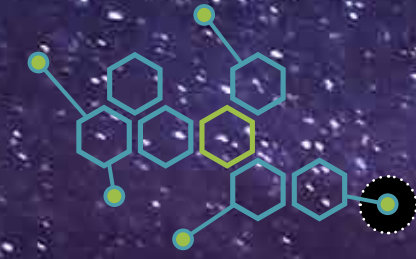
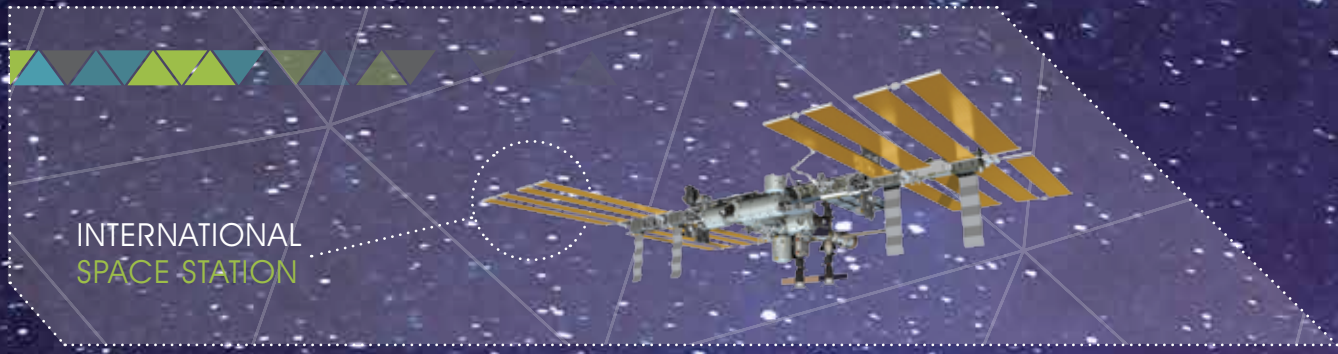


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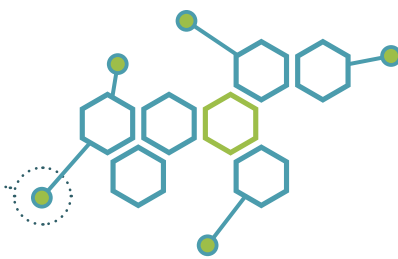


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THE CASIS MISSION is to enable and increase the use of the International Space Station U.S. National Laboratory as a unique dynamic platform for scientific discovery, technology development and education for the benefit of life on Earth. CASIS is responsible for maximizing the value of the ISS to the nation by developing and managing a diversified R&D portfolio based on U.S. national needs for basic and applied research and by using the ISS as a venue for Science, Technology, Engineering and Mathematics (STEM) educational activities.



LETTER FROM THE PRESIDENT/EXECUTIVE DIRECTOR



As the year draws to a close, I am delighted with the progress our organization has made in just two years. Collectively, we have made tremendous strides and continue to pursue the task that Congress and the American people entrusted us with—managing the U.S. National Laboratory aboard the International Space Station—with a profound sense of responsibility and optimism about the future. In the short time since we were founded in late 2011, CASIS has evolved from a start-up organization to a fully operational one.

GREGORY H. JOHNSON



Our organizational goals can be summarized in three words: innovate, maximize and educate. Our strategic plan outlines specific objectives:

1. Establish a robust “innovation cycle” where first-class science drives the development of technologies, new intellectual property and commercial opportunities
2. Utilize the International Space Station U.S. National Laboratory (ISS NL) for developing new capabilities based on existing proof-of-concept technologies, while allowing time for longer-term scientific commercial initiatives to develop
3. Promote the value of the ISS NL to the nation, and establish it as a leading laboratory and environment for Science, Technology, Engineering and Mathematics (STEM) education

In fiscal year 2013 (FY13), CASIS reached a major milestone by inducting its first members of its Board of Directors. These seven highly distinguished entrepreneurs, institutional leaders and researchers have been greatly instrumental in the continued development of this organization. The Board of Directors provides our team with structure, direction, ideas and overwhelming support to promote the ISS NL and the benefits that are possible through station research and technology development.

► **SETTING THE PACE:** During FY12-13, CASIS issued five public solicitations in addition to receiving numerous unsolicited proposals. These solicitations have generated numerous research and technology development projects destined for the ISS NL. Furthermore, we continue to build strong relationships within academic and commercial communities in order to increase awareness

5

PUBLIC SOLICITATIONS

and create new and innovative ways to take advantage of the unique capabilities of the ISS NL. CASIS has forged valuable partnerships with corporate and academic entities that will yield profitable and enriching results. Our business development ecosystem model, which maximizes relationships between academia, business, investment communities and research interests, has helped our organization create a network of users and resources in key geographic locations, which lends invaluable assistance to our third key objective—promotion. Through strategic communication and targeted media campaigns, CASIS has increased brand recognition and connected with new users.

As our portfolio and partnerships increase, we are committed to educating the next generation of researchers and scientists about the benefits and promise of space. Our STEM program has launched several key educational initiatives that are involving students in hands-on experiments to learn about new research, scientific principles and even robotics.

► **A NEW MARKET:** We are on the verge of a new era. Space is an emerging commercial market, and CASIS is at the forefront of enabling this new and exciting time in exploration. We have access to an unparalleled platform, and our ultimate goal is to facilitate next-generation science—today. Support from the scientific community is growing as a number of researchers look to expand beyond the reach of gravity through CASIS.

I am encouraged that CASIS has achieved such positive growth, but we will not rest on early accomplishments. In the next twelve months, we look to launch a variety of payloads, a testament to the growing community of researchers and influx of ideas generated by CASIS and the ISS NL. Our organization is sticking to the basics and adhering to our mission. CASIS is facilitating, funding and promoting sound scientific research in an effort to improve life on Earth and pave the way to an exciting future for our people and our planet.

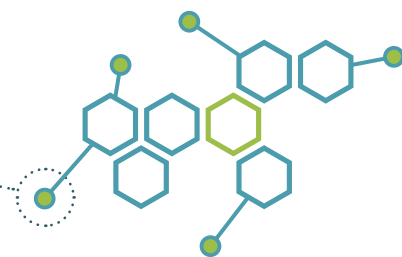
Welcome to the next emerging market—in space!

