ISS NATIONAL LABORATORY®

ISS National Laboratory Q3FY22 Report

Quarterly Report for the Fiscal Year 2022 Period April 1, 2022 – June 30, 2022

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Q3FY22 Metrics

ISS NATIONAL LAB UTILIZATION AND OPERATIONS TARGET METRICS

TARGET METRIC	FY22 Q1	FY22 Q2	FY22 Q3	FY22 Q4	FY22 Total	FY22 Target	FY22 Stretch
FUNDAMENTAL SCIENCE							
1) Fundamental Science projects selected	0	4	0			**10**	**13**
2) External funding supporting Fundamental Science users of the ISS National Lab	0	$1M	0			**$5M**	**N/A**
APPLIED RESEARCH & DEVELOPMENT							
3) Applied Research & Development projects selected through an NLRA	0	4	3			**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	1:1			**1:1**	**2:1**
TECHNOLOGY DEMONSTRATION							
5) Technology Demonstration projects selected through an NLRA	7	0	2			**12**	**13**
6) Ratio of external funding to CASIS funding (self-reported) supporting Technology Demonstration users of the ISS National Lab (cumulative)	6:1	6:1	6:1			**3:1**	**5:1**
EDUCATION & OUTREACH							
7) Education & Outreach projects selected through an NLRA	0	0	0			**7**	**9**
8) Total individuals participating in ISS National Lab Education & Outreach programs and projects (self-reported)	2,188,101	3,212,320[a]	2,414,481			**2M**	**4M**
9) Total individual users of ISS National Lab online education products (self-reported)	4,059,959	4,751,858	3,747,870			**5M**	**8M**
PROPOSAL MANAGEMENT							
10) Time from solicitation close to selection/nonselection notification (cumulative)	72 days	56 days	58 days			**≤75 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	FY22 Q1	FY22 Q2	FY22 Q3	FY22 Q4	FY22 Total
1) Commercial Service Provider Facility Utilization payloads delivered	14	10	25		
(a) Percentage of Commercial Service Provider Facility Utilization payloads flown that meet the minimum research objectives	TBD[b]	TBD[b]	TBD[b]		
(b) Percentage of Commercial Service Provider Facility Utilization payloads flown that meet the payload integration expectations	29%	0%	24%		
2) Education & Outreach payloads delivered	0	1	0		
3) Fundamental Science payloads delivered	3	0	0		
(a) Percentage of Fundamental Science payloads flown that meet the minimum research objectives	TBD[b]	N/A[c]	N/A[c]		
(b) Percentage of Fundamental Science payloads flown that meet the payload integration expectations	33%	N/A[c]	N/A[c]		
4) Applied Research & Development payloads delivered	0	0	0		
(a) Percentage of Applied Research & Development payloads flown that meet the payload integration expectations	N/A[c]	N/A[c]	N/A[c]		
5) Technology Demonstration payloads delivered	1	5	0		
(a) Percentage of Technology Demonstration payloads flown that meet the minimum research objectives	TBD[b]	TBD[b]	N/A[c]		
(b) Percentage of Technology Demonstration payloads flown that meet the payload integration expectations	0%	20%	N/A[c]		
6) Total ISS National Lab-sponsored payloads delivered*	18	16	25		
7) Total external funding committed	$8,092,367[d]	$1,296,969	$1,113,100		
8) Multiplier on CASIS grant funding committed (cumulative)	11:1[d]	9:1	6:1		

9) Funds raised post award and postflight by startup companies with ISS National Lab-sponsored flight projects					
(a) Funds raised postflight	$554.3M	$52.8M	$19.7M		
(b) Funds raised post award	$580.5M	$61.5M	$20.3M		
10) Users by new/returning					
(a) ISS National Lab return users	5	3	2		
(b) ISS National Lab new users	3	5	3		
11) Users by type					
(a) Commercial	8[e]	2[f]	2		
(b) Academic/nonprofit	0[e]	5[f]	3		
(c) Government agency	0	1	0		
12) ISS National Lab concepts received	61	116	36		
13) ISS National Lab proposals received	3	21	74		
(a) Total proposals with a rating of very good or excellent	2	2[g]	13		
(b) Proposals not selected with a rating of very good or excellent	0	0	1		
14) ISS National Lab projects selected	8	8	5		
15) Active solicitations	3	2	0		
16) Time from selection notification to agreement draft sent to principal investigator (cumulative)	51 days	53 days	48 days		
17) New commercial facilities added	0	0	0		
18) Commercial facilities (cumulative)	24	24	24		
19) New Umbrella User Agreements executed	1	0	0		
20) Percentage of Commercial Service Providers that have an active Umbrella User Agreement	96%	96%	93%		
21) Crew time (actual vs. increment pair – 3 months allocation)	44%		[Increment Basis]		
(a) Ascent flight resources	**Crew-3, SpX-24**	**NG-17**	**Crew-4**		
Upmass	80%	89%[h]	148%		
Cold stowage	20%	53%	0%		
Big bags	88%	67%	N/A		

