ISS NATIONAL LABORATORY®

International Space Station National Laboratory
Annual Report for Fiscal Year 2025

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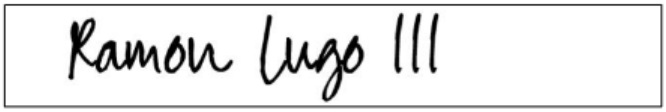

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About the International Space Station National Laboratory

Every day, 250 miles above our planet, groundbreaking research and technology development to improve life on Earth takes place onboard the International Space Station (ISS). Researchers from academic institutions, private industry, and government agencies conduct investigations sponsored by the ISS National Laboratory® that leverage unique conditions found only in space. From improving quality of life for cancer patients to developing innovative treatments for osteoporosis, producing advanced materials, and, one day, manufacturing artificial tissue and organs in space, we're enabling a broad community of dreamers to solve some of the world's most pressing challenges. The Center for the Advancement of Science in Space® (CASIS®) manages the ISS National Lab, under a Cooperative Agreement with NASA.
Visit us at www.ISSNationalLab.org.

Mission:

We manage the premier space laboratory, providing expertise, connection, and inspiration to visionaries.

Vision:

To be the leading source for innovation in space, enabling life-changing benefits for humanity.

Core Values:

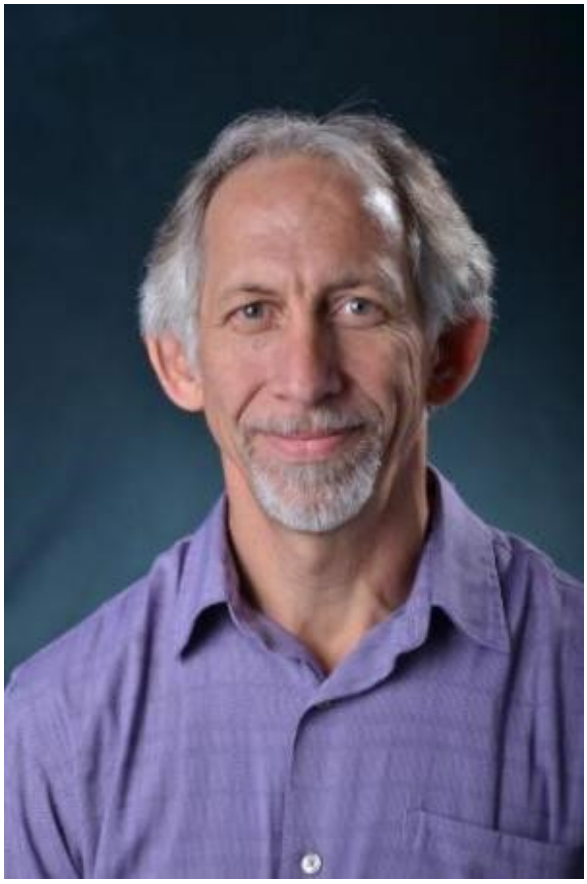
Integrity – We always strive to be true to ourselves and do the right thing.
Service – We work as a team with humility of heart and trust in each other.
Stewardship – We treasure our responsibility to fulfill our mission with care and excellence.

Strategic Priorities:

- Develop and maintain organizational resources to successfully manage the ISS National Lab to enable cutting edge research, technology development and educational outreach in low Earth orbit.
- Establish, foster, and maintain public-private partnerships that maximize value creation from ISS National Lab resources.
- Serve all current and future stakeholders as "honest brokers," providing impartial access to resources and information as a trusted neutral partner.
- Be the recognized experts in managing a space-based national lab.

Tribute: Louis Stodieck

Louis Stodieck, chief scientist and former director of BioServe Space Technologies at the University of Colorado Boulder (CU), has retired after nearly 50 years of service in bioastronautics.



Stodieck earned his bachelor's, master's, and Ph.D. degrees at CU and has been a central figure at BioServe Space Technologies since its founding in 1987, when space payloads were almost exclusively the domain of NASA. For more than three decades, he successfully championed BioServe's mission of broadening industry participation in space-based research, expanding educational outreach, and driving workforce development. Under his leadership, BioServe increased its payload cadence from two to nearly 20 complex payloads per year. Stodieck also contributed to the development of BioServe's permanent hardware on the ISS, including incubators, microscopes, and cold storage systems for astronaut food and medications.

The ISS National Lab extends its sincere gratitude to Louis Stodieck for his dedication to advancing the commercial space economy and wishes him continued success, happiness, and good health in retirement.

Executive Summary

Over the past 14 years, the Center for the Advancement of Science in Space® (CASIS®) has made remarkable progress in advancing the mission of the International Space Station (ISS) National Laboratory—managing a premier research platform in space and providing the expertise, connection, and inspiration that fuel cross-disciplinary innovation. In fiscal year 2025 (FY25), the ISS National Lab continued its momentum in establishing a robust and sustainable low Earth orbit (LEO) economy by driving demand for space-based research, cultivating supply-side growth, and spurring increased investment by demonstrating the value of science in space.

> ***"NASA and the ISS National Lab continue to maximize the International Space Station's science throughput and impact. Our partnership is producing a record number of products, patents, and publications, all while increasing the number of commercial payloads being delivered to the space station and investments from startup companies using microgravity."***
>
> – *Robyn Gatens, Director of NASA's International Space Station and Commercial Spaceflight Divisions*

However, FY25 also brought considerable challenges. Resource constraints affecting budget, launch allocation, and crew time led to a substantial reduction in the ISS National Lab's statement of work. The resulting impacts are referenced throughout this report. Despite these challenges, the ISS National Lab achieved many notable accomplishments in FY25.

> ***"The International Space Station delivers research that benefits life on Earth, strengthens the low Earth orbit economy, and supports human exploration of the Moon and Mars. The research managed by the ISS National Lab through a Cooperative Agreement with NASA ensures we support the highest-quality space science and technology demonstrations, leveraging the orbital complex's unique microgravity environment."***
>
> – *Ken Bowersox, Associate Administrator of NASA's Space Operations Mission Directorate*

It was a landmark year for research and technology development (R&D) successes. Close to 80 peer-reviewed articles related to ISS National Lab-sponsored research were published, with 20% appearing in top-tier journals, indicating the high impact of the results. A testament to the growing translational value of LEO R&D, 13 patents and six products related to ISS National Lab-sponsored research were identified this year, setting a new record. Among these are Encapsulate's tumor-on-a-chip system, MicroQuin's revolutionary cancer therapeutic, Orbit Fab's in-orbit refueling system, MIT's impact-sensing spacecraft material, Orbital Sidekick's hyperspectral imaging system for underground pipeline leak detection, and virtual educational tools from miniPCR and VRCORE Education.

Outreach and engagement efforts also grew, bolstering support for space-based R&D from a diverse stakeholder community. Three robust issues of *Upward®* showcased cutting-edge results from research sponsored by the ISS National Lab to the magazine's nearly 10,000 subscribers. The ISS National Lab also debuted its new podcast, *Between a Rocket & a Hard Space*, which has already gained more than 2,700 subscribers. In addition, CASIS partnered with the American Institute of Aeronautics and Astronautics to expand programming for its 2025 and 2026 ASCEND conferences to include content highlighting the ISS National Lab's critical role in advancing R&D in LEO.

"In 2025, the CASIS User Advisory Committee focused on uniting ISS National Lab stakeholders to communicate the importance of our work—not just in research, but in developing the LEO economy—and to advocate for its continued growth. We helped build an understanding that Commercial Service Providers, Implementation Partners, NASA, and current and future researchers and customers all need a healthy ISS National Lab through 2030 to enable a thriving LEO economy now and in the future. We will continue this work to ensure there's a solid foundation when the ISS reaches the end of its mission."

– Mark Gittleman, Chair of the ISS National Lab User Advisory Committee and of the Aegis Aerospace Board of Advisors

In FY25, a record-breaking 115 ISS National Lab-sponsored payloads were delivered to station, nearly 80% of which were commercial research projects. Furthermore, the ISS National Lab brought in more than $10 million in external, non-NASA funding, with 65% coming from commercial entities. These points serve as clear indicators of the private industry's continued high demand to access space for R&D. Additionally, the ISS National Lab's long-standing partnerships with the U.S. National Science Foundation (NSF) and the National Institutes of Health (NIH) continued to advance valuable fundamental science, laying a foundation for countless future applications. The ISS National Lab also continued to support supply-side Implementation Partners (IP) who provide critical payload development services, and more than 65% of ISS National Lab funding in FY25 went toward IP costs for projects.

