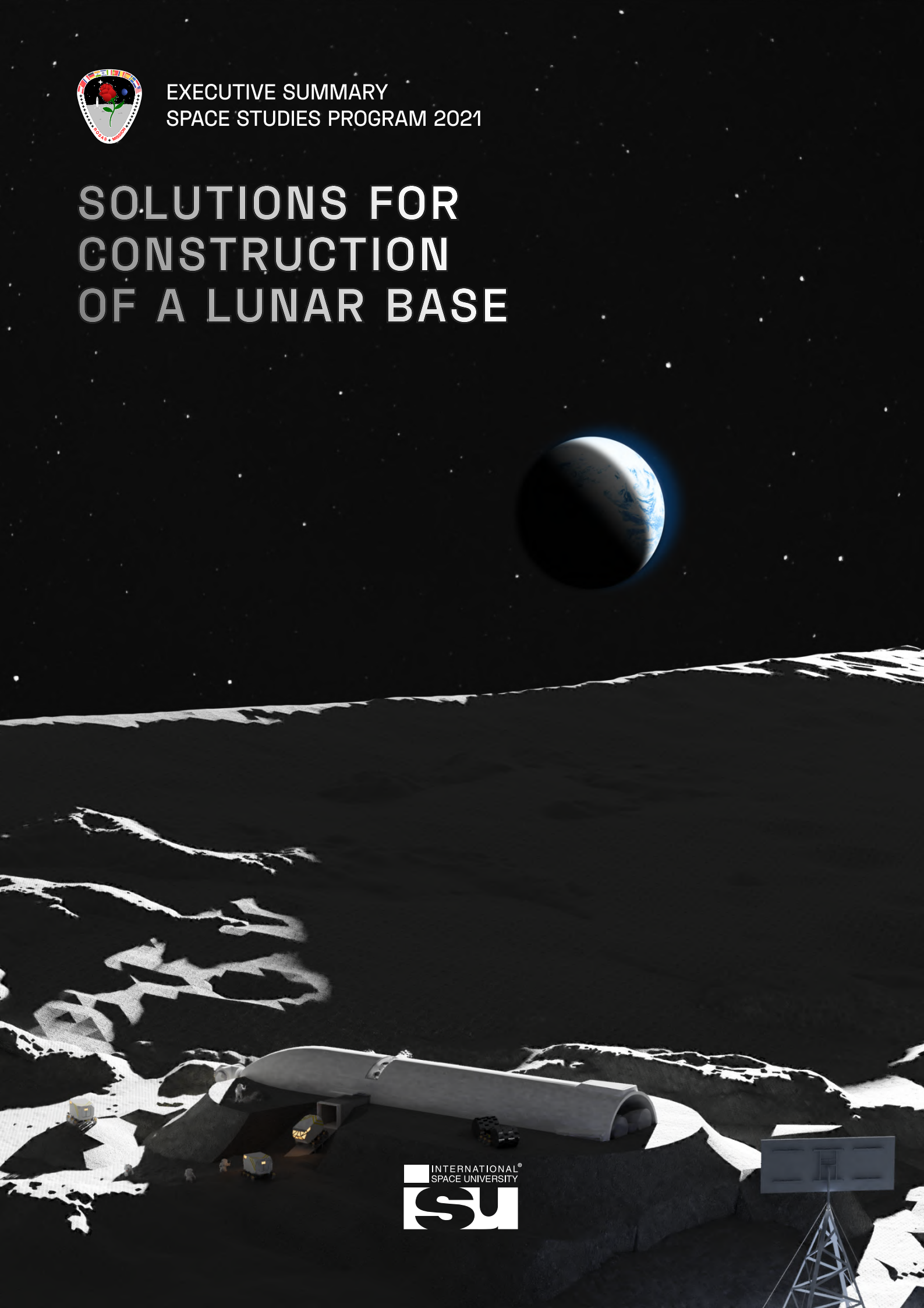
EXECUTIVE SUMMARY
SPACE STUDIES PROGRAM 2021

SOLUTIONS FOR CONSTRUCTION OF A LUNAR BASE



INTERNATIONAL® SPACE UNIVERSITY

CREATING A LUNAR BASE IN YEARS INSTEAD OF DECADES

The next step forward in space exploration is returning humans to the Moon and establishing a permanent human presence.

Sending humans to the Moon encompasses challenging environmental factors to human performance and health.

