ISS National Laboratory Q2FY22 Report

Quarterly Report for the Fiscal Year 2022 Period January 1, 2022 – March 31, 2022

Table of Contents

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Q2FY22 Metrics

ISS NATIONAL LAB UTILIZATION AND OPERATIONS ACTUAL METRICS

TARGET METRIC	FY22 Q1	FY22 Q2	FY22 Q3	FY22 Q4	FY22 Total	FY22 Target	FY22 Stretch
1) Fundamental Science projects selected	0	4				**10**	**13**
2) External funding from sources (Sponsored Programs) supporting Fundamental Science users of ISS National Lab	0	$1M				**$5M**	**N/A**
3) In-Space Production Application projects selected thru NLRA	0	4				**8**	**N/A**
4) Ratio of external funding from sources supporting In-Space Production Application users of ISS National Lab to CASIS funding (self-reported) (cumulative)	0	1:1				**1:1**	**2:1**
5) Technology Demonstration projects selected thru an NLRA	7	0				**12**	**13**
6) Ratio of external funding from sources supporting Technology Demonstration or Development users of ISS National Lab to CASIS funding (self-reported) (cumulative)	6:1	6:1				**3:1**	**5:1**
7) STEM projects selected thru NLRA	0	0				**7**	**9**
8) Total individuals participating in ISS National Lab STEM programs and STEM projects (self-reported)	2,188,101	358,755				**2M**	**4M**
9) Total individual users of ISS National Lab online education products (self-reported)	4,059,959	4,751,858				**5M**	**8M**
10) Time from solicitation close to selection/non-selection notification (cumulative)	72 days	56 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 Utilization payloads delivered	14	10			
(a) Percentage of Commercial Service Provider payloads flown that meet the minimum research objectives	TBD*	TBD*			
(b) Percentage of Commercial Service Provider payloads flown that meet the payload integration expectations	TBD*	TBD*			
2) Education and Outreach payloads delivered	0	1			
3) Fundamental Science payloads delivered	3	0			
(a) Percentage of Fundamental Science experiments that meet minimum science requirements	TBD*	N/A†			
(b) Percentage of Fundamental Science payloads flown that meet the payload integration expectations	33%	N/A†			
4) In-Space Production Applications payloads delivered	0	0			
(a) Percentage of In-Space Production Applications payloads flown that meet the payload integration expectations	N/A†	N/A†			
5) Technology Development payloads delivered	1	5			
(a) Percentage of Technology Demonstration payloads that meet minimum research objectives	TBD*	TBD*			
(b) Percentage of Technology Demonstration payloads flown that meet the payload integration expectations	0%	20%			
6) Total ISS National Lab payloads delivered*	18	16			
7) Total external funding committed	$8,092,367‡	$1,396,174			
8) Multiplier on CASIS grant funding committed (cumulative)	11:1‡	9:1			
9) Funds raised post award and postflight by startup companies with ISS National Lab flight projects					
(a) Funds raised postflight	$554.3M	$52.8M			

(b) Funds raised post award	$580.5M	$61.5M			
10) Users by new/returning type					
(a) ISS National Lab return users	5	3			
(b) ISS National Lab new users	3	5			
11) Users by type					
(a) Commercial	6	3			
(b) Academic/nonprofit	2	4			
(c) Government agency	0	1			
12) ISS National Lab concepts received	61	116			
13) ISS National Lab proposals received	3	21			
(a) Total proposals with a rating of very good and excellent	2	1			
(b) Proposals not selected with a rating of very good and excellent	0	0			
14) ISS National Lab projects selected	8	8			
15) Active solicitations	3	2			
16) Selection notification to agreement draft sent to PI (cumulative)	51 days	53 days			
17) New commercial facilities added	0	0			
18) Commercial facilities (cumulative)	24	24			
19) New umbrella user agreements executed	1	0			
20) Umbrella user agreements current with all current commercial facility managers	96%	96%			
21) Crew time (*actual vs. increment pair – 3 months allocation)*	44%		[Increment Basis]		
(a) Ascent flight resources	**Crew-3, SpX-24**	**NG-17**			
Upmass	80%	45%			
Cold stowage	20%	53%			
Big bags	88%	67%			
Powered lockers	100%	0%			
(b) Facility resources (reported in Q2 and Q4)	**Increment Basis**		**Increment Basis**		
Commercial facilities	60%				

