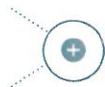


## FY15 Q2 REPORT

Quarterly Report for the Period January 1st – March 31st, 2015

CENTER FOR THE ADVANCEMENT OF SCIENCE IN SPACE (CASSIS)





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## EXECUTIVE SUMMARY

CASIS has continued to make great strides toward increasing valuable utilization of the International Space Station (ISS). In the second quarter (Q2) of FY15, two CASIS-sponsored projects launched to the ISS, three projects returned, and four new projects were selected for CASIS sponsorship.

The research and development portfolio of the ISS National Laboratory has undergone significant evolution. The breadth of the research supported by CASIS spans across numerous scientific disciplines, including life sciences, physical sciences, Earth observation, and technology development. In previous years, the R&D portfolio was predominated with life sciences and a large majority of academic users while we continued to educate the commercial user community on the benefits of our unique laboratory. We are pleased to report that we have diversified our portfolio and 60 percent of CASIS-sponsored research and development projects are from a wide range of commercial companies.

CASIS continues to facilitate research from a multitude of users, which demonstrates growing interest in the research capabilities of the space station, from pharmaceutical juggernauts like Eli Lilly, Novartis, and Merck to innovative startups and even other government agencies like the Department of Defense and the National Institutes of Health. We plan to support follow-on flights for Merck and Novartis in the upcoming quarter — a sign that these repeat customers also see value in the ISS National Lab.

A major focus of the quarter was continuing to leverage outside funding to enable ISS utilization:

- At the strategic level, CASIS ramped up efforts to execute "Sponsored Programs," or calls for ISS research proposals that are financially supported by a sponsor organization focused on solving a specific terrestrial problem. In Q2, our fund development team submitted formal requests to several organizations proposing joint sponsorship of research and education programs.
- At the collaboration level, the Boeing Company agreed to partner with CASIS again to support flight projects from startup companies involved in the MassChallenge business accelerator competition. Additionally, in an exciting new partnership with the Chicago Boy Scouts of America, CASIS will expand its original National Design Challenge pilot program to the Chicago Area, with the agreement to expand the education program nationwide in following years, sustained by the Boy Scouts and Exploring Scouts organizations.
- At the outreach level, our business development team conducted numerous meetings with several large commercial entities interested in funding commercial research and technology development on the ISS National Lab.

A significant outreach win this quarter that promises to attract additional attention to ISS utilization was securing Elon Musk to serve as a powerful keynote

speaker for CASIS' annual conference in July, at which we will aggressively promote proposal development by new users.

In the Education arena, CASIS hosted a two-day STEM Summit attended by dozens of educational thought leaders from across the country, kick starting a significant effort this quarter to broaden and deepen our STEM mission vision and impact. Additionally, the CASIS-supported education program Zero Robotics held its final competition, which included live interaction with astronauts on orbit. The program reached thousands of high school students across the country and the world.

Finally, our broader initiatives gained significant momentum this quarter. The Good Health campaign is synergistically concurrent with the start of NASA's one-year crew mission, including NASA's Twins Study, which is a pathfinder for the systems biology approaches underlying many Good Health initiatives. A committee of NASA and CASIS representatives, as well as leaders in the field of omics analysis, was formed in Q2 and is defining the trajectory of Good Health toward the benefit of the multi-institutional stakeholders. The Good Earth campaign gained traction in both the commercial and government sectors as our team facilitated interest and collaboration in multiple areas. UNITAR/UNOSAT hopes to soon secure ~\$3 million in funding to seed an initial technology demonstration for the campaign.

The following report provides detail on the above successes, includes quarterly organizational metrics and projected milestones. It also illustrates progress toward the key CASIS goals to create innovation cycles, utilize the ISS for developing new capabilities, promote the value of the ISS National Lab to the nation, and establish the lab as a platform for education initiatives.

## RESEARCH AND TECHNOLOGY DEVELOPMENT: ESTABLISH INNOVATION CYCLES & UTILIZE THE ISS FOR DEVELOPING NEW CAPABILITIES

Maintenance and expansion of a diverse research and technology portfolio onboard the ISS National Lab involves multiple complementary and parallel efforts to define priority R&D areas, encourage interest in these areas, and engage potential investigators in the key sectors of government, commercial industry, and academia. This involves focused research and development campaigns that will support multiple projects within specific scientific themes, issuance of solicitations for proposals in key areas, and targeted outreach to the new-to-space community, particularly institutions with respected and highly successful R&D departments. Much progress was made in these portfolio development activities within Q2.

### Campaign Good Earth

During Q2, there was significant traction made toward achieving the FY15 milestones for Campaign Good Earth — a large-scale collaborative campaign focused on maximizing ISS Earth observation capabilities for Earth benefit.

FY15 milestones for Good Earth include the following:

1. Coordinate the vision with a commercial company who has an existing agreement with NASA to place a pointing platform and sensors on the ISS.
2. Facilitate a partnership with at least one global technology partner to supply memory, central processing units, and ground search capability.
3. Define a collaborative relationship with a NASA center to serve as a technology and applications development Center of Excellence.
4. Engage multiple entities to fund/supply the initial sensors.

Pursuant to these milestones, CASIS held discussions with prospective commercial partners to support Good Earth. CASIS met with Google Earth and Google X to discuss data hosting and supporting technologies necessary to advance Good Earth. Google X expressed interest in exploring future projects in data layering (fusion) and high-bandwidth communications — two technologies of interest. Google Earth was interested in the campaign conceptually but expressed reservations about engaging before sensor development had begun. CASIS will re-engage with Google Earth once sensor delivery to ISS is three to six months away.

Additionally, CASIS is fully engaged with UNITAR/UNOSAT to assist in efforts to obtain test case and sample product funding. CASIS delivered a letter of support to UNOSAT in anticipation of their proposal to obtain up to \$3 million in support of Good Earth. Finally, CASIS continued engagement with the Marshall Space Flight Center to provide research-to-applications expertise and to solicit the center's support along with UNOSAT to develop sample products and test cases to assist in the marketing of Good Earth.

