ISS National Laboratory
CENTER FOR THE ADVANCEMENT OF SCIENCE IN SPACE

International Space Station National Laboratory

Appendices for Annual Report for Fiscal Year 2021

Published January 31, 2021

Contents

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

A. Solicitations

Previously released solicitations with project selection in FY21:

- **Advanced Materials Research and Development Onboard the ISS National Laboratory** – The purpose of this RFP was to solicit project concepts that propose use of the ISS National Lab for investigations in the field of advanced materials science and engineering from investigators associated with any U.S.-based institution (academic, government, commercial, or nonprofit). Exposure to microgravity conditions and the extreme environment of space induces changes in materials themselves and in physical phenomena that profoundly impact materials science investigations. This solicitation sought flight experiments (to be conducted on the interior or exterior of the ISS) that enable the development of next-generation production methods, improve understanding of mechanisms involved in material transformations, advance fundamental materials discovery, or test processes or manufacturing methods of novel design and synthesis pathways.
  www.issnationallab.org/research-on-the-iss/solicitations/rfp2019-2
- **Industrial Biomedicine Research and Development Onboard the ISS National Laboratory** – The purpose of this RFP was to solicit project concepts that propose use of the ISS National Laboratory for investigations in the field of industrial biomedicine. Investigators associated with any U.S.-based institution (academic, government, commercial, or nonprofit) were invited to propose ISS National Laboratory flight experiments to enable biomedical advancements with a defined pathway for translation from scientific research to industrial or clinical applications, such as new therapeutics, medical procedures, or diagnostic devices.
  www.issnationallab.org/research-on-the-iss/solicitations/rfp2019-3

Solicitations released and closed within FY21:

- **NSF/CASIS 2021 Collaboration on Transport Phenomena Research on the ISS to Benefit Life on Earth**, *funded by the National Science Foundation (up to $4 million)* – The Division of Chemical, Bioengineering and Environmental Transport (CBET) in the Engineering Directorate of NSF partnered with the ISS National Lab to solicit research projects in the general field of transport phenomena that utilize the ISS National Lab to conduct research that will benefit life on Earth. Many processes that affect the behavior of fluids on Earth (such as convection, sedimentation, hydrostatic pressure, and buoyancy) are absent in microgravity, providing benefits for the study of fluid dynamics, multiphase processes, thermal transport, and combustion and fire systems.
  www.issnationallab.org/research-on-the-iss/solicitations/rfp2021-1
- **NSF/CASIS 2021 Collaboration on Tissue Engineering and Mechanobiology on the ISS to Benefit Life on Earth**, *funded by the National Science Foundation (up to $2 million)* – The Division of Chemical, Bioengineering and Environmental Transport (CBET) and the Division of Civil, Mechanical, and Manufacturing Innovation (CMMI) in the Engineering Directorate of NSF partnered with the ISS National Lab to solicit research projects in the general fields of tissue engineering and modeling of physiological systems that can utilize the ISS National Lab to conduct research that will benefit life on Earth. Microgravity affects organisms, from viruses and bacteria to humans, inducing changes such as altered gene expression and DNA regulation, changes in cellular function and physiology, and 3D aggregation of

cells. Spaceflight studies are advancing research in the fields of pharmaceutical research, disease modeling, regenerative medicine, industrial biomedicine, and many other areas within the life sciences. www.issnationallab.org/research-on-the-iss/solicitations/rfp2021-2

- **ISS National Lab Research Announcement for Technology Advancement and Applied Research on the ISS National Lab, Cycle 1 –** CASIS, in coordination with NASA, has identified multiple ISS National Lab lines of business that support strategic priorities and programmatic focus areas aimed at bringing value to our nation and enabling a robust and scalable market in low Earth orbit. Technology development and demonstrations enabled by access to space bring tremendous growth potential due to the ability to conduct applied research in space to accelerate technology maturation. Through this research announcement for the technology development/demonstration line of business, respondents proposed to use the unique ISS environment to develop, test, or mature products and processes that have a demonstrated potential to produce near-term and positive direct or indirect economic impact. www.issnationallab.org/research-on-the-iss/solicitations/nlra2021-3
- **ISS National Lab Research Announcement for In-Space Production: Advanced Manufacturing and Materials –** The purpose of this research announcement was to solicit proposals for applied research and development seeking to demonstrate space-based manufacturing and production activities in microgravity. For the in-space production line of business, research concepts were solicited for which space-based testing can uniquely enable technical solutions to known science and engineering challenges and the creation of new products and business opportunities. The objective is to use the unique ISS environment to develop, test, or mature products and processes that have a demonstrated potential to produce near-term, positive direct or indirect economic impact. www.issnationallab.org/research-on-the-iss/solicitations/nlra2021-5
- **ISS National Lab Research Announcement for In-Space Production: Tissue Engineering and Biomanufacturing –** The purpose of this research announcement was to solicit proposals for applied research and development seeking to demonstrate space-based biomanufacturing activities in microgravity. For the in-space production line of business, research concepts were solicited for which space-based testing can uniquely enable technical solutions to known science and engineering challenges and the creation of new products and business opportunities. The objective is to use the unique ISS environment to develop, test or mature products and processes that have a demonstrated potential to produce near-term, positive direct or indirect economic impact. www.issnationallab.org/research-on-the-iss/solicitations/nlra2021-6
- **ISS National Lab Research Announcement: Leveraging the ISS National Lab to Enable Digital Engagement and Higher Education (Cycle 1 and Cycle 2) –** The purpose of this research announcement was to solicit applications for programs, products, and public-private partnerships focused on educational objectives related to the ISS National Lab. This announcement was open to U.S.-based entities (academic, government, commercial, not-for-profit institutions) seeking to establish or expand programs and products in the fields of science, technology, engineering, and mathematics (STEM) education for students of all ages. www.issnationallab.org/research-on-the-iss/solicitations/nlra2021-8
- **Genes in Space, student DNA experiments**, *co-funded by Boeing, miniPCR, Math for America, and New England Biolabs, Inc. (up to $250,000*) – The Genes in Space program holds a free annual competition for students in grades 7 through 12 to propose pioneering DNA experiments that use the unique environment of the ISS. The winning proposals are developed into flight projects that are launched to the space station.

Solicitations released in FY21 with project selection expected in FY22:

- **Technology in Space Prize (in association with MassChallenge Boston)**, co-*funded by CASIS and Boeing (up to $250,000)* – Each year, the ISS National Lab and Boeing support a prize for startups associated with MassChallenge, one of the largest global startup accelerator organizations. The Technology in Space Prize provides an opportunity for entrepreneurs to leverage the ISS National Lab to enhance their products and business models on Earth. This is the seventh year the ISS National Lab has supported the Technology in Space Prize and the sixth year Boeing has supported the prize.
- **ISS National Lab Research Announcement for Technology Advancement and Applied Research on the ISS National Lab, Cycle 2 –** CASIS, in coordination with NASA, has identified multiple ISS National Lab lines of business that support strategic priorities and programmatic focus areas aimed at bringing value to our nation and enabling a robust and scalable market in low Earth orbit. Technology development and demonstrations enabled by access to space bring tremendous growth potential due to the ability to conduct applied research in space to accelerate technology maturation. Through this research announcement, respondents proposed to use the unique ISS environment to develop, test, or mature products and processes that have a demonstrated potential to produce near-term and positive direct or indirect economic impact.
  www.issnationallab.org/research-on-the-iss/solicitations/nlra2021-7

B. Implementation Partners

ISS National Lab Implementation Partners are organizations that work with the ISS National Lab to provide services related to payload development.

Institution	City	State
The Aerospace Corporation	Los Angeles	CA
AIRBUS DS Space Systems, Inc.*	Houston	TX
Aegis Aerospace Inc. (new company from merger of Alpha Space Test & Research Alliance and MEI Technologies)*	Houston	TX
Axiom Space*	Houston	TX
Barrios Technology	Houston	TX
Bionetics Corporation	Yorktown	VA
BioServe Space Technologies*	Boulder	CO
Boeing*	Houston	TX
Business Integra Technology Solutions (BI Tech)	Houston	TX
Craig Technologies*	Merritt Island	FL
CSS-Dynamac	Fairfax	VA
Emerald City Initiatives, Inc.	Huntsville	AL
Felix & Paul Studios	Santa Monica	CA
HNu Photonics, LLC	Wailuku	HI
ICE Cubes by Aerospace Applications North America, Inc.	Houston	TX
Intuitive Machines	Houston	TX
Iron Ring Technologies, LLC	Houston	TX
Jacobs XPrSS	Houston	TX
KBR	Houston	TX
LaMont Aerospace	Houston	TX
Leidos Innovations Corporation	Reston	VA
M&B Engineering	League City	TX
Micro Aerospace Solutions	Melbourne	FL
Nanoracks, LLC*	Houston	TX
Oceaneering Space Systems	Houston	TX
ProXopS, LLC	Houston	TX
Redwire Space*	Jacksonville	FL
Rhodium Scientific*	San Antonio	TX
SEOPS, LLC*	Houston	TX
Sierra Nevada Corporation*	Sparks	NV
Space Tango, Inc.*	Lexington	KY
Space Technology and Advanced Research Systems Inc. (STaARS)	Houston	TX
Tec-Masters, Inc.	Huntsville	AL
Techshot, Inc.*	Greenville	IN
Teledyne Brown Engineering, Inc.	Huntsville	AL

University of Alabama Birmingham Center for Biophysical Sciences and Engineering	Birmingham	AL
Visioneering	Boise	ID
Voxa*	Seattle	WA
Zin Technologies, Inc.	Cleveland	OH

*Commercial Service Providers (a subset of Implementation Partners that own and operate commercial facilities on the ISS.)

