National Aeronautics and Space Administration

# BPS Director Update

**Lisa Carnell, Ph.D.**
Division Director
Biological and Physical Sciences Division
NASA's Science Mission Directorate

October 8, 2024

BPS

**B**iological & **P**hysical **S**ciences

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

# BPS's Mission

Pioneer Scientific Discovery

Enable Exploration

Contribute to Life on Earth

# BPS Program Areas

Space Biology

Physical Sciences

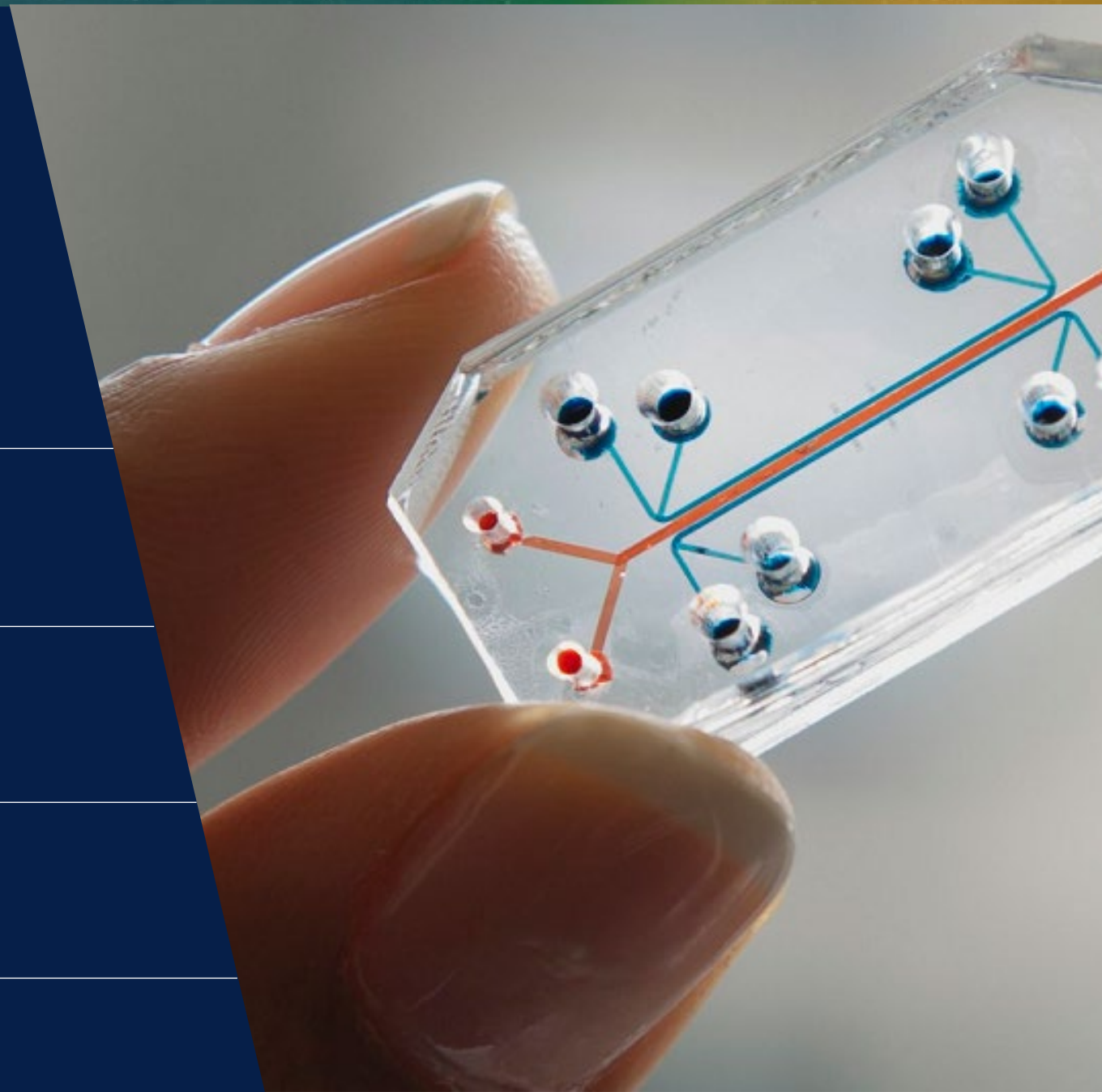
Fundamental Physics

Commercially Enabled RapId Space Science (CERISS)