This year, the ISS National Lab launched its Orbital Edge Accelerator program, bringing global investors and high-potential startups into the growing space economy. It was also a strong year for fundraising by startups within the ISS National Lab ecosystem. In FY25, startups that have completed an ISS National Lab-sponsored project cumulatively raised $251 million—an increase of more than 70% over last year—bringing the total amount of such funding to nearly $2.5 billion.

For a snapshot of all ISS National Lab activities in FY25, please see the map in Appendix D.

A Personal Note From Ramon Lugo, Principal Investigator and CEO of CASIS:

This past year has tested the resilience and ingenuity of the ISS National Lab, our user community, and our industry partners. I am proud to say that we did more than overcome these challenges—we emerged stronger, with a more robust program and deeper relationships that will serve us well into the future.

One of the most significant hurdles was the cancellation of the ISS Research and Development Conference, a cornerstone event for our community. Yet, through collaboration and determination, we developed an alternative for 2025 that allowed us to gather, share ideas, and continue the vital dialogue that drives progress in the LEO economy.

We also made strategic shifts in our approach. While we discontinued traditional ISS National Lab solicitations, we launched Orbital Edge, our accelerator program that connects the investment community with the LEO economy. The inaugural cohort was a success—six innovative startups were selected to fly projects in space, with the ultimate goal of creating new commercial ventures and expanding economic activity. We are now working closely with NASA to explore deploying another Orbital Edge Accelerator solicitation in 2026.

2025 was also a landmark year for collaboration with our User Advisory Committee (UAC). Under the leadership of the new UAC Chair, the committee provided critical guidance on a prioritization framework that will shape the remainder of the ISS Program. We recognize that such a change at this stage can feel disruptive, but with limited resources, it is essential. Our commitment is to monitor outcomes and adjust as needed. As the voice of our community, the UAC's contributions were instrumental in ensuring this process is transparent and fair.

As we close the year, I want to express my gratitude to NASA, our government partners, our user community, our commercial partners, and, importantly, the CASIS team for their trust and collaboration. Together, we have navigated a challenging year and laid the foundation for an even brighter future.

Please take a few moments to review our Annual Report. It reflects the hard work and achievements of 2025—none of which came easily, but all of which move us forward.

FY25 Metrics

ISS NATIONAL LAB UTILIZATION AND OPERATIONS TARGET METRICS

TARGET METRICS	FY25 Total	FY25 Target	FY25 Stretch
DEMAND FOR ISS RESOURCES			
1) Ratio of awardable proposals evaluated to expected awards (cumulative)	4:1[a]	3:1	N/A
2) Leverage ratio of external funding to CASIS funding (cumulative)[a]	2:1	1:1	2:1
FUNDAMENTAL SCIENCE			
3) Fundamental Science projects selected	7	7	9
4) External funding supporting Fundamental Science users of the ISS National Lab	$3.6M[a]	$6M	$9M
APPLIED RESEARCH & DEVELOPMENT			
5) Applied Research & Development projects selected	1[a]	2	3
6) Ratio of external funding to CASIS funding (self-reported) supporting Applied Research & Development users of the ISS National Lab (cumulative)[a]	--	1:1	2:1
TECHNOLOGY DEMONSTRATION			
7) Technology Demonstration projects selected	7[a]	11	14
8) Ratio of external funding to CASIS funding (self-reported) supporting Technology Demonstration users of the ISS National Lab (cumulative)[a]	6:1[a]	4:1	6:1
EDUCATION & OUTREACH			
9) Education & Outreach projects selected	1[a]	2	3
10) New Corporate or OGA sponsorships agreements	0	1	2
PROPOSAL MANAGEMENT			
11) Time from solicitation close to selection/non-selection notification (cumulative)	57[a] days	≤65 days	≤60 days

ISS NATIONAL LAB UTILIZATION AND OPERATIONS TRACKING METRICS

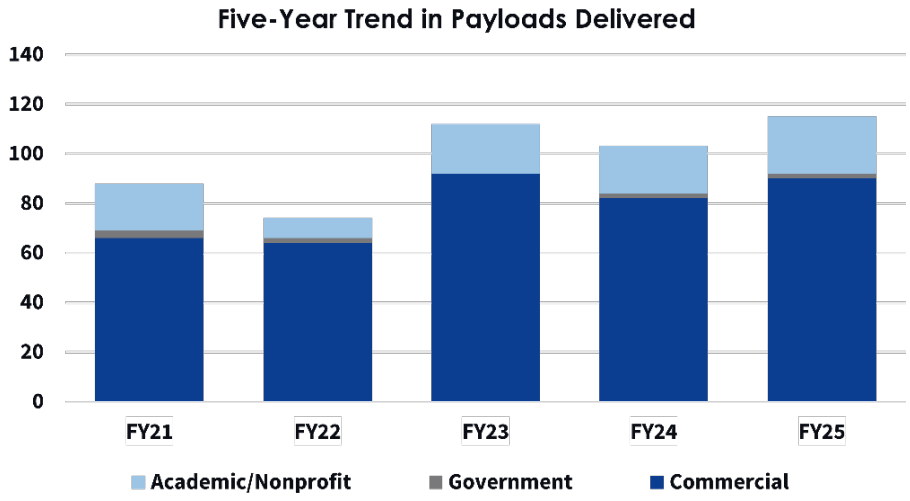
TRACKING METRICS	FY25 Total
OVERALL PROJECT QUALITY AND DEMAND	
1) Percent of proposals reviewed that were awardable (cumulative)	62%
2) Percent of proposals reviewed that were high quality (cumulative)	15%
3) Percent of high-quality proposals not selected (cumulative)	50%
4) Percent of completed projects that met ≥80% of their research objectives (cumulative)	83%
5) Percent of completed Technology Dev/Demo and In-Space Production projects demonstrating technology readiness level (TRL) advancement (cumulative)	100%
6) ISS National Lab projects selected	18[a]
7) Users by new/returning	
(a) ISS National Lab return users	5[a]
(b) ISS National Lab new users	13[a]
8) Projects by type	

(a) **Commercial**	10[a]
(b) **Academic/nonprofit**	8[a]
(c) **Government agency**	0[a]
9) Multiplier on CASIS grant funding committed (cumulative)[a]	2:1
10) Active solicitations	6[a]
11) ISS National Lab concepts received	281[a]
12) ISS National Lab proposals received	121[a]
13) Time from selection notification to agreement draft sent to principal investigator (cumulative)	35 days
14) Time from agreement draft to award (cumulative)	35 days
15) Time to flight	17 months
PAYLOADS DELIVERED	
16) Commercial Service Provider Facility Utilization payloads delivered	80
(a) **Percentage of Commercial Service Provider Facility Utilization payloads flown that met mission success criteria (previous fiscal year quarter)[b]**	99%
17) Education & Outreach payloads delivered	8
18) Fundamental Science payloads delivered	14
(a) **Percentage of Fundamental Science payloads flown that met mission success criteria (previous fiscal year quarter)[b]**	93%
19) Applied Research & Development payloads delivered	7
(a) **Percentage of Applied Research & Development payloads flown that met mission success criteria (previous fiscal year quarter)[b]**	22%
20) Technology Demonstration payloads delivered	6
(a) **Percentage of Technology Demonstration payloads flown that met mission success criteria (previous fiscal year quarter)[b]**	50%
21) Total ISS National Lab-sponsored payloads delivered	115
COMMUNITY ENGAGEMENT AND INVESTMENT	
22) New partnerships formed	5
23) Total external funding committed	$10,131,764[a]
24) Funds raised post award and postflight by startup companies with ISS National Lab-sponsored flight projects	
(a) **Funds raised postflight**	$250.8M
(b) **Funds raised post award**	$266.0M
25) External funding committed from new OGA partnerships	$0
26) New educational partnerships	0
27) Number of high school and higher education students contributing to research projects completed during the fiscal year	50
28) Total individuals participating in ISS National Lab Education & Outreach programs and projects (self-reported)	18
29) Total individual users of ISS National Lab online education products (self-reported)	1,671,282[a]
IMPLEMENTATION PARTNERS AND COMMERCIAL SERVICE PROVIDER ACTIVITIES	
30) Number of Implementation Partners (cumulative)	33
IMPLEMENTATION PARTNERS AND COMMERCIAL SERVICE PROVIDER ACTIVITIES (CONTINUED)	
31) Number of Commercial Service Providers (cumulative)	14
32) New Umbrella User Agreements executed	1
33) New commercial facilities added	1

