HELIOS

DARPA 10-Year Lunar Architecture (LunA-10) TA-1

Oxygen Production from Lunar Regolith

LSIC Spring Meeting

April 23 - 25, 2024

HOW WILL WE GET BACK TO THE MOON TOGETHER?

HELIOS

- Helios is developing novel technology for the direct production of oxygen out of lunar regolith, where it is both ubiquitous and 42% of the total regolith weight.
- Helios's technology does not require consumables brought from Earth.
- Technology performs at a lower temperature than direct Molten Regolith Electrolysis (MRE).
- Produces high purity oxygen (above 99.6%) by physically separating the oxygen creation zone from the regolith melt zone.

What we contribute:

Oxygen gas for life support and LOX propellant

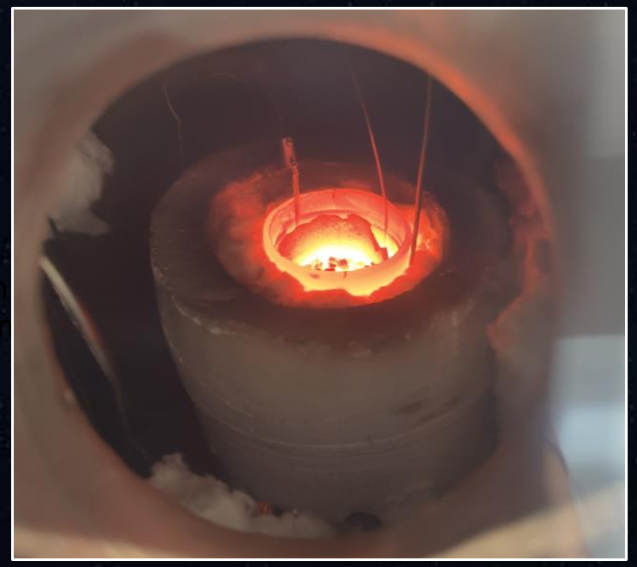
Source: [Helios]

Construction raw Materials Heated Metal and de-oxygenated regolith

Source: [https://www.freepik.com]

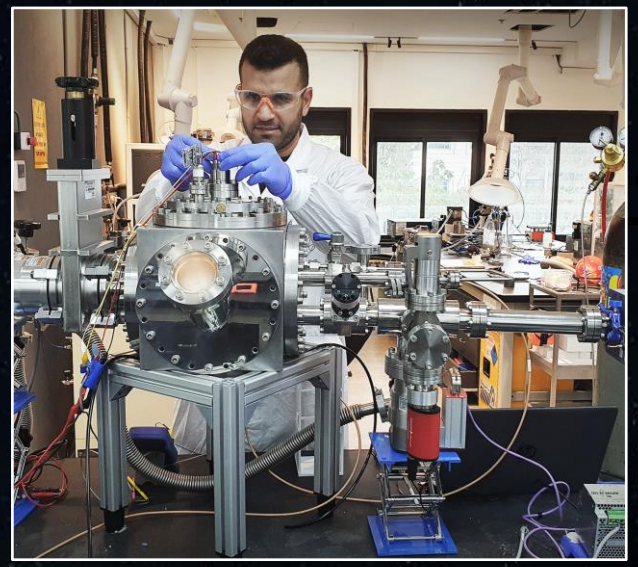
OUR TECHNOLOGY

- After years exploring MOE, Helios gravitated to developing cells based on solid-oxide electrolyzer cell (SOEC) technology.
- Currently, Helios is focusing on developing "scaleup friendly" SOEC tubular cells.



Source: [Helios]

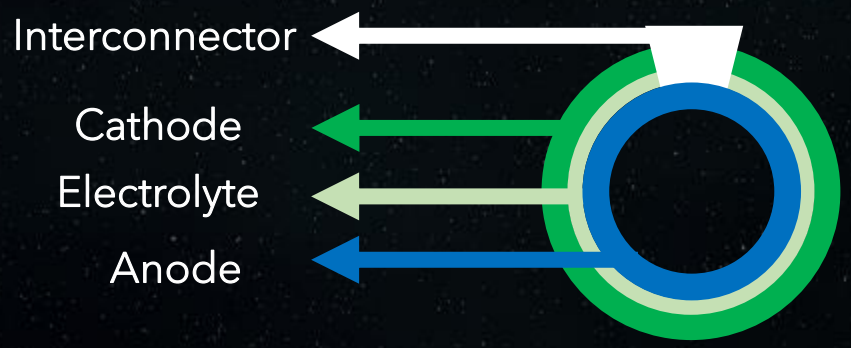
Maturing technology



Source: [Helios]

