ISS National Laboratory
CENTER FOR THE ADVANCEMENT OF SCIENCE IN SPACE

ISS National Laboratory Q3FY21 Report

Quarterly Report for the Fiscal Year 2021 Period April 1, 2021 – June 30, 2021

Table of Contents

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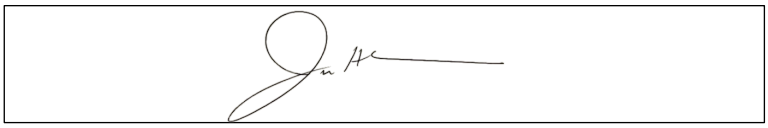

Q3FY21 Metrics

FUNDAMENTAL SCIENCE	ACTUAL Q1	ACTUAL Q2	ACTUAL Q3	ACTUAL Q4	ACTUAL FY21	TARGET FY21
External Funding from Other Government Agencies Supporting Fundamental Science Users	--	--	--	--		$10M
Fundamental Science Payloads Delivered	12	2	3			10
IN-SPACE PRODUCTION APPLICATIONS						
New Roadmaps Developed for In-Space Production Applications	0	0	0			3
TECHNOLOGY DEVELOPMENT						
Funds Raised Postflight by Startup Companies with Flight Projects	$30.4M	$28.7M	$75.8M			$15M
Technology Demonstration Payloads Delivered	8	6	6			10
External Funding from Other Government Agencies Supporting Technology Demonstration or Development Users	--	--	--	--		$20M
COMMERCIAL SERVICE PROVIDERS						
Umbrella Agreements Signed with All Current Commercial Facility Managers	92%	92%	98%			100%
Pioneer Allocation Resource Utilization	N/A	N/A	N/A			100%
EDUCATION AND OUTREACH						
Individuals Participating in ISS National Lab STEM Programs and STEM Grants Projects	203,633	666,326	2,658,945			1.5M
Total Audience of ISS National Lab Online Education Products	1,848,878	1,289,818	1,221,455			3.5M
CORE ISS NATIONAL LAB RESOURCE UTILIZATION METRICS						
Crew Time (*Actual vs. increment pair-3 months allocation)*	60%		38%			100%
Upmass	100%		47%			100%

FULL ISS NATIONAL LAB UTILIZATION AND OPERATIONS TRACKING METRICS

	ACTUAL Q1	ACTUAL Q2	ACTUAL Q3	ACTUAL Q4	ACTUAL FY21
Commercial Service Provider Utilization Payloads Delivered	11	3	8		
Education and Outreach Payloads Delivered	4	0	1		
In-Space Production Applications Payloads Delivered	3	1	1		
Total ISS National Lab Payloads Delivered	38	12	19		
New ISS National Lab Proposals Received	7	2	122		
New ISS National Lab Projects Selected	1	4	3		
By New/Returning Type					
ISS National Lab Return Users	1	2	1		
ISS National Lab New Users	0	2	2		
By User Type					
Commercial	1	3	2		
Academic/Nonprofit	0	0	1		
Government Agency	0	1	0		
Number of Days from Solicitation Close to Announcement	52	52	76		
New Commercial In-Orbit Facilities Added	0	0	0		
Commercial In-Orbit Facilities (cumulative)	17	17	17		
Ascent Flight Resources					
Upmass	149%		47%		
Cold Stowage	53%		77%		
Big Bags	90%		57%		
Powered Lockers	29%		18%		
Facility Resources					
Commercial Facilities	50%		50%		
JEM Airlock	100%		100%		
Life Science Glovebox	16%		67%		
Microgravity Science Glovebox	120%		50%		

Note: Resource data is projected/estimated based on payload requirements in the queue at the start of FY2021.

FINANCIALS

Business Status Report (unaudited)

Expenses	Q3 Actuals	Q3 Budget	Variance	Actual YTD FY21	Budget YTD FY21	Variance YTD FY21
Direct Labor	$1,685,887	$1,998,869	$(312,982)	$5,106,181	$5,858,689	$(752,508)[a]
Subcontracts	$290,263	$206,200	$84,063	$845,942	$776,570	$69,372 [b]
Other Direct	$184,473	$334,922	$(150,449)	$542,241	$802,429	$(260,188)[c]
Travel	$22,815	$127,627	$(104,812)	$33,811	$151,709	$(117,898)[d]
Office Supplies and Equipment	$74,820	$53,325	$21,495	$181,398	$209,619	$(28,221)
Grants & Mission-Based Costs	$818,442	$1,497,529	$(679,087)	$2,744,743	$5,116,825	$(2,372,082)[e]
Total Expenses	**$3,076,700**	**$4,218,472**	**$(1,141,772)**	**$9,454,316**	**$12,915,841**	**$(3,461,525)**

a) *Direct Labor: 59 budgeted positions vs actual headcount of 46 at 6/30/21.*
b) *Subcontracts: Higher primarily because subcontractors were used in lieu of certain staffing positions.*
c) *Other Direct: Other direct were primarily lower due to decreased advertising expenses and trade shows.*
d) *Travel: Travel is lower due to travel restrictions that remained in place during the third quarter.*
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 the awarding of additional grants.*