Sincerely,

Gregory H. Johnson
President and Executive Director, CASIS

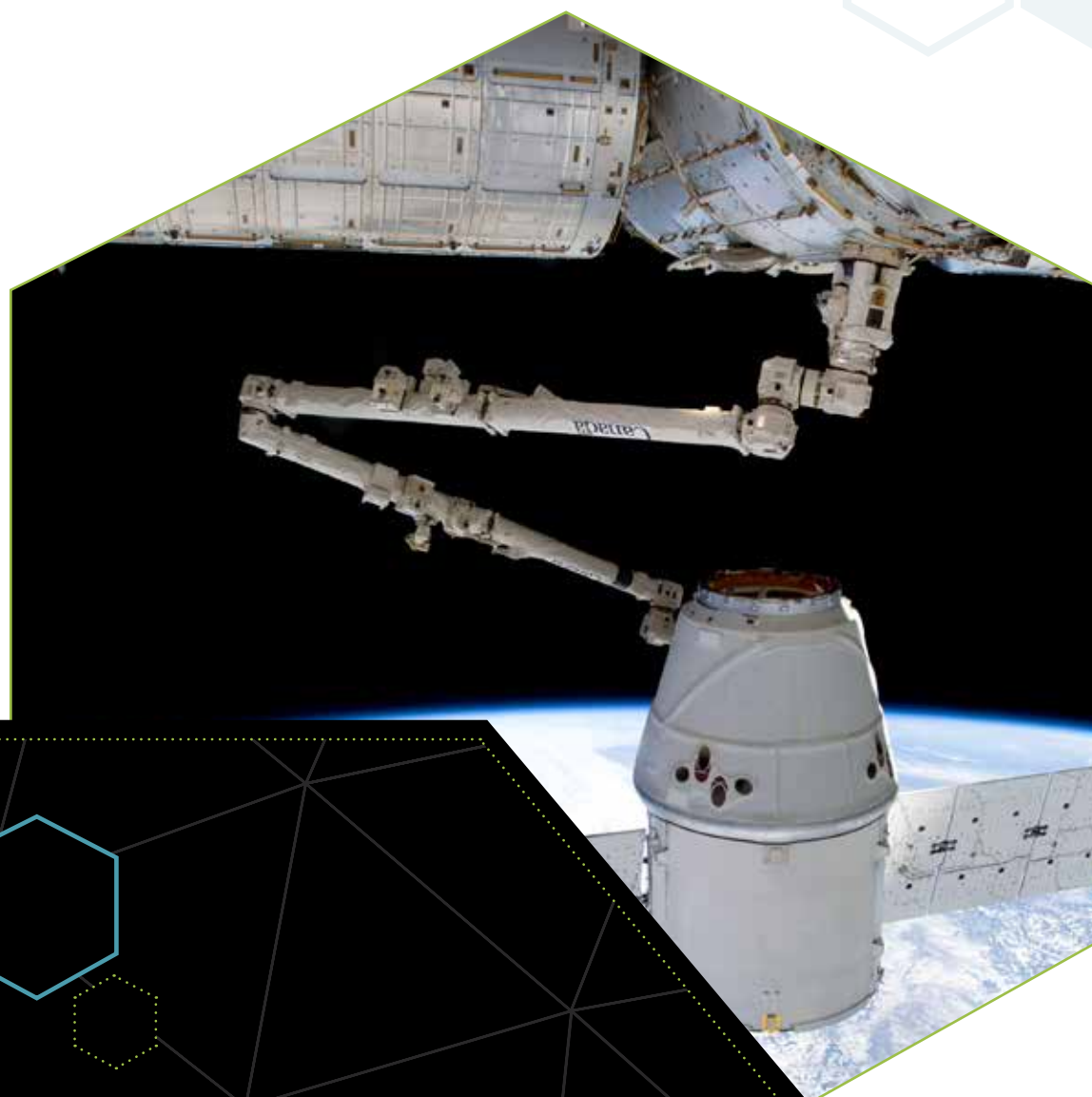


VISION & GOALS



THE CASIS VISION

The CASIS vision is to fully realize the unique scientific, technological and educational potential of the ISS NL by focusing both outwardly—toward exposing the scientific, technological and educational communities to the benefits that can come from research and operations in space, and inwardly—toward improving humankind's wellbeing on Earth. The outward- and inward-looking aspects of the CASIS Vision are intertwined and will require close collaboration with NASA, other government agencies, research and educational institutions, industry partners and commercial entities committed to exploring the intellectual, technological and economic opportunities offered by space. An important focus of the CASIS mission is to engage and connect to new stakeholders who have not been traditionally involved with NASA or with space research.



CASIS STRATEGIC GOALS AND OBJECTIVES

Innovate. Maximize. Educate.

1. CASIS will establish a robust "innovation cycle" where first-class science will drive the development of technologies, new intellectual property and commercial opportunities, which in turn drive new ideas and novel first-class science.
 - ▶ **OBJECTIVES:** Identify key R&D areas; generate solicitations; broker awards; track investments, progress and results; manifest flights; establish an "innovation cycle;" balance the R&D portfolio; increase diversity in the R&D community over time; and develop a strong research program with demonstrable impacts to life on Earth.
2. Utilize the ISS for developing new capabilities based on existing proof-of-concept technologies, while allowing time for longer-term scientific commercial initiatives to develop.
 - ▶ **OBJECTIVES:** Demonstrate the utilization of the ISS as a technology development and test bed; attract commercial and applied interests; identify near-term technology candidates and pursue near-term flight opportunities; and develop partnerships and programs leveraging ISS and contributing to national technology initiatives.
3. Undertake a strong public outreach promoting the value of the ISS NL to the nation, and establish the ISS NL as a leading laboratory and environment for STEM education.
 - ▶ **OBJECTIVES:** Develop new partnerships in STEM; create opportunities for STEM utilizing the ISS and leveraging a variety of methods and settings; cultivate existing research ecosystems to develop flight opportunities with associated STEM content; assess (benchmark) awareness of CASIS and the ISS NL among key stakeholders; develop communications, marketing, business development, outreach and public awareness efforts to raise awareness over time; increase the number of contacts with CASIS; and increase the utilization of the ISS NL.



LEADERSHIP STRUCTURE

BOARD OF DIRECTORS

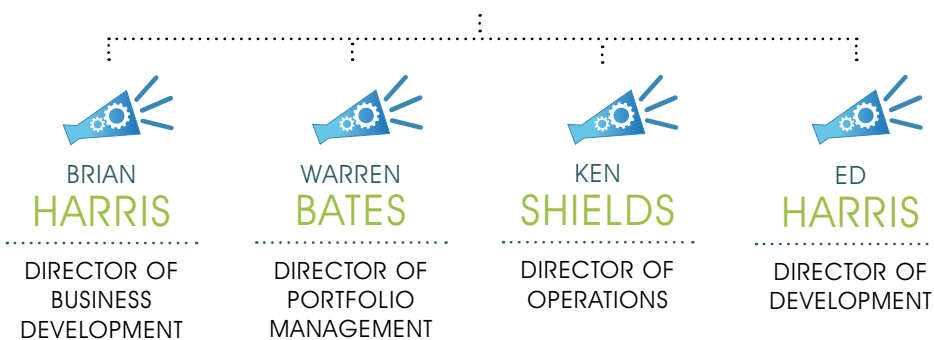
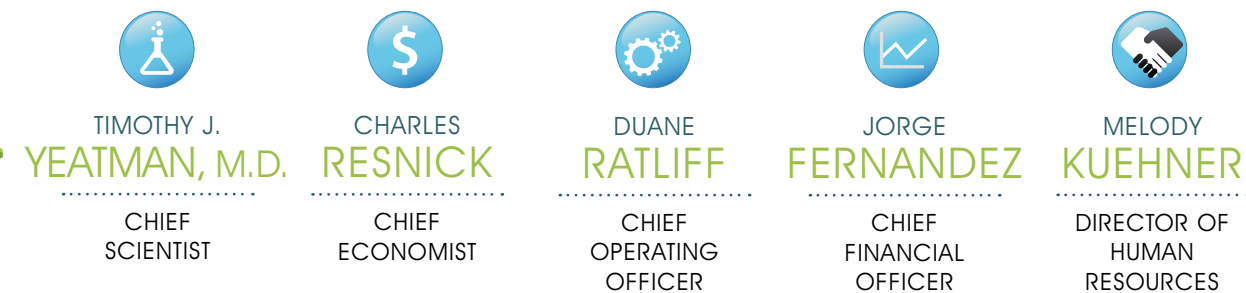
- FRANCE CORDOVA, PH.D.
- BESS DAWSON-HUGHS, M.D.
- LEWIS DUNCAN, PH.D.
- LEROY HOOD, M.D., PH.D.
- ANDREI E. RUCKENSTEIN, PH.D.
- GORDANA VUNJAK-NOVAKOVIC, PH.D.
- HOWARD ZUCKER, M.D., J.D.



RATLIFF, JOHNSON AND FERNANDEZ OUTSIDE THE WHITE HOUSE

GREGORY H. JOHNSON
EXECUTIVE DIRECTOR

SCIENCE & TECHNOLOGY ADVISORY PANEL



LETTER FROM THE BOARD OF DIRECTORS CHAIRPERSON

In November 2012, CASIS inducted the first seven members of its Board of Directors. As Chairperson of the Board, I am pleased to report the accomplishments we have achieved with CASIS over the past year. Transitioning from an interim Board in itself was a critical milestone for CASIS. The distinguished scientists, renowned researchers and respected academic leaders that join me on the Board are eager to advance the CASIS mission as a means to accelerate U.S. R&D and demonstrate to the world that space-based science remains a priority in this country.

In addition to formalizing the Board and its governance, CASIS worked closely with us to enhance and finalize its Strategic Plan, which will guide the organization in the coming years toward its ultimate goal of increasing ISS NL utilization and success. The plan incorporates critical input from the broad science and management expertise of the Board, CASIS staff experience in the realities of everyday operations, and external consultation from multiple fronts. The highlights of this plan, detailed earlier in this report, embody a major accomplishment for CASIS in FY13.

Moreover, the formation of Board subcommittees dedicated to specific areas of CASIS operations has optimized our ability to provide guidance and expertise in the following areas: governance, compensation, audit and science. These subcommittees meet regularly and represent the core of the Board's ability to supervise and support CASIS actively and effectively.

Finally, by far the most substantial action of the Board in FY13 was the selection and appointment of a President and Executive Director of CASIS. We rigorously reviewed dozens of excellent candidates for this position, and we are confident that our selection of former astronaut Greg Johnson will not only transform and unite CASIS under strong leadership but also provide a recognizable and respected new face to represent the organization to the nation and the world.

The task of CASIS is challenging, but the success of its mission could revolutionize U.S. scientific achievement. FY13 saw many milestones in improving CASIS organization and operations, many supported by active involvement of the Board—and this is strongly complemented by additional scientific and commercial achievements. The momentum is great entering into FY14, and I look forward to observing and contributing to even greater successes as we move forward into the new year.

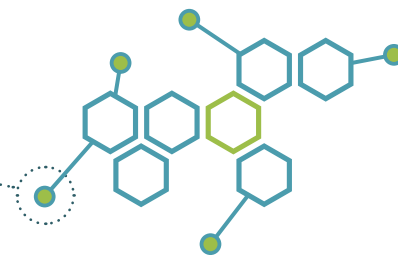
Sincerely,

France Cordova, Ph.D.
Chairperson,
CASIS Board of Directors

FRANCE CORDOVA, PH.D.



ANNUAL ACHIEVEMENTS



CASIS AT A GLANCE (BRIEF OVERVIEW OF FY13 [OCT. 1, 2012–SEPT. 30, 2013])

FY 2013 was very productive for CASIS. Our organization made tremendous strides to maximize use of the ISS NL for terrestrial benefit. We have worked closely with NASA and other government agencies (OGAs) to develop an effective process for bringing new research opportunities to new/continuing users of the ISS NL. We have also established ourselves within scientific and academic communities and continue to avail the research capabilities of the ISS NL for the ultimate benefit of Earth. In 2013, CASIS met all of its goals and proudly excelled in many areas, detailed below.