## Campaign Good Health

Continuing our mission-oriented initiative to use research on the ISS to improve human health on Earth — particularly the prevention, identification, and treatment of disease — CASIS hosted a one-day workshop in January 2015 with many key stakeholders in the space science community who may benefit from Campaign Good Health. At the workshop, several CASIS staff and board members joined representatives from NASA Headquarters, the Human Research Program (HRP), the National Lab Office, the Program Science Office, and the Space Life and Physical Sciences Research and Applications Division (SLPS). Also present were representatives from the CASIS sponsored “omics collaborative” at Baylor College of Medicine and the chief scientist of the National Biomedical Space Research Institute (NSBRI).

Overall, there were positive sentiments regarding multi-institutional collaboration on an overarching “signature” initiative (championed by CASIS) that would translate observations in microgravity to human health benefits on Earth. This initiative would leverage an array of microgravity-based data/resources from human and model organisms with an aim of using systems approaches to understand the mechanisms that underpin the transition from wellness to disease so that interventions can be designed to preserve health on Earth. Future studies under the Good Health Campaign, which will maximize use of advanced integrated systems biology analyses, will benefit all stakeholders:

- SLPS’s GeneLab database will be augmented by results of Good Health investigations.
- HRP/NSBRI can glean information relevant to astronaut health and wellness, including a broader dataset to complement findings from the ongoing Astro-Omics study.
- CASIS may (1) obtain results that will improve human health on Earth and (2) attract more commercial interest in ISS utilization if it can be demonstrated through use of omics tools and an integrated systems biology approach that microgravity mimics accelerated disease states .

As topics were discussed at the January workshop, the group formulated action items to begin defining specific Good Health objectives. Many of these action items were completed during Q2.

- A Good Health Steering Committee was formed (the preliminary meeting was held February 9 and the formal kickoff call was March 10), consisting of members from CASIS, HRP, NSBRI, SLPS, and outside organizations. The main deliverables of this committee (scheduled for completion in Q3) are:
  1. A white paper outlining the specific objectives of Good Health
  2. A list of recommended individuals to serve on a Science Definition Team, which will drive the development of specific plans, research protocols, and planned analyses for the experiments performed and the data collected as part of Good Health
- During the February 9 meeting, the following topic areas were defined. For these areas, CASIS will convene subject matter experts from outside the space community to discuss the most ideal model organisms, data collection, and data analyses to truly inform cutting-edge research in the respective biomedical fields. Planning is underway for

CASIS to co-host a workshop with HRP during which some of these focus groups will be held. Topics include: musculoskeletal effects; radiation effects, particularly on the nervous system; microbiome alterations; immune dysfunction; cardiovascular deconditioning; intracranial hypertension; nutrition and metabolomics; pharmacology and pharmacokinetics; cell differentiation and cancer; and aging.

### Foundational Projects

CASIS selected four flight projects during Q2: one originating from the MassChallenge accelerator competition, one originating from the recently awarded Materials Science Request for Proposals (RFP), and two others from experienced space investigators looking to further their research toward downstream Earth applications. The subject areas span both the life and physical sciences, including plant science, therapeutic development and testing, and technology development for next-generation electronics and ISS flight hardware. For more details, see the "Q2 FY15 Project Pipeline" table on page 14 of this report.

During the quarterly meeting of the CASIS Science and Technology Advisory Panel, CASIS staff discussed the desire to leverage outside funding for CASIS-issued RFPs via partially or fully "sponsored" RFPs or "programs" — in which projects awarded in response to CASIS RFPs are supported by some level of outside funding. The next planned RFP in Fluid Mechanics aims to conform to this strategy. Group discussion focused on whether and how to re-vector priority areas and objectives to both fit within this paradigm and also maximize support of the CASIS Good Health and Good Earth Campaigns. Also discussed were methods to improve RFP response rate and ways to continue to interact with NASA initiatives that complement CASIS research objectives (e.g., GeneLab, Astro-Omics, and MaterialsLab).

### Operational Logistics Update

During Q2 FY15, one Commercial Resupply (CRS) mission successfully launched to and returned from the ISS. On January 10, 2015 the SpaceX-5 Dragon capsule safely delivered two CASIS payloads: the *T-Cell Activation in Aging* experiment, led by Dr. Millie Hughes-Fulford from the Northern California Institute for Research and Education, and the *Role of Gravity and Geomagnetic Field in Flatworm Regeneration* experiment, a joint research project being conducted by Kentucky Space, Inc. and Tufts University. On February 12, 2015, the Dragon capsule splashed down in the Pacific Ocean carrying the two CASIS-sponsored payloads noted above and the second of two planned payloads in the *Optimization of Protein Crystal Growth for Determination of Enzyme Mechanisms Through Advanced Diffraction Techniques* experiment led by Dr. Constance Schall from the University of Toledo.

CASIS remains within Advancing Research Knowledge-3 (ARK3) in Q2, as ARK3 encompasses all of the CASIS-sponsored payloads slated to launch in the calendar year 2015. The payload development and integration activities associated with payloads scheduled to fly to the ISS during ARK3 correspond to NASA Increment 41/42 (September 2014 – March 2015) and Increment 43/44 (March 2015 – September 2016). The transition

between these ISS Mission Increments occurred in Q2: Increment 42 ended mid-March and ushered in the beginning of Increment 43, which will feature the start of NASA's "one-year crew mission."

## BUSINESS DEVELOPMENT AND PARTNERSHIPS: EXPAND THE Casis NETWORK, LEVERAGE FUNDING, & DRIVE COMMERCIAL UTILIZATION

During Q2, CASIS conducted four major project development sessions with key accounts (Smuckers, Nemak, Google, and Kaiser Permanente). Additionally, CASIS supported NASA's Destination Station program with a weeklong session in the Bay area, during which seminars were conducted with industry representatives, and a research symposium was held at Stanford University. Largely resultant from targeted business development activities like these, potential investigators worked with CASIS to develop and submit 11 proposals for consideration during Q2. To continue expanding these efforts, CASIS has hired an additional business development manager to expand our presence in the California R&D markets.

Also during Q2, relationships with major innovation partners, including MassChallenge and the Rice Business Plan Competition, were announced and kicked off for 2015. This included a commitment from Boeing to partner with CASIS in MassChallenge again this year to support flight projects on the ISS National Lab — an example of CASIS success in expanding our network by leveraging external funding (in this case, a \$250,000 contribution from Boeing).

