



Space Science Week 2024

Panel on Living and Traveling in Space

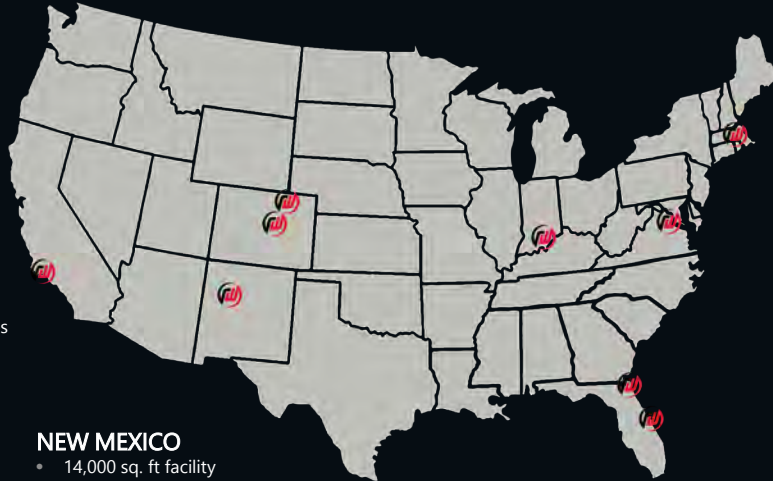


Aaron J. Rogers, PhD
Redwire Senior Scientist

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Over 700 Employees Working at 14 Locations in U.S. and Europe

Redwire Space Provides 50+ Years of Space Flight Heritage and Innovative Capabilities for Civil Space and National Security Missions



COLORADO (Littleton and Longmont)

- 102,000 sq. ft total in CO
- Clean Rooms
- RF & Antenna Systems
- Deployable and Retractable Space Structures
- Solar Arrays, Batteries, Thermal Products
- Space Systems Engineering Services
- Camera Systems
- Flight Avionics
- Data Recovery Systems
- In-House Testing Capabilities
- Digital Engineering
- Modeling & Simulation

NEW MEXICO

- 14,000 sq. ft facility
- Operate and Maintain AFRL testing facility
- Design and Analysis Services
- Structural & Thermal Testing
- Launch Accommodation Hardware
- Thermal Control Hardware
- Deployable Technologies

CALIFORNIA

- Collaborating with JPL
- 33,620 sq. ft facility
- Additional 47,047 sq. ft under construction
- 3-Story High Bay
- Human Spaceflight Avionics
- Deployables / ROSA
- High Power Solar Arrays

FLORIDA

Redwire Corporate Headquarters in Jacksonville

- 37,247 sq. ft facility
- Clean rooms
- Advanced In-Space Manufacturing Technology
- In-Space Robotic Assembly & Manufacturing/ISAM

Merritt Island, FL (near KSC)

- 2,377 sq. ft. facility
- Strong partnership with NASA KSC
- Prelaunch processing laboratory and support
- In-space plant biology research
- ISS and lunar Payload Development

MASSACHUSETTS

- 18,000 sq. ft. facility
- Clean Rooms
- Sun Sensors & Star Trackers
- Integrated Camera Systems
- ADACS Systems
- Satellite Systems

INDIANA

- 22,000 sq. ft facility
- In-space Research
- ISS/LEO Payload Development
- Advanced Space Manufacturing Technology
- Biotechnology, bioprinting, on-orbit manufacturing, environmental control & life support systems

DC/VA/MD

- 8,000 sq. ft. facility (2/3 SCIF)
- SCIF, Classified Systems Access
- Digital Engineering Lab
- Engaging NASA GSFC in MD



BELGIUM

- 19,000 sq. ft. facility
- Hi-Ref SmallSats
- Berthing & Docking Mechanisms, Avionics
- Advanced Data and Power Management Systems
- Life Support Systems

LUXEMBOURG

- 2,500 sq. ft facility
- Redwire Engineering & Sales Center in Europe
- Robotic Systems
- Avionics



Redwire Microgravity Payload Heritage



Redwire In Space Industries President John Vellinger in 1985 preparing for a space experiment



NASA Astronaut Janice Voss inspects the Redwire ORSEP payload she operated aboard a space shuttle in 1993



Legendary Astronaut John Glenn with Redwire microgravity hardware aboard a space shuttle in 1998



NASA Astronaut Serena Auñón-Chancellor aboard the ISS with the Redwire MVP payload in 2018



NASA Astronaut Jessica Meir calibrates the Redwire Bone Densitometer aboard the ISS in 2019



