



National Aeronautics and
Space Administration

BPS Status Update

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Biological and Physical Sciences Division
NASA's Science Mission Directorate

April 25, 2024

Biological & Physical Sciences



Agenda

- 1 | BPAC 101
- 2 | BPS Status Update



BPAC 101

**Welcome to the BPAC!
Thank you for your
service.**

What is the BPAC?

- The Biological and Physical Sciences Advisory Committee (BPAC) is an advisory committee chartered under the Federal Advisory Committee Act (FACA)
- FACA committees are established to provide information and advice on a broad range of issues affecting federal policies and programs
- FACA committees should (per the GSA):
 - Provide advice that is relevant, objective, and open to the public
 - Act promptly to complete their work
 - Comply with reasonable cost controls and record keeping requirements (this one is mostly on the Executive Secretary)
- The BPAC provides advice to the Director of the BPS Division

Charge to BPAC

- **Per the BPAC Charter**
 - Provide advice and make recommendations to the Director on
 - Programs
 - Policies
 - Plans
 - Priorities
 - The implementation of the above
 - Enable a broad discussion of
 - BPS science
 - The role of BPS science within and outside NASA
 - Evaluate BPS annually for progress against its NASA performance objectives
- **Process**
 - Real-time feedback in the BPAC meeting
 - BPAC Chair provides BPS Division Director with a letter within ~30 days of the meeting
 - Summary of meeting events
 - Findings (do not require a response)
 - Recommendations (require a response)
 - Requests for follow-up

BPS-Relevant FY22 GPRAMA Science Performance Goal

1.2.8 “NASA shall demonstrate progress in understanding the properties of physical and biological systems in spaceflight environments to advance scientific knowledge, enable space exploration, and benefit life on Earth.”

BPAC Meeting Requirements

- All meetings must be available to the public
 - Generally this is accomplished through video conferencing
- The Committee must stick to the agenda
 - The public comment period cannot begin early
- Questions/comments during the regular meeting are from BPAC members only
 - Questions from the general public are only allowed in the public comment period
- Any potential finding must be substantively discussed during the public meeting
- The Executive Secretary (a Civil Servant representative of BPS) or a Civil Servant delegate must be present at all times

Following the BPAC Meeting

- The professional notetaker provides notes to the Executive Secretary
- The Executive Secretary distributes the notes to all speakers for verification of their accuracy
 - Revisions may be sent back to the notetaker and the final version is read and signed by the Executive Secretary and the BPAC Chair
- Details of findings (wording, etc.) are discussed and determined by the BPAC
- The final findings are signed by the BPAC Chair



BPS Updates

October 2023 - present

BPS

A close-up photograph of a man with a friendly expression, wearing a green t-shirt and a blue earpiece. He is holding a pipette and a clear multi-well plate, appearing to be in a laboratory or spaceflight environment. The background shows metallic equipment and a circular hatch.

