



Rhodium Scientific's Variable Gravity Centrifuge: Enabling High Throughput Lunar & Martian Biomanufacturing on the ISS

Dr. Heath J. Mills

Chief Scientific Officer

Heath@RhodiumScientific.com

Rhodium Scientific LLC Proprietary – Use or disclosure of data contained on this sheet is subject to the restrictions on the title page.
© 2022 Rhodium Scientific

"America's First Commercial Space Biotech Company"

Our Mission is to Provide Reproducible, Quality Assured Science on Earth and in Space



*The First
Space Biotech
Company*

Founded in 2014, Rhodium Scientific is a **Hispanic-American, woman-owned and operated small business** specializing in:

- Commercial Services Provider to multiple National Laboratories including the ISS National Laboratory
- Translating benchtop science into feasible spaceflight procedures
- Providing turn-key ISS mission and science support
- Maintaining a proven, flight-certified biotech hardware portfolio



Company Proprietary

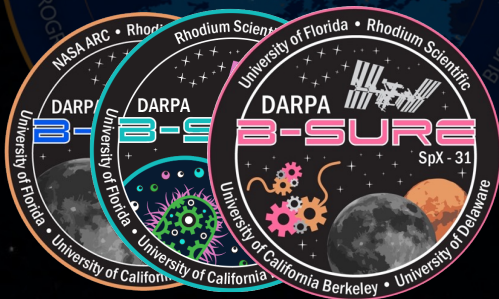
*Focused on
Quality Assurance
and Rapid Mission
Success*

Since 2020, we have:

Successfully executed and supported >25 S&T missions on the ISS:

- 8 DoD missions (6 DTRA and 2 DARPA)
- 6 additional missions currently scheduled in 2024
- Space flight certified >15 ISS science facilities and hardware

DARPA Missions



Industry & Academia Missions



Other DoD Missions



Astronaut Raja Chari holding a
Rhodium Science TempLog 20iB

Photo: Rhodium Scientific

Unique Environmental Stressors in Space



Unique Genotypic Shifts

- Gravitational Acclimation
- Gain of Function Mutations



Novel Physiologies

- Increased Metabolic Rates
- Secondary Metabolite Changes

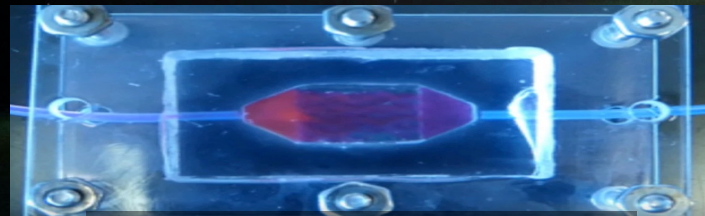


Photo Credit: Rhodium Scientific

Cyanobacteria launched to ISS Rhodium Synthetic Cryptobiology

Functional Advantages

- Effective 3D Cell Culture
- New Bioprinting/Scaffolding



Madeline, P. 3D Printing News. June 15, 2021

Regenerative
Medicine

Drug Discovery/
Development

Biomanufacturing

Unique Genotypic Shifts

- Gravitational Acclimation
- Gain of Function Mutations



Novel Physiologies

- Increased Metabolic Rates
- Secondary Metabolite Changes

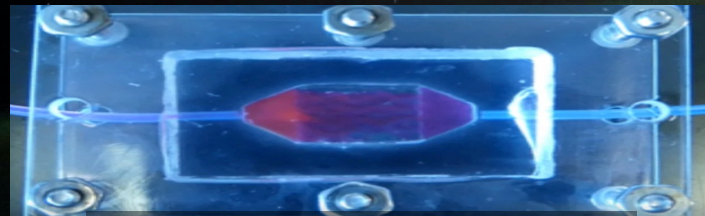


Photo Credit: Rhodium Scientific

Cyanobacteria launched to ISS Rhodium Synthetic Cryptobiology

Functional Advantages

- Effective 3D Cell Culture
- New Bioprinting/Scaffolding



Madeline, P. 3D Printing News. June 15, 2021



Photo: Rhodium Scientific

Regenerative Medicine

- Age related studies
- Cell cultures from bacteria to stem cells

R&D Programs

Drug Discovery/Development

- Bioprospecting novel molecules
- Advanced drug formulations



Photo: Rhodium Scientific

For Use by Rhodium Scientific Only

Technology Development

- Engineering support for Life Science and Health markets
- Rapid flight safety certification