Current state-of-the-art technologies, like the Artemis program and the SpaceX Starship Human Landing System (HLS), is the inspiration of the Rosas Mission, to ensure feasibility and optimize human performance.

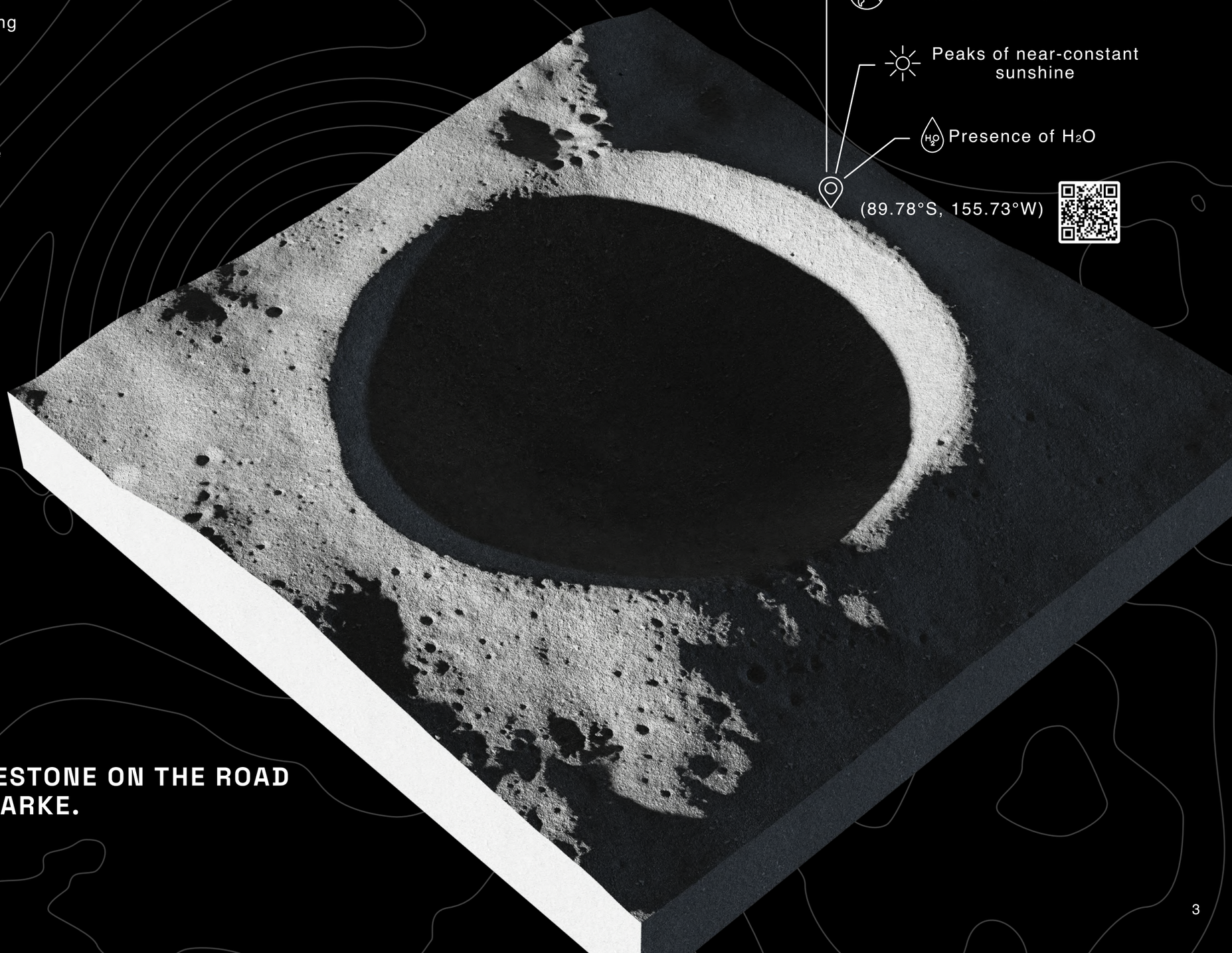
OUR MISSION STATEMENT

To develop a roadmap for the construction of a sustainable, habitable, and permanent lunar base. This will address regulatory and policy frameworks, confront technological and anthropological challenges and empower scientific and commercial lunar activities for the common interest of all humankind.