In an initiative to enable future Sponsored Research Program collaborations, CASIS continues to formally request external funding from organizations dedicated to R&D in specific areas. Sponsored Research Programs involve CASIS solicitation of a series of related projects that are within both the CASIS mission and the external organization's area of interest. As part of each currently proposed Sponsored Research Program (to be funded fully or in part by the sponsor organization), CASIS will commit to a multi-faceted campaign designed to gather formal project ideas from the broad scientific community, support and execute a subset of qualified projects vetted by both CASIS and the sponsor organization, and promote these projects and resultant outcomes. Each request to an outside organization is tailored to appeal to the values promoted by the funding institution and may be individualized according to the organization's desired level of administrative coordination.

In Q2, two formal submissions to external organizations proposed ideas for Sponsored Research Program collaborations — one grant proposal was submitted to an external organization requested funding to support a CASIS STEM education initiative ; and a crowd funding

campaign was launched to support an additional CASIS STEM education program.

## STEM EDUCATION:

### ESTABLISH THE ISS AS THE LEADING LABORATORY AND ENVIRONMENT FOR STEM EDUCATION

CASIS recognizes the importance of substantive STEM education programs and the value of multi-organizational collaboration to sustain educational programming. As a result of our continued focus on STEM education, CASIS hosted an interactive workshop attended by thought leaders, educational programming strategists, and leading STEM advocates from across the country. This workshop provided valuable insight to help CASIS bolster its current educational programming and opened doors for new partnership opportunities.

In Q2, CASIS amplified efforts to expand STEM education outreach through our core programs as well as a number of programs that we support. CASIS announced a major partnership with the Chicago Boy Scouts of America and Exploring Scouts programs to conduct the Space Station National Design Challenge (NDC) in the Chicago Area. This program will allow student teams (with both male and female participants) the opportunity to propose, design, and execute research experiments to be sent to the ISS. This pilot program in Chicago will pave the way for a multi-year national initiative that will be sustained by the Boy Scouts of America and Exploring Scouts organizations.

Furthermore, student teams participating in the original NDC pilot programs by CASIS — NDC-Houston and NDC-Denver — are preparing their experiments for upcoming flights in Q3. Preflight activities include finalizing testing, payload integration, and completing NASA safety reviews. There are a total of 300 students and educators involved in NDC-Houston and NDC-Denver. Additionally, CASIS hosted three CASIS Academy Live events during this quarter, which featured presentations from CASIS-sponsored investigators and hands-on activities for student participants.

There was continued progress in each of the STEM education programs that CASIS supports. Most notably, Zero Robotics held the finals competition for its high school program. Approximately 2,020 high school students participated in the national event held at Massachusetts Institute of Technology, in parallel with events at the European Space Agency and the Russian Federal Space Agency, while astronauts onboard the ISS supported the event by running the finalists' codes to manipulate SPHERES satellites. In addition, the eighth mission of the Student Spaceflight Experiments Program (SSEP) began in February 2015. SSEP gives students the opportunity to design and propose authentic flight experiments for the ISS. There are 14

participating communities: 11 in the U.S. and three in Canada.

## OUTREACH:

### PROMOTE THE VALUE OF THE ISS NATIONAL LAB TO THE NATION

During Q2, CASIS capitalized on opportunities to expand outreach within targeted areas and made strides in significantly expanding the awareness and significance of its annual conference. Pursuant to the July 2014 NASA/CASIS decision that CASIS would expand its leadership and marketing role in the International Space Station Research & Development Conference (ISS R&D, July 7-9, 2015 in Boston, MA: [www.issconference.org](http://www.issconference.org)), CASIS has worked to transform the event into the premier gathering of the entire ISS community. In a major Q2 success toward this goal, CASIS announced in January 2015 that Elon Musk, world-renowned innovator and president of SpaceX and Tesla Motors, would serve as a keynote speaker for ISS R&D, signifying a major milestone for attracting event attendees from new communities. Furthermore, CASIS has leveraged this broadened awareness to expand and diversify event sponsorships at the conference, enabling future growth and investment.

CASIS attended various conferences and events in Q2, in particular maximizing its presence at the 2015 American Association for the Advancement of Science (AAAS) Annual meeting — the world's largest general science convention — by participating in the general meeting and the concurrent AAAS Family Science Days STEM expo. Representatives from NASA Ames Research Center, Made In Space, and Techshot, Inc. enhanced CASIS presence at the general meeting by displaying hardware, lending technical expertise, and supporting key messaging regarding ISS National Lab research opportunities. CASIS leveraged this conference as an opportunity to conduct outreach and business development meetings while also interfacing with the broad scientific community to learn about new developments within various scientific fields.



## FINANCIALS

### BUSINESS STATUS REPORT

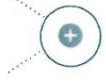
JAN 1-MAR 31, 2015	ACTUALS Q2 2015	BUDGET Q2 2015	VARIANCE	ACTUAL YTD 2015	BUDGET YTD 2015	VARIANCE
Direct Labor	\$1,202,780	\$1,574,586	\$371,805	\$2,397,571	\$2,923,181	\$525,610
Subcontracts	\$427,096	\$869,041	\$441,945	\$756,557	\$1,633,694	\$877,137
Permanent Equipment > \$5k	\$22,117	\$66,500	\$44,384	\$113,535	\$86,500	(\$27,035)
Expendable Supplies & Equipment	\$56,186	\$64,585	\$8,398	\$91,356	\$126,830	\$35,474
Travel	\$180,373	\$242,918	\$62,546	\$390,364	\$486,606	\$96,242
Grants Awarded	\$1,335,313	\$2,391,943	\$1,056,629	\$2,280,564	\$4,891,744	\$2,611,180
Other Direct Costs	\$533,140	\$432,523	(\$100,617)	\$900,432	\$797,999	(\$102,433)

### BREAKOUT OF COOPERATIVE AGREEMENT FUNDING

	Q1 FY15	Q2 FY15	Q3 FY15	Q4 FY15
Direct	49%	46%		
Indirect	21%	19%		
Grants	30%	35%		

### BREAKOUT OF CASIS GRANTS

	Q1 FY15	Q2 FY15	Q3 FY15	Q4 FY15
Private/Commercial	\$564,063	\$764,972		
Academic	\$297,400	\$439,100		
Other Government	\$0	\$0		
Mission Based Costs	\$83,787	\$131,242		



## METRICS

In addition to the quarterly metrics displayed on the following pages, CASIS will be tracking several metrics on an annual basis and reporting them in our annual report. These metrics include:

- Leverage of CASIS Seed Funding — CASIS will measure the ratio of external contribution to project cost for all proposals versus CASIS seed funding.
- Operational Efficiency — CASIS will track the efficiency of reviews and operations by measuring the elapsed time from inquiry to award to flight.