Monitoring abilities and upscaling

Tubular cell Top view



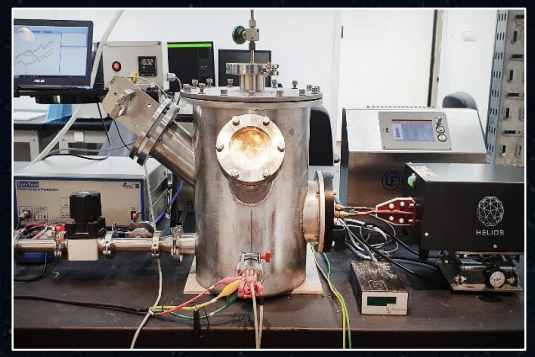
Source: [Helios]

OUR SCALE-UP APPROACH

Timeline

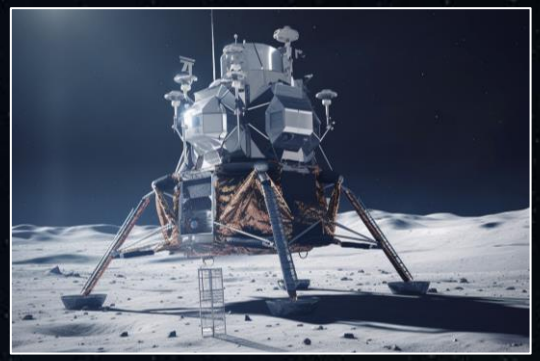
2022 — 2023 — 2028 — 2030 — 2035

MVP in Lab on Earth



Source: [Helios]

MVP on the Moon

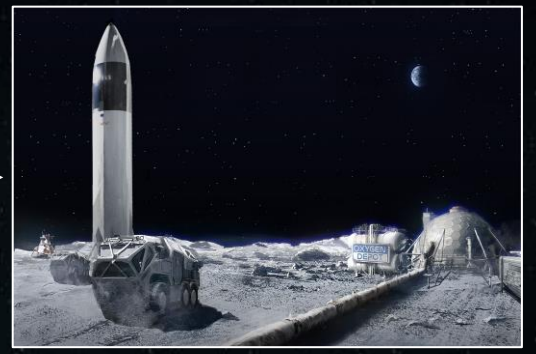


Source: [https://www.freepik.com]

Maximum Performance Unit (MPU) on the Moon

Source: [https://www.freepik.com]