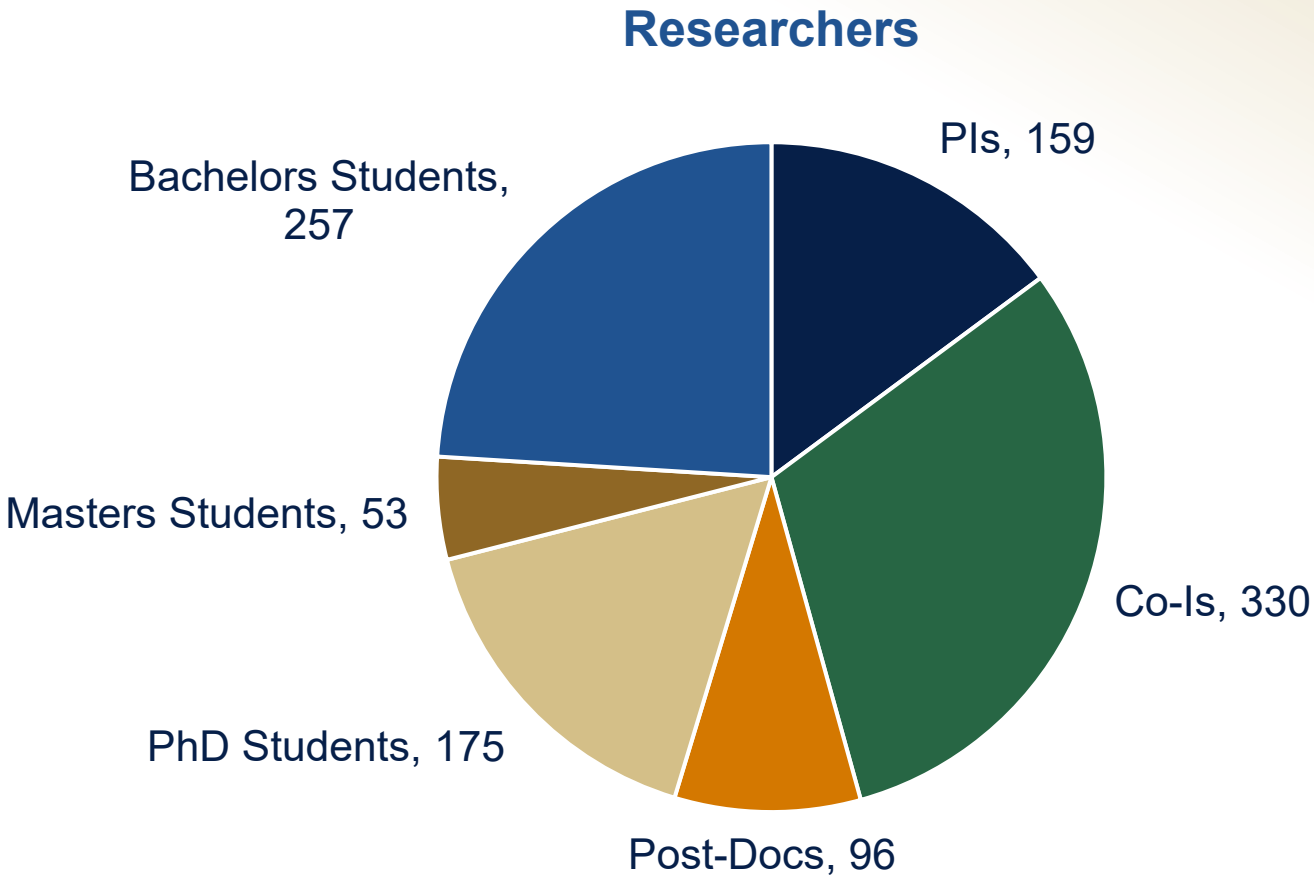
Open Science

# Impacts Include

- Biomedical Research
- Agricultural Innovations
- Consumer Products
- Technology Advancements