Powered lockers	100%	0%	N/A[c]		
(b) Facility resources (reported in Q2 and Q4)	**Increment Basis**		**Increment Basis**		
Commercial facilities	60%				
JEM airlock	100%				
Life Sciences Glovebox	50%				
Microgravity Science Glovebox	50%				
22) Number of payloads that did not turnover per the nominal delivery schedule	6	8	2		
Principal investigators	0	0	0		
Implementation Partners	6	8	2		
CASIS	0	0	0		
NASA	0	0	0		
23) Number of reflight experiments flown	0	1	0		
Fundamental Science	0	0	0		
Applied Research & Development	0	0	0		
Technology Demonstration	0	1	0		
Education and Outreach	0	0	0		
Commercial Service Provider Utilization	0	0	0		
24) Number of payloads ready to fly that were left on the ground due to limited upmass	0	1	0		
25) Number of payloads removed from the manifest after the freeze date because the principal investigator/payload could not make the flight	2	2	0		

Note: Resource data is projected/estimated based on payload requirements in the queue at the start of FY2022.

a. Story Time From Space did not submit Q2 numbers in time for the original Q2 report. This number has been updated with the additional data.

b. Pending further analysis.

c. Not applicable due to zero payloads flying.

d. An adjustment was made after Q1 reporting completed to account for Boeing's contribution to MassChallenge as an external funding source. As a result, the Q1 number in the FY22 Q2 report will differ from the Q1 number in the FY22 Q1 report.

e. Update from FY22 Q1 report.

f. Update: BioServe/U of CO was set to Commercial instead of Academic.

g. Update: Cured proposal (rated very good) received and re-rated in Q3 was added to Q2 count.

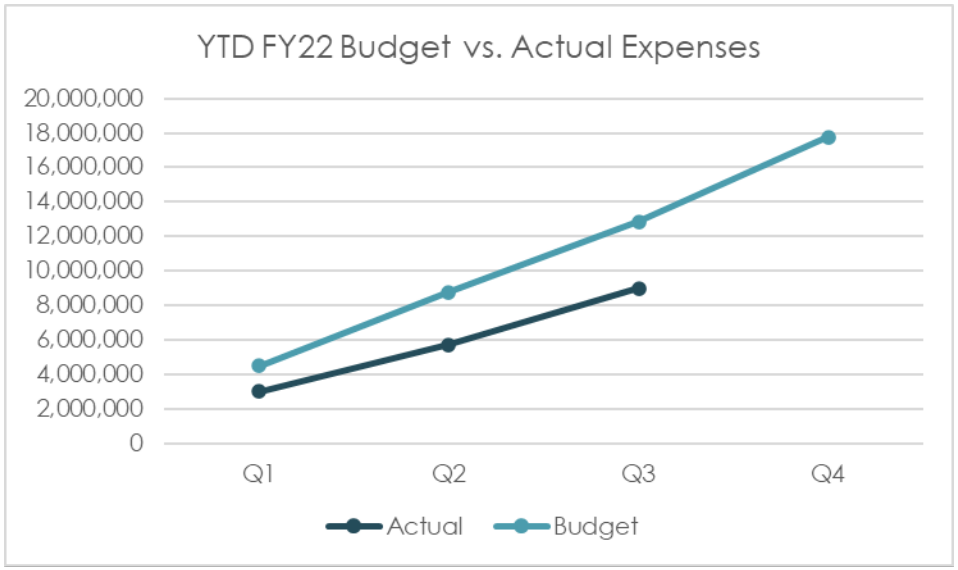
h. Update from FY22 Q2 report.

