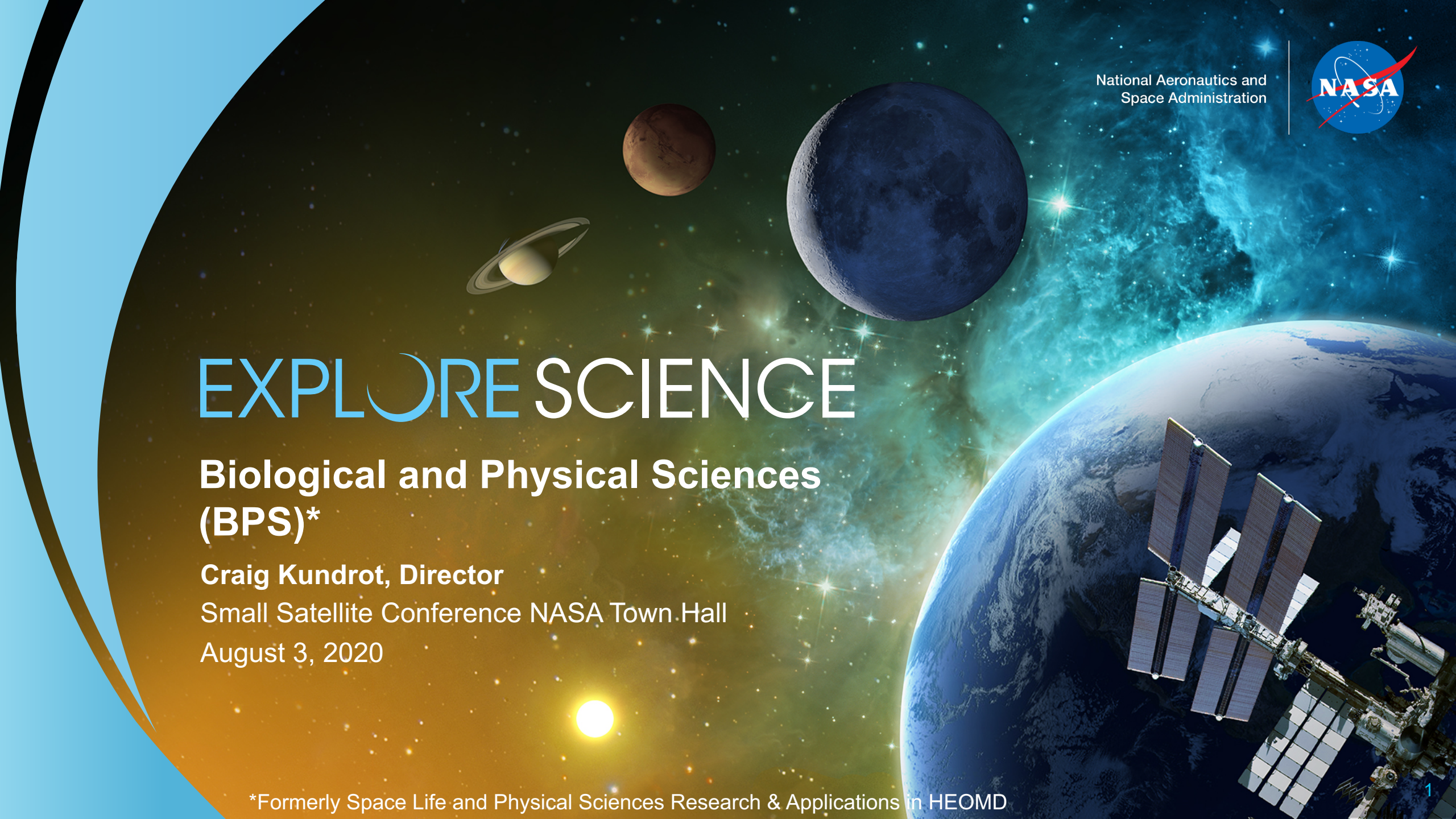
National Aeronautics and Space Administration