Oxygen Production Plant (MPUs) on the Moon

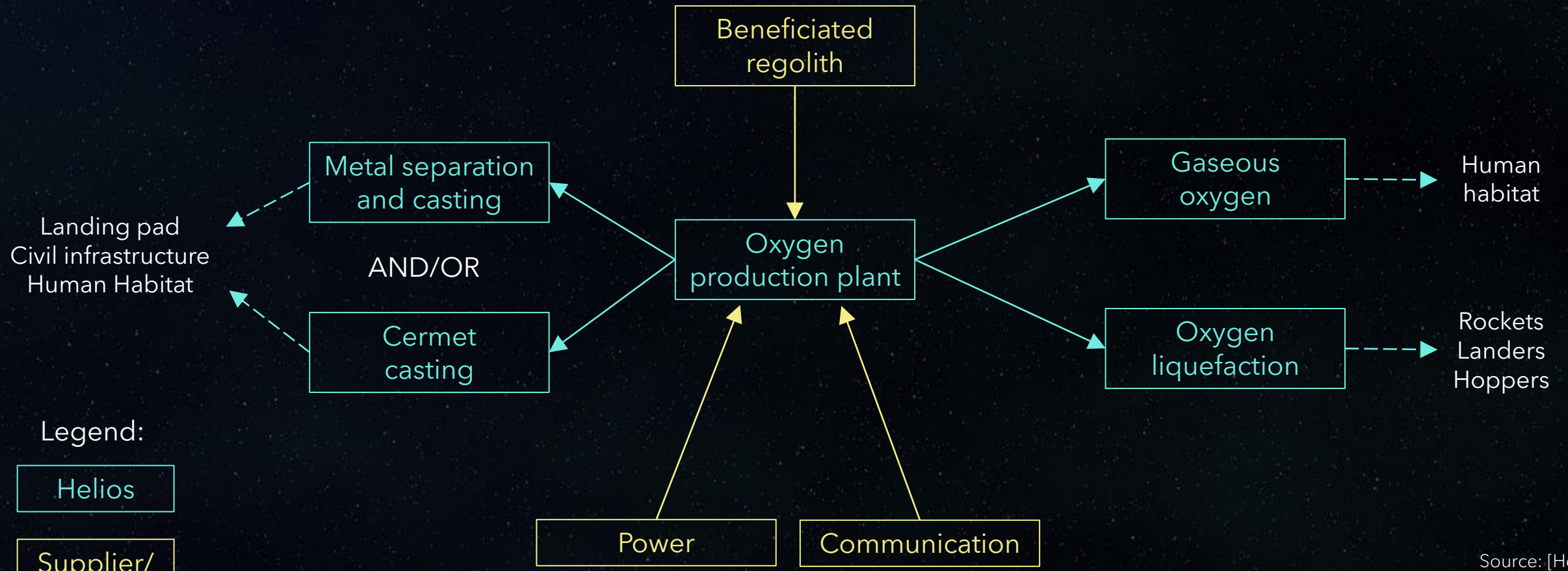


Source: [Helios]

10^{-3} — 10^{-1} — 10^{2} — 10^{3} — 10^{5}

Kg O_2 per month

OUR INITIAL INTEGRATED SYSTEM CONCEPT



Source: [Helios]