Breakout of ISS National Lab Grants Payments

	Q1FY21	Q2FY21	Q3FY21	Q4FY21	FY21 YTD Total
Academic	$369,997	$382,625	$363,176		$1,115,798
Commercial	$639,564	$446,291	$343,187		$1,429,042
Other Government Agency	-	-	$59,996		$59,996
Mission-Based Costs	$43,912	$43,912	$52,083		$139,907
Total	**$1,053,473**	**$872,828**	**$818,442**		**$2,744,743**

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

	ACTUAL Q1	ACTUAL Q2	ACTUAL Q3	ACTUAL Q4	ACTUAL FY21
Total value of grants awarded*	$0	$172,471	$214,500		

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

Breakout of Cooperative Agreement Funding

	Q1FY21	Q2FY21	Q3FY21	Q4FY21	FY20 YTD Total
Direct	48%	50%	52%		50%
Indirect	21%	21%	21%		21%
Grants	31%	29%	27%		29%

Program Activities

Commercial Service Provider Utilization

An allocation of ISS National Lab crew time and upmass resources that will be utilized by Commercial Service Providers for the purpose of promoting, enabling, and facilitating their respective commercial demand-generation efforts, thereby contributing to the growth and development of the broader LEO market economy.

- Sierra Nevada Corporation announced the creation of Sierra Space, a new commercial space company.
- Nanoracks completed the 20th CubeSat deployment mission from the ISS using the Nanoracks CubeSat deployer. This mission marks Nanoracks' 262nd CubeSat released from the ISS.
- Felix & Paul Studios won two Webby Awards for its virtual reality series "The ISS Experience: Episode 1," being filmed on the ISS in collaboration with TIME.
- The Redwire Space Additive Manufacturing Facility on the ISS returned to nominal operation and completed a test print of a replacement part for ISS urine processing hardware.

Fundamental Science

Peer-reviewed science that will lead to new discovery and knowledge, or advance our current understanding or knowledge, in various scientific disciplines through the use of microgravity, the extreme environments of space, or the unique vantage point of the ISS. Economic output from results is not required.

- CASIS facilitated an event with Emory University researchers and NASA astronaut Jessica Meir associated with an ISS National Lab-sponsored heart stem cell investigation from Emory. CNN covered the event.
- Six peer-reviewed fundamental science articles were published in Q3:
  - Carney A, Li Y, Liao YT, et al. (2021). Concurrent-flow flame spread over thin discrete fuels in microgravity. Combustion and Flame, 226:211-221. https://doi.org/10.1016/j.combustflame.2020.12.005
  - Chakraborty N, Zamarioli A, Gautam A, et al. (2021). Gene-metabolite networks associated with impediment of bone fracture repair in spaceflight. Computational and Structural Biotechnology Journal, 19, 3507–3520. https://doi.org/10.1016/j.csbj.2021.05.050
  - Goelzer M, Dudakovic A, Olcum M, et al. (2021). Lamin A/C Is Dispensable to Mechanical Repression of Adipogenesis. International Journal of Molecular Sciences, 22(12), 6580. https://doi.org/10.3390/ijms22126580
  - Hirsa, AH and Lopez JM. (2021). Coupling Vortical Bulk Flows to the Air-Water Interface: From Putting Oil on Troubled Waters to Surfactants on Protein Solutions. Fluids, 6, 198. https://doi.org/10.3390/fluids6060198
  - Riley FP, McMackin PM, Lopez JM, et al. (2021). Flow in a ring-sheared drop: Drop deformation. Phys Fluids, 33:042117. https://doi.org/10.1063/5.0048518
  - Tsui JH, Leonard, A, Camp, ND, et al. (2021). Tunable electroconductive decellularized extracellular matrix hydrogels for engineering human cardiac microphysiological systems. Biomaterials, 272, 120764. https://doi.org/10.1016/j.biomaterials.2021.120764

In-Space Production Applications

LEO-based applied R&D microgravity applications seeking to demonstrate space-based manufacturing and production activities that enable new business growth and capital investment, represent scalable and sustainable market opportunities, and produce reoccurring value with the potential to generate demand for and revenue from access to space.

- CASIS staff presented and led a panel session at the World Stem Cell Summit, which has been a valuable partner in reaching potential investigators within the area of regenerative medicine.

STEM Education and Outreach

Programs, projects, and public-private partnerships that leverage the ISS and space-based research to advance U.S. leadership in space-based R&D and industry-related workforce development. These programs, projects, and partnerships will engage K-12 students and enhance higher education to promote diversity and outreach into underrepresented demographics.