EXPLORE SCIENCE

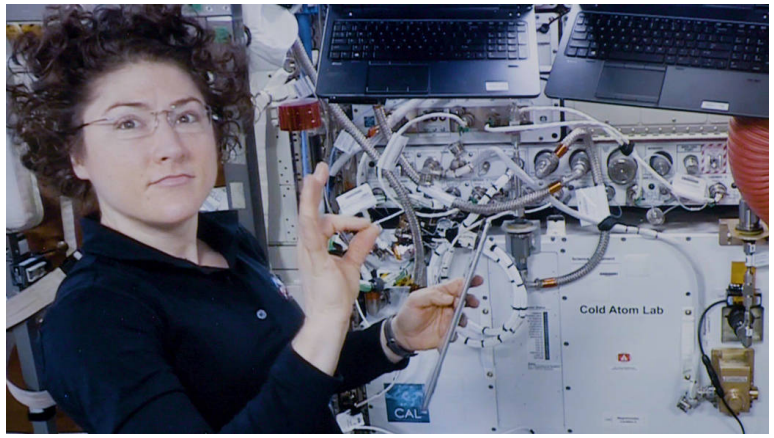
Biological and Physical Sciences (BPS)*

Craig Kundrot, Director

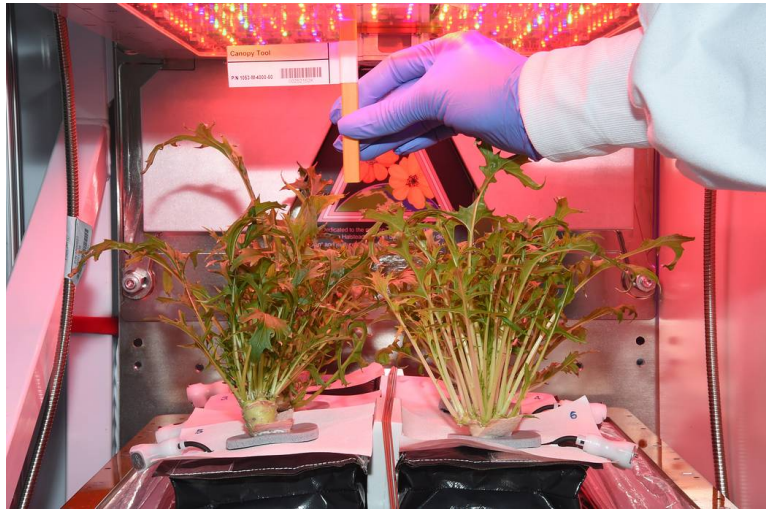
Small Satellite Conference NASA Town Hall

August 3, 2020

*Formerly Space Life and Physical Sciences Research & Applications in HEOMD



Example of Physical Sciences research: Studying quantum gasses



Example of Space Biology research: Growing plants in space

What We Do

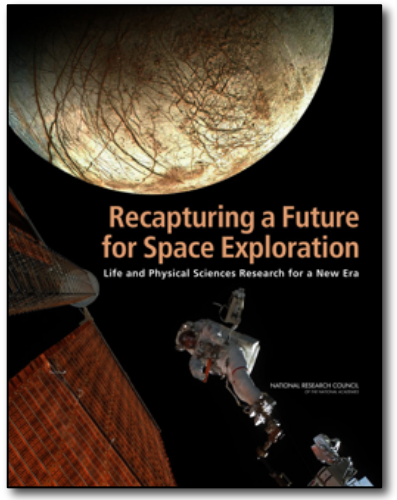
We use spaceflight environments to **study biological and physical systems**.

Examining phenomena under extreme conditions can **help us better understand how they function**.

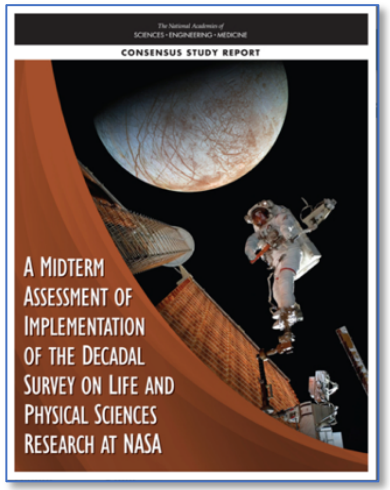
This can contribute to significant scientific and technological advancements that **enable space exploration and benefit life on Earth.**