34) Commercial facilities (cumulative)	23
35) RRFs submitted	67[a]
36) RRFs approved	64[a]
37) RRF approval time (cumulative)	12[a] days
RESOURCE UTILIZATION	
38) Crew time (actual vs. increment pair – 3 months allocation)	50%
(a) **Ascent flight resources**	
Upmass	105%
Cold stowage	59%
Big bags	23%
Powered lockers	49%
(b) **Facility resources (reported in Q2 and Q4)**	
Commercial facilities	50%
JEM airlock	84%
Life Sciences Glovebox	50%
Microgravity Science Glovebox	69%
39) Number of payloads that did not turnover per the nominal delivery schedule	5
Principal investigators	2
Implementation Partners	2
CASIS	0
NASA	1
40) Number of re-flight experiments flown	1
Fundamental Science	1
Applied Research & Development	0
Technology Demonstration	0
Education & Outreach	0
Commercial Service Provider Utilization	0
41) Number of payloads ready to fly that were left on the ground due to limited resources (upmass, crew time, cold stowage, etc.)	51
42) Number of payloads removed from the manifest after the freeze date because the principal investigator/payload could not make the flight	1
OVERALL PROJECT RESULTS	
43) Number of peer-reviewed papers including those accepted for publication in Tier 1 journals	76
44) Number of new patents pending	13

a. Numbers impacted due to budget reductions beginning in Q3.

In-Orbit Activities: The ISS as a Research Platform



In FY25, a record 115 ISS National Lab-sponsored payloads were delivered to the space station. Nearly 80% were research projects being done by commercial entities, underscoring the sustained demand from private industry for space-based R&D. The total number of ISS National Lab-sponsored payloads delivered since transition to CASIS management is now nearly 950, marking steady growth in both research and commercial innovation in LEO.

- Seven missions (SpaceX-31, SpaceX-32, Axiom-4, SpaceX Crew-10, SpaceX Crew-11, SpaceX-33, and Northrop Grumman-23) carried ISS National Lab-sponsored research to station.
- Of the payloads delivered this year, 70% were sourced through Commercial Service Providers that own and operate facilities on the space station.
- More than 20% of the payloads delivered this year launched on Axiom's fourth private astronaut mission to the ISS.
- ISS National Lab crew time utilization decreased by 27% this year (575 crew hours compared with 791 in FY24) due to the phase-out of rodent research and increased use of automation and commercial facilities. Additionally, the Alpha Magnetic Spectrometer upgrade, which will require several hundred crew hours, was planned for FY25 but did not occur this year due to resource constraints.

Key in-orbit activities in FY25 include the following.

- R&D from large commercial companies:
  - Bristol Myers Squibb and Redwire Space advanced pharmaceutical manufacturing by studying model small-molecule compounds using the PIL-BOX facility to improve drug stability and streamline therapeutic production.
  - Booz Allen, Axiom Space, and Oura demonstrated edge computing capabilities for real-time biometric data processing, enabling crews to assess astronaut readiness for critical tasks without relying solely on ground support.
- Research from emerging companies and startups:

- Sachi Bioworks tested gene-targeting drugs on brain organoids to accelerate development of treatments for neurodegenerative diseases including Alzheimer's, Parkinson's, ALS, and aggressive brain tumors.
- Kall Morris Inc (KMI) evaluated its REACCH debris-capture system, which uses tentacle-like mechanical arms and gecko-inspired adhesive surfaces to collect and stabilize free-floating orbital debris.

"With KMI's focus on in-space capture, servicing, and relocation, demonstration on the ISS was of the utmost importance to prove out our capabilities in microgravity. Support from the teams at the ISS National Lab, the Astrobee team, and the onboard crew helped lower the barrier of entry for our team to launch and successfully operate our complex hardware, even as a first-time payload developer. The ISS National Lab is a phenomenal partner to get payloads into space."

– Austin Morris, Co-Founder and CTO of Kall Morris Inc (KMI)

- Studies funded through the U.S. National Science Foundation (NSF):
  - The University of California, Santa Barbara examined active matter and its ability to influence the separation of unmixable fluids—research that may inform the development of self-healing and adaptive materials.
  - The University of Alabama at Birmingham investigated the formation of ceramic composites to support aerospace, defense, and advanced energy applications.
- Research from academic and medical Institutions:
  - Mayo Clinic studied how microgravity affects bone marrow mesenchymal stem cells, deepening understanding of skeletal regeneration and bone loss associated with aging and long-duration spaceflight.
  - Portland State University launched a holographic microscope to capture 3D images of cells and microbes, helping reveal how life adapts in extreme environments for advanced biomedical and astrobiological research.
- Commercial Service Provider-enabled research:
  - Axiom Space and Burjeel Holdings PLC tested glucose monitoring accuracy and insulin stability in microgravity, advancing technologies that will enable astronauts with insulin-dependent diabetes to participate in future missions.
  - Rhodium Scientific and the University of Puerto Rico at Mayagüez tested a new method for expanding small batches of mesenchymal stem cells, which could be used to treat immune disorders and other conditions.
- STEM education and workforce development:
  - The Student Spaceflight Experiments Program flew 39 student-led experiments from more than 35 school communities, engaging students from grades 5-12 and undergraduates.

- Genes in Space™ flew a project from high school students that explored bacteriophage therapies to counter microbial infections in space, contributing to future astronaut health and biotechnology innovation.

R&D Progress and Successes

FY25 marked a record-breaking year of results from ISS National Lab-sponsored research, with the highest number of publications, patents, and products in a single fiscal year. These achievements highlight the growing impact of space-based R&D on the scientific community and commercial development.

A total of 76 peer-reviewed articles were published (citations in Appendix C)—up from last year's record of 51. Of this year's publications, 15 are in top-tier journals, underscoring the significance of the findings and their impact on national and scientific priorities. This brings the cumulative total to nearly 630 peer-reviewed publications, more than 22% of which appeared in top-tier journals. Examples of FY25 publications include:

- University of California, San Diego researchers published results from four ISS National Lab-sponsored flights that affirm the use of stem cells in space as an accelerated model for the study and treatment of aging and diseases like cancer.
- Mayo Clinic researchers published results on critical "master regulator" genes activated in microgravity that could be used to identify health risks and develop preventative measures to ensure astronaut safety on future long-duration missions.
- Arizona State University researchers published findings on a new method to improve water treatment using UV light.
- University of Alabama Birmingham researchers published results that could guide the development of specialized ceramics for spacecraft design, insulation, and lightweight building materials for use on Earth.
- University of California, Berkley researchers published findings on an enhanced hydrogen sensor that would be valuable in factories and other industrial settings where hydrogen must be carefully monitored.

> ***"The ISS National Lab has been instrumental in transforming low Earth orbit from a research frontier into an economic engine, and nowhere is that transformation more evident than in Texas. We're now seeing the return on our investments in this ecosystem through new companies, products, and technologies that benefit every American. The ISS National Lab continues to showcase the power of public-private partnerships and the advancement of R&D in microgravity."***
>
> *– Brian Freedman, President of the Bay Area Houston Economic Partnership*

- The Alpha Magnetic Spectrometer research team published measurements of two types of lithium atoms in cosmic rays, showing that these atoms are created when cosmic rays collide with space dust rather than originating from the Big Bang as previously assumed.

Thirteen patents related to ISS National Lab-sponsored research were identified this year. Examples include:

- Orbit Fab was granted a patent for its system to transfer and store fuel or propellants in space to refuel spacecraft and satellites.
- MicroQuin filed a patent for a new peptide therapeutic to treat cancer.
- Encapsulate was granted a patent for the nCapsule biochip, a tumor-on-a-chip system that allows cancer cells to grow in a 3D environment that more closely resembles tumor growth in the body. The startup filed a second patent for nVasive, a novel method for predicting the metastatic potential of cancer cells recovered from patient biopsies.
- Orbital Sidekick was granted a patent for a space-based hyperspectral imaging system and method to detect and identify leaks in underground oil and gas pipelines.

