



Cross Space & Sustainability, LLC



Space for a Better Earth

- How Space Innovation Drives our Sustainable Future -

Cross Space & Sustainability, LLC
Satoru Cross (Kurosu), CEO

March 21, 2026

2026/3/23

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Introduction of Satoru Cross (Kurosu)

- **CEO, Cross Space & Sustainability, LLC**
- Founder of Space Business Organization in Yokogawa Electric Corporation
- Former **Chief Sustainability Officer (CSO)** of Yokogawa
 - **Director, University Space Engineering Consortium (UNISEC) Global**
 - Board of Directors, Moon Village Association
 - Supporter, CROSS U (Open Innovation Platform for the Space Business)
 - Director, Japan Marketing Academy



International Space University, Strasbourg, France
Lecture on "Space x SDGs" in the Master Class
(April 25, 2023)



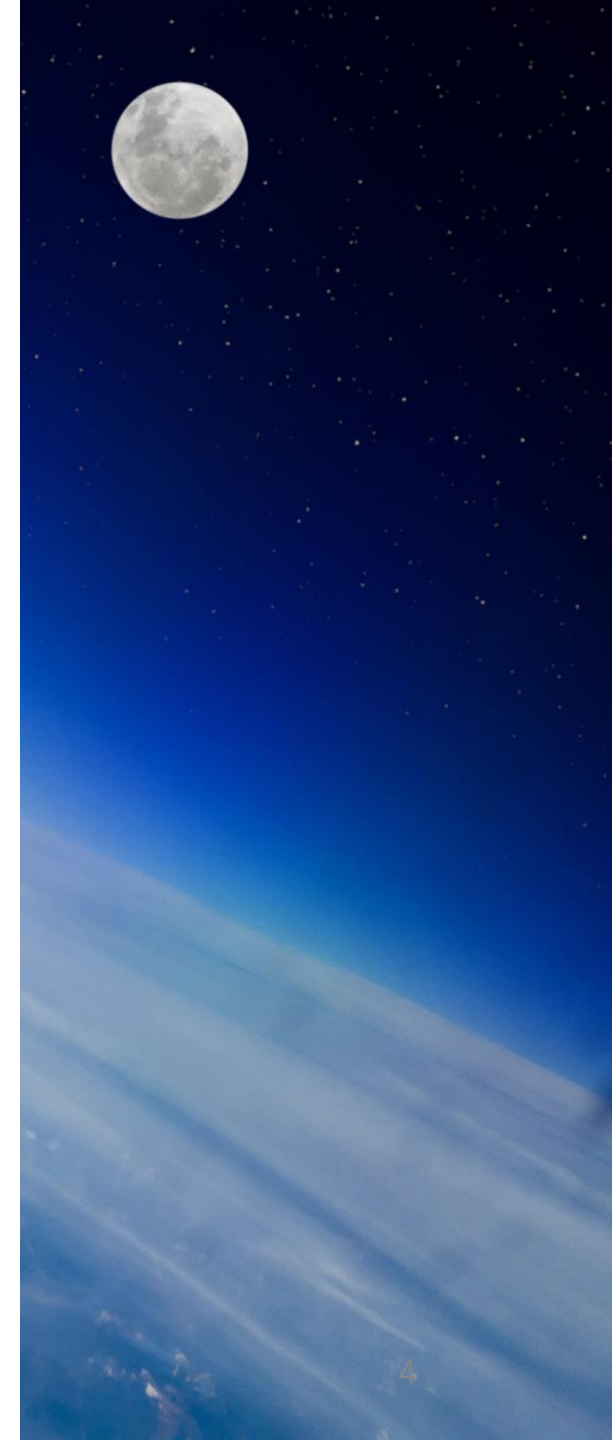
Satoru Kurosu, Souichiro Koduka, *Space Business and Space Debris Countermeasures*, NTS, 2025

Agenda

- Introduction
- Space for Achieving SDGs
- Business Use Cases
- Closing

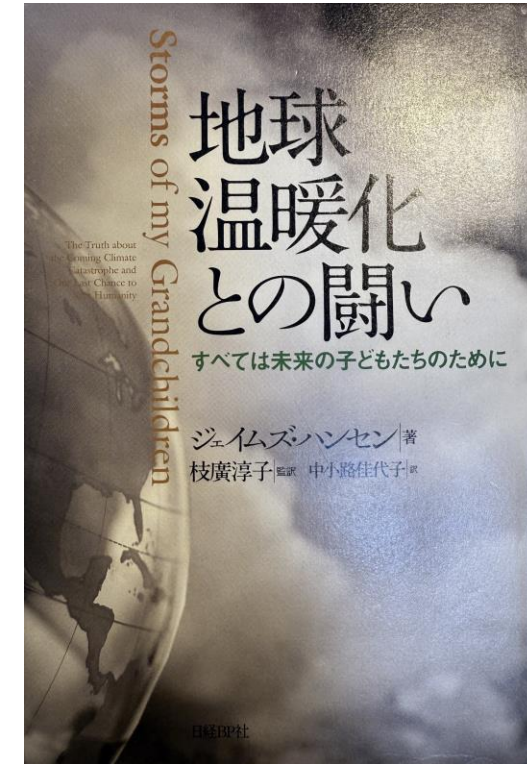
Introduction

- Thinking about Space is thinking about Earth -



A Warning from Space

- Dr. James Hansen is the former director of NASA's Goddard Institute for Space Studies and **a pioneer in raising global awareness of climate change risks.**
- His research on **Venus** showed the planet once had water but became extremely hot (over 400° C) due to a **CO₂-driven greenhouse effect.**
- In the 1980s, he warned that a similar mechanism **could drive global warming on Earth.**



Hansen, James, *STORMS OF MY GRANDCHILDREN*, Bloomsbury Publishing Inc., 2009

Thinking about Space is thinking about Earth

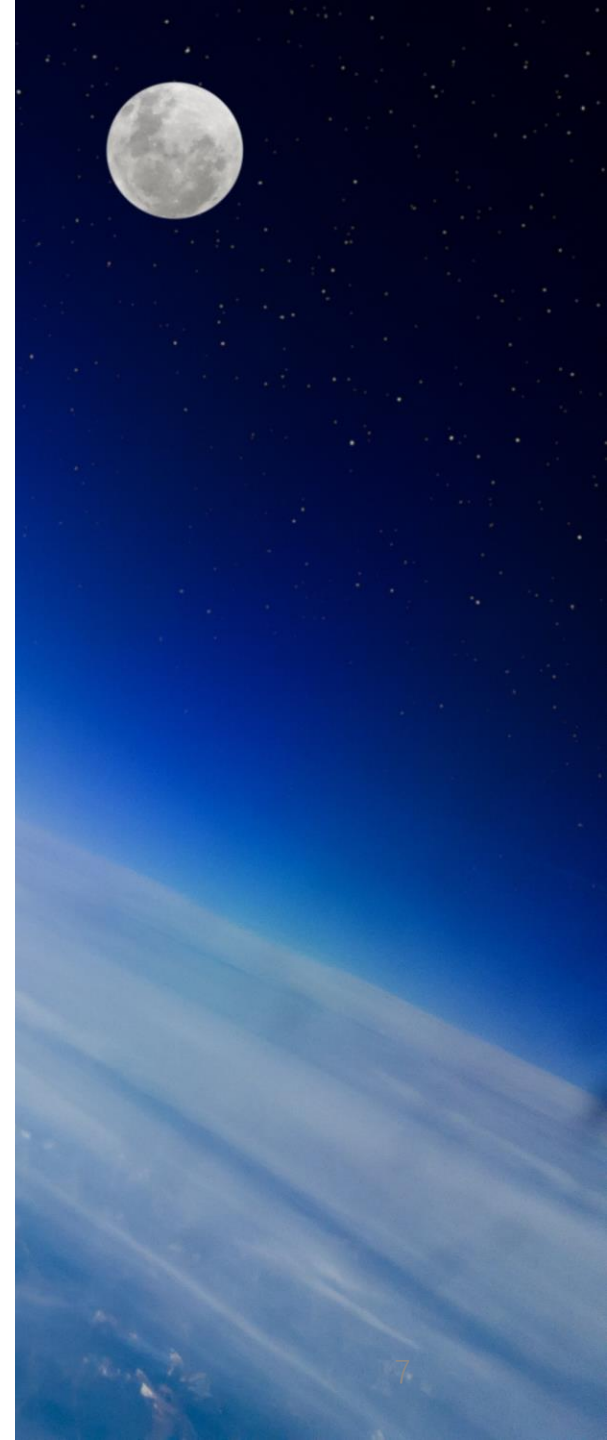
SDGs Wedding Cake



Source: Stockholm Resilience Centre
<https://www.stockholmresilience.org/research/research-news/2016-06-14-the-sdgs-wedding-cake.html>

