

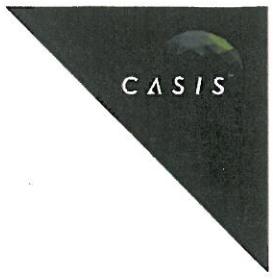
FY15 Q1 REPORT

Quarterly Report for the Period October 1st – December 31st, 2014

CENTER FOR THE ADVANCEMENT OF SCIENCE IN SPACE (CASSIS)

FY2015 Q1: OCT 1-DEC 31 • 2014

C A S I S™



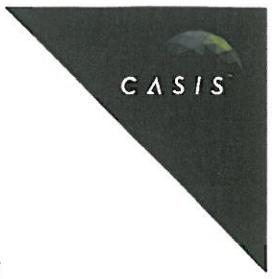
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EXECUTIVE SUMMARY



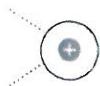
CASIS continued the positive momentum from FY14 into a new fiscal year with further productivity and highly visible outreach opportunities in Q1 FY15. In the area of Research and Technology Development, key CASIS Q1 FY15 foundational project achievements included the awarding of sixteen new research projects and the issuance of two solicitations creating additional, funded research and technology opportunities on the International Space Station (ISS) U.S. National Laboratory. CASIS-sponsored projects, whether in preflight development, on-orbit operations, or postflight analysis, continued progressing, with preliminary data promising exciting implications for medical advances in treating cancer, heart and liver disease, osteoporosis, muscle wasting, and much more. Commercial applications of projects nearing completion also include improved sporting equipment and longer shelf-life for consumer products.

In addition to our quarterly achievements, we made substantial progress on the development of two focused strategic campaigns, Good Earth and Good Health, that will bring together large-scale collaborations to stimulate ISS utilization over the coming years. Good Earth is an international collaboration seeking to maximize ISS Earth observation capabilities for Earth benefit, via the development and deployment of next-generation sensors; and Good Health is a grand challenge taken on by CASIS to truly impact human health on Earth—by capitalizing on the unique benefits of ISS for studying disease transitions, such as osteoporosis and muscle wasting, and for developing means to avert them.

Finally, with the announcement of the first-ever CASIS Request for Proposals (RFP) that will be fully funded by an outside organization—the Massachusetts Life Sciences Center—CASIS partnerships and development activities reached a significant milestone. This is the first step toward a commercial model in which CASIS secures external funding to facilitate and manifest innovative project ideas from targeted sectors and geographic ecosystems.

The following report illustrates progress toward each of the key CASIS mission goals: 1) create innovation cycles; 2) utilize the ISS for developing new capabilities; and 3) promote the value of the ISS National Lab to the nation, and establish the ISS National Lab as a leading laboratory and environment for science, technology, engineering, and mathematics (STEM) education. The report also includes quarterly organizational metrics and achievements as well as projected milestones for FY15.





RESEARCH AND TECHNOLOGY DEVELOPMENT: ESTABLISHING INNOVATION CYCLES & UTILIZING THE ISS FOR DEVELOPING NEW CAPABILITIES

In 2015, CASIS will implement focused research and development campaigns that will support multiple projects within specific scientific themes. These campaigns represent an evolution in how CASIS—with its business development and research solicitation activities—promotes and expands the ISS National Lab research portfolio.

Campaign Good Earth

Campaign Good Earth is a vision to strategically maximize ISS Earth observation capabilities for Earth benefit. Initial CASIS collaboration partners include the United Nations Institute for Training and Research (UNITAR), National Geographic, NASA, and others, who will collectively broaden the use of the ISS by supporting projects for imaging the Earth. CASIS will facilitate the development and deployment of a concatenation of next-generation sensors onboard the ISS. CASIS identified an initial four next-generation sensors to be potentially installed, including: 1) a multi-band hyperspectral imager, 2) a SAR (Synthetic Aperture Radar) imager, 3) a LIDAR (Light Detection and Ranging) sensor, and 4) a thermal imager. These proposed sensors could be used to support a variety of applications, including water and forest management, humanitarian relief, disaster prevention and risk reduction, recovery after disaster, and in-country planning and development. Portions of the sensor data stream will be made available to academic institutions, the United Nations (U.N.), other government agencies, and not-for-profit organizations to develop new hyperspectral and other applications including data fusion techniques.

During Q1 FY15, CASIS identified potential funding sources for sensor development. CASIS also added commercial technology partners and continued to build relationships with NASA, who will provide unique expertise to the coordination of this project. Additionally, non-disclosure agreements were signed and discussions progressed with global technology companies who are interested in providing technical support capabilities such as data storage, global position units, and other capabilities that will be critical for the success of this project.

The FY15 milestones for Campaign Good Earth include:

- Coordinate the vision with a commercial company who has an existing agreement with NASA to place a pointing platform and sensors on the ISS.
- Facilitate a partnership with at least one global technology partner to supply memory, central processing units, and ground search capability for Campaign Good Earth.

- Define a collaborative relationship with a NASA center to serve as a technology and applications development Center of Excellence.
- Engage multiple entities to fund/supply the initial sensors.

Campaign Good Health

Campaign Good Health is a major initiative that seeks to understand the mechanisms that underpin the transition from wellness to disease—a process in many cases accelerated by microgravity—so that interventions can be designed to preserve health on Earth. To best accomplish this mission, CASIS will need to leverage a vast array of data and resources produced by other agencies alongside its own to ensure the highest probability of success.