FINANCIALS

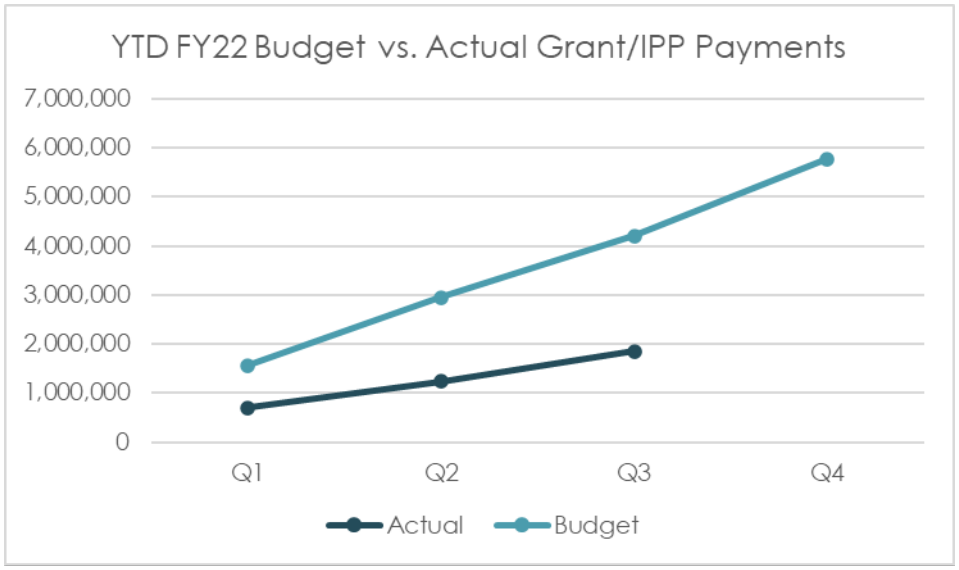
Business Status Report (unaudited)

Expenses	Q3 Actuals	Q3 Budget	Variance	Actual YTD FY22	Budget YTD FY22	Variance YTD FY22
Direct Labor	$1,557,128	$2,044,911	$(487,783)	$4,848,724	$5,826,296	$(977,572)[a]
Subcontracts	$437,375	$223,336	$214,039	$859,780	$920,613	$(60,833)
Other Direct	$446,430	$352,637	$93,793	$931,317	$1,197,315	$(265,998)[b]
Travel	$128,320	$166,813	$(38,493)	$268,380	$465,555	$(197,175)[c]
Office Supplies and Equipment	$95,891	$58,729	$37,162	$240,057	$251,749	$(11,692)
Grants	$613,185	$1,255,451	$(642,266)	$1,857,890	$4,199,915	$(2,342,025)[d]
Total Expenses	**$3,278,329**	**$4,101,877**	**$(823,548)**	**$9,006,148**	**$12,861,443**	**$(3,855,295)**

a. Direct Labor: Headcount of 45 at 6/30/2022 vs a budgeted 56 positions.
b. Other Direct: Reduced number of trade show expenses.
c. Travel: Lower travel due to reduced headcount and fewer trade shows and some impact due to COVID variants.
d. Grants: Recipient milestone payments shifted based on awardees' actual spend rates and their ability to successfully deliver milestones on schedule as well as a delay in contracting new awards.



IPP = Implementation Partner Payments



IPP = Implementation Partner Payments

Breakout of ISS National Lab Grants Payments

	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22 YTD Total
Academic	$156,577	$173,093	$58,422		$388,092
Commercial	$547,867	$367,168	$543,094		$1,458,129
Other Government Agency	-	-	$11,668		$11,668
Total	**$704,444**	**$540,261**	**$613,184**		**$1,857,889**

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

	ACTUAL Q1	ACTUAL Q2	ACTUAL Q3	ACTUAL Q4	ACTUAL FY22
Total value of grants awarded[a]	$723,157[b]	$296,620	$779,726		

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

b. An adjustment was made after Q1 reporting completed to account for Boeing's contribution to MassChallenge as an external funding source. As a result, the Q1 number in the FY22 Q2 report will differ from the Q1 number in the FY22 Q1 report.