# 188 Active Investigations, FY 2024*




*Based on NASA Task Book entries, September 2024*

# BIOLOGICAL & PHYSICAL SCIENCES FLEET

- FORMULATION
- IMPLEMENTATION
- OPERATIONAL

*Partner-led

Mars

Moon

ARTEMIS III

FM2

LEIA LEAF*

ARTEMIS II

BRIC-LED

BRIC

APH

CAL

ELF*

VEGGIE

XROOTS

EML*

SPECTRUM

FBCE

SOFIE

FLARE*

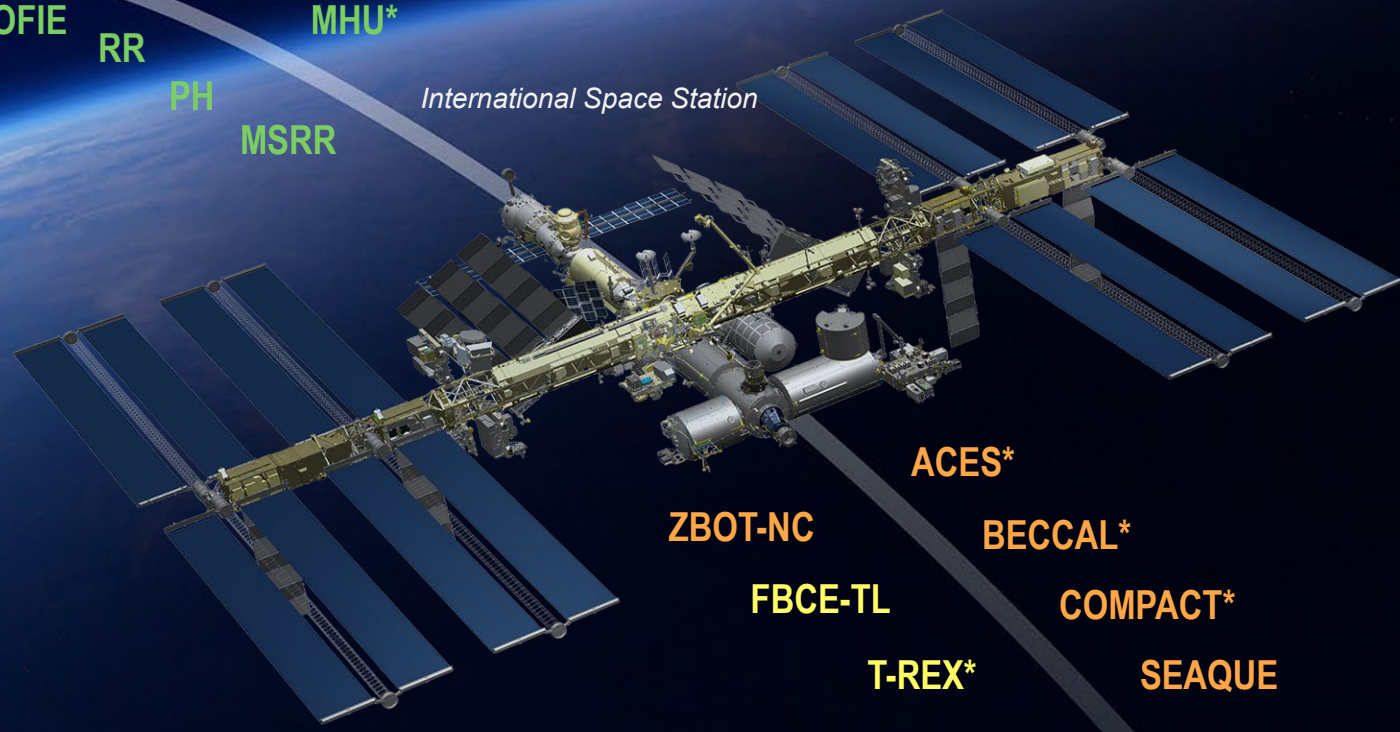
RR

MICRO

PH

MSRR

MHU*



International Space Station

ACES*

ZBOT-NC

BECCAL*

FBCE-TL

COMPACT*

T-REX*

SEAQUE

2024-10-01


# BPS Status Updates

# BPS People Updates

Diana Ly, Deputy Director

Lynn Harrison, Space Biology Program Scientist

Matthew Lera, Exploration Project Scientist

Sylvain Costes, Data Officer, ARC Open Science Program Office

Vanessa Salazar, Research Analyst


BPS Communications Team

# BPS Awards

**NASA 2023 Agency Award**
**Multi-Agency Tissue Chips Team**
For creating a pioneering multiagency team to support high priority public service research in a manner reflecting NASA's core values of excellence, teamwork, and inclusion.

**NASA 2023 Agency Award**
**BioExperiment-01**
For exceptional leadership and team coordination to achieve a successful mission outcome while serving as a pathfinder for biological research on Artemis I.

**NASA Space Flight Awareness Silver Snoopy Award**
**Diana Ly**
For for enabling successful Space Biology research investigations and setting the stage for sustained human exploration and biological studies in the Artemis era.