2

BPS Mission & Goals



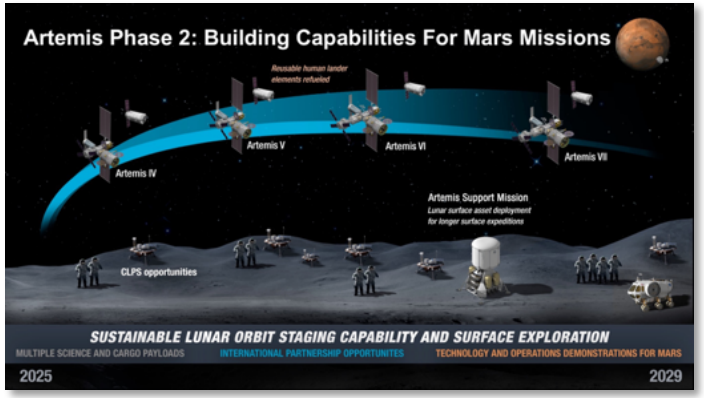
Decadal Survey



Midterm Assessment

Pioneer Scientific Discovery

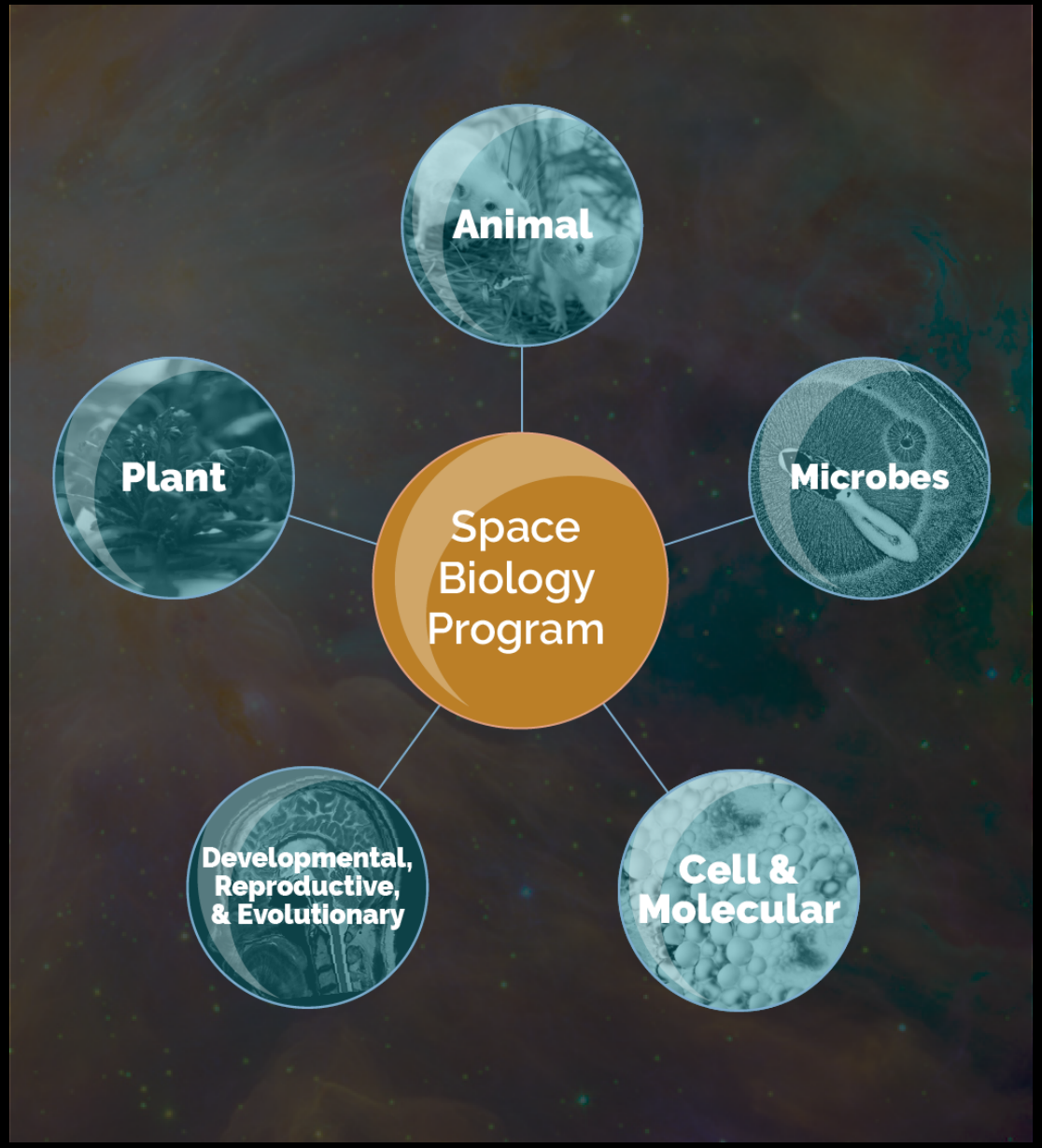
- Use the unique environments in space to expand fundamental scientific knowledge
- Provide expertise and support to others seeking to utilize space



