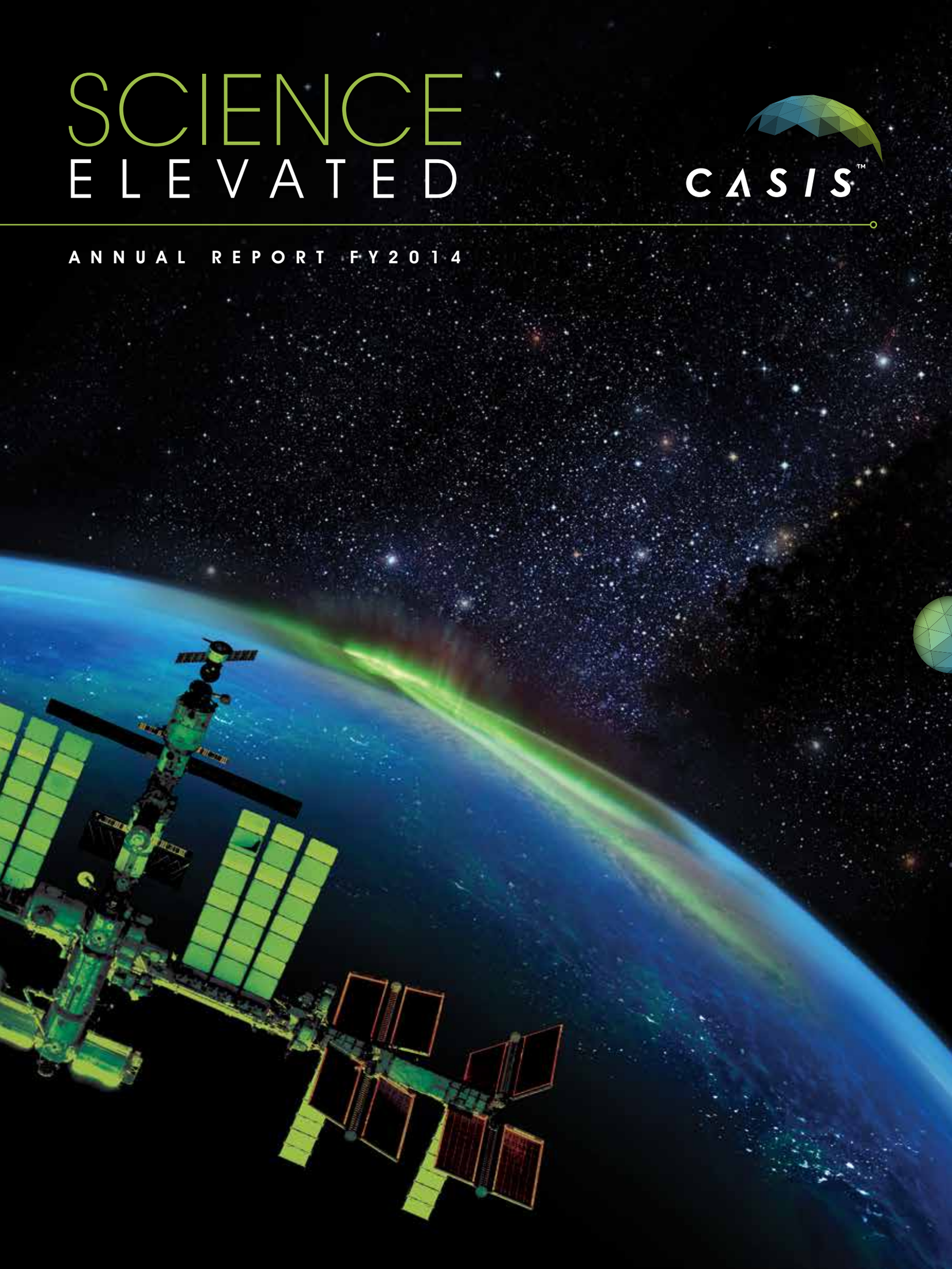
SCIENCE ELEVATED

CASIS™

ANNUAL REPORT FY2014



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PERSPECTIVES FROM 2014

LETTER FROM THE PRESIDENT

Filled with exciting accomplishments, Fiscal Year 2014 (FY14) was excellent for the Center for the Advancement of Science in Space (CASIS). Every core area of the CASIS mission—utilization, commercialization, diversification, and education—saw tangible achievements:

- *Promoting the International Space Station (ISS) as a research platform, we doubled the number of CASIS-sponsored projects.*
- *Of the new research and technology projects, more than half resulted from targeted efforts to expand the commercial footprint in low Earth orbit (LEO).*
- *Ramping up efforts across disciplines through our formal solicitations, we expanded and diversified the ISS U.S. National Laboratory's research portfolio.*
- *We supported dozens of education projects and outreach initiatives, reaching hundreds of thousands of students and educators across the United States.*

WE ALSO REACHED A MAJOR LANDMARK: the first completion of a CASIS payload "life cycle." With the launch and return of SpaceX-3, the first experiments selected, manifested, and sponsored by CASIS took flight and returned for analysis. Let's reflect on how reaching that landmark fits into our journey as a young organization. A true startup, CASIS began a little over three years ago as a nonprofit, nongovernment entity charged to manage a monumental asset, the ISS National Lab. CASIS set out to maximize the use of this lab for Earth benefit, supporting projects that exploit the benefits of space-based science to improve the quality of life on our home planet.

This past summer, shortly before our third birthday, CASIS saw this mission come to fruition as we celebrated the return of our first payloads, borne of the first of many CASIS-issued requests for proposals (RFPs). CASIS released this first RFP in August 2012, just a year after forming. In less than two years, selected proposals were submitted, reviewed, awarded, manifested, flown, and returned for analysis. This represents a concerted effort, in collaboration with NASA, to shorten both review cycles and payload development schedules. Striving to accelerate schedules is part of what sets CASIS apart as a facilitator of ISS science and technology projects: We elevate expectations by breaking down barriers and giving researchers a practical, affordable, and streamlined path to space.

CASIS™

GREGORY H.
JOHNSON

<2 YEARS
RFP RELEASE TO PAYLOAD RETURN

As we begin to see results from our first returned payloads, now in postflight analysis, we expect to show even further the viability of the CASIS–ISS National Lab model. Moreover, CASIS-sponsored projects in orbit at the end of FY14 include investigations from Novartis, the U.S. Department of Veterans Affairs, Procter & Gamble, and Cobra Puma Golf—whose results can only bolster the ISS National Lab's credibility and utility.

In support of future flight investigations, CASIS committed nearly $6 million to projects in FY14, enabling high-impact science to take place onboard the ISS—with more than half of the research and technology projects coming from commercial companies. Moreover, each dollar of CASIS seed funding leveraged into approximately seven dollars of external contributions and benefits toward our projects—a compelling display of commercial confidence in the value of ISS National Lab research. These commercial projects came from organizations ranging in both size and scope. We selected proposals from heavy-hitting companies such as Milliken & Company, well-established centers such as the Broad Institute, and small businesses and startups with innovative ideas for using the ISS—including the first CASIS grant awardee from the oil and gas industry.

Each $1 of CASIS seed funding leveraged into $7 of external contributions.

Selected FY14 projects also came from a stellar lineup of academic and nonprofit institutions, such as Stanford, Emory, UCLA, and the Mayo Clinic. CASIS is bringing new faces and big names to the table, and experiments from resulting projects have serious home-run potential. The steady drumbeat of CASIS grant solicitations and business development efforts is building an R&D portfolio with world-renowned investigators and game-changing research. And the community is taking notice. Along with receiving national media exposure in FY14 from Bloomberg TV, *Fast Company*, the *Washington Post*, and *Forbes*, CASIS formed 13 new partnerships, with such organizations as National Geographic and the United Nations. CASIS also engaged venture capitalists and angel networks to review proposed flight projects and consider investment. Finally, participation in CASIS-sponsored education initiatives has skyrocketed—the BioServe Ants in Space Program alone reached almost 9,000 students in FY14, and the SPHERES Zero Robotics Competition (in partnership with MIT) reached students across nine U.S. states.