NASA Astronaut Josh Cassada installing the Redwire 3D BioFabrication Facility aboard the ISS in 2023

Redwire has 9 payloads on the ISS, more than any other company, with more hardware in development

Redwire has direct experience with biotechnology and material science in space, providing innovative and reliable space equipment and service solutions for more than 30 years

Living and Traveling in Space

Redwire enables long term space habitation

- Power
- Navigation
- Food
- Waste Handling
- Maintenance / Repair



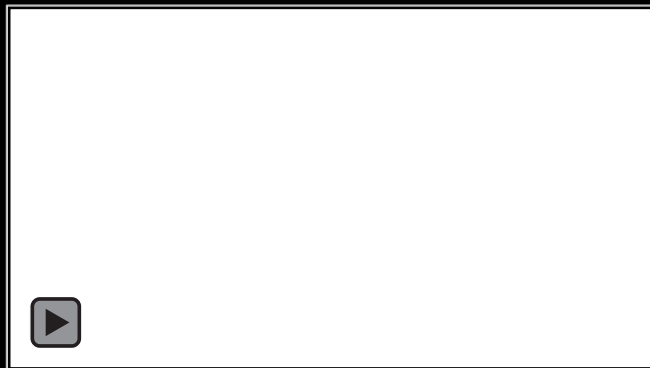


Need Power

Redwire's Roll-Out Solar Arrays (ROSAs)

Redwire has delivered four 28kW iROSA wings to amplify power on the International Space Station (ISS).

Jun 2021 Dec. 2022 Jun 2023 TBD
Wings 1 & 2 Wings 3 & 4 Wings 5 & 6 Wings 7 & 8



Redwire is building the largest solar arrays ever deployed by humanity in space for **Gateway's Power and Propulsion Element (PPE)**.

Redwire's two 3.5kW ROSA's powered the entire spacecraft for **NASA's Double Asteroid Redirection Test (DART) mission**, the world's first planetary defense test mission that impacted an asteroid on September 26, 2022.



BUILD ABOVE



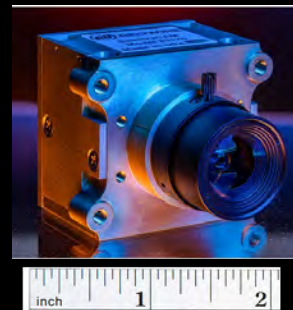


Need Navigation

Commercial Lunar Payload Services (CLPS)

Redwire Cameras Onboard Intuitive Machines IM-1

- Redwire provided multiple SpectraCam cameras for Terrain Relative Navigation, Hazard Detection & Avoidance
- SpectraCam is a high-resolution camera capable of supporting diverse applications in LEO, GEO, Cislunar, including Rendezvous Proximity Operations & Docking, and Space Situational Awareness



Redwire's
SpectraCAM Image of
Moon from IM-1





REDWIRE TECHNOLOGY SUPPORTING THE ORION SPACECRAFT FOR ARTEMIS I

In partnership with Lockheed Martin, Redwire is providing the Orion Camera System, an array of 11 internal and external inspection and navigation cameras developed for the Orion Spacecraft. As the “eyes” of Orion, our camera system will enable advanced vehicle imaging capability for the spacecraft.

- **Four cameras** positioned on each of Orion's four solar arrays allow in-flight inspection of the spacecraft, from the docking hatch to the main engine.
- **Optical Navigation Camera** provides data to the Camera Controller for machine vision processing to determine Orion's position and velocity relative to Earth.
- **In addition** to the Orion Camera System, a mission-unique kit that includes a virtual reality camera and forward-facing console camera.
- **Additional cameras** inside and outside Orion record and stream high-quality video of events such as separation, jettison, deployment and release events.

Redwire is also providing four redundant Coarse Sun Sensor (CSS) detector assemblies for Orion's European Service Module (ESM) through a contract with Airbus.

"Eyes of Orion" for NASA's Artemis I Mission

Redwire manufactured the cameras for Orion which captured stunning imagery from the historic Artemis I mission.