Artemis Missions

Enable Exploration

- Anticipate and investigate critical areas for scientific knowledge and technology development
- Deliver results to STMD and HEOMD

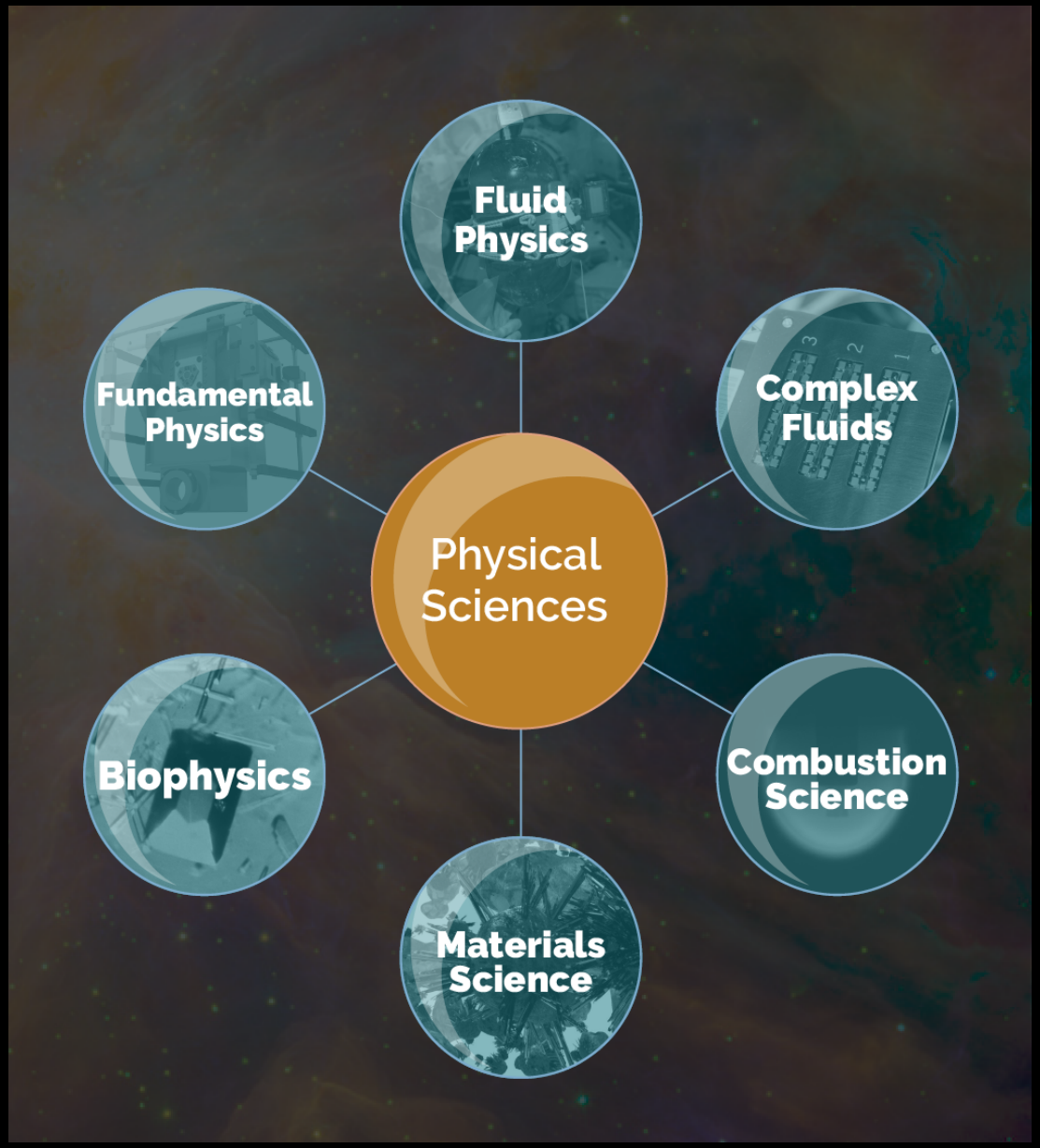


Objectives

- Discover how biological systems respond to the space environment
- Identify the underlying mechanisms and develop physiological models for biological systems in space
- Promote open science through the GeneLab Data System and Life Science Data Archive
- Developing cutting-edge biological technologies to facilitate spaceflight research
- Provide mechanistic understanding to support human health in space
- Support the transfer of knowledge and technology of space-based research to the understanding of life on Earth to benefit life on Earth

Databases and Biospecimen Sharing

- GeneLab (genelab.nasa.gov)
- Life Sciences Database Archive (lsda.nasa.gov)



Objectives

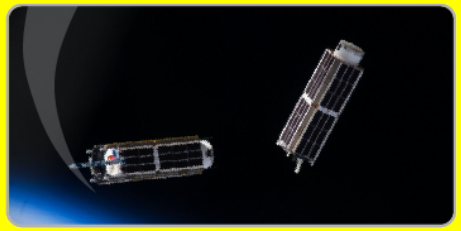