“THE MOON IS THE FIRST MILESTONE ON THE ROAD TO THE STARS” ARTHUR C. CLARKE.

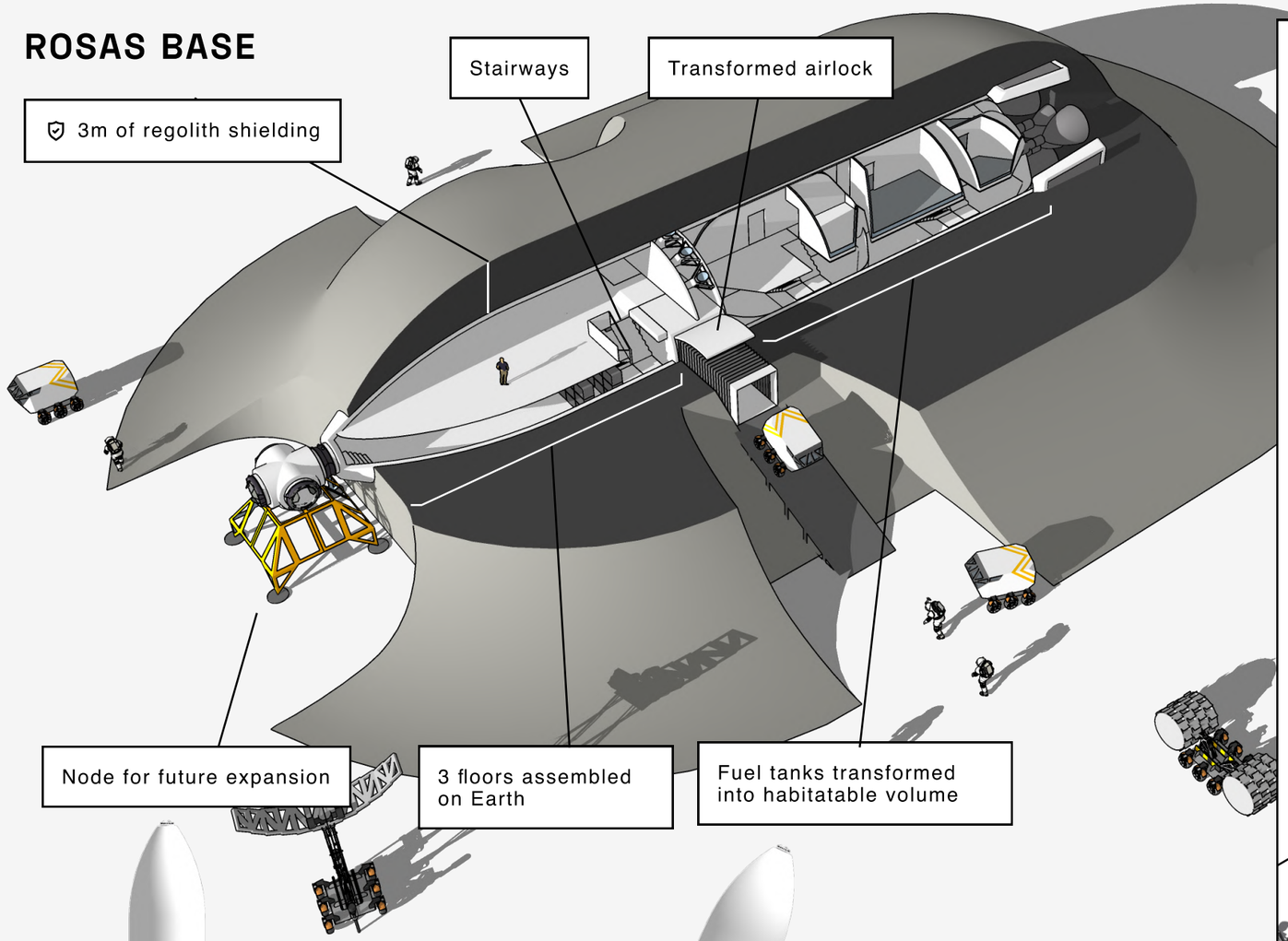
An optimal destination:

