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INDUSTRIAL ROBOTIC WORKFORCE

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LESSONS LEARNED

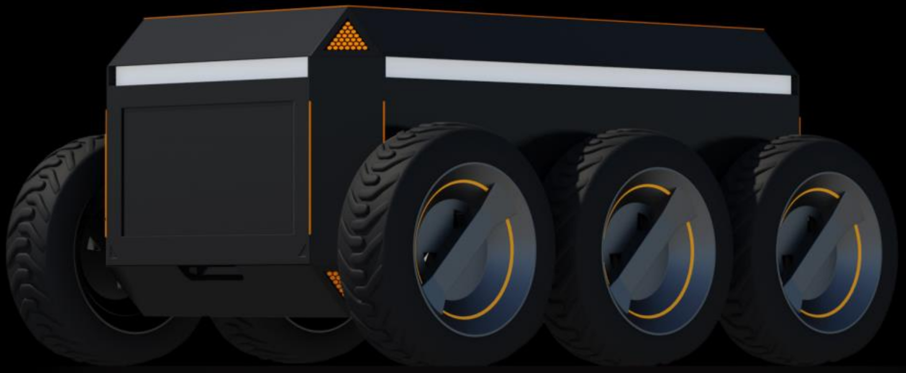
1. Proceed as if there is no such thing as a space business – it's just business
2. Don't bank on the upper quartile likelihood that your assumptions are valid
3. Building a business model on cascading best case assumptions should be a red flag
4. If you can't baseline ROI within 36 months your investment pool drops by an order of magnitude
5. If you can't reference contracted customers within 12 months of conception, your investment pool drops by a further order of magnitude

LESSONS LEARNED

IF YOU CAN'T CONVINCE A BILLIONAIRE TO FUND YOUR SPACE PROGRAM…

LESSONS LEARNED

THE ONLY OPTION REMAINING IS TO BECOME A BILLIONARE AND DO IT YOURSELF.



TOUGH JOBS ARE MADE FOR ROBOTS

We are developing
a robotic workforce for heavy
industrial jobs on Earth, Moon,
asteroids & Mars.

MILLIONS OF SMART ROBOTS

working under human supervision on- and offworld, turning the inner solar system into a better, gentler, greener place for life and civilization.

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AD ASTRA PER TERRAM ENABLING HUMAN EXPANSION OFF OUR HOME PLANET

1. Life insurance policy
2. Sustainable development on Earth
3. The new frontier

WORKFORCE FOR THE INNER SOLAR SYSTEM

SETTLEMENT HAS ALWAYS BEEN DIFFICULT

- Limited supply chain
- Harsh environment
- Forced labor

SPACE SETTLEMENT IS EVEN HARDER

1. No usable atmosphere
2. Radiation environment
3. No supply chain
4. Variable gravities
5. Biological challenges
6. No indigenous foods
7. The most expensive labor

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SPACE NEEDS TAKERS FOR TOUGH JOBS

- build landing pads
- excavate underground habitats
- extract water ice and materials
- make drinkable water, breathable air and rocket propellant
- manufacture basic structures and solar cells
- produce electricity
- …and eventually replicate themselves

CANNOT JUST EXPORT EARTH TECHNOLOGY...


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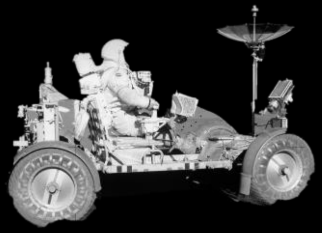
...MUST REINVENT HOW WE
MINE, PROCESS,
MANUFACTURE
AND BUILD CITIES
ON EARTH

BUILDING ON LESSONS FROM DECADES OF REMOTE AUTOMATION



1. Expensive
2. One-offs
3. Long build times

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THREE AMBITIOUS GOALS

#1:

Reduce total cost of operations 10X

We are looking for at least an order of magnitude reduction in the total cost of operations within any industrial sector.

#2:

Create fully scalable solutions

We are after a solution where everything becomes an operational cost with no/little CAPEX. Our costs will be able to scale up and down in line with size of industrial operations.

#3:

Accelerate growth of industrial productivity

We aim to create a solution that does not just establish a new static level for industrial productivity. We aim to create a solution that has inbuilt levers for continued gains in productivity for decades to come.

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FOUR DESIGN CONSTRAINTS

IDEAL SOLUTION SPACE

#1
No infrastructure
Assume we cannot build new facilities and other infrastructure, cannot access external power sources, etc.