**International Space Station 2024 Compelling Results Award**
**Ethan Elliott**
For the outstanding observation of the first ever dual species Bose-Einstein Condensates and dual atom interferometry in space using the Cold Atom Lab.

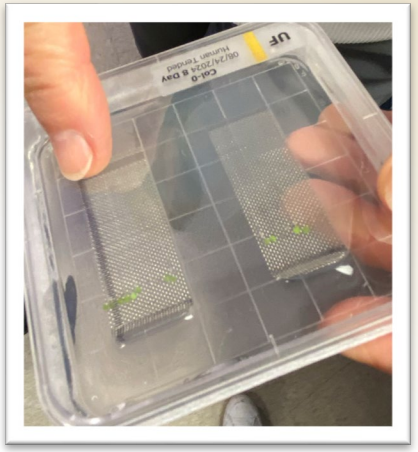
# NG-21 Launch (Aug. 4, 2024)

- **Grass growth and bio-regenerative support (APEX-09)**
  - Principal Investigator: Dr. Handakumbura, Pacific Northwest National Laboratory
- **Water purification and gravity (PBRE-WRS)**
  - Mars Campaign Office (MCO) - lead organization; BPS provided co-funding
- **Core physics of the formation of alloys (EML batch 4)**
  - Using ESA's Electromagnetic Levitation Facility (EML)
  - Principal Investigators: Drs. Matson, Hyers, and Kelton
- **Removing impurities in melted materials (ELF re-flight)**
  - Using JAXA's Electrostatic Levitation Furnace (ELF)
  - Principal Investigator: U.S. PI Narayanan, University of Florida

# NS-26 Launch (Aug. 29, 2024)

- **Blue Origin's New Shepard-26 (Suborbital Flight)**
  - Co-funded with NASA's Flight Opportunities Program and BPS's Commercially Enabled Rapid Space Science (CERISS) program

- **First NASA-funded researcher to fly on suborbital rocket**
  - Rob Ferl, plant biologist with the University of Florida, gathered samples at various stages of the flight while his co-principal investigator Anna-Lisa Paul conducted identical ground experiments simultaneously.
  - Research seeks to understand how changes in gravity during spaceflight affect plant biology
  - Could contribute to insights for future space crops