Because sample sizes for data from astronauts are limited, human and non-human data will be included. Campaign Good Health will be designed to integrate all possible sources of biological and molecular data, using a systems approach to better understand the transitions from wellness to disease. The ISS will thus be used to study disease transitions, such as osteoporosis and muscle wasting, and to develop means to avert them and maintain human health. Stakeholders and their roles/data resources include:

- NASA Space Life and Physical Sciences Research and Applications Division – Discovery research in space biology, physical sciences, and human research relative to spaceflight (Ongoing investigations, GeneLab)
- National Space Biomedical Research Institute, NASA Human Research Program – Exploration-related research to support long-term human presence in space (Twins Study, Repository, Archive)
- CASIS – Translation of discoveries in microgravity into Earth benefits

Initial goals of Campaign Good Health include:

- Promote the spirit of collaboration among various groups including the stakeholders listed above
- Realize synergies between existing and future related projects
- Identify how to best work together towards maximum translational outputs

Foundational Projects

CASIS awarded funding to eleven flight projects in Q1: three projects via the MassChallenge accelerator program, three from the CASIS RFP "Materials Science in Space," three from the RFP "Enabling Technology to Support Science in Space for Life on Earth," and two unsolicited projects also supported by NIH. Additionally, CASIS awarded five non-funded user agreements to D-Orbit Inc. and Eli Lilly.

This is the second year CASIS has partnered with MassChallenge, which is the largest startup accelerator to support high-impact, early-stage entrepreneurs without taking any equity. During this year's MassChallenge competition,

CASIS also partnered with Boeing, who provided \$250,000 in funding to support the three selected innovative flight projects. The total value of the prize, awarded by CASIS and Boeing, was \$600,000.

The Materials Science RFP sought flight research investigations focused on developing new or improving existing materials that will have direct terrestrial benefit. The purpose of the Enabling Technology RFP was to identify and support technology development projects that would enable increased use of ISS for Earth benefits—for example, improvements in hardware/capabilities or methods to improve bandwidth, throughput, or quality of future research projects.

CASIS also released two additional solicitations: a targeted RFP seeking access to remote sensing capabilities on the ISS for Earth-based energy applications and a Request for Information (RFI) seeking to identify animal and cell-based models for use on the ISS National Lab to improve understanding of human disease and drug screening.

During the quarterly meeting of the CASIS Science and Technology Advisory Panel (STAP), panel members discussed the RFP outlook for this year. Disease modeling remains the focus of our next life sciences RFP, and the next physical sciences RFP will focus on fluid dynamics, targeting research and technology development focused on fluid flow phenomena (particularly multidisciplinary inquiries) with potential for significant societal impact. Plant Biology was also discussed as a high priority RFP topic and will also be considered for release in 2015.

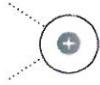
Operational Logistics Update

During Q1 FY15, eight investigations were successfully initiated on the ISS, experiments were fully executed, and samples/data have been returned to the respective PI teams on the ground. These investigations included research from Novartis Biomedical Research Institute, COBRA PUMA Golf, and the Broad Institute.

The only launch scheduled during Q1 was Orbital Sciences Orb-3, which suffered a catastrophic failure during the attempted launch on October 28, 2014, and all science payloads and resupply cargo were lost. The six CASIS National Design Challenge (NDC) educational experiments, from three Houston-area schools, were a part of this manifest. The resulting total "grant value" loss of the NDC projects is approximately \$105,000. Plans are already underway to re-fly the NDC experiments in 2016. All schools are eager to rebuild and re-fly their experiments. In addition, eighteen Student Spaceflight Experiments Program (SSEP) experiments were also lost. Nine of the SSEP projects lost were directly funded by CASIS totaling \$50,000. The majority of the SSEP projects will re-fly on the next SpaceX resupply mission, SpaceX-5.

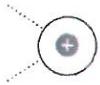
Q1 marked the end of Advancing Research Knowledge-2 (ARK2) and ushers in the start of Advancing Research Knowledge-3 (ARK3), which will encompass all of the CASIS-sponsored payloads slated to launch in the calendar year 2015. The payload

development and integration activities associated with payloads scheduled to fly to the ISS during ARK3, which corresponds to NASA Increment 41/42 (September 2014 – March 2015) and Increment 43/44 (March 2015 – September 2016), continue on a nominal schedule to meet the requirements of the projected launch dates. Adjustments to these launch schedules are expected, but no formal announcements have been made by NASA or the commercial resupply companies.



PARTNERSHIPS AND DEVELOPMENT: EXPANDING THE Casis NETWORK – LEVERAGING FUNDING

In Q1 FY15, CASIS announced its first ever externally funded solicitation, the "Galactic Grant Competition," enabled through a partnership with Massachusetts Life Science Center (MLSC). The MLSC provided a \$550,000 grant to fund flight and STEM projects. The Massachusetts Governor announced the grant competition on November 13, 2014, and will provide Massachusetts-based companies a unique opportunity to access the ISS to conduct life sciences research. The grant competition is open for applications from December 1, 2014 through April 3, 2015.



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

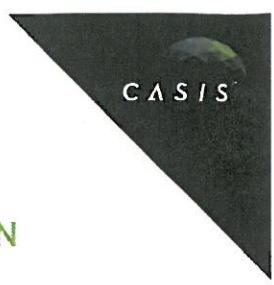
During Q1, the CASIS education team held a two-day critical design review workshop for NDC-Denver. Three NDC-Denver schools attended the workshop at the Wings Over the Rockies Air and Space Museum in Denver on November 13 and 14, 2014. Student teams presented their prototypes and engaged in a working design session with CASIS and industry mentors, including NanoRacks (safety) and the Texas A&M Mobile Integrated Solutions Lab (MISL) team. Chatfield High School in Littleton, CO, invited a feeder school, Deer Creek Middle School (Jefferson County) to help them grow algae for their biofuel experiment. CASIS has entered into a Memorandum of Agreement with the Boy Scouts of America to implement the 2015-16 NDC in Chicago, IL.