Additionally, as results come back and are made available, CASIS will track:

- Contributions to Scientific Knowledge — CASIS will track the publishing of results in scientific journals to demonstrate the importance of the scientific investigations being conducted through CASIS.
- Commercial Impact — CASIS will report all products or services created that derived from National Lab research to track tangible impact to markets.

### SCIENCE PORTFOLIO AND OPERATIONS METRICS BY QUARTER

METRIC	Q1 FY15	Q2 FY15	Q3 FY15	Q4 FY15
CASIS RFPs/RFIs issued	2	0		
Responses received from RFPs and RFIs (Including Step-1 and Step-2 proposals)	17	1		
Project proposals awarded from CASIS grant calls (solicited)	6	1		
Project proposals received (unsolicited)	6	11		
Project proposals awarded (unsolicited)	10	3		
Return customers: Proposals received from CASIS customers pursuing a re-flight	1	1		
New customers: Projects awarded to principal investigators that have never flown	11	1		
Flight projects manifested	33	12		
Flight projects delivered to the ISS NL	0	8		

### STEM EDUCATION AND OUTREACH METRICS BY QUARTER

METRIC	Q1 FY15	Q2 FY15	Q3 FY15	Q4 FY15
STEM projects executed	5	12		
Total reach of STEM projects	7,265	7,412		
CASIS outreach events				
Trade shows	6	2		

<b>Print advertisements</b>	<b>0</b>	<b>0</b>	
<b>Total media impact</b>			
<b>You Tube posts</b>	<b>2</b>	<b>2</b>	
-Views (cumulative)	10,744	255,875	
<b>Twitter posts</b>	<b>166</b>	<b>235</b>	
-Followers (cumulative)	59,058	69,596	
<b>Facebook posts</b>	<b>123</b>	<b>175</b>	
-Likes (cumulative)	4,129	4,622	
<b>Website visitors</b>	<b>49,254</b>	<b>49,715</b>	
<b>News releases</b>	<b>10</b>	<b>5</b>	
<b>Media events</b>	<b>9</b>	<b>3</b>	
<b>News mentions (clips, blogs)</b>	<b>1,379</b>	<b>733</b>	
<b>Twitter mentions</b>	<b>620</b>	<b>957</b>	

### HISTORICAL ISS NATIONAL LAB USAGE

During increment planning, NASA sets aside certain resources dedicated to ISS utilization for all partners. These resources include upmass, downmass, and crew time. The ISS National Lab is granted half of NASA's 79-percent share of the available resources. Upmass and downmass vary based on the number of cargo vehicles and their capabilities. Crew time is based on an average of 35 hrs/week available for ISS utilization. Other resources such as power and cold stowage are not considered in this metric due to their shared nature.

Increment	Uppmass (kg)			Downmass (kg)			Crewtime (hrs)		
	Allocation	Actuals	Usage	Allocation	Actuals	Usage	Allocation	Request	Usage
Inc 37/38	287	334.7	117%	6	7.9	132%	427	95	22%
Inc 39/40	766	389.1	51%	244	197.8	81%	386	96.2	25%
Inc 41/42	539	716	133%	225	705.5	314%	346	178.9	52%
Inc 43/44 (projected)	1202	1215	101%	537	359	67%	229	224	98%

(Data through 3/31/15)

## Q2 FY15 PROJECT PIPELINE

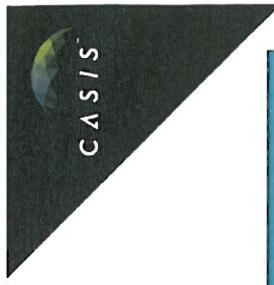
PROJECTS AWARDED IN Q2 FY15					PROJECT DESCRIPTION
PROJECT TITLE	PRINCIPAL INVESTIGATOR (PI)	ORGANIZATION	LOCATION		
Capillary-Driven Microfluidics in Space	Dr. Luc Gervais	1Drop Diagnostics	Boston, MA		Development of a portable, laboratory quality, affordable medical diagnostics device involving microfluidic chips that can automatically detect multiple biomarkers after the addition of merely one drop of sample —triggering a cascade of events powered by capillary forces. By examining the microfluidics in microgravity, greater understanding of critical elements may be gained, enabling improved design of microfluidic chips. Direct benefits on Earth include potential next-generation medical diagnostics that save time and costs to patients and practitioners.
Molecules Produced in Microgravity from the Chernobyl Nuclear Accident	Dr. Kasthuri Venkateswaran	Jet Propulsion Laboratory/Caltech	Pasadena, CA		Fungal strains isolated from the Chernobyl nuclear power plant accident will be screened under the stressful conditions of spaceflight for the secretion of novel natural products that could be beneficial for drug discovery and agricultural applications. The capability of fungal organisms to produce bioactive secondary metabolites is well known, previously leading to investigations of natural products for applications in human medicine (e.g., antibiotics and anticancer drugs) and agriculture (e.g., antifungal agents to protect economically important crops). The 16 fungal strains in this experiment may produce never-before-isolated drug candidates and antifungal agents.
Characterizing Arabidopsis Root Attractions (CARA) Grant Extension Request	Dr. Anna-Lisa Paul	University of Florida	Gainesville, FL		This experiment is a follow-on to a previous CASSIS experiment that analyzed data from plant seedlings grown on nutrient agar Petri plates and exposed to light or dark on the ISS, with a specific focus on how roots know which direction to grow when gravity is absent. The first goal of the follow-on project is to expand the data analyses of the existing samples to include full transcriptome arrays appropriate for contribution to Genelab. The second goal is to conduct an extensive additional imaging experiment on the ISS.
Multilab: Research Server on the ISS	Twyman Clements	Space Tango Corp.	Lexington, KY		Space Tango will develop a facility that will serve as a multi-use general-purpose research platform to be built for commercial, academic, and government use. The Multilab EXPRESS Rack Locker facility will be permanently installed on the ISS and will give users the ability to request data from their experiments as well as upload new parameters on a regular basis, which will significantly increase investigators' interactions with their research on the ISS.