Graphics by Jerker Lokrantz/Azote

Space for Achieving SDGs



Seeing Earth from the outside, we changed fundamentally



Earth Globe Photo by Apollo 17 Astronauts on Dec. 7, 1972
©NASA

The Overview Effect



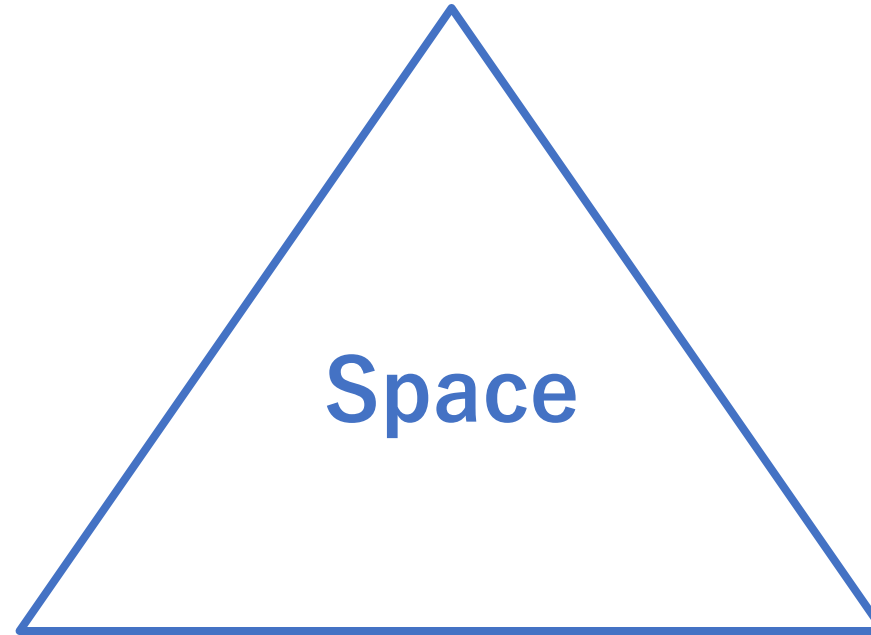
Earth Globe Photo by Apollo 17 Astronauts on Dec. 7, 1972
©NASA

“The **Overview Effect** is a shift in worldview ... Earth is in space, a tiny, fragile ball of life, “hanging in the void,” shielded and nourished by a paper-thin atmosphere. ... Some common aspects of it are ... a renewed sense of responsibility for taking care of the environment.”

White, Frank, 2023,
The Overview Effect 4th Edition,
the USA: Multiverse Publishing

