ISS NATIONAL LABORATORY®

ISS National Laboratory Q1FY23 Report

Quarterly Report for the Fiscal Year 2023 Period October 1, 2022 – December 31, 2022

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Q1FY23 Metrics

ISS NATIONAL LAB UTILIZATION AND OPERATIONS TARGET METRICS

TARGET METRIC	FY23 Q1	FY23 Q2	FY23 Q3	FY23 Q4	FY23 Total	FY23 Target	FY23 Stretch
FUNDAMENTAL SCIENCE							
1) Fundamental Science projects selected	0					10	15
2) External funding supporting Fundamental Science users of the ISS National Lab	$0					$4M	N/A
APPLIED RESEARCH & DEVELOPMENT							
3) Applied Research & Development projects selected	0					8	N/A
4) Ratio of external funding to CASIS funding (self-reported) supporting Applied Research & Development users of the ISS National Lab (cumulative)	0					1:1	2:1
TECHNOLOGY DEMONSTRATION							
5) Technology Demonstration projects selected	1					12	15
6) Ratio of external funding to CASIS funding (self-reported) supporting Technology Demonstration users of the ISS National Lab (cumulative)	4:1					4:1	6:1
EDUCATION & OUTREACH							
7) Education & Outreach projects selected	0					7	9
8) Total individuals participating in ISS National Lab Education & Outreach programs and projects (self-reported)	1,820,222					2M	4M
9) Total individual users of ISS National Lab online education products (self-reported)	5,656,397					5M	8M
PROPOSAL MANAGEMENT							
10) Time from solicitation close to selection/nonselection notification (cumulative)	68					≤65 days	N/A

ISS NATIONAL LAB UTILIZATION AND OPERATIONS TRACKING METRICS

The following metrics have no target for FY22 but will be tracked internally and discussed in face-to-face meetings with NASA.

TRACKING METRIC	FY23 Q1	FY23 Q2	FY23 Q3	FY23 Q4	FY23 Total
1) Commercial Service Provider Facility Utilization payloads delivered	27				
(a) Percentage of Commercial Service Provider Facility Utilization payloads flown that meet the minimum research objectives (previous fiscal year quarter) [a]	92%				
(b) Percentage of Commercial Service Provider Facility Utilization payloads flown that meet the payload integration expectations	22%				
2) Education & Outreach payloads delivered	0				
3) Fundamental Science payloads delivered	9				
(a) Percentage of Fundamental Science payloads flown that meet the minimum research objectives (previous fiscal year quarter) [a]	50%				
(b) Percentage of Fundamental Science payloads flown that meet the payload integration expectations	67%				
4) Applied Research & Development payloads delivered	4				
(a) Percentage of Applied Research & Development payloads flown that meet the payload integration expectations	25%				
5) Technology Demonstration payloads delivered	2				
(a) Percentage of Technology Demonstration payloads flown that meet the minimum research objectives (previous fiscal year quarter) [a]	100%				
(b) Percentage of Technology Demonstration payloads flown that meet the payload integration expectations	0%				
6) Total ISS National Lab-sponsored payloads delivered	42				
7) Total external funding committed	$464,548				

8) Multiplier on CASIS grant funding committed (cumulative)	4:1				
9) Funds raised post award and postflight by startup companies with ISS National Lab-sponsored flight projects					
(a) Funds raised postflight	$93.0M				
(b) Funds raised post award	$93.0M				
10) Users by new/returning					
(a) ISS National Lab return users	0				
(b) ISS National Lab new users	1				
11) Users by type					
(a) Commercial	1				
(b) Academic/nonprofit	0				
(c) Government agency	0				
12) ISS National Lab concepts received	13				
13) ISS National Lab proposals received	28				
(a) Total proposals with a rating of very good or excellent	4				
(b) Proposals not selected with a rating of very good or excellent	0				
14) ISS National Lab projects selected	1				
15) Active solicitations	4				
16) Time from selection notification to agreement draft sent to principal investigator (cumulative)	69				
17) New commercial facilities added	0				
18) Commercial facilities (cumulative)	24				
19) New Umbrella User Agreements executed	0				
20) Percentage of Commercial Service Providers that have an active Umbrella User Agreement	100%				
21) Crew time (actual vs. increment pair – 3 months allocation)					
(a) Ascent flight resources					
Upmass	155%				