32
NEW PARTNERSHIPS

5
RFPs/RFIs DISTRIBUTED

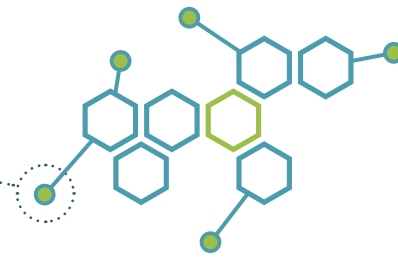
40
UNSOLICITED PROPOSALS RECEIVED

28
SELECTED/AWARDED PROJECTS

\$4.9
MILLION ATTRIBUTED TO FLIGHT PROJECTS

DEPARTMENT	GOALS	STATUS
OPERATIONS DIVISION	<ul style="list-style-type: none"> ▶ Identify how the CASIS prioritization method maps to the NASA ISS Research Office priority matrix ▶ Engage OGAs to develop Memorandums of Agreement and to create a process for bringing research opportunities into CASIS for new/continued users of the ISS NL ▶ Provide a forum for access for OGAs involved in ISS NL utilization to enable regular communication of activities and planning ▶ Establish a guide for providing information to investigators that describes all steps of the payload development, testing and manifest process ▶ Support the American Astronautical Society conference by developing and managing an operationally focused direct dialogue and network event as part of the planned breakout sessions ▶ Provide a one-year and five-year outlook and utilization plan for CASIS-sponsored payloads utilizing the ISS NL 	✓

DEPARTMENT	GOALS	STATUS
SCIENCE AND TECHNOLOGY	<ul style="list-style-type: none"> ▶ Recruit and establish a science and technology advisory panel to support the development of research pathways and to serve as needed to conduct proposal reviews, perform analyses and provide science and technology consultation ▶ Identify approved research pathways and provide documentation of the process used to establish those pathways ▶ Create a schedule that identifies the planned execution of CASIS grant opportunities ▶ Establish the approach for OGAs to collaboratively conduct science reviews for CASIS-sponsored research 	✓
ECONOMIC VALUATION	<ul style="list-style-type: none"> ▶ Provide an established policy and procedure for conducting fair and transparent valuation of projects that span the spectrum from basic to applied science and technology development ▶ Develop and execute a process for identifying issues and lessons learned from RFPs ▶ Develop criteria and a plan for a market-based "environmental scan" mapping new trends in technology investment with potential need for space-based platforms 	✓
FUNDRAISING & DEVELOPMENT	<ul style="list-style-type: none"> ▶ Create a near-term strategy for targeting and capturing funding opportunities that will assist commercial, academic and other interests in ISS utilization ▶ Create a robust funding prospect contact plan and database ▶ Develop a yearly fundraising campaign planning process ▶ Validate that CASIS is prepared for a fundraising campaign that includes the integration of all relevant areas (communications, education, finance, Board status, etc.) 	✓
BUSINESS DEVELOPMENT	<ul style="list-style-type: none"> ▶ Create a business plan for targeting and capturing research opportunities that will utilize the ISS NL for commercial interests ▶ Develop a customer contact plan and database 	✓
STEM EDUCATION	<ul style="list-style-type: none"> ▶ Enter into discussions with national organizations/commercial entities to begin the development of ISS-based STEM programs and partnership opportunities ▶ Complete development of the STEM strategic plan and begin implementation 	✓
MARKETING & COMMUNICATION	<ul style="list-style-type: none"> ▶ Finalize a press strategy for CASIS Increment 37/38 participation and begin a promotional campaign using videos and outlets to create excitement over the milestone event ▶ Establish and track metrics for outreach ▶ Complete the CASIS MarComm Strategic Plan 	✓



Protein Crystallization: Previously, in FY12, CASIS issued its first Request for Proposals (RFP) to advance the understanding of protein crystallization in space. The emphases of this RFP were (1) improving yield and resolution in crystallographic studies and (2) developing new crystallization approaches that have commercial, medical or scientific applications. Based on the announcement, in FY13 CASIS selected the following six proposals for flight opportunities onboard the ISS:



Advancing Protein Crystallization By Using Microgravity

Dr. Stephen Aller – *University of Alabama Birmingham*
Life Sciences

1.

This research will help determine the structure of human membrane proteins, which could accelerate the commercialization of next-generation drugs to treat AIDS-related dementia, high cholesterol, atherosclerosis, cystic fibrosis and multi-drug resistance as it relates to cancer.

Crystallization of Huntington Exon 1 Using Microgravity

Dr. Pamela Bjorkman – *California Institute of Technology*
Life Sciences

2.

This research will focus on Huntington's disease. The structure of the protein critical to the detrimental effects of Huntington's disease remains unknown. If successful in producing a high-resolution structure, this study could have a significant scientific and medical impact on understanding the structural basis for neural toxicity and developing treatments for Huntington's disease and other related disorders, such as spinocerebellar ataxia.

Crystallization of Medically Relevant Proteins Using Microgravity

Dr. Sergey Korolev – *Saint Louis University School of Medicine*
Life Sciences

3.

This research will focus on improving crystals of two medically important proteins. These two proteins have multiple functions within cells, and results could therefore assist in the development of various medical interventions, from anticoagulant therapies to drug treatments for cardiovascular disease, diabetes, muscular dystrophy and Parkinson's disease.

Exploiting On-orbit Crystal Properties for Structural Studies of Medically and Economically Important Targets

Dr. Edward Snell – *University of Buffalo*
Life Sciences

4.

This research will focus on growing crystals of four proteins associated with human disease. These proteins crystallize on Earth but not with sufficient quality and uniformity to determine their structures. Larger, better-organized crystals of these specific proteins could have a significant impact on drug development for Parkinson's disease, bovine spongiform encephalopathy, ethylmalonic aciduria and cutaneous squamous cell carcinoma.

Large Volume Crystal Growth of Inorganic Pyrophosphatase Complexes by Counter-diffusion Under Microgravity for Neutron Diffraction Studies

Dr. Joseph Ng – *iXpressGenes Inc.*
Life Sciences

5.

This research will grow proteins capable of being studied by neutron diffraction. Neutron diffraction is a method used to determine the structures of proteins, but the method requires large protein crystals, which are hard to produce on the ground. This study could show that microgravity is a powerful avenue to obtain proteins sufficient for neutron diffraction studies while also informing further research into the roles of the specific studied proteins, which are involved in various aspects of human health.

Optimization of Protein Crystal Growth for Determination of Enzyme Mechanisms Through Advanced Diffraction Techniques

Dr. Constance Schall – *University of Toledo*
Life Sciences

6.

This research will also use the space environment to grow crystals of sufficient size for neutron diffraction—examining the effects of various experimental conditions on three medically important proteins to optimize the growth of quality crystals. Potential Earth benefits from the investigation may include improved disease treatments for Salmonella infection, peptic ulcer disease, heart attack and liver disease.

Materials Science: This RFP focused on facilitating research in the field of materials science, on station, by commercial and academic investigators. This solicitation sought proposals intent on using extreme conditions of space for the development and testing of new materials, components and systems that will have Earth-based applications. CASIS plans to maximize the variety of platforms on station, including the NanoRacks external platform. Space provides the ultimate test condition for materials testing. Specific conditions include atomic oxygen (a highly reactive atomic species in low Earth orbit), extreme ultraviolet radiation and a vacuum that affects physical properties. Exposure to multiple environmental extremes can provide a mechanism for rapid failure mode analysis that ground-based simulations cannot.



Characterization of Light-Trapping Thin Film Photovoltaic Cells in the Space Environment

Dr. W. Jud Ready – *Georgia Institute of Technology*
Materials Science

1.

This research will focus on improving solar cells to increase cost effectiveness and energy efficiency. Past research using this solar-cell design, which uses lightweight carbon nanotubes, showed an increased ability to efficiently capture photons from the sun to create energy. The solar-cell material to be tested on the space station is lighter weight and less costly to manufacture compared to previous designs because it is more abundant and less toxic. In addition, an improved textured design will more efficiently "trap" the sun's energy.

The Evaluation of Gumstix™ Modules in Low Earth Orbit

Dr. Kathleen Morse – *Advance Materials Applications, LLC*
Materials Science

2.

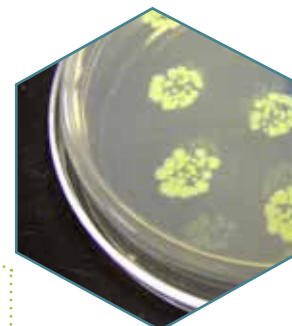
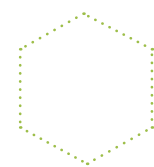
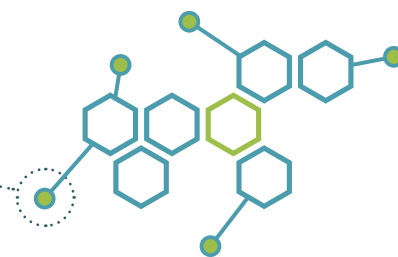
This research will test how exposure to the space environment affects the Gumstix™, a computer-on-module (COM)-based computer design. This gum stick-sized computer may improve satellite capabilities that are currently constrained by the limited computing power of radiation-hardened computers. The ability of the Gumstix™ COM to withstand radiation exposure will enable the usefulness of fault-tolerant computers as an alternative approach to meet the intensive needs of current and next-generation satellites.