Biomanufacturing

- Industry/DOD leader for Space SynBio
- ISS Centrifuge for Lunar/Martian gravity

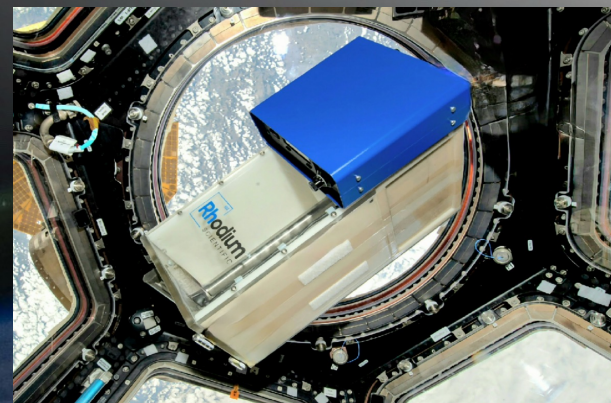


Photo: Rhodium Scientific

Company Proprietary

RhSC-05CT



Photo Credit: Rhodium Scientific

RhSC-1LIV

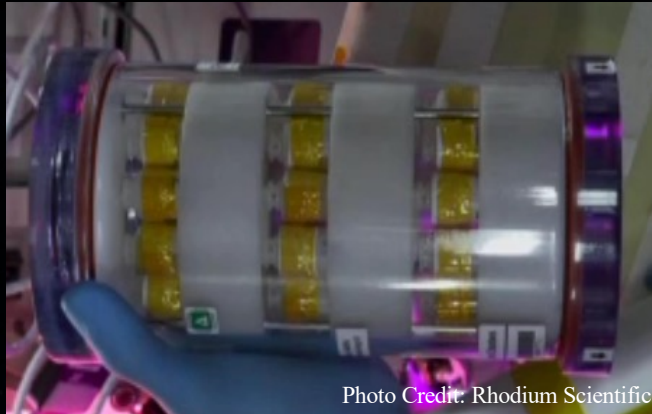


Photo Credit: Rhodium Scientific

RhSC-32CB



Photo Credit: Rhodium Scientific

RhSC-4MLS

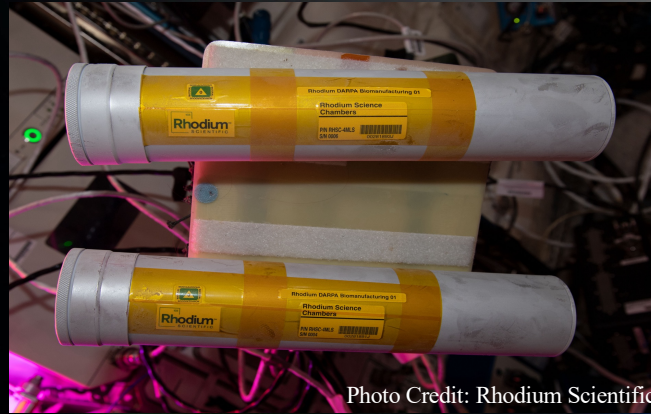


Photo Credit: Rhodium Scientific

103

RhodiumSM
SCIENTIFIC

Flight Hardware

Rhodium Science
Chambers

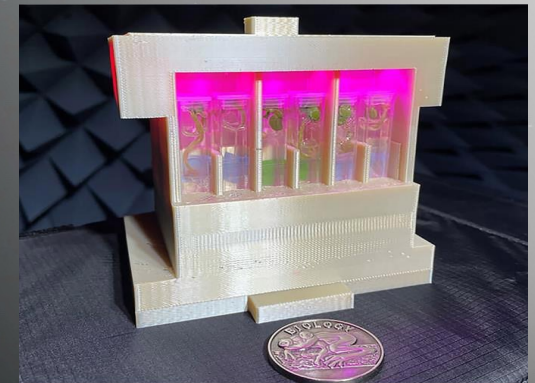
Science supported: liquid or lyophilized cultures of bacteria, fungi, plants, virus, microeukaryotes, medical-grade fecal material, human biological material, plants, seed growth, plants, soils, food production, synthetic biology, tissue culture, organoids, and stem cells. Additional support for inorganic chemistry reagents and molecules, crystalline formations, pharmaceutical formulations, and material samples.