JEM airlock	100%				
Life Science Glovebox	50%				
Microgravity Science Glovebox	50%				
22) Number of payload deliveries that did not turnover per nominal delivery schedule and why	6	8			
Principal investigators	0	0			
Implementation Partners	6	8			
CASIS	0	0			
NASA	0	0			
23) Number of reflight experiments flown	0	1			
Fundamental Science	0	0			
In-Space Production Applications	0	0			
Technology Development	0	1			
STEM	0	0			
Commercial Service Providers	0	0			
24) Number of payloads left on the ground that are ready to fly (upmass limit)	0	1			
25) Number of payloads that had to be removed from the manifest after the freeze date because the PI/payload could not make the flight	2	2			

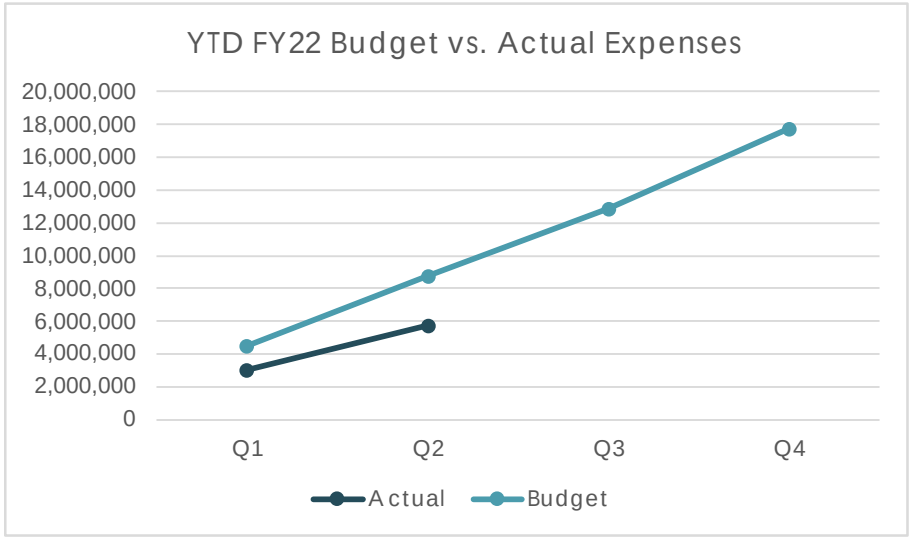
Note: Resource data is projected/estimated based on payload requirements in the queue at the start of FY2022.
* Pending further analysis.
† Not applicable due to zero payloads flying.
‡ An adjustment was made after Q1 reporting completed to account for Boeing's contribution to MassChallenge as an external funding source. As a result, the Q1 number in the FY22 Q2 report will differ from the Q1 number in the FY22 Q1 report.

