

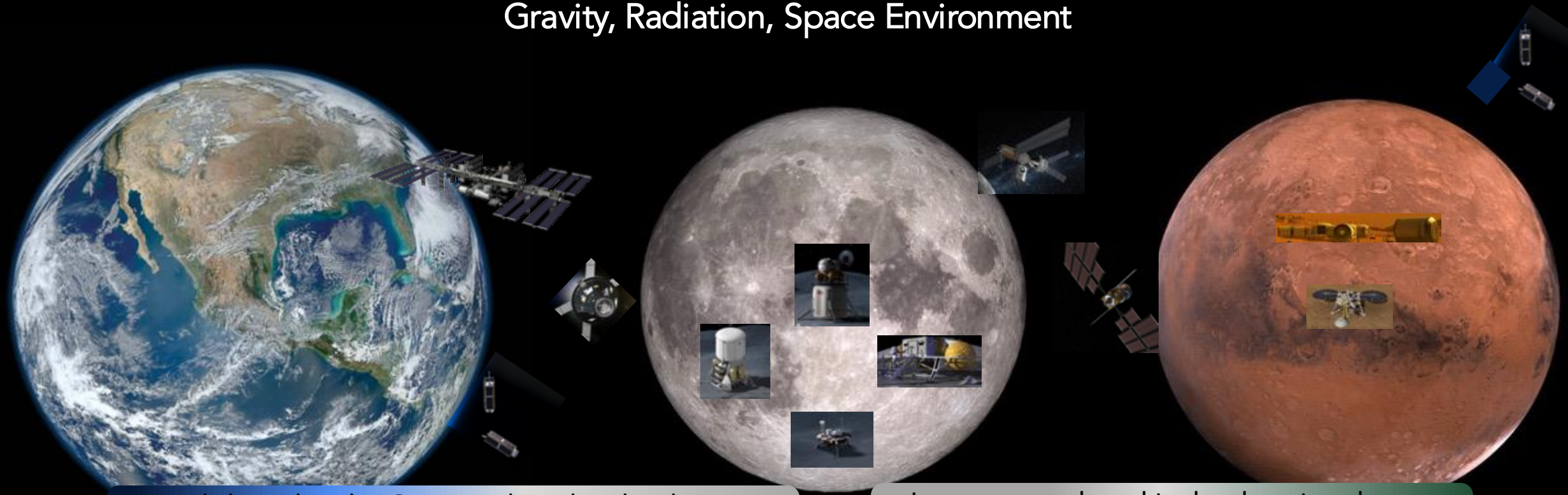
National Aeronautics and Space Administration

BPS Payload concepts for future small sat missions

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Biological & Physical Sciences

Gravity, Radiation, Space Environment



Earth-based and LEO research and technology to advance lunar exploration and habitats development

Lunar research and technology to advance Mars exploration and habitat development

Basic Research → Advance Scientific Knowledge

Basic Research → Data and Process Models → Technology R&D and Applications

Knowledge/Data Gaps → Basic Research → Data and Models → Technology R&D and Applications

Understanding Physical Systems in the Unique Environment of the Moon

- Altered gravity
- Deep Space and Lunar Surface Albedo Radiation
- Unique Environmental Factors
- Distance From Earth
- Outside Earth's Atmosphere and Magnetosphere
- Extreme cold environment, especially in the permanently shadowed regions

Life Sciences

Physiology, Biochemistry, and Molecular Biology of Model Organisms/Cell Systems of Human Biology and Disease; Plants biology

Physical Sciences

Combustion; Flammability; Fluid Physics; Dust; Material Sciences; Complex Fluids

Fundamental Physics

General Relativity, Gravitational Physics, Quantum Mechanics, Quantum Entanglement, Einstein Equivalence Principle; Soft Matter

Space Crops

ENABLING SPACE EXPLORATION:

- Provide astronauts with fresh and nutritious food
- Enable bioregenerative life support systems
- Support astronauts' overall psychological well-being



BENEFITS TO HUMANITY:

- Improve the growth and nutritional value of crops
- Contribute to innovations in farming and agriculture

ADVANCING MOON BASE OBJECTIVES:

- Lunar Effects on Agricultural Flora (LEAF) – planned Artemis III experiment on the Lunar surface
- Plant research aboard the International Space Station, including Veggie and Advanced Plant EXperiment-12 (APEX-12)