C. Permanent ISS Commercial Facilities

Institution	Permanent ISS Commercial Facilities
Aegis Aerospace Inc.	• MISSE Flight Facility
BioServe Space Technologies	• Space Automated Bioproduct Lab (SABL) • Space Automated Laboratory Incubator (SALI)
Craig Technologies	• Space Station Integrated Kinetic Launcher for Orbital Payload Systems (SSIKLOPS)*
Nanoracks, LLC	• Nanoracks Internal Platform (NanoLabs) • Nanoracks CubeSat Deployer • Nanoracks External Platform (NREP) • Nanoracks Plate Reader • Nanoracks Kaber MicroSat Deployer (Kaber)
Redwire Space	• Additive Manufacturing Facility (AMF)
SEOPS, LLC	• SlingShot
Space Tango	• TangoLab-1 • TangoLab-2
STaARS	• STaARS-1
Techshot	• Bone Densitometer • Multi-use Variable-gravity Platform • BioFabrication Facility (BFF)
Teledyne Brown Engineering	• Multi-User System for Earth Sensing (MUSES)

*Management of facility transferred from NASA

D. Space Station Explorers Partner Programs

Program	Partner	Location
Amateur Radio on the International Space Station (ARISS)	AMSAT (Amateur Satellite Radio Corporation)	Kensington, MD
DreamUp	DreamUp, PBC	Washington, DC
ExoLab on the International Space Station	Magnitude.io	Berkeley, CA
Genes in Space	Amplyus LLC	Cambridge, MA
Go for Launch!	Higher Orbits	Leesburg, VA
Growing Beyond Earth (GrowLab)	Fairchild Tropical Botanic Garden	Coral Gables, FL
ISS Above	Image BEAM, Inc.	Monrovia, CA
ISS Virtual Tour	Delaware North Companies & Parks at KSC, Inc.	Kennedy Space Center, FL
	The Astronauts Memorial Foundation	Kennedy Space Center, FL
	Christa Corrigan McAuliffe Center for Integrated Science Learning	Framingham, MA
	Colorado Consortium for Earth & Space Science Education	Colorado Springs, CO
	Scobee Education Center at San Antonio College	San Antonio, TX
	Museum of Aviation Georgia	Robins Airforce Base, GA
	Tulsa Air & Space Museum	Tulsa, OK
	Living Arts and Science Center	Lexington, KY
JFK Space Labs	JFK Library Foundation	Boston, MA
National Geographic Learning: Exploring Science	Cengage Learning	Independence, KY
Non-Newtonian Fluids (Slime) in Space	Nickelodeon	New York, NY
NSF Eager – Student Mission Control	National Science Foundation	Arlington, VA
Orion's Quest	Orion's Quest	Plymouth, MI
Quest for Space	Quest Institute for Quality Education	San Jose, CA
Sally Ride ISS EarthKAM	U.S. Space & Rocket Center	Huntsville, AL
SciGirls in Space	Twin Cities PBS	St. Paul, MN
Space Station Academy	Virtual High School Collaborative	Maynard, MA
Space Station Ambassador Program	ISS National Lab	Melbourne, FL

Story Time From Space	T2 Science & Math Education Consultants	League City, TX
Student Spaceflight Experiments Program (SSEP)	National Center for Earth and Space Science Education	Capitol Heights, MD
Tomatosphere	First the Seed Foundation	Alexandria, VA
Windows on Earth	Technical Education Research Centers	Cambridge, MA
Zero Robotics	Massachusetts Institute of Technology	Cambridge, MA

E. Peer-Reviewed Journal Publications

- Adam JA, Middlestead HR, Debono NE, and Hirsa AH. Effects of shear rate and protein concentration on amyloidogenesis via interfacial shear. J Phys Chem B. 2021; 125(36):10355-10363. https://doi.org/10.1021/acs.jpcb.1c05171
- Black RM, Wang Y, Struglics A, et al. Proteomic analysis reveals dexamethasone rescues matrix breakdown but not anabolic dysregulation in a cartilage injury model. Osteoarthr Cartil. 2020;2(4):100099. https://doi.org/10.1016/j.ocarto.2020.100099
- Bugg D, Bretherton R, Kim P, et al. Infarct collagen topography regulates fibroblast fate via p38-yes-associated protein transcriptional enhanced associate domain signals. Cir Res. 2020;127(10):1306-1322. https://doi.org/10.1161/CIRCRESAHA.119.316162
- Camberos V, Baio J, Mandujano A, et al. The impact of spaceflight and microgravity on the human islet-1+ cardiovascular progenitor cell transcriptome. Int J Mol Sci. 2021;22(7):3577. https://doi.org/10.3390/ijms22073577
- Carney A, Li Y, Liao YT, Olson S, and Ferkul P. Concurrent-flow flame spread over thin discrete fuels in microgravity. Combust flame. 2021;226:211-221. https://doi.org/10.1016/j.combustflame.2020.12.005.
- Chakraborty N, Zamarioli A, Gautam A, et al. Gene-metabolite networks associated with impediment of bone fracture repair in spaceflight. Comput Struct Biotechnol J. 2021;19:3507-3520. https://doi.org/10.1016/j.csbj.2021.05.050
- Cho S, Lee C, Skylar-Scott MA, Heilshorn SC, and Wu JC. Reconstructing the heart using iPSCs: Engineering strategies and applications. J Mol Cell Cardiol. 2021;157:56-65. https://doi.org/10.1016/j.yjmcc.2021.04.006
- Goelzer M, Dudakovic A, Olcum M, et al. Lamin A/C Is dispensable to mechanical repression of adipogenesis. Int J Mol Sci. 2021;22(12):6580. https://doi.org/10.3390/ijms22126580
- Hirsa AH and Lopez JM. Coupling vortical bulk flows to the air-water interface: From putting oil on troubled waters to surfactants on protein solutions. Fluids. 2021;6(6):198. https://doi.org/10.3390/fluids6060198
- Hwang H, Liu R, Maxwell JT, Yang J, and Xu C. Machine learning identifies abnormal Ca2+ transients in human induced pluripotent stem cell-derived cardiomyocytes. Sci Rep. 2020;10(1):16977. https://doi.org/10.1038/s41598-020-73801-x
- Kennedy Z, Newberg J, Goelzer M, Judex S, Fitzpatrick CK, and Uzer G. Modeling stem cell nucleus mechanics using confocal microscopy. Biomech Model Mechanobiol. 2021;20:2361-2372. https://doi.org/10.1007/s10237-021-01513-w
- Li Y, Liao YTT, and Ferkul P. Numerical study of the effects of confinement on concurrent-flow flame spread in microgravity. J Heat Transfer. 2020;142(11):111301-111307. https://doi.org/10.1115/1.4047645
- Lidberg, KA, Annalora AJ, Jozic M, et al. Antisense oligonucleotide development for the selective modulation of CYP3A5 in renal disease. Sci Rep. 2021;11(1):4722. https://doi.org/10.1038/s41598-021-84194-w
- Liu R, Sun F, Armand LC, Wu R, and Xu C. Chronic ethanol exposure induces deleterious changes in cardiomyocytes derived from human induced pluripotent stem cells. Stem Cell Rev. 2021;17:2314-2331. https://doi.org/10.1007/s12015-021-10267-y

- Miller CP, Shin W, Ahn EH, Kim HJ, and Kim DH. Engineering microphysiological immune system responses on chips. Trend Biotechnol. 2020;38(8):857-872. https://doi.org/10.1016/j.tibtech.2020.01.003
- Obal D and Wu JC. Induced pluripotent stem cells as a platform to understand patient-specific responses to opioids and anaesthetics. Br J Pharmacol. 2020;177(20):4581-4594. https://doi.org/10.1111/bph.15228
- Orozco GA, Eskelinen A, Kosonen JP, et al. Shear strain and inflammation-induced fixed charge density loss in the knee joint cartilage following ACL injury and reconstruction: A computational study. J Orthop Res. 2021; advance online publication. https://doi.org/10.1002/jor.25177
- Rampoldi A, Jha R, Fite J, Boland G, and Xu C. Cryopreservation and CO2-independent culture of 3D cardiac progenitors for spaceflight experiments. Biomaterials. 2021;269:120673. https://doi.org/10.1016/j.biomaterials.2021.120673
- Rau A, Knott K, and Lu K. Porous SiOC/SiC ceramics via an active-filler catalyzed polymer-derived method. Mater Chem Front. 2021;5(17):6530-6545. https://doi.org/10.1039/D1QM00705J
- Riley FP, McMackin PM, Lopez JM, and Hirsa AH. Flow in a ring-sheared drop: Drop deformation. Phys Fluids. 2021;33:042117. https://doi.org/10.1063/5.0048518
- Shin YJ, Shafranek RT, Tsui JH, Walcott J, Nelson A, and Kim DH. 3D bioprinting of mechanically tuned bioinks derived from cardiac decellularized extracellular matrix. Acta Biomater. 2021;119:75-88. https://doi.org/10.1016/j.actbio.2020.11.006
- Stahl-Rommel S, Li D, Sung M, et al. A CRISPR-based assay for the study of eukaryotic DNA repair onboard the International Space Station. PloS One. 2021;16(6):e0253403. https://doi.org/10.1371/journal.pone.0253403
- Thomas D, Kim H, Lopez N, and Wu JC. Fabrication of 3d cardiac microtissue arrays using human ipsc-derived cardiomyocytes, cardiac fibroblasts, and endothelial cells. J Vis Exp. 2021;169:e61879. https://doi.org/10.3791/61879
- Thompson M, Woods K, Newberg J, Oxford JT, and Uzer G. Low-intensity vibration restores nuclear YAP levels and acute YAP nuclear shuttling in mesenchymal stem cells subjected to simulated microgravity. NPJ Microgravity. 2020;6(1):35. https://doi.org/10.1038/s41526-020-00125-5
- Tsui JH, Leonard A, Camp ND, et al. Tunable electroconductive decellularized extracellular matrix hydrogels for engineering human cardiac microphysiological systems. Biomaterials. 2021;272:120764. https://doi.org/10.1016/j.biomaterials.2021.120764
- Zamarioli A, Campbell ZR, Maupin KA, et al. Analysis of the effects of spaceflight and local administration of thrombopoietin to a femoral defect injury on distal skeletal sites. NPJ Microgravity. 2021;7(1):12. https://doi.org/10.1038/s41526-021-00140-0

