ISS NATIONAL LABORATORY®

ISS National Laboratory Q2FY24 Report

Quarterly Report for the Fiscal Year 2024 Period January 1, 2024 – March 31, 2024

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Q2FY24 Metrics

ISS NATIONAL LAB UTILIZATION AND OPERATIONS TARGET METRICS

TARGET METRICS	FY24 Q1	FY24 Q2	FY24 Q3	FY24 Q4	YTD FY24 Total	FY24 Target	FY24 Stretch
DEMAND FOR ISS RESOURCES							
1) Ratio of awardable proposals evaluated to expected awards (cumulative)	3:1	3:1			**3:1**	**3:1**	**N/A**
2) Leverage ratio of external funding to CASIS funding (cumulative)[a]	9:1	6:1			**6:1**	**1:1**	**2:1**
FUNDAMENTAL SCIENCE							
3) Fundamental Science projects selected	--	--			**--**	**8**	**10**
4) External funding supporting Fundamental Science users of the ISS National Lab	$--	$--			**$--**	**$4M**	**N/A**
APPLIED RESEARCH & DEVELOPMENT							
5) Applied Research & Development projects selected	--	--			**--**	**8**	**10**
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	3	2			**5**	**8**	**10**
8) Ratio of external funding to CASIS funding (self-reported) supporting Technology Demonstration users of the ISS National Lab (cumulative)[a]	9:1	6:1			**6:1**	**1:1**	**2:1**
EDUCATION & OUTREACH							
9) Education & Outreach projects selected	--	--			**--**	**4**	**5**
10) New Corporate or OGA sponsorships agreements	0	0			**0**	**1**	**3**
PROPOSAL MANAGEMENT							
11) Time from solicitation close to selection/non-selection notification (cumulative)	59 days	63 days			**63 days**	**≤65 days**	**≤60 days**

ISS NATIONAL LAB UTILIZATION AND OPERATIONS TRACKING METRICS

The following metrics have no target for FY24 but will be tracked internally and discussed in face-to-face meetings with NASA.

TRACKING METRICS	FY24 Q1	FY24 Q2	FY24 Q3	FY24 Q4	YTD FY24 Total
OVERALL PROJECT QUALITY AND DEMAND					
1) Percent of proposals reviewed that were awardable (cumulative)	74%	76%			**76%**
2) Percent of proposals reviewed that were high quality (cumulative)	3%	8%			**8%**
3) Percent of high-quality proposals not selected (cumulative)	0%	0%			**0%**
4) Percent of completed projects that met ≥80% of their research objectives (cumulative)	0%	0%			**0%**
5) Percent of completed Technology Dev/Demo and In-Space Production projects demonstrating technology readiness level (TRL) advancement (cumulative)	100%	100%			**100%**
6) ISS National Lab projects selected	3	2			**5**
7) Users by new/returning					
(a) ISS National Lab return users	2	0			**2**
(b) ISS National Lab new users	1	2			**3**
8) Projects by type					
(a) Commercial	2	2			**4**
(b) Academic/nonprofit	1	0			**1**
(c) Government agency	0	0			**0**
9) Multiplier on CASIS grant funding committed (cumulative)[a]	3:1	3:1			**3:1**
10) Active solicitations	3	3			**6**
11) ISS National Lab concepts received	16	108			**124**
12) ISS National Lab proposals received	37	14			**51**
13) Time from selection notification to agreement draft sent to principal investigator (cumulative)	76 days	73 days			**73 days**
14) Time from agreement draft to award (cumulative)	50 days	56 days			**56 days**
15) Time to flight	21 months	17 months			**19 months**

