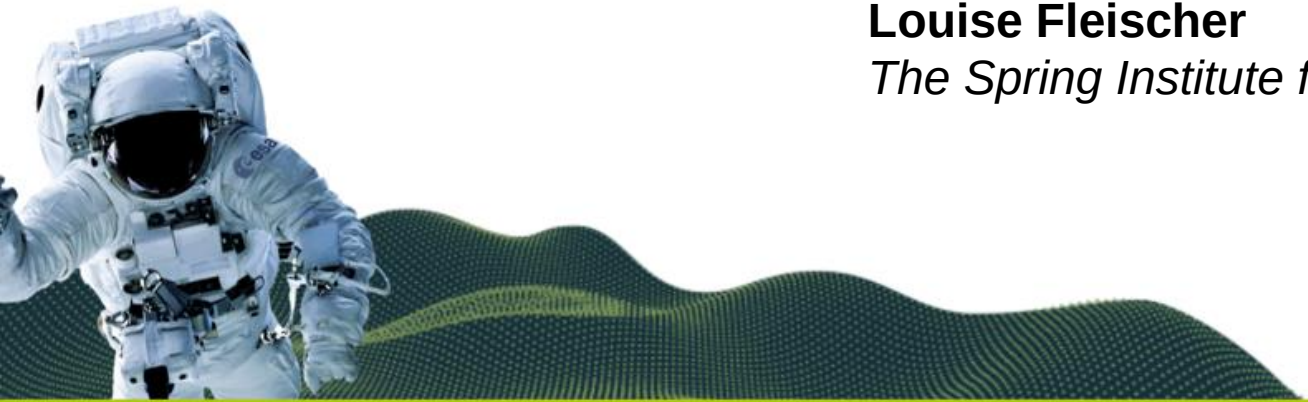
MELISSA
MICRO-ECOLOGICAL LIFE SUPPORT SYSTEM ALTERNATIVE

2022 MELISSA CONFERENCE
8-9-10 NOVEMBER 2022

CREATING A CIRCULAR FUTURE

Autonomous complex biospheres in space : moral grounds, historical perspectives and a way forward

Louise Fleischer
The Spring Institute for Forests on the Moon



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Forests on the Moon

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Photo by Nanang Sujana/CIFOR


Humans are space travelers
Photo by NASA

THE SPRING INSTITUTE

FOR FORESTS ON THE MOON

Artworks by Azuma Makoto,
Photographs: Shiinoki Shunsuke

Spread life into space that can thrive in a closed-matter, open-energy ecosystem for millenniums

Spread life into space that can thrive in a closed-matter, open-energy ecosystem for millenniums

PLANET EARTH

Credit NASA

Wardian cases

Ward, Nathaniel Bagshaw. *On the growth of plants in closely glazed cases*. J. Van Voorst, 1852.

and foliage, but also about their roots. Why do farmers hoe their turnips? why do gardeners labour to "stir the earth" between growing crops? why does every thing pine and perish that is left to starve in a soil which hoe or fork never disturb? Whatever the form of a Wardian case may be, the idea that it might be hermetically sealed must be abandoned, and we must go back to nature, who sends many a fresh breeze to stir and agitate her verdant darlings.

Hibberd, Shirley. "HOW TO CONSTRUCT A WARDIAN CASE." *National magazine* 1, no. 4 (1857): 238-239.

The Bottle

“In 1960 David Latimer got curious and decided to plant a glass bottle with seed. He would have never guessed it would turn into a beautiful case study of a self-sustaining sealed ecosystem that has been called “the world’s oldest terrarium.”

In fact, after all these years, David’s sealed bottle garden is still thriving and robust. With thriving plant life, despite not watering it since **1972**.”

- Biologic performance

The Shrimp

Developed in the 80s as a NASA spin-off, the Ecosphere is a closed aquatic ecosystem a delicate balance of Hawaiian shrimps, algae and microorganisms. According to testimonies from original customers, some ecospheres have shrimps still living after 20 years.