SHACKELTON CRATER



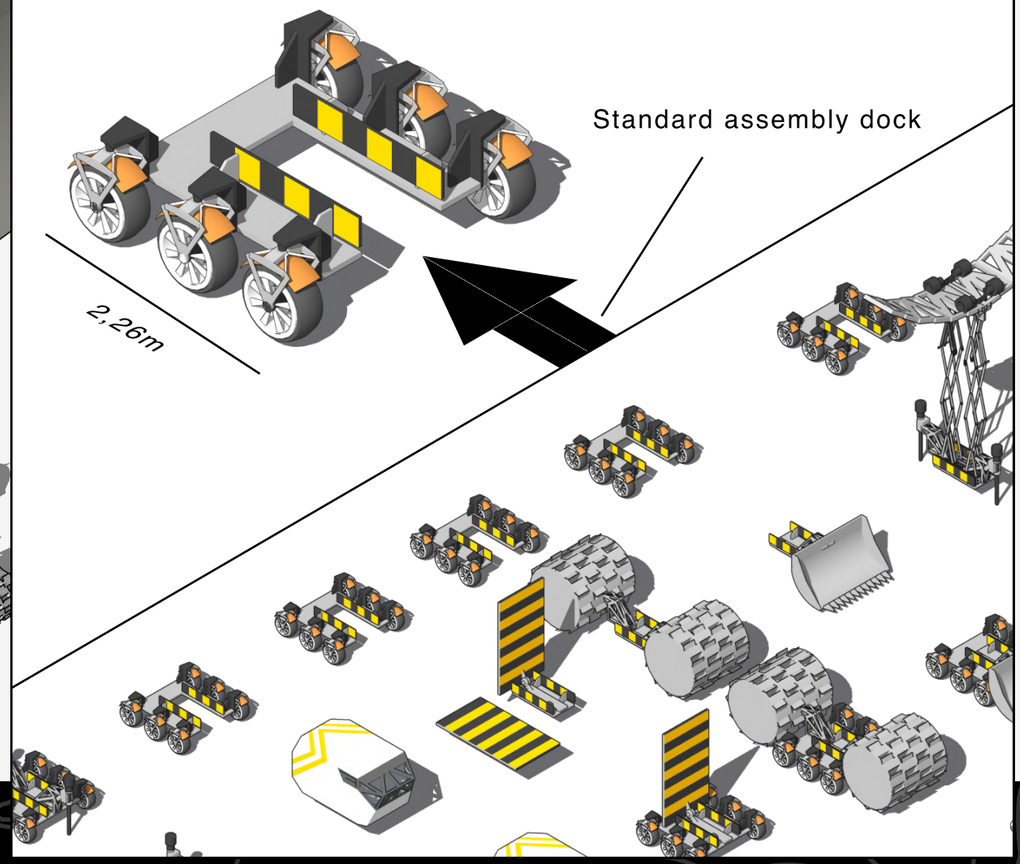
A NOVEL CONCEPT OF A LUNAR BASE

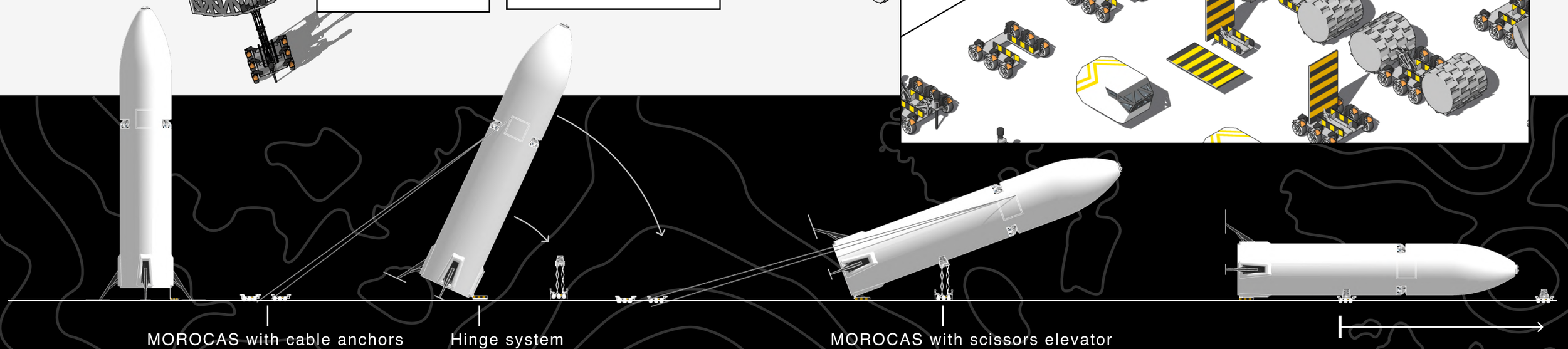
ROSAS BASE



MOROCAS

The Modular Robotics Construction Autonomous System is a modular, remotely operated, team of robots capable of preforming construction tasks





HOW TO HORIZONTALIZE A STARSHIP

CONSTRUCTION TIMELINE

Crew Mission Operations Construction crew

Starship (SS) 501: Construction crew delivery.
Will return to Earth for transportation of future crews.