Stem Cell Research*: This RFP sought proposals from commercial and academic investigators looking to study mammalian stem cell biology for 1) rapid turn-around spaceflight experiments for the ISS NL or 2) ground-based research designed to lead to or facilitate future spaceflight experiments. The purpose of this RFP was to avail ISS NL resources to accelerate important stem cell research that could be critical in developing medical treatments.

*Awardees announced in FY14.



UNSOLICITED PROPOSALS



CASIS supports investigations across a broad spectrum of basic and applied research. In order to maximize the unparalleled research capabilities of the ISS NL, CASIS regularly provides formal solicitation opportunities in the life, physical, materials and observational sciences. However, CASIS also welcomes unsolicited proposals for research and product development that might be suitable for the ISS NL. CASIS recognizes that exciting ideas for groundbreaking space-based R&D may emerge anywhere and at anytime, and unsolicited proposals provide an ideal platform to engage commercial and academic communities. The CASIS mission is to maximize utilization of the ISS NL, facilitating cutting-edge research on station from every corner of the country. Each unsolicited proposal is carefully vetted by CASIS staff for operational feasibility, scientific merit and economic value. The CASIS staff works diligently to ensure that qualifying proposals are transformed into flight-ready projects.

Binary Colloidal Alloy Test – Low Gravity Phase Kinetics Platform
Dr. Matthew Lynch – *Procter & Gamble*
Dr. Carlos Grodzinsky – *ZIN Technologies*
Physical Sciences

1.

This research will use the absence of buoyancy-driven convection in microgravity to examine aspects of complex fluid physics—specifically the movement of particles within colloids and the way these mixtures crystallize, melt and undergo phase separation. A fundamental understanding of the underlying physics needed to stabilize everyday commercial products may help in the development of new colloidal materials and product formulations with unique properties. These improved products may have enhanced performance, better stability and lower manufacturing costs.

Commercial Space-Borne Hyperspectral Harmful Algal Bloom Products
Dr. Rahul Amin – *U.S. Naval Research Laboratory*
Remote Sensing

2.

This research will use remotely sensed hyperspectral optical measurements from the Hyperspectral Imager for the Coastal Oceans (HICO) on the ISS to develop early harmful algal bloom detection, quantification and classification algorithms. This study will focus in the Gulf of Mexico, particularly in the eastern part where toxic algal blooms, specifically dinoflagellate *Karenia brevis*, regularly occur.

Drug Development and Human Biology
Dr. Timothy Hammond – *Department of Veterans Affairs*
Life Sciences

3.

This research will investigate a yeast-based assay that is used in developing drug therapies on the ground. Previous investigations on the U.S. Space Shuttle showed changes in this assay in space, and Dr. Hammond seeks to demonstrate that these changes can be used for discovery and evaluation of drugs such as cancer therapeutics. Initial experiments studying existing drugs may reveal new uses for these drugs—while optimizing the experimental methodology and paving the way for future experiments.

An Enterprise Architecture for Transferring Remote Sensing Algorithms from Research to Operations – Hyperspectral Applications in the Littoral Zone
Dr. James Goodman – *HySpeed Computing LLC*
Remote Sensing

4.

This investigation will use the HICO instrument on the ISS to develop an enterprise architecture for image processing that leverages existing investments in Earth observation data acquisition and enables the remote sensing community to more effectively transform research ideas into functional software applications.

International Space Station Hyperspectral Collection Support for the National Ecological Observation Network
Dr. Brian Penn – *National Ecological*
Remote Sensing

5.

The National Ecological Observatory Network (NEON) is an ecological observatory funded by the National Science Foundation. Researchers will use HICO in conjunction with three aerial observation platform sensors and NEON imaging spectrometers to collect hyperspectral imagery of 20 distinct ecological regions on Earth.

Longitudinal Assessment of Intracranial Pressure During Prolonged Spaceflight
Dr. Clifford Dasco – *Baylor College of Medicine*
Life Sciences

6.

This research will evaluate physiological changes in the eye caused by a prolonged increase in intracranial pressure (ICP), a known side effect of spaceflight on astronauts. By studying the effects of ICP on the retina and optic nerve in microgravity, Dr. Dasco and his team hope to identify early indicators of ICP that will aid in the monitoring, early diagnosis and treatment of visual impairment in patients who experience this condition on Earth, such as children and adults with Type II diabetes.

Molecular Biology of Plant Development in the Spaceflight Environment
Dr. Anna-Lisa Paul – *University of Florida*
Life Sciences

7.

This research focuses on the growth and development of *Arabidopsis thaliana* seedlings in the spaceflight environment. Researchers seek to identify the genes involved in plant root morphology and adaptive physiology; specifically, how a root knows in which direction to grow when gravity is absent. Results will expand on those of previous ISS research in this area and further the study of specific molecular pathways involved in plant adaptive physiology on Earth.

Nanofluidics Decoupling Diffusive Transport Phenomena
Dr. Alessandro Grattoni – *The Methodist Hospital Research Institute*
Life Sciences

8.

The awarded project will examine the feasibility of modeling nanofluidics by studying slightly larger (microscale) systems of fluid transport in space, which will allow greater control of the experimental system. Past research has shown that fluid transport through extremely small channels (at the nanoscale, where fluid molecules highly interact with pore walls) occurs differently than in larger-sized systems—and these differences must be better understood to improve the use of nanofluidics for clinical medicine and diagnosis, including the engineering of drug delivery systems and biological imaging agents.

Novartis Rodent Research
Dr. David Glass; Dr. Sam Cadena – *Novartis*
Life Sciences

9.

This research will explore the molecular basis of muscle atrophy caused by extended microgravity exposure from spaceflight by examining a transgenic mouse model deficient in the Muscle RING Finger-1 (MuRF-1) gene. Novartis scientists will assess muscle changes in mouse hind limb muscles including muscle mass, muscle fiber size and type (fast vs. slow) and compare the differential protein and gene expression in MuRF-1 Knock-out (KO) mice compared with control mice with normal expression of this gene. Ten mice (5 MuRF-1 KO and 5 wild-type controls) will be flown onboard the SpaceX-4 mission to the ISS, where they will be housed for approximately 3 weeks.

Project Meteor
Michael Fortenberry – *Southwest Research Institute*
Remote Sensing

10.

This project will launch a visible spectroscopy instrument for meteor observations. Project Meteor will provide a continuous monitor of meteor interaction with the Earth's atmosphere without the limitations of ozone absorption. The resultant data will be the first measurement of meteor flux and will allow for monitoring of carbon-based compounds. Investigation of meteor elemental composition is important to our understanding of how the planets developed.

Role of Gravity and Geomagnetic Field in Flatworm Regeneration
Dr. Mahendra Jain – *Kentucky Space*
Life Sciences

11.

This research will examine the effects of a microgravity environment on the enhanced healing abilities of planarian flatworms. Gravity, and the lack thereof, influences the way cells behave and their ability to rebuild tissue. Studying planarians in space may reveal new aspects of how cells rebuild tissue, which could lead to breakthroughs in medical treatments for humans. For example, regenerative medicine has the potential to treat conditions like Parkinson's, heart disease or lost limbs.

Cobra Puma Golf Materials Testing in Microgravity
Mike Yagley – *Cobra Puma Golf*
Materials Sciences

12.

In this investigation, the sporting goods company Cobra Puma Golf will examine electroplating—the process of coating a metallic surface using an electric current—in microgravity. A variety of coating materials will be applied to materials used in commercial golf products, and differences in the bonding, strength and weight of the resulting materials will be analyzed. Examining the bonding of dissimilar materials in space might yield insight into improved alloy development for stronger and lighter golf equipment on Earth.

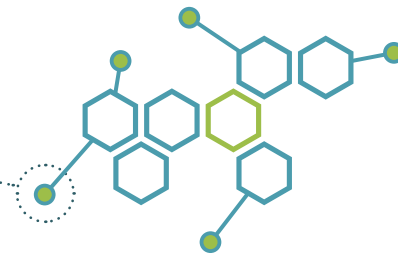
Omics Research Platform
Dr. Clifford Dasco – *Baylor College of Medicine*
Life Sciences

13.

The development of an omics Research Platform will include a number of the Medical Center researchers, NASA and other commercial interests. This platform will create a high-throughput omics-based research model that will allow multiple investigators access to data and analyses that will ultimately be targeted toward developing personalized medicine decision tools. Researchers will be able to analyze results from ground and space-based experiments and communicate these within the omics research community. Omics research has a myriad of terrestrial applications, including disease diagnosis, drug design and epidemiology.

EDUCATIONAL INITIATIVES

ACTIVE STEM PROJECTS



CASIS strongly believes in maintaining an interactive and accessible STEM program. Our educational initiatives are designed to catalyze and sustain students' interest and motivation. We also provide a wealth of experiences and resources for teachers to engage students in a variety of STEM subjects—all capitalizing on the real-world excitement of the ISS. CASIS has engineered stimulating content and forged valuable partnerships that enable students to pursue questions, investigate, explore and solve problems. CASIS programs do not limit students' ingenuity or creativity. Rather, they facilitate wonder and excitement and encourage student input and industriousness.