*Researchers Ferl, Paul, and Blue Origin staff after the launch*

# Upcoming SpX-31 Launch (Oct. 2024)*

- **Developing Firefighting Techniques in Microgravity**
  - Solid Fuel Ignition and Extinction - Material Ignition and Suppression Test (SoFIE-MIST)
  - Principal Investigator: Dr. Fernandez-Pello, University of California, Berkeley
- **Combating Antibiotic Resistance**
  - Genomic Enumeration of Antibiotic Resistance in Space (GEARS)
  - Principal Investigator: Dr. Carr, Georgia Institute of Technology
- **Understanding Inflammation and Blood Clotting**
  - Megakaryocytes Orbiting in Outer Space and Near Earth: The MOON Study (MeF1)
  - Principal Investigator: Dr. Schwertz, University of Utah, Salt Lake City
- **'Outredgeous' Romaine Lettuce Studies**
  - Plant Habitat-07 (PH-07)
  - Principal Investigator: Dr. Massa, NASA
- **Mixing Moss with Space Radiation**
  - Antarctic Isolate 1 (ANT1) Radiation Tolerance Experiment with Moss in Orbit on the Space Station (ARTEMOSS)
  - Principal Investigator: Dr. Zupanska, University of Florida, Gainesville
- **Enabling Probing the Relationship Between Quantum and General Relativity**
  - Space Entanglement and Annealing QUantum Experiment (SEAQUE)
  - BPS contributed funding to ground precursor work via the Deep Space Quantum Link (DSQL) investigation
  - Principal Investigator: Dr. Kwiat, University of Illinois Urbana-Champaign


*Date and payloads subject to change

# BPS Event Updates Since Spring, 2024

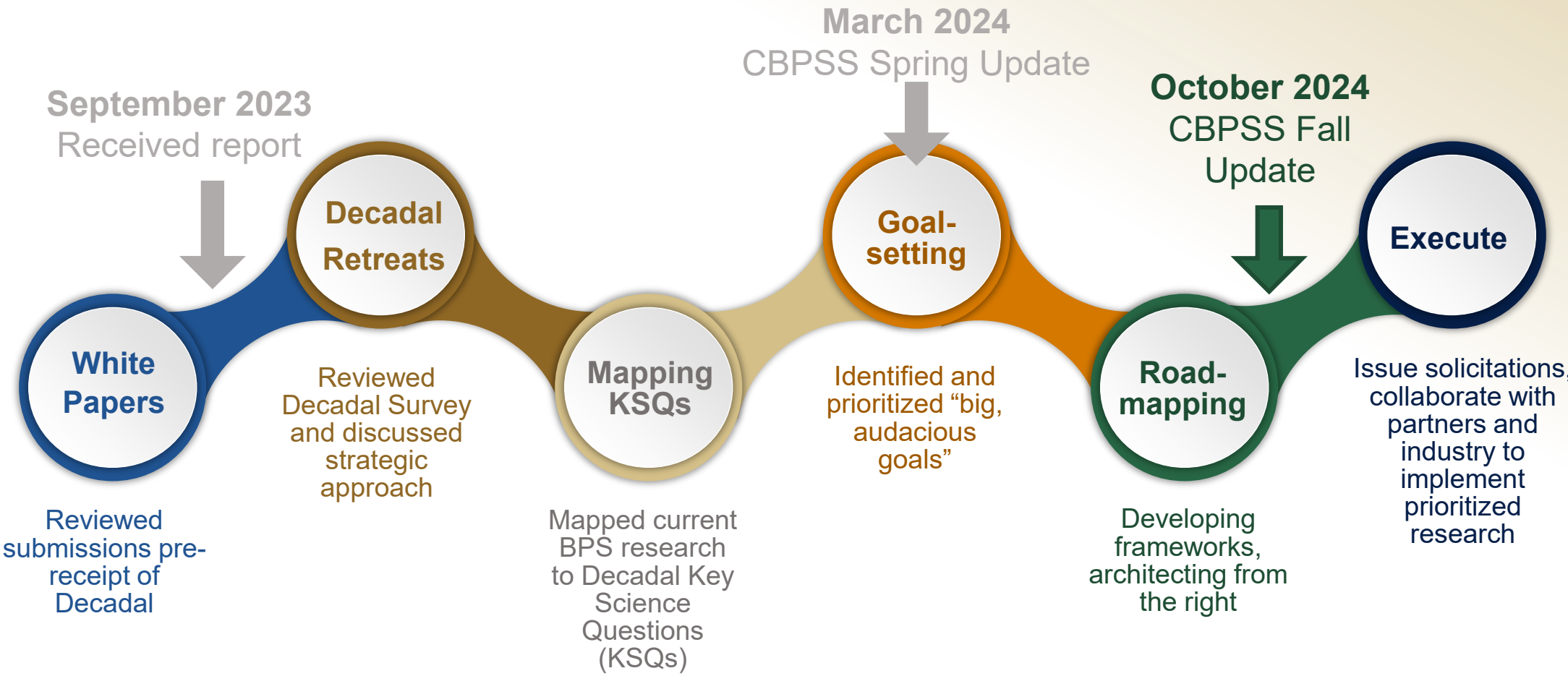
- **Apr. 25 – 26** – Biological and Physical Sciences Advisory Committee (BPAC) Meeting
- **May 14 – 16** – International Space Life Sciences Working Group (ISLSWG) 67th Meeting
- **July 15 – 16** – Japanese Space Agency (JAXA) trip to Tsukuba Space Center
- **July 30 – Aug. 1** – ISS Research and Development Conference (ISSRDC)
- **Sept. 6** – LEO Microgravity Strategy Working Group (LMS WG) with International Partners in London