Space: New Values Beyond Earth

Overview Effect

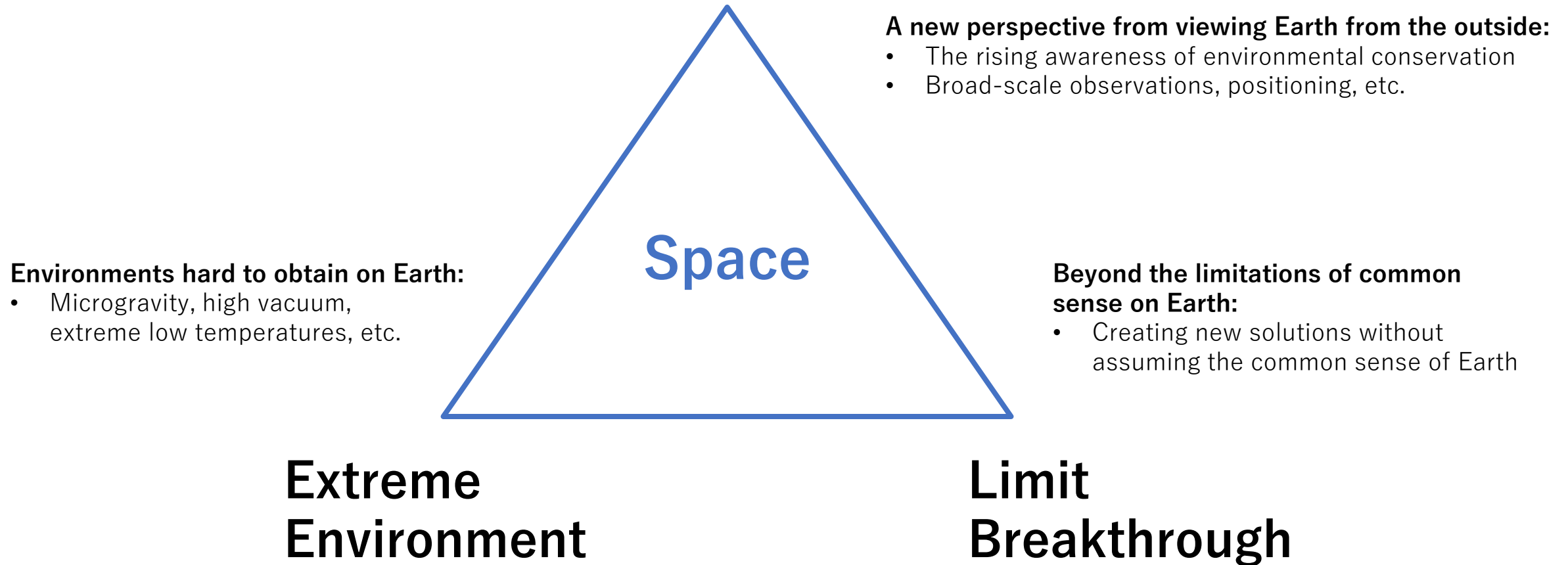


**Extreme
Environment**

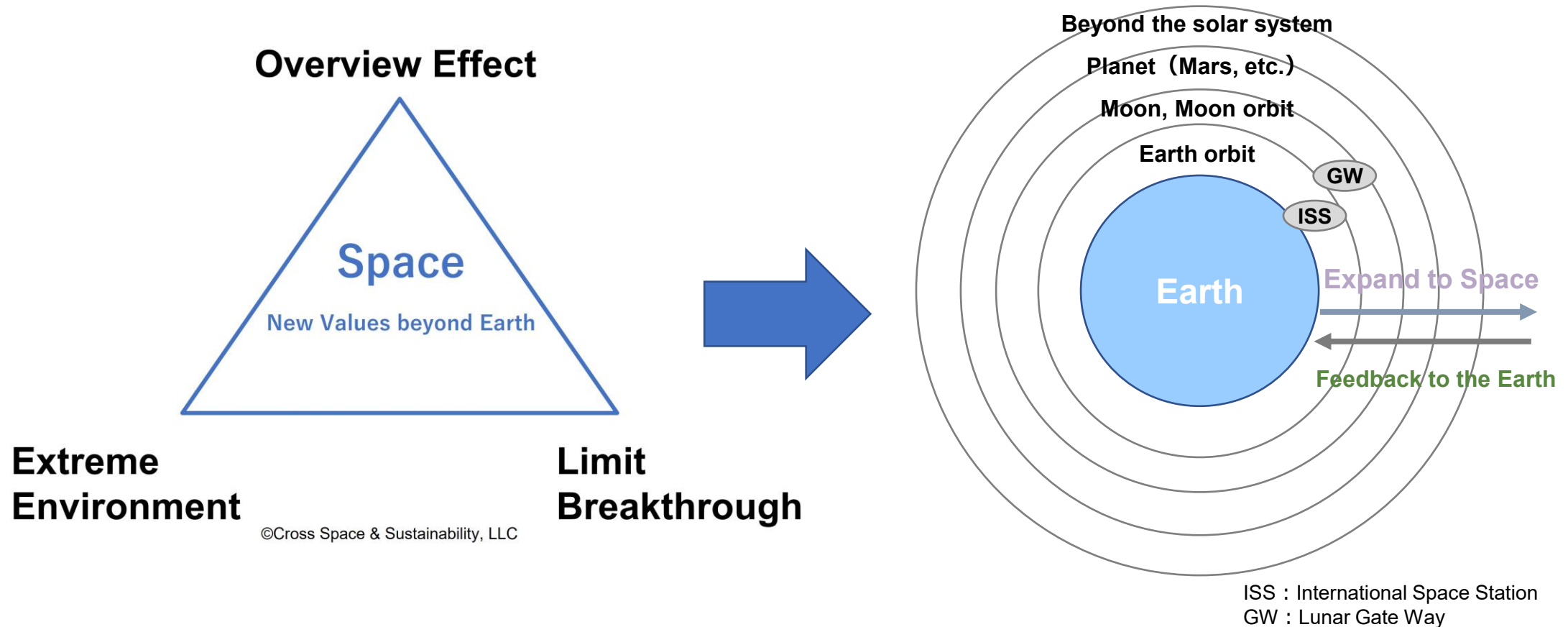
**Limit
Breakthrough**

Space Value Triangle

Overview Effect



From Earth to Space, and Back to Earth



Thinking about Space is thinking about Earth

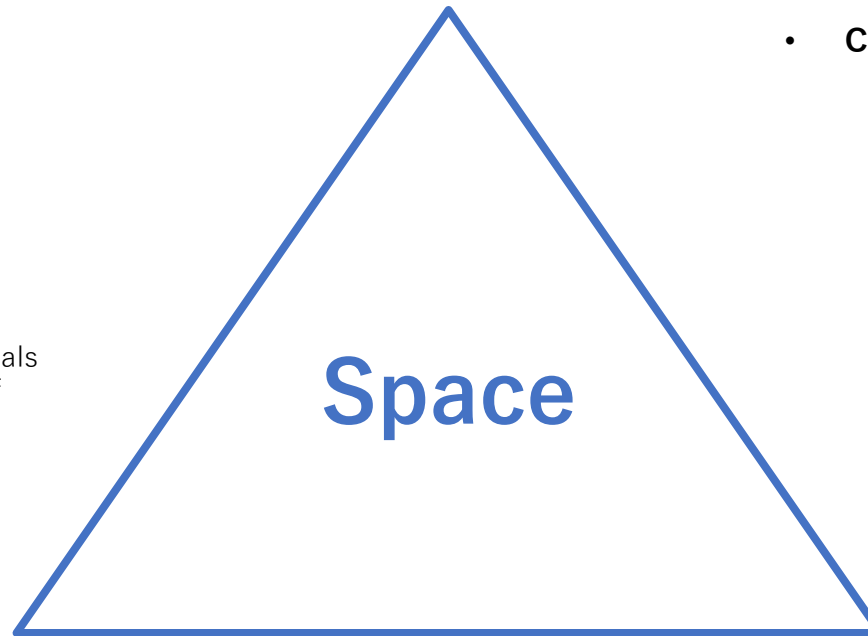
Overview Effect

- **New Solutions Utilizing Extreme Environments**

- **Life sciences** and new materials development utilizing microgravity environments on space stations
- High thermal and cold resistance materials
- Data center utilizing the extreme cold of space



Extreme Environment



- **Earth Observation**

- Monitoring and Improvement of the Earth Environment through Satellite Data
- Disaster Monitoring and Prevention

- **Activity Optimization**

- Positional Information Acquisition and Optimization through Satellite Global Positioning System (GPS)

- **Communication and Broadcasting**

- Information Divide Resolution through Satellite Internet
- Communication during Disasters and Emergencies



©UNOOSA

- **Deployment of the Space Circular Economy Model to Earth**

- Application of advanced recycling and reuse technologies in Space for a circular economy on Earth.

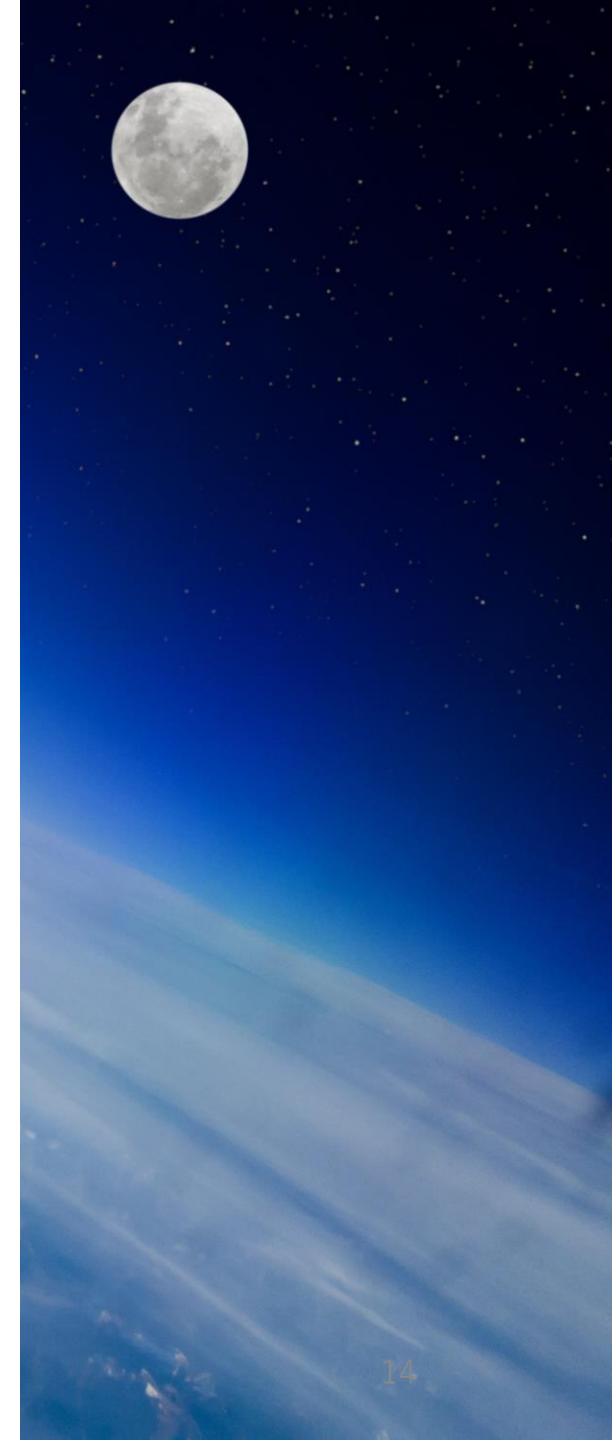
- **Unmanned and Autonomous Automation**