Breakout of Cooperative Agreement Funding

	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22 YTD Total
Direct	49%	60%	55%	%	54%
Indirect	28%	20%	26%	%	25%
Grants	23%	20%	19%	%	21%

IN-ORBIT ACTIVITIES

- Axiom Mission 1 (Ax-1) launched to the ISS on a SpaceX Falcon 9 rocket, carrying four private astronauts to station in the first all-private astronaut mission. The ISS National Lab sponsored 24 Axiom-supported investigations that launched on Ax-1 and three Axiom-supported investigations that launched on SpaceX CRS-24 that the Ax-1 crew operated during the mission. The investigations that launched on Ax-1 include:
  - A project to test a device that could provide autonomous health monitoring of astronauts
  - A technology demonstration of a portable electroencephalography (EEG) headset to measure differences in brain activity during spaceflight
  - An investigation testing autonomous and self-assembling robotic swarms of tiles to help assess the feasibility of in-orbit construction of satellites and future space habitats
- The SpaceX Crew-4 mission carried four astronauts to the ISS as well as one Space Tango-supported investigation sponsored by the ISS National Lab. Additionally, during their mission, the Crew-4 astronauts will perform dozens of investigations sponsored by the ISS National Lab.
- During operations on the ISS, a project from Astrobotic Technology Inc. tested a novel technology that transforms audio patterns into actionable information using Astrobee, a mobile robotic platform on station. Such technology could monitor machines, environments, and critical infrastructure by "making sense" of distinctive audio patterns they emit.
- Operations continued for an Axiom Space-supported project testing the ability of the Universal Intelligent Glass Optics (UNIGLO) module to process complex glasses for applications in space and on Earth.
- The crew continued to test the performance of the AstroRad radiation shielding vest from Lockheed Martin Corp., which selectively protects organs most sensitive to radiation exposure.

R&D PROGRESS AND SUCCESSES

- The ISS National Lab hosted the second phase of a Biomanufacturing in Space Symposium, which gathered more than 50 thought leaders in regenerative medicine and space-based R&D to develop a roadmap to establish a sustainable biomanufacturing market in low Earth orbit (LEO).
- Five new peer-reviewed journal articles were published in Q3 (view a complete list of peer-reviewed journal publications related to the ISS National Lab at www.issnationallab.org/publications).
  - Henrich M, Ha P, Wang Y, Ting K, Stodieck L, Soo C, Adams JS, Chun R. Alternative splicing diversifies the skeletal muscle transcriptome during prolonged spaceflight. Skelet Muscle. 2022 May 31;12(1):11. https://doi.org/10.1186/s13395-022-00294-9
  - Drago VN, Devos JM, Blakeley MP, Forsyth VT, Kovalevsky AY, Schall CA, Mueser TC. Microgravity crystallization of perdeuterated tryptophan synthase for neutron diffraction. NPJ Microgravity. 2022 May 4;8 (1):13. https://doi.org/10.1038/s41526-022-00199-3
  - Weislogel MM, Graf JC, Wollman AP, Turner CC, Cardin KJT, Torres LJ, Goodman JE, Buchli JC. How advances in low-g plumbing enable space exploration. NPJ Microgravity. 2022 May 20;8(1):16. https://doi.org/10.1038/s41526-022-00201-y
  - Yu J, Pawar A, Plawsky JL, Chao DF. The effect of bubble nucleation on the performance of a wickless heat pipe in microgravity. NPJ Microgravity. 2022 Apr 28;8(1):12. https://doi.org/10.1038/s41526-022-00197-5
  - Rice O, Surian A, Chen Y. Modeling the blood-brain barrier for treatment of central nervous system (CNS) diseases. J Tissue Eng. 2022 May 14;13:20417314221095997. https://doi.org/10.1177/20417314221095997

LEO ECONOMY

Demand

- Five new projects were selected in Q3:
  - Two selected projects were from cycle 1 of NLRA 2022-5: Applied Research, Translational Science, and Technology Development:
    - A project from Exum Instruments Inc. seeks to adapt a commercially available laser mass spectrometer for use in microgravity on the ISS.
    - A project from OmniTeq seeks to utilize the global vantage point of the ISS to test data streaming and artificial intelligence technologies used for maritime awareness.
  - One selected project was from NLRA 2022-3: In-Space Production Applications: Tissue Engineering and Biomanufacturing:
    - A project from the University of Colorado aims to test the in-space production of induced pluripotent stem cells for clinical applications.
  - Two selected projects were from NASA Research Announcement: NNJ13ZBG001N: Soliciting Proposals for Exploration Technology Demonstration and National Lab Utilization Enhancements:
    - A project from Cedars-Sinai Medical Center aims to establish a foundation for in-space production of stem cell therapies.
    - A project from the University of Connecticut will investigate the advantages of in-space manufacturing of specialized biomimetic nanoparticles for improved drug delivery and efficacy.

