ISS NATIONAL LABORATORY®

ISS National Laboratory Q1FY24 Report

Quarterly Report for the Fiscal Year 2024 Period October 1, 2023 – December 31, 2023

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Authorized for submission to NASA by: *Ramon Lugo III*

Ramon Lugo III

Q1FY24 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	3:1				**3:1**	**3:1**	**N/A**
2) Leverage ratio of external funding to CASIS funding	--				**--**	**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)	--				**--**	**1:1**	**2:1**
TECHNOLOGY DEMONSTRATION							
7) Technology Demonstration projects selected	3				**3**	**8**	**10**
8) Ratio of external funding to CASIS funding (self-reported) supporting Technology Demonstration users of the ISS National Lab (cumulative)	--				**--**	**1:1**	**2:1**
EDUCATION & OUTREACH							
9) Education & Outreach projects selected	--				**--**	**4**	**5**
10) New Corporate or OGA sponsorships agreements	0				**0**	**1**	**3**
PROPOSAL MANAGEMENT							
11) Time from solicitation close to selection/non-selection notification (cumulative)	59 days				**59 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.	74%				**74%**
2) Percent of proposals reviewed that were high quality.	3%				**3%**
3) Percent of high-quality proposals not selected.	0%				**0%**
4) Percent of completed projects that met ≥80% of their research objectives	0%				**0%**
5) Percent of completed Technology Dev/Demo and In-Space Production projects demonstrating technology readiness level (TRL) advancement	100%				**100%**
6) ISS National Lab projects selected	3				**3**
7) Users by new/returning					
(a) ISS National Lab return users	2				**2**
(b) ISS National Lab new users	1				**1**
8) Projects by type					
(a) Commercial	2				**2**
(b) Academic/nonprofit	1				**1**
(c) Government agency	0				**0**
9) Multiplier on CASIS grant funding committed (cumulative)	--				**--**
10) Active solicitations	3				**3**
11) ISS National Lab concepts received	16				**16**
12) ISS National Lab proposals received	37				**37**
13) Time from selection notification to agreement draft sent to principal investigator (cumulative)	76 days				**76 days**
14) Time from agreement draft to award	50 days				**50 days**
15) Time to flight	21 months				**21 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	11				**11**
(a) Percentage of Commercial Service Provider Facility Utilization payloads flown that met mission success criteria (previous fiscal year quarter) [a]	TBD				**TBD**
17) Education & Outreach payloads delivered	1				**1**
18) Fundamental Science payloads delivered	3				**3**
(a) Percentage of Fundamental Science payloads flown that met mission success criteria (previous fiscal year quarter) [a]	71%				**71%**
19) Applied Research & Development payloads delivered	1				**1**
(a) Percentage of Applied Research & Development payloads flown that met mission success criteria (previous fiscal year quarter) [a]	100%				**100%**
20) Technology Demonstration payloads delivered	0				**0**
(a) Percentage of Technology Demonstration payloads flown that met mission success criteria (previous fiscal year quarter) [a]	100%				**100%**
21) Total ISS National Lab-sponsored payloads delivered	16				**16**
COMMUNITY ENGAGEMENT AND INVESTMENT					
22) New Partnerships Formed	2				**2**
23) Total external funding committed	$4,049,227				**$4,049,227**
24) Funds raised post award and postflight by startup companies with ISS National Lab-sponsored flight projects					
(a) Funds raised postflight	$53.8M				**$53.8M**
(b) Funds raised post award	$53.8M				**$53.8M**
25) External funding committed from new OGA Partnerships	$0				**$0**
26) New Educational Partnerships	0				**0**

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.	--				**--**
28) Total individuals participating in ISS National Lab Education & Outreach programs and projects (self-reported)	1,576,201				**1,576,201**
29) Total individual users of ISS National Lab online education products (self-reported)	6,040,751				**6,040,751**
IMPLEMENTATION PARTNERS AND COMMERCIAL SERVICE PROVIDER ACTIVITIES					
30) Number of Implementation Partners	33				**33**
31) Number of Commercial Service Providers	14				**14**
32) New Umbrella User Agreements executed	0				**0**
33) New commercial facilities added	0				**0**
34) Commercial facilities (cumulative)	24				**24**
35) RRFs Submitted	14				**14**
36) RRFs Approved	13				**13**
37) RRF Approval Time	9 days				**9 days**
RESOURCE UTILIZATION					
38) Crew time (actual vs. increment pair – 3 months allocation)					
(a) Ascent flight resources					
Upmass	53%				**53%**
Cold stowage	74%				**74%**
Big bags	0%				**0%**
Powered lockers	75%				**75%**
(b) Facility resources (reported in Q2 and Q4)					
Commercial facilities					
JEM airlock					
Life Sciences Glovebox					
Microgravity Science Glovebox					