Starship (SS) Rosas: Transformed into a permanent lunar base.

Unloading MOROCAS

Cut tanks

Deploy airlocks

Assemble interior

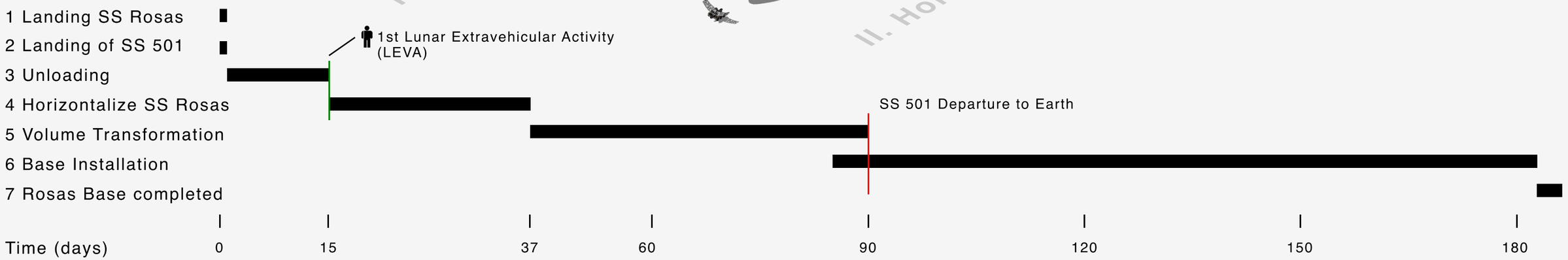
I. Landing

II. Horizontalization

III. Volume transformation

IV. Regolith coverage

CONSTRUCTION TIMELINE

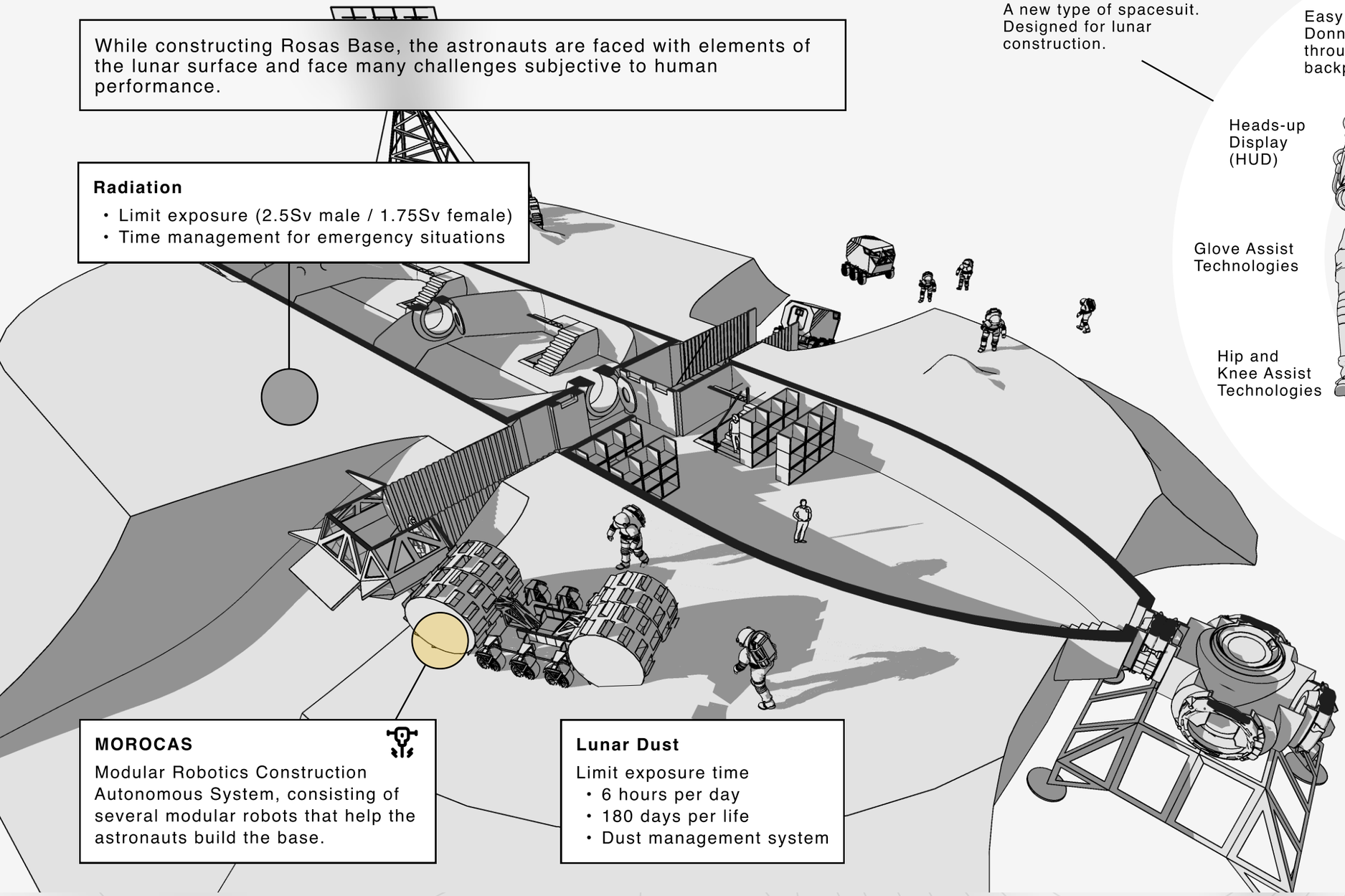


LIFE IN THE LUNAR CONSTRUCTION SITE