OUTREACH:

PROMOTE THE VALUE OF THE ISS NATIONAL LAB TO THE NATION



The first quarter of FY15 offered CASIS a number of outreach opportunities to reach both broad and targeted audiences. In October, CASIS announced a series of project awards that garnered media attention, including a premium feature article in *Popular Science* highlighting the CASIS-awarded Intuitive Machines terrestrial return vehicle.

In November, to support the "Galactic Grant Competition" announcement, CASIS worked with the MSLC to coordinate a press conference with Governor Deval Patrick, astronaut Dan Tani, and members from the pharmaceutical company Novartis. The event was an incredible success, garnering media features in the Boston Herald, the Boston Globe, and National Public Radio.

During the quarter, CASIS also introduced two new video products highlighting key developments. The first video featured a new partnership with actor/producer Seth Green, a well-known space advocate, to develop the ARK3 mission patch—which will symbolize all CASIS sponsored ISS investigations during calendar year 2015. This video has already amassed great attention through both CASIS and NASA social media channels, including 214,000 views and more than 6700 likes through the NASA Facebook page. The second video is an exciting development from a scientific outreach perspective featuring the CASIS, NASA, and NIH collaboration to fund Dr. Hughes-Fulford's T-cell activation experiment to examine key factors in aging and immune suppression in microgravity. This video was released in the days prior to the anticipated December SpaceX-5 launch. This has garnered strong interest from our viewers, reaching over 46,000 people on Facebook just 24 hours after it was released, and will also be prominently featured within NIH's website and other channels.

CASIS ARK3 Mission Patch Video: http://youtu.be/_rJAtFhwI1I

CASIS SpaceX-5 Payload Overview Video: http://youtu.be/A_y7w-vhLNg





FINANCIALS

CASIS' Independent Auditors, Carr, Riggs, Ingram, LLC, issued their audit report for the year ended September 30, 2014 on December 2, 2014.

BUSINESS STATUS REPORT

| OCT 1-DEC 31, 2014 | ACTUALS Q1 2015 | BUDGET Q1 2015 | VARIANCE | ACTUAL YTD 2015 | BUDGET YTD 2015 | VARIANCE |
|------------------------------------|--------------------|-------------------|---------------|--------------------|--------------------|---------------|
| Direct Labor | \$1,194,792 | \$1,348,595 | (\$153,803) | \$1,194,792 | \$1,348,595 | (\$153,803) |
| Subcontracts | \$323,460 | \$764,653 | (\$441,193) | \$323,460 | \$764,653 | (\$441,193) |
| Permanent Equipment > \$5k | \$91,419 | \$20,000 | (\$71,419) | \$91,419 | \$20,000 | (\$71,419) |
| Expendable Supplies & Equipment | \$34,942 | \$62,245 | (\$27,303) | \$34,942 | \$62,245 | (\$27,303) |
| Travel | \$212,273 | \$243,688 | (\$31,415) | \$212,273 | \$243,688 | (\$31,415) |
| Grants to be Awarded | \$945,250 | \$2,499,801 | (\$1,554,551) | \$945,250 | \$2,499,801 | (\$1,554,551) |
| Other Direct Costs | \$366,238 | \$365,477 | \$761 | \$366,238 | \$365,477 | \$761 |

BREAKOUT OF COOPERATIVE AGREEMENT FUNDING

| | Q1 FY15 | Q2 FY15 | Q3 FY15 | Q4 FY15 |
|----------|---------|---------|---------|---------|
| Direct | 49% | | | |
| Indirect | 21% | | | |
| Grants | 30% | | | |

BREAKOUT OF CASIS GRANTS

| | Q1 FY15 | Q2 FY15 | Q3 FY15 | Q4 FY15 |
|---------------------|-----------|---------|---------|---------|
| Private/Commercial | \$564,063 | | | |
| Academic | \$297,400 | | | |
| Other Government | \$0 | | | |
| Mission Based Costs | \$83,787 | | | |



METRICS

In addition to the quarterly metrics displayed in the following pages, CASIS will be tracking several metrics on an annual basis and reporting this in our annual report. Those 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 done through CASIS
- Commercial Impact – CASIS will report all products or services created which 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 | | | |
| Responses received from RFIs and RFPs (Including Step-1 and Step-2 proposals) | 17 | | | |
| Project proposals awarded from CASIS grant calls (solicited) | 6 | | | |
| Project proposals received (unsolicited) | 6 | | | |
| Project proposals awarded (unsolicited) | 10 | | | |
| Return Customers: Proposals received from CASIS customers pursuing a re-flight | 1 | | | |
| New Customers: Projects awarded to principal investigators that have never flown | 11 | | | |
| Flight projects manifested | 33 | | | |
| Flight projects delivered to ISS NL | 0 | | | |