GROUND PROJECTS				STATUS UPDATE
PROJECT TITLE	PRINCIPAL INVESTIGATOR (PI)	ORGANIZATION		
Longitudinal Assessment of Infracranial Pressure During Prolonged Spaceflight	Dr. Clifford Dasco	Baylor College of Medicine	(b) (4)	
Optimizing Jammable Granular Assemblies in a Microgravity Environment	Jason Hill	Benevolent Technologies for Health	(b) (4)	
Spacecraft-on-a-Chip Experiment Platform	Dr. Mason Peck	Cornell University	This project was kicked off in January 2015, and there are no significant updates to report at this time.	
Generation of Cardiomyocytes from Human iPS Cell-derived Cardiac Progenitors	Dr. Chunhui Xu	Emory University School of Medicine	(b) (4)	
Improving Astronaut Performance of National Lab Research Tasks	Dr. Jayfus Doswell	Juxtapia, LLC	(b) (4)	
Great Lakes Specific HICO Water Quality Algorithms	Dr. Robert Shuchman	Michigan Technological University	HICO experienced a fatal malfunction beginning in early November 2014 and is now considered to be permanently out of commission. The PI is requesting archived HICO imagery that may be used to support science objectives.	
Impact of Increased Venous Pressure on Cerebral Blood Flow Velocity Morphology	Dr. Robert Hamilton	Neural Analytics	The NASA Human Research Program (HRP) has accepted the PI's request to share transcranial Doppler (TCD) and EKG data for the ISS Ocular Health study. The agreement will include data sharing that includes all pre-, in-, and post flight sessions. The final report is pending.	
Microbead Fabrication using Rational Design Engineering	Dr. Brian Plouffe	Quad Technologies	The final report for this ground project is expected in Q3FY15.	

Hyperspectral Mapping of Iron-bearing Minerals	Dr. William H. Farrand	Space Science Institute	HICO experienced a fatal malfunction beginning in early November 2014 and is now considered to be permanently out of commission. The requested HICO collection of data did not take place prior to the malfunction. The PI is searching for data sets from other sensors to be able to carry out some of the proposed work on Australian acid saline lakes such as Lake Tyrell.
Examine Bone Tumor and Host Tissue Interactions Using Micro-Gravity Bioreactors	Dr. Carl Gregory	Texas A&M Health Science Center	(b) (4) expected in Q3FY15.
Commercial space-borne hyperspectral harmful algal bloom (HAB) products	Dr. Ruhul Amin	United States Naval Research Laboratory	(b) (4)
Generation of Mesendoderm Stem Cell Progenitors in the ISS-National Laboratory	Dr. Robert Schwartz	University of Houston	(b) (4)
Hyperspectral remote sensing of terrestrial ecosystem carbon fluxes	Dr. Fred Huemmrich	University of Maryland Baltimore County	HICO experienced a fatal malfunction beginning in early November 2014 and is now considered to be permanently out of commission. The PI is requesting archived HICO imagery that may be used to support science objectives. (b) (4)
HICO Identification of Harmful Algal Blooms	Dr. Richard Becker	University of Toledo	HICO experienced a fatal malfunction beginning in early November 2014 and is now considered to be permanently out of commission. The PI is requesting archived HICO imagery that may be used to support science objectives.
Viral infection dynamics and inhibition by the Vecoy nanotechnology	Erez Livneh	Vecoy Nanomedicines	(b) (4)

IN PREFLIGHT DEVELOPMENT				LAUNCH VEHICLE/DATE
PROJECT TITLE	PRINCIPAL INVESTIGATOR (PI)	ORGANIZATION		
Capillary-Driven Microfluidics in Space	Dr. Luc Gervais	1Drop Diagnostics	TBD	
Corrosion Inhibitor Exposed to the Extreme Environments in Space	Lauren Thompson	A-76 Technologies, LLC	TBD	
Materials Testing: The Evaluation of Gumstix Modules in Low Earth Orbit	Dr. Kathleen Morse	Advanced Materials Applications, LLC	SpaceX-8, 9/2/15	
Demonstration and TRL Raising of the Net Capture System on the ISS	Ron Dunklee	Astrium North America	TBD	
Osteo-4	Dr. Paolo Divieti Pojevic	Boston University	SpaceX-6, 4/13/15	
Electrolytic Gas Evolution under Microgravity	Larry Alberts	Cam Med LLC	TBD	
Controlled Dynamics Locker for Microgravity Experiments on ISS	Dr. Scott A. Green	Controlled Dynamics Inc.	TBD	
Survivability of Variable Emissivity Devices for Thermal Control Applications	Dr. Hulya Demiryon	Eclipse Energy Systems, Inc.	TBD	
Eli Lilly_Lyophilization	Jeremy Hinds	Eli Lilly and Company	TBD	
Eli Lilly_Dissolution of Hard to Wet Solids	Dr. Richard Cope	Eli Lilly and Company	TBD	
Eli Lilly_RR3 Myostatin	Dr. Rosamund Smith	Eli Lilly and Company	SpaceX-8, 9/2/15	
Eli Lilly_PCG	Kristofer R Gonzalez-Dewitt	Eli Lilly and Company	SpaceX-8, 9/2/15	
Development and Deployment of Charge Injection Device Imagers	Dr. Daniel Batchelder	Florida Institute of Technology	TBD	
Materials Testing - Earth Abundant Textured Thin Film Photovoltaics	Dr. Jud Ready	Georgia Institute of Technology	SpaceX-8, 9/2/15	
Ultra-Portable Remote-Controlled Microfluidics Microscopy/Microenvironment	Dan O'Connell	HNU Photonics	SpaceX-12, 8/24/16	
Honeywell/Morehead-DM Payload Processor	Dr. Benjamin Malphrus	Honeywell/Morehead State University	TBD	
Detached Melt and Vapor Growth of In in SUBSA Hardware	Dr. Aleksandar Ostrogorsky	Illinois Institute of Technology	TBD	
Intuitive Machines-1S Terrestrial Return Vehicle (IRV)	Steve Altemus	Intuitive Machines	TBD	
Espresso Cup	Dr. Mark Weislogel	IRPI LLC	SpaceX-6, 4/13/15	
GLASS AIS Transponder Global AIS on Space Station (GLASS)	Robert Carlson	JAMSS America, Inc. (JAI)	SpaceX-9, 12/5/15	
Functional Effects of Spaceflight on Cardiovascular Stem Cells	Dr. Mary Kearns-Jonker	Loma Linda University	SpaceX-9, 12/5/15	
Application of Microgravity Expanded Stem Cells in Regenerative Medicine	Dr. Abba Zubair	Mayo Clinic	SpaceX-10, 2/13/16	