#2
No humans
Assume humans cannot be used to perform any of the industrial functions directly, only to oversee and enable the performance of robotic workforce.

#3
No footprint
Assume we cannot use fossil fuels to power robotic operations. Assume footprint at the site of operations must return to pre-existing format

#4
No consumables
Assume we cannot bring any consumables to the operations site or use locally sourced water in the process.

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AMBITIOUS INTEGRATION REQUIREMENTS

A.I. & Computer Science

Machine learning
Virtual Assistants
Structured analysis
Knowledge representation
Workflow automation
Activity recognition
Cyber & security
Trusted systems
Data analytics
Automated reasoning
Cyber-physical systems

Space and Planetary Surfaces

Spacecraft propulsion
Modular architectures
In-space assembly
Extraterrestrial mining
In situ processing
Volatile extraction
Surface construction
Remote operations
Environmental systems
Propellant transfer
Radiation tolerant systems

Robotics & Automation

Modular systems
Manipulation
Mobility
Actuators
Automation systems
Machine learning
Perception
SLAM
Electro-active materials
Space operations
Extreme environment robotics
Teleoperations

Sensing & Interaction Devices

Multi-spectral imagers
Communication systems
Radars
Lasers
RF
Position
Tactile & Force
Physiological monitoring
Speech recognition
Perception
Visual search
Augmented reality
Object recognition

Energy & Materials

Custom polymers
Solar power
Gas separations
Efficient energy transfer
Sustainable materials
Extreme deployment solar
Resilient storage
Supercapacitors

NEW ROBOTIC GENERATION CHARACTERISTICS

1. SMALL AND ROBUST

To neatly pack into and survive launches on rockets

2. EXTREMELY ADAPTABLE

To function across a wide range of environments on Earth, Moon, asteroids and Mars without major redesign

3. SOLAR ELECTRIC POWER

To use the one sustainable power source we can count on in the inner solar system

4. AUTONOMOUS AND FAST LEARNING

To get by with machine intelligence without onsite humans to bail them out

5. MODULAR AND RECONFIGURABLE

To maximize the re-use of launched hardware as there will be no local hardware shops or Amazon deliveries (for a while)