> ***"Our time onboard the ISS gave us the critical data and validation to strengthen our precision oncology technology and accelerate its path to market. Microgravity testing results directly informed several patent applications and helped refine our cancer-cell analysis platform, underscoring its potential for truly personalized medicine and paving the way for our next-generation biochips aimed at predicting metastasis."***
>
> *– Armin Rad, CEO and President of Encapsulate Inc*

- The New Jersey Institute of Technology filed a patent for a method and apparatus to fabricate complex reflective structures for optical applications like lasers.
- Researchers at the Massachusetts Institute of Technology filed a patent for a novel spacecraft material with integrated sensors capable of detecting impacts, electrical charge, temperature fluctuations, and radiation.
- Oregon State University was granted a patent on a cardiac tissue chip platform that mimics human cardiac tissue structures. The university filed two additional patents: one on bio-compatible scaffolds to support tissues and organoids, and one on systems, methods, and devices related to microstructure characterization of 3D printed tissues.

Six products and services related to ISS National Lab-sponsored research were identified in FY25:

- Sen is providing 24/7 views of Earth from the ISS through a live 4K video, expanding the ability to experience the beauty of our planet from space.
- miniPCR added commercial content to its free online learning tool that immerses students in a virtual ISS environment during a lab activity.

- Orbital Sidekick developed two products: SIGMA Monitor is an integrated platform for global monitoring that captures and analyzes hyperspectral data to provide real-time insight reporting. SIGMA Data enables users to send the company's fleet of satellites to collect hyperspectral imaging on-demand and receive calibrated data for analysis.
- Orbit Fab began delivering hydrazine to satellites in geosynchronous orbit and signed a contract with the U.S. Space Force to deliver fuel to satellites.
- VRCORE Education offers a virtual reality lesson that allows students to tour the ISS and conduct experiments to learn how microgravity research advances science and engineering.

This year also included two important successes related to pharmaceutical research through the ISS National Lab:

- Earlier this year, the U.S. Food and Drug Administration (FDA) approved a new injectable form of a cancer therapeutic from Merck & Co. that combines the active ingredient in Keytruda® with an enzyme to treat a wide range of solid tumors. Previous research on the ISS by Merck explored the effects of microgravity on the production of highly uniform protein crystals with properties that would allow its Keytruda® cancer therapeutic to be given as an injection instead of a lengthy IV infusion delivered in a clinical setting.
- Researchers from UCSD's Sanford Stem Cell Institute discovered that an enzyme linked to cancer spread was activated during spaceflight and tested therapies that halt the enzyme's activity. One of these drugs was recently approved by the FDA to start clinical trials.

Additionally, in FY25, the ISS National Lab published three issues of *Upward®* magazine, highlighting successful results from ISS National Lab-sponsored R&D:

- Issue 7.3 detailed MicroQuin's research that could lead to a way to treat all types of cancer, Axonis' brain organoid study testing a new treatment for neurological conditions, and AstroRad's innovative radiation shielding vest for astronauts.
- Issue 8.1 showcased Oculogenex's research to treat macular degeneration, Eascra Biotech's in-space manufacturing of nanomaterials to treat disease, and Emory University's heart cell studies to advance regenerative heart therapies.
- Issue 8.2 highlighted Spatiam's technology for interplanetary Internet, Encapsulate's

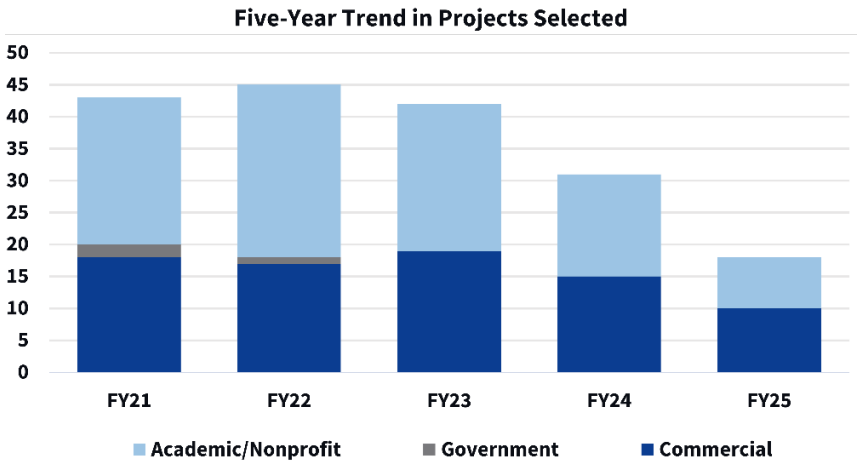
"MicroQuin's ISS National Lab research revealed cancer cells depend on regulating their chaotic intracellular environment (ICE) to survive and spread. This discovery extended beyond cancer, as ICE dysregulation underlies several diseases and injuries. Using these insights, MicroQuin developed targeted therapies for cancer, Parkinson's, Alzheimer's, TBI, and viral infections. The ISS National Lab has been indispensable, allowing us to observe cellular mechanisms impossible to study on Earth and accelerating our path from basic science to transformative treatments."

– Scott Robinson, Founder and CEO of MicroQuin

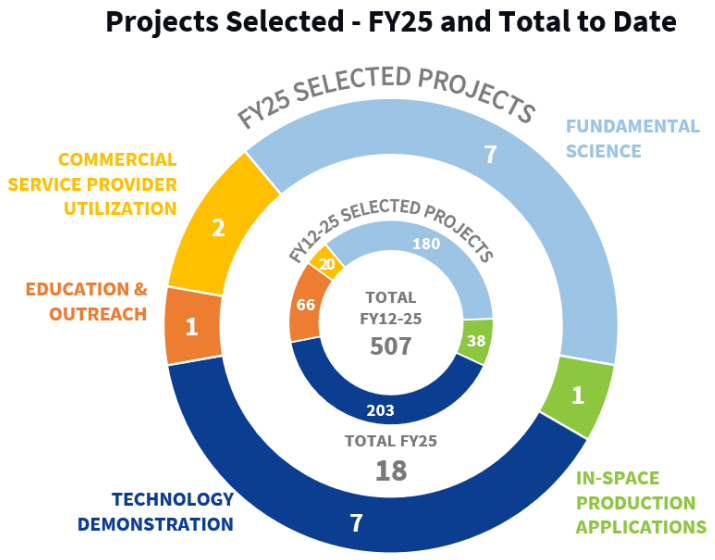
space-grown tumors that could lead to personalized cancer treatment, and how the Genes in Space™ student research program is shaping the workforce of tomorrow.

LEO Economic Development: Demand

In FY25, the ISS National Lab continued to build demand for space-based R&D among diverse users, helping to establish a robust and sustainable LEO economy. In particular, demand remained strong among commercial entities, demonstrating the value private industry finds in conducting research in space. However, resource constraints led to the cancellation of several planned solicitations (see Appendix A) and a pause in Resource Request Forms (RRFs) that enable customer access to facilities Commercial Service Providers own and operate on the ISS.



- CASIS selected 18 new projects (a little less than half as many as last year) through a variety of solicitations in strategic focus areas. For a full list of all selected ISS National Lab-sponsored projects, see the ISS National Lab Project Pipeline.
- This year, more than $10 million in external, non-NASA funding (down nearly 60% from last year due to the selection of fewer projects) was committed to support ISS National Lab-sponsored R&D projects, bringing the total amount committed to date to more than $325 million.
- CASIS funding for newly selected projects was matched 2.5:1 by committed funding from non-NASA, third-party entities, and the institutions themselves. Nearly two-thirds of the external funding committed this year was from private-sector organizations.



Note: This chart represents the ISS National Lab's strategic focus areas that were implemented in FY21. Projects selected before FY21 were recategorized post-selection as accurately as possible using the new classification system.

- Of the projects selected in FY25, nearly three-fourths were from new-to-space users, and more than half were from commercial entities.
- Examples of selected projects from new-to-space users:
  - RedPoint Oncology will use tumor organoids to test antibody-drug conjugates, a new class of drugs targeting cancers resistant to conventional treatments. This project was selected through the Technology in Space Prize, funded by CASIS and Boeing in partnership with MassChallenge.
  - SQUID3Space will test a new thermal control system for satellites that can be easily adjusted using software to manage heat in changing orbits and mission environments.
  - The University of Kentucky will examine how alloys melt and flow in microgravity, which is important for applications that involve joining two metals in space, such as in-orbit spacecraft repair or assembly. This investigation is funded by NSF.
- Examples of selected projects from return users:
  - Rensselaer Polytechnic Institute will expand on prior research studying protein solution flow and clumping to improve pharmaceutical manufacturing processes. This project is funded by NSF.
  - Skycorp Incorporated will validate a 100-terabyte-class computing server in space, measuring wear and tear on the server's storage devices and testing software in the harsh space conditions.

