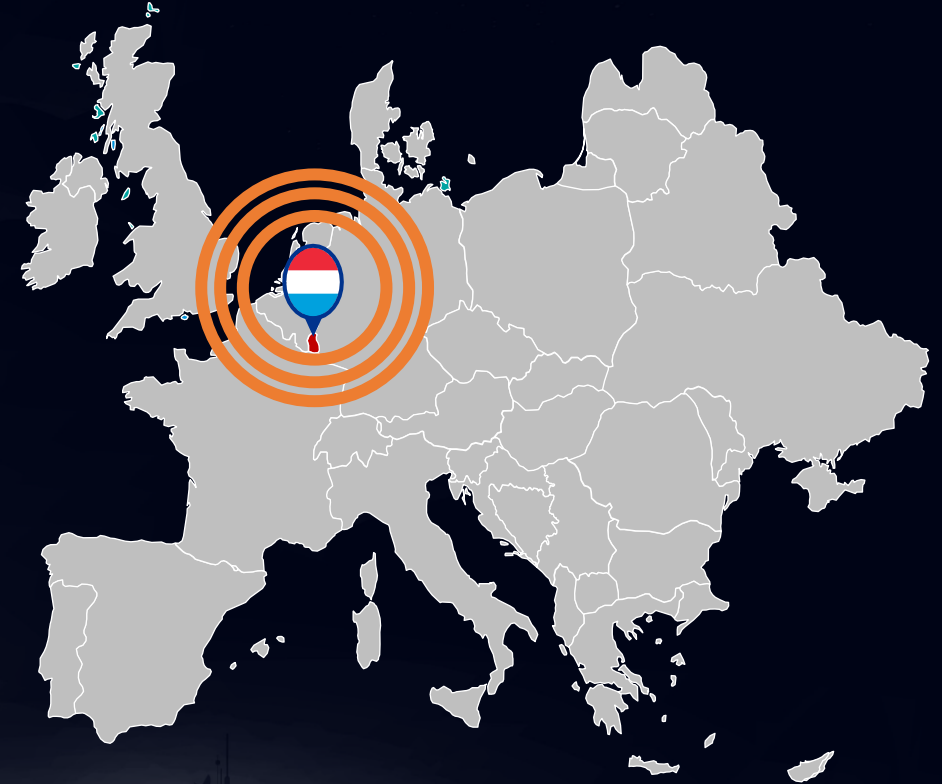
LUXEMBOURG  
INSTITUTE OF SCIENCE  
AND TECHNOLOGY



## Start-ups



June 2023



***WE ARE HIRING - Business Acceleration Expert***

**June 2023**



# Thank you

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[www.esric.lu](http://www.esric.lu)

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SPACE AGENCY



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**technoport®**  
technology business incubator