BIOSPHERE 2

Biosphere 2 by the Numbers

- 3.14 acre research facility belonging to the University of Arizona
- 7,200,000 cubic feet under sealed glass; 6,500 windows
- sealed from the earth below by a 500-ton welded stainless steel liner
- 2 crewed missions, 2-year long in 1991 and 6 months long in 1994

Biomes under Glass

- Ocean
- Mangrove wetlands
- Tropical rainforest
- Savanna grassland
- Fog desert

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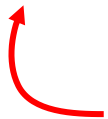

What is the right balance of species for long term ecosystem survival?

Spread life into space that can thrive in a closed-matter, open-energy ecosystem for millenniums

credit NASA


Fruit flies, 1947


Albert II, 1949


Spiders, 1973


Laika, 1957


Felicette, 1963


Water bears and bobtail squids, 2021


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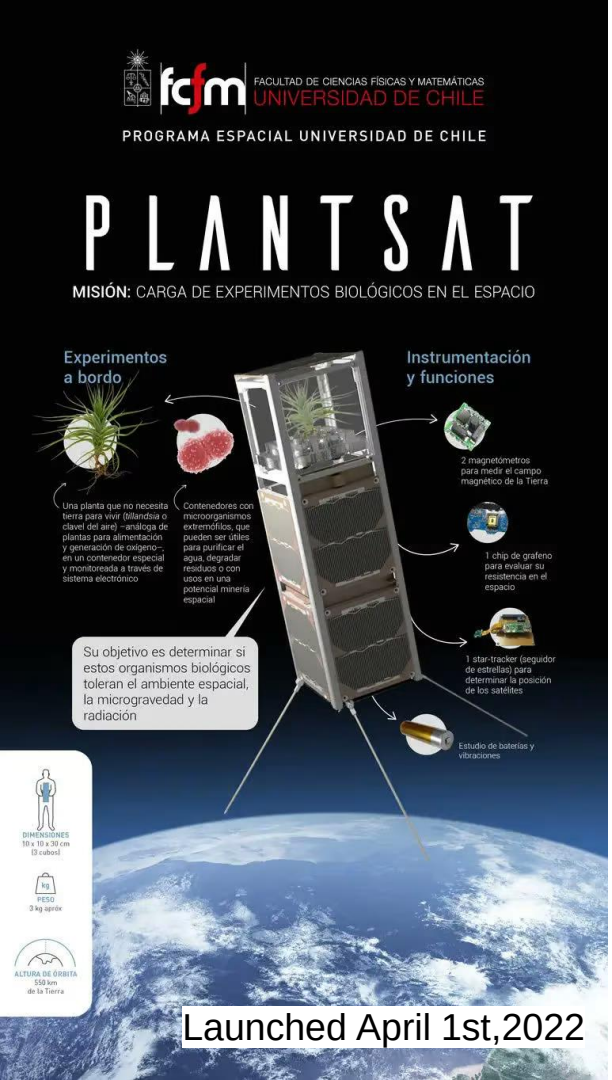
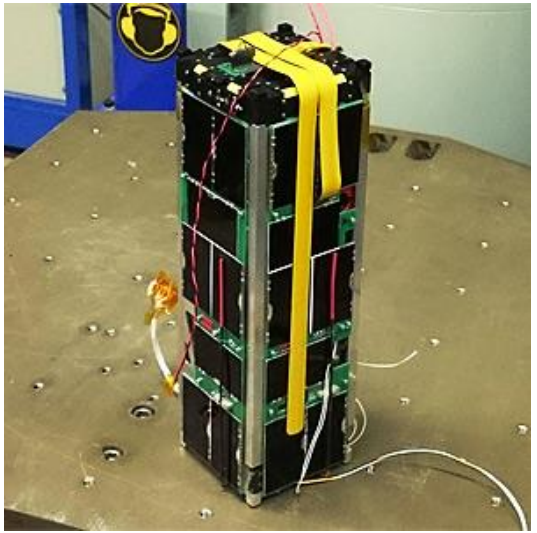
ALTERNATIVE
SPACE PLANT BIOLOGY
Veggie
Food Production and Astronaut Nutrition
credit NASA



Launched April 1st,2022

"Started in 1999, the CubeSat Project began as a collaborative effort to reduce cost and development time, increase accessibility to space, and sustain frequent launches."