CASIS continued its multi-year partnerships with the U.S. National Science Foundation and the National Institutes of Health (NIH) through solicitations leveraging the ISS National Lab to advance fundamental science. This year, CASIS also partnered with global investors Cook Inlet Region, Inc. (CIRI), E2MC Ventures, and Stellar Ventures on the inaugural Orbital Edge Accelerator program solicitation. The program aims to bridge the gap between early-stage companies and innovation in space.

"One way that NSF promotes scientific and technological advances is by providing research infrastructure beyond the capabilities of a single investigator or institution. The NSF-CASIS partnership to conduct microgravity experiments on the ISS represents the ultimate example of exceptional infrastructure—a laboratory that is, quite literally, beyond this world."

– Sachin Velankar, NSF Program Director

- CASIS issued two joint solicitations with NSF, one on tissue engineering and one on the physical sciences area of transport phenomena, and three projects were selected through each.
- As part of the ISS National Lab's renewed partnership with NIH's National Center for Advancing Translational Science (NCATS) on the Tissue Chips in Space initiative, NIH awarded

grants for six projects to improve the development of tissue chips as model systems to study, diagnose, treat, and prevent aging-related functional decline and age-related diseases.

- CASIS received more than 150 applications for the Orbital Edge Accelerator solicitation, and six startups were selected for the initial cohort: Kall Morris Inc, Magma Space, Melagen Labs, Olfera, Quantum Qool, and Raptor Dynamix.
- Due to resource constraints in FY25, the ISS National Lab was unable to issue the Technology in Space Prize solicitation and select projects through the Igniting Innovation solicitation. The Technology in Space Prize, which CASIS has co-funded with Boeing for more than a decade, supports startups through the MassChallenge Accelerator program. Igniting Innovation, issued in collaboration with NASA's Division of Biological and Physical Sciences, sought research addressing some of the most pressing diseases of our time. Prior to its cancellation, the Igniting Innovation solicitation had a robust response, with 73 concept submissions and 11 proposals.

In FY25, the ISS National Lab continued its legacy of bringing together thought leaders and subject matter experts from industry, academia, and government to inform and advance strategic focus areas.

- Prior to the 2024 American Society for Gravitational and Space Research (ASGSR) conference, the ISS National Lab hosted a workshop on biomanufacturing and advanced materials.
- In collaboration with the Air Force Office of Scientific Research, the ISS National Lab organized a symposium highlighting ISS capabilities for biological and physical sciences R&D and capabilities on future commercial space platforms.
- The ISS National Lab organized a webinar with the Cancer Prevention & Research Institute of Texas (CPRIT) on accelerated cancer models in space.

LEO Economic Development: Supply

The ISS National Lab continues to bolster the supply side of the LEO economy by supporting a network of Implementation Partners (IP), organizations that provide hardware and services to translate ground-based science into successful spaceflight investigations. In FY25, the ISS National Lab collaborated with 32 IPs, 13 of which are Commercial Service Providers that own and operate facilities on the space station or are developing future facilities. Biannual IP workshops hosted by the ISS National Lab strengthened collaboration and advanced a shared mission to enhance supply-side capabilities for space-based R&D to meet the growing demand. For a full list of IPs, see the Implementation Partner Directory.

- Two new Commercial Service Providers were added in FY25: Vast and Tec-Masters. For a full list of commercial facilities, see Appendix B.
- More than 65% of ISS National Lab funding this year went toward IP costs for payload development services.

- More than 70% of ISS National Lab-sponsored payloads delivered this year were sourced by Commercial Service Providers, underscoring the ISS National Lab's commitment to enabling customer access to commercial facilities on station.
- There are now 24 commercial ISS facilities, 17 permanently installed on station and seven launched as needed.
- The searchable ISS Research Facilities Directory of R&D capabilities available through NASA and ISS National Lab commercial facilities had more than 7,100 website pageviews in FY25.
- One new commercial facility was added this year, Tec-Masters' Microgravity Research for Versatile Investigations (MaRVIn) platform, which supports a wide range of physical science research with its interchangeable experiment modules.
- Redwire's PIL-BOX pharmaceutical crystallization facility was updated with a new insert to better protect the hardware from harsh chemicals.

Key IP milestones for FY25 include:

- Aegis Aerospace
  - Was awarded a $10 million grant from the Texas Space Commission's Space Exploration and Aeronautics Research Fund program to develop an in-space manufacturing platform for advanced materials.
  - Announced it will partner with Texas A&M University to develop a private flight facility on the ISS dedicated to university research.
  - CEO Stephanie Murphy was named on Inc.'s 2025 Female Founders 500 List.
- BioServe Space Technologies supported its 100th space mission, marking more than three decades of enabling ISS research.
- Redwire Space
  - Was awarded a $25 million NASA grant for in-space pharmaceutical manufacturing and launched SpaceMD, a new venture company that will use PIL-BOX to grow protein crystals in space for new and reformulated therapeutics on Earth.
  - Chief Scientist Kenneth Savin was named to *TIME*'s 2025 Health 100 list for his leadership in pharmaceutical innovation and space biotech research.

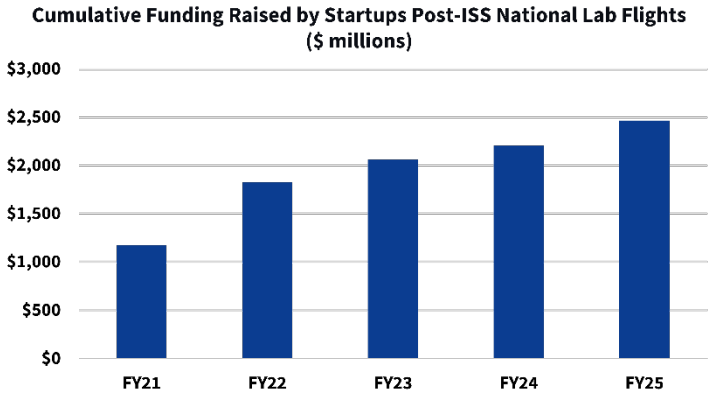
"Since 2019, Rhodium Scientific and the ISS National Laboratory have partnered to expand ISS access for first-time space researchers. This partnership has enabled Rhodium to establish itself as America's first commercial space biotech company, accelerating R&D into marketable results by leading the largest in-space biomanufacturing program, generating new stem-cell IP, and advancing mission readiness for microgravity programs spanning drug development to agricultural systems. Together, we streamline the end-to-end process to ensure every mission is executed seamlessly and with scientific excellence."

– Olivia Gámez Holzhaus, Founder and CEO of Rhodium Scientific

- Space Tango supported the continuation of LambdaVision's research to advance retinal implants to restore meaningful vision to those with macular degeneration.
- Vast completed production of the primary structure for its Haven-1 commercial space station, planned for launch in 2026, and is collaborating with SpaceX to solicit research to fly on it.
- Voyager Technologies (previously Voyager Space)
  - Went public, raising $382.8 million and reaching a peak valuation of $3.8 billion.
  - Acquired LEOcloud, a space-based cloud computing startup that is testing its Space Edge micro datacenter in an ISS National Lab-sponsored investigation.
  - Announced the Starlab commercial space station, being developed in collaboration with Airbus, is moving into full-scale production.

LEO Economic Development: Investor Network and Capital Connections

The ISS National Lab's startup ecosystem remained strong this year, despite challenging capital market conditions and budgetary uncertainties. Many startup companies that have leveraged the ISS National Lab to advance their R&D had successful fundraising activities in FY25.



- The total funding raised this year by startups after completion of ISS National Lab flight projects was $251 million—an increase of more than 70% compared to last year. The all-time cumulative total of such funding is now nearly $2.5 billion.
- When including startups selected for future spaceflight projects that have not yet launched, the funding total for this year rises to close to $270 million, and the all-time total is nearly $2.7 billion.
- Capital raising activity in the ISS National Lab startup ecosystem included a broad range of early-stage companies, including Axonis Therapeutics, Aphios Corp., Brain.Space, Eascra Biotech, Encapsulate, EnduroSat, FluxWorks, GITAI, iXpressGenes, Kall Morris Inc., Lynk Global, Orbital Sidekick, Orbit Fab, Opterus, Rendezvous Robotics, Sachi Bioworks, SatRev, SQUID3 Space, Tympanogen, and Xheme.
- The ISS National Lab investor ecosystem, which includes 331 participants across financial and corporate investment organizations, remains a source of capital connections and potential future funding for early-stage companies planning studies on the ISS.