While constructing Rosas Base, the astronauts are faced with elements of the lunar surface and face many challenges subjective to human performance.

Radiation

- Limit exposure (2.5Sv male / 1.75Sv female)
- Time management for emergency situations



MOROCAS

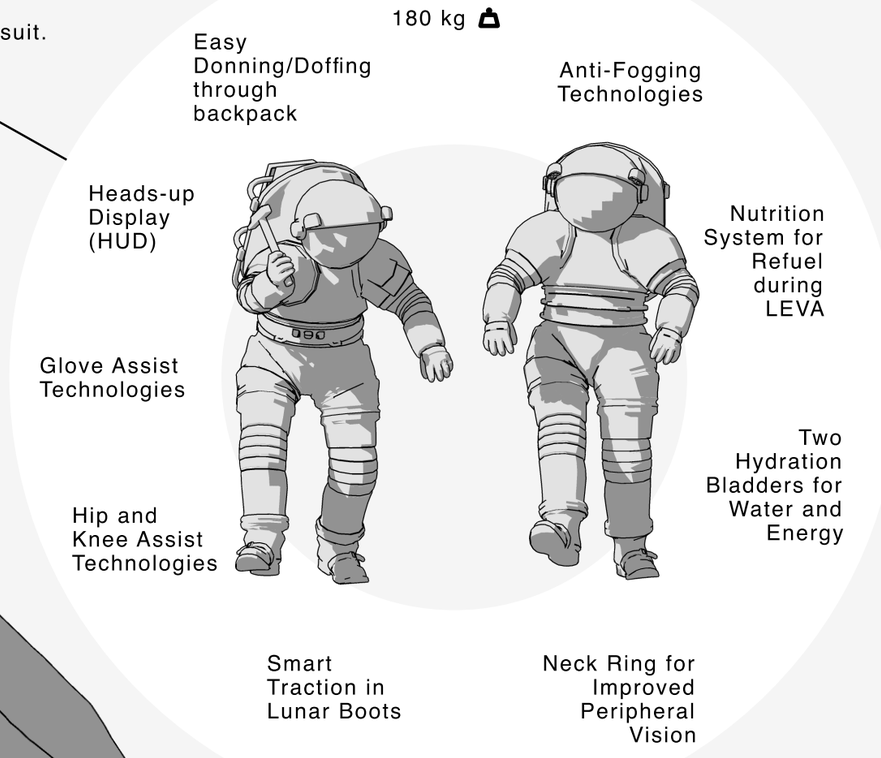
Modular Robotics Construction Autonomous System, consisting of several modular robots that help the astronauts build the base.