- CASIS gained two new STEM education partners in Q3 to further ISS National Lab education initiatives:
  - The American Institute of Aeronautics and Astronautics (AIAA): The world's largest technical society dedicated to the global aerospace profession.
  - The Center for Applied Space Technology (CAST): Helps educators apply insights from the learning sciences and leading-edge practices to educational design and implementation.
- During Q3, CASIS staff participated in several STEM education and outreach events, including the Science is Cool Conference (SciC5), with a recorded session on the ISS as humanity's great learning outpost; a STEM panel discussion featuring NASA astronaut Ricky Arnold, as part of the International Destination Station event; and a session during the 2021 Center of Science and Industry (COSI) Science Festival.
- Space Station Explorers program updates:
  - One peer-reviewed STEM article was published in Q3 on results from a Genes in Space student investigation in which CRISPR technology was used to edit DNA for the first time in space:
    - Stahl-Rommel S, Li D, Sung M, et. al. (2021). A CRISPR-based assay for the study of eukaryotic DNA repair onboard the International Space Station. PloS one, 16(6), e0253403. https://doi.org/10.1371/journal.pone.0253403
  - NASA astronaut Shannon Walker read the book "Give Me Some Space," by Philip Blunting, as part of the Story Time From Space program, with approximately 2 million viewers from around the world.
  - Zero Robotics screened its film "Zero Gravity: The Journey to Space is Just a Code Away," highlighting its coding and robotics challenge. The film garnered attention at numerous film festivals and won several awards.

Technology Development/Demonstration

Applied R&D, translational science, technology readiness level maturation, and technology demonstration to improve products and/or processes that will produce positive economic impact. All projects with an expressed commercial purpose or intent are included. Most of these will be sourced and/or serviced by Implementation Partners.

- CASIS held a virtual International Destination Station event and two breakout sessions in partnership with NASA.
- Eli Lilly and Company launched an experiment to examine the effects of gravity on the physical state and properties of freeze-dried pharmaceutical products. Results could help Lilly improve the chemical and physical stability of pharmaceutical products for patients on Earth.
- Colgate-Palmolive launched the first private-sector oral health care investigation to the ISS focused on microbial biofilms and molecular approaches to identify differences between a healthy and a diseased oral microbiome. Results could help the company create more effective products for consumers on Earth.
- Hewlett Packard Enterprise's Spaceborne Computer-2 (SBC-2) was installed and began operations on the ISS. SBC-2, following SBC-1's successful 1.5-year technology demonstration on the ISS, will enable in-space data processing and analysis, providing quicker results that will enable iteration of experiments on station.

- Procter & Gamble built upon its earlier research on the ISS in colloids and made a splash with its announcement to launch Tide to the ISS under sponsorship of the ISS National Lab. The announcement coincided with their NASA Space Act Agreement, bringing further visibility to their research in space and drawing coverage from The Today Show, USA Today, Ad Age, CNBC, Fortune, and many other worldwide outlets.

Additional Updates

- Three new projects were selected in Q3:
  - One was a fundamental science project from the University of South Carolina, a new ISS National Lab user, that resulted from the NSF/CASIS Transport Phenomena 2021 research announcement. The project aims to understand gravity's effects on flow boiling.
  - Another was a technology development project from Launchspace Technologies Corporation, a new ISS National Lab user. The project is a proof-of-concept demonstration of a multilayered structure to be installed outside the ISS for capturing small debris.
  - The third was a Commercial Service Provider utilization user agreement with Rhodium Scientific, a return ISS National Lab user.
- CASIS hosted two sessions of Women Defying Gravity, a space industry women's networking event. One was with guest speaker Ellen Stofan, under secretary for science and research at the Smithsonian Institution, and the other was with guest speaker Hanna Steplewska, founder and CEO of Eva Strategies.
- Investor updates:
  - The ISS National Lab Investor Network continues to expand, reaching 224 members. To date, CASIS has facilitated close to 890 capital introductions between startups and investors in the ISS National Lab ecosystem. The investor network is a potential source of capital connections and funding for early-stage companies planning studies on the ISS.
  - CASIS participated in several investor event speaking engagements: Keystone Space Collaborative, Aerospace Innovation and Technology Forum, and H4X Labs Deep Tech Connect Summit.
- SpaceX's 22nd Commercial Resupply Services (CRS) mission launched in Q3, delivering more than a dozen ISS National Lab-sponsored payloads. For more information, see the mission overview page.
  - The CASIS Marketing and Communications team worked with Colgate-Palmolive to craft marketing content on their experiment. GeekWire profiled the University of Washington kidney tissue chip investigation, which was covered by a variety of media outlets worldwide.

Full Project Pipeline Details

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