As we move into FY15, we look forward to continuing these trends and to seeing results. CASIS-funded projects promise to revolutionize health care, improve commercial products, promote science literacy in our youth, and change our world. I'm very proud of the successes of the CASIS team, and I invite you to join in our excitement. Explore this report and follow CASIS throughout the year as we empower the scientific revolutionaries of our world to ascend ever higher. This is science—elevated!

Sincerely,

Gregory H. Johnson
President and Executive Director, CASIS

LOOKING AHEAD TO 2015

LETTER FROM THE CASIS BOARD OF DIRECTORS CHAIRMAN

After joining the CASIS Board of Directors earlier this year, I was honored to accept the role of chairman this summer. After my decades of involvement in aeronautics, the opportunity to serve on the CASIS Board—with the challenge to advise CASIS on the best strategies to maximize ISS utilization—has been stimulating. Former Chair Dr. France Córdova left the CASIS Board in March to accept an appointment as director of the National Science Foundation. We thank her and Interim Chair Dr. Lewis Duncan for their outstanding service in the ISS National Lab's continued growth.

The space community is in the midst of a movement to commercialize low Earth orbit (LEO), and CASIS is strategically poised to be a major player enabling this trend. As the accomplishments detailed in this report show, CASIS has made great strides to develop the ISS National Lab's research portfolio and promote awareness of space science for Earth benefit. Moving into FY15, CASIS will continue these outreach efforts while implementing an additional, Board-recommended strategy to foster innovation and partnership in using the ISS National Lab to tackle complex problems.

CASIS has made great strides to develop the ISS National Lab's research portfolio and promote awareness of space science for Earth benefit.

Starting in 2015, CASIS will implement focused R&D "Campaigns"—targeted support of multiple projects within scientific themes. Seeking to extend its reach within strategic channels, 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. This thematic approach shows promise to increase ISS utilization, particularly in its ability to attract high-powered scientists, stimulate community investments, and yield high-impact results.

FY15
WILL START THE IMPLEMENTATION OF FOCUSED R&D "CAMPAIGNS"

CASIS™

LT. GEN. (RET.) JAMES A. ABRAHAMSON

While continuing to support projects across many scientific disciplines, CASIS will ramp up targeted efforts during FY15 in the first two Board-recommended areas of Campaign focus: using the ISS to observe Earth and to improve human health.

CAMPAIGN GOOD EARTH *will broaden the use of the ISS for imaging Earth by supporting projects that could substantively affect our world—for example, through humanitarian relief, disaster recovery, or commercial market growth. Leveraging relationships with the United Nations Institute for Training and Research, the National Geographic Society, NASA, USAID, and other commercial players, CASIS will facilitate efforts to launch next-generation sensors to the ISS while promoting use of existing and commercial-off-the-shelf (COTS) hardware.*

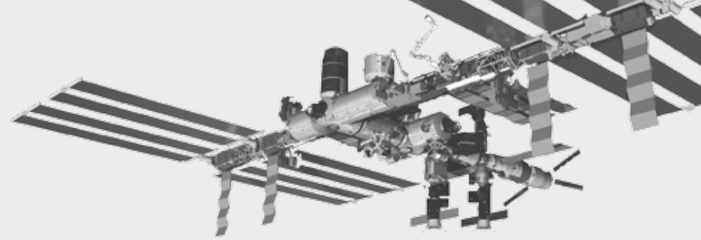
CAMPAIGN GOOD HEALTH *will use the ISS to study human wellness—not only to develop disease treatments but also to improve understanding of individual variations that contribute to overall health. More than half of children born today will probably live to be over 100, so to ensure future quality of life we must shift our focus from merely treating illness to actively promoting wellness. Because the stress of spaceflight in many ways mimics the effects of disease and aging, the ISS offers a powerful platform to accelerate our understanding of wellness on Earth.*

Many CASIS-sponsored projects already fall within one of these Campaigns. In FY15, we hope to not only attract additional projects but also cultivate collaborations within these areas and promote the fusion of great minds, organizations, and resources from the academic, commercial, and nonprofit sectors. The success of these and other high-profile efforts to increase ISS utilization and provide tangible outcomes to people on Earth will benefit the ISS National Lab's future as the centerpiece of LEO commercialization. Space science and technology will continue to enhance our everyday lives, and I feel confident that CASIS can elevate successes in this arena. I look forward to being a part of furthering the CASIS mission during FY15 as our established approaches continue to attract high-quality projects and as we ramp up our new Campaigns to bring space science home to Earth.