- **Space-based Solar Power Generation**

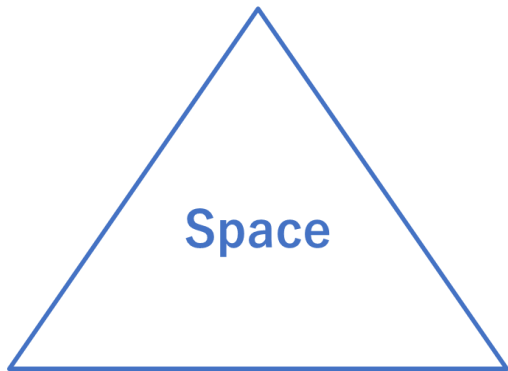


Limit Breakthrough

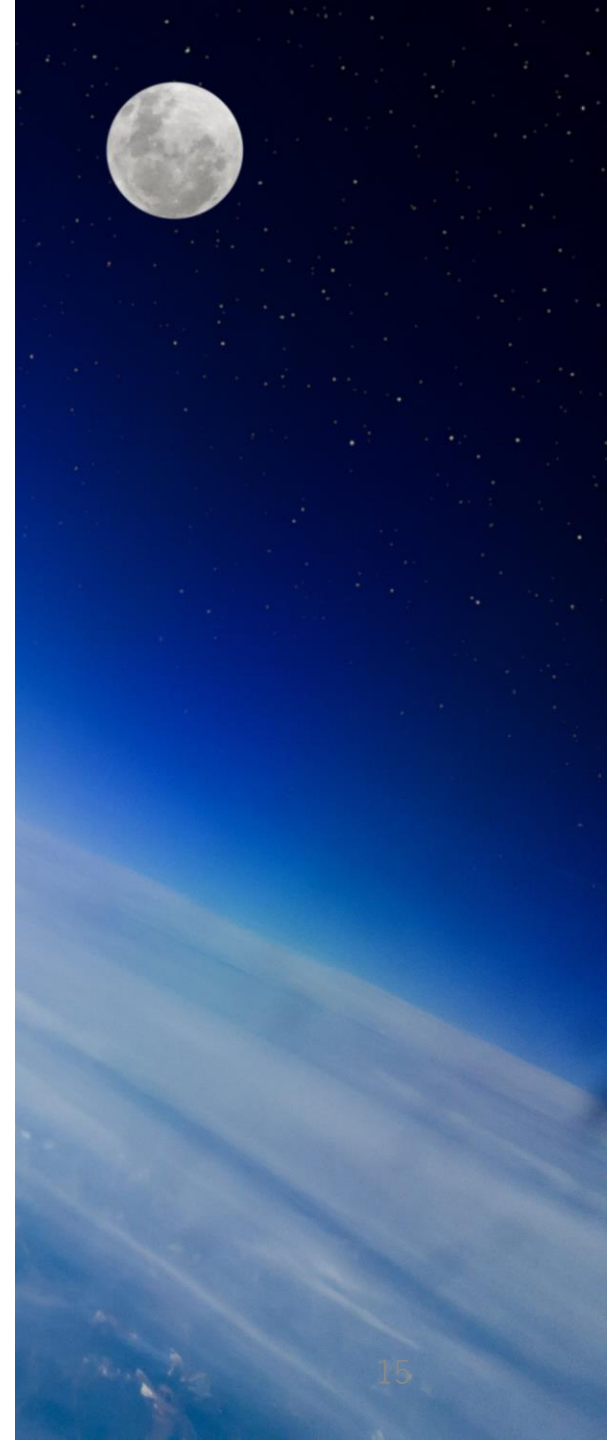
Business Use Cases



Overview Effect



Remote Sensing



Summary of Remote Sensing Solutions

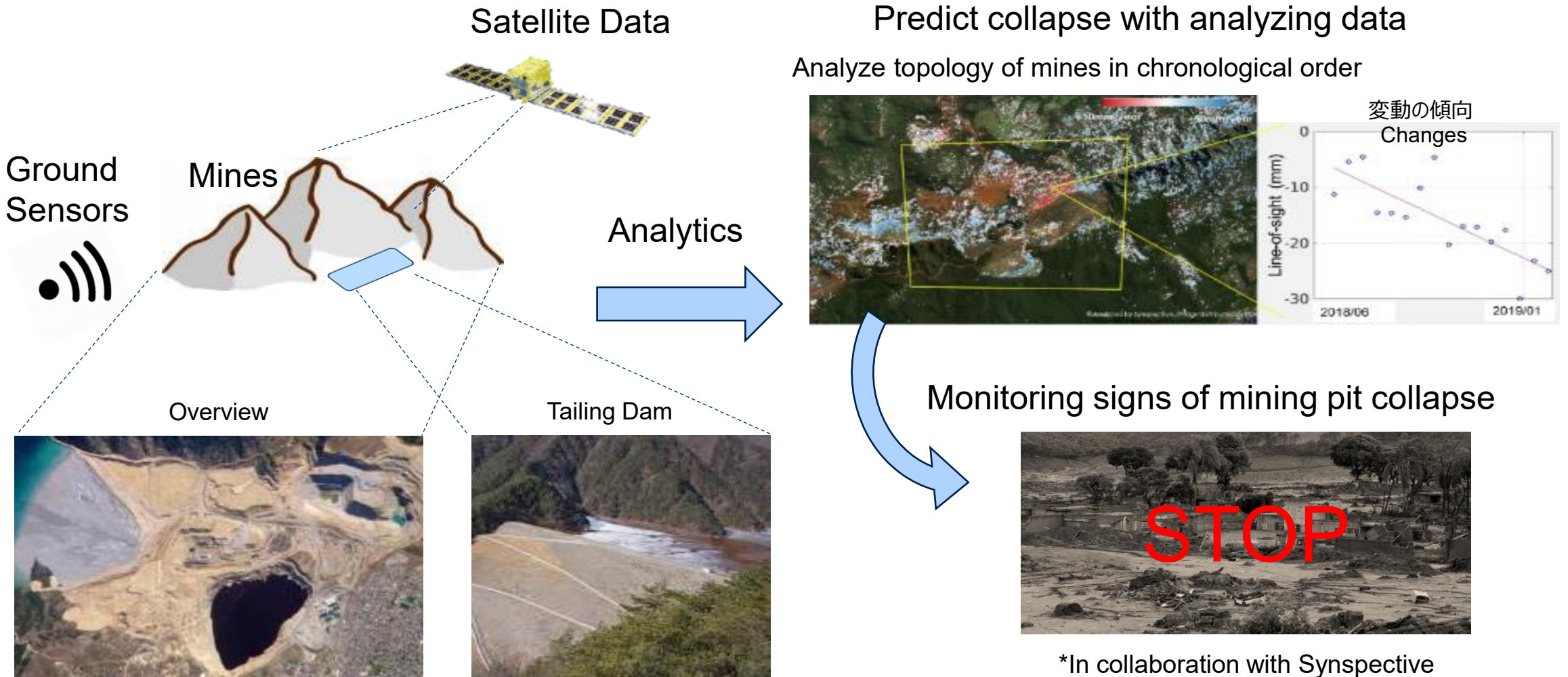
- Definition
 - The science and art of obtaining information about an object, area, or phenomenon through the analysis of data acquired by a device not in contact with the object, area or phenomenon.
- Types of sensors
 - Passive sensors
 - Emitted – thermal infrared, passive microwave
 - Or reflected (solar) – visible, near infrared
 - Active sensors
 - Lasers (visible)
 - Radars (microwave)
 - Altimeters (visible or microwave)
- Application examples
 - Climate studies
 - Agricultural monitoring
 - Fishing monitoring
 - Resource management
 - Urban planning
 - Disaster management