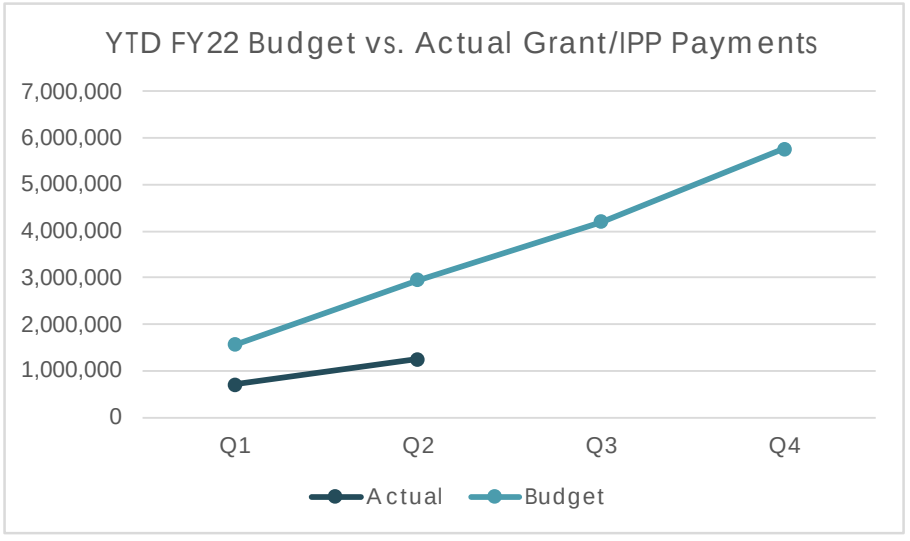
FINANCIALS

Business Status Report (unaudited)

Expenses	Q2 Actuals	Q2 Budget	Variance	Actual YTD FY22	Budget YTD FY22	Variance YTD FY22
Direct Labor	$1,574,200	$2,044,911	$(470,711)	$3,291,596	$3,781,385	$(489,789)[a]
Subcontracts	$194,060	$235,537	$(41,477)	$422,405	$697,277	$(274,872)[b]
Other Direct	$277,308	$353,543	$(76,235)	$484,887	$844,677	$(359,790)[c]
Travel	$69,902	$193,578	$(123,676)	$140,060	$298,743	$(158,683)[d]
Office Supplies and Equipment	$57,762	$58,878	$(1,116)	$144,166	$193,019	$(48,853)
Grants	$540,261	$1,382,288	$(842,027)	$1,244,705	$2,944,464	$(1,699,759)[e]
Total Expenses	**$2,713,493**	**$4,268,735**	**$(1,555,242)**	**$5,727,819**	**$8,759,565**	**$(3,031,746)**

a. *Direct Labor: Headcount of 43 at 3/31/2022 vs a budgeted 56 positions.*
b. *Subcontracts: Difference in the timing of expenses related to content, web development, external proposal review, and subcontracts on a grant. Expenses will be realized as the year progresses.*
c. *Other Direct: Timing of trade show expenses and costs related to representing CASIS at annual ISSRDC event.*
d. *Travel: Lower travel due to timing of trade shows and some impact due to COVID variants.*
e. *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

Breakout of ISS National Lab Grants Payments

	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22 YTD Total
Academic	$156,577	$173,093			$329,670
Commercial	$547,867	$367,168			$915,035
Other Government Agency	-	-			-
Total	**$704,444**	**$540,261**			**$1,244,705**

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*	$723,157†	$296,620			

** 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.*
† 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%	%	%	54%
Indirect	28%	20%	%	%	24%
Grants	23%	20%	%	%	22%

IN-ORBIT ACTIVITIES

- Northrop Grumman's 17th Commercial Resupply Services (CRS) mission delivered several ISS National Lab-sponsored payloads, including the following (full details on the Northrop Grumman CRS-17 launch page):
  - Colgate-Palmolive conducted the first-ever private-sector skin health experiment to collect data on the changes to skin health biomarkers that occur in the stressful environment of microgravity.
  - MicroQuin, a biotechnology startup, used 3D cell cultures to better understand the onset and progression of cancer; results could help MicroQuin refine its cancer therapeutic and develop new drugs for targeted treatment of breast and prostate cancers.
  - The University of Notre Dame conducted an investigation to better understand bubble dynamics on nanostructured surfaces; results could improve medical diagnostics and water purification methods.
  - Higher Orbits launched a student-designed project, developed by the winning team of the program's "Go for Launch" competition, to test the effects of microgravity on oxygen production in algal cultures.
  - SkyCorp Inc., a company focused on orbital logistics, sought to raise the technology readiness level of components related to its modular satellite infrastructure, which will enable in-orbit satellite servicing.
  - Axiom Space tested the capability of the Universal Intelligent Glass Optics (UNIGLO) module to process various types of complex glasses for a variety of applications in space and on Earth.
- The crew completed operations for a protein crystallization experiment from Merck & Co. that builds on previous research to improve the manufacture and storage of the cancer immunotherapy drug Keytruda®.
- During operations on the ISS, a project from Procter & Gamble's Tide team tested the stability of cleaning ingredients in microgravity conditions to develop a low-resource-use, sustainable laundry solution.
- Crew members worked on a Clemson University investigation, funded by Target through the ISS Cotton Sustainability Challenge, to better understand cotton regeneration; results could aid in the development of cotton varieties with improved disease resistance and drought tolerance.