TRACKING METRICS (Continued)	FY24 Q1	FY24 Q2	FY24 Q3	FY24 Q4	YTD FY24 Total
PAYLOADS DELIVERED					
16) Commercial Service Provider Facility Utilization payloads delivered	12[c]	39			**51**
(a) Percentage of Commercial Service Provider Facility Utilization payloads flown that met mission success criteria (previous fiscal year quarter)[b]	80%[c]	98%			**89%**
17) Education & Outreach payloads delivered	1	3			**4**
18) Fundamental Science payloads delivered	3	5			**8**
(a) Percentage of Fundamental Science payloads flown that met mission success criteria (previous fiscal year quarter)[b]	71%	100%			**86%**
19) Applied Research & Development payloads delivered	1	4			**5**
(a) Percentage of Applied Research & Development payloads flown that met mission success criteria (previous fiscal year quarter)[b]	100%	100%			**100%**
20) Technology Demonstration payloads delivered	0	4			**4**
(a) Percentage of Technology Demonstration payloads flown that met mission success criteria (previous fiscal year quarter)[b]	100%	100%			**100%**
21) Total ISS National Lab-sponsored payloads delivered	17[c]	55			**72**
COMMUNITY ENGAGEMENT AND INVESTMENT					
22) New partnerships formed	2	4			**6**
23) Total external funding committed	$4,049,227	$725,996			**$4,775,223**
24) Funds raised post award and postflight by startup companies with ISS National Lab-sponsored flight projects					
(a) Funds raised postflight	$56.5M[c]	$6.4M			**$62.9M**
(b) Funds raised post award	$56.5M[c]	$6.6M			**$63.1M**
25) External funding committed from new OGA partnerships	$0	$0			**$0**
26) New educational partnerships	0	3			**3**

TRACKING METRICS (Continued)	FY24 Q1	FY24 Q2	FY24 Q3	FY24 Q4	YTD FY24 Total
COMMUNITY ENGAGEMENT AND INVESTMENT (CONTINUED)					
27) Number of high school and higher education students contributing to research projects completed during the fiscal year	27[c]	0			**27**
28) Total individuals participating in ISS National Lab Education & Outreach programs and projects (self-reported)	1,576,201	2,154,605			**3,730,806**
29) Total individual users of ISS National Lab online education products (self-reported)	6,040,751	3,759,642			**9,800,393**
IMPLEMENTATION PARTNERS AND COMMERCIAL SERVICE PROVIDER ACTIVITIES					
30) Number of Implementation Partners (cumulative)	33	33			**33**
31) Number of Commercial Service Providers (cumulative)	14	14			**14**
32) New Umbrella User Agreements executed	0	0			**0**
33) New commercial facilities added	0	0			**0**
34) Commercial facilities (cumulative)	24	23			**23**
35) RRFs submitted	14	24			**38**
36) RRFs approved	13	22			**35**
37) RRF approval time (cumulative)	9 days	7 days			**7 days**
RESOURCE UTILIZATION					
38) Crew time (actual vs. increment pair – 3 months allocation)	66%				**66%**
(a) Ascent flight resources					
Upmass	53%	150%			**102%**
Cold stowage	74%	79%			**77%**
Big bags	0%	84%			**42%**
Powered lockers	75%	73%			**74%**
(b) Facility resources (reported in Q2 and Q4)					
Commercial facilities	56%				**56%**
JEM airlock	2				**2**
Life Sciences Glovebox	7				**7**
Microgravity Science Glovebox	9				**9**

TRACKING METRICS (Continued)	FY24 Q1	FY24 Q2	FY24 Q3	FY24 Q4	YTD FY24 Total
RESOURCE UTILIZATION (CONTINUED)					
39) Number of payloads that did not turnover per the nominal delivery schedule	2	2			**4**
Principal investigators	0	0			**0**
Implementation Partners	2	3			**5**
CASIS	0	0			**0**
NASA	0	0			**0**
40) Number of re-flight experiments flown	0	0			**0**
Fundamental Science	0	0			**0**
Applied Research & Development	0	0			**0**
Technology Demonstration	0	1			**1**
Education and Outreach	0	0			**0**
Commercial Service Provider Utilization	0	0			**0**
41) Number of payloads ready to fly that were left on the ground due to limited resources (upmass, crew time, cold stowage, etc.)	2	1			**3**
42) Number of payloads removed from the manifest after the freeze date because the principal investigator/payload could not make the flight	2	0			**2**
OVERALL PROJECT RESULTS					
43) Number of peer-reviewed papers including those accepted for publication in Tier 1 journals	5[c]	16			**21**
44) Number of new patents pending	0	0			**0**

a. CASIS awards funded with NASA MI&O are included.

b. Data is from previous fiscal year quarter. Whether a payload met research objectives often cannot be determined until it has been returned to the investigator and initial data has been reviewed.

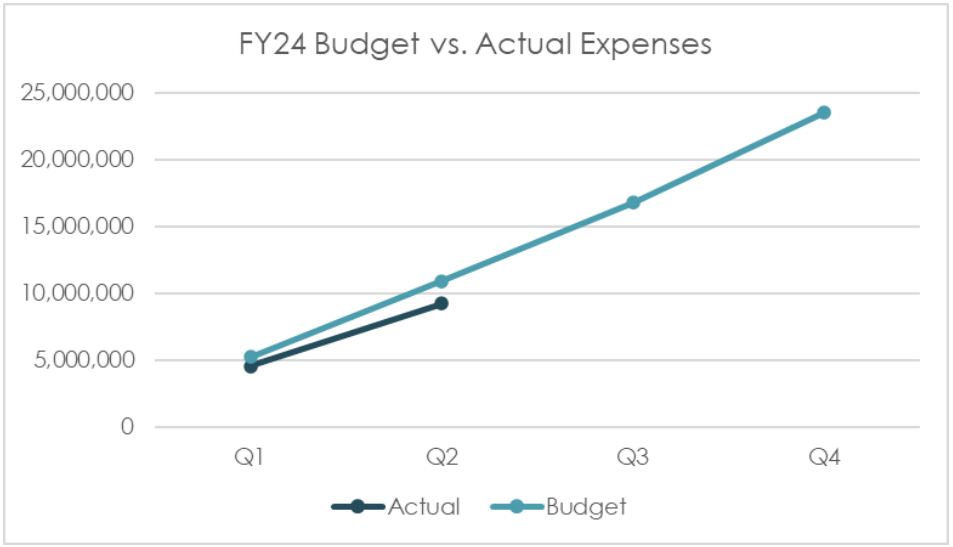
c. Additional/new data available after previous quarterly report completion.

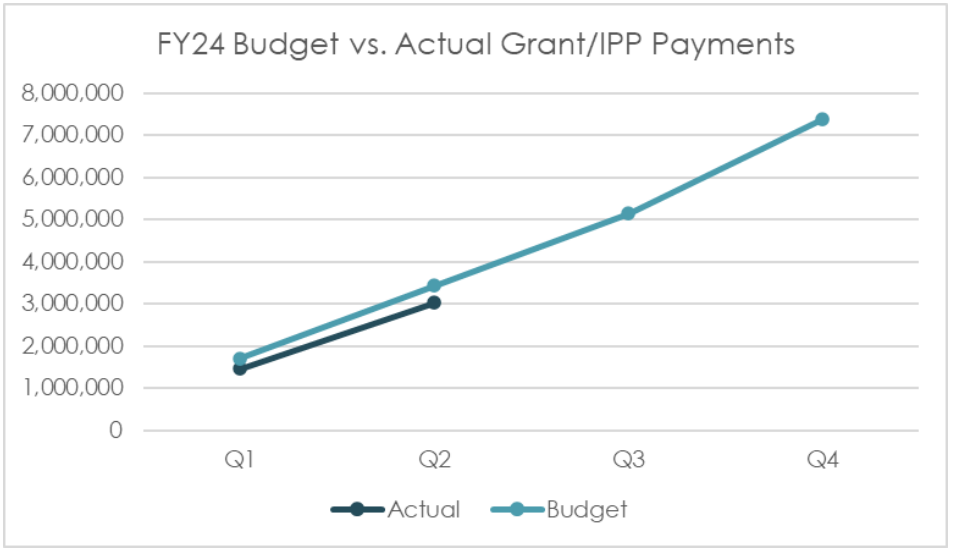
FINANCIALS

Business Status Report (unaudited)

Expenses	Q2 Actuals	Q2 Budget	Variance	Actual YTD FY24	Budget YTD FY24	Variance YTD FY24
Direct Labor	$2,227,879	$2,673,656	($445,777)	$4,563,361	$5,236,954	$(673,593)[a]
Subcontracts	$341,852	$368,585	($26,733)	$583,042	$694,092	$(111,050)[b]
Other Direct	$308,521	$537,794	($229,273)	$625,203	$932,699	$(307,496)[c]
Travel	$138,570	$180,479	($41,909)	$295,528	$295,409	$119
Office Supplies and Equipment	$97,167	$171,443	($74,276)	$180,260	$332,894	$(152,634)[d]
Grants & Mission-Based Costs	$1,570,614	$1,718,799	($148,185)	$3,025,961	$3,432,132	$(406,171)[e]
Total Expenses	$4,684,603	$5,650,756	($966,153)	$9,273,355	$10,924,180	**$(1,650,825)**

a. Salaries and Benefits: At 3/31 58 full-time equivalent vs 63.5 budgeted.
b. Subcontracts: Reduced legal costs as contracts personnel have been filled.
c. Other Direct: In part due to advertising having been adjusted below plan, as well as the timing of some budgeted trade shows.
d. Office Supplies and Equipment: Computer purchases have been capitalized and some reduced costs in subscriptions.
e. Grants: Recipient milestone payments shifted based on awardees' actual spend rates and their ability to successfully deliver milestones on schedule.





Breakout of ISS National Lab Grants Payments

	Q1FY24	Q2FY24	Q3FY24	Q4FY24	FY24 YTD Total
Academic	$477,216	$660,169			$1,137,385
Commercial	$978,131	$910,444			$1,888,575
Other Government Agency	-	-			-
Total	**$1,455,347**	$1,570,613			$3,025,960

Total Value of Grants Awarded *(i.e., funds committed toward future projects)*

	ACTUAL Q1	ACTUAL Q2	ACTUAL Q3	ACTUAL Q4	ACTUAL FY24
Total value of grants awarded[a]	$197,188	$417,648			$614,836

a. Grants include awards to projects and programs as well as modifications and extensions. The ability to award new grants will be dependent on the availability of additional funding for the ISS National Lab.

Breakout of Cooperative Agreement Funding

	Q1FY24	Q2FY24	Q3FY24	Q4FY24	FY24 YTD Total
Direct	46%	44%	%	%	45%
Indirect	22%	23%	%	%	22%
Grants	32%	34%	%	%	33%

IN-ORBIT ACTIVITIES

- Axiom Space's third private astronaut mission, Ax-3, launched to the ISS carrying an all-European crew of astronauts and dozens of investigations sponsored by the ISS National Lab, including the following (full details on the launch page):
  - The Sanford Stem Cell Institute at the University of California, San Diego, launched two investigations building on previous ISS research:
    - One investigation studies tumor organoids in microgravity to identify changes that can be used as early warning signs of cancer to improve diagnosis and treatment.
    - The other investigation collects private astronauts' blood cells to evaluate DNA damage and changes in blood enzymes during and after spaceflight to better understand their role in health and disease.
  - Several investigations tested technology and materials for future long-duration spaceflight, including radiation-shielding textiles, a spacesuit that collects medical data on astronauts, and technology to determine the amount of ionizing radiation absorbed by astronauts in real time.
- Northrop Grumman's 20th Commercial Resupply Services mission, contracted by NASA, delivered more than 20 ISS National Lab-sponsored payloads, including the following (full details on the launch page):
  - LambdaVision is refining its process for in-space manufacturing of artificial retinas to restore significant vision in patients with retinitis pigmentosa, a genetic disorder that causes vision loss.
  - The University of Connecticut is using engineered cartilage tissue to test an innovative nanoparticle therapy that may help repair cartilage in patients with degenerative joint diseases.
  - Hewlett Packard Enterprise (HPE) is testing its updated HPE Spaceborne Computer-2, aiming to reshape the trajectory of high-performance computing in space.
  - Flawless Photonics aims to validate the company's method for the in-space manufacturing of ZBLAN optical fiber, which has applications in communications, sensors, and laser technology.
  - In collaboration with Nanoracks, GITAI is testing an autonomous robotic arm system designed to carry out intricate maneuvers for in-space servicing, assembly, and manufacturing on the exterior of the ISS.
- SpaceX's 30th Commercial Resupply Services mission, contracted by NASA, delivered more than 40 ISS National Lab-sponsored payloads, including the following (full details on the launch page):
  - Oculogenex is testing a new gene therapy to prevent and even reverse vision loss from age-related macular degeneration, which affects more than 200 million people globally.
  - In its sixth ISS investigation, the National Stem Cell Foundation is using 3D brain models to better understand neuroinflammation and find new ways to treat neurodegenerative diseases.
  - Encapsulate is testing its automated tumor-on-a-chip system to grow patient-derived cancer cells for testing chemotherapeutic drugs.

R&D PROGRESS AND SUCCESSES

- In Q2, 16 new peer-reviewed articles were published (view a full list of peer-reviewed publications related to ISS National Lab research at www.ISSNationalLab.org/publications/):
  - Anand R, Lu K. Fate of polymer derived SiC monolith at different high temperatures. J Anal Appl Pyrol. 2024;178:106386.
  - Anand R, Lu K. Understanding thermodynamic stability and carbothermal reduction in SiOC. Mat Chem Phys. 2024;316:129123.
  - Cardin K, Cabrera-Booman F, Cal RB. Droplet jump from a particle bed. J Soft Matter. 2024;20:2887-2891.
  - Dwivedi G, Flaman L, Alaybeyoglu B, et al. Effects of dexamethasone and IGF-1 on post-traumatic osteoarthritis-like catabolic changes in a human cartilage-bone-synovium microphysiological system in space and ground control tissues on Earth. Front Space Technol, 2024:5;1358412.

- Forghani P, Rashid A, Armand LC, et al. Simulated microgravity improves maturation of cardiomyocytes derived from human induced pluripotent stem cells. Sci Rep. 2024;14(1):2243.
- Ignatius IB, Dinesh B, Dietze GF, et al. Influence of parametric forcing on Marangoni instability. J Fluid Mech. 2024;981:A8.
- Lian X, Karnaukh KM, Zhao L, et al. Dynamic manipulation of droplets on liquid-infused surfaces using photoresponsive surfactant. ACS Cent Sci. 2024;10:684-694.
- Plis EA, Badura G. The spectral characterization of novel spacecraft materials in the low Earth orbit environment. J Astronaut Sci. 2024;71:15.
- Ren Z, Ahn EH, Do M, et al. Simulated microgravity attenuates myogenesis and contractile function of 3D engineered skeletal muscle tissues. npj Microgravity. 2024;10(1):18.
- Scotti MM, Wilson BK, Bubenik JL, et al. Spaceflight effects on human vascular smooth muscle cell phenotype and function. npj Microgravity. 2024;10 (1):41.
- Sridhar K, Narayanan V, Bhavnani S. Enhanced heat transfer in microgravity from asymmetric sawtooth microstructure with engineered cavities. Int J Heat Mass Tran. 2024;22:125158.
- Velasco MÁ, Casaus J, Molero M. Determination of the anisotropy of elementary particles with the Alpha Magnetic Spectrometer on the International Space Station. Adv Space Res. 2024. (in press)
- Waddell KA, Yablonsky G, Constales D, et al. The kinetics and warm flame chemistry associated with radiative extinction of spherical diffusion flames. Combust Theor Model. 2024:1-18.
- Whorton MS, Crassidis JL. Multi-user system for Earth sensing spacecraft attitude calibration and analysis. J Spacecr Rocket. 2024:1-13.
- Wubshet NH, Cai G, Chen SJ, et al. Cellular mechanotransduction of human osteoblasts in microgravity. npj Microgravity. 2024;10(1):35.
- Zhang Q, Mo D, Moon S, et al. Bubble nucleation and growth on microstructured surfaces under microgravity. npj Microgravity. 2024;10:13.

- Flawless Photonics generated more than 11 km of ZBLAN optical fiber on the ISS—with the longest single pull measuring more than a kilometer—the longest fiber pull on station to date.

LEO ECONOMY

Demand

- Two new projects were selected in Q2, both through the Technology in Space Prize, funded by CASIS and Boeing in partnership with the MassChallenge startup accelerator program:
  - Symphony Biosciences is testing an implant that activates an immune response to treat solid cancerous tumors, and FluxWorks, Inc. is testing a noncontact magnetic gear that could increase the lifetime of mechanical gears in extreme environments.
- Three solicitations opened in Q2:
  - NLRA 2024-4: Technology Advancement and Applied Research Leveraging the ISS National Lab: Cycle 1
  - NLRA 2024-5: Leveraging the International Space Station for STEM Education and Workforce Development
  - NLRA 2024-6: In-Space Production Applications: Advanced Materials & Manufacturing

Supply

- Space Tango received NASA Small Business Innovation Research (SBIR) Ignite funding for its TangoBox™ hardware, which expands on CubeLab™ capabilities and enables optimized automated space manufacturing and research.
- Two Implementation Partners received SBIR Phase I awards from the U.S. National Science Foundation's Directorate for Technology, Innovation, and Partnerships:

- Space Tango is building a consortium for its high-throughput CubeLab, which launched for the first time on SpaceX CRS-30 carrying 588 biological samples from five different research groups. With this high-throughput capacity, statistical evidence will be gathered to begin to match the quality of a ground-based study.
- Rhodium Scientific is developing a space-based biobank to store microbial species that are optimized and produced in the space environment.

- Texas Governor Greg Abbott announced Aegis Aerospace CEO Stephanie Murphy as an Executive Committee member for the newly formed Texas Aerospace Research and Space Economy Consortium.
- Barrios Technology was awarded a Boeing Engineering and Technical Support Services contract for software services supporting the ISS and Boeing's Starliner.
- Wake Forest Institute for Regenerative Medicine was awarded a 10-year grant for $160 million by NSF to develop a Regional Innovation Engine focused on Development and Manufacturing, Biomaterials, Cell Biology, In-Space Manufacturing, and Workforce Development, which includes in-space biomanufacturing that will be done in partnership with Axiom Space and the ISS National Lab.

Investment

- The first quarter of calendar year 2024 brought a seasonally slower pace of funding activity in the ISS National Lab startup ecosystem, similar to last year. The capital access environment for early-stage companies in the space industry remained challenging. Based on the publicly available data, $6.4 million of private capital and grant funding was raised during the quarter by startups that have completed a flight project with the ISS National Lab. To date, more than $2.1 billion of such startup funding has been raised post-ISS National Lab flight projects.
  - Companies that secured funding in Q2 include Orbital Sidekick and Cosmic Shielding Corporation.
- The ISS National Lab Investor Network includes more than 300 participants across financial and corporate investment organizations. To date, CASIS has facilitated 1,340 capital introductions between startups and investors in the ISS National Lab ecosystem. While the investor appetite toward space startups has remained highly selective, the ISS National Lab ecosystem remains a source of capital connections and potential future funding for early-stage companies planning studies on the ISS.

STEM EDUCATION AND WORKFORCE DEVELOPMENT

- Three student projects from Higher Orbits launched on SpaceX CRS-30: one testing fungus growth and radiation in space; another comparing fruit flies' diets to assess variations in iron levels in microgravity; and a third measuring yeast cellular respiration and growth in space versus on Earth.
- Space Station Explorers gained three new partners in Q2:
  - Space for Teachers, developed by Carthage College, allows educators to design and conduct experiments with their students during reduced-gravity flights.
  - Perseid Foundation, founded by Axiom Space private astronaut John Shoffner, aims to bring STEM programming to schools and underserved students in rural Appalachia.
  - Rosie Riveters, an after-school program, gives girls the skills and confidence to tackle STEM projects and future jobs in STEM fields.
- The Space Station Ambassadors program continued to expand, with 144 new members in Q2.
- At the Space Exploration Educators Conference, the ISS National Lab hosted a networking event for 100 educators and partners to highlight ISS National Lab educational resources.
- At the National Science Teachers Association National Conference, the ISS National Lab hosted a networking event for 100 educators to learn about ISS National Lab educational resources and participate in The Infinite virtual reality experience.

- The ISS National Lab participated in a college and career readiness event hosted by the Astronaut's Memorial Foundation, engaging with nearly 500 local high school students about opportunities in the space industry.

OUTREACH AND STAKEHOLDER ENGAGEMENT

- CASIS released the ISS National Lab Annual Report for Fiscal Year 2023, highlighting the many successes achieved during FY23 to advance the ISS National Lab's mission.
- The ISS National Lab hosted two pre-launch webinars with NASA leadership that focused on the science launching on NG-20 and SpaceX CRS-30, with each drawing more than a dozen members of the media and hundreds of participants from the general public.
- In Q2, ISS National Lab press releases resulted in more than 49,240 views by media and more than 14,170 click-throughs.
- The ISS National Lab website had more than 476,130 views in Q2, a 71-percent increase from Q2 of FY23.
- *Upward*, official magazine of the ISS National Lab, gained more than 1,000 new subscribers in Q2, bringing the total number of subscribers to more than 6,500.
- ISS National Lab media coverage during Q2 includes:
  - A Modern Retina article and a Scripps News special interest segment highlighted an investigation from Oculogenex testing a new gene therapy to prevent and reverse vision loss from age-related macular degeneration.
  - A Space News article discussed Flawless Photonics' kilometer-length production of ZBLAN fiber on station, including an interview with an ISS National Lab Science team member.
  - An *Exploring Drug Discovery and Development* magazine article discussed 3D bioprinting in space and included quotes from the ISS National Lab chief scientist.
  - A Payload article discussed the evolution of the ISS National Lab and featured the ISS National Lab chief scientist.
  - An Electronics Weekly article highlighted the ISS National Lab in-space production applications research announcement.
  - A CT Insider article highlighted several ISS National Lab-sponsored investigations from researchers in Connecticut, including an interview with an ISS National Lab Science team member.
- The ISS National Lab moderated two sessions with NASA astronaut Raja Chari at the 2024 Consumer Electronics Show, the world's largest gathering of technology companies and researchers.
- The ISS National Lab participated in several events related to in-space manufacturing, including:
  - The ISS National Lab Science team participated in the In-Space Servicing, Assembly, and Manufacturing (ISAM) Roadmapping Standards and Policies Workshop in Washington, D.C., hosted by Booz Allen Hamilton and the University of New Hampshire, among others.
  - The ISS National Lab Science team participated in a panel discussion at a Space Forge and British Embassy-hosted event called "Enabling the Next Industrial Revolution: Advancing the Future Through In-Space Manufacturing."
  - The ISS National Lab chief scientist spoke on a panel about in-space manufacturing at the Sanford Stem Cell Institute (SSCI) Astrobiotechnology Hub event.
  - The ISS National Lab Science team participated in the Worldwide Advanced Manufacturing Symposium.
- ISS National Lab staff participated in several additional conferences, workshops, and events, including the 26th Annual FAA Commercial Space Transportation Conference, the Arizona Space Summit, NASA Human Research Program Investigators' Workshop, and SpaceCom.

Full Project Pipeline Details

- Visit our project pipeline database for a complete list of ISS National Lab-sponsored projects and programs, including flight status.