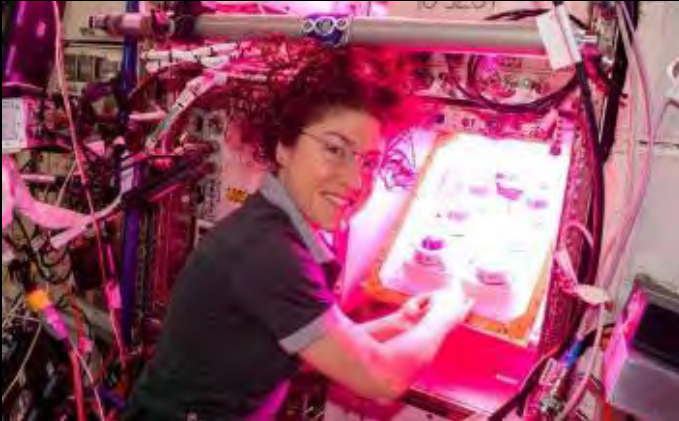




Need Food

Redwire PONDS

Passive Orbital Nutrient Delivery System (PONDS)



- Next generation on orbit plant device
- Developed in partnership with Tupperware Brands
- Plants grow in arcelite, large reservoir provides water/nutrients



Redwire Managed APH

Advanced Plant Habitat (APH)



- NASA-owned, Redwire managed plant habitat
- APH is the most complex greenhouse ever flown in space.
- Chile Peppers, radishes, *Arabidopsis*, cotton spores, etc.

First Human Knee Meniscus Construct Biprinted In Space!

Can Print Food Too!

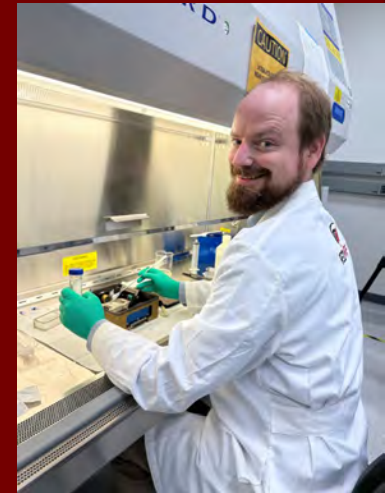
UAE Astronaut among those helping conduct the experiment



In-space 3D biprinted human knee meniscus material



Very happy Redwire Senior Scientist Dr. Aaron Rogers





Need Waste Handling

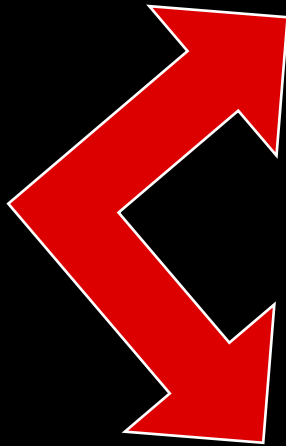
Redwire Space Toilet "Cosmic Commode"



Single Use Bag System



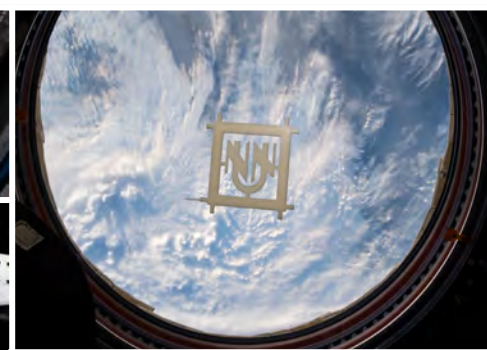
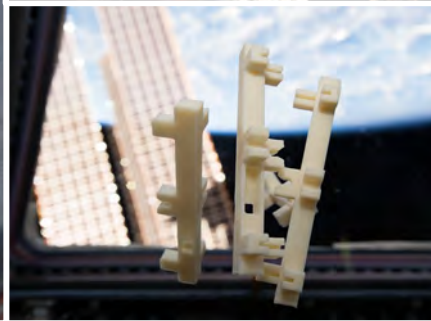
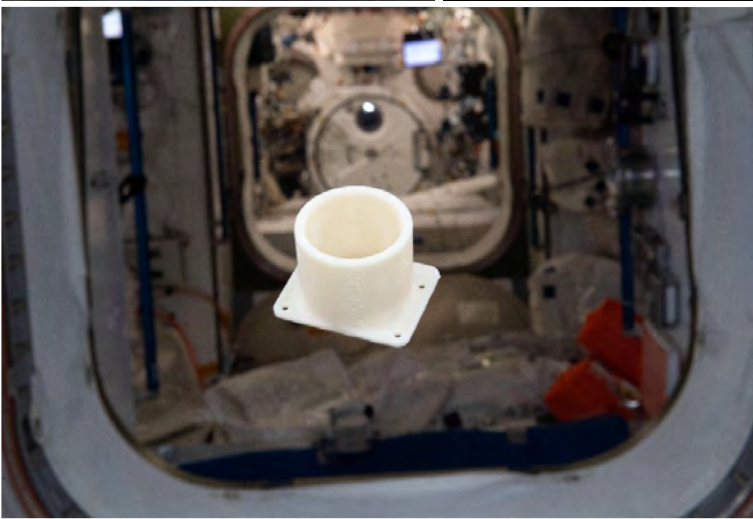
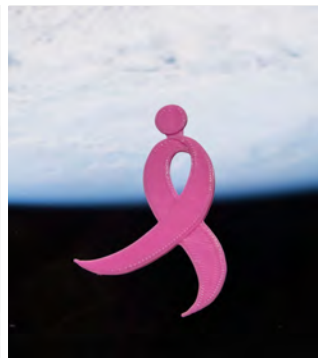
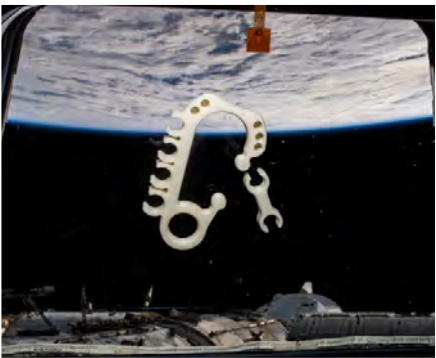
Iris Closure System