F. Full Project Pipeline

Project Title	Institution	Principal Investigator(s)	Payload Status	City	State
Capillary-Driven Microfluidics in Space	1Drop Diagnostics, Inc	Dr. Luc Gervais	Complete	Boston	MA
Comparative Real-time Metabolic Activity Tracking	490 Biotech, Inc.	Dr. Gary Sayler	Complete	Knoxville	TN
Technology Readiness Level Raising of the Net Capture System	AIRBUS DS Space Systems, Inc.	Ron Dunklee	Complete	Webster	TX
SPHERES Tether - Slosh	AIRBUS DS Space Systems, Inc.	Hans-Juergen Zachrau	Complete	Webster	TX
Genes In Space - 1	Amplyus LLC	Anna-Sophia Boguraev	Complete	Cambridge	MA
Genes in Space - 2	Amplyus LLC	Julian Rubinfien	Complete	Cambridge	MA
Genes in Space - 5 Lakeside	Amplyus LLC	Sophia Chen	Complete	Cambridge	MA
Genes in Space - 5 Stuyvesant	Amplyus LLC	Elizabeth Reizis	Complete	Cambridge	MA
Endothelial Cells in Microgravity for Evaluation of Cancer Therapy Toxicity	Angiex, Inc	Dr. Shou-Ching Jaminet	Complete	Cambridge	MA
Barley Germination and Malting in Microgravity Objective 3 (1 & 2 complete)	Anheuser-Busch	Gary Hanning	Complete	New York	NY
Targeted Nanoparticles for Orphan and Chronic Diseases	Aphios Corporation	Dr. Trevor Castor	Complete	Woburn	MA
Crystallization of Taspase1	Arizona State University	Dr. Jose Martin Garcia	Complete	Tempe	AZ
The Universal Manufacture of Next Generation Electronics	Astrileux Corporation	Dr. Supriya Jaiswal	Complete	Oakland	CA
National Design Challenge - 2 Bell	Bell Middle School	Shanna Atzmiller	Complete	Golden	CO
Protein Crystal Growth to Enable Therapeutic Discovery (Clifton)	Beryllium Discovery Corp.	Dr. Matt Clifton	Complete	Bedford	MA
Implantable Glucose Biosensors	Biorasis, Inc.	Dr. Michail Kastellorizios	Complete	Storrs/Mansfield	CT
Ants in Space	BioServe Space Technologies	Stefanie Countryman	Complete	Boulder	CO

Crystal Growth - WI - 2017	Board of Regents of the University of Wisconsin System	Ilia Guzei	Complete	Madison	WI
Crystal Growth WI - 2018	Board of Regents of the University of Wisconsin System	Ilia Guzei	Complete	Madison	WI
Effects of Microgravity on Stem Cell-Derived Heart Cells	Board of Trustees of the Leland Stanford Junior University	Dr. Joseph Wu	Complete	Stanford	CA
National Design Challenge - 3 Rogers	Boy Scouts of America - Chicago	Dr. Sandra Rogers	Complete	Chicago	IL
National Design Challenge - 3 McFarland	Boy Scouts of America - Chicago	Norman McFarland	Complete	Chicago	IL
Structural and Crystallization Kinetics Analysis of Monoclonal Antibodies	Bristol Myers Squibb	Dr. Robert Garmise	Complete	Lawrence Township	NJ
SG100 Cloud Computing Payload	Business Integra Technology Solutions (BI Tech)	Trent Martin	Complete	Houston	TX
Crystallization of Huntington Exon-1 Using Microgravity	California Institute of Technology	Dr. Pamela Bjorkman	Complete	Pasadena	CA
Electrolytic Gas Evolution under Microgravity	Cam Med, LLC	Larry Alberts	Complete	West Newton	MA
Design of Scalable Gas Separation Membranes via Synthesis under Microgravity	Cemsica	Negar Rajabi	Complete	Houston	TX
National Design Challenge - 2 Centaurus	Centaurus High School	Brian Thomas	Complete	Lafayette	CO
Biofilm Thickness/Viability and Elevated Microbial Corrosion Risk	ChampionX LLC	Dr. Vic Keasler	Complete	Sugar Land	TX
National Design Challenge - 2 Chatfield	Chatfield Senior High School	Joel Bertelsen	Complete	Littleton	CO

Lung Host Defense in Microgravity	Children's Hospital of Philadelphia	Dr. G Scott Worthen	Complete	Philadelphia	PA
Microgravity Electrodeposition Experiment	Cobra Puma Golf	Michael Yagley	Complete	Carlsbad	CA
Controlled Dynamics Locker for Microgravity Experiments on ISS	Controlled Dynamics Inc.	Dr. Scott A. Green	Complete	Huntington Beach	CA
Inertial Spreading and Imbibition of a Liquid Drop Through a Porous Surface	Cornell University	Dr. Michel Louge	Complete	Ithaca	NY
Space Development Acceleration Capability (SDAC)	Craig Technical Consulting, Inc	Ryan Jeffrey	Complete	Merritt Island	FL
Microgravity Crystallization of Glycogen Synthase-Glycogenin Protein Complex	Dover Lifesciences	Dr. David S. Chung	Complete	Dover	MA
National Design Challenge - 1 Duchesne Duquesnay	Duchesne Academy of the Sacred Heart	Kathy Duquesnay	Complete	Houston	TX
National Design Challenge - 1 Duchesne Knizner	Duchesne Academy of the Sacred Heart	Susan Knizner	Complete	Houston	TX
Rodent Research - 3	Eli Lilly and Company	Dr. Rosamund Smith	Complete	Indianapolis	IN
Eli Lilly - Protein Crystal Growth 1	Eli Lilly and Company	Kristofer Gonzalez-DeWhitt	Complete	Indianapolis	IN
Dissolution of Hard-to-Wet Solids	Eli Lilly and Company	Alison Campbell	Complete	Indianapolis	IN
Eli Lilly - Protein Crystal Growth 2	Eli Lilly and Company	Michael Hickey	Complete	Indianapolis	IN
Generation of Cardiomyocytes from Induced Pluripotent Stem Cells	Emory University	Dr. Chunhui Xu	Complete	Atlanta	GA
Organ-Chips as a Platform for Studying Human Enteric Physiology	Emulate, Inc.	Dr. Chris Hinojosa	Complete	Boston	MA
Tomatosphere on MISSE	First the Seed Foundation	Sabrina Foley	Complete	Alexandria	VA
Tomatosphere	First the Seed Foundation	Ann Jorss	Complete	Alexandria	VA

Development and Deployment of Charge Injection Device Imagers	Florida Institute of Technology	Dr. Daniel Batcheldor	Complete	Melbourne	FL
Crystallization of RAS in Space	Frederick National Laboratory for Cancer Research	Dr. Dhirendrea Simanshu	Complete	Frederick	MD
Materials Testing Earth Abundant Textured Thin Film Photovoltaics	Georgia Tech Applied Research Corporation	Dr. Jud Ready	Complete	Atlanta	GA
Pushing the Limits of Silica Fillers for Tire Applications	Goodyear Tire & Rubber Co.	Derek Shuttleworth	Complete	Akron	OH
Exploiting On-orbit Crystal Properties for Medical and Economic Targets	Hauptman Woodward Medical Research Institute, Inc.	Dr. Edward Snell	Complete	Buffalo	NY
Growth Rate Dispersion as a Predictive Indicator for Biological Crystal Samples	Hauptman Woodward Medical Research Institute, Inc.	Dr. Edward Snell	Complete	Buffalo	NY
Spaceborne Computer	Hewlett Packard	David Petersen	Complete	Palo Alto	CA
The Effect of Microgravity on Stem Cell Mediated Recellularization	Houston Methodist Research Institute	Dr. Alessandro Grattoni	Complete	Houston	TX
Implantable Nanochannel System for Delivery of Therapeutics for Muscle Atrophy	Houston Methodist Research Institute	Dr. Alessandro Grattoni	Complete	Houston	TX
Decoupling Diffusive Transport Phenomena in Microgravity	Houston Methodist Research Institute	Dr. Alessandro Grattoni	Complete	Houston	TX
IPPase Crystal Growth in Microgravity	iXpressGenes, Inc.	Dr. Joseph Ng	Complete	Huntsville	AL
Role Of Gravity and Geomagnetic Field In Flatworm Regeneration	Kentucky Space, LLC	Dr. Mahendra Jain	Complete	Lexington	KY
Leveraging µg to screen onco-selective messenger RNAs	Kernal Biologics	Dr. Yusuf Erkul	Complete	Cambridge	MA