R&D PROGRESS AND SUCCESSES

- Solicitations that opened in Q2 include:
  - Three ISS National Lab Research Announcements (NLRAs):
    - NLRA 2022-5: Technology Advancement and Applied Research Leveraging the ISS National Lab (Cycle 2)
    - NLRA 2022-6: In-Space Production Applications: Advanced Materials and Manufacturing
    - NLRA 2022-7: Leveraging the ISS National Lab to Enable Digital Engagement For K-12 and Higher Education
  - One solicitation in collaboration with the U.S. National Science Foundation (NSF):
    - NSF/CASIS 2022 Collaboration on Transport Phenomena Research on the ISS to Benefit Life on Earth
- Five new peer-reviewed journal articles were published in Q2 (view a complete list of peer-reviewed journal publications related to the ISS National Lab at www.issnationallab.org/publications):
  - Griger S, Sands I, Chen Y. Comparison between Janus-Base Nanotubes and Carbon Nanotubes: A Review on Synthesis, Physicochemical Properties, and Applications. Int J Mol Sci. 2022 Feb 27;23(5):2640. https://doi.org/10.3390/ijms23052640
  - Hu C, Ayan B, Chiang G, et al. Comparative Effects of Basic Fibroblast Growth Factor Delivery or Voluntary Exercise on Muscle Regeneration after Volumetric Muscle Loss. Bioengineering (Basel). 2022 Jan 14;9(1):37. https://doi.org/10.3390/bioengineering9010037
  - Li Y, Liao Y. Numerical study of flame spread in a narrow flow duct in microgravity—effects of flow confinement and radiation reflection. Combust Flame. 2022 Jan 1;235:111714. https://doi.org/10.1016/j.combustflame.2021.111714

- Maldarelli C, Donovan N, Subramaniam G, et al. Continuum and Molecular Dynamics Studies of the Hydrodynamics of Colloids Straddling a Fluid Interface. Annu Rev Fluid Mech. 2022 Jan 1; 54(1): 495-523. https://doi.org/10.1146/annurev-fluid-032621-043917
- Zhao L, Seshadri s, Liang X, et al. Depinning of Multiphase Fluid Using Light and Photo-Responsive Surfactants. ACS Cent Sci 2022 Jan 13;8(2):235-245. https://doi.org/10.1021/acscentsci.1c01127

LEO ECONOMY

Demand

- Eight new projects were selected in Q2:
  - Two selected projects were from the NSF/CASIS 2021 Collaboration on Tissue Engineering and Mechanobiology: projects from Virginia Polytechnic Institute and State University and the University of Virginia, Charlottesville seek to understand the effects of microgravity on wound healing processes.
  - Two selected projects were from the NASA Vascular Tissue Challenge (VTC): projects from two research teams at Wake Forest University aim to produce thick, vascularized metabolic tissue to advance research on human physiology, fundamental space biology, and medicine.
    - CASIS funded the VTC winning team and partnered with a nonprofit organization to provide matching funding to the runner-up for technology demonstrations leveraging the ISS National Lab.
  - Four selected projects were from the 2022 NASA Research Announcement for In-Space Production:
    - A project from Lawrence Livermore National Laboratory aims to test volumetric additive manufacturing for organ production in space.
    - An investigation from Flawless Photonics, Inc. seeks to study the formation of heavy metal fluoride glasses that can be used in high-powered lasers and sensors.
    - A project from BioServe Space Technologies seeks to expand the use of hematopoietic stem cells for clinical applications.
    - A project from Redwire Space, Inc. aims to make its hardware for crystal production in microgravity available to industrial and institutional customers.