National Design Challenge (NDC)

CASIS is developing the NDC, a national education campaign that provides educators and their students the opportunity to design and implement an authentic research experiment on the ISS. CASIS and its partners will develop standards-based STEM curriculum support materials that will model STEM best practices and feature science and engineering practices as developed in the new Next Generation Science Standards. Educators will be able to use these materials to involve their entire classroom in the experiment development and engineering design process. A series of professional development opportunities will be developed for educators who participate in the program.

National Design Challenge Pilot Project: The NDC Pilot Project, designed as a proof of concept for the NDC national campaign, is intended to support the development of the NDC and the Houston Ecosystem (see p.19 for information on CASIS ecosystems). Six educators from three Houston schools will design and scale experiments that will be flown in 1U ArduLabs to the ISS in the spring of 2014.



CASIS Academy Live

CASIS Academy Live is a program that brings middle and high school students to the Kennedy Space Center Visitor Complex (KSCVC) and the Space Life Sciences Lab (SLSL). This all-day event allows students to interact with a NASA astronaut and a research scientist selected by CASIS to send their experiment to the ISS. Students engage in a hands-on activity and tour the SLSL and KSCVC. In addition, CASIS Academy Live is able to reach classrooms nationwide via NASA's Digital Learning Network, which streams live interviews of CASIS researchers.

Story Time From Space (STFS)

STFS is an advocacy STEM project that combines STEM literacy with simple science demonstrations. It provides a cross-curricular activity that reaches out to new demographic organizations such as the International Reading Association and American Public Library Association. The project includes videotapes of astronauts reading selected stories from the cupola of the ISS and conducting simple physics demonstrations that complement the STEM concepts in the books. As part of the project, award-winning author Dr. Jeffrey Bennett and Astronaut Alvin Drew have written a children's book based on the ISS, "Max Goes to the Space Station." Other STFS activities will include professional development and lesson plans for educators and a planetarium show that can be used in science centers across the country.

CASIS Academy Interactive Website

casisacademy.org

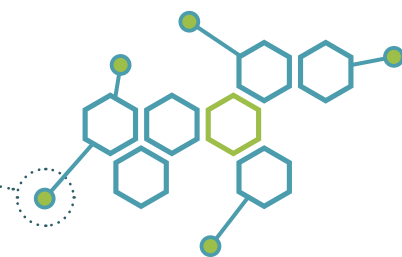
CASIS Academy is an interactive learning website created to educate middle school students about the ISS and to pique their interest through multimedia videos and features. The website incorporates multiple sections, including breakthroughs resulting from ISS research, a tour of the station and interactive definitions of key terminology. There is also an educator section that includes background information on ISS research pathways, lesson plans and suggestions for using the CASIS Academy in the classroom.

CASIS Fellows

The CASIS Education Fellows Program is designed to work with motivated volunteers across the nation. These educator volunteers communicate the excitement of the CASIS mission and information about recent research conducted onboard the ISS NL. In addition, the Fellows provide a base group of educators who will pilot test materials, serve as a focus group and provide training to their local community on CASIS Education programs.

CONTINUED »





PGA STEM Golf Camp

CASIS partners with the Professional Golfers' Association of America Center for Golf Learning and Performance, Cobra Puma Golf and St. Lucie County Schools to bring together science and golf by offering a five-day golf summer camp for 7th- and 8th-grade underprivileged students. The program is designed to engage students in a fun activity that teaches them fundamental elements of math and physics. CASIS provides guest speakers that include engineers, researchers, scientists and astronauts.

Zero Robotics Middle School Program

CASIS is sponsoring the SPHERES Zero Robotics Competition, a fun and flexible STEM curriculum for middle school students. Over the five-week program, beginning in mid-summer, participants work in teams with program staff, MIT mentors and prominent scientists to learn about programming, robotics and space engineering while gaining hands-on experience working with and programming SPHERES (Synchronized Position Hold, Engage, Reorient, Experimental Satellites). The program culminates in a tournament where each team's SPHERES will "battle" for spots to operate on the ISS. At the end of the summer, participants will get to see their SPHERES in space via a live feed and have a conversation with ISS astronauts.

BioServe Ants In Space

CASIS is a sponsor of the BioServe Ants in Space program, which offers students the ability to participate in near real-time life science research onboard the ISS. Students conduct ground control experiments and compare their experiment results with those from the spaceflight experiments. The Ants in Space program, scheduled to launch to the ISS in FY14, will study foraging ant behavior. For each experiment conducted, teachers are provided a standards-based curriculum to utilize.



Student Spaceflight Experiments Program (SSEP)

CASIS is a sponsor of Mission 3, 4, 5 and 6 of the Student Spaceflight Experiments Program, which includes 5,400 middle and high school students. SSEP is a program of the National Center for Earth and Space Science Education that gives 300 to 1,000 students across a community the ability to design and propose real experiments to fly in low Earth orbit on the ISS.

Space Station Academy

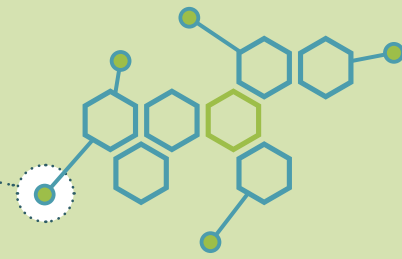
CASIS is sponsoring the Space Station Academy, a program designed to take participants on a simulated mission to the ISS as "virtual astronauts." This highly engaging six-week online program will be offered in middle and high schools as well as outside of school to young people and adults who want to participate on their own. As part of the mission, participants will contribute to authentic research, helping to geo-reference and annotate photographs of Earth taken by astronauts. The project builds on Windows on Earth, a CASIS-funded mission to ISS, supporting on-orbit Earth photography. The Space Station Academy will be piloted in FY14 and will reach 5,000 participants by the end of the second year.

HUNCH

CASIS is sponsoring a high school team participating in the NASA HUNCH (High School Students United with NASA to Create Hardware) Program, a partnership between high schools and NASA where students design, build and implement an experiment in microgravity. The Billings, Montana team will send their experiment to the ISS in the spring of 2014 to study the effects of microgravity on *Chlorella pyrenoidosa*, an algae with several potential and beneficial uses for living and conducting research in the space environment.



REGIONAL ECOSYSTEMS



The CASIS ecosystem model enables access to academic institutions, research-specific organizations, philanthropic entities and industry partners—localized due to the region’s targeted economy and market concentration—that have the potential to benefit from use of the ISS NL in the areas of research and technology development.

Our organization identified three U.S. regions as innovation hubs—Boston, Houston and the Silicon Valley—and tapped into the resources in these regions. CASIS is working with many new partners within these regions and has since begun establishing other ecosystems.

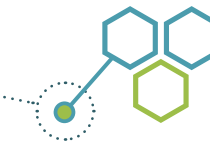
Boston houses over 100 universities and over 300 biotech companies, and the Boston/Cambridge area has more than 30 technology transfer offices that support the commercialization of research for the public good. This fits well with the CASIS mission of translating space science into knowledge and products that will benefit humankind. Additionally, Boston has the world’s highest concentration of government-sponsored research and contains R&D facilities for most of the top pharmaceutical companies.

Houston has a rich space legacy, a booming energy industry and is home to the largest medical complex in the world. The Texas Medical Center is an internationally recognized community of fifty-four member institutions, dedicated to patient care, research and education. These include twenty-one renowned hospitals and two specialty institutions, three medical schools, six nursing schools and schools of dentistry, public health, pharmacy and various other health-related careers.

Silicon Valley in California is arguably the world’s epicenter for entrepreneurship and start-up activity, capturing the highest level of venture capital investment and deal flow in the world. Silicon Valley/San Francisco has the greatest numbers of high-tech jobs in the U.S., with the highest concentration of these jobs in any metropolitan area. Additionally, the space economy in California has already laid a foundation advantageous to the CASIS mission: innovative transfer of space-based initiatives into non-space sectors.

While CASIS has identified Boston, Houston and Silicon Valley as our major ecosystems, the organization continues to identify areas of opportunity in other regional cities. For instance, the city of Denver, with its robust aerospace industry and philanthropic history, has paved the way for many great partnerships. Our home state, Florida, also has a storied space history with numerous aerospace and research institutions presenting ideal partnership opportunities. CASIS will continue to identify opportunities that further utilize the ISS across the nation.