Source: ISU ESC19

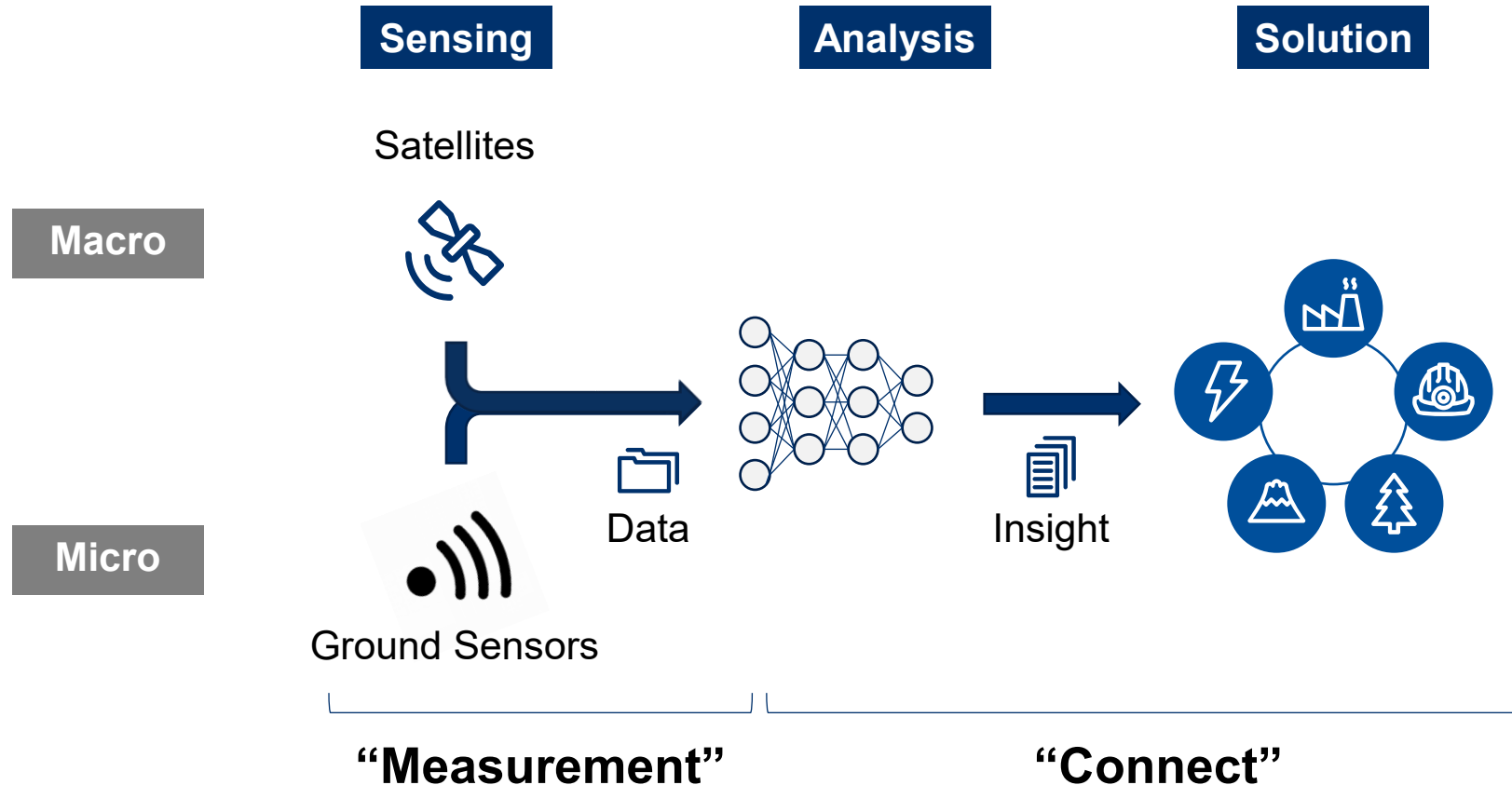
Land Displacement Monitoring

Solution Development Using Satellite and Ground Sensor Data



Overview of YOKOGAWA's Satellite Data Solution

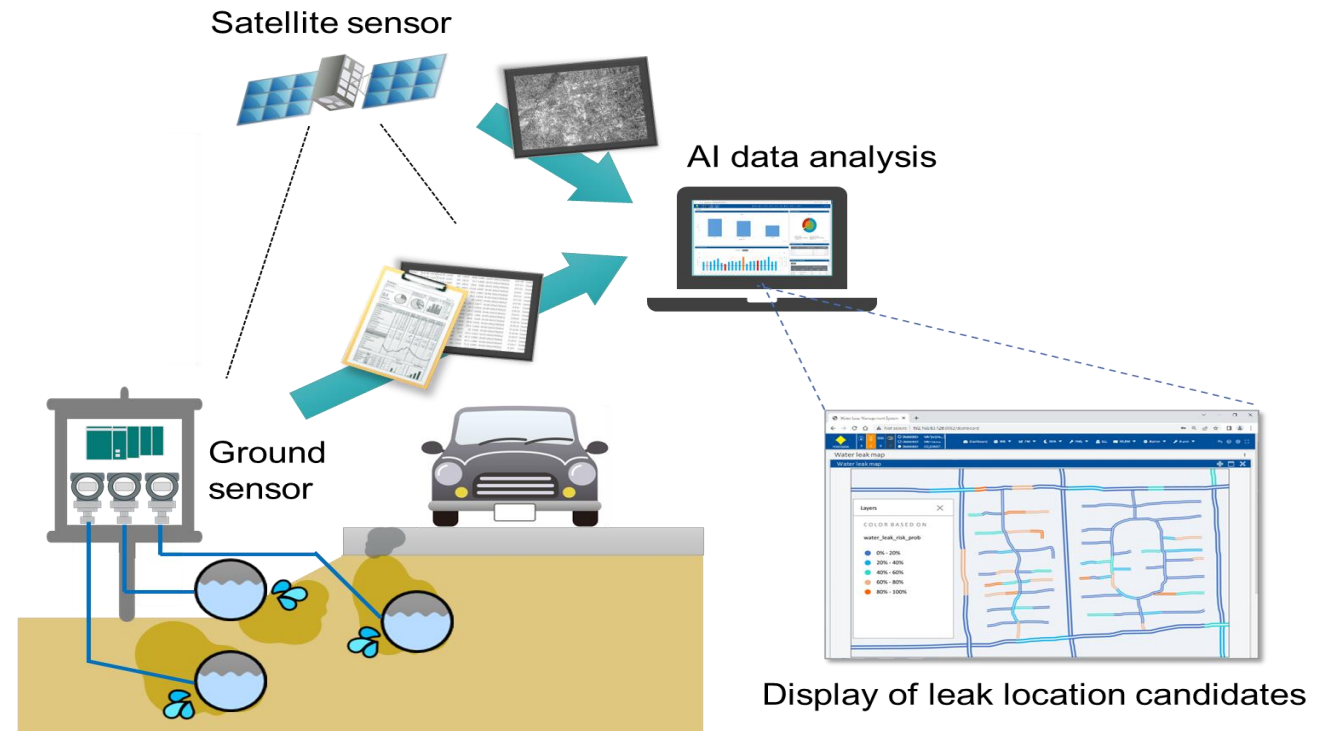
- Assist management decision making with insight extracted from combined macro and micro information

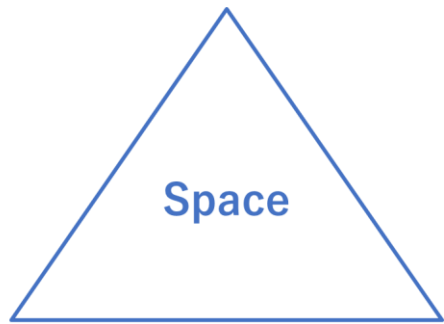


Yokogawa's solution

(under development)

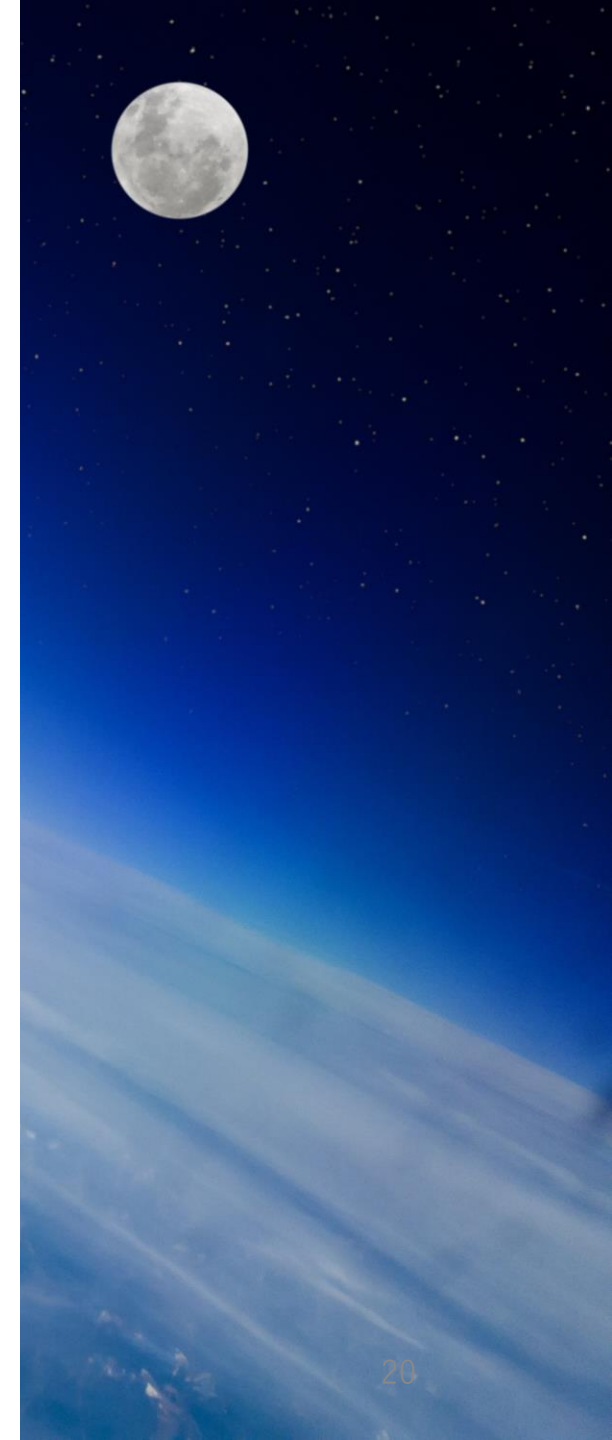
- By combining ground facility information and sensing data with satellite data, AI analysis is used to estimate leak locations
- By narrowing down the estimated leak areas to a small area, it is possible to efficiently implement leak countermeasures, reduce the leakage rate, and reduce the operation and maintenance costs for water utility companies





Extreme
Environment

Microgravity Experiments in ISS



Yokogawa's contribution to life science research and development in Space

Life science research and development in "Kibo"

- Various life science research and development using the micro-gravity environment, such as culture experiments of three-dimensional tissues for cell medicine, are being carried out.
- **Three-dimensional observation of cell tissue is indispensable "in-situ" in orbit** in order to evaluate minute effects on cell-cell interactions.

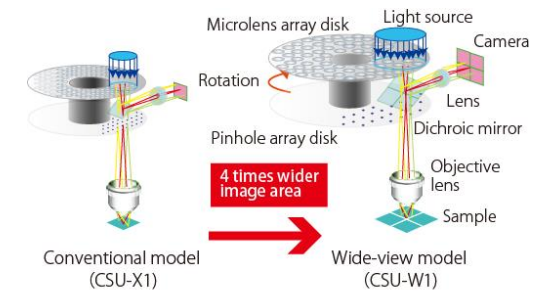


In 2020, the live imaging system COSMIC was installed in "Kibo".