Supply

- LaMont Aerospace became the newest ISS National Lab Commercial Service Provider. LaMont is focused on developing infrastructure and technologies that enable the use of space to discover, manufacture, replicate, and then market spaceborne products and data.
- The ISS National Lab hosted the first of two semi-annual Implementation Partner workshops, and all Implementation Partners were in attendance.

Investment

- Capital-raising activities by startups in the ISS National Lab ecosystem continued in Q2. Based on publicly available data, $53 million of private and public capital and grant funding was raised during Q2 by startups that have completed a flight project through the ISS National Lab, bringing the total amount to date to more than $1.8 billion.
- In Q2, $9 million of private capital was raised by startups awarded a flight project through the ISS National Lab, but the project had not yet launched to the ISS.
- The ISS National Lab Investor Network continues to expand, reaching a cumulative 260 members in Q2. 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 launched Expedition Space Lab, an online tool that provides educators with easy access to free ISS-related lessons, activities, and other resources to integrate into their curriculum.
- The Space Station Ambassador program continued to expand, with 154 new members in Q2.
- The ISS National Lab collaborated with Mattel to launch Barbie to the space station to inspire girls to pursue careers in STEM fields.
- The ISS National Lab STEM team presented and exhibited at the Space Exploration Educator's Conference (SEEC) and the National Science Teachers Association Conference (NSTA).
- The ISS National Lab STEM team sponsored more than 220 educators to attend "The Infinite" virtual reality (VR) experience, a traveling exhibit developed by Felix & Paul Studios in which visitors are immersed in visuals captured through nearly two years of video footage filmed on the ISS.

OUTREACH AND STAKEHOLDER ENGAGEMENT

- CASIS released its 2021 Annual Report of the ISS National Laboratory, highlighting organizational accomplishments of the past fiscal year and providing insights into strategic initiatives moving forward.
- The ISS National Lab hosted a virtual event to discuss how the orbiting platform can facilitate plastics alternatives research and to highlight finalists in the ISS National Lab Sustainability Challenge: Beyond Plastics.
- ISS National Lab public relations outreach for the Colgate-Palmolive skin health experiment and the ISS National Lab Sustainability Challenge: Beyond Plastics led to media coverage in outlets such as Smithsonian Magazine, SyFy, Happi, and MIT Tech Review.
- The ISS National Lab and NASA hosted a virtual Destination Station outreach event to gather companies, researchers, and educators to discuss how the ISS can advance science and technology development.
- The ISS National Lab hosted its fourth Women Defying Gravity networking session, this time with NASA's director of the International Space Station, Robyn Gatens, as the guest speaker.
- ISS National Lab staff participated in several speaking engagements at conferences, workshops, and events, including Florida Space Day, the Commercial Space Summit, a 3D Bioprinting in Space workshop by the European Space Agency, the American Chemical Society Annual Meeting, the Consumer Technology Association CES event, and a meeting of experts convened by the National Academies of Sciences, Engineering, and Medicine for NASA.

ADDITIONAL UPDATES

- CASIS announced two new members of the Board of Directors: Margaret Jenny and John Sheets.
- CASIS named Michael Roberts as Chief Scientist for the ISS National Lab.

Full Project Pipeline Details

- For a full list of ISS National Lab-sponsored projects and programs, including flight status, visit our project pipeline database.