IMPLEMENTATION PARTNERS

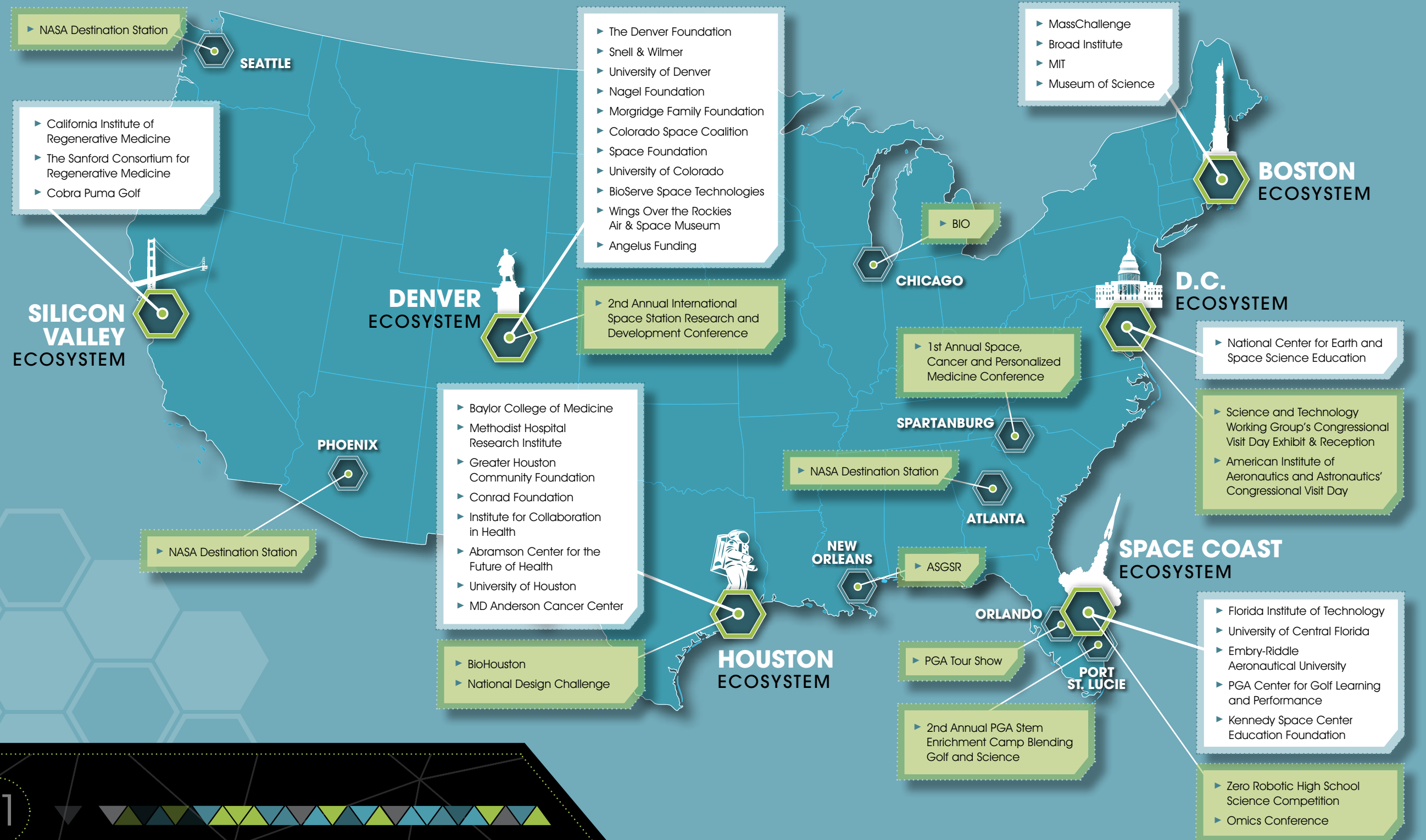


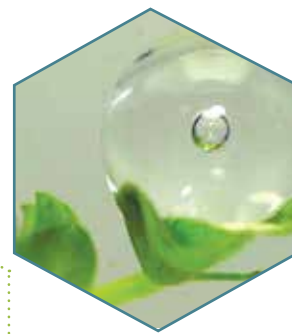
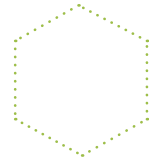
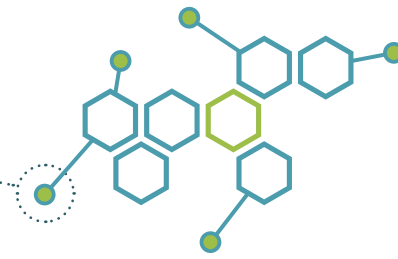
A critical role for CASIS in brokering research to the ISS is ensuring that hardware and integration specialists are properly identified, providing safe, reliable and cost-effective transport of payloads to the station. In its first year, the CASIS operations staff reached out to numerous hardware providers, flight and integration specialists and ground/engineering operation vendors to establish a “preferred partnership” list of implementation partners. In 2013, CASIS expanded that list to over 30 companies, pairing researchers with flight integration and hardware providers specific to their needs.



THE CASIS NETWORK

During FY13, CASIS identified academic institutions, research-specific organizations, philanthropic entities and industry partners throughout the United States. These relationships have been cultivated through defined ecosystems, participation in tradeshows/conferences and strategic meetings to discuss the benefits of ISS research. Below is a snapshot highlighting the scope of the CASIS network during the past year.

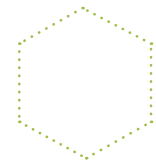
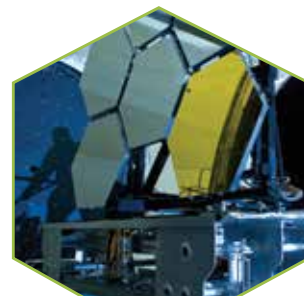


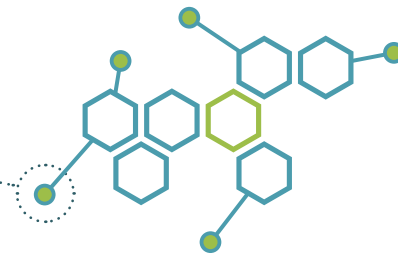


ARK1: Increment 37/38

PROJECT NAME	PI	PROJECT DESCRIPTION	STATUS	PLANNED FLIGHT
PROTEIN CRYSTALLOGRAPHY				
Crystalline Monoclonal Antibody (Merck PCG)	Dr. Paul Reichert, Merck Research Laboratories	Crystallization of a human monoclonal antibody that is currently undergoing clinical trials for the treatment of an immunological disease.	Hardware delivered; Payload in development	SpaceX-3
IPPase Crystal Growth in Microgravity (CASIS PCG GCF-1)	Dr. Joseph Ng, iXpressGenes, Inc.	<i>CASIS RFP 2012-1 Awardee.</i> Improved crystallization of medically important proteins—seeking to achieve sufficient quality for analysis by neutron diffraction.	Payload in development	SpaceX-3
Crystallization of Huntington Exon-1 Using Microgravity (CASIS PCG HDPCG-1)	Dr. Pamela Bjorkman, Caltech	<i>CASIS RFP 2012-1 Awardee.</i> Crystallization of the huntingtin protein, defects in which cause Huntington's disease.	Payload in development	SpaceX-3
Crystallization of Human Membrane ABC Proteins in Microgravity (CASIS PCG HDPCG-2)	Dr. Stephen Aller, UAB	<i>CASIS RFP 2012-1 Awardee.</i> Crystallization of several membrane proteins, including multi-drug resistance transporters, of relevance to diseases such as Cystic Fibrosis.	Payload in development	SpaceX-3
Exploiting On-Orbit Crystal Properties for Structural Studies of Medically and Economically Important Targets (CASIS PCG GCF-2b)	Dr. Edward Snell, SUNY Buffalo	<i>CASIS RFP 2012-1 Awardee.</i> Crystallization of four proteins (two with large disordered regions) relevant to neurodegenerative diseases, squamous cell carcinoma, prion diseases and other conditions.	Payload in development	SpaceX-3
Crystallization of Medically Relevant Proteins Using Microgravity (CASIS PCG GCF-2a)	Dr. Sergey Korolev, St. Louis Medical Center	<i>CASIS RFP 2012-1 Awardee.</i> Crystallization of two proteins relevant to cardiovascular disease, hemorrhage, thrombosis, muscular dystrophy, Parkinson's disease and diabetes.	Payload in development	SpaceX-3
Commercial PCG (CPCG-HM)	Dr. Lawrence DeLucas, UAB	A National Lab Office investigation that seeks to demonstrate the scientific and commercial value of protein crystallization in microgravity by growing crystals of high-value proteins with unknown structures.	Payload in development	SpaceX-3
BIOLOGY & BIOTECHNOLOGY				
Molecular Biology of Plant Development in the Spaceflight Environment (Petri Plants)	Dr. Anna-Lisa Paul, University of Florida	Evaluation of <i>A. thaliana</i> seedling growth and development, specifically root morphology direction of root growth.	Payload in development	SpaceX-3
T-Cell Activation in Aging 1 (T-Cell Act in Aging-1)	Dr. Millie Hughes-Fulford, San Francisco Veterans Administration Medical Center, NCIRE	An NIH transition payload that seeks to characterize the role of candidate molecular regulatory factors and cellular factors involved in T-cell activation.	Payload in development	SpaceX-3
Antibiotic Effectiveness in Space-1 (AES-1)	Dr. David Klaus, BioServe Space Technologies, University of Colorado	Examination of microbial-induced and constitutive gene expression in the development of antimicrobial drug resistance.	Launching January 2014	Orbital 1
Microscope Holder: Methodist Hospital Research Institute	Dr. Alessandro Grattoni, Methodist Hospital Research Institute	Design/fabrication of a custom microscope holder to be integrated into the Light Microscopy Module and used to gain insight into nanoscopic diffusive transport relevant to drug delivery, molecular sieving and particle filtration in Earth-based applications.	Payload in development	TBD