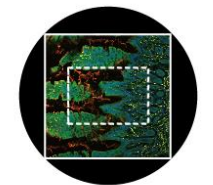
- COSMIC is a microscope system for space experiments developed by Chiyoda Corporation.
- It has the function of a confocal microscope widely used for stereoscopic observation of cell tissues.
- Yokogawa's CSU-W1 is used for the confocal scanner, which is the core of the confocal microscope.
- **Yokogawa have been involved in the development of COSMIC for installation in Kibo.**



Confocal scanner
CSU-W1



Conventional model
10mmx7mm



CSU-W1
17mmx16mm

Principle diagram of confocal scanner

Experimental themes using COSMIC

- **Space Organogenesis experiment**

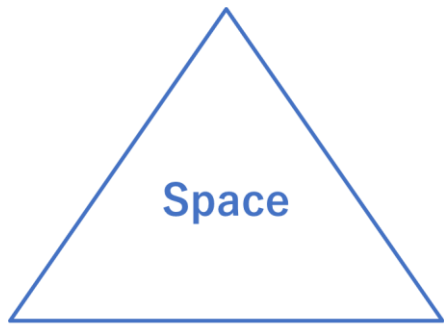
Representative Researcher: Professor Hideki Taniguchi, University of Tokyo, Yokohama City University

- Confocal observation of hepatocyte tissue cultured in space will be carried out with the aim of developing a technology for creating three-dimensional organs using iPS cells.
- In March 2024, COSMIC was used to observe cell aggregates formed by a rotary device.

- **Cell Gravisensing experiment**

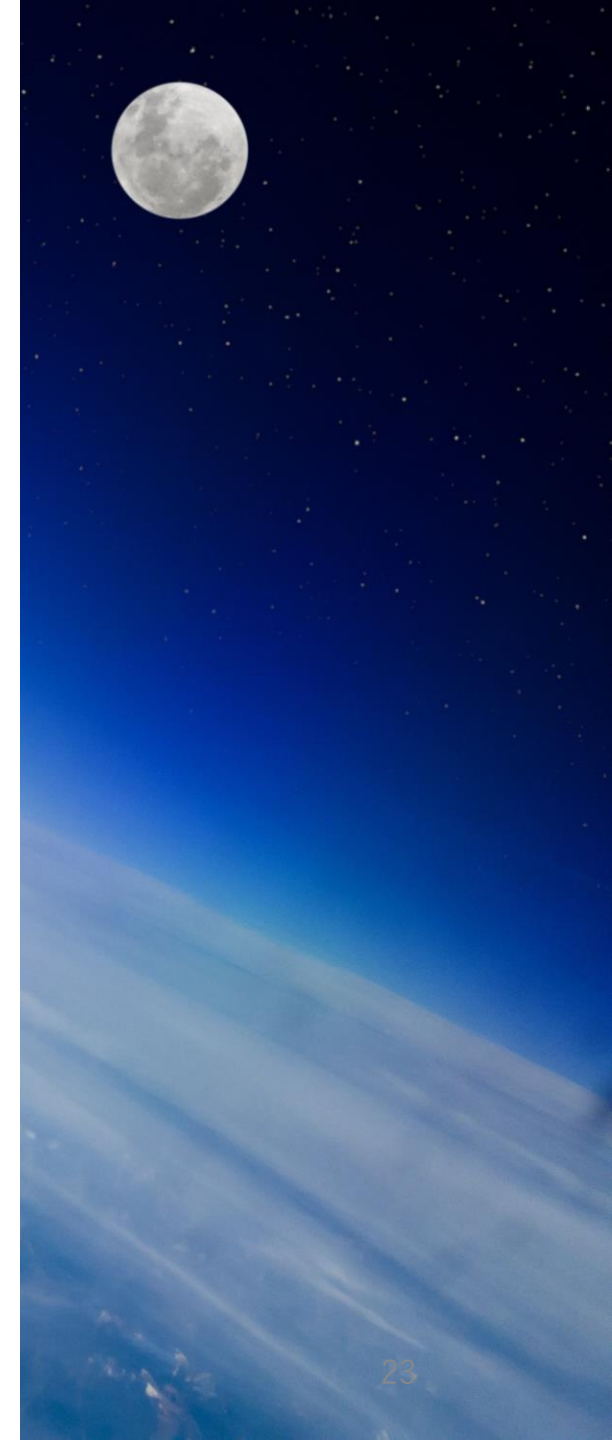
Representative Researcher: Dr. Masahiro Sokabe (Professor Emeritus at Nagoya University/Currently Professor at Kanazawa Institute of Technology)

- He aims to clarify the mechanism by which cells are sensitive to gravity and lead to muscular atrophy and bone loss, and uses COSMIC's confocal observation function and FRET measurement function to image and analyze intracellular signals.
- In 2021, the experiment achieved the world's first dual-wavelength confocal fluorescence imaging of live cells in orbit. In the second round in November 2023, COSMIC was used to perform seven observations.

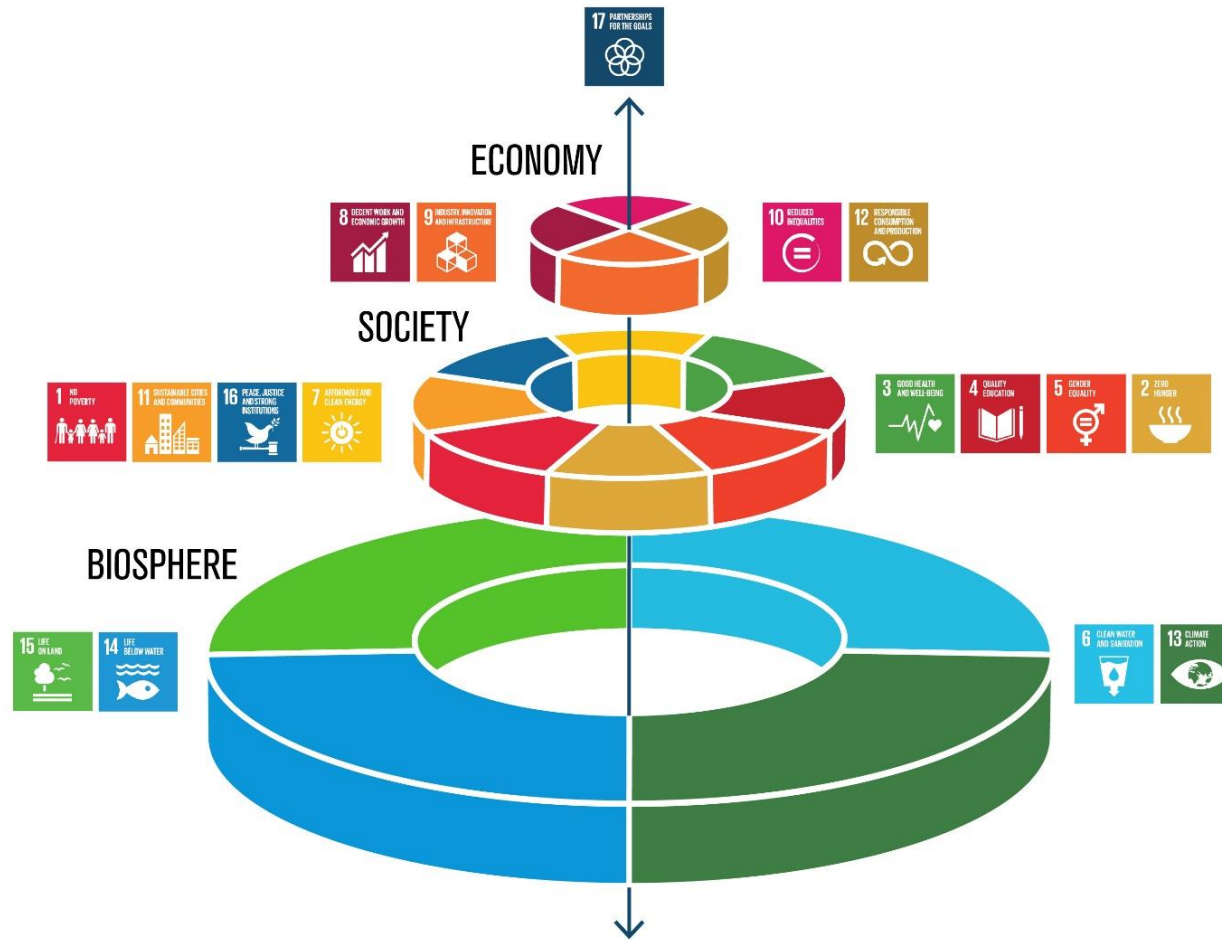


Limit
Breakthrough

Circular Economy Model in Space



SDGs Wedding Cake

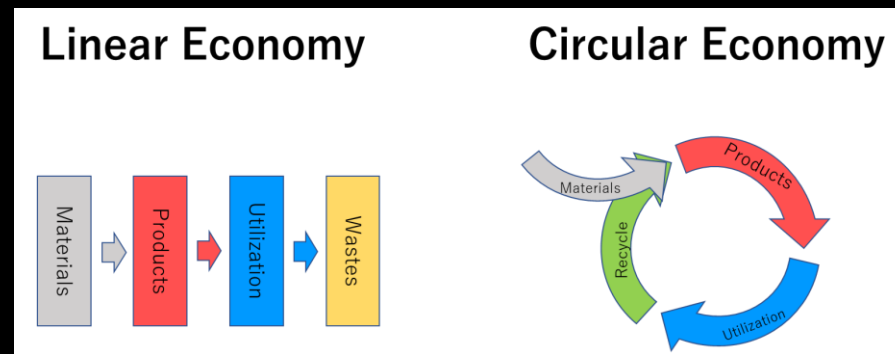


Source: Stockholm Resilience Centre
<https://www.stockholmresilience.org/research/research-news/2016-06-14-the-sdgs-wedding-cake.html>

Can we keep relying on our Biosphere?