Merck PCG (follow-on)	Dr. Paul Reichert	Merck Pharmaceuticals	SpaceX-6, 4/13/15
Milliken-Ventrical Burn	Dr. Jeff Strahan	Milliken	TBD
Magnetic 3D Cell Culture for Biological Research in Microgravity	Dr. Glauco Souza	Nano3D Biosciences, Inc.	Orb-6, 6/30/16
NanoRacks External Platform	Michael Johnson	Nanoracks, LLC	HTV5, 8/17/15
Novartis Rodent Research (follow-on)	Dr. David Glass	Novartis Institute for Biomedical Research	SpaceX-6, 4/13/15
Zero-G Characterization & On-Orbit Assembly for Cellularized Satellite Tech	Talbot Jaeger	Novaworks, Inc.	SpaceX-8, 9/2/15
Map the Penetration Profile of a Contact-Free Transdermal Drug Delivery System	Dr. Robert Applegate	Novopyxis	TBD
Crystal Growth of Cs2LiYCl6:Ce Scintillators in Microgravity	Dr. Alexei Churilov	Radiation Monitoring Devices, Inc.	TBD
Synthetic Muscle: Resistance to Radiation	Dr. Lenore Rasmussen	Ras Labs	SpaceX-6, 4/13/15
UNCH Chlorella/Billings Central Catholic High	-	Rocky Mountain College	SpaceX-7, 6/22/15
Project Meteor (re-flight)	Michael Fortenberry	Southwest Research Institute	SpaceX-7, 6/22/15
Intracellular Macromolecule Delivery and Cellular Biomechanics in Microgravity	Harrison Bratower	SQZ Biotechnologies	TBD
Effects of Microgravity on Stem Cell-Derived Heart Cells	Dr. Joseph Wu	Stanford University	SpaceX-9, 12/5/15
Story Time From Space	Patricia Tribe	T2 Science and Math Education Consultants	SpaceX-7, 6/22/15 Orb-4, 11/19/15
MUSES Imaging Platform	Bill Corley	Teledyne Brown Engineering	TBD
Decoupling Diffusive Transport Phenomena in Microgravity	Dr. Alessandro Grattoni	The Methodist Hospital Research Institute	SpaceX-7, 6/22/15
Systemic Therapy of NELL-1 for Osteoporosis	Dr. Chia Soo	UCLA	TBD
NIH-Osteo	Dr. Declan McCole	University of Minnesota	SpaceX-9, 12/5/15



PROJECT TITLE	PRINCIPAL INVESTIGATOR (PI)	ORGANIZATION	CURRENTLY IN ORBIT		STATUS UPDATE
			RETURN DATE		
Zero Robotics	Dr. Alvar Saenz Otero	Massachusetts Institute of Technology Space Systems Laboratory	N/A		The SPHERES hardware onboard the ISS was utilized during Q2FY15 to support the MIT-CASIS Zero Robotics High School competition. Both crew and hardware performed nominally in the execution of the high school finals.
ISERV	-	NASA	N/A		The ISERV camera is currently in stowage onboard the ISS awaiting required use in response to humanitarian or disaster response.
AMS	Dr. Samuel Ting	NASA	N/A		The Alpha Magnetic Spectrometer continues to operate nominally and collect data on board the ISS and Dr. Ting's team is continuing to analyze data.
Binary Colloidal Alloy Test - Low Gravity Phase Kinetics Platform	Dr. Matthew Lynch	Procter and Gamble	SpaceX-7, 7/15/2015	(b) (4)	
Windows On Earth	Dan Barstow	Technical Education Research Centers (TERC)	N/A		The WinEarth software continues to perform optimally and is providing the ISS crew with a valuable tool to facilitate Crew Earth Observations and imaging.
Bone Densitometer	John Vellinger	Techshot, Inc.	N/A		The on orbit Bone-D validation run was completed on 1/28/15. The bone scan procedures were reported to have gone extremely well. ISS crew member Cristoforetti was able to manipulate the mice rather easily and place them on the exam trays. She completed all of the activities well within her crew time allocation. The Bone Densitometer Hardware performed extremely well, results of the validation test were successful, and the facility is available for operations.(b) (4)

PROJECT TITLE	PRINCIPAL INVESTIGATOR (PI)	ORGANIZATION	IN POSTFLIGHT ANALYSIS	STATUS UPDATE
Ants in Space, CSI-06	Stefanie Countryman	BioServe Space Technologies	The flight portion of this STEM program was completed in 2014. This is now a ground-based STEM program that leverages the data/findings/results of the flight project.	
PCG-Crystallization of Huntington Exon-1 Using Microgravity	Dr. Pamela Bjorkman	California Institute of Technology	Dr. Bjorkman and her science team are still conducting post-flight analysis. (b) (4)	
Cobra Puma Goli Microgravity Electrodeposition Experiment	Mike Yagley	Cobra Puma Goli	(b) (4)	
PCG - IPPase Crystal Growth in Microgravity	Dr. Joseph Ng	iXpressGenes, Inc.	The PI received samples from SpX-4 on October 25, 2014. The initial results are outstanding, with a variety of crystals large enough and of sufficient quality for neutron diffraction. Samples were transferred to Argonne National Laboratory on November 17 for synchrotron analysis. In most cases, the flight crystals diffracted to a higher resolution with better intensity-to-noise signals than ground samples. Samples were transferred to Oak Ridge National Laboratory in mid-December for neutron diffraction. The PI completed data collection at Oak Ridge in February. Data analysis and structural determination are ongoing, but the PI has three publications in the works.	
Kentucky Space/Exomedicine Lab - Flatworm	Dr. Mahendra Jain	Kentucky Space, LLC	The payload returned in February, and post-flight analysis is ongoing.	
Merck PCG	Dr. Paul Reichert	Merck Pharmaceuticals	(b) (4)	
T-Cell Activation in Aging	Dr. Millie Hughes-Fulford	Northern California Institute for Research and Education (NCIRE)	The post-flight ground analysis of data is ongoing. (b) (4)	
Novartis Rodent Research	Dr. David Glass	Novartis Institute for Biomedical Research	(b) (4)	
PCG - Crystallization of Human Membrane Proteins in Microgravity	Dr. Stephen Aller	University of Alabama at Birmingham	(b) (4)	
Antibiotic Effectiveness in Space-1 (AES-1)	Dr. David Klaus	University of Colorado Boulder	(b) (4)	

PROJECT TITLE	PRINCIPAL INVESTIGATOR (PI)	ORGANIZATION	PROJECT TYPE	COMPLETED PROJECTS	STATUS UPDATE
Protein Crystal Growth for Determination of Enzyme Mechanisms	Dr. Constance Schall	University of Toledo	(b) (4)		
Drug Development and Human Biology: Use of microgravity for drug development	Dr. Timothy Hammond	Veterans Administration Medical Center	(b) (4)	Post-flight analysis is still underway.	(b) (4)
Molecular Biology of Plant Development (Petri Plants)	Dr. Anna-Lisa Paul	University of Florida	Flight	(b) (4)	
Cyclone Intensity Measurements from the International Space Station (CIMISS)	Dr. A.T. Stair	Visidyne, Inc.	Flight	(b) (4)	
Testing TiSi2 Nanonet Based Lithium Ion Batteries for Safety in Outer Space	Emily Fannon	EnerLeap	Ground	(b) (4)	
Architecture to Transfer Remote Sensing Algorithms from Research to Operations	Dr. James Goodman	HySpeed Computing	Ground	(b) (4)	

Utilize ISS Energy Systems Data for Microgrid Design and Operation	Nicholas Kurlas	Raja Systems	Ground	(b) (4)
Reducing signal interruption from cosmic ray background in neutron detectors	Dr. Andrew Inglis	Silverside Detectors	Ground	(b) (4)
Effects of Simulated Microgravity on c-kit+ Cardiac Stem Cells	Dr. Joshua Hare	University of Miami	Ground	(b) (4)
Exploiting on-orbit crystal properties for medical and economic targets	Dr. Edward Snell	Hauptman Woodward Medical Research Institute, Inc.	Flight	(b) (4)
Collaborative project-i-protein crystal growth to enable therapeutic discovery	Dr. Matthew Clifton	Beryllium Discovery Corp.	Flight	This is a collaborative project with Protein BioSolutions (see below). The payload returned on SpX-4. (b) (4)
Collaborative project-i-protein crystal growth to enable therapeutic discovery	Dr. Cory Gerds	Protein BioSolutions	Flight	This is a collaborative project with Beryllium Discovery Corp. (see above). The payload returned on SpX-4. (b) (4)
PCG - Crystallization of Medically Relevant Proteins Using Microgravity	Dr. Sergey Korolev	Saint Louis University	Flight	(b) (4)

## Q2 FY15 CONFERENCES AND EVENTS

DATE	EVENT TITLE	LOCATION	AUDIENCE	DESCRIPTION
January 8-9, 2015	CASIS Executive STEM Workshop	Cape Canaveral, FL	Executives, STEM education professionals, and educators	CASIS hosted a STEM education workshop with 45 participants to generate discussion, brainstorming, and recommendations from attendees. Goals of the workshop include: (1) develop ideas for both on-orbit and terrestrial education programs that will effectively utilize the ISS and the environment of space to inspire and engage students, (2) generate effective strategic education outreach concepts aimed at increasing the general awareness of CASIS education programs as well as opportunities that educators and other organizations have to utilize the ISS as a unique STEM education resource, and (3) develop novel ideas for funding and partnerships to support CASIS STEM and educational outreach programs.
January 12, 2015	Space4-Houston	Houston, TX	Potential users and developers of satellite-based information	The Space Applications Catapult sponsored a workshop with the Rice Space Institute to bring together users of satellite data in the Houston community and discuss opportunities for collaboration.
January 13-15, 2015	2015 Human Research Program Investigators' Workshop	Galveston, TX	NASA and NSBRI-funded investigators	The goal of this workshop was to provide an informal, collegial atmosphere for cross-disciplinary interaction. Specific topics covered at the workshop include the role of the individual investigators in HRP's risk-management structure and statistical approaches to experiments with small numbers of subjects.
January 16, 2015	Ortronicon Technology Event	Orlando, FL	General public	CASIS teamed up with Windows on Earth to participate at the annual Ortronicon technology event held at the Orlando Science Center. Dan Barstow of Windows on Earth was a featured presenter.
January 16, 2015	CASIS Academy Live	Kennedy Space Center, FL	Students and educators	Eighth-grade students from Madison Middle School in Brevard County, Florida participated in a CASIS Academy Live event, which featured a presentation from Dan Barstow, a CASIS PI who manages the Windows on Earth program. This program focuses on Earth observation from the ISS — specifically photographs taken by astronauts. Students manipulated images from the ISS in an interactive activity and also participated in "Living in Space" hands-on activities. Five educators and 47 students participated.
February 9-11, 2015	CoDev 2015	Scottsdale, AZ	Open innovation community, including Fortune 500 companies	CoDev is the largest conference focused on open innovation, industry collaboration, and new product and business creation. The CASIS team generated numerous leads by attending this event, including BASF, Goodyear, Ford Motor Company, Michelin, Nestle, and Ansell.
February 12-16, 2015	AAAS Annual Meeting	San Jose, CA	Scientists, researchers, students, educators, and the general public	CASIS maximized its presence at the 2015 AAAS Annual meeting, the world's largest general science convention, by participating in the general meeting and the concurrent AAAS Family Science Days STEM expo. The conference was an ideal venue to promote the research capabilities of the space station to a wide cross section of scientists, researchers, and R&D professionals. Additionally, CASIS engaged more than 3,000 students, parents, and educators by participating in the Family Science Days STEM expo.

<b>February 17-20, 2015</b>	<b>Destination Station</b>	San Francisco, CA	Targeted commercial companies and academic institutions	CASIS joined NASA for Destination Station Bay Area to meet with interested researchers and companies to discuss the capabilities and opportunities available through space station research. During this week, outreach opportunities at Kaiser Permanente, Stanford University and Google X took place to discuss the avenues by which researchers can access the ISS. During this week, CASIS was instrumental in placing astronaut Reid Wiseman on the nationally broadcasted live show of "Bloomberg West," discussing Destination Station and his time in space. Additionally, CASIS was responsible for leveraging astronaut Doug Wheelock for media opportunities with the local NBC TV affiliate and CBS radio stations.
<b>February 23, 2015</b>	<b>CASIS Academy Live</b>	Kennedy Space Center, FL	Students and educators	Students from University High School in Orlando, Florida attended a CASIS Academy Live event, which featured CASIS Senior Research Analyst Dr. Mike Roberts. Dr. Roberts discussed Microbes in Space and current space station research. Students also participated in two hands-on activities: a DNA extraction activity and a "Living in Space" activity. Four educators and 36 students participated.
<b>March 10, 2015</b>	<b>NASA FluidsLab and CombustionLab Briefings</b>	NASA's Glenn Research Center, OH	Representatives from NASA HQ, NASA GRC, NASA physical scientists and potential PIs in fluids and combustion	CASIS presented its endorsement of the NASA FluidsLab and CombustionLab initiatives to NASA SP&RA directors at Glenn Research Center. These open science programs will help grow ISS research in fluid dynamics and combustion. CASIS will be able to utilize hardware from these initiatives as well as sponsor projects that have both terrestrial benefit and fit within the scope of the research goals of these programs.
<b>March 12-15, 2015</b>	<b>National Science Teachers Association (NSTA)</b>	Chicago, IL	Approximately 12,000 K-12 educators, administrators, science publishers, curriculum vendors, colleges, and educational organizations	A CASIS representative attended this event to learn about new developments within the area of STEM education as well as promote CASIS-sponsored education programs. The event included ,500 innovative science education-based presentations, sessions, hands-on workshops, more than 400 exhibits, and an all-day NGSS [Next Generation Science Standards] event.
<b>March 17-19, 2015</b>	<b>IRI Spring Multi-Networks Meeting</b>	San Diego, CA	Innovation leaders	A CASIS representative participated in IRI-sponsored meetings focused on new business development, external technology, and innovation leaders in industry. Numerous leads were generated from this meeting, including Aramco, Michelin, Eastman, PPG Coatings, Kraft, and Coca-Cola.
<b>March 18-20, 2015</b>	<b>Biomarker Summit</b>	San Diego, CA	Scientists, researchers, industry, and academia	This summit featured a mixture of academia and pharmaceutical companies developing/identifying useful biomarkers for disease diagnosis, prevention, and monitoring. A CASIS representative attended the event and numerous connections to key accounts were initiated, including Takeda Pharmaceuticals, Pfizer, Astrazeneca, Janssen, Genentech, and Amgen Pharmaceuticals. These leads are being developed for future brainstorming and project development opportunities.

<b>March 26, 2015</b>	Air Quality Technologies TCC Event	Houston, TX	Researchers in industry, academic and federal labs	This event featured presentations from local oil and gas companies, including Shell and Baker Hughes, and their service companies, including Rice Business Plan Competition winner Rebellion Photonics. This event led to a meeting between the CASIS business development team and TCC founder Bob Prochnow to discuss how CASIS can work with the TCC to create challenges of our own and respond to industry needs identified by other TCC members.
<b>March 26-27, 2015</b>	MassBio Annual Meeting	Boston, MA	C-Level executives, science professionals, and business development professionals	This two-day meeting featured senior executives from the Massachusetts life science community. The goal of the meeting was to share best practice ideas and connect large companies to cutting-edge startups.
<b>March 30, 2015</b>	Final NASA Economic Development of LEO Study Workshop	NASA Headquarters, Washington D.C.	Various independent economists, NASA HQ representatives, and CASIS representatives	NASA commissioned five groups of economists to produce studies focused on the commercialization of Low Earth Orbit (LEO). Each of these groups presented during the workshop. Discussion followed on how NASA and CASIS can best support the acceleration of the commercialization of LEO. The economists will now produce final papers to be published by NASA.
<b>March 30, 2015</b>	New Mexico Space Grant Consortium	Las Cruces, NM	Commercial, academic, national lab, and STEM education participants from New Mexico	This event provided a platform for CASIS to engage interested parties in research opportunities on the ISS National Laboratory. The featured presentations covered life sciences, materials science, commercial opportunities, and STEM education projects. Through this event, approximately six potential flight projects were identified as well as two potential STEM initiatives. Additionally, CASIS made introductions with a new angel funding network (RedSky).
<b>March 31, 2015</b>	CASIS Education Presentation	Las Cruces, NM	Students and educators	A CASIS representative gave a presentation to 140 students at Arrowhead Park High School in Las Cruces, New Mexico. The presentation discussed space station research and various STEM careers related to microgravity research.
<b>March 31, 2015</b>	CASIS Academy Live	Kennedy Space Center, FL	Students and educators	Twyman Clements, an experienced ISS researcher, was the featured presenter at this CASIS Academy Live event. Clements is president and CEO of Space Tango Inc., which focuses on utilizing space for solutions on Earth. He is also the senior space systems engineer of Kentucky Space, LLC (the R&D partner of Space Tango) and has led a variety of entrepreneurial space projects and missions. His experiences include multiple PocketCube and CubeSat missions as well as ISS technology and Exomedicine-related experiment design. He gave an engaging presentation to Sebastian River High School students entitled "How to Build a Satellite in One Hour." Students were given an update on current space station research, and Clements described the tissue regeneration/flatworm experiment sponsored by Kentucky Space, which launched and returned from space on SpaceX-5.