Enhancement of Performance and Longevity of a Protein-Based Retinal Implant	LambdaVision	Dr. Nicole Wagner	Complete	Farmington	CT
Functional Effects of Spaceflight on Cardiovascular Stem Cells	Loma Linda University	Dr. Mary Kearns-Jonker	Complete	Loma Linda	CA
Test Multilayer Polymer Convection and Crystallization Under Microgravity	Lux Labs, Inc	Dr. Yichen Shen	Complete	Cambridge	MA
Space-Based Ubiquitous Cellular Phone Connectivity	Lynk Global, Inc.	Tyghe Speidel	Complete	Falls Church	VA
ExoLab	Magnitude.io	Ted Tagami	Complete	Berkeley	CA
Marvel Competition - Rocket	Marvel Entertainment	Mitch Dane	Complete	New York	NY
Marvel Competition - Groot	Marvel Entertainment	Mitch Dane	Complete	New York	NY
Application of Microgravity Expanded Stem Cells in Regenerative Medicine	Mayo Clinic - Jacksonville	Dr. Abba Zubair	Complete	Jacksonville	FL
Preparation of PLGA Nanoparticles Based on Precipitation Technique	Medimmune Inc	Dr. Puneet Tyagi	Complete	Gaithersburg	MD
Merck Protein Crystal Growth - 3	Merck Sharp & Dohme Corp	Dr. Paul Reichert	Complete	Kenilworth	NJ
Crystallization of LRRK2 under Microgravity Conditions	Michael J. Fox Foundation	Dr. Marco Baptista	Complete	New York	NY
Microfluidic Lab-on-a Chip to Track Biomarkers in Skeletal Muscle Cells	Micro-gRx, Inc.	Dr. Siobhan Malany	Complete	Orlando	FL
Crystallize an Oncologically Important Protein to Promote Therapeutic Discovery	MicroQuin	Scott Robinson	Complete	Boston	MA
Vertical Burn	Milliken	Dr. Jeff Strahan	Complete	Spartanburg	SC

Dependable Multi-processor Payload Processor (DM7) Validation	Morehead State University	Dr. Benjamin Malphrus	Complete	Morehead	KY
National Ecological Observatory Network (NEON)	National Ecological Observation Network	Brian Penn	Complete	Boulder	CO
Magnetic 3D Cell Culture for Biological Research in Microgravity	Nano3D Biosciences, Inc.	Dr. Glauco Souza	Complete	Houston	TX
Proof-of-Concept for Gene-RADAR Predictive Pathogen Mutation Study	Nanobiosym	Dr. Anita Goel	Complete	Cambridge	MA
Validation of WetLab-2 System for qRT-PCR capability on ISS	NASA Ames Research Center	Julie Schonfeld	Complete	Mountain View	CA
Molecules Produced in Microgravity from the Chernobyl Nuclear Accident	NASA Jet Propulsion Laboratory	Dr. Kasthuri Venkateswaran	Complete	Pasadena	CA
Student Space Flight Experiment Program (SSEP) - 15	NCESSE/Tides Center	Dr. Jeff Goldstein	Complete	Capitol Heights	MD
Nonequilibrium Processing of Particle Suspensions	New Jersey Institute of Technology	Boris Khusid	Complete	Newark	NJ
Non-Newtonian Fluids in Microgravity - Slime	Nickelodeon	Andrew Machles	Complete	New York	NY
T-Cell Activation in Aging-1 & -2	Northern California Institute for Research and Education	Dr. Millie Hughes-Fulford	Complete	San Francisco	CA
SharkSat	Northrup Grumman Maryland	Jeffrey Hobbs	Complete	Linthicum	MD
Rodent Research - 1	Novartis Institute for Biomedical Research	Dr. David Glass	Complete	Cambridge	MA
Rodent Research - 2	Novartis Institute for Biomedical Research	Dr. David Glass	Complete	Cambridge	MA
Zero-G Characterization & On-Orbit Assembly for Cellularized Satellite Tech	NovaWurks, Inc	Talbot Jaeger	Complete	Los Alamitos	CA
Efficacy and Metabolism of Azonafide Antibody-Drug Conjugates (ADCs)	Oncolinx Pharmaceuticals LLC	Sourav Sinha	Complete	Boston	MA

Metal Additive Manufacturing Aluminum Alloy Satellite Antennas	Optisys	Michael Hollenbeck	Complete	West Jordan	UT
Furphy-Residual Momentum and Tank Dynamics	Orbit Fab	Daniel Faber	Complete	Cupertino	CA
Orbital Sidekick ISS Hyperspectral Earth Imaging System Trial	Orbital Sidekick	Daniel Katz	Complete	San Francisco	CA
A SiC UV Sensor for Reliable Operation in Low Earth Orbit	Ozark Integrated Circuits, Inc.	Jim Holmes	Complete	Fayetteville	AR
Microgravity Effect on Entomopathogenic Nematodes	Pheronym, Inc.	Dr. Fatma Kaplan	Complete	Davis	CA
Low Phase Gravity Kinetics	Procter and Gamble Company	Dr. Matthew Lynch	Complete	Westchester Township	OH
Protein Crystal Growth to Enable Therapeutic Discovery	Protein BioSolutions	Dr. Cory Gerdts	Complete	Gaithersburg	MD
Crystal Growth of Cs2LiYCl6:Ce Scintillators in Microgravity	Radiation Monitoring Devices, Inc.	Joshua Tower	Complete	Watertown	MA
Synthetic Muscle: Resistance to Radiation	Ras Labs LLC	Dr. Lenore Rasmussen	Complete	Hingham	MA
Gravitational Regulation of Osteoblast Genomics and Metabolism	Regents of the University of Minnesota	Dr. Bruce Hammer	Complete	Minneapolis	MN
Assessing Osteoblast Response to Tetranite	RevBio	Brian Hess	Complete	Lowell	MA
New Phage-Bacteria Interactions from Exposure to Space Environment	Rhodium Scientific	Heath Mills	Complete	San Antonio	TX
Genomics Investigation of Human Gut Microbiome	Rhodium Scientific	Dr. R.P. Oates	Complete	San Antonio	TX
Biomanufacturing Processes for Human Systems in Remote Environments	Rhodium Scientific	Olivia Gamez Holzhaus	Complete	San Antonio	TX
Effects on Soil Stability for Controlled Environment Agriculture	Rhodium Scientific	Heath Mills	Complete	San Antonio	TX

Crystallization of Medically Relevant Proteins Using Microgravity	Saint Louis University	Dr. Sergey Korolev	Complete	Saint Louis	MO
MDCK Influenza Virus Infection	Sanofi Pasteur US	Patrick Farrell	Complete	Orlando	FL
Project Meteor	Southwest Research Institute	Michael Fortenberry	Complete	San Antonio	TX
Intraterrestrial Fungus Grown in Space (iFunGIS)	Space Technology and Advanced Research Systems Inc. (STaARS)	Dr. Heath Mills	Complete	Houston	TX
STaARS-1 Research Facility	Space Technology and Advanced Research Systems Inc. (STaARS)	Craig Walton	Complete	Houston	TX
SpaceCells-01	Space Technology Holdings, LLC	Richard Godwin	Complete	Frisco	TX
Mutualistic Plant/Microbe Interactions	SyNRGE, LLC	Dr. Gary Stutte	Complete	Exploration Park	FL
Windows On Earth	Technical Education Research Centers	Dave Libby	Complete	Cambridge	MA
Windows on Earth - Earth Videos with a Related Education Program	Technical Education Research Centers	Dave Libby	Complete	Cambridge	MA
Next-gen Development of Collagenous Allograft Meniscal Prosthetics	Techshot, Inc.	Dr. Carlos Chang	Complete	Greenville	IN
ISS Bioprinter Facility	Techshot, Inc.	Dr. Eugene Boland	Complete	Greenville	IN
National Design Challenge - 1 Awtry Glidwell	The Awty International School	Angela Glidwell	Complete	Houston	TX
National Design Challenge - 1 Awty Smith	The Awty International School	Jessika Smith	Complete	Houston	TX
Mighty Mice in Space	The Jackson Laboratory	Dr. Se-Jin Lee	Complete	Farmington	CT
Google ISS Streetview	ThinkSpace Consulting	Ann Kapusta	Complete	Mountain View	CA
Osteocyte Response to Mechanical Forces	Trustees of Boston University	Dr. Paola Divieti Pajevic	Complete	Boston	MA