Why Moon?

- A unique testbed for developing sustainable technologies for Earth, **independent of natural ecosystems**
 - No fossil energy resources and limited supply from Earth
 - A cradle for Circular Economy driven by the ultimate 3R (Reduce, Reuse, and Recycle) requirements



- A proving ground for **space-based resource utilization**
- **Driving innovation** as a frontier of technology development, inspiring STEM education and creating new jobs on Earth

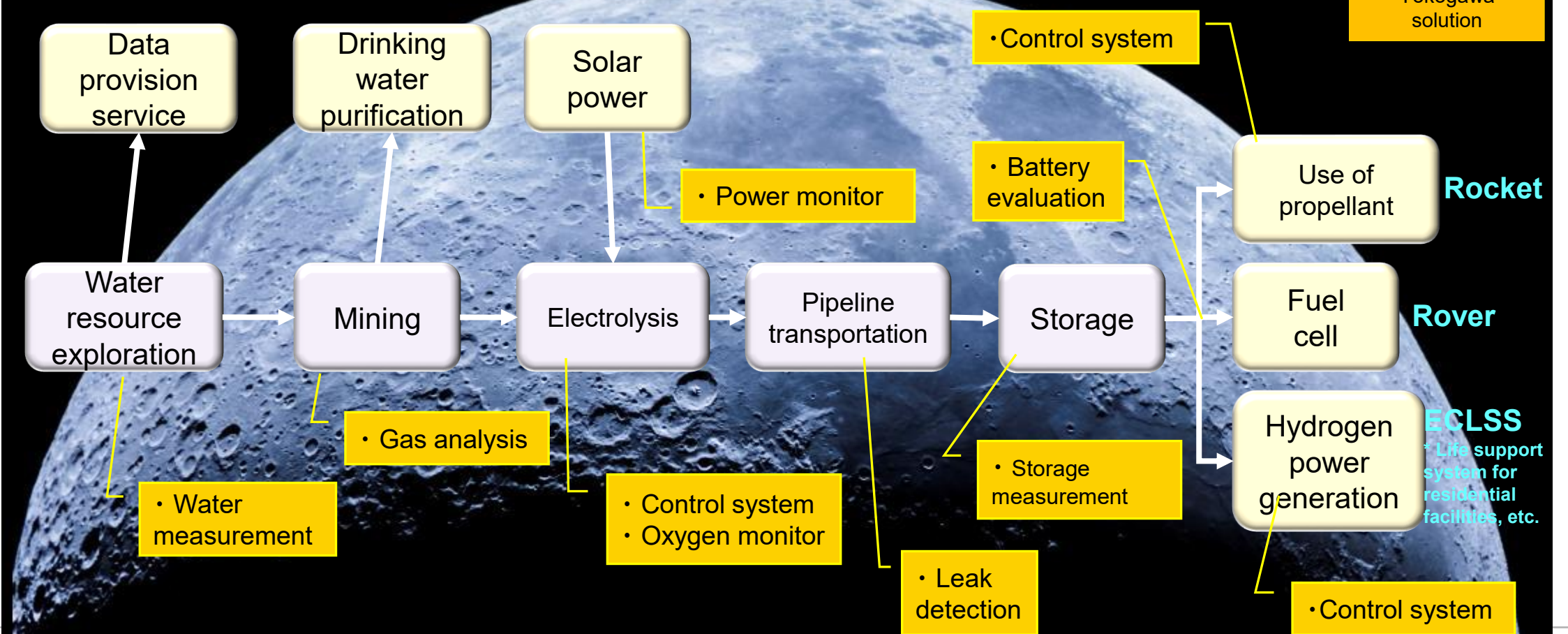
Yokogawa's contribution to the lunar hydrogen value chain (examples)

Usage Guide :

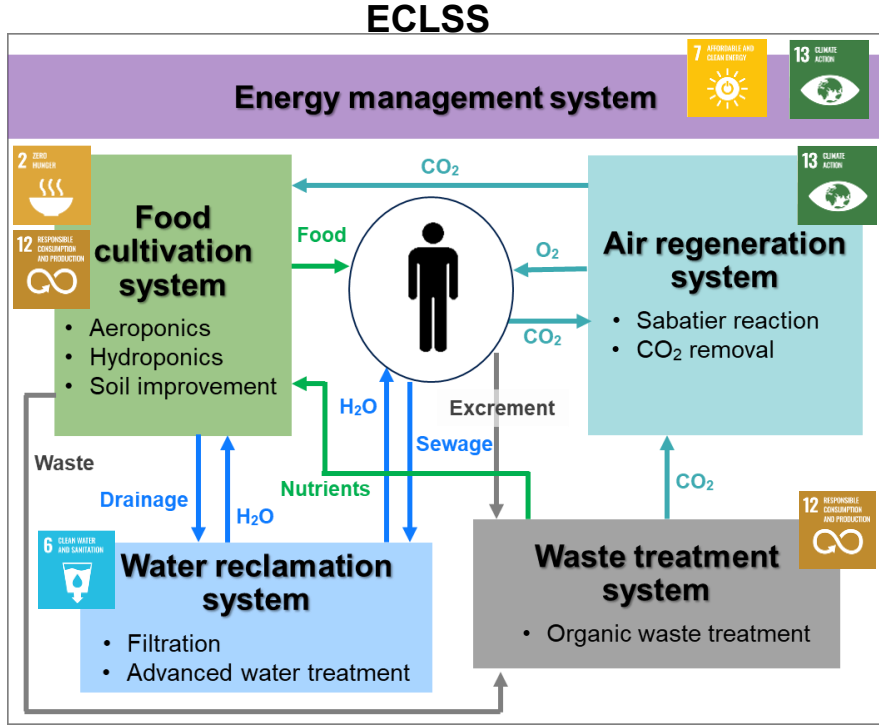
Hydrogen production flow

Related business

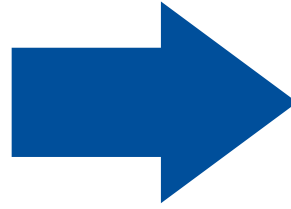
Yokogawa solution



Utilization of space-developed technologies to address major social issues



Technologies developed in the extreme environment like space contribute to...



Challenges on Earth



Space-developed technologies for solving challenges



Technologies for removing and capturing CO₂, a cause of global warming



Technologies enabling efficient, stable, and sustainable energy supply



Water recycling technologies using microorganisms and filters, as well as sewage treatment technologies necessary for establishing water recycling systems



Effective hydroponic and aeroponic cultivation technologies
Sustainable soil improvement technologies
Technologies for preserving food with its nutrients intact for long periods