Cold stowage	31%				
Big bags	50%				
Powered lockers	60%				
(b) Facility resources (reported in Q2 and Q4)					
Commercial facilities					
JEM airlock					
Life Sciences Glovebox					
Microgravity Science Glovebox					
22) Number of payloads that did not turnover per the nominal delivery schedule	6				
Principal investigators	0				
Implementation Partners	6				
CASIS	0				
NASA	0				
23) Number of reflight experiments flown	3				
Fundamental Science	1				
Applied Research & Development	0				
Technology Demonstration	0				
Education and Outreach	0				
Commercial Service Provider Utilization	2				
24) Number of payloads ready to fly that were left on the ground due to limited resources (upmass, crewtime, cold stowage, etc.)	5				
25) Number of payloads removed from the manifest after the freeze date because the principal investigator/payload could not make the flight	1				

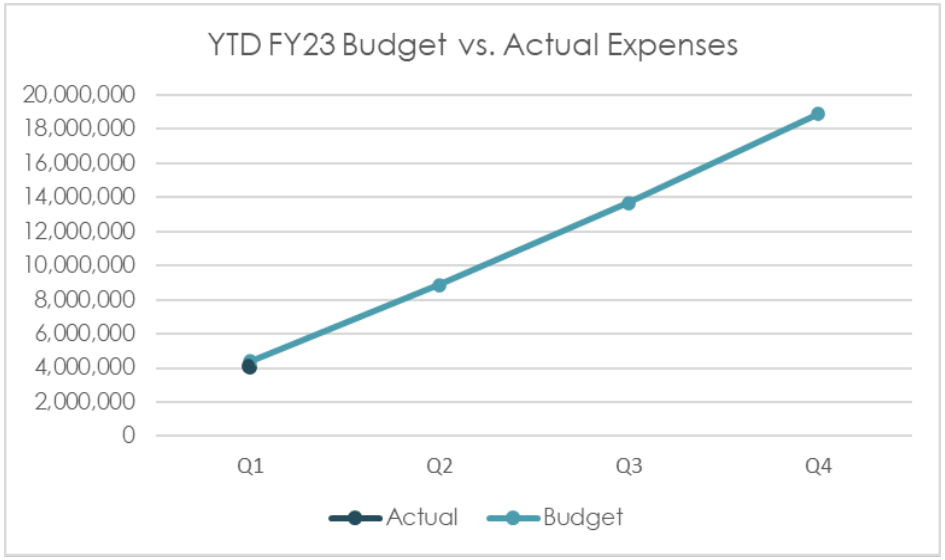
a. Data is from previous fiscal year quarter. Determination of whether a payload met research objectives often cannot be determined until the payload has been returned to the investigator and review of initial data has taken place.

FINANCIALS

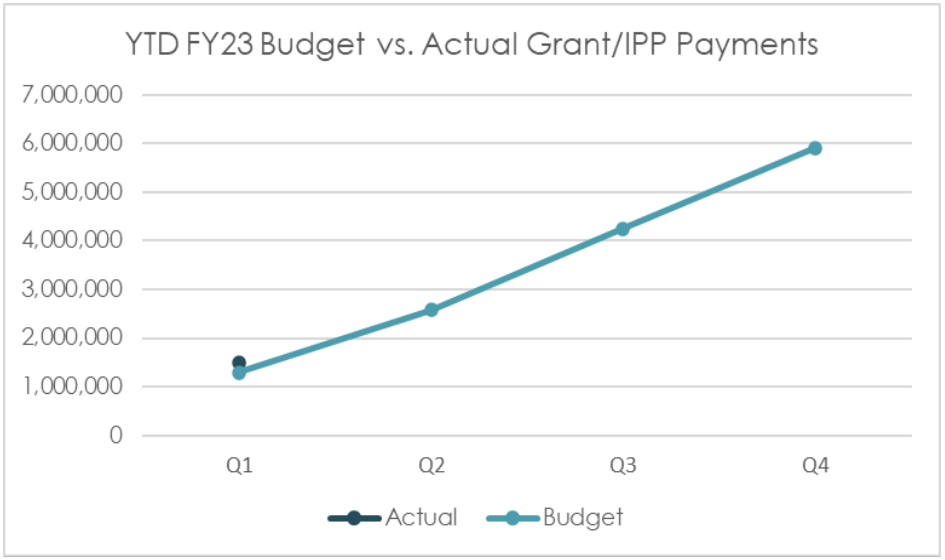
Business Status Report (unaudited)