AVATAR

A Virtual Astronaut Tissue Analog Response

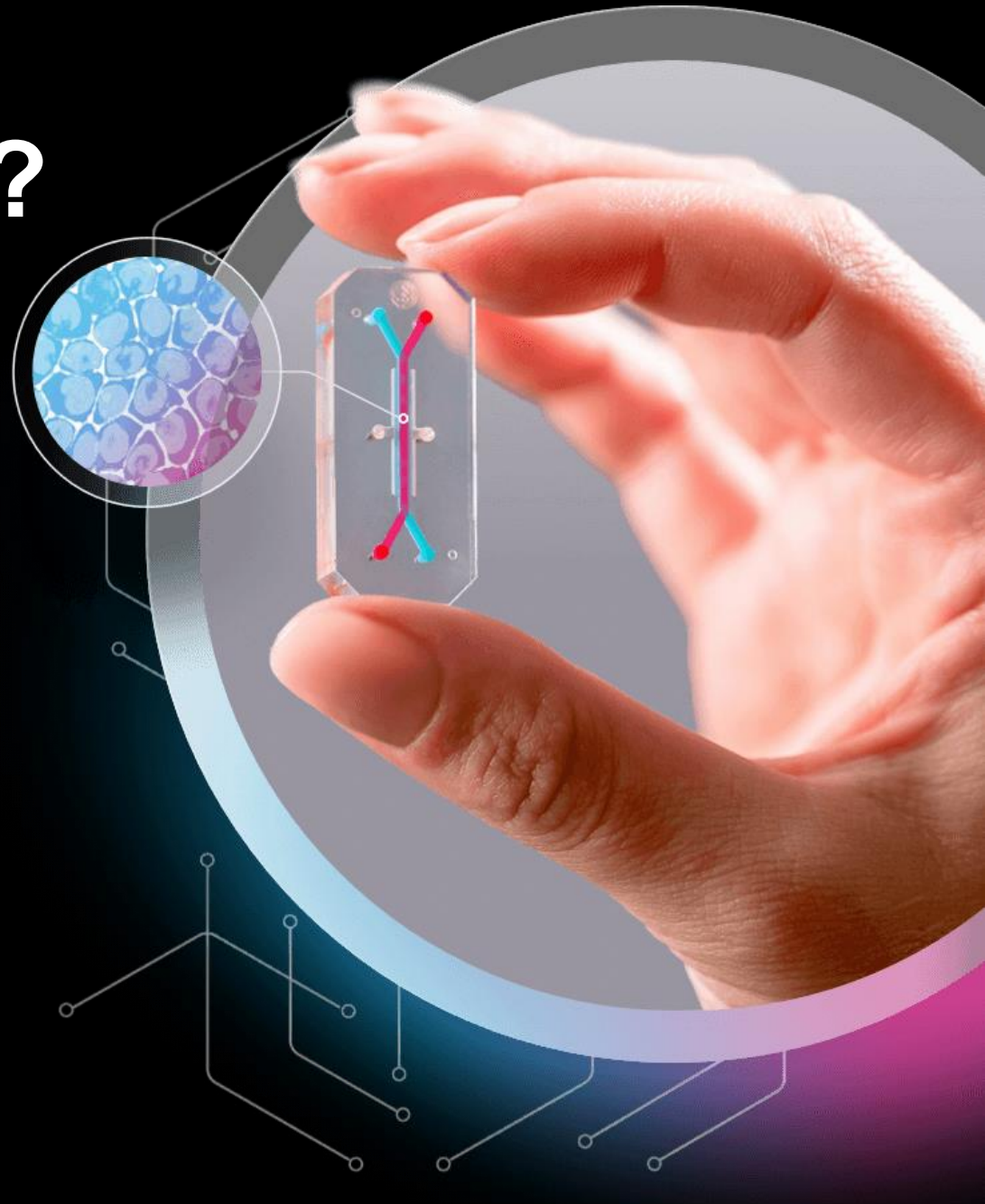
Objectives:

- **"Know before we go"** on future deep space missions to the Moon, Mars, and beyond.
- Identify **potential risks to individual crew health** using organ-chip technology.
- Leverage conditions of space to **conduct experiments impossible to do on Earth**.



What Are Organ Chips?

- **Tiny devices** the size of a USB thumb drive.
- Contain **living human cells** collected via a blood donation.
- **Replicates organ physiology** – breathe like a lung, beat like a heart, or process like a liver.
- Also known as **tissue chips** and **microphysiological systems**.





- Designed and built by Space Tango, Lexington, KY
- Based on the design of ISS-proven Tango Lab hardware
- Organ Chips are housed inside a science bay purged with 5% CO_2
- Chips are continuous fed throughout experiment with culture media
- Chips are maintained at 37C throughout experiment
- Once on the ground, chips are fixed with 4% paraformaldehyde to preserve gene expression profile for post-flight analysis

SPACE TANGO

https://spacetango.com/

Paving the way for personalized medicine.

In Space…

Identify risks to individual crew health before missions and inform personalized medical kits.

On Earth…

Advance medical research and enable clinicians to tailor treatments to individual patients.

National Aeronautics and Space Administration

Thank you…

https://science.nasa.gov/biological-physical/

emulate

Wyss Institute

Space Tango

BARDA

FDA

NIH National Center for Advancing Translational Sciences

Biological & Physical Sciences