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



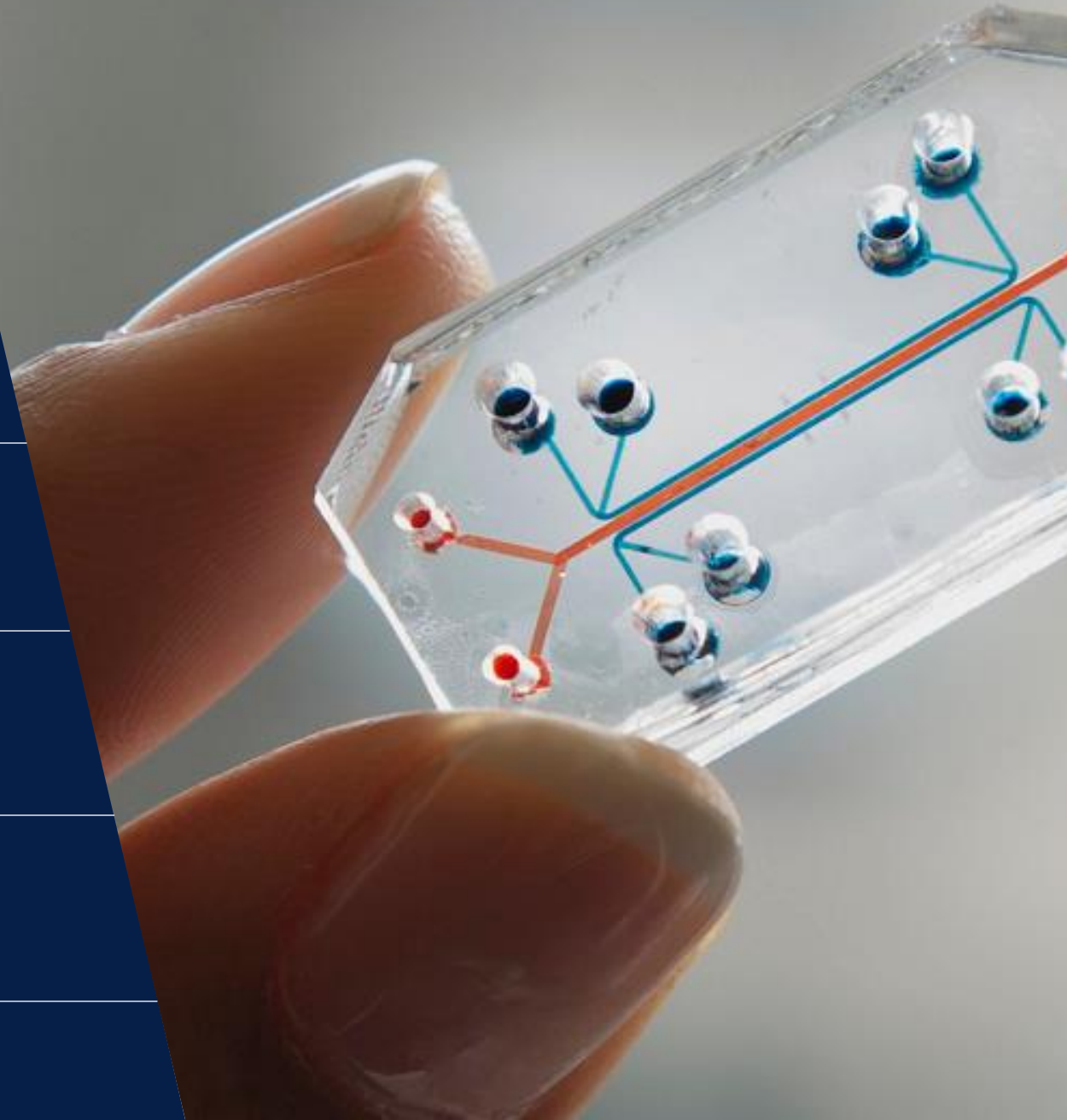
Impacts Include

Biomedical Research

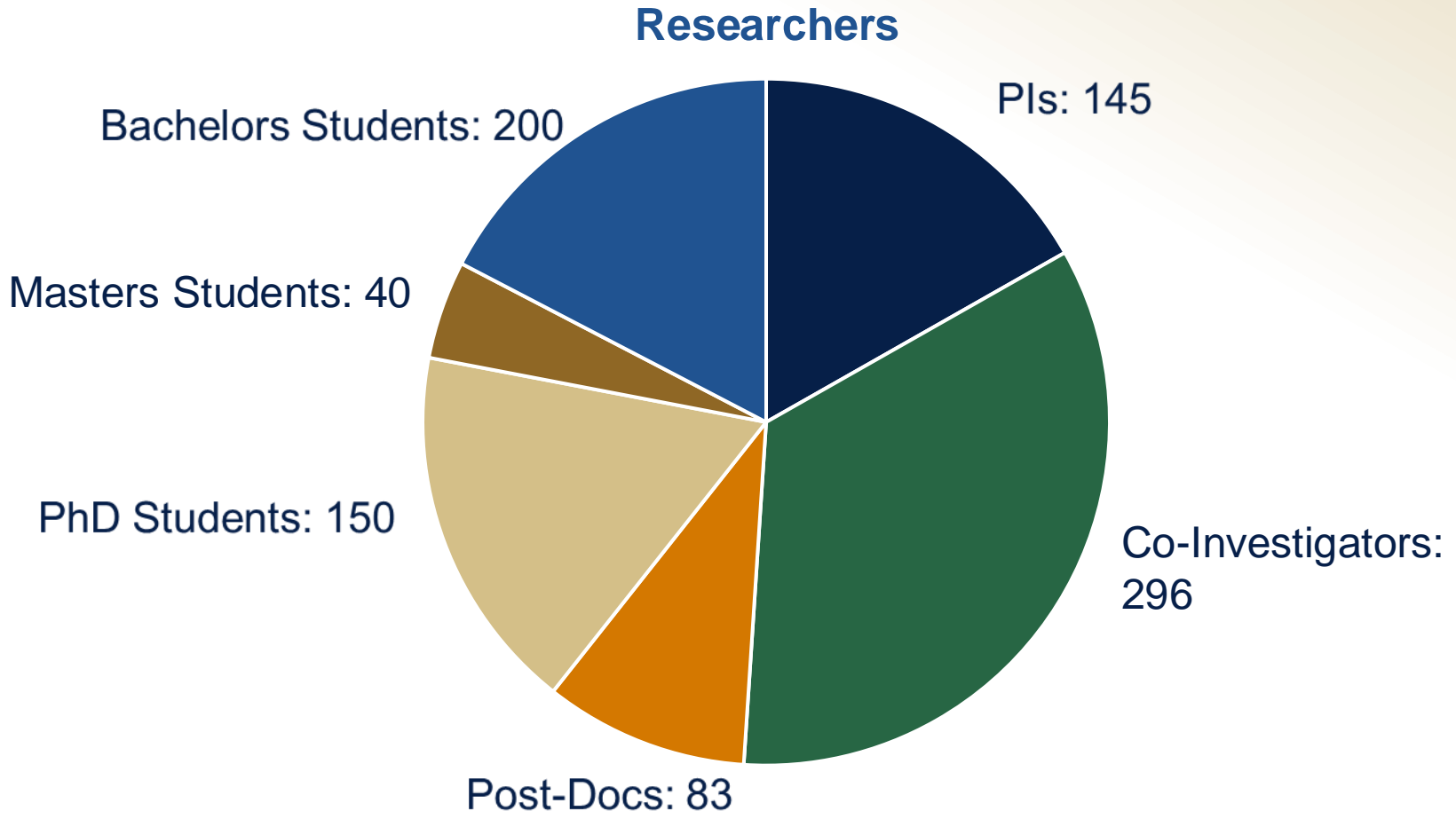
Agricultural Innovations

Consumer Products

Technology Advancements

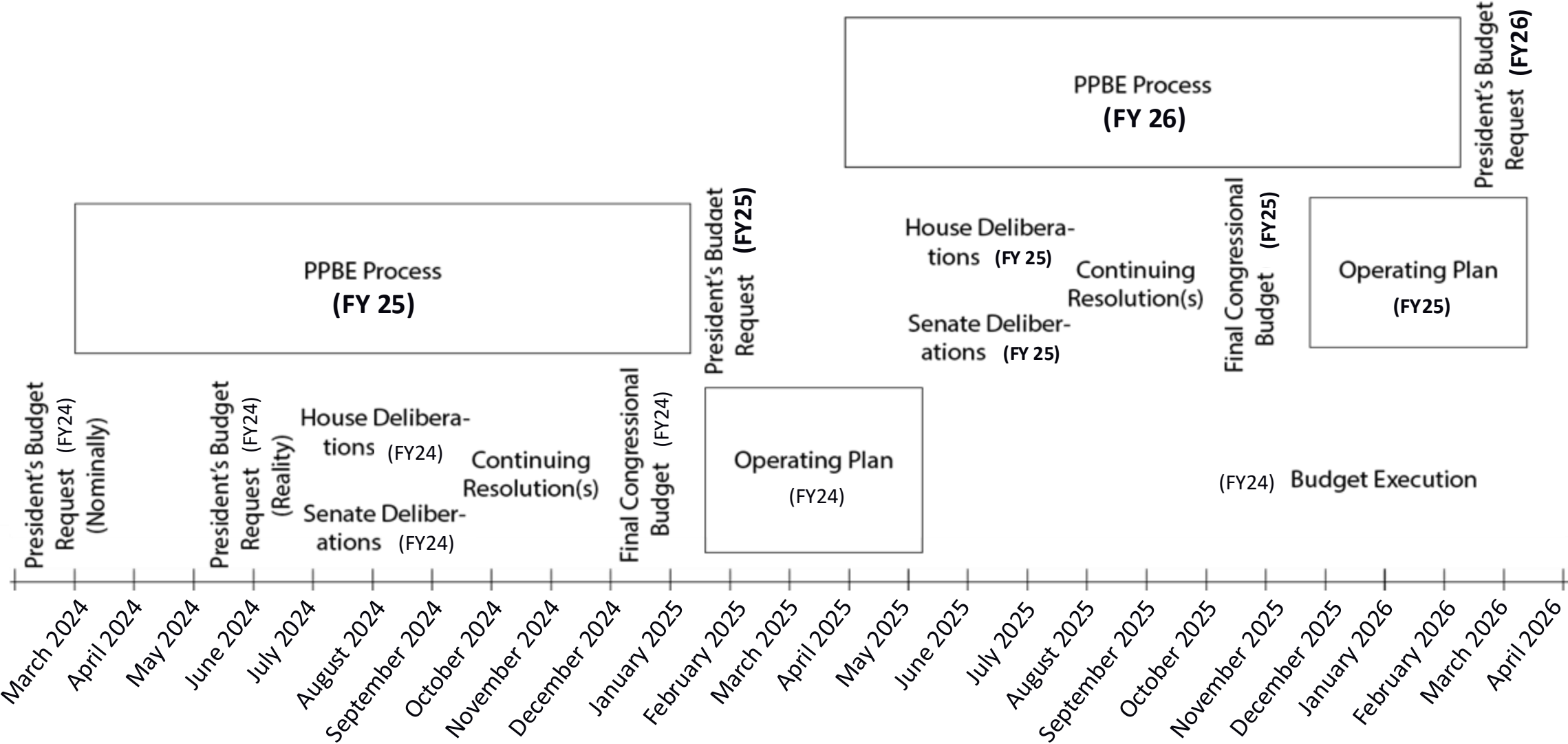


167 Active Investigations, FY 2024*



*Based on NASA Task Book entries, 10/20/2023 – 3/12/2024

Example Federal Budget Process



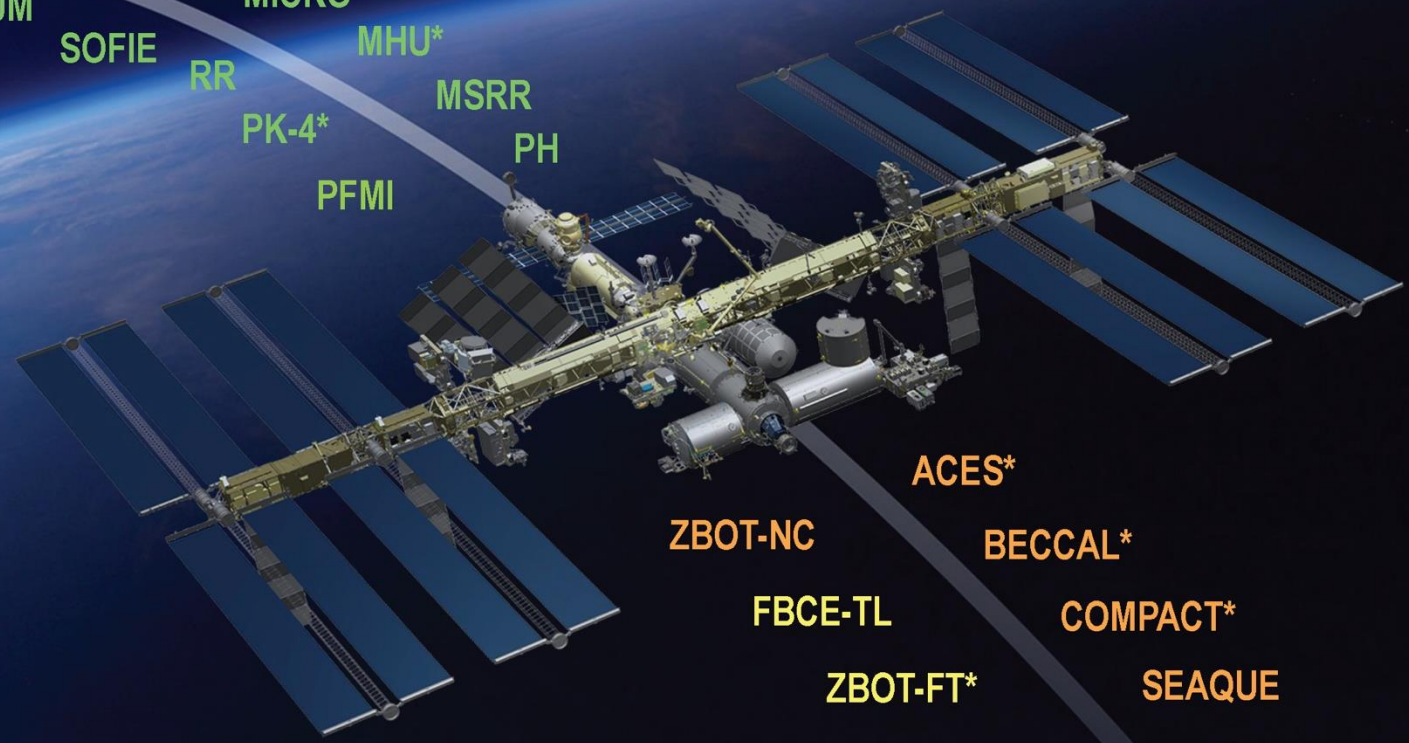
BIOLOGICAL & PHYSICAL SCIENCES FLEET

- FORMULATION
- IMPLEMENTATION
- OPERATIONAL
- PARTNER-LED*



ARTEMIS II
LEAF*

DECLIC*
CAL
BRIC-LED
BRIC
APH
VEGGIE
XROOTS
SPECTRUM
SOFIE
RR
PK-4*
PFMI
ELF*
EML*
FBCE
FLARE*
MICRO
MHU*
MSRR
PH



FY25 President's Budget Request Highlights

- Developing transformative research capabilities with commercial space industry
 - Dramatically increase the pace of research through the CERISS initiative
- Optimizing BPS's budget through partnerships, including
 - Artemis campaign research, which will include science on Artemis II
 - ISS Program: Development of facility-class payloads
 - International Partnerships: rideshares, facilities, joint studies
 - Other Government Agencies, and ISS National Lab, NASA's Human Research Program (HRP) and Astromaterials Research & Exploration Science (ARES): Joint solicitations and studies
- Aligning with high-priority, high-visibility initiatives such as Cancer Moonshot
- Transformative science to address Decadal Survey recommendations
- Sustaining core capabilities, open science platforms, education and engagement, training programs, and inclusion, diversity, equity and accessibility (IDEA)

Biological & Physical Sciences FY25 President's Budget Request (\$M)

	Actual	CR	Request	<u>Out-Years</u>			
	2023	2024	2025	2026	2027	2028	2029
Biological and Physical Sciences	\$85.0	\$87.5	\$90.8	\$91.3	\$93.0	\$94.8	\$96.6
Biological and Physical Sciences	\$85.0	\$87.5	\$90.8	\$91.3	\$93.0	\$94.8	\$96.6
BPS Program Management	\$9.5		\$10.4	\$13.0	\$12.9	\$15.6	\$15.7
Space Biology	\$34.7		\$30.5	\$30.5	\$33.3	\$36.9	\$37.4
Physical Sciences	\$39.9		\$39.8	\$38.9	\$37.9	\$33.2	\$34.4
Commercially-Enabled Rapid Space Science	\$0.8		\$10.0	\$8.9	\$8.9	\$9.0	\$9.1

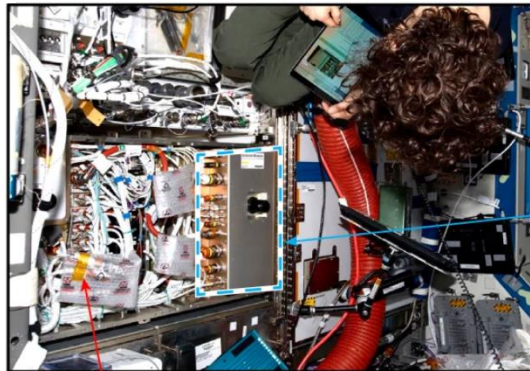


Science Highlights

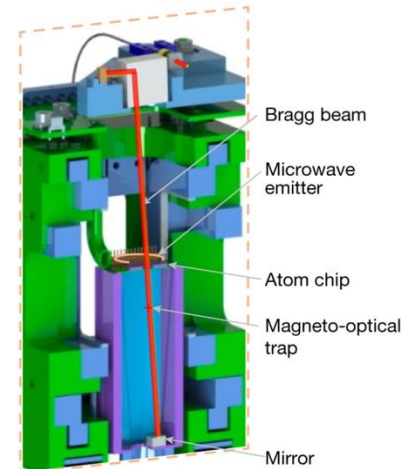
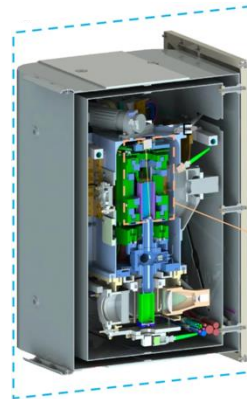
BPS

Science Spotlight: Quantum Science

- Cold Atom Lab published in Nature paper
 - Quantum gas mixtures and dual-species atom interferometry in space. Elliott, E.R., Aveline, D.C., Bigelow, N.P. et al., Nature 623, 502–508 (2023), [Abstract](#)



Science module



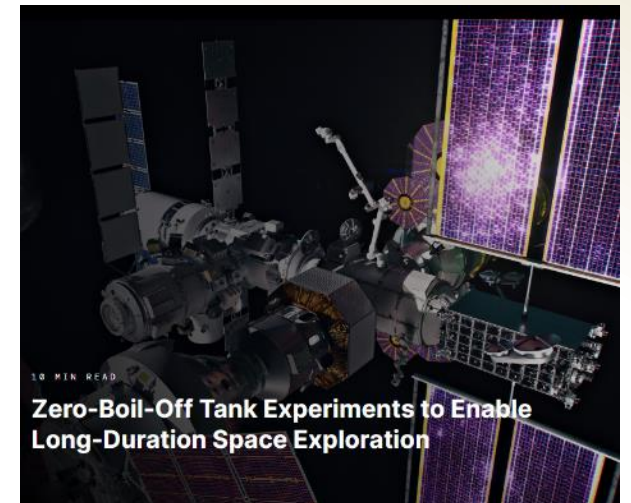
Learn more at [Nature.com](https://www.nature.com)

Science Spotlight: μ G Fluids Science

- SMD technology highlight on Zero Boil-off Tank (ZBOT) experiment series identifies challenges of propellant management in space
 - PI: Mohammed Kassemi, Case Western Reserve University



CFD Models predict fluid and thermal profile against ZBOT-1 data



Learn more at [Science.NASA.gov](https://www.nasa.gov/science)

Launches (1 of 2)

3 Launches | 11 Investigations/Resupplies

- SpX-29 (Nov. 2023)
 - **Bacterial Adhesion and Corrosion (BAC):** Studying biofilm growth aboard station – *Dr. Robert McLean, Texas State University*
 - **Plant Water Management (PWM-05, -06):** Understanding of the physical aspects of fluid flow and inform designs of fluid delivery systems for reduced gravity environments – *Dr. Mark Weislogel, Portland State University*
 - **Rodent Research (RR-20):** Studying reproductive capabilities – *Dr. Lane K. Christenson, University of Kansas Medical Center*
 - **Plant Habitat (PH-06):** Investigating the physiological and genetic responses to defense activation and immune system function in tomatoes during spaceflight – *Dr. Anjali Iyer-Pascuzzi, Purdue University*
- NG-20 (Jan. 2024)
 - **Advanced Plant Experiment (APEX-10):** Plant-microbe interactions in space – *Dr. Simon Gilroy, University of Wisconsin*
 - **MABL-A:** Role of Mesenchymal stem cells in microgravity-induced bone loss, part A – *Dr. Abba Zubair, Mayo Clinic*
 - **Biological Research in Cannisters (BRIC-25):** Studying the Accessory Gene Regulator quorum-sensing system of *Staphylococcus aureus* – *Dr. Kelly Rice, University of Florida*

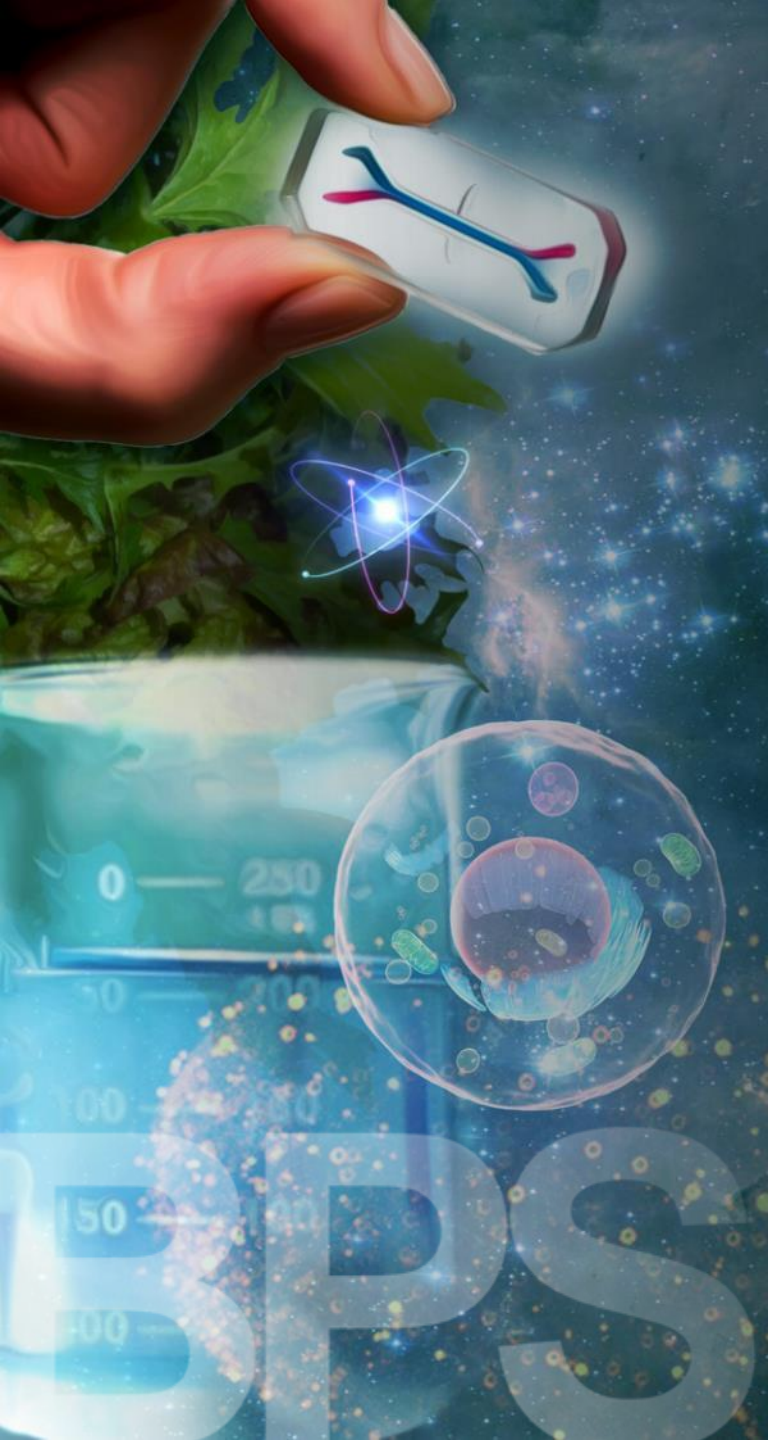


Launches (2 of 2)

3 Launches | 11 Investigations/Resupplies

- SpX-30 (Mar. 2024)
 - **Genomic Enumeration of Antibiotic Resistance in Space (GEARS):** Studying how bacteria adapt to space by surveying the space station for antibiotic resistant-organisms – *Christopher Carr, Georgia Institute of Technology*
 - **Electrostatic Levitator Furnace Experiment (ELF-1):** Investigating thermophysical properties affecting impurities during the steel-making process – *JAXA partner-lead investigation, co-principal investigator Dr. Robert Hyers, Worcester Polytechnic Institute*
 - **Cold Atom Lab Science Module-1 (CAL-SM-1):** A temporary replacement module that will enable NASA to continue quantum experiments aboard the International Space Station while researchers troubleshoot upgraded equipment – *Kamal Oudrhiri, CAL Project Manager and Jason Williams, CAL Project Scientist, Jet Propulsion Laboratory*
 - **Flow Boiling Condensation Module Power Filter Module (FBCE-CMHT PFM):** Replacing equipment and resuming research – *Dr. Issam Mudawar, Purdue University*

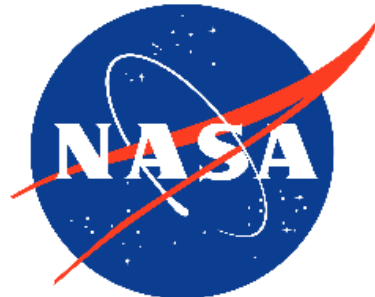




Award Spotlights

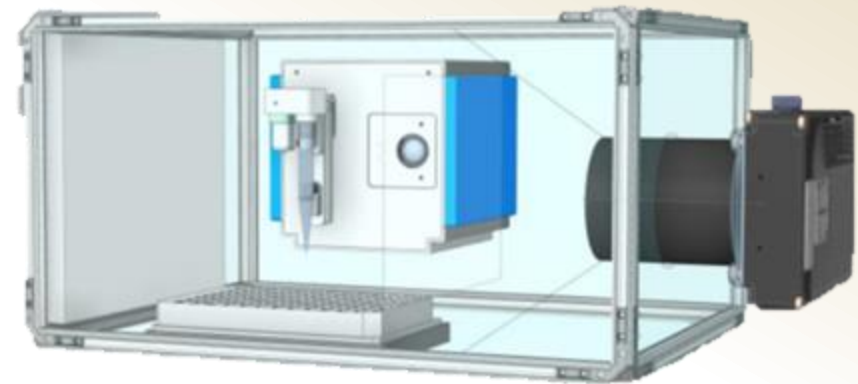
Award Spotlight: Tissue Chips

- \$18M investment: multi-agency tissue chip longevity awards
 - Multi-agency partnership investing in tissue chip models for respective agency missions
 - Research to extend viability & physiological function to a minimum of 6 months
 - Enables study of exposure to acute or chronic stressors, conditions, or compounds
 - 9 contracts supporting research through 2026-2027 timeframe at institutions across the U.S.



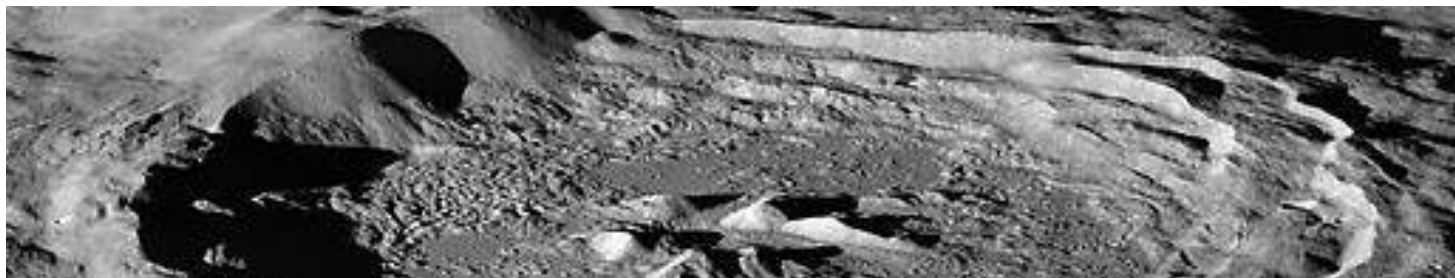
Award Spotlight: CERISS

- Commercially Enabled Rapid Space Science (CERISS) advances transformative in-space research capabilities to support NASA exploration
 - In partnership with NASA's Flight Opportunities Program, TechFlights 2023 selection
 - Sierra Lobo, Inc. Principal Investigator Phil Putnam awarded opportunity to demonstrate automated fluidic sample preparation capability enabling physical and biological scientific research in microgravity
 - Flight demonstration scheduled to begin in late 2024
 - Three 2023 Small Business Innovation Research Phase I awards



Award Spotlight: Space Bio & Regolith

- Space Biology Research Studies released in partnership with NASA's Astromaterials Research and Exploration Sciences (ARES) Division
- First Space Biology solicitation to look at the effects of lunar regolith
 - On plants: microbial interactions and plant growth.
 - On animal and human, cellular and tissue systems: microbial interactions and stress responses.
 - 11 proposals funded – Total of \$ 2.3M over 3 years
- Lunar regolith simulant formulated to resemble regolith from the Lunar Highlands of the Moon's south pole (to match material at the candidate landing sites for the Artemis III mission)
- Lunar regolith collected from Apollo missions granted to a subset of awardees who have demonstrated sufficient progress with simulant to conduct a final set of validation studies



Award Spotlight: Plants on the Moon

- Space Biology investigation, Lunar Effects on Agricultural Flora (LEAF), chosen for astronauts to deploy on the surface of the Moon during Artemis III
- LEAF will...
 - be installed near the lunar South Pole
 - investigate the lunar surface environment's effects on space crops
 - be the first experiment to observe plant photosynthesis, growth, and systemic stress responses in space-radiation and partial gravity
 - help scientists understand the use of plants grown on the Moon for both human nutrition and life support on the Moon and beyond



Learn more at [NASA.gov](https://www.nasa.gov)

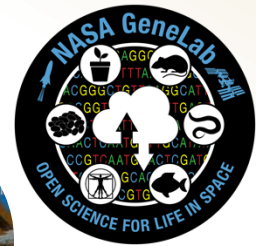


Education, Outreach, IDEA Updates

EBPS

Inclusion, Diversity, Equity, Accessibility

- Growing Beyond Earth for Spanish speakers
- GeneLab 4 Universities (HBCUs/MSIs)
- Open Source Science
- SMD Bridge Program
 - Minority Serving Institutions (MSI)
 - Historically Black Colleges & Universities (HBCU)
 - Tribal Colleges & Universities (TCU)
 - Including primarily undergraduate institutions and PhD granting universities
- Dual-Anonymous Peer Review (DAPR)



Conferences, Events & Briefings

14+ Conferences & Events | 6 Hill Staffer Briefings

- American Society for Gravitational Space Research Annual Meeting (ASGSR)
- International Space Life Sciences Working Group Meeting
- International Microgravity Strategic Planning Group Meeting
- Great Lakes Science Center Exhibit Opening
- American Geophysical Union Annual Event
- 50th Space Congress
- Architecture Workshop for International, Industry, and Academic Partners



SXSW Quantum Panel



ASGSR

- Human Research Program Investigators' Workshop (Open Science Data Repository & Plenary with Other Government Agencies)
- Congressional Staff Briefings (New York, Texas, Appropriations Staff, Authorizations Staff)
- ASCEND panel
- South by Southwest Quantum Panel
- Commercial Space Transportation Conference panel
- 23rd NIH Tissue Chip Consortium Meeting
- Engineering Biology Research Consortium Space Health Roadmap Workshops
- AwesomeCon (Attended)
- Growing Beyond Earth Symposium



Thank you!

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Website: science.nasa.gov/biological-physical