- CalPoly Cubesat Design Specification



GreenCube (ENEA)
Launched in July, 2022

What is the minimal protection from space needed to maintain a high-plant ecosystem alive?

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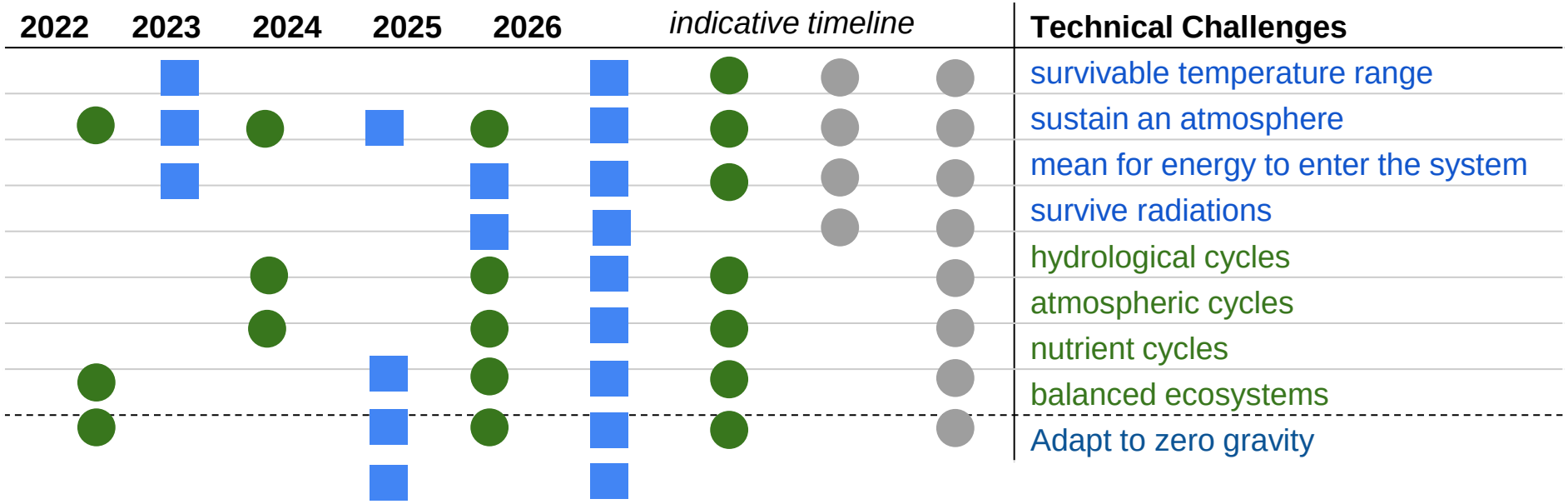
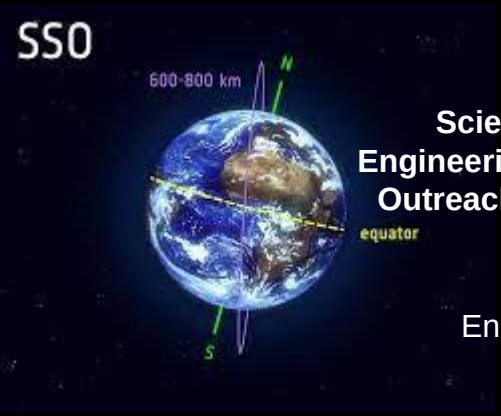
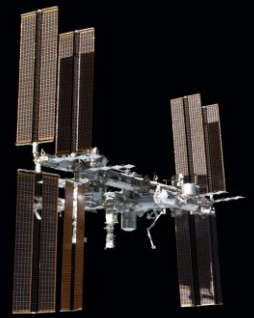
Forests on the Moon