Waste treatment technologies that enable 100% recycling



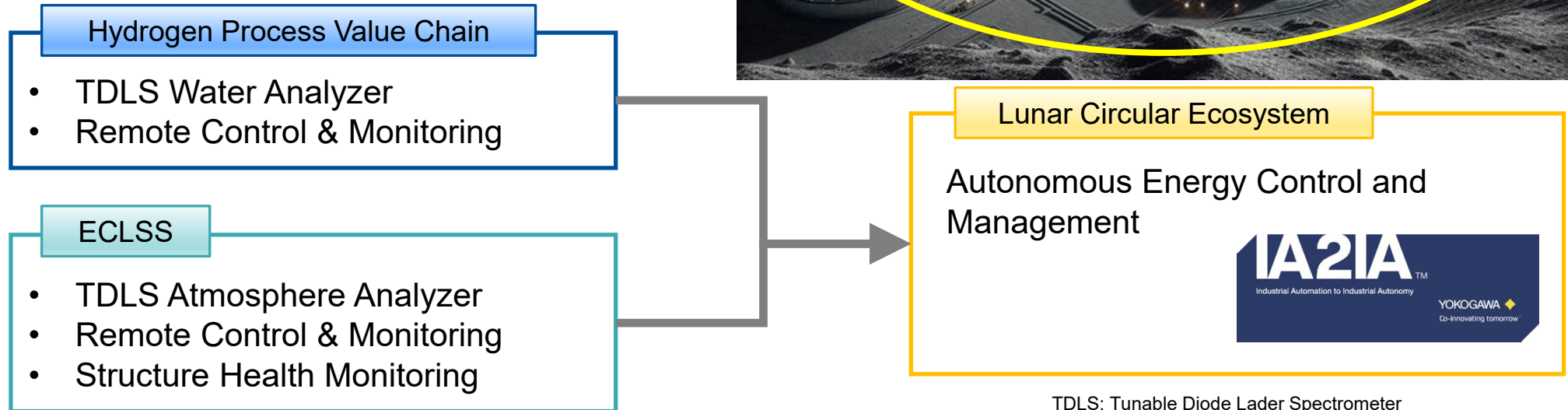
Space is an extreme environment, and human habitation requires that all air, food, and water be locally produced and consumed

Complete circular ecosystem in space

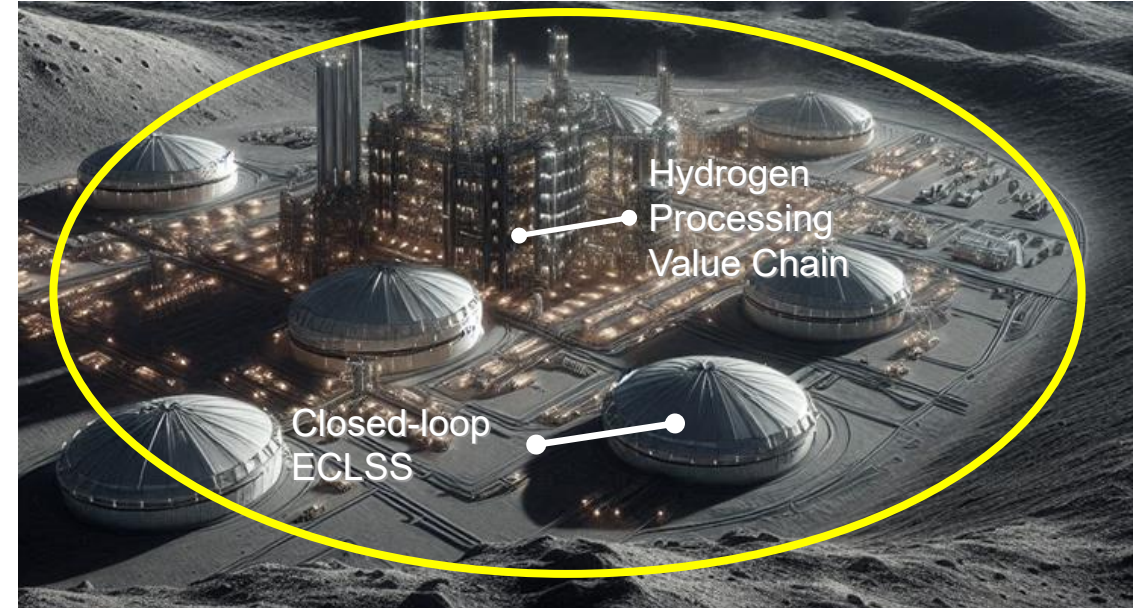
Permanent Lunar Circular Ecosystem

Optimized Measurement & Control

- Commercial proven sensors for terrestrial mission critical applications
- Leading Main Automation Contractor with ample experiences for complex plant controls
- Trustable company with more than 100 years history to support industry 24/7, operating in 60 countries

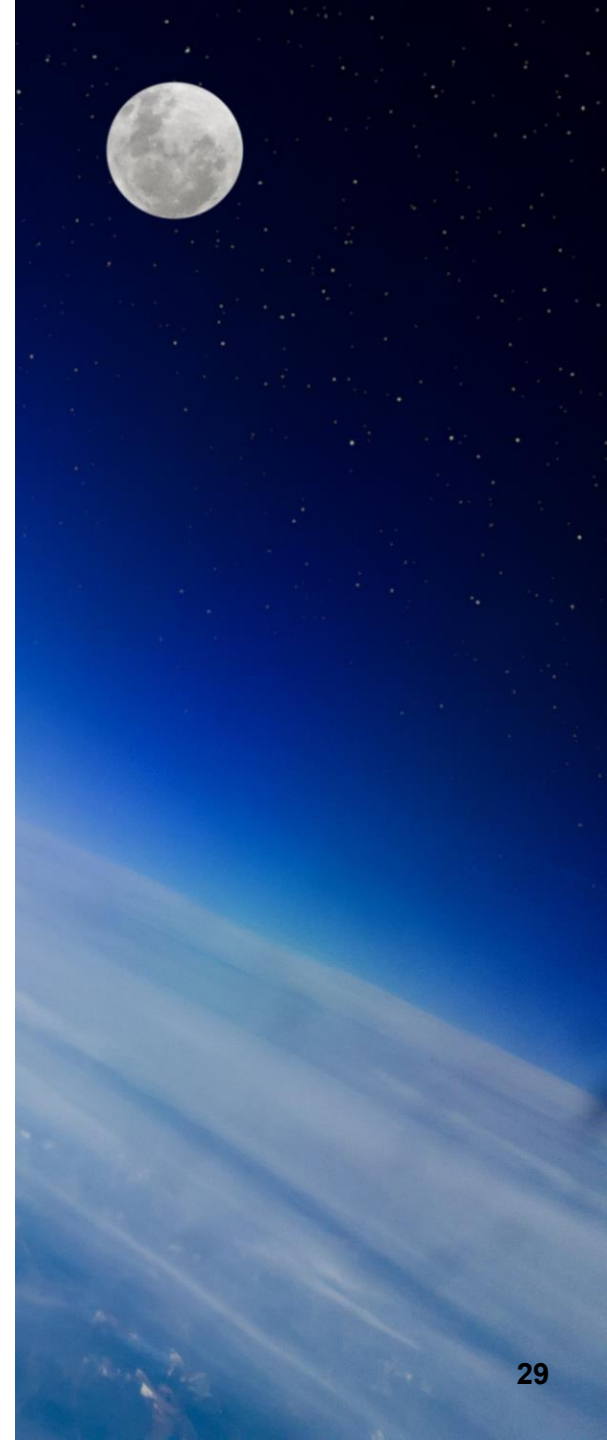


Energy Management



TDLS: Tunable Diode Lader Spectrometer
ECLSS: Environment Control & Life Support System

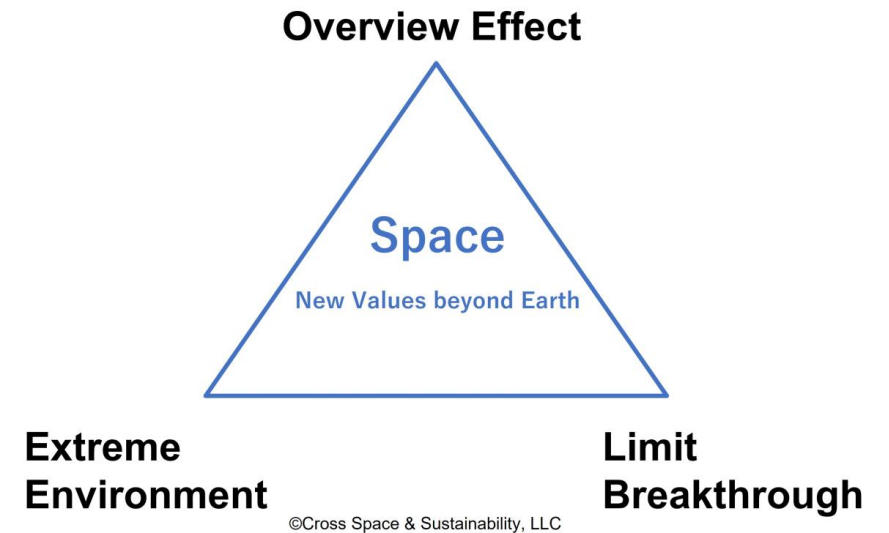
Closing



Conclusion

- In Space, there are **new values beyond Earth**, as illustrated by the ‘Space Value Triangle.’
- Space-enabled solutions can help solve terrestrial challenges through sustainable businesses and contribute to **achieving the SDGs**.
- **Let’s take action together now!**

Space Value Triangle





Cross Space & Sustainability, LLC

Thank you for your attention.

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