Need Maintenance and Repair

Over 200 objects physically manufactured in space to date





FabLab Multi-material 3D Printer

Make It, Don't Take It!

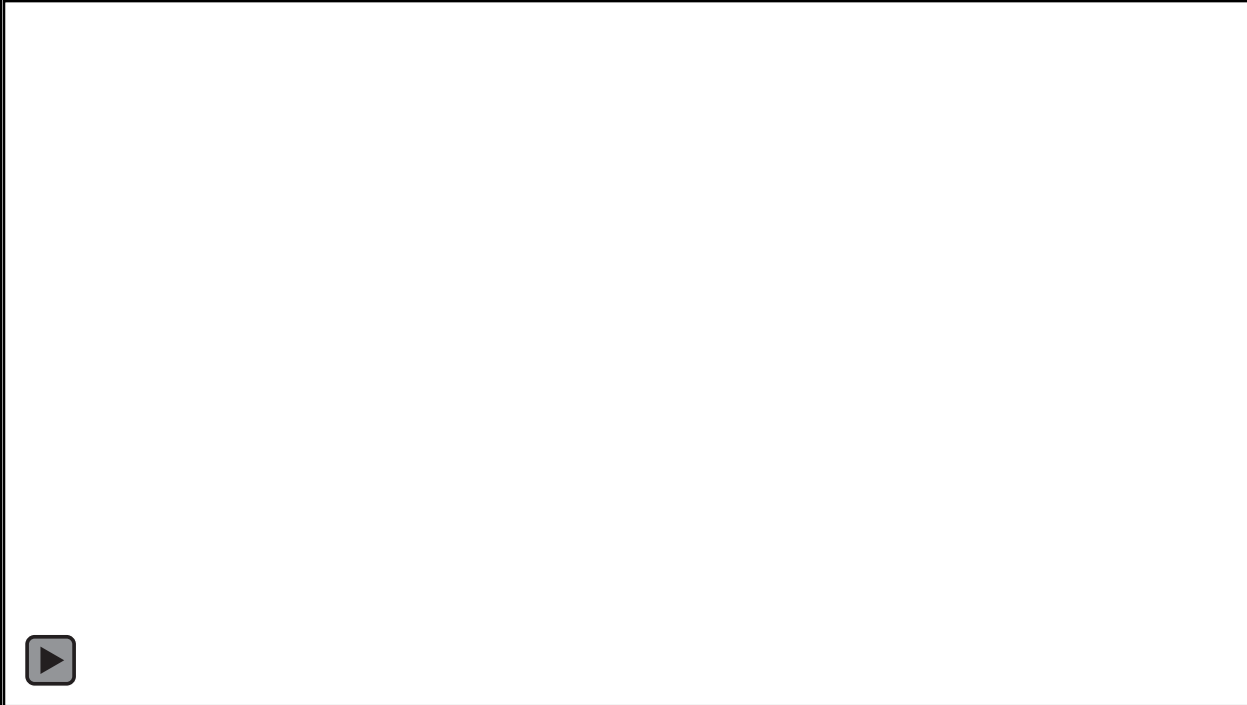


- Onboard maintenance
- All-in-one solution
- Additive manufacturing
- Subtractive manufacturing
- In-space 3D printing
 - Aerospace-grade replacement parts, tools
 - Electronics
 - Plastics
 - Ceramics



FabLab Multi-material 3D Printer

Make It, Don't Take It!





Want to know more? Contact me!
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National Academy of Sciences
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March 20, 2024