For Use by Rhodium Scientific Only

Company Proprietary

Rhodium Science Powered Facilities

- Flight-tested, proven, and ready to launch
- Rhodium-developed spaceflight hardware that meets DoD Science/R&D needs



Rhodium Science TempLog-4RAD

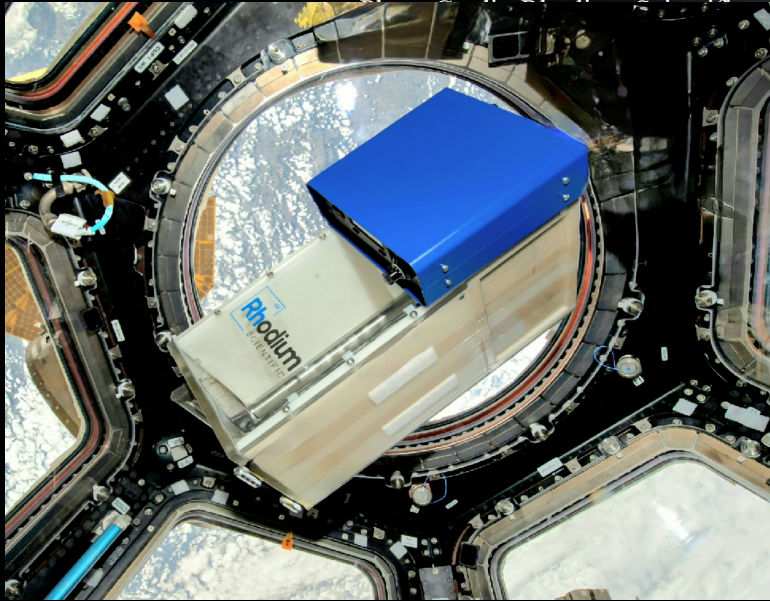
- Temperature and humidity logging at time intervals from minutes to hours
- Radiation dosimeter
- Temp range: -40°C and +85°C
- Small, rugged design
- 10 prior successful missions
 - 1 mission currently on orbit
 - 6 manifest for upcoming launches

Rhodium Variable Gravity Simulator 01

- Produces Lunar, Martian and Earth gravity on ISS
- Supports up to 36 samples per operation
- On orbit sample exchange permits timed incubations
- 1 prior successful missions
 - 2 manifest for upcoming launches

Rhodium SOFIA 01

- Provides 12 individual growth chambers for up to 4 ml of volume per sample
- Light source for photosynthetic growth
- Can be frozen to preserve sample
- 1 manifested upcoming launch
 - 3 pending manifest on future launches



- Produces artificial gravity equal to Earth, Lunar, and Martian gravity
- Provides continuous operation mode for stable gravity analogs
- Contains “Plug and Play” cartridges of various sizes for a **total volume up to 1.5 U** per operation, supports up to 36, 4 mL cryotubes for a **total working volume of 144 ml**
- Rhodium Science Chamber 4MLS provides temporary stowage for cryotubes before and after insertion into this centrifuge

Flight Hardware

Rhodium Variable Gravity Simulator 01

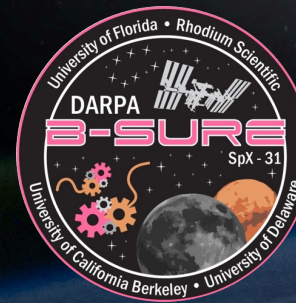
DARPA Biomanufacturing 01



Mission Results

- 216 samples incubated in microgravity, Lunar gravity and Martian gravity
- Continuous operation for up to 9 days
- Higher production concentrations in Lunar and Martian gravity

Biomanufacturing 03



Upcoming Mission

- 216 samples incubated in microgravity, Lunar gravity and Martian gravity
- Continuous operation for up to 9 days
- Launch and return on SpX-31

Seeking R&D collaborators in biotech, medical, and tech dev.



Looking for collaborators in:

- Fast-Paced Engineering Support
- Biomanufacturing
- Regenerative Medicine
- Pharmaceutical/crystallization

We specialize in developing missions
with first-time fliers



Dr. Heath J. Mills, CSO
heath@rhodiumscientific.com