This year, the ISS National Lab debuted the Orbital Edge Accelerator Program, an initiative designed to integrate investment partners and cutting-edge startups into the rapidly expanding space economy.

- In partnership with global investors Cook Inlet Region, Inc. (CIRI), E2MC Ventures, and Stellar Ventures, six innovative startups were selected for the program's inaugural cohort. Each received $500,000 in investment funding and the opportunity to conduct research on the ISS.
- The accelerator engaged 84 mentors to provide the startups with valuable mentorship sessions and curriculum programming toward development of their flight projects and building their business operations. Sessions were held in Alaska; Washington, D.C.; and Los Angeles, along with virtual mentor sessions and curriculum events. The program also included several well-attended investor and industry networking events on the east and west coast as well as a demo day in San Francisco.
- To execute the 18-week accelerator program, the ISS National Lab partnered with TechConnect, which has more than 25 years of experience connecting innovators with high-value commercialization opportunities.

"The new Orbital Edge Accelerator is providing in-space testing opportunities and private venture funding to promising startups working in critical technologies, allowing them to accelerate their development. This helps guarantee U.S. leadership in these areas important for the successful development of a self-sustaining commercial space economy as well as for national security and resilience. The first edition of the accelerator was a tremendous success, with over 150 applications received. We look forward to continuing working with our partners at ISS National Lab for many years to come, including after a transition from the ISS to future commercial space platforms."

– Raphael Roettgen, Founding Partner of E2MC Ventures

The fiscal year ended in a capital markets environment where investor sentiment remained positive despite the volatility in 2025.

- The S&P 500 Index was up 14% year-to-date through mid-November, following a total return of 25% in 2024 and 26% in 2023. For the more technology stock-heavy NASDAQ Index, the metrics were 19%, 25%, and 54% respectively, with appreciation heavily driven by growth expectations and related infrastructure needs around all things AI. Some financial market participants have raised questions around the return on capital and overspending on AI-related investment, and there have been some jitters around broader economic growth readings. However, despite recent market volatility, there appears to be more positivity than caution reflected in the current market sentiment.
- With the rebound of market risk appetite during 2025, we saw internal public offerings (IPOs) from space and defense companies such as Firefly Aerospace and Voyager Technologies. We also now see news on SPAC (special purpose acquisition company) financings making a return as a funding structure. That being said, looking ahead to 2026, one should question the likelihood of continued appreciation in public market valuations at double-digit rates, and well

above broader economic growth rates, for the fourth year in a row. In recent history, such lengthy double-digit per year return performance was achieved in the 1995-1999 period, followed by a substantial correction.

- When it comes to the private capital markets, such as venture capital, the trends tend to lag public markets. Current indications of increased IPO and mergers and acquisitions (M&A) activity, both of which have been improving in 2025, are typically viewed as a positive as they point to increased liquidity events to realize financial returns on prior years' investments.
- Based on NVCA/Pitchbook data, U.S. 2025 venture capital deal activity is shaping up to be the highest since 2021. However, more than 64% of venture capital dollars have been going toward AI companies. Defense tech investment activity has remained strong through 2025, driving solid investment interest in parts of the space technology ecosystem. Space economy funding activity data from Space Capital points to a pace of funding for space infrastructure and distribution companies in 2025 that is likely to surpass 2024 levels.
- In terms of fundamental demand drivers, we do not see the defense and dual-use-driven demand for space innovation abating. Given the multipolar geopolitical environment and growing contestation over the space domain, we expect a solid investment appetite for relevant space technologies, absent broader financial market shocks. We also do not see communications or data processing needs subsiding any time soon. With AI-driven advances in areas such as remote sensing and Earth observation, as well as therapeutics and materials development, we could see additional demand tailwinds. Innovation in robotics and manufacturing should support favorable cost trends in the space industry. Advancements with launch platforms such as New Glenn are very encouraging as well.
- The question here is clearly not in the long-term value proposition, but rather in how these very promising advancements should be valued in the current financial market context.

Educational Outreach

In FY25, the ISS National Lab continued to enable students to engage with space-based research and emerging commercial space opportunities. However, in alignment with administration priority changes, the ISS National Lab began to wind down science, technology, engineering, and mathematics (STEM) education initiatives. The ISS National Lab will not begin any new initiatives and has stopped collecting outreach metrics from its education partner programs.

Despite these changes, the ISS National Lab will remain a hub for education partners, sharing STEM education resources and highlighting student accomplishments and opportunities across the broader space ecosystem. This year, through experiential learning programs, industry internships, and long-standing educational partnerships, students gained exposure to cutting-edge science in orbit and career pathways critical to the future LEO economy.

- The ISS National Lab facilitated industry-embedded internships, offering students work-based learning experiences with Commercial Service Providers and engaging them in career opportunities in the growing space economy. In FY25, 10 students were funded, each

receiving $5,000, with participating companies (Rhodium Scientific, Aegis Aerospace, and Tec-Masters) providing matching support.

- Nearly 100 students contributed to ISS National Lab-sponsored science and technology projects through direct research participation and classroom programs.
- The ISS National Lab raised more than $5,700 to send nearly 100 STEM kits to U.S. classrooms, providing hands-on space science experiments that enhanced the curriculum and promoted active learning.
- The ISS National Lab continued to support previously awarded STEM education projects, including one from VRCORE Education, which debuted an immersive virtual reality lesson that lets students tour the ISS and conduct simulated experiments.
- The Genes in Space™ program celebrated its 10th anniversary. In collaboration with Boeing and miniPCR bio, the program engages students in grades 7-12 in space-based molecular biology research.
- Higher Orbits, which enables student-driven research and leadership development for grades 7-12, also marked its 10th anniversary. In partnership with Cook Inlet Region, Inc. (CIRI) and the ISS National Lab's Orbital Edge Accelerator, Higher Orbits hosted a "Go for Launch! Stellar Space Experience" in Alaska, where students worked with retired NASA astronaut Don Thomas to design ISS-bound experiments.
- Through the Amateur Radio on the International Space Station (ARISS) program, thousands of students connected with astronauts on the ISS in real time at ham radio events, building science communication skills and inspiring interest in space-related career pathways.

> ***"For over a decade, miniPCR bio has been honored to work alongside Boeing, New England Biolabs, and the ISS National Lab to engage over 11,000 students from across the United States as participants in the Genes in Space™ competition. Their engagement highlights the enthusiasm for space-based research and creative potential of these science and engineering workforce leaders of tomorrow. Beyond opening new avenues for participants, this program has also yielded significant advancements in space-based biomedical research, including nine student-led peer-reviewed publications that contribute to the scientific community at large."***
>
> *– Kristin Hennessy-McDonald, Outreach and Community Engagement Lead at miniPCR*

Outreach and Stakeholder Engagement

In FY25, the ISS National Lab expanded communication and engagement efforts to bolster support for space-based research and increase awareness of the groundbreaking results from R&D in LEO. These efforts reached diverse stakeholder groups spanning industry, academia, government, and education. However, overall visibility and website pageviews declined over the course of the year

due to a mid-year pause in paid advertising, reduced communications staffing, and the cancellation of key in-person events. Robust engagement growth during the first half of the fiscal year partially offset this reduction, resulting in higher overall interaction totals year-to-year, but trends in the latter half of FY25 reflected the expected impact of reduced promotional capacity.

Digital engagement grew across multiple channels, demonstrating both strong audience interest and the effectiveness of content distribution strategies. Notably, content engagement increased even as paid advertising and impressions decreased, indicating the high quality of the content and a more targeted audience.

- Key outreach and engagement metrics for FY25 include:
  - 275% increase in social media engagement
  - 25% increase in press release pickups
  - 60% increase in email click-throughs
  - 62% increase in ad click-throughs
  - 80% increase in overall engagement
  - 15% decrease in website pageviews
  - 76% decrease in impressions
- High-visibility media mentions this year include:
  - *The Wall Street Journal* highlighted microbial research on the ISS.
  - The *Associated Press* distributed a release tied to an *Upward®* feature on the AstroRad radiation shielding vest.
  - *Space.com* covered testing of a new 3D microscope to study life in extreme environments.
  - *Astrobiology Magazine* featured a Genes in Space™ student experiment.