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1. SMALL AND ROBUST

Digger bot

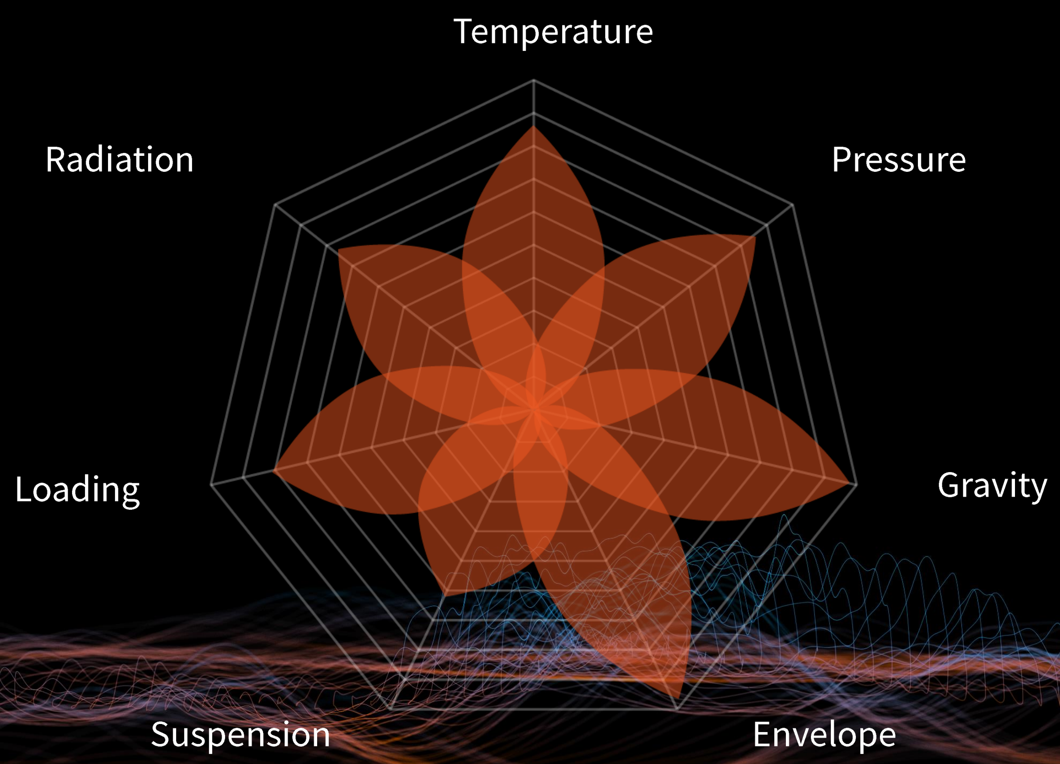
Mass: 53 kg

Size: 30x60x20 cm

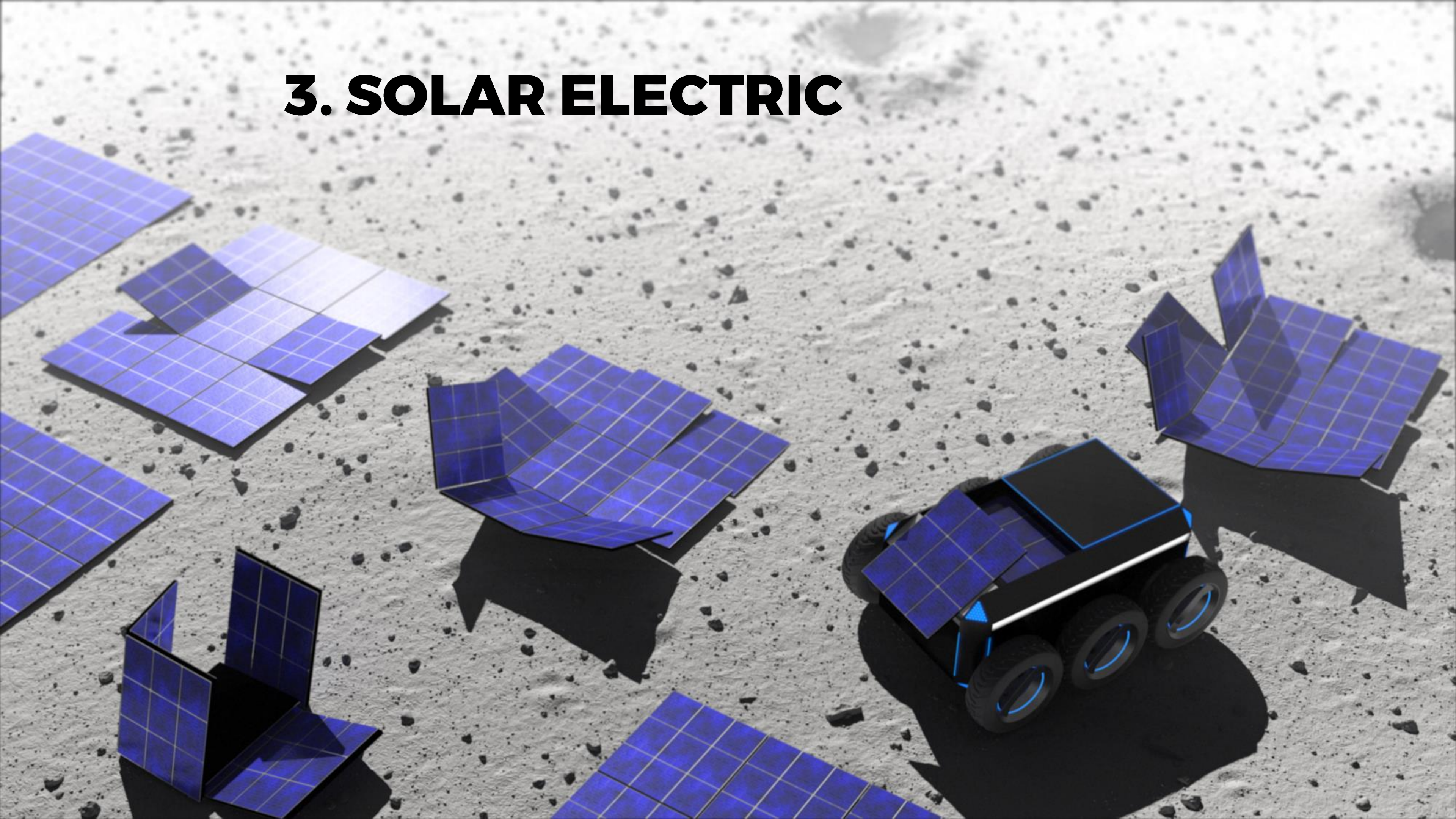
Power Capacity: 13.5 kWh

Excavation rate: 390 kg/h

2. EXTREMELY ADAPTABLE



3. SOLAR ELECTRIC



4. AUTONOMOUS AND FAST LEARNING

Types of machine intelligence learning:

- Imitation
- Deep reinforcement
- Social

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5. MODULAR AND RECONFIGURABLE

Universal platform

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OUR MASTERPLAN

1 Develop a **universal robotics platform** and build mining, construction and manufacturing robots for use cases on Earth (Genus Terra)

2 Use that platform, experience and profit to evolve terrestrial robots to do industrial jobs in **free space and on the Moon** (Genus Astra, Genus Luna)

3 Evolve lunar robots to do basic industrial jobs on **Mars and asteroids** (Genus Martialis, Genus Etiam)

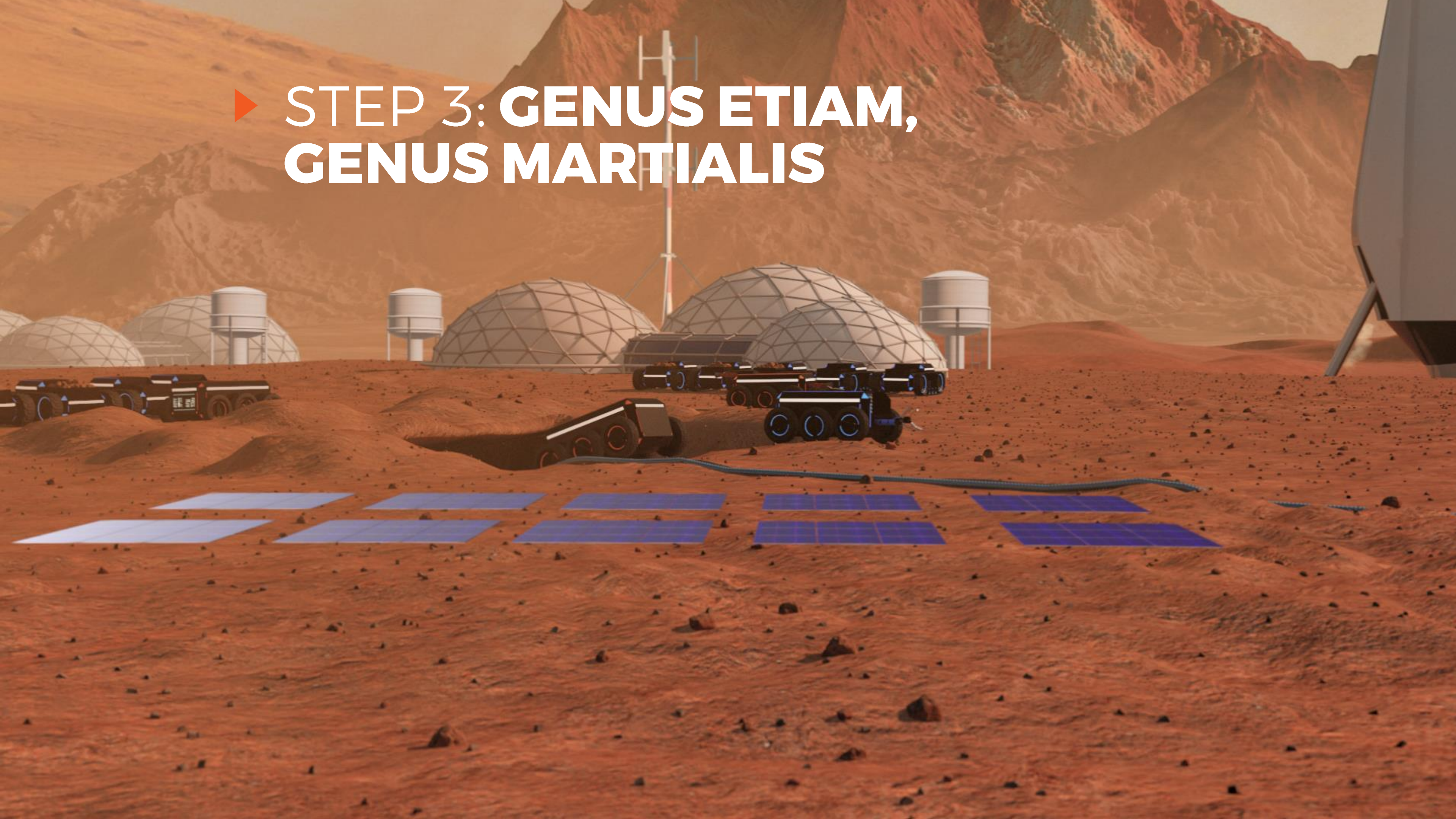
4 Evolve **robotic self-replication** with increasing capability based on using local resources