# BPS Early Career Engagement Updates

- **Future Investigators in NASA Earth and Space Science and Technology (FINESST)**
  - FINESST funds graduate student "Future Investigators" for up to 3 years
  - BPS awarded 4 graduate student awards as part of FINESST-23:
    - Louisiana State University and A&M College (PI: Bhuvnesh Bharti / FI: Ruchi Patel) *"Designing space-time modulated reconfigurable structures using active colloids"*
    - Purdue University (PI: Ivan Christov / FI: Nishanth Surianarayanan) *"Modeling the Impact of Spaceflight on Perivascular Flows"*
    - Texas A&M AgriLife Research (PI: Terry Gentry / FI: Jessica Atkin) *"Bioremediation of lunar regolith leveraging plant-microbe associations"*
    - University Of Alabama, Huntsville (PI: Yooseob Song / FI: Ledia Shehu), *"Physics-based multiscale constitutive model for ISRU-based 3D-printed lunar concrete"*
- **STAR-5 Cohort began September 10, 2024**
- **GeneLab 4 Universities (GL4U) RNA Sequencing Bootcamp course**
- **GeneLab Educator Resources Translated into Spanish**
- **Growing Beyond Earth Program Kicks Off 2024-2025 School Year**
- **Many summer interns!**

# Decadal Status Update

# BPS Decadal Response Approach



# Strategic Roadmap Approach


- **Identified and prioritized "big, audacious goals"**
  - Aug. 5 – BPS Leadership and Communications Retreat
  - Aug. 21 – Internal Announcement of BPS Goals

- **Discussed Goals, Prepared to Roadmap**
  - Sept. 17 – 19 – BPS Quarterly and Roadmapping Working Sessions

# Thriving in Space

Revolutionary research in extraordinary places.