Supply

- ISS National Lab Commercial Service Provider Axiom Space achieved a historic first when the company launched four of its astronauts on Axiom Mission 1, the first all-private astronaut mission to the ISS.
- ISS National Lab Commercial Service Provider Redwire Space achieved a significant milestone for LEO commercialization with the first sale of an optical crystal produced in the Redwire Industrial Crystallization Facility on station—one of the first times a space-produced materials product has been sold on Earth.

Investment

- Increased volatility in the broader financial markets during Q3 resulted in a more modest pace of capital raising activity by startups in the ISS National Lab ecosystem. Based on publicly available data, $20 million of private and public capital and grant funding was raised during Q3 by startups that have completed a flight project through the ISS National Lab, bringing the total amount to more than $1.8 billion to date.
- The ISS National Lab Investor Network continues to expand, reaching 267 members in Q3. CASIS has facilitated more than 1,000 capital introductions between startups and investors in the ISS National Lab ecosystem.

EDUCATION OUTREACH AND ENGAGEMENT

- The ISS National Lab gained a new STEM education partner program in Q3: PocketLab, which hosts ScIC Science is Cool, a free virtual "unconference" that brings together STEM educators worldwide.
- The Space Station Ambassador program continued to expand, with 159 new members in Q3.
- Two Space Station Ambassadors were selected to receive Space Station Explorers Exceptional Ambassador Awards, and one was selected to receive the first Tony So Excellence in Education Award.
- Mattel's "You Can Be Anything" YouTube series episode featuring footage of two Barbie dolls onboard the ISS went live in Q3. The dolls launched to station last quarter as part of an ISS National Lab-sponsored project from Mattel to capture footage for the episode, which aims to inspire girls to pursue STEM careers.

- The ISS National Lab sponsored the Teacher Liaison Program Breakfast as part of the 37th annual Space Symposium, which included a presentation from Space Station Ambassador Sian Procter, a crew member on Inspiration4, the first all-civilian orbital mission. The ISS National Lab STEM Education team also presented during the breakfast session and at the Space Foundation's prestigious Swigert Society meeting held in conjunction with the conference.
- The ISS National Lab facilitated a webinar for Space Station Ambassadors in which NASA K-12 education advisor Cindy Hasselbring presented NASA's newest networking program, NASA Connects, a content-sharing platform for educators.

OUTREACH AND STAKEHOLDER ENGAGEMENT

- The ISS National Lab worked with Procter & Gamble (P&G) and Hewlett Packard Enterprise (HPE) on outreach showcasing important commercial milestones for the companies and the space station research community. Outreach highlighted P&G's Febreze Unstoppables product that benefited from ISS National Lab-sponsored research and the role of HPE's Spaceborne Computer-2 in allowing investigators to go from sample analysis to results while their experiment was on station.
- The ISS National Lab facilitated a media event in the Boston area in which NASA astronaut Kate Rubins met with representatives from miniPCR bio and the Genes in Space educational program as well as students from the nearby Arlington High School to discuss space-based research.
- The ISS National Lab and NASA hosted a virtual Destination Station outreach event with approximately 600 Starbucks employees to discuss how the ISS can be used to advance science and technology development.
- The ISS National Lab worked with Chapman University on joint public relations outreach highlighting the first archaeological experiment in space—a project sponsored by the ISS National Lab. This resulted in several national media hits, including CNN, NPR, Smithsonian Magazine, PBS, and Scientific American.
- The ISS National Lab worked with NASA to facilitate a live ISS downlink featuring NASA astronaut Kjell Lindgren during a main-stage session at BIO International, the largest biomedical conference in the world. The ISS National Lab also facilitated a session with representatives from Axiom Space, Merck & Co., Redwire Space, and SpaceX discussing how each supports life sciences R&D on the ISS.
- The ISS National Lab participated in a keynote address and roundtable discussion at the Indoor AgTech Innovation Summit. Before the summit, ISS National Lab staff members were interviewed for an article published by Agritecture discussing space-based agriculture R&D.
- The ISS National Lab hosted its fifth Women Defying Gravity networking session with guest speaker Stellar Solutions CEO Janet Grondin.
- ISS National Lab staff participated in several additional speaking engagements at conferences and events, including the 37th annual Space Symposium, the Innovation Research Interchange Annual Conference, the Association of University Research Parks Bio Health Caucus held before BIO International, an American Society of Mechanical Engineers town hall, and the International Society for Stem Cell Research Annual 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.