5 Build the **first offworld computer chips** and close the robotic self-replication loop

STEP 1: **GENUS TERRA**

STEP 2: **GENUS ASTRA, GENUS LUNA**

STEP 3: **GENUS ETIAM, GENUS MARTIALIS**



STEP 4: **SELF-REPLICATION**

STEP 5: **OFFWORLD CHIP**

TUNNELLING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INFRASTRUCTURE REPAIR


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LANDFILL MINING


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CONSTRUCTION


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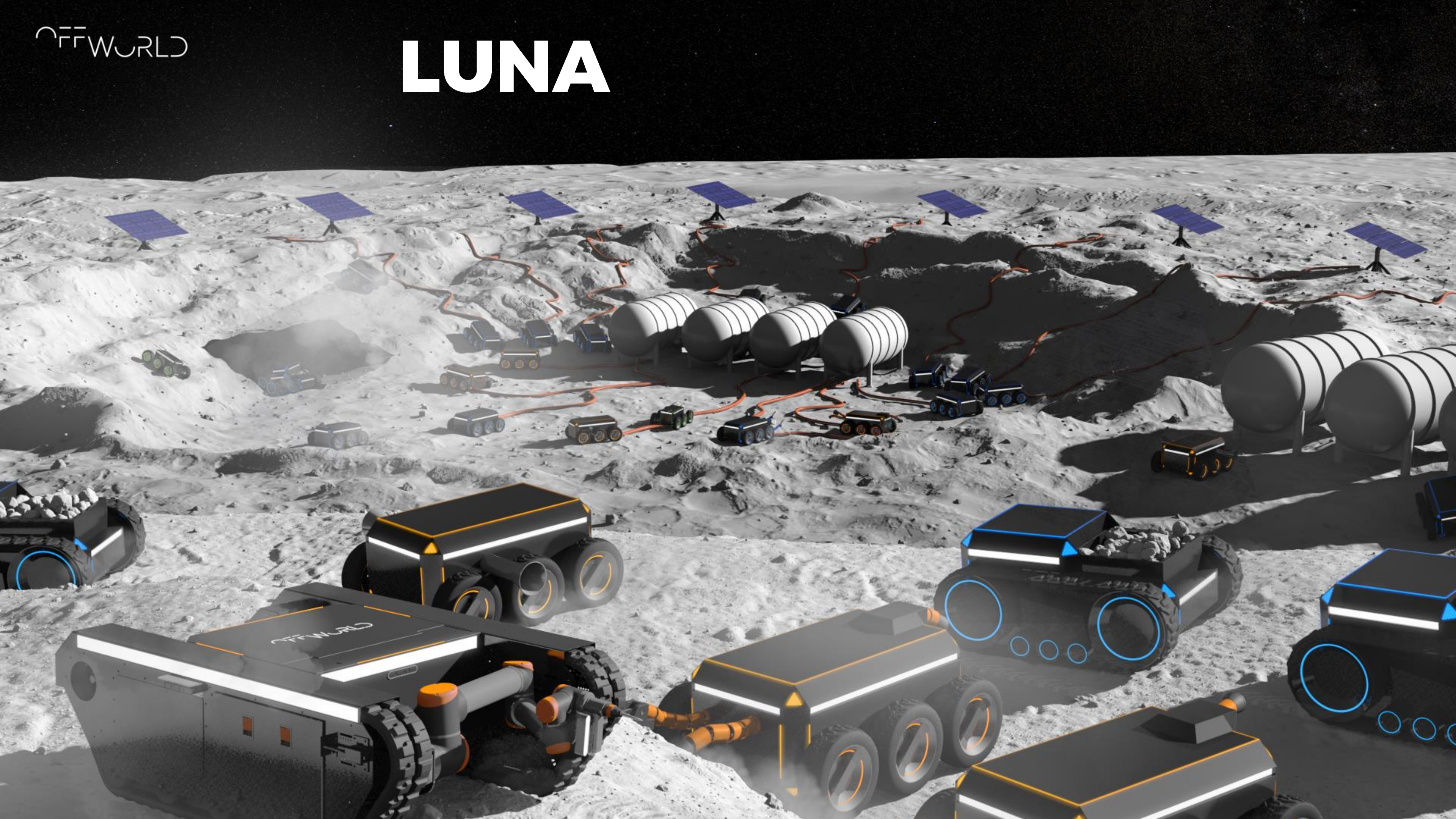
MINING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LUNA
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