STEM EDUCATION AND OUTREACH METRICS BY QUARTER

| METRIC | Q1 FY15 | Q2 FY15 | Q3 FY15 | Q4 FY15 |
|-------------------------------------|---------|---------|---------|---------|
| STEM projects executed | 5 | | | |
| Total reach of STEM projects | 7,265 | | | |
| CASIS outreach events | | | | |
| Trade Shows | 6 | | | |
| Print Advertisements | 0 | | | |
| Total media impact | | | | |
| You Tube Posts | 2 | | | |
| -views (cumulative) | 10,744 | | | |
| Twitter Posts | 166 | | | |
| -followers (cumulative) | 59,058 | | | |
| Facebook Posts | 123 | | | |
| -likes (cumulative) | 4,548 | | | |
| Website visitors | 49,254 | | | |
| News Releases | 10 | | | |
| Media Events | 9 | | | |
| News Mentions (Clips, Blogs) | 1,379 | | | |
| Twitter Mentions | 620 | | | |

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 crewtime. The ISS National Lab is granted half of NASA's share (79%) of the available resources. Upmass and downmass vary based on the number of cargo vehicles and their capabilities. Crewtime 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 | 1166.9 | 97% | 537 | 173 | 32% | 378 | 318.8 | 84% |

(Data through 12/31/14)

PROJECT PIPELINE

| PROJECTS AWARDED IN Q1 FY15 | | | | PROJECT DESCRIPTION |
|--|------------------------|------------------------------------|----------------------|--|
| PROJECT TITLE | PRINCIPAL INVESTIGATOR | ORGANIZATION | LOCATION | |
| Crystal Growth of Cs₂LiYCl₆:Ce Scintillators In Microgravity | Alexei Churilov | Radiation Monitoring Devices, Inc. | Watertown, MA | A series of experiments on the ISS to grow scintillator crystals. Scintillators excite when exposed to certain types of radiation. They can be used in detectors, primarily for homeland security applications. |
| Survivability of Variable Emissivity Devices (VEDs) for Thermal Control Applications in Space | Hulya Demiryon | Eclipse Energy Systems, Inc. | St. Petersburg, FL | Project examining how variable emissivity devices (VEDs) interact with the punishing environment of space. VEDs could be used on Earth in energy-saving smart-roofing technology that will switch from blocking heat in the summer months to passing heat in the winter months in order to reduce heating and cooling costs. |
| Detached Melt and Vapor Growth of In In SUSS Hardware | Aleksandar Ostrogorsky | Illinois Institute of Technology | Chicago, IL | Project synthesizing new types of semiconductor crystals on the ISS. They will show this material can positively compare with other semiconductor materials, in how it is non-toxic, and can be grown at a much faster rate. |
| Materials Science RFP | | | | |
| Improving Astronaut Performance of National Lab Research Tasks | Jayfus Doswell | Juxtaporia LLC | Baltimore, MD | Project to develop and evaluate an innovative augmented reality (AR)oggle/software system, the Juxtapix® Context-Aware Mobile Mixed Assistive Device (CAMMARD). These AR goggles will provide virtual assistance that seeks to improve the speed and accuracy with which astronauts perform ISS National Lab science experiments. Moreover, Earth-based markets for this product exist in emergency response organizations that employ first responders who work in remote, austere, or extreme environments. |
| Controlled Dynamics Locker for Microgravity Experiments on ISS | Scott Green | Controlled Dynamics Inc. | Huntington Beach, CA | Project to develop an insert for existing ISS hardware that will provide research payloads with a "controlled dynamic acceleration environment"—in other words, a technology that will dampen fluctuations/disturbances in the microgravity environment that occur onboard moving spacecraft. This technology promises to attract a new class of research experiments and private funding aimed at exploiting this controlled acceleration environment in microgravity, which has the potential to improve space experiments in crystallization; cell, tissue, and plant culturing; and other studies. |



| | | | | | |
|---|------------------------------|---|---|--|---|
| Spacecraft-on-a-Chip Experiment Platform | Mason Peck | Cornell University Ithaca, NY | Adapting a spacecraft-on-a-chip experimental satellite platform called "Sprite" to eventually be programmed in place and deployed from ISS, providing a low-cost, rapidly-deployable, crew-configurable, small-satellite platform for science and technology development. Expected users of this technology include those in the GPS, space tourism, entertainment, and DIY space industries. | | |
| | | | MassChallenge Accelerator | | |
| Electrolytic Gas Evolution under Microgravity | | | | | |
| | Larry Alberts | Cam Med LLC Boston, MA | | | Project examining the use of electrolysis to generate bubbles to improve methods of drug delivery and precision dosage control in CamMed's "Evopump," a small, bandage-like pump that can deliver medications directly through the skin. |
| Intracellular Macromolecule Delivery and Cellular Biomechanics in Microgravity | | | | | |
| | Harrison Bratower | SQZ Biotechnologies Somerville, MA | | | Project investigating the effects of microgravity on an experimental technology, the "Cellsqueeze platform," a novel method for delivering large molecules (with up to 100x greater efficiency than current techniques) into targeted cells by using a microfluidic chip to physically squeeze cells. |
| Map the Penetration Profile of a Contact-Free Transdermal Drug Delivery System | | | | | |
| | Robert Applegate | Novapixis Boston, MA | | | Project seeking to improve a patient-pending device, "Droplette," also for drug delivery directly through skin contact. Droplette can deliver drug molecules up to 60% larger than current topical treatments deep into the skin over broad or uneven surface areas. |
| Unsolicited (unfunded) | | | | | |
| The Effect of Microgravity on the Co-crystallization of Membrane Proteins and on-orbit crystallographic study of medically-relevant protein-ligand complexes as an orthogonal approach to facilitating structure-based drug design | | | | | |
| | Kristofer R Gonzalez-Dewhitt | Eli Lilly and Company Indianapolis, IN | | | A series of experiments examining the effects of microgravity on the co-crystallization of several protein-ligand complexes, which have been either difficult to crystallize and/or difficult to obtain diffraction data of sufficient resolution by Earth-based crystallization methods |
| The Effect of Microgravity on the Dissolution of Hard to Wet Solids | | | | | |
| | Richard Cope | Eli Lilly and Company Indianapolis, IN | | | A set of experiments seeking to exploit microgravity to better understand of the fundamental processes at play in the wettability and ultimate dissolution rate of "hard to wet" solids, commonly used in active pharmaceutical ingredients. The experiments will also specifically explore "float effect" to better appreciate the effect of material floating and gain a better understanding of the mechanisms involved in mixing solids and liquids in general. |