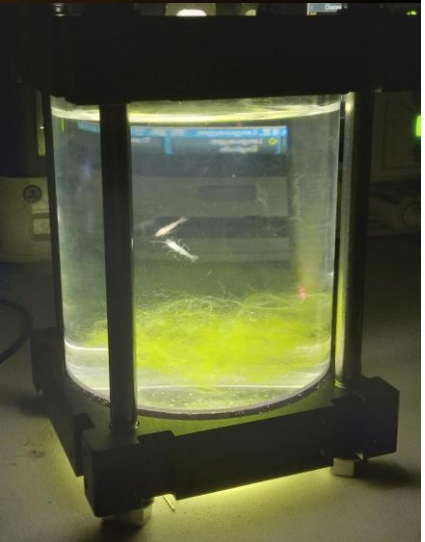


First Steps in Orbit



	Cubesat terrarium	*Station aquarium*
Why	**Science:** passive thermal control **Engineering:** space grade capabilities **Outreach:** online community building and artistic coverage	**Science:** ecosystem evolution in 0g **Engineering:** space requirements **Outreach:** international collaborative student team
When	End of 2023/ beginning of 2024 Duration of 1 - 5 years	End of 2024 Duration of multiple months
	Is it possible to maintain life-compatible temperatures in a partially transparent container in orbit?	What is the impact of microgravity on a stable marine ecosystem?