Flow Chemistry Platform	Trustees of Boston University	Dr. Aaron Beeler	Complete	Boston	MA
Tympanogen - Wound Healing	Tympanogen, LLC	Dr. Elaine Horn-Ranney	Complete	Norfolk	VA
Crystallization of Human Membrane Proteins in Microgravity	University of Alabama Birmingham	Dr. Stephen Aller	Complete	Birmingham	AL
The Effect of Macromolecular Transport on Microgravity PCG	University of Alabama Birmingham	Dr. Lawrence ("Larry") DeLucas	Complete	Birmingham	AL
Enhance the Biological Production of the Biofuel Isobutene (Reflight)	University of Alaska Anchorage	Brandon Briggs	Complete	Anchorage	AK
Systemic Therapy of NELL-1 for Osteoporosis (Rodent Research - 5)	University of California, Los Angeles	Dr. Chia Soo	Complete	Los Angeles	CA
Quantifying Cohesive Sediment Dynamics for Advanced Environmental Modeling	University of California, Santa Barbara	Dr. Paolo Luzzatto-Fegiz	Complete	Santa Barbara	CA
Spaceflight Effects on Vascular Endothelial and Smooth Muscle Cell Processes	University of Florida	Dr. Josephine Allen	Complete	Gainesville	FL
Domesticating Algae for Sustainable Production of Feedstocks in Space	University of Florida	Dr. Mark Settles	Complete	Gainesville	FL
Molecular Biology of Plant Development	University of Florida Board of Trustees	Dr. Anna-Lisa Paul	Complete	Gainesville	FL
Conversion of Adipogenic Mesenchymal Stem Cells into Mature Cardiac Myocytes	University of Houston	Dr. Robert Schwartz	Complete	Houston	TX
Protein Crystal Growth for Determination of Enzyme Mechanisms	University of Toledo	Dr. Constance Schall	Complete	Toledo	OH
Microgravity Crystal Growth for Improvement in Neutron Diffraction	University of Toledo	Dr. Timothy Mueser	Complete	Toledo	OH

Drug Development and Human Biology: Use of Microgravity for Drug Development	Veterans Affairs Medical Center - Durham	Dr. Timothy Hammond	Complete	Durham	NC
Tropical Cyclone Intensity Measurements from the ISS (CyMISS)	Visidyne, Inc.	Dr. Paul Joss	Complete	Burlington	MA
Tropical Cyclone Intensity Measurements from the ISS (CyMISS)	Visidyne, Inc.	Dr. Paul Joss	Complete	Burlington	MA
Materials Testing: The Evaluation of Gumstix Modules in Low Earth Orbit	Yosemite Space	Dr. Kathleen Morse	Complete	Groveland	CA
Continuous Liquid-Liquid Separation in Microgravity	Zaiput Flow Technologies	Dr. Andrea Adamo	Complete	Cambridge	MA
Corrosion Inhibitor Exposed to the Extreme Environments in Space	A-76 Technologies, LLC	Lauren Thompson Miller	Withdrawn	Houston	TX
SiC Microgravity Enhanced Electrical Performance	ACME Advanced Materials	Rich Glover	Withdrawn	Albuquerque	NM
Audacy Lynq	Audacy Corporation	Ellaine Talle	Withdrawn	Walnut	CA
Cranial Bone Marrow Stem Cell Culture in Space	Brigham and Women's Hospital	Dr. Yang (Ted) D. Teng	Withdrawn	Boston	MA
ARQ: A Platform for Enhanced ISS Science and Commercialization	bSpace Corporation	Jason Budinoff	Withdrawn	Seattle	WA
Investigating Proliferation of NanoLaze Gene-edited Induced Pluripotent	Cellino Biotech, Inc.	Matthias Wagner	Withdrawn	Cambridge	MA
DexMat CASIS CNT Cable Project	DexMat, Inc.	Dr. Alberto Goenaga	Withdrawn	Houston	TX
Survivability of Variable Emissivity Devices for Thermal Control Applications	Eclipse Energy Systems, Inc.	Dr. Hulya Demiryont	Withdrawn	St. Petersburg	FL

Delivery of Bisphosphonate-prostaglandin for Prevention of Osteopenia	Houston Methodist Research Institute	Dr. Ying Xuan (Corrine) Chua	Withdrawn	Houston	TX
Intuitive Machines-ISS Terrestrial Return Vehicle (TRV)	Intuitive Machines	Steve Altemus	Withdrawn	Houston	TX
GLASS AIS Transponder Global AIS on Space Station (GLASS)	JAMSS America, Inc.	Rob Carlson	Withdrawn	Houston	TX
Global Receive Antenna and Signal Processor (GRASP)	JAMSS America, Inc.	Rob Carlson	Withdrawn	Houston	TX
Remote Manipulator Small-Satellite System (RM3S)	LaMont Aerospace	Craig Walton	Withdrawn	Houston	TX
The Effects of Microgravity on Synovial Fluid Volume and Composition	National Jewish Health	Dr. Richard Meehan	Withdrawn	Denver	CO
Nemak Alloy Solidification Experiments	NEMAK	Dr. Glenn Byczynski	Withdrawn	Southfield	MI
Map the Penetration Profile of a Contact-free Transdermal Drug Delivery System	Novopyxis	Rathi Srinivas	Withdrawn	Boston	MA
Intracellular Macromolecule Delivery and Cellular Biomechanics in Microgravity	SQZ Biotechnologies	Harrison Bralower	Withdrawn	Somerville	MA
Space Based Optical Tracker	Vision Engineering Solutions	Dr. John Stryjewski	Withdrawn	Orlando	FL
Commercialization of the GLASS Payload	Adcole Maryland Aerospace, LLC	Darko Filipi	Flight	Crofton	MD
Materials International Space Station Experiment (MISSE) Flight Facility	Alpha Space Test & Research Alliance	Stephanie Murphy	Flight	Houston	TX
ARISS - 2019/2020	ARISS-USA (Amateur Radio on the International Space Station, Inc.)	Frank Bauer	Flight	Towson	MD

Investigation of Deep Audio Analytics on the International Space Station	Astrobotic Technology Inc.	Andrew Horchler	Flight	Pittsburgh	PA
Characterizing the Effects of Microgravity on Wound Healing	Center for Military Psychiatry and Neuroscience	Dr. Rasha Hammamieh	Flight	Fort Detrick	MD
Novel Protein Aggregation/Degradation Studies in the Unique ISS Environment	GlaxoSmithKline	Dr. Deidre Dalmas Wilk	Flight	Collegeville	PA
Spaceborne Computer 2	Hewlett Packard	Dr. Mark Fernandez	Flight	Palo Alto	CA
3-D printed RF Systems and Materials for High Frequency Communications	L3Harris Technologies	Dr. Arthur Paolella	Flight	Palm Bay	FL
AstroRad Vest - ISSNL Co-Sponsored Project	Lockheed Martin Corporation	Jerry Posey	Flight	Littleton	CO
Astrobee-ROAM (Relative Operations for Autonomous Maneuvers)	Massachusetts Institute of Technology	Dr. Alvar Saenz-Otero	Flight	Cambridge	MA
SPHERES-ReSwarm	Massachusetts Institute of Technology	Prof. David Miller	Flight	Cambridge	MA
An Ultra-compact Spectral Imager	Nanohmics Inc.	Dr. Chris Mann	Flight	Austin	TX
NanoRacks External Platform	Nanoracks, LLC	Michael Johnson	Flight	Webster	TX
PIRPL	Northrop Grumman Systems Corporation	Scott Sage	Flight	Colorado Springs	CO
Faraday Research Facility Commercialization	ProXopS, LLC	Chad Brinkley	Flight	Houston	TX
Erosion and Radiation Tests of Nanometals and Nanoceramics	Purdue University	Dr. Xinghang Zhang	Flight	West Lafayette	IN
Additive Manufacturing Operations Program	Redwire Space, Inc.	Michael Snyder	Flight	Jacksonville	FL
Commercial Polymer Recycling Facility (CPRS)	Redwire Space, Inc.	Matthew Napoli	Flight	Jacksonville	FL
TangoLab-2	Space Tango	Twyman Clements	Flight	Lexington	KY

Bone Densitometer	Techshot, Inc.	John Vellinger	Flight	Greenville	IN
Space Durability of 3D Printed Frontal Polymerization Nanocomposites	The Board of Trustees of the University of Illinois	Dr. Ioannis Chasiotis	Flight	Champaign	IL
Spacewalk VR Experience	Time USA	Mia Tramz	Flight	New York	NY
Kinetics of Nanoparticle Self-assembly in Directing Fields	University of Delaware	Dr. Eric Furst	Flight	Newark	DE
Spherical Cool Diffusion Flames Burning Gaseous Fuels	University of Maryland College Park	Peter Sunderland	Flight	College Park	MD
Radiation and Temperature Excitation of Thermographic Phosphor Composites	University of Memphis	Firouzeh Sabri	Flight	Memphis	TN
MALDI Imaging of Microgravity Exposed Rodent Brain	711 Human Performance Wing (AFRL)	Correy Vigil	Ground	Wright-Patterson AFB	OH
Microgravity As a Stress Accelerator for Omic Profiling of Human Disease	Baylor College of Medicine	Dr. Clifford Dacso	Ground	Houston	TX
Cellular and Molecular Changes Induced by Absence of Gravity	Biogen	Giulio Tomassy	Ground	Cambridge	MA
Single-Cell and Whole-Organ Transcriptomics and Proteomics of 20 Mouse Organs	Board of Trustees of the Leland Stanford Junior University	Nicholas Schaum	Ground	Stanford	CA
Effects of Spaceflight and Aging on the Circulation of the Head and Neck	Florida State University	Dr. Michael Delp	Ground	Tallahassee,	FL
Effects Spaceflight and Aging on the Circulation and Musculoskeletal Systems	Florida State University	Dr. Anand Narayanan	Ground	Tallahassee,	FL
Data-driven Model for Bone Degradation to Study the Progression of Osteoporosis	Iowa State University	Dr. Azadeh Sheidaei	Ground	Ames	IA
A Mouse Model to Characterize Ocular Risks of Spaceflight	KBR Wyle Services, LLC	Dr. Susana Zanello	Ground	Houston	TX