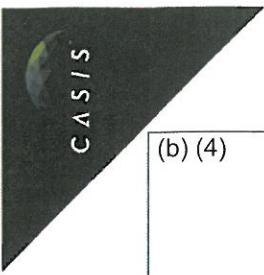


| Project Title | Principal Investigator | Organization | Launch Vehicle/ Estimated Flight Date |
|---|--|--------------|---|
| Lyophilization in Microgravity: Impact on Physical Properties and Critical Quality Attributes | Jeremy Hinds Eli Lilly and Company Indianapolis, IN | | Studies to improve understanding of the fundamental properties that impact the physical characteristics of lyophilized ("freeze-dried") materials—used in the pharmaceutical industry to increase chemical stability—thus improving processes in pharmaceutical and other industries. |
| Effect of Myostatin Antibody on Murine Muscle Mass and Function during Spacelift | Rosamund Smith Eli Lilly and Company Indianapolis, IN | | Experiments in the microgravity environment of space provide the ability to determine the impact of an anti-myostatin antibody on muscle wasting in the absence of artificial constraints or co-morbidities that might interfere with the interpretation of results. |
| D-SAT Active Decommissioning Demonstration | Luca Rossetti D-Orbit Inc. Los Angeles, CA | | Project aiming to demonstrate a full controlled-quick-and-safe reentry of a LEO satellite through D-Orbit decommissioning device. |
| Unsolicited (funded) | | | |
| Osteocyte response to mechanical forces | Paola Divietri Pajevic Massachusetts General Hospital Boston, MA | | Project to identify cellular and molecular mechanisms of mechano-sensation and mechano-transduction in osteocytes, the bone cells deeply embedded into the mineralized tissue. An osteocyte cell line, Ocy45, developed by the PI will be exposed to μ g and analyzed at early (3 days) and late (7 and 14 days) time points for comparison against ground controls by genetic analysis (RNAseq) and histological examination (immuno-Histochemistry and in situ hybridization) |
| T-Cell Activation in Aging | Milice Hughes-Fulford Northern California Institute for Research and Education (NCIRE) San Francisco, CA | | Project to examine how exposure to microgravity can mimic aging of immune cells and to reveal the biochemical mechanisms that underlie immune system dysfunction. This knowledge may be applied to develop treatments not only for immune suppression but also for inflammatory diseases in which the immune system misbehaves by overreacting rather than failing to act. |

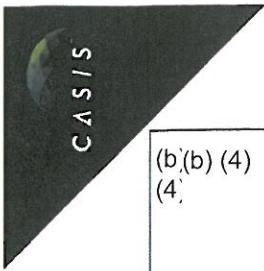
| | | | |
|--|---------------------|--|--|
| Decoupling Diffusive Transport Phenomena In Microgravity | Alessandro Grattoni | The Methodist Hospital Research Institute | Orb-4 Expected to launch in Q1 FY16 |
| Kentucky Space 5: Role of Gravity and Geomagnetic Field in Flatworm Regeneration | Mahendra Jain | Kentucky Space, LLC | SpaceX-5 1/10/2015 |
| Application of Microgravity Expanded Stem Cells In Regenerative Medicine | Abba Zubair | Mayo Clinic | SpaceX-7 6/13/2015 |
| Functional Effects of Spaceflight on Cardiovascular Stem Cells | Mary Kearns-Jonker | Loma Linda University | SpaceX-9 12/5/2015 |
| Effects of Microgravity on Stem Cell-Derived Heart Cells | Joseph Wu | Stanford University | SpaceX-7 6/13/2015 |
| Synthetic Muscle: Resistance to Radiation | Lenore Rasmussen | Ras Labs | Orb-4 Expected to launch in Q1 FY16 |
| HNU Photonics - Ultra-Portable Remote-Controlled Microfluidics Microscopy Microenvironment | Don O'Connell | HNU Photonics | TBD |
| Magnetic 3D Cell Culture for Biological Research In Microgravity | Glaucio Souza | Nano3D Biosciences | Orb-6 4/1/2016 |
| Remote controlled nanochannel implant for tunable drug delivery (Matching Funding for Graftoni 5-year grant) | Alessandro Grattoni | The Methodist Hospital Research Institute d/b/a Houston Methodist Research Institute | TBD |
| Morehead/Honeywell-DM Payload Processor | Benjamin Malipinus | Honeywell/Morehead State University | TBD |
| Evaluation of a Corrosion Inhibitor Exposed to the Extreme Environments in Space | Lauren Thompson | A-76 | TBD |
| Global AIS on Space Station (GLASS) | Robert Carlson | JAMSS America, Inc. (JA) | SpaceX-9 12/5/2015 |
| Intuitive Machines-1SS Terrestrial Return Vehicle (TRV) Program | Steve Altemus | Intuitive Machines | TBD |
| Zero-G Characterization, On-Orbit Assembly, and Free Flight Experiments for Cellularized Satellite Technology | Talbot Jaeger | NovaWurks, Inc. | TBD |
| Net Capture System | Ron Dunklee | Astrium North America | TBD |

| PROJECT TITLE | PRINCIPAL INVESTIGATOR | ORGANIZATION | GROUND PROJECTS | |
|--|------------------------|------------------------------------|--|---------|
| | | | (b) (4) | (b) (4) |
| Systemic Therapy of NELL-1 for Spaceflight-Induced Osteoporosis | Chia Soo | UCLA, School of Medicine | TBD | TBD |
| Flame retardant behavior of modified cellulose vs. meta-aramid (Nomex) in microgravity | Jeff Strahan | Milliken & Company | TBD | TBD |
| Development and Deployment of Change Injection Device Imagers | Daniel Batchelder | Florida Institute of Technology | TBD | TBD |
| Longitudinal Assessment of Intracranial Pressure During Prolonged Spaceflight | Clifford Dacsco | Baylor College of Medicine | | |
| Impact of Increased Venous Pressure on Cerebral Blood Flow Velocity Morphology | Robert Hamilton | Neural Analytics | The team is coordinating with a NASA Ocular Health PI (Christion Otto) for sharing transcranial doppler (TCD) data. Edits to data sharing agreements are in progress. | |
| Viral Infection dynamics and Inhibition by the Vecoy nanotechnology | Erez Livneh | Vecov Nanomedicines | In vitro ground testing of Vecov nanoparticles in both the Dengue and Baculovirus models are underway. | |
| Optimizing Jamnable Granular Assemblies in a Microgravity Environment | Ramin Abrishamian | Benevolent Technologies for Health | | |
| Testing TiSi2 Nanonet Based Lithium Ion Batteries for Safety in Outer Space | Song Han | EnerLeap | When applied in the cathode of lithium ion batteries, TiSi2 nanonets can survive high temperature baking at 120 °C for 30min with no observed material degradation. This indicates TiSi2 nanonet properties can be maintained when exposed to an electrolyte at high temperature and is promising for further consideration of using lithium batteries in space. More ground testing is required. | |
| Reducing signal Interruption from cosmic ray background in networked neutron detectors | Andrew Inglis | SilverSide Detectors | A review of requirements and specifications for launching a potential flight project utilizing the NanoRacks Nanolab has determined payload specificiations. The team is refining experimental design and cost estimates for a potential "phase 2" flight project onboard the ISS. | |
| Utilize ISS Energy Systems Data for Microgrid Design and Operation | Evan Kantor | Relia Systems | The team utilized portions of the ISS power grid data to conduct operational approaches across 864 possible power system configurations, which enabled an understanding of the value proposition for various possible customer systems and profiles. | |
| Microbead Fabrication using Railford Design Engineering | Brian Plouffe | Quad Technologies | Phase one of the project has successfully developed a robust, reproducible, and easy-to-characterize QuickBead process, which will enable accurate comparisons of QuickBeads that could potentially be manufactured in the microgravity environment of the ISS. Quad has also developed assays to effectively measure QuickBead specifications for a potential comparison study of QuickBeads manufactured on the ground versus those grown in microgravity. | |

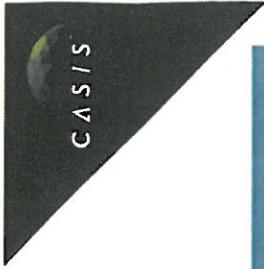
| PROJECTS ONBOARD ISS | | | | | |
|---|------------------------|---|-------------------------------------|--|--|
| PROJECT TITLE | PRINCIPAL INVESTIGATOR | ORGANIZATION | ESTIMATED RETURN DATE | STATUS UPDATE | |
| Generation of Cardiomyocytes from Human iPS Cell-derived Cardiac Progenitors | Chunhui Xu | Emory University School of Medicine | | | |
| Effects of Simulated Microgravity on c-kit+ Cardiac Stem Cells | Joshua Hare | University of Miami | | | |
| Superior Methods to Examine Bone Tumor and Host Tissue Interactions Using Micro-Gravity Bioreactors | Carl Gregory | Texas A&M Health Sciences Center | | | |
| Generation of Mesendoderm Stem Cell Progenitors In the ISS-National Laboratory | Robert Schwartz | University of Houston | | | |
| Baylor College of Medicine-Dept. of Molecular & Cellular Biology OMICS grant | Clifford Dacso | Baylor College of Medicine | | | |
| PROJECTS ONBOARD ISS | | | | | |
| Windows On Earth | Dan Barstow | Technical Education Research Centers (TERC) | No planned return | The Windows On Earth software continues to experience heavy use by the Crew Earth Observations programs and projects. WOE is also heavily utilized in several outreach and education programs. | |
| Deployment of a bone-density scanner for on-orbit animal research | John Vellinger | Techshot, Inc. | Facility class, no planned returned | This payload was hardware delivery of a bone-density scanner | |



| (b) (4) | | | | | |
|--|------------------------|--|-------------------|--|---------|
| PROJECT TITLE | PRINCIPAL INVESTIGATOR | ORGANIZATION | RETURNED PROJECTS | STATUS UPDATE | |
| Binary Colloidal Alloy Test - Low Gravity Phase Kinetics Platform | Matthew Lynch | Zh Technologies, Inc. | 7/15/2015 (SpX-7) | Remote Sensing Project—ongoing | |
| HICO Project - An Enterprise Architecture for Transferring Remote Sensing Algorithms from Research to Operations -Hyperspectral applications in the littoral zone | James Goodman | HySpeed Computing | N/A | Remote Sensing Project—ongoing | |
| HICO Project - Commercial space-borne hyperspectral harmful algal bloom (HAB) products | Ruhul Amin | United States Naval Research Laboratory | N/A | Remote Sensing Project—ongoing | |
| Hyperspectral Collection Support for the National Ecological Observatory Network (NEON) | Brian Penn | National Environmental Observation Network | N/A | Remote Sensing Project—ongoing | |
| Great Lakes Specific HICO Water Quality Algorithms | Robert Shuchman | Michigan Technological University | N/A | Joint Remote Sensing Project (with Becker)—ongoing | |
| HICO Identification of Harmful Algal Blooms | Richard Becker | University of Toledo | N/A | Joint Remote Sensing Project (with Shuchman)—ongoing | |
| Cyclone Intensity Measurements from the International Space Station (CIMISS) | A.T. Stair | Visidyne | N/A | Crew time only, no launch of hardware | |
| Hyperspectral remote sensing of terrestrial ecosystem carbon fluxes | Fred Huemmerich | University of Maryland Baltimore County | N/A | Remote sensing project, no launch of hardware | |
| Hyperspectral Mapping of iron-bearing Minerals | William H. Farrand | Space Science Institute | N/A | Remote sensing project, no launch of hardware | |
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| (b) (4) | (b) (4) | (b) (4) | (b) (4) | (b) (4) | (b) (4) |



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|---|------------------|--|----------------|---|
| Optimization of Protein Crystal Growth for Determination of Enzyme Mechanisms Through Advanced Diffraction Techniques | Constance Schall | University of Toledo | (b) (4) (4) | Experiment returned SpaceX-4 - 10/25/2014. |
| COBRA PUMA GOLF Microgravity Electrodeposition Experiment | Mike Yagley | Cobra Puma Golf | | Experiment returned SpaceX-4 - 10/25/2014 and is in postflight analysis. |
| Novartis Rodent Research | David Glass | Novartis Institute for Biomedical Research | | All in orbit operations were completed as planned and all samples, tissues, carcasses were returned on SpaceX-4 - 10/25/2014 (b) (4) |
| Collaborative proposal for protein crystal growth in space to enable therapeutic discovery | Matt Clifton | Beryllium Discovery Corp | | (b) (4) |
| Using the International Space Station to Evaluate Antibiotic Efficacy and Resistance | David Klaus | University of Colorado Boulder | | Experiment returned SpaceX-4 - 10/25/2014 and is in postflight analysis. |



CONFERENCES & EVENTS IN Q1 FY15

| DATE | EVENT TITLE | LOCATION | AUDIENCE | DESCRIPTION |
|--------------------------|--|----------------|--|--|
| September 30 - October 1 | Clinical Research Workshop (US Navy Marine Mammal Program and National Marine Mammal Foundation) | San Diego, CA | Researchers and clinicians | <p>Workshop Objective: To identify and prioritize clinical research that can continue to reduce morbidity, expand longevity, and improve the quality of life for Navy marine mammals.</p> <p>CASIS Objective: To establish connections with USN Department of the Navy Science and Technology and the clinical research community supporting marine mammal health at the workshop. The workshop included internationally-recognized experts in translational medicine working on the prevention, detection, and treatment of metabolic and infectious diseases (e.g., pre-diabetes metabolic syndrome, chronic inflammation, pneumonia) common to humans and marine mammals. These disease models are, in many cases, directly transferable to the ISS National Lab.</p> |
| October 14-16, 2014 | Industrial Research Conference | Denver, CO | C-level Executives representing 50% of all of the nation's R&D investments | Industrial Research Institute's Annual Meeting. At this event, the nation's leading companies and research organizations discuss how to best leverage investments in R&D and collaborate where it makes sense to do so. CASIS was introduced to 19 new leads, all at Fortune 500 companies, as a result of this meeting. |
| October 15-16, 2014 | International Symposium for Personal and Commercial Spaceflight (ISPCS) | Los Cruces, NM | Aerospace and researchers | For the past 10 years, ISPCS has set the industry standard for commercial space conferences. ISPCS offers an intimate setting that fosters unstructured networking, an agenda rich in content, and it is the only conference focused on the commercial space industry. If the space industry, space exploration, military, civil or commercial spaceflight, or human space travel interest you, if you want to invest, learn about the latest trends or meet our leaders, ISPCS is the place to be for two days of intense interaction. |
| October 22-26, 2014 | American Society for Gravitational and Space Research (ASGR) | Pasadena, CA | Aerospace and researchers | ASCSR brings together a diverse group of scientists and engineers to encourage and exchange ideas bridging basic and applied biological and physical science research in space and gravitational sciences. The members represent academia, government, and industry interests bonded by a common issue - how living organisms and physical systems respond to gravity and the many related broad-reaching questions regarding biological presence in extraterrestrial environments. The society's mission also includes education and outreach. The Vision of ASGR is to advance biological and physical science research in, of and for space by bringing together professional communities spanning gravitational biology, radiation biology, physical sciences, biastronautics and astrobiology, and mentoring the future scientific and engineering leaders in these fields. |
| October 27-30, 2014 | Von Braun Symposium | Huntsville, AL | Aerospace and researchers | The 7th AAS Wernher von Braun Memorial Symposium was held at the campus of The University of Alabama in Huntsville. The theme was "Moving Forward in Exploration," and the symposium brought together leaders in government, industry, and academia, and entrepreneurs. A full range of topics was covered, including NASA's space exploration strategy, ISS utilization, exploration perspectives from the millennial generation, SLS and Orion updates, senior industry leaders' perspectives, and advanced propulsion technologies. Senior NASA speakers participated in the program, and NASA Administrator Charlie Bolden was guest speaker at the luncheon on October 28. |

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| October 27, 2014 | Marshall Space Flight Center Media Day | Huntsville, AL | National and local media | CASSI representatives collaborated on the official NASA media tour of MSFC preceding Von Braun Symposium and introduced both national and local media, including the Huffington Post and the major broadcast outlets, to our industrial R&D engagement strategy. As a result of this event, CASSI was introduced to a key influencer with such organizations as Google and the Clinton Global Initiative. |
| October 29-30, 2014 | Mass Challenge Awards Ceremony | Boston, MA | Innovative and technical minded entrepreneurial coincided with business leaders through the northeast region | Awards dinner with 2000 of said individuals learning about various start up organizations and how they intend to benefit their local communities. CASSI grant recipients were announced at the awards ceremony. |
| November 6, 2014 | Flagstaff Science Alliance | Flagstaff, AZ | Science educators | A CASSI Fellow gave a presentation to educators at the November meeting. |
| November 6-7, 2014 | National Science Teacher Association (NSTA) Regional Conference | Orlando, FL | K-12 educators | NSTA regional conference offered the latest in science content, teaching strategy, and research to enhance and expand educators' professional growth. Educators can use this unique opportunity to collaborate with science education leaders and peers. |
| November 10, 2014 | National Design Challenge Houston School Assemblies | Houston, TX | Students and educators | A recognition event that acknowledged the achievements of the students and educators who have successfully designed experiments to send to the ISS as part of the CASSI National Design Challenge Pilot Program. |
| November 13, 2014 | Mass Life Sciences Press Conference (Museum of Science) | Boston, MA | Local dignitaries to include elected officials, researchers and prominent business leaders | Ceremony commemorating a partnership between CASSI and Massachusetts Life Science Centers with a keynote from Massachusetts Governor Deval Patrick. |
| November 13-14, 2014 | National Design Challenge - 2 Critical Design Review and Payload Workshop | Denver, CO | Students, CASSIS OPS, Implementation Partners | Students presented design of experiments, CASSIS Operations/Implementation Partners assisted students with Payload Integration activities. |
| November 20, 2014 | American Association of Pharmaceutical Scientists Webinar | Webinar | Industry, academia, government, and other research institutes in the pharmaceutical, biomedical, biotechnological, and public health sciences | The objectives of the blog and webinar (organized by CASSI and Dr. Franklin Spriggs) were: introduce pharmaceutical researchers to space science and the ISS National Laboratory, share case studies and relevant research that is happening now on the space station, build a better understanding of the unique laboratory capabilities of the ISS, discuss new pathways for funding and opportunities in the coming years, foster a collaborative dialogue on this innovative field of research. |
| November | University of Notre Dame-CASSI Collaboration Session | Notre Dame, IN | Administration and faculty members | A member of CASSI's Portfolio Management team, met with Notre Dame's Dean of Engineering, Associate Dean of Research, and several other professors to discuss project ideas as well as ways to potentially generate business and customer support for ISS research by Notre Dame PIs. |
| November 22, 2014 | Spacefest: Accelerating Discovery Museum of Flight | Seattle, WA | High school students and industry professionals | Weekend event demonstrating why space exploration is important and focusing on new advancements, discoveries in the world of space flight and research, highlighting the companies and people leading the way |

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| December 3-6, 2014 | World Stem Cell Summit | San Antonio, TX | Industry leaders, scientists, clinicians, students, regulators, policymakers, patient advocates, philanthropists, economic development officers and experts in law and ethics | The World Stem Cell Summit, produced by the Genetics Policy Institute (GPI), is the largest interdisciplinary, networking meeting of stem cell science and regenerative medicine stakeholders, uniting the diverse community. With the overarching purpose of fostering biomedical research, funding and investments targeting cures, the Summit is the single conference charting the future of this burgeoning field. |
| December 5, 2014 | Nemak-CASIS Collaboration Session | Houston, TX | Research executives | CASIS met with the research executives from Nemak, a multinational and world-leading high-tech aluminum components company, to develop a suite of flight project concepts for metallurgy on the ISS National Lab. |
| December 8, 2014 | Pumps & Pipes | Houston, TX | C-level executives and leadership from oil & gas, the Texas Medical Center, and NASA | CASIS displayed core messages in the Pumps & Pipes exhibit area and participate in industry sessions at the premier collaboration event between the Gulf Coast region's leaders in energy, medicine, and aerospace technologies. |
| December 10-11, 2014 | LEO Commercialization Workshop | Washington, DC | Thought leaders from private industry, aerospace, and NASA | CASIS management team participated and communicated CASIS' industrial R&D and aerospace applications strategies into working group sessions regarding the establishment of Low Earth Orbit as an economic development zone. |
| December 14-16, 2014 | New Mexico Space Grant Consortium Strategic Planning Meeting | Las Cruces, NM | NMSGC leadership | CASIS team discussed with NMSGC leadership our plans for STEM education and industrial R&D over the next year and consider how to leverage New Mexico's unique resources and infrastructure. |
| December 18, 2014 | Smuckers-CASIS Collaboration Session | Orville, OH | Research executives | CASIS met with research executives from Smuckers, the world-famous food company, to develop a suite of flight project concepts for colloids and other materials research on the ISS National Lab. |