**Precision Health**

*Leveraging space to unlock the secrets of aging and disease*

**Space Crops**

*Boldly growing where no one has grown before*

**Quantum Leaps**

*Unraveling mysteries of the universe*

**Foundations**

*Revealing the novel behaviors of fluids, fire, and materials in space*

**Space Labs**

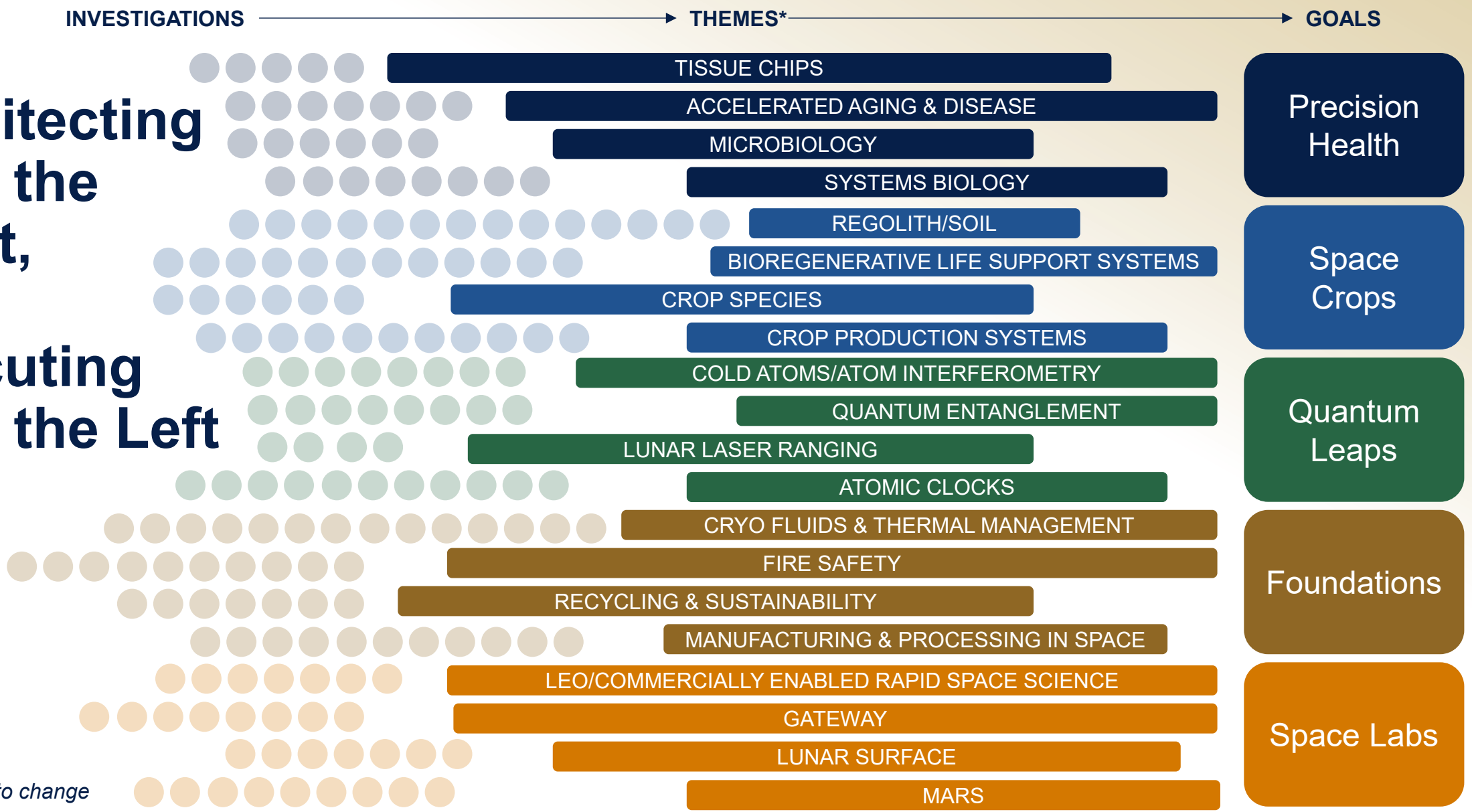
*Accelerating the pace and productivity of research*

# Strategic Roadmap Approach

- **Align with Decadal Recommendations**
  - Address Key Science Questions, advance research campaigns
- **Establish BPS's Vision**
  - Position BPS, its community, and partners as leaders in space-based research
- **Integrate with NASA Missions, National Priorities**
  - Identify opportunities that enable or are enabled by BPS science
- **Seek State-of-the-Art Capabilities**
  - Pursue next-gen technologies, CLD facilities, off-the-shelf tools
- **Identify Budgetary Considerations, Gaps**
  - Develop a phased approach that progresses goals
- **Engage Science Community**
  - Engage the community to uncover risks, opportunities in roadmaps

# Architecting from the Right,

# Executing from the Left




**Draft – subject to change*

# Next Steps

# Upcoming Decadal Engagement

## 10/8-9/2024 CBPSS

- Present updates and consider engagement opportunities with National Academies

## 11/13-15/2024 ISLSWG/IMSPG

- Share Decadal updates with International Partners (joint ISLSWG/IMPSG meeting hosted by Italian Space Agency (ASI))

## 11/22/2024 BPAC

- Discuss roadmap plans with BPS's Advisory Committee

## 12/5-7/2024 ASGSR

- Share roadmap progress with science community
- ASGSR will be running Analysis Groups for BPS

# BPS Next Steps