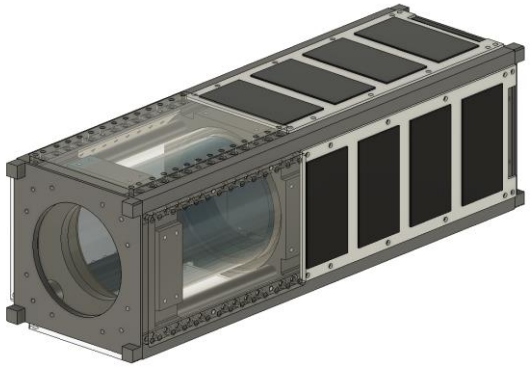


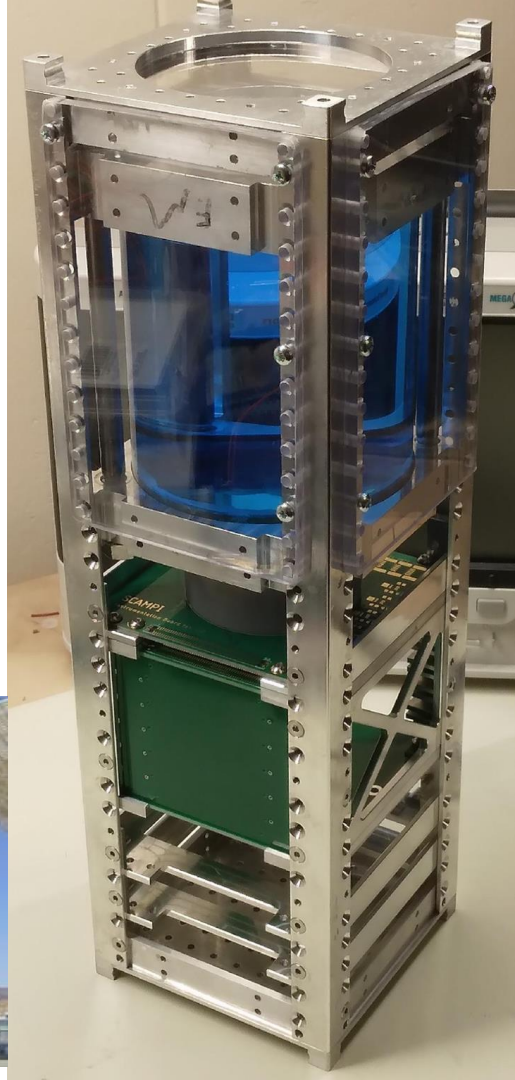


Ecosphere in Space

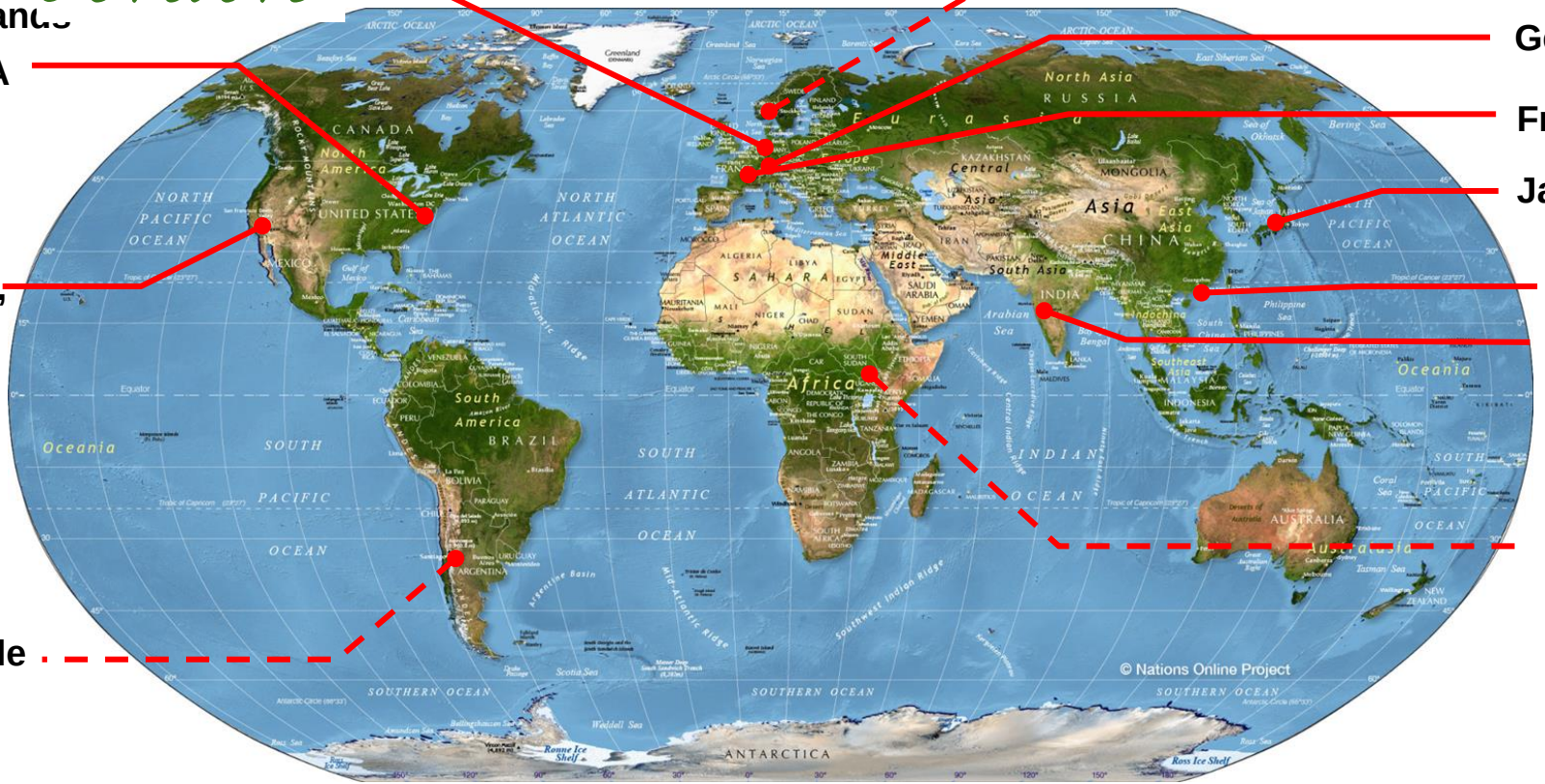
MIT student Christian Haughwout's phD thesis explored the design of a cubesat carrying an ecosphere: a biosphere made of shrimps, algae and microbacteries.

His thesis covers the mechanical, thermal and instrumental design along with an economic assessment of the project.





From Space, there are no borders




Paris
Spring germinated here
Cantal
You are here
Toulouse


esa
@explorasciences

ALL HELP IS WELCOME

As a student

- Join the ISS team as a Master or PhD
- Apply for internships

As a scientist

- sign up as mentors
- share your knowledge, papers and expertise
- partner in consortiums
- participate in our science interviews

As an institution

- sponsor outreach efforts
- communicate about your grants and call for projects

And any other step you can take to help us get closer to our goal

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& Humans making a difference

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