Lunar Dust

Limit exposure time

- 6 hours per day
- 180 days per life
- Dust management system

A new type of spacesuit. Designed for lunar construction.



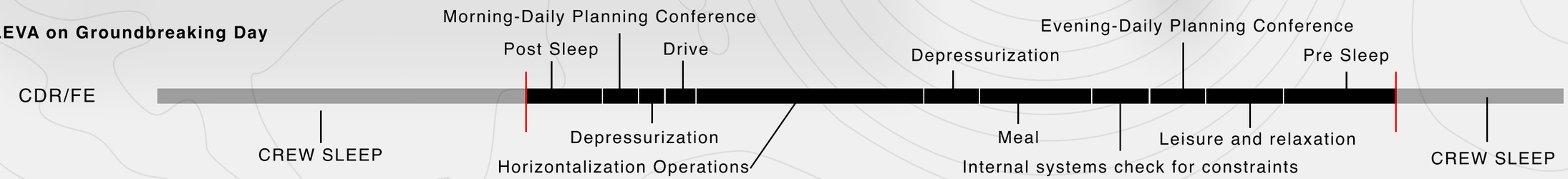
Hypogravity

- Resistance training exercise
- High-intensity interval training
- Pre-launch strength training

Crew Schedule

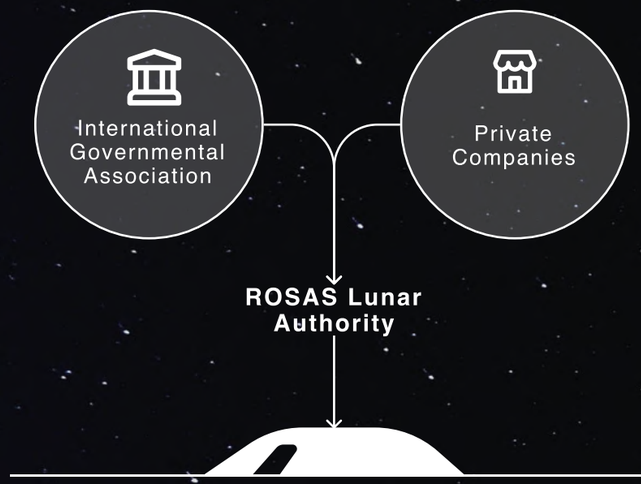
- Manage workload
- Project-focused
- Recreation
- Sleep and rest
- Crew resource management

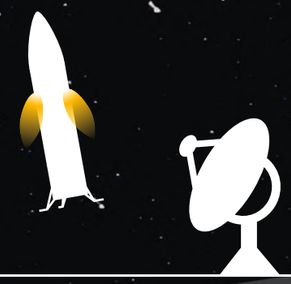
LEVA on Groundbreaking Day



THE LUNAR ECONOMY

PUBLIC PRIVATE PARTNERSHIP (PPP) STRUCTURE





A SUSTAINABLE LUNAR BASE

The birth of a new space marketplace

POLICY AND LAW

I. Compliance with International Law

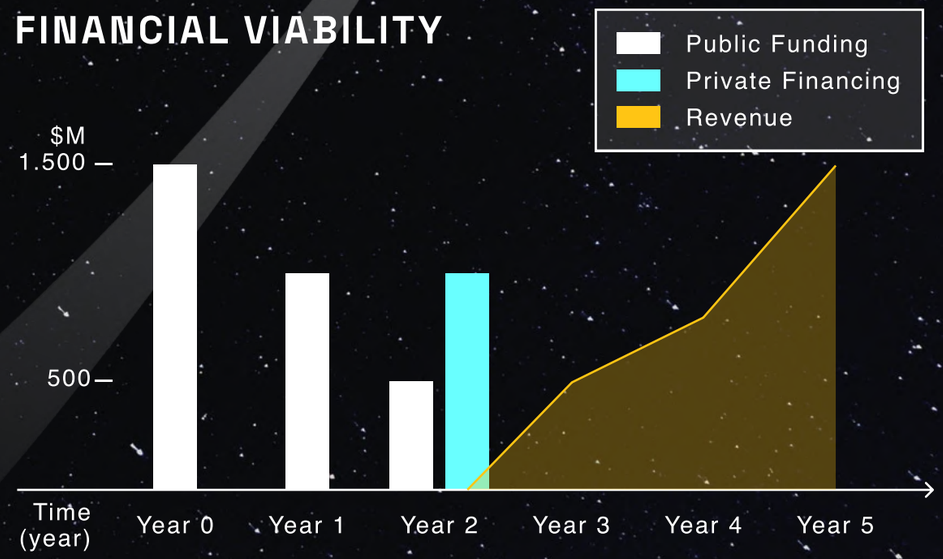
To ensure the smooth implementation of Rosas Base construction.