RNA Profiling of Mouse Tissues to Support Open Science	NASA Ames Research Center	Dr. Afshin Beheshti	Ground	Mountain View	CA
Single Cell Profiling of Immune Factors Related to Circulating microRNAs	NASA Ames Research Center	Dr. Afshin Beheshti	Ground	Mountain View	CA
Single-Cell RNA-Sequencing to Reveal Changes to Bone and Immune Functions	NASA Ames Research Center	Dr. Jonathan Galazka	Ground	Mountain View	CA
Evaluation of the Microbiota of the Gastrointestinal Tract	Northwestern University	Dr. Martha Hotz Vitaterna	Ground	Evanston	IL
Orion's Quest	Orion’s Quest	Pete Lawrie	Ground	Livonia	MI
Structural and Biochemical Changes of Craniofacial Bones and Long Bone	RevBio	Michael Brown	Ground	Lowell	MA
Effects of Spaceflight and Aging on Specialized Circulations	Texas A&M Health Science Center	Dr. Pooneh Bagher	Ground	College Station	TX
Gastrointestinal Alterations of Combined Aging and Space Flight	Texas A&M Health Science Center	Dr. Walter Cromer	Ground	College Station	TX
Comprehensive Analysis of Musculoskeletal System Changes in Mice	University of Colorado Boulder	Dr. Virginia Ferguson	Ground	Boulder	CO
Evaluation of Microgravity on Ovarian Estradiol Production.	University of Kansas Medical Center	Dr. Lane Christenson	Ground	Kansas City	KS
Aging and Microgravity Effects on Ovarian Estrogen Production	University of Kansas Medical Center	Dr. Lane Christenson	Ground	Kansas City	KS
Advanced Histological Analysis of the Effects of Microgravity	University of Southern California	Dr. Mark Humayun	Ground	Los Angeles	CA
Microgravity Unloading Influence on Age-Related Extracellular Matrix Remodeling	University of Washington	Dr. Jennifer Davis	Ground	Seattle	WA
Transcriptomic Analyses of Age-Related Changes in Muscle and Bone	Virginia Commonwealth University	Dr. Henry Donahue	Ground	Richmond	VA

3D Neural Microphysiological System	AxoSim Technologies	Dr. Michael Moore	Ground - Complete	New Orleans	LA
Longitudinal Assessment of Intracranial Pressure During Prolonged Spaceflight	Baylor College of Medicine	Dr. Clifford Dacso	Ground - Complete	Houston	TX
High Data Rate Polarization Modulated Laser Communication System	Belcan	Dr. Eric Wiswell	Ground - Complete	Huntsville	AL
Optimizing Jammable Granular Assemblies in a Microgravity Environment	Benevolent Technologies for Health	Jason Hill	Ground - Complete	Cambridge	MA
Microbead Fabrication using Rational Design Engineering	Bio-Techne	Dr. Brian Plouffe	Ground - Complete	Beverly	MA
Commercial Space-borne Hyperspectral Harmful Algal Bloom (HAB) Products	BioOptoSense, LLC	Dr. Ruhul Amin	Ground - Complete	Metairie	LA
Spacecraft-on-a-Chip Experiment Platform	Cornell University	Dr. Mason Peck	Ground - Complete	Ithaca	NY
Generation of Cardiomyocytes from Human Induced Pluripotent Stem Cells	Emory University	Dr. Chunhui Xu	Ground - Complete	Atlanta	GA
Testing TiSi2 Nanonet Based Lithium Ion Batteries for Safety in Outer Space	EnerLeap	Emily Fannon	Ground - Complete	Newton	MA
Architecture to Transfer Remote Sensing Algorithms from Research to Operations	HySpeed Computing	Dr. James Goodman	Ground - Complete	Miami	FL
Rodent Research-4 Validation Study	Indiana University	Dr. Melissa Kacena	Ground - Complete	Indianapolis	IN
Improving Astronaut Performance of National Lab Research Tasks	Juxtopia, LLC	Dr. Jayfus Doswell	Ground - Complete	Baltimore	MD
Unfolded Protein Response in Osteoporosis and Sarcopenia	Louisiana State University Health Sciences Center	Dr. Imran Mungrue	Ground - Complete	New Orleans	LA
Viral Infection Dynamics and Inhibition by the Vecoy Nanotechnology	Lovelace Respiratory Research Institute	Dr. Drew Cawthon	Ground - Complete	Albuquerque	NM

Great Lakes Specific HICO Water Quality Algorithms	Michigan Technological University	Dr. Robert Shuchman	Ground - Complete	Houghton	MI
Impact of Increased Venous Pressure on Cerebral Blood Flow Velocity Morphology	Neural Analytics	Dr. Robert Hamilton	Ground - Complete	Los Angeles	CA
Utilize ISS Energy Systems Data for Microgrid Design and Operation	Raja Systems	Nicholas Kurlas	Ground - Complete	Boston	MA
Reducing Signal Interruption from Cosmic Ray Background in Neutron Detectors	Silverside Detectors	Dr. Andrew Inglis	Ground - Complete	Boston	MA
Hyperspectral Mapping of Iron-bearing Minerals	Space Science Institute	Dr. William H. Farrand	Ground - Complete	Boulder	CO
National Design Challenge - 4 Talbot	Talbot Innovation Middle School	Benjamin Coleman	Ground - Complete	Fall River	MA
Examine Bone Tumor and Host Tissue Interactions Using Micro-Gravity Bioreactors	Texas A&M Health Science Center	Dr. Carl Gregory	Ground - Complete	College Station	TX
Combined Evaluation of Mouse Musculoskeletal Data	University of Colorado Boulder	Dr. Virginia Ferguson	Ground - Complete	Boulder	CO
Faraday Waves and Instability-Earth and Low G Experiments	University of Florida Board of Trustees	Dr. Ranga Narayanan	Ground - Complete	Gainesville	FL
Generation of Mesendoderm Stem Cell Progenitors in the ISS-National Laboratory	University of Houston	Dr. Robert Schwartz	Ground - Complete	Houston	TX
Hyperspectral Remote Sensing of Terrestrial Ecosystem Carbon Fluxes	University of Maryland Baltimore County	Dr. K. Fred Huemmrich	Ground - Complete	Baltimore	MD
Effects of Simulated Microgravity on Cardiac Stem Cells	University of Miami	Dr. Joshua Hare	Ground - Complete	Miami	FL
Microphysiological System for Studying Composite Skeletal Tissues	University of Pittsburgh	Dr. Rocky S. Tuan	Ground - Complete	Pittsburgh	PA

Identification of Harmful Algal Blooms	University of Toledo	Dr. Richard Becker	Ground - Complete	Toledo	OH
Field Scale, Aggregated Best Management Practice Verification and Monitoring	Upstream Tech	Marshall Moutenot	Ground - Complete	Alameda	CA
Tropical Cyclone Intensity Measurements from the ISS (CyMISS) 2015 Season	Visidyne, Inc.	Dr. Paul Joss	Ground - Complete	Burlington	MA
Axiom Space Partnership	Axiom Space, Inc.	Christian Maender	NA	Houston	TX
Bartolomeo External Platform Commercialization	AIRBUS DS Space Systems, Inc.	Kris Kuehnel	NA	Webster	TX
BioServe Commercial Partnership	BioServe Space Technologies	Stefanie Countryman	NA	Boulder	CO
Craig Commercial Partnership	Craig Technical Consulting, Inc	Carol Craig	NA	Merritt Island	FL
NanoRacks Commercial Projects	Nanoracks, LLC	Christopher Cummins	NA	Webster	TX
Redwire Partnership	Redwire Space, Inc.	Matthew Napoli	NA	Jacksonville	FL
Rhodium Scientific Partnership	Rhodium Scientific	Olivia Gamez Holzhaus	NA	San Antonio	TX
Slingshot Facility Partnership	SEOPS	Chad Brinkley	NA	Bastrop	TX
Space Tango Commercial Projects	Space Tango	Twyman Clements	NA	Lexington	KY
Techshot Partnership	Techshot, Inc.	Rich Boling	NA	Greenville	IN
Boeing Company Partnership	The Boeing Company - Houston	Scott Copeland	NA	Houston	TX
Rotation-Induced Characteristics of a Sphere	didas America, Inc.	Dr. Henry Hanson	Postflight	Portland	OR
Boost in Space	adidas America, Inc.	Dr. Henry Hanson	Postflight	Portland	OR

Genes in Space - 6	Amplyus LLC	David Li	Postflight	Cambridge	MA
Development of a Brain Organoid Model for Commercial Applications	Arthur C Clarke Center (UCSD)	Dr. Erik Viirre	Postflight	San Diego	CA
Microgravity as Disruptor of the 12-hour Circatidal Clock	Baylor College of Medicine	Dr. Brian York	Postflight	Houston	TX
Targeting the Roots of Cotton Sustainability	Board of Regents of the University of Wisconsin System	Dr. Simon Gilroy	Postflight	Madison	WI
Study of the Interactions between Flame and Surrounding Walls	Case Western Reserve University	Ya-Ting Liao	Postflight	Cleveland	OH
Effect of Environmental Stressors on Oral Biofilm Growth and Treatment	Colgate-Palmolive	Carlo Daep	Postflight	New York	NY
Unmasking Contact-line Mobility for Inertial Spreading using Drop Vibration	Cornell University	Dr. Susan Daniel	Postflight	Ithaca	NY
National Design Challenge - 1 Cristo Rey	Cristo Rey Jesuit College Preparatory of Houston	Fr. Brian Reedy	Postflight	Houston	TX
Droplet Formation Studies in Microgravity	Delta Faucet	Garry Marty	Postflight	Indianapolis	IN
Lyophilization in Microgravity (Reflight)	Eli Lilly and Company	Jeremy Hinds	Postflight	Indianapolis	IN
MISSE Variant 2 Exposure of Photovoltaic Cells on the ISS	Georgia Tech Applied Research Corporation	Dr. Jud Ready	Postflight	Atlanta	GA
Study of Lamborghini's Carbon Fiber Composites for Aerospace Applications	Houston Methodist Research Institute	Dr. Alessandro Grattoni	Postflight	Houston	TX
Remote Controlled Nanochannel Implant for Tunable Drug Delivery	Houston Methodist Research Institute	Dr. Alessandro Grattoni	Postflight	Houston	TX
Detached Melt and Vapor Growth of Indium Iodide	Illinois Institute of Technology	Dr. Aleksandar Ostrogorsky	Postflight	Chicago	IL
Cartilage-Bone-Synovium Microphysiological System	Massachusetts Institute of Technology	Dr. Al Grodzinsky	Postflight	Cambridge	MA