- Investigate fundamental laws of physics and physical processes, often using either microgravity or interplanetary distances as research tools
- Provide a mechanistic understanding of processes underlying space exploration technologies such as power generation and storage, space propulsion, life support systems, and environmental monitoring and control
- Promote open science through Physical Science Informatics
- Develop cutting-edge technologies to facilitate spaceflight research
- Support the transfer of knowledge and technology of space-based research to terrestrial systems to benefit life on Earth

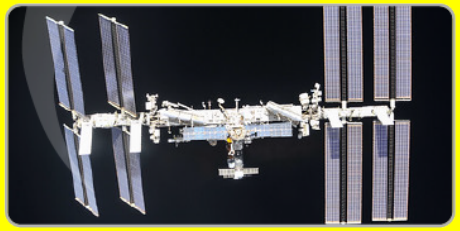
Database

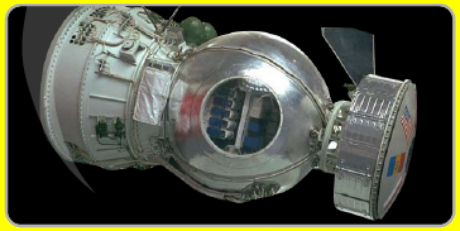
- Physical Sciences Informatics (psi.nasa.gov)

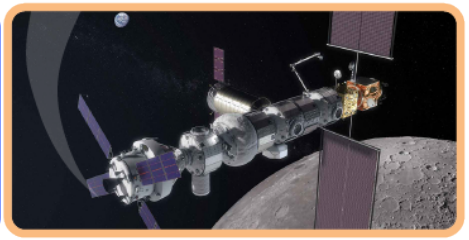
BPS Platforms for Research

*Future Platforms

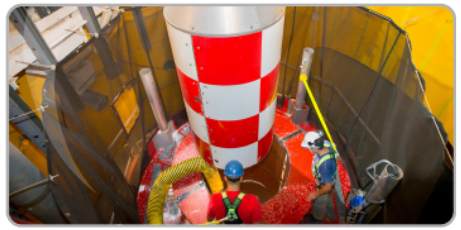

CubeSat


International Space Station


Free Flyers (BION)