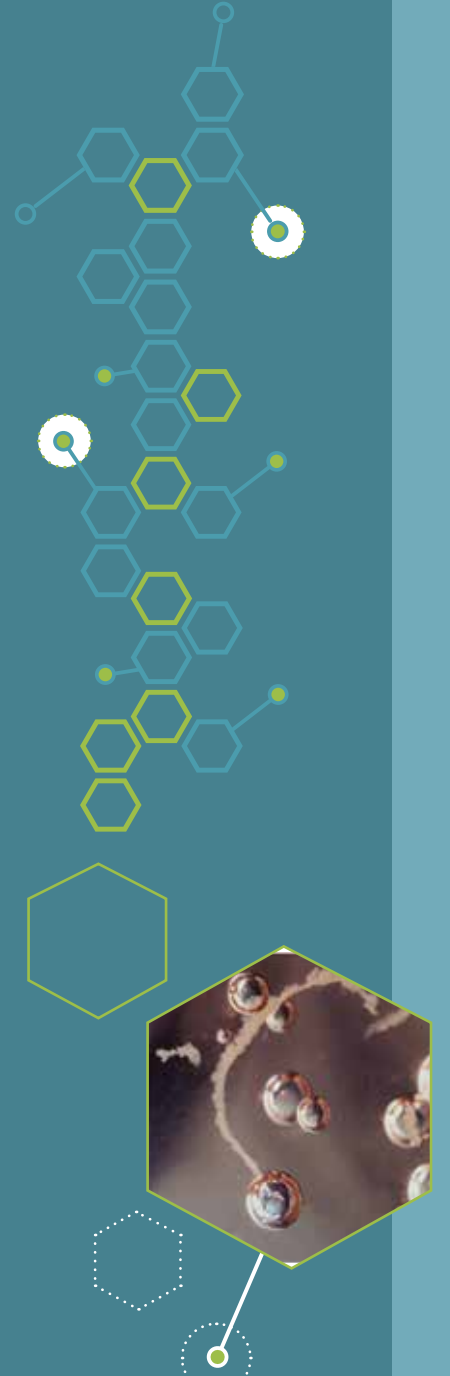
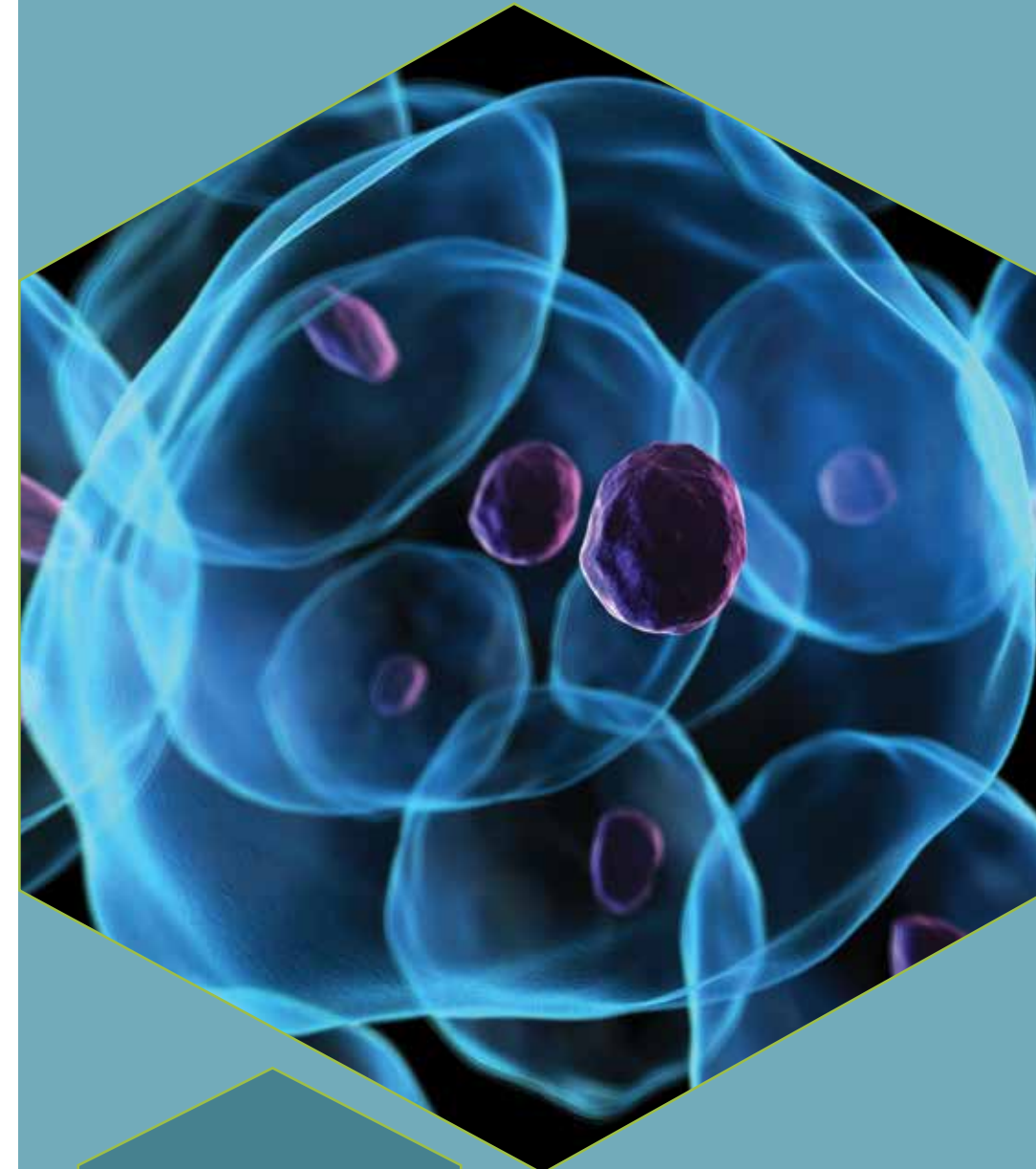
PROJECT NAME	PI	PROJECT DESCRIPTION	STATUS	PLANNED FLIGHT
PHYSICAL SCIENCE				
Cobra Puma Golf Materials Testing in Microgravity	Cobra Puma Golf	Electroporation using various coating materials toward the development of stronger, more effective alloys for use in commercial sporting goods. May develop associated educational programs.	Payload in development	TBD
Binary Colloidal Alloy Test: Low Gravity Phase Kinetics Platform (BCAT-KP)	Dr. Matthew Lynch, Procter and Gamble, with ZIN Technologies	The latest in a series of BCAT experiments. Investigation of complex fluid physics and colloid phase changes, toward improved performance and shelf life of commercial foams and gels.	Payload in development	Orbital 1
EARTH OBSERVATION				
Commercial Space-Borne Hyperspectral Harmful Algal Bloom (HAB) Products	Dr. Ruhul Amin, Naval Research Laboratory, Stennis Space Center	<i>CASIS RFI 2012-3 Awardee.</i> Development of harmful algal bloom early detection, quantification and classification algorithms using ISS imaging data.	Project is underway	Ground based
Remote Sensing Algorithms from Research to Operations – Hyperspectral Applications in the Littoral Zone	Dr. James Goodman, Hyspeed Computing LLC	<i>CASIS RFI 2012-3 Awardee.</i> Development of a prototype enterprise architecture for rapidly implementing new remote sensing algorithms and applications.	Project is underway	Ground based
ISERV	Burgess Howell	[ISS SERVIR Environmental Research and Visualization System.] Automated image acquisition of the Earth's surface, expected to aid in disaster monitoring/assessment and environmental decision making.	Continuing operations on ISS	Already on ISS
EDUCATION				
Story Time From Space (STFS-1)	Patricia Tribe, T2 Science & Math Education Consultants Author: Jeffrey Bennett	Educational program in which crewmembers videotape themselves reading children's books and performing accompanying science demonstrations.	Launching January 2014. Videotapings will be completed by March 2014.	Orbital 1
NanoRacks-National Center for Earth and Space Science Education-Falcon (NR Module-9 (S/N 1007))	NanoRacks	Within the Student Spaceflight Experiments Program (SSEP) and overseen by the National Center for Earth and Space Science Education, U.S. student teams are launching 17 experiments using flight-approved fluids and materials.	National Laboratory Transition Payload	Orbital Demo-1
Ants In Space (CSI-06)	Dr. Deborah Gordon, Stanford University	CASIS-sponsored BioServe transition payload with NSBRI. An educational program that examines ant interactions during group foraging and search behavior.	Payload in development	Orbital 1
SPHERES Zero Robotics	Dr. Alvar Saenz-Otero, MIT	[The Synchronized Position Hold, Engage, Reorient, Experimental Satellites: Zero Robotics investigation.] A competition in which students write algorithms for the SPHERES satellites to accomplish tasks relevant to future space missions.	Continuing operations	Already on ISS
Windows On Earth (WOE)	Dan Barstow, TERC	A suite of software tools using an augmented reality system to manage Earth observation targets, support on-orbit photography, and help scientists and the public interpret ISS-based Earth imaging data.	Continuing operations	Utilizes On-Orbit Resources
TECHNOLOGY DEVELOPMENT & DEMONSTRATION				
SATS Interact	Lockheed Martin	[Supervision of Autonomous and Teleoperated Satellites.] Improvement of the remote operation of space assets through "Interact," a command and control user interface that enables one user to control the tasking/activity of a team of remote nanosatellites.	Payload in development, software upload	Already on ISS
NanoRacks CubeSat Deployer (NRCSD)	NanoRacks	Deployment of multiple customer CubeSats, ejected through deployer doors during increment 38—hosting UAPSat, ArduSat-2, SkyCube, LitSat-1 and LituaniaSat-1.	Launching January 2014	Orbital 1