Grape Juice Fermentation in Microgravity aboard ISS	Michael David Winery, Inc.	Jeffrey Farthing	Postflight	Lodi	CA
Three-dimensional Microbial Mapping (3DMM) of ISS Environment	NASA Jet Propulsion Laboratory	Dr. Kasthuri Venkateswaran	Postflight	Pasadena	CA
Tissue Engineered Muscle as a Novel Platform to Study Sarcopenia	Palo Alto Veterans Research Institute	Dr. Ngan Huang	Postflight	Palo Alto	CA
Utilizing the MISSE Platform Materials Science in Space	Redwire Space, Inc.	Paul Shestople	Postflight	Jacksonville	FL
Industrial Crystallization Facility Expansion for ISS Utilization	Redwire Space, Inc.	Michael Snyder	Postflight	Jacksonville	FL
Influence of Gravity on Human Immune Function in Adults and the Elderly	Sanofi Pasteur US	Dr. Donald Drake	Postflight	Orlando	FL
TangoLab-1: Research Server for the ISS	Space Tango	Twyman Clements	Postflight	Lexington	KY
(Re-flight) Impact of Nanostructure Geometry on Photo-Thermal Evaporation	University of Notre Dame	Tengfei Luo	Postflight	Notre Dame	IN
Structure of Proximal and Distal Tubule Microphysiological Systems	University of Washington	Dr. Jonathan Himmelfarb	Postflight	Seattle	WA
Multipurpose Active Target Particle Telescope on the ISS	AIRBUS DS Space Systems, Inc.	Hans-Juergen Zachrau	Preflight	Webster	TX
Interfacial bioprocessing of pharmaceuticals via the Ring-Sheared Drop module	Arizona State University	Dr. Juan Lopez	Preflight	Tempe	AZ
Thermally Activated Directional Mobility of Vapor Bubbles	Auburn University	Sushil Bhavnani	Preflight	Auburn	AL
Innovative Paralysis Therapy Enabling Neuroregeneration	AXONIS Therapeutics, Inc.	Dr. Lisa McKerracher	Preflight	North Cambridge	MA
Neutron Crystallographic Studies of Human Acetylcholinesterase	Battelle Oak Ridge National Lab	Dr. Andrey Kovalevsky	Preflight	Oak Ridge	TN

Microgravity Crystal Growth of Photovoltaic Semiconductor Materials	Board of Trustees of the Leland Stanford Junior University	Dr. Debbie Senesky	Preflight	Stanford	CA
Space-production of Lightweight 3D Graphene Aerogels	Board of Trustees of the Leland Stanford Junior University	Dr. Debbie Senesky	Preflight	Stanford	CA
Effect of Microgravity on Drug Responses Using Engineered Heart Tissues	Board of Trustees of the Leland Stanford Junior University	Dr. Joseph Wu	Preflight	Stanford	CA
3D Bone Marrow Analog	Boise State University	Gunes Uzer	Preflight	Boise	ID
Unveiling the Biomechanical Principles of Embryonic Brain and Heart Torsion	Brigham and Women's Hospital	Dr. Zi Chen	Preflight	Boston	MA
Structure and Stability of Foams and Emulsions	City College of New York	Dr. Jing Fan	Preflight	New York	NY
Unlocking the Cotton Genome to Precision Genetics	Clemson University	Christopher Saski	Preflight	Clemson	SC
Microgravity Effects on Skin Aging and Health	Colgate-Palmolive	Laurence Du-Thumm	Preflight	New York	NY
Engineering Stem Cell-Derived Cardiac Microtissues	Emory University	Dr. Chunhui Xu	Preflight	Atlanta	GA
Effects of Microgravity on Human Physiology: Blood-Brain Barrier Chip	Emulate, Inc.	Dr. Chris Hinojosa	Preflight	Boston	MA
Encapsulate: Personalized Cancer Screening	Encapsulate LLC	Armin Rad	Preflight	Farmington	CT
Individual and Collective Behavior of Active Colloids in Microgravity	Florida International University	Dr. Alicia Boymelgreen	Preflight	Miami	FL
Fiber Optics Manufacturing in Space (FOMS)	FOMS, Inc.	Dr. Dmitry Starodubov	Preflight	San Diego	CA

Spectral Characterization of Novel Spacecraft Materials at LEO Environment	Georgia Tech Applied Research Corporation	Dr. Elena Plis	Preflight	Atlanta	GA
Convection-free Synthesis of 2D Nanomaterials	Guardion Technologies	Dan Esposito	Preflight	Boston	MA
BioChip Spacelab	HNu Photonics, LLC	Dr. Dan O'Connell	Preflight	Wailuku	HI
Influence of Microgravity on Neurogenesis	HNu Photonics, LLC	Dr. Caitlin O'Connell-Ridwell	Preflight	Wailuku	HI
Ionic Liquid CO2 Scrubber and Liquid Containment in Microgravity	Honeywell International	Phoebe Henson	Preflight	Glendale	AZ
Microphysiologic Model of Human Cardiovascular Stiffness-related Diseases	Icahn School of Medicine at Mount Sinai	Dr. Kevin Costa	Preflight	New York	NY
Photonic Integrated Circuits (PIC) Technology Space Flight Experiment	L3Harris Technologies	Dr. Arthur Paolella	Preflight	Palm Bay	FL
The Debris Impact Pad Materials Demonstrator (Resubmission)	Launchspace Technologies Corporation	Dr. Marshall H. Kaplan	Preflight	Boca Raton	FL
Thermophoresis in Quiescent Non-Newtonian Fluids for Bioseparations	Lehigh University	Dr. James Gilchrist	Preflight	Bethlehem	PA
AmpliRx: A Manufacturing Pharmaceutical Lightweight Instrument	MakerHealth	Anna Young	Preflight	Boston	MA
Active Deployment of First Aerospace Electronic Textile	Massachusetts Institute of Technology	Joseph Paradiso	Preflight	Cambridge	MA
Monoclonal Antibody Production and Stability in Microgravity	Medimmune Inc	Dr. Albert Ethan Schmelzer	Preflight	Gaithersburg	MD
Monoclonal Antibody Crystallization	Merck Sharp & Dohme Corp	Dr. Paul Reichert	Preflight	Kenilworth	NJ
Investigation of Key Signaling Cascades Involved in Tumorigenesis	MicroQuin	Scott Robinson	Preflight	Boston	MA

Crystallization on the Synchrony and Uniformity of an RNA Crystal Phase	National Cancer Institute	Dr. Yun-Xing Wang	Preflight	Bethesda	MD
Melanized Microbes for Multiple Uses in Space (MELSP)	Naval Research Laboratory	Dr. Zheng Wang	Preflight	Washington	DC
GOALI: Transients and Instabilities in Flow Boiling	New Jersey Institute of Technology	Boris Khusid	Preflight	Newark	NJ
Bimodal Colloidal Assembly, Coarsening and Failure	Northeastern University	Safa Jamali	Preflight	Boston	MA
X-Sat	Northrup Grumman - Cincinnati	Anthony Webb	Preflight	Cincinnati	OH
High Strain Composite Spiral Wrapped Parabolic Antenna Technology (HSC SWATH)	Opterus Research & Development	Thomas W. Murphey	Preflight	Loveland	CO
Fiber Optic Production	Physical Optics Corporation	Avinash Vasudevan	Preflight	Torrance	CA
Effects of Microgravity on Production of Fluoride-Based Optical Fibers	Redwire Space, Inc.	Michael Snyder	Preflight	Jacksonville	FL
GOALI: Transients and Instabilities in Flow Boiling and Condensation	Rensselaer Polytechnic Institute	Dr. Joel Plawsky	Preflight	Troy	NY
Constrained Vapor Bubbles of Ideal Mixtures	Rensselaer Polytechnic Institute	Dr. Joel Plawsky	Preflight	Troy	NY
Osteopromotive Bone Adhesive on Skeletal Stem Cells-Resubmission	RevBio	Giuseppe Intini	Preflight	Lowell	MA
Experimental Flight Qualification of iSSI	SkyCorp Incorporated	Dennis Wingo	Preflight	Los Gatos	CA
A New Paradigm for Explaining Catastrophic Post-Wildfire Mudflows	University of California, San Diego	Ingrid Tomac	Preflight	La Jolla	CA
ISS: Liver Tissue Engineering in Space	University of California, San Francisco	Dr. Tammy Chang	Preflight	San Francisco	CA
Tissue Engineered Liver Immune Chips in Microgravity	University of California, San Francisco	Dr. Tobias Deuse	Preflight	San Francisco	CA