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**
Principal investigators	0				**0**
Implementation Partners	2				**2**
CASIS	0				**0**
NASA	0				**0**
40) Number of re-flight experiments flown	0				**0**
Fundamental Science	0				**0**
Applied Research & Development	0				**0**
Technology Demonstration	0				**0**
Education and Outreach	0				**0**
Commercial Service Provider Utilization	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				**2**
42) Number of payloads removed from the manifest after the freeze date because the principal investigator/payload could not make the flight	2				**2**
OVERALL PROJECT RESULTS					
43) Number of peer-reviewed papers including those accepted for publication in Tier 1 journals	4				**4**
44) Number of new patents pending	0				**0**

a. Data is from previous fiscal year quarter. Determination of whether a payload met research objectives often cannot be determined until the payload has been returned to the investigator and review of initial data has taken place.

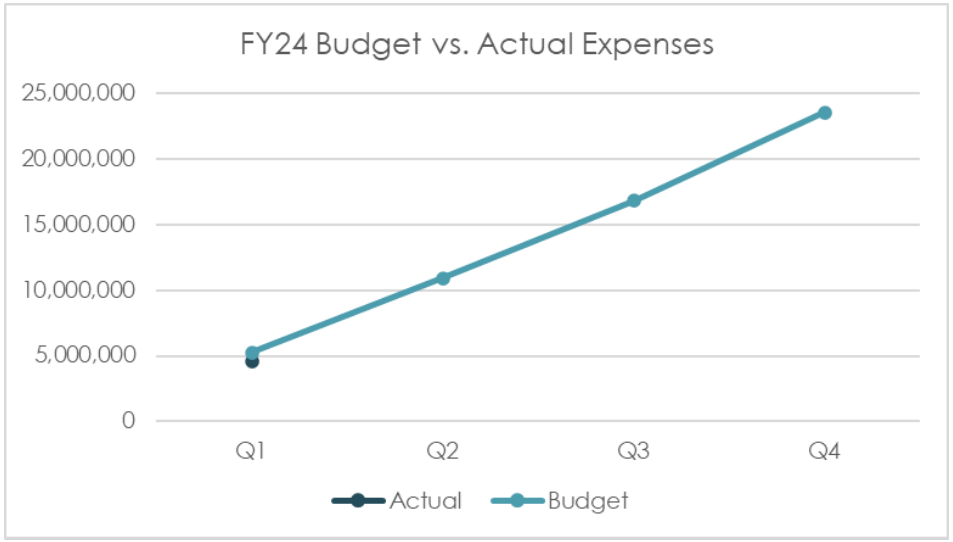
FINANCIALS

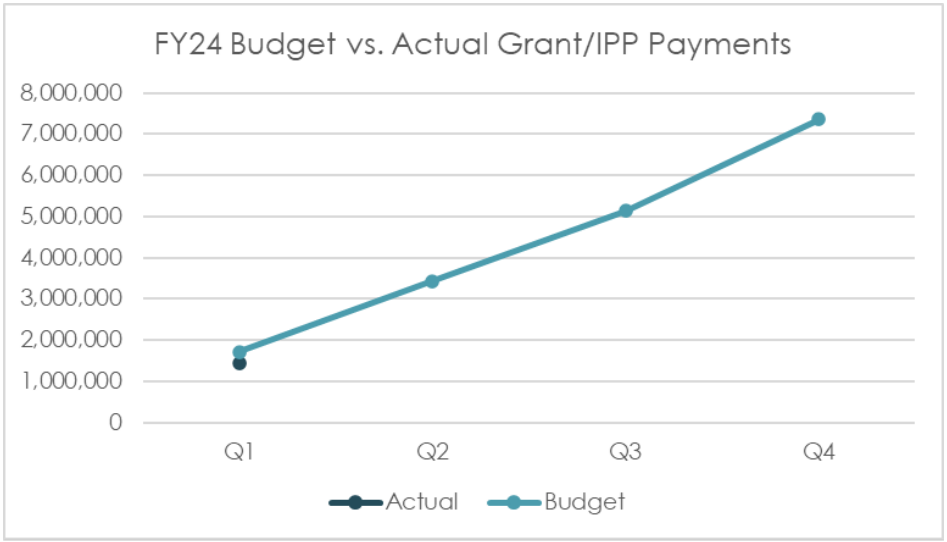
Business Status Report (unaudited)

Expenses	Q1 Actual FY24	Q1 Budget FY24	Q1 Variance FY24
Direct Labor	$2,335,482	$2,563,298	($227,816)[a]
Subcontracts	$241,190	$325,507	($84,317)
Other Direct	$316,682	$394,905	($78,223)
Travel	$156,958	$114,930	$42,028
Office Supplies and Equipment	$83,093	$161,451	($78,358)
Grants	$1,455,347	$1,713,333	($257,986)[b]
Total Expenses	$4,588,752	$5,273,424	($684,672)

a. Salaries and Benefits: At 12/31 58 FTE vs 63.5 budgeted.

b. Grants: Recipient milestone payments shifted based on awardees' actual spend rates and their ability to successfully deliver milestones on schedule.





IPP = Implementation Partner Payments

Breakout of ISS National Lab Grants Payments

	Q1FY24	Q2FY24	Q3FY24	Q4FY24	FY24 YTD Total
Academic	$477,216				$477,216
Commercial	$978,131				$978,131
Other Government Agency	-				-
Total	**$1,455,347**				$1,455,347

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				

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%	%	%	%	46%
Indirect	22%	%	%	%	22%
Grants	32%	%	%	%	32%

IN-ORBIT ACTIVITIES

- SpaceX's 29th Commercial Resupply Services (CRS) mission delivered more than 25 ISS National Lab-sponsored payloads, including the following (full details on the SpaceX CRS-29 launch page):
  - The University of California, Santa Barbara used gel-coated tubes to study how mucus lining in the lungs affects drug delivery.
  - The University of California, San Francisco sent tissue chips containing liver cells and immune cells to space to study tissue regeneration.
  - The University of California, San Diego explored brain aging in space to inform potential applications for treating and preventing late-onset diseases like Alzheimer's and dementia.
  - The U.S. Naval Research Laboratory studied microbes in space to uncover new melanin variants for a wide variety of applications.
  - Redwire Corporation launched PIL-BOX, an in-space pharmaceutical manufacturing platform that enables the growth of small-batch crystals of proteins and other molecules for pharmaceutical research.
  - Boeing tested the effectiveness and durability of an antimicrobial coating that could be valuable for future long-duration spaceflight missions.
- Redwire continued testing the updated Biofabrication Facility (BFF) through studies aimed at printing cardiac tissue on station.

R&D PROGRESS AND SUCCESSES

- Four new peer-reviewed journal articles were published in Q1 (view a full list of peer-reviewed journal publications related to the ISS National Lab at www.ISSNationalLab.org/publications/):
  - Faber L, Yau A, Chen Y. Translational biomaterials of four-dimensional bioprinting for tissue regeneration. *Biofabrication*. 2023;16(1):012001.
  - Hwang H, Rampoldi A, Forghani P, et al. Space microgravity increases expression of genes associated with proliferation and differentiation in human cardiac spheres. *NPJ Microgravity*. 2023;9(1):88.
  - Li D, Armand LC, Sun F, et al. AMPK activator-treated human cardiac spheres enhance maturation and enable pathological modeling. *Stem Cell Res Ther.* 2023;14(322).
  - Swope J, Mirza F, Dunkel E, Candela A, et al. Benchmarking space mission applications on the snapdragon processor onboard the ISS. *J. Assoc. Inf. Syst.* 2023;20(12).

LEO ECONOMY

Demand

- Three new projects were selected through ISS National Lab Research Announcement (NLRA) 2023-8: Technology Advancement and Applied Research Leveraging the ISS National Lab, Cycle 3: Sierra Space will expand in-orbit capabilities for iterative human cell and tissue culture R&D by developing and integrating a platform for in-orbit biomanufacturing and regenerative medicine research, the University of Notre Dame will test the mechanical properties of new ultra-high-molecular-weight polyethylene-graphene composite film material for aerospace applications, and LEOcloud, Inc. will establish a concept of operations for and demonstrate the viability of multi-cloud edge computing services in low Earth orbit (LEO).
- Three solicitations opened in Q1:
  - NLRA 2024-1: In-Space Production Applications: Tissue Engineering and Biomanufacturing
  - NSF/CASIS 2024 Collaboration on Transport Phenomena Research on the ISS to Benefit Life on Earth

- NSF/CASIS 2024 Collaboration on Tissue Engineering and Mechanobiology on the ISS to Benefit Life on Earth

Supply

- Aegis Aerospace was named one of the 2023 Top Workplaces by the Houston Chronicle, and Aegis founder and CEO Stephanie Murphy was honored with an award by Girlstart, a national women-led organization devoted to empowering girls in science, technology, engineering, and mathematics (STEM).
- Redwire's BioFabrication Facility (BFF) was awarded a 2023 Popular Science Best of What's New Award in the health category.

Investment

- During Q1, the modest pace of capital raising activity by early-stage companies in the ISS National Lab ecosystem continued in a generally subdued funding environment. Based on the publicly available data, $53.8 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 during Q1 included GITAI, Lonestar Data Holdings, and RevBio (previously LaunchPad Medical).
- The ISS National Lab Investor Network grew to include more than 300 members in Q1. To date, CASIS has facilitated more than 1,300 capital introductions between startups and investors in the ISS National Lab ecosystem. While the investor appetite toward space startups has become more selective since 2021, the ISS National Lab ecosystem remains a source of capital connections and potential future funding for early-stage companies planning studies on the ISS.

EDUCATION OUTREACH AND ENGAGEMENT

- Multiple STEM education projects launched on SpaceX CRS-29, including:
  - Three experiments designed by North Carolina elementary students through the STARWard STEM program: one studying microgravity's effects on the growth of Swiss chard, another examining the physical properties of frankincense resin (which has been shown beneficial for anxiety and depression) in space, and the third aiming to develop a vitamin D supplement for astronauts.
  - Nearly 40 Student Spaceflight Experiments Program (SSEP) experiments, including a project from middle school students studying whether a component in horseshoe crab blood can detect bacterial contamination in space as it does on Earth.
  - In collaboration with Oklahoma State University, a project from the Choctaw Nation of Oklahoma sent five varieties of Choctaw heirloom seeds to the ISS, and Choctaw students will grow the space-flown seeds back on Earth to see whether spaceflight affects plant growth.
- The ISS National Lab presented three students with awards for their posters at the 2023 American Society for Gravitational and Space Research (ASGSR) Annual Meeting in Washington, D.C.
- The ISS National Lab STEM Education team participated in World Space Week at Kennedy Space Center and interacted with around 300 attendees, showcasing ISS National Lab STEM education resources.
- The Space Station Ambassador program continued to expand, with 81 new members in Q1.
  - At the Florida Association of Science Teachers (FAST) conference, Space Station Ambassador and Space Station Explorer Excellence in Education Award winner Mary Vaughn interacted with more than 375 educators, highlighting Space Station Explorers programs.

- Amateur Radio on the ISS (ARISS), a Space Station Explorers partner program, celebrated the 40th anniversary of HAM radio in space and was featured on the Today Show.
- Through Club for the Future, a Space Station Explorers partner, 38,000 student postcards from across the globe were launched to space on Blue Origin's New Shepard rocket that returned to flight in Q1.

OUTREACH AND STAKEHOLDER ENGAGEMENT

- The ISS National Lab led its first ever pre-launch webinar with NASA leadership that focused on the science launching on SpaceX CRS-29, with more than 10 media members participating.
  - ISS National Lab launch press releases resulted in a Gizmodo article on an antimicrobial investigation from Boeing and local news coverage of an experiment from Cape Canaveral middle school students.
- In Q1, ISS National Lab press releases resulted in more than 28,700 views by media and more than 16,800 click-throughs.
- Additional ISS National Lab media coverage in Q1 includes:
  - A Bloomberg article discussing biomedical research on the space station.
  - An Interesting Engineering article on scientific breakthroughs from research on the ISS.
  - A Reuters video on bioprinting in space that featured Redwire.
  - A *Scientific American* article on crystal growth in space authored by a Stanford University researcher who did ISS National Lab-sponsored research funded by the U.S. National Science Foundation (NSF).
- The ISS National Lab website had more than 289,200 views in Q1, a 98-percent increase from Q1 of FY23.
- *Upward*, official magazine of the ISS National Lab, gained nearly 1,800 new subscribers in Q1, bringing the total number of subscribers to more than 5,500.
- The ISS National Lab attended a series of Creative Destruction Lab startup accelerator sessions for early-stage companies and participated in group pitch sessions and interviews to identify companies that could advance their technologies through space-based R&D.
- At the 2023 ASCEND conference, ISS National Lab staff moderated three sessions: one on biomanufacturing in space, one on maintaining the viability of space-based research platforms, and one on engaging the public through the ISS.
- The ISS National Lab led a session at the 2023 ASGSR Annual Meeting with panelists from NSF, the National Institutes of Health, and NASA.
- The ISS National Lab attended the kickoff meeting for COSMIC, a new consortium funded by NASA to bring together the in-space servicing, assembly, and manufacturing (ISAM) community.
- ISS National Lab staff presented at several additional conferences, workshops, and events, including the 2023 TechConnect World Innovation Conference & Expo, the Sanford Stem Cell Institute Symposium, the 2023 Materials Research Society Fall Meeting, the Beyond Earth Symposium, the International Society for Stem Cell Research 2023 Vienna International Symposium, the inaugural Space Force Association Spacepower Conference, the Vertical Farming World Congress, and the Inter Astra Conference.

Full Project Pipeline Details

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