A notable change in FY25 was the cancellation of the International Space Station Research and Development Conference (ISSRDC). For the last 13 years, ISSRDC has played a pivotal role in gathering leaders from the research, technology, industry, and government communities to advance the LEO economy. Although NASA and the ISS National Lab determined that the regulatory and budgetary environment did not support holding the in-person event, the ISS National Lab continued to share information about its role in enabling groundbreaking space-based research and building a robust LEO economy.

- CASIS partnered with the American Institute of Aeronautics and Astronautics

"AIAA was honored to work with the CASIS team to showcase compelling programming at this year's ASCEND conference. We benefited from learning about the work taking place on the ISS, which has been continuously operating for 25 years in low Earth orbit. Looking ahead to ASCEND in 2026, AIAA and CASIS will continue to collaborate, communicating the value of this pivotal research outpost that's advancing space-based R&D while driving a robust and sustainable space economy."

– Clay Mowry, CEO of AIAA

(AIAA) to expand programming for its ASCEND 2025 conference in Las Vegas and the upcoming ASCEND 2026 in Washington, D.C., to highlight the ISS National Lab's vital role in advancing R&D in LEO.

- In partnership with NASA and the American Astronautical Society, the ISS National Lab hosted three days of virtual ISSRDC technical sessions. Nearly 60 research teams presented findings from space-based R&D, drawing more than 730 registrants from across industry, government, and academia.

Through both digital and print media, the ISS National Lab amplified the impact of space-based research and highlighted advances within the commercial space ecosystem. Across publications, podcasts, and social platforms, the organization continued to engage audiences and demonstrate the growing interest in space-enabled innovation.

- *Upward*®, the ISS National Lab's flagship publication, continued to elevate R&D outcomes and showcase commercial and scientific achievements in LEO. The magazine's subscribers grew to nearly 10,000, up from 7,700 in FY24, and the *Upward* website received nearly 90,000 pageviews this year.
- The monthly *Space Station Spotlight* newsletter, which provides ISS National Lab updates and timely industry insights, expanded significantly, with more than 2,700 subscribers—a 68% jump from last year.
- The ISS National Lab launched its first podcast *Between a Rocket & a Hard Space*, creating a new avenue for communicating about science in space and engaging with stakeholders. The podcast achieved more than 2,000 downloads across seven episodes and garnered international attention, expanding the visibility of space-based research. High-profile guests included:
  - Jackie Wattles (CNN), Raphael Roettgen (E2MC Ventures), Arun Sharma (Cedars-Sinai), Yupeng Chen (University of Connecticut), ISS National Lab Chief Scientific Officer Michael Roberts, ISS National Lab User Advisory Committee Chair Mark Gittleman, and NASA astronauts Jonny Kim, Mike Fincke, and Zena Cardman.
- The ISS National Lab published eight new articles as part of its "Forging the Path" series, in which CASIS experts and partners share knowledge and insights on managing a national lab in space and the increasing importance of R&D in LEO.

ISS National Lab staff represented the organization at 23 speaking engagements, including:

- Co-chaired the 2025 SelectBIO Space Summit
- Participated in panel sessions at the Space Symposium
- Presented at the W.M. Keck Observatory in Hawaii, the Sanford Stem Cell Institute's Global Astrobiotechnology Hub, the 2024 Annual Symposium, and the NSF Directorate for Technology, Innovation and Partnerships (TIP) meeting

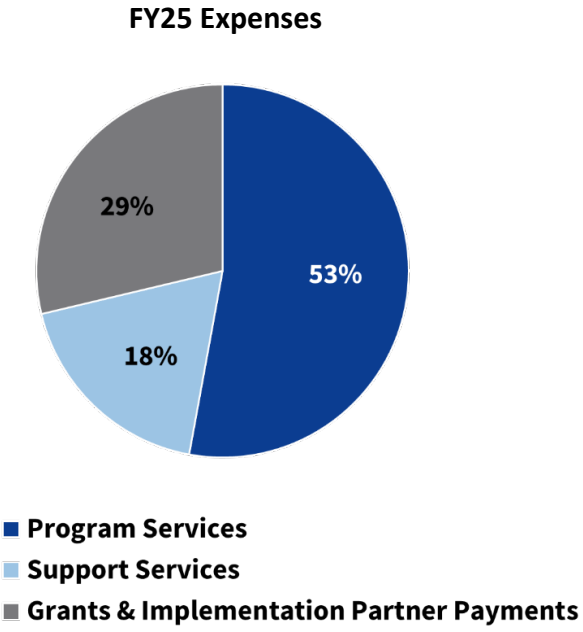
Financials

Unaudited Summary Statement of Financial Position as of September 30

	2025	2024	2023
Total assets	5,217,948	5,392,095	6,721,509
Total liabilities	2,982,244	2,664,730	3,705,243
Total net assets	2,235,704	2,727,365	3,016,266
Total liabilities and net assets	5,217,948	5,392,095	6,721,509

Unaudited Summary Statement of Activities for Years Ended September 30

	2025	2024	2023
Total revenues and other support	16,994,259	19,595,205	17,806,312
Total operating expenses	17,556,487	19,884,106	17,204,593
Change in net assets	(562,228)	(288,901)	601,719
Net assets, beginning of the year	2,797,932	3,016,266	2,414,547
Net assets, end of the year	2,235,704	2,727,365	3,016,266



Appendix A: ISS National Lab Solicitations

Solicitation	Release Date	Concepts Received	Proposals Received	Projects Awarded
NLRA for Follow-on Projects (NLRA 2025-1)	October 2024	12	3	0*
NSF/CASIS Tissue Engineering 2025	November 2024	37	20	3
NSF/CASIS Transport Phenomena 2025	December 2024	55	32	3
NLRA for Applied Research, Translational Science, and Tech Dev 2025-5: Cycle 1	January 2025	29	9	0*
NLRA for Education 2025 (NLRA 2025-6)	February 2025	50	14	0*
Orbital Edge Accelerator 2025 (NLRA 2025-7)	March 2025	53	6	0**
NLRA for Applied Research, Translational Science, and Tech Dev 2025-8: Cycle 2	Planned May 2025 (Cancelled Prior to Release)	Cancelled	Cancelled	Cancelled
Technology in Space Prize/Mass Challenge 2025 (NLRA 2025-9)	Planned May 2025 (Cancelled Prior to Release)	Cancelled	Cancelled	Cancelled
NLRA - Igniting Innovation: Science in Space to Cure Diseases on Earth 2025 (NLRA 2025-10)	August 2025 (Cancelled Prior to Release)	Cancelled	Cancelled	Cancelled

*Solicitation cancelled prior to selection/award

**Six projects identified through the Orbital Edge Accelerator program were selected for the cohort in FY25 but not approved to submit Resource Request Forms until FY26

Appendix B: ISS National Lab Commercial Facilities

Institution	ISS Commercial Facilities	Type	Location
AIRBUS U.S. Space & Defense, Inc.	• ArgUS	• On Station	• External
Aegis Aerospace, Inc.	• MISSE Flight Facility	• On Station	• External
BioServe Space Technologies	• Space Automated Bioproduct Lab (SABL) • Space Automated Laboratory Incubator (SALI) • BioServe Centrifuge	• On Station • On Station • On Station	• Internal • Internal • Internal
HNu Photonics, LLC	• Mobile SpaceLab	• Launch on Demand	• Internal
LaMont Aerospace	• STaARS-EF-1	• On Station	• Internal
Redwire Space Technologies, Inc.	• Additive Manufacturing Facility (AMF) • ADvanced Space Experiment Processor (ADSEP) • Multi-use Variable-gravity Platform (MVP) • BioFabrication Facility (BFF)	• On Station • On Station • On Station • On Station	• Internal • Internal • Internal • Internal
Rhodium Scientific	• Rhodium Science Chambers	• Launch on Demand	• Internal
Space Tango	• TangoLab • Powered Ascent Utility Locker (PAUL)	• On Station • Launch on Demand	• Internal • Internal
Tec-Masters, Inc.	• MaRVIn	• Launch on Demand	• Deployer
Teledyne Brown Engineering, Inc.	• Multi-User System for Earth Sensing (MUSES)	• On Station	• External
Voyager Technologies, Inc.	• Nanoracks Mainframe Alpha (Nanode) • Nanoracks CubeSat Deployer (NRCSD) • Nanoracks External Platform (NREP) • Nanoracks Plate Reader • Nanoracks Kaber MicroSat Deployer (Kaber) • BISHOP Airlock (NRAL) • Nanoracks BlackBox	• On Station • Launch on Demand • On Station • On Station • On Station • On Station • Launch on Demand	• Internal • Deployer • External • Internal • Deployer • External • Internal