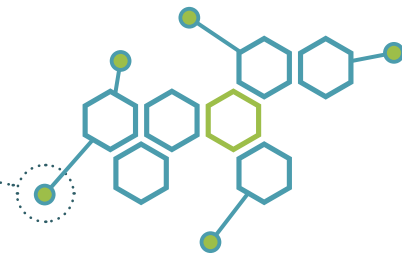


ARK2: Increment 39/40

PROJECT NAME	PI	PROJECT DESCRIPTION	STATUS	PLANNED FLIGHT
PROTEIN CRYSTALLOGRAPHY				
Optimization of Protein Crystal Growth for Determination of Enzyme Mechanisms Through Advanced Diffraction Techniques (CASIS PCG 2-A)	Dr. Constance Schall, University of Toledo	CASIS RFP 2012-1 Awardee. Crystallization of three proteins, medically relevant to Salmonella infection, peptic ulcer disease and related MDR, and biomarkers for heart attack and liver disease.	Payload in development	SpaceX-4
Crystalline Monoclonal Antibody (Merck PCG-2)	Dr. Paul Reichert, Merck	A follow-on to the ARK1 experiment: Crystallization of pharmaceutically relevant proteins.	Payload in development	SpaceX-4
BIOLOGY & BIOTECHNOLOGY				
Drug Development and Human Biology	Dr. Timothy Hammond, Veterans Affairs Medical Center	Evaluation of the utility of a yeast chemogenomic assay to yield novel information about the mechanisms of action and the side effects of known and novel anti-cancer therapeutics, with the goal of drug development and potential repurposing of existing drugs for other uses.	Payload in development	SpaceX-4
Bone Densitometer	TechShot	Deployment of a bone-density scanner for on-orbit animal research.	Payload in development	SpaceX-4
Rodent Research-1	Novartis Pharmaceuticals	Validation mission for the Bone Densitometer. A multi-user payload sponsored in collaboration by NASA and CASIS. The CASIS-sponsored portion of the payload, developed by Novartis Pharmaceuticals, will study muscle atrophy in mice.	Payload in development	SpaceX-4
PHYSICAL SCIENCE				
The Evaluation of Gumstix™ Modules in Low Earth Orbit	Dr. Kathleen Morse, Advanced Materials Applications LLC	CASIS RFP 2012-2 Awardee. Radiation studies of the Gumstix™ Computer-on-Module to examine fault-tolerant computers to meet the intensive demands of current and future satellites.	Payload in development	SpaceX-5
Earth Abundant Textured Thin Film Photovoltaics	Dr. W. Jud Ready, Georgia Tech Applied Research Corporation	CASIS RFP 2012-2 Awardee. Development of cost-effective, energy-efficient photovoltaic cells made of lightweight carbon nanotubes.	Payload in development	SpaceX-5
ENABLING TECHNOLOGY				
NanoRacks External Platform	NanoRacks and Astrium	Development of enabling technology for a U.S. external platform to be used by commercial customers—launches integrated with NanoRacks External Platform.	Payload & facility in development	SpaceX-5
EDUCATION				
National Design Challenge Pilot Program CASIS EDU-1	CASIS	Students will design and scale experiments that will be flown in 1U ArduLabs to the ISS.	Payloads in development	Orbital 2



MARKETING OVERVIEW



In the past year, CASIS has blended its marketing and advertising initiatives to heighten awareness of organization, increase response rates to CASIS RFPs and improve understanding of the capabilities onboard the ISS NL. Through a more in-depth, and at times innovative, outreach program, a wider net has been cast over CASIS.

ARK1 MISSION PATCH



The first official CASIS mission patch was designed to commemorate Advancing Research Knowledge-1 (ARK1), the first increment of CASIS-sponsored flight projects sent to the ISS. Mission patches are a longstanding tradition within the aerospace community, and CASIS began a new chapter with National Lab sponsored research by enlisting iconic artist Shepard Fairey (OBEY and designer of the Obama Hope campaign posters) to develop its inaugural patch. Unveiled at "Engadget Expand," a conference drawing high-tech innovators and entrepreneurs from across the country to San Francisco on May 17th, the event and the patch became a focus of media attention, garnering over 10,000 media "hits" within days of the announcement.

2013 Marketing/Communications Snapshot:

24 NEWS RELEASES DISTRIBUTED

34,532 TWITTER FOLLOWERS AMASSED

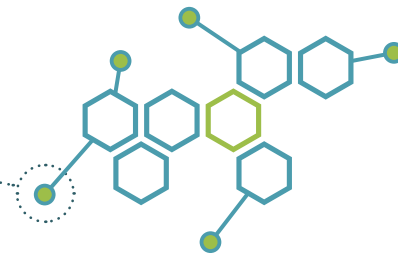
189,000 WEBSITE VISITORS



CASIS mixes interesting, out-of-the-box ideas (like working with Shepard Fairey) with much more conventional outreach; for example, social media updates to over 35,000 twitter followers, strategically placed online banner campaigns, print advertising and media partnerships with high-tech organizations like Engadget. CASIS utilizes its "On Station" blog to constantly provide updates on space and ISS-related topics for the general public. Additionally, CASIS frequently contributes to NASA's website to discuss ISS NL projects.

Moving forward, CASIS marketing activities will become more refined, bolder and visible to larger and more diverse audiences than before. The precedent for creative, unusual, non-traditional and innovative marketing has been set, allowing CASIS to develop innovative approaches to reach new audiences, balanced with traditional avenues for outreach and engagement.





Statement of financial position as of September 30, 2013.

ASSETS	2013	2012
CASH AND CASH EQUIVALENTS	\$ 1,485,647	\$ 1,097,322
INVESTMENTS, RESTRICTED	50,126	50,047
GRANTS RECEIVABLE	—	292,874
DEPOSIT	1,350	2,250
PREPAID EXPENSES	259,987	100,141
PROPERTY AND EQUIPMENT AT COST, NET OF ACCUMULATED DEPRECIATION OF \$179,046 AND \$42,495	266,896	296,804
INTANGIBLE ASSETS AT COST, NET OF ACCUMULATED AMORTIZATION OF \$10,530 AND \$15,988	11,836	64,488
TOTAL ASSETS	\$ 2,075,842	\$ 1,903,926

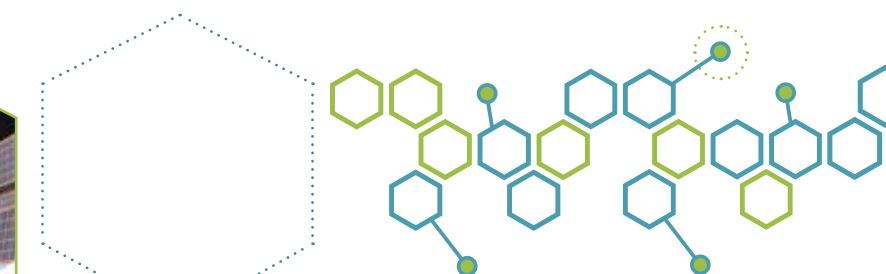
LIABILITIES AND NET ASSETS	2013	2012
LIABILITIES:		
ACCOUNTS PAYABLE AND ACCRUED EXPENSES	\$ 199,564	\$ 284,899
DEFERRED GRANT REVENUE	396,400	—
TOTAL LIABILITIES	595,964	284,899
NET ASSETS:		
UNRESTRICTED NET ASSETS	294,960	369,897
TEMPORARILY RESTRICTED NET ASSETS	1,184,918	1,249,130
TOTAL NET ASSETS	1,479,878	1,619,027
TOTAL LIABILITIES AND NET ASSETS	\$ 2,075,842	\$ 1,903,926

Statement of activities for the year ended September 30, 2013.

REVENUES AND OTHER SUPPORT	2013	2012
FEDERAL GRANTS	\$ 15,274,726	\$ 11,544,789
CONTRIBUTIONS	5,000	—
MEMBERSHIPS	210	3,210
DONATED FACILITY	75,750	63,167
INTEREST INCOME	2,414	1,774
TOTAL REVENUES AND OTHER SUPPORT	\$ 15,358,100	\$ 11,612,940

EXPENSES	2013	2012
PROGRAM SERVICES	\$ 12,498,010	\$ 7,687,979
SUPPORTING SERVICES	2,964,114	3,558,685
TOTAL EXPENSES	\$ 15,462,124	\$ 11,246,664
LOSS ON DISPOSAL OF INTANGIBLES AND EQUIPMENT	35,125	—
CHANGE IN NET ASSETS	(139,149)	366,276
NET ASSETS, BEGINNING OF YEAR	1,619,027	1,252,751
NET ASSETS, END OF YEAR	\$ 1,479,878	\$ 1,619,027

Summarized financial statements from CASIS fiscal year 2013. Audited financial statements, including footnotes as an integral part of the statements, are available upon request. Audit reports issued by Carr, Riggs & Ingram, LLC, November 2013.





ANNUAL
REPORT
FY2013

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