James A. Abrahamson

Lt. Gen. (Ret.) James A. Abrahamson
Chairman, CASIS Board of Directors

FY14 ANNUAL ACHIEVEMENTS



NEARLY
$6M
($5,859,314)
FUNDING ATTRIBUTED TO PROJECTS

4
SOLICITATIONS ANNOUNCED

13
NEW PARTNERSHIPS

7:1 = EXTERNAL CONTRIBUTION TO PROJECT COST VERSUS CASIS SEED FUNDING
for unsolicited projects

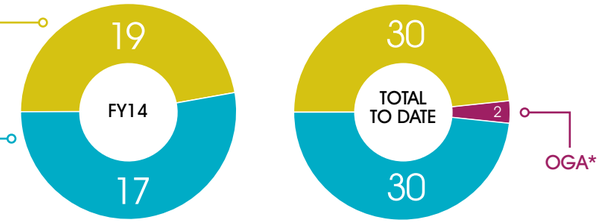
60
PROJECTS AWARDED/SELECTED

122
PROPOSALS SUBMITTED

CASIS-SPONSORED PROJECTS [BY RESEARCH AREA]

LIFE SCIENCES	REMOTE SENSING	PHYSICAL SCIENCES	TECHNOLOGY DEVELOPMENT	EDUCATION
14 FY14	5 FY14	5 FY14	12 FY14	24 FY14
28 TOTAL TO DATE	11 TOTAL TO DATE	10 TOTAL TO DATE	13 TOTAL TO DATE	52 TOTAL TO DATE

COMMERCIAL INSTITUTIONS 19 FY14 — 30 TOTAL TO DATE
ACADEMIC INSTITUTIONS 17 FY14 — 30 TOTAL TO DATE

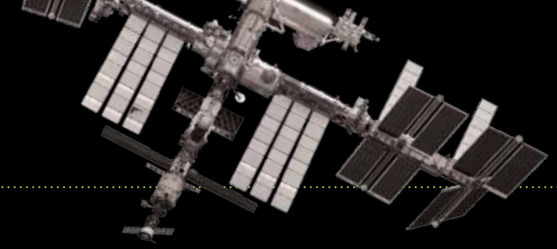


CASIS-SPONSORED RESEARCH & TECHNOLOGY PROJECTS [BY ORGANIZATION TYPE]
[does not include education projects]

*Other Government Agency

11 BOARD MEMBERS
In FY14, CASIS added 5 new board members, which brings the CASIS Board of Directors to 11 members.

PROJECT PIPELINE



LEGEND:

- CASIS PAYLOADS*
- EDUCATION
- ADDITIONAL ISS NATIONAL LAB PAYLOADS

CURRENTLY IN ORBIT[1]

- **AES-1:** Additional samples waiting for return, part of the antibiotic efficacy study
- **BCAT-KP-1 (2 projects):** Complex fluid physics analysis to improve product formulations and shelf life
- **Bone Densitometer:** A multiuser (NASA/CASIS/SBIR) instrument developed by Techshot to analyze bone mineral density (via dual-energy X-ray absorptiometry) of rodents in orbit
- **Rodent Research-1:** Hardware validation experiment for the NASA Animal Enclosure Module; experiments to determine the molecular basis of microgravity-induced muscle atrophy
- **Drug Metabolism:** Using a yeast-based assay to evaluate known and new anticancer drug therapies
- **Cobra Puma Golf:** Bonding of dissimilar materials by electroplating in microgravity to improve alloys for commercial applications
- **Windows on Earth:** Software suite using an augmented-reality system to improve Earth imaging
- **Tropical Cyclone:** Stereoscopic imaging from the ISS that will measure wind speed and intensity within mature tropical cyclones
- **Protein Crystal Growth (PCG) Experiments:**
  - GCF-1: Crystallization to locate hydrogen atoms relevant to various cell functions
  - PCG 2-A/B: Crystallization of