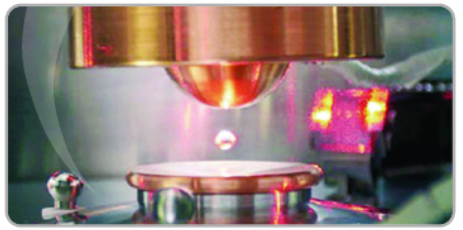

*Lunar Gateway


*Commercial Lunar Lander Services


Drop Tower

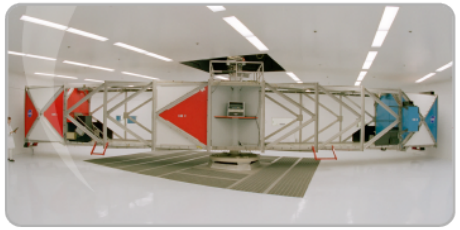

Parabolic Flight


Sounding Rocket
Sub-orbital Vehicle


Electrostatic Levitator


*Human Landing System


Rodent Unloading

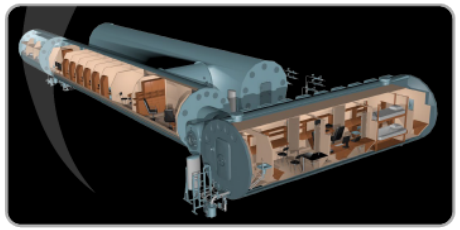

Centrifuge


Balloon Flight

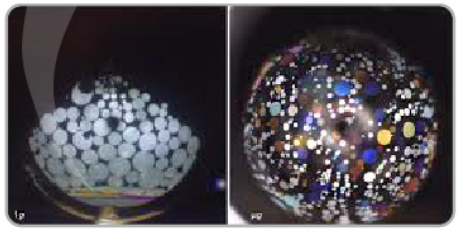

NASA Space Radiation Lab


NASA Isolation Chamber


NSF Polar Station

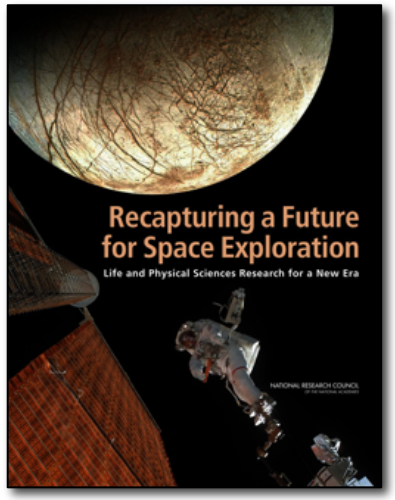

Russian Isolation Chamber


Gravity Vector Averaging

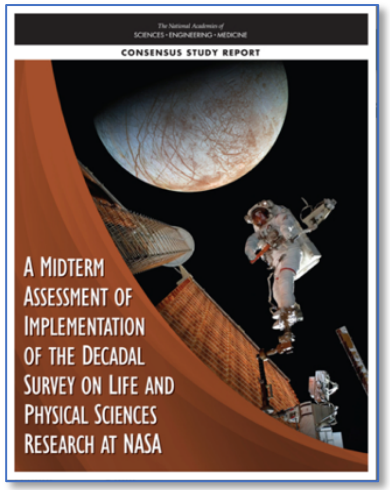

Physical Sciences
Informatics


GeneLab

Decadal Survey



Decadal Survey



Midterm Assessment

- Produced by the National Academies of Science, Engineering, and Mathematics (NASEM) and incorporating broad community input
- First Decadal Survey for Life and Physical Sciences produced in 2011
- Second Decadal Survey to be commissioned in 2020
  - Provide recommendations to implement a comprehensive strategy and vision for a decade of transformative science at the frontiers of biological and physical sciences research in space
    - Identify requirements for facility and platform capabilities
    - Assemble notional proof-of-concept research campaigns as part of complex or multi-disciplinary missions or mission sets
- Preliminary ideas (whitepapers) being solicited now by the NASEM Committee on Biological and Physical Sciences in Space (CBPSS)
  - www.nationalacademies.org/our-work/committee-on-biological-and-physical-sciences-in-space
- Formal call for whitepapers will be issued after Decadal Survey Committee is created late 2020 or early 2021.

7

Conclusion

- **The Biological and Physical Sciences (BPS) Division:**
  - Pioneers scientific discovery and enables exploration
  - Studies a broad range of biological and physical systems
  - Develops technologies for research
  - Uses a broad range of platforms
  - Is interested in small satellite capabilities
- **The Decadal Survey process welcomes input on the use of small satellites to support the mission of BPS**
- **For more information:**
  - BPS
    - Kevin Sato at kevin.y.sato@nasa.gov
    - www.nasa.gov/directorates/heo/slpsra (until 8/15)
    - www.science.nasa.gov/biological-physical (after 8/15)
  - NASEM Committee on Biological and Physical Sciences in Space (CBPSS)
    - www.nationalacademies.org/our-work/committee-on-biological-and-physical-sciences-in-space