Microgravity Model for Immunological Senescence on Tissue Stem Cells	University of California, San Francisco	Dr. Sonja Schrepfer	Preflight	San Francisco	CA
Manipulation of Multi-Phase Flow Using Light-Responsive Surfactants	University of California, Santa Barbara	Yangying Zhu	Preflight	Santa Barbara	CA
Wicking in Gel-Coated Tubes	University of California, Santa Barbara	Dr. Emilie Dressaire	Preflight	Santa Barbara	CA
Engineering Multiple-Compartment Cartilage Tissue Construct	University of Connecticut	Dr. Yupeng Chen	Preflight	Storrs	CT
Gravitational Effects on the Faraday Instability	University of Florida Board of Trustees	Dr. Ranga Narayanan	Preflight	Gainesville	FL
Electrical Stimulation of Human Myocytes in Microgravity	University of Florida Board of Trustees	Dr. Siobhan Malany	Preflight	Gainesville	FL
Cellular Mechanotransduction by Osteoblasts in Microgravity	University of Michigan	Dr. Allen Liu	Preflight	Ann Arbor	MI
Solidification of High-Quality Magnesium Alloys Under Microgravity Conditions	University of Pittsburgh	Dr. Prashant Kumta	Preflight	Pittsburgh	PA
Understanding the Gravity Effect on Flow Boiling	University of South Carolina	Dr. Chen Li	Preflight	Columbia	SC
Studying the Effects of Microgravity on 3D Cardiac Organoid Cultures	University of Texas El Paso	Dr. Binata Joddar	Preflight	El Paso	TX
Human iPSC-based 3D Microphysiological System for Modeling Cardiac Dysfunction	University of Washington	Dr. Deok-Ho Kim	Preflight	Seattle	WA
Electrically Conductive Ti3C2-SiOC and TiC-SiC Temperature Composites	Virginia Polytechnic Institute and State University	Dr. Peizhen (Kathy) Lu	Preflight	Blacksburg	VA
Spacecraft On-orbit Advanced Refueling and Storage (SOARS)	Zero-G Horizons Technologies, LLC	Deepak Sathyanarayan	Preflight	Daytona Beach	FL
Genes in Space Digital Interactives: A Virtual ISS National Lab Experience	Amplyus LLC	Dr. Sebastian Kraves	NA	Cambridge	MA

BCM-Dept. of Molecular & Cellular Biology OMICS Seed Grant (original)	Baylor College of Medicine	Dr. Clifford Dacso	NA	Houston	TX
Bigelow Expandable Activity Module (BEAM) Commercialization	Bigelow Space Operations, Inc.	Robert Bigelow	NA	North Las Vegas	NV
Providing Spherical Video Tours of ISS	Bradford Space	David Gump	NA	San Jose	CA
Screening and Batch Manufacture of Complex Biotherapeutics in Microgravity	Bristol Myers Squibb	Dr. Robert Garmise	NA	Lawrence Township	NJ
National Design Challenge - 4 Collins	Collins Middle School	Matthew Weaver	NA	Salem	MA
Individual and Collective Behavior of Active Colloids-Boymelgreen collaborator	Colorado Mesa University	Dr. Jarrod Schiffbauer	NA	Grand Junction	CO
Advancing SpaceFiber Manufacturing in Microgravity Onboard the ISS	Flawless Photonics Inc.	Dr. Michael Vestel	NA	Mountain View	CA
Data Transmissions from the ISS: A series of mathematical tasks for K12	Georgia Tech Applied Research Corporation	Tyler Kinner	NA	Atlanta	GA
Evaluations of Bacteriorhodopsin Structural and Functional Stability	LambdaVision	Dr. Nicole Wagner	NA	Farmington	CT
Layer-by-Layer Deposition of a Protein-based Artificial Retina in Microgravity	LambdaVision	Dr. Nicole Wagner	NA	Farmington	CT
Upgrading Zero Robotics to enable accessible space robotics with Astrobee	Massachusetts Institute of Technology	Dr. Danielle Wood	NA	Cambridge	MA
STEM: Next Generation Zero Robotics Educational Programs with Astrobee	Massachusetts Institute of Technology	Dr. Danielle Wood	NA	Cambridge	MA
Barbie Dream Gap Program	Mattel	Shelby Powell	NA	El Segundo	CA
Fiber Optics Production 3 (FOP3)	Mercury Mission Systems, LLC	Avinash Vasudevan	NA	Torrance	CA
MSG Sphere Space Exploration	MSG Entertainment Group, LLC	Andrew Shulkind	NA	New York	NY

Human Brain Organoid Models for Neurodegenerative Disease	National Stem Cell Foundation	Paula Grisanti	NA	Louisville	KY
Development of an Automated MPS Culturing and Imaging Platform	Nikon Instruments Inc.	Dr. Jeffery Bylund	NA	Melville	NY
Worms in Space 2.0	Orion's Quest	Pete Lawrie	NA	Livonia	MI
Drug Screening of Engineered Skeletal Muscle	Palo Alto Veterans Research Institute	Dr. Ngan Huang	NA	Palo Alto	CA
ELVIS (Extant Life Volumetric Imaging System)	Portland State University	Dr. Jay Nadeau	NA	Portland	OR
Using the ISS to Evaluate Antibiotic Efficacy and Resistance (AES-1)	Regents of the University of Colorado	Dr. David Klaus	NA	Boulder	CO
Chip-Based in vitro Modeling of Endocortical Microenvironment	Regents of the University of Minnesota	Dr. Bruce Hammer	NA	Minneapolis	MN
Advanced STARCS Technology for Resilience ISS Demonstration (ASTRID)	Sandia National Laboratories	James Meub	NA	Albuquerque	NM
Sierra Nevada Partnership	Sierra Nevada Corporation	Christopher Allison	NA	Sparks	NV
SpaceLink-ISS Connectivity End-to-End Demonstration (SLICED)	SpaceLink Corporation	Rabindra Singh	NA	McLean	VA
STEM to the STARS (Students Taking Aerospace Research Studies)	Stewart Middle Magnet School	Baretta Wilson	NA	Tampa	FL
Orbiting the Alphabet: An Adventure on the International Space Station	The Children?s Museum of Indianapolis	Becky Wolfe	NA	Indianapolis	IN
Negative Thermal Expansion ALLVAR Alloys in Space	Thermal Expansion Solutions, Inc, DBA ALLVAR	Dr. James A. Monroe	NA	College Station	TX
STFS Blast Off SciGirls: Engaging Young Learners in Science and Literacy	Twin Cities PBS	Rita Karl	NA	Saint Paul	MN
Rodent Research - 4 (Wound Healing) Post Flight Analysis	United States Army Medical Research and Materiel Command	Dr. Rasha Hammamieh	NA	Fort Detrick	MD
4-H Multi-State Space Exploration Consortium	University of Arizona	Gerardo U. Lopez	NA	Tucson	AZ

Effect of Unloading on Extracellular Matrix Remodeling	University of Colorado Boulder	Dr. Sarah Calve	NA	Boulder	CO
Online Higher Ed Spaceflight Experiments Mentoring Program	University of Maryland College Park	Daniel Serrano	NA	College Park	MD
Flight Tech Demo of Docking / Undocking CubeSats Inside ISS	University of Nevada, Las Vegas	Ke-Xun Sun	NA	Las Vegas	NV
Portable Spectroscopic Scanning Electron Microscope On ISS	Voxa	Dr. Christopher Own	NA	Seattle	WA
Flame Spread Response to Non-steady Airflow	Worchester Polytechnic Institute	Dr. James L. Urban	NA	Worcester	MA

G. FY21 Metrics

	ACTUAL FY21	TARGET FY21
External Funding from Other Government Agencies Supporting Fundamental Science Users	$4M	$10M
Fundamental Science Payloads Delivered	21	10
New Roadmaps Developed for In-Space Production Applications	3	3
Funds Raised Postflight by Startup Companies with Flight Projects	$522.9M	$15M
Technology Demonstration Payloads Delivered	16	10
External Funding from Other Government Agencies Supporting Technology Demonstration or Development Users	N/A	$20M
Umbrella Agreements Signed with All Current Commercial Facility Managers	100%	100%
Pioneer Allocation Resource Utilization	N/A	100%
Individuals Participating in ISS National Lab STEM Programs and STEM Grants Projects	3,721,815	1.5M
Total Audience of ISS National Lab Online Education Products	7,791,883	3.5M
Crew Time (actual vs. increment pair – 3 months allocation)	76%	100%
Upmass	81%	100%

FULL ISS NATIONAL LAB UTILIZATION AND OPERATIONS TRACKING METRICS

	ACTUAL FY21
Commercial Service Provider Utilization Payloads Delivered	41
Education and Outreach Payloads Delivered	6
In-Space Production Applications Payloads Delivered	4
Total ISS National Lab Payloads Delivered	88
New ISS National Lab Proposals Received	185
New ISS National Lab Projects Selected	42
ISS National Lab Return Users	15
ISS National Lab New Users	27
Commercial	17
Academic/Nonprofit	23
Government Agency	2
Number of Days from Solicitation Close to Announcement	72
New Commercial In-Orbit Facilities Added	1
Commercial In-Orbit Facilities (cumulative)	18
Upmass	81%

Cold Stowage	67%
Big Bags	63%
Powered Lockers	22%
Commercial Facilities	50%
JEM Airlock	100%
Life Science Glovebox	50%
Microgravity Science Glovebox	90%
Peer-Reviewed Scientific Journal Publications from Projects	27
Funds Raised Post Award by Startup Companies with Flight Projects	$193M

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