FROM MVP TO ROBUST OXYGEN PRODUCTION PLANT

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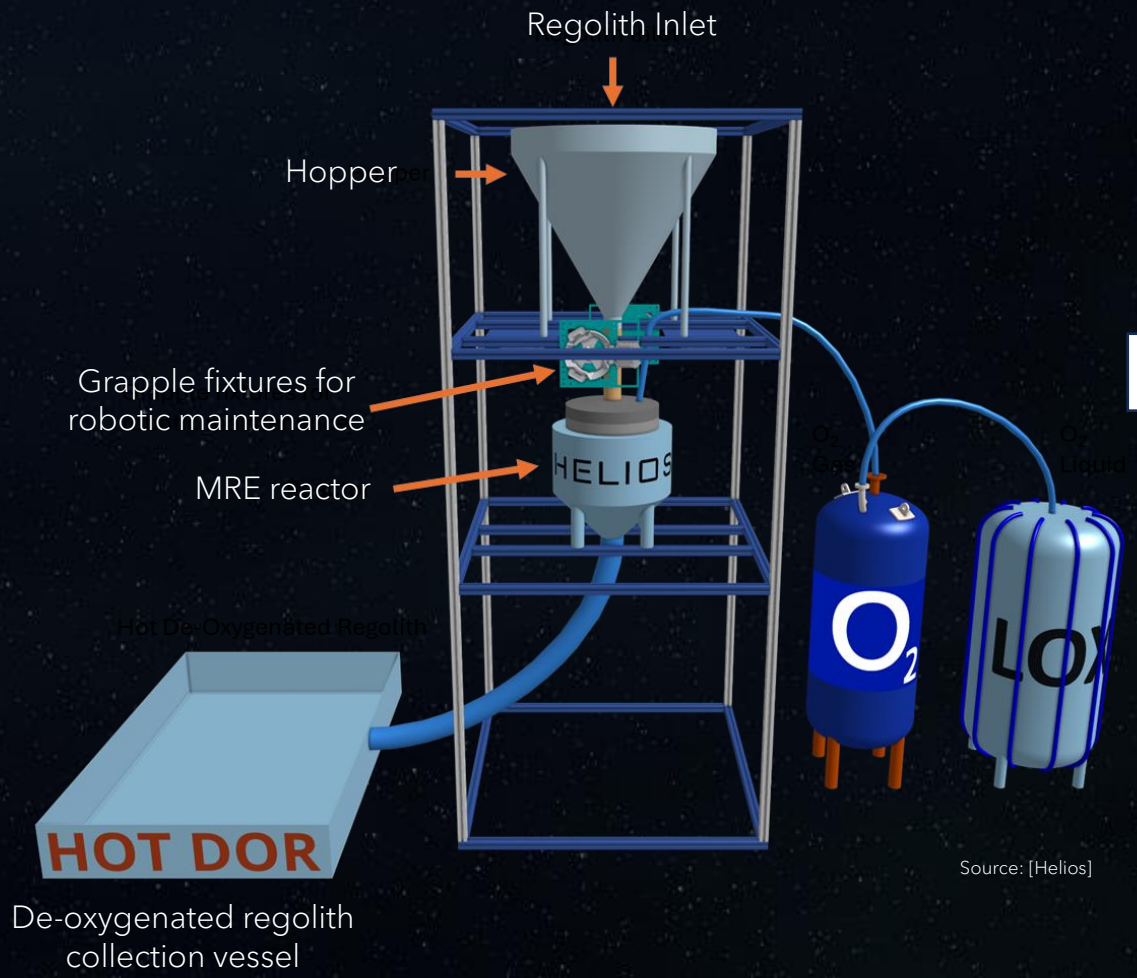
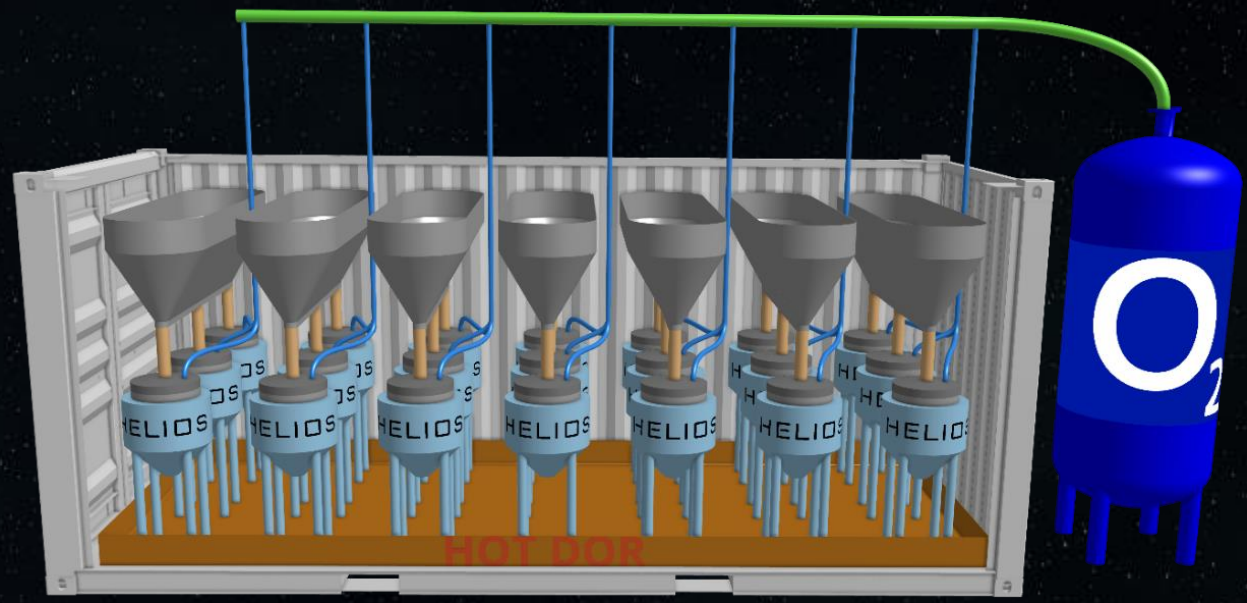
250 Kg/month crew life support system



Source: [Helios]

~120 ton/month container equiv. system



Source: [Helios]

OUR OPPORTUNITIES AND CHALLENGES

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Lunar Dust	Lunar dust, a combination of highly abrasive and electrostatically charged particles, poses a significant threat to the functionality and longevity of any system deployed on the lunar surface
Lunar Gravity	Lunar gravity is anticipated to impact the dynamics of the molten regolith flow within the MRE reactor on the lunar surface, which must be understood to optimize reactor design and performance
System Lifespan	Unique lunar environment with periods of intense sunlight and extreme heat juxtaposed with cooled lunar nights devoid of sunlight will impact the activity vs. stability of a lunar MRE system
Standardization	Standardization of system interfaces (regolith handling, power, comms etc.) ensures different systems work together seamlessly, simplifies maintenance, and reduces risk, paving the way for a robust and sustainable lunar future.
Economics	To achieve a sustainable presence on the Moon, economics must be sustainable. For commercial companies, this means that lunar business opportunities must generate a profit and a return on investment

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Thank you!