Expenses	Q1 Actual FY23	Q1 Budget FY23	Q1 Variance FY23
Direct Labor	$1,935,694	$1,955,111	$(19,417)
Subcontracts	$215,157	$348,724	$(133,567)[a]
Other Direct	$224,960	$445,048	$(220,088)[b]
Travel	$104,091	$206,952	$(102,861)[c]
Office Supplies and Equipment	$81,021	$136,522	$(55,501)
Grants	$1,499,504	$1,290,020	$209,484[d]
Total Expenses	**$4,060,427**	**$4,382,377**	**$(321,950)**

a. Subcontracts: Difference in the timing of fees related to branding and mission statements, additionally some permanent savings in some budgeted professional fees.
b. Other Direct: Timing related to advertising spend and when trade shows occur.
c. Travel: Running under budget as management further scrutinizes what events to attend and which personnel should be present.
d. Grants: Timing due to recipients' submission of invoices and a pickup from the timing/underrun from the prior year.



IPP = Implementation Partner Payments



IPP = Implementation Partner Payments

Breakout of ISS National Lab Grants Payments

	Q1FY23	Q2FY23	Q3FY23	Q4FY23	FY23 YTD Total
Academic	$480,951				$480,951
Commercial	$1,018,553				$1,018,553
Other Government Agency	-				-
Total	**$1,499,504**				**$1,499,504**

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

	ACTUAL Q1	ACTUAL Q2	ACTUAL Q3	ACTUAL Q4	ACTUAL FY23
Total value of grants awarded[a]	$107,100				

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

	Q1FY23	Q2FY23	Q3FY23	Q4FY23	FY23 YTD Total
Direct	41%	%	%	%	41%
Indirect	22%	%	%	%	22%
Grants	37%	%	%	%	37%

IN-ORBIT ACTIVITIES

- Northrop Grumman's 18th Commercial Resupply Services (CRS) mission delivered more than 20 ISS National Lab-sponsored payloads, including the following (full details on the NG CRS-18 launch page):
  - A University of California San Diego investigation funded by the U.S. National Science Foundation (NSF) studied the hydrodynamics of post-wildfire mudslides to improve mudflow models and early-warning systems.
  - A project from Madison Square Garden Entertainment Corp. tested a high-resolution camera system to guide the design of cameras that will capture space imagery on future missions for MSG Sphere, currently under construction in Las Vegas.
- NG CRS-18 experienced an anomaly with solar array deployment during transit to the ISS, resulting in a loss of power for multiple ISS National Lab-sponsored payloads during transit. Due to the loss of science, the ISS National Lab and NASA will support the payloads for reflight at a later date.
- The SpaceX CRS-26 mission delivered multiple ISS National Lab-sponsored payloads, including the following (full details on the SpaceX CRS-26 launch page):
  - An investigation from RevBio (previously LaunchPad Medical) examined the ability of its proprietary, patented bone adhesive called Tetranite® to regenerate new bone in microgravity. This investigation builds on a previous project awarded through the Technology in Space Prize, funded by CASIS and Boeing in collaboration with the MassChallenge startup accelerator program.
  - Student investigations from programs such as the STARWard STEM program and Student Spaceflight Experiments Program studied various topics, including microgravity's effects on seed germination and microbial solutions for food waste in space.
  - A project from Houston Methodist Research Institute that builds on previous research tested a new remotely controlled drug delivery implant device.
- The SpaceX CRS-26 mission required multiple spacewalks to install new and improved roll-out solar arrays on the ISS. This constrained crewtime available for science support during the increment and impacted multiple ISS National Lab-sponsored payloads, as well as others. Several payloads had to be removed from the mission manifest late in the integration flow and will be rescheduled to fly on a later mission.
- SpaceX's Crew-5 mission carried four astronauts to the ISS along with multiple research investigations sponsored by the ISS National Lab, including the following:
  - An investigation from biotechnology company LambdaVision built on previous research awarded through the Technology in Space Prize focused on creating a protein-based artificial retina capable of restoring vision in patients with degenerative eye diseases.
  - A study from Los Alamos National Lab in collaboration with ISS National Lab Commercial Service Provider Rhodium Scientific examined gut microbiome changes in microgravity; results could lead to new tests to identify changes in gut microbiota that contribute to overall health.
- In-orbit activities in Q1 included the following:
  - Apsidal continued testing of ZBLAN optical fiber production; high-quality optical fibers could significantly improve the efficiency of communications systems.
  - Two NSF-funded transport phenomena projects completed operations using the Flow Boiling and Condensation Experiment (FBCE) facility on the ISS; results from these investigations have multiple applications on Earth and in space, such as water treatment and in-space fueling of spacecraft.
  - The crew worked on a University of Florida project that demonstrated a human skeletal muscle tissue chip system to study microgravity-induced changes that mimic age-related muscle loss on Earth and to test therapeutics for muscle wasting; this is the most recent in a series of projects from this team funded by the National Institutes of Health (NIH).