II. Multilateral Cooperation Framework

To facilitate the involvement of international and commercial partners in the construction mission.

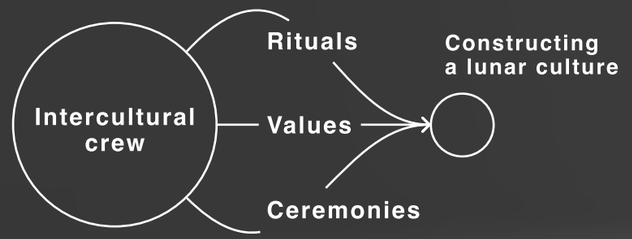
III. Pathway Forward for Legal Development

FINANCIAL VIABILITY



THE NEXT STEP IN THE JOURNEY OF HUMANITY

WORKPLACE CULTURE



A Mirror for Humanity

- High-resolution cameras for the third person view.
- Maintain the support of involved stakeholders and the public.
- Near-real-time communication for interaction and play on Earth.
- Reuse of imagery, video, audio, and virtual reality to connect and engage with audiences during lunar activities.

A MONUMENT TO EARTH AND THE MOON

The lunar base will rise from the lunar soil as the world has seen the rise of the Great Wall of China, Pyramids in Egypt, Colosseum, or Taj Mahal. The lunar base will serve as a monument to the creativity and curiosity to humandkind.

A WINDOW FOR OUR HOME

Near-Constant View of Earth

During the lunar orbital cycle, the Earth spins across a narrow region of the sky. The Rosas Base includes a large observational deck, OSCAR, where the astronauts have a chance to view the Earth from our celestial neighbor.

LIST OF PARTICIPANTS

ADAM ABDIN
AIDEN O'LEARY
ALBERTO ZA
DAMIANA IRRERA
EMILY APOLLONIO
GIANMARCO CIOCCA
JOAO MONTENEGRO
LAURA PAUZIE
MONICA EKAL
SHAY MONAT
ZHUANG TIAN
ADINA GODEANU
ALAN GARCIA JUAN
ALEXANDRA SOKOLOWSKI
CHARLOTTE POUWELS
GAUTIER BARDI DE FOURTOU
GIORGIO LORINI
KARL BOLMGREN
LEONARD CARL LUIGI LIDGARD
ORI ONN
STEFAN AMBERGER

ACKNOWLEDGMENTS

CHAIRS Rob Postema
Matthew Sorgenfrei
Antonio Martelo Gómez

TEACHING ASSOCIATE Xiaochen Zhang

ISU and Team Project Solutions for Construction of a Lunar Base wish to express their sincere appreciation to Lockheed Martin Corporation for its sponsorship of this project.

We would also like to thank the chairs and teaching assistants for their amazing support during this team project. They have been the key factor in supporting this team during the process and therefore the success of this lunar team report.

Lastly, we would like to thank the International Space University and SSP21 staff for making this year's program happen, during the COVID-19 period and supporting the team in the best way possible.

In loving memory of Oscar Federico Rosas Castillo – an adventurous and spirited soul who brought us together and made our world a better place. We are better for having known you. May your light shine bright upon us until we see you on the other side of the stars.

Ad Astra

Electronic copies of the Final Report can be dowloaded from the ISU Library:
http://isulibrary.isunet.edu

International Space University
Strasbourg Central Campus
Parc d'Innovation
1 Rue Jean-Dominique Cassini
67400 Illkirch-Graffenstaden, France

Tel: +33 (0)3 88 65 54 30
Fax: +33 (0)3 88 65 54 47
E-mail: publications@isunet.edu
www.isunet.edu

SOLUTIONS FOR CONSTRUCTION OF A LUNAR BASE

SPONSORED BY

LOCKHEED MARTIN