Appendix C: Peer-Reviewed Journal Publications

1. Adam JA, Riley FP, Lopez JM, et al. Non-Newtonian interfacial modeling of protein drops sheared in microgravity. Fluids. 2025;10(3):58.
2. Aguilar M, Alpat B, Ambrosi G, et al. Solar modulation of cosmic nuclei over a solar cycle: Results from the Alpha Magnetic Spectrometer. Phys Rev Lett. 2025;134:051001.
3. Aguilar M, Ambrosi G, Anderson H, et al. Antiprotons and elementary particles over a solar cycle: Results from the Alpha Magnetic Spectrometer. Phys Rev Lett. 2025;134:051002.
4. Aguilar M, Ambrosi G, Anderson H, et al. Properties of cosmic lithium isotopes measured by the Alpha Magnetic Spectrometer. Phys Rev Lett. 2025;134(20):201001.
5. Anand R, Madhavi V, Lu K. Effect of boron on phase, nanostructure, and thermal stability of polycarbosilane-derived SiC ceramics. Ceram Int. 2024;50:53701-53711.
6. Barilaro L, Lopresti S, Olivieri L, Wylie M. ASTROBEAT: Advancing cold-welding technology for in-situ spacecraft repairs. J Space Saf Eng. 2025;12(3):405-418.
7. Brosius N, Zoueshtiagh F, Narayanan R. Enhancement of heat transfer using Faraday instability. J Fluid Mech. 2025;1016:A35.
8. Cahill R, Blaber EA, Juran CM, et al. 37-Day microgravity exposure in 16-Week female C57BL/6J mice is associated with bone loss specific to weight-bearing skeletal sites. PLoS One. 2025(3):e0317307.
9. Cai G, Rodgers NC, Liu AP. Unjamming transition as a paradigm for biomechanical control of cancer. Cytoskeleton. 2025;82:388-403.
10. Coblentz M, Evans JD, Kothe CI, et al. Food fermentation in space: Opportunities and challenges. iScience. 2025;28(4):112189.
11. Collman S, Plis EA, Semenova A, et al. Impacts of atomic oxygen exposure on surface morphology of selected spacecraft materials. J Spacecr Rockets. 2025;1-8.
12. Conradt J, Furst E. Quantitative imaging of colloidal structures. Langmuir. 2025;41(12):8176-8191.
13. du Moulin G, Sands I, Snow MA, Chen Y. Technical and regulatory opportunities and challenges for cell and gene therapies in low earth orbit: a status report. Cell Gene Ther Insights. 2025;11(4):545–577.
14. Dunlap C, Li C, et al. Hit2flux: A machine learning framework for boiling heat flux prediction using hit-based acoustic emission sensing. AI Therm Fluids. 2025;1:100002.
15. Faber L, Yau A, Stack R, Chen Y. Bioprintable Janus base nano-matrix for improved cartilage tissue engineering. Regen Eng Transl Med. 2025.
16. Farahat A. Examination of Cloud Seeding on Board of the International Space Station: Experimental and Modeling Approach. Microgravity Sci Technol. 2024;36(63).
17. Finch RH, Vitry G, Siew K, et al. Spaceflight causes strain-dependent gene expression changes in the kidneys of mice. npj Microgravity. 2025;11(1):11.

18. Forghani P, Liu W, Wang Z, et al. Spaceflight alters protein levels and gene expression associated with stress response and metabolic characteristics in human cardiac spheroids. Biomater. 2025:123080.
19. Fouchal Y, Ramirez R, Beloreshka M, Plis EA. Comparative evaluation of spacecraft materials properties under simulated and true space environments. J Astron Sci. 2024;71(6):53.
20. Friedman MA, Zeineddine Y, Tuyambaze O, et al. Simulated microgravity accurately models long-duration spaceflight effects on bone and skeletal muscle in skeletally immature mice. Bone Rep. 2025;26:101871.
21. Fu Y, Frechette J. Distinct contributions of particle adsorption and interfacial compression to the surface pressure of a fluid interface. Langmuir. 2024;40:2471-24483.
22. Gautam A, Chakraborty N, Dimitrov G, et al. Microgravity's effects on miRNA-mRNA regulatory networks in a mouse model of segmental bone defects. PloS One. 2024(12):e0313768.
23. Georgescu A, Oved JH, Galarraga JH, et al. Self-organization of the hematopoietic vascular niche and emergent innate immunity on a chip. Cell Stem Cell. 2024;31(12):1847-64.
24. Goelzer M, Howard S, Zavala AG, et al. Depletion of SUN1/2 induces heterochromatin accrual in mesenchymal stem cells during adipogenesis. Commun Biol. 2025;8:428.
25. Gupta A, Elliott R. REX: An autonomous resource exchange system for optimizing microgravity manufacturing efficiency. IEEE Aero Conf Proc. 2025;979-8-3503-5597-0.
26. Harriot AD, Ward CW, Kim DH, et al. Microphysiological systems to advance human pathophysiology and translational medicine. J Appl Physiol. 2024;137:1494-1501.
27. Hernandez I, Chithiravelu G, Padilla AE, Joddar B. Identifying and establishing the critical elements of a human cardiac in-vitro model for studying type-II diabetes. Discov Appl Sci. 2025;7:788.
28. Hu C, Chiang G, Chan AHP, et al. A mouse model of volumetric muscle loss and therapeutic scaffold implantation. Nat Protoc. 2025;20:608-619.
29. Huang P, Piatkowski BT, Cherukuri Y, et al. Impact of spaceflight on gene expression in cultured human mesenchymal stem/stromal cells. PLoS One. 2025;20(3):e0315285.
30. Ignatius IB, Dinesh B, Dietze GF, Narayanan R. Gravitational effects on Faraday instability in a viscoelastic liquid. J Fluid Mec. 2025;1011:A28.
31. Ignatius IB, Dinesh B, Dietze GF, Narayanan R. Thwarting Marangoni instability in a viscoelastic liquid film via parametric forcing. Phys Rev Fluids. 2025;10:04401.
32. Irace PH, Reeves RD, Stephens S, Roberts MS. Transport phenomena research in microgravity via the ISS National Lab to benefit life on Earth. Grav Space Res. 2024;12:145-158.

33. Jain I, Chan AHP, Yang G, et al. Combinatorial extracellular matrix tissue chips for optimizing mesenchymal stromal cell microenvironment and manufacturing. NPJ Regen Med. 2025;10:21.
34. Jain I, Oropeza BP, Hu C, et al. Temporal dynamics of gene and protein signatures following volumetric muscle loss. Front Cell Dev Biol. 2025;13:1606609.
35. Khan OM, Gasperini W, Necessary C, et al. Development and characterization of a low intensity vibrational system for microgravity studies. npj Microgravity. 2024;10:107.
36. Kim DW, Bevan MA. Energy landscapes for interfacial colloidal crystallization on three-dimensional surface topographies. J Colloid Interf Sci. 2025;696:137882.
37. Kim YJ, Min Hj, Ozbakir Y, et al. Dual-functional amphiphilic copolymer for enhanced dispersion and humidity tolerance of high-performance SnO2/Pd hydrogen sensors. Chem Eng J. 2025;524:168912.
38. Klarmann GJ, Rogers AJ, Gilchrist KH, Ho VB. 3D bioprinting meniscus tissue onboard the International Space Station. Life Sci Space Res. 2024;43:82-91.
39. Kleischmann F, Vowinckel B, Meiburg E, Luzzatto Fegiz P. Long-term microgravity experiments reveal a new mechanism for particle aggregation in suspension. npj Microgravity. 2025;11:63.
40. Kokkinos V, Koupparis AM, Fekete T, et al. The posterior dominant rhythm remains within normal limits in the microgravity environment. Brain Sci. 2024;14:1194.
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Appendix D: ISS National Lab on the Map