R&D PROGRESS AND SUCCESSES

- Two 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):
  - Vigil C, Daubenspeck ., Coia H, et al. Matrix-assisted laser desorption/ionization analysis of the brain proteome of microgravity-exposed mice from the International Space Station. Front Space Technol. 2022;3:971229.
  - Rubin J, van Wijnen AJ, Uzer G. Architectural control of mesenchymal stem cell phenotype through nuclear actin. Nucleus. 2022;13(1):35-48.

LEO ECONOMY

Demand

- One new project was selected in Q1: Startup company Machine Bio was awarded the Technology in Space Prize. The project aims to validate technology capable of generating cell-free protein from a DNA template in a single step in persistent microgravity.
- Four solicitations opened in Q1:
  - ISS National Lab Research Announcement (NLRA) 2023-2: In-Space Production Applications: Tissue Engineering and Biomanufacturing
  - NLRA 2023-5: Leveraging the International Space Station for Education and Workforce Development
  - NSF/CASIS 2023 Collaboration on Tissue Engineering and Mechanobiology on the ISS to Benefit Life on Earth
  - NSF/CASIS 2023 Collaboration on Transport Phenomena Research on the ISS to Benefit Life on Earth

Supply

- ISS National Lab Commercial Service Provider Redwire Space launched an upgraded version of its BioFabrication Facility capable of printing biological tissues and, eventually, organs in space. This upgraded version provides improved temperature regulation and advanced imaging.
- ISS National Lab Implementation Partner Felix and Paul Studios continued the successful run of traveling virtual reality (VR) experience Space Explorers: The Infinite. The experience is based on the company's Emmy-winning VR series "Space Explorers: The ISS Experience," produced using footage filmed on the ISS. In Q1, The Infinite opened in San Francisco after successful runs in Montreal, Houston, and Seattle.

Investment

- With continued volatility in the broader financial markets and few exit transactions, the overall venture capital investment activity continued to slow during Q1, resulting in a modest pace of capital-raising activity in the ISS National Lab ecosystem. Based on publicly available data, $93 million of private and public capital, including grant funding, was raised in Q1 by early-stage companies with a completed ISS National Lab flight project. To date, more than $1.9 billion of such startup funding has been raised post ISS National Lab flight projects.
  - Q1 capital raising activity was led by Redwire Corporation's $80 million acquisition and growth financing.
  - Other companies in the ISS National Lab ecosystem that secured funding in Q1 include Orbital Sidekick, Astrobotic Technology, and Cryptosat.
- The ISS National Lab Investor Network grew to include 280 members in Q1. To date, CASIS has facilitated more than 1,200 capital introductions between startups and investors in the ISS National Lab ecosystem.

EDUCATION OUTREACH AND ENGAGEMENT

- The ISS National Lab hosted a launch event at Kennedy Space Center to highlight student experiments launching on SpaceX CRS-26 that included a student poster session and presentations.
- The Space Station Ambassadors program continued to expand, with 145 new members in Q1.
- A STEM education investigation from Magnitude.io that was awarded through an NLRA studied the sequestration of carbon by plants and provided educational opportunities for underrepresented communities.
- ISS National Lab User Advisory Committee (UAC) education sub-committee chair Stephen White and UAC member Melissa Poore attended the U.S. Department of Education YOU Belong in STEM National Coordinating Conference, which reached more than 1,000 participants.

OUTREACH AND STAKEHOLDER ENGAGEMENT

- ISS National Lab public relations outreach for NG CRS-18 and SpaceX CRS-26 earned media coverage in outlets such as the Boston Business Journal, United Press International, Atlanta News First, and 7News WHDH Boston.
- The ISS National Lab chief scientific officer led a panel session at the 2022 American Society for Gravitational and Space Research (ASGSR) Annual Meeting on the ISS and ISS National Lab transition.
- The ISS National Lab director of science and technology gave a virtual presentation to Merck & Co. scientists on pharmaceutical and protein crystallization experiments on the ISS.
- ISS National Lab staff participated in several additional speaking engagements, including:
  - The 2022 ASCEND conference, SelectBio's Space Summit 2022, the 2022 Biomanufacturing World Summit, the 2022 Materials Research Society Fall Meeting, and the 2022 Space Grant Southeast Regional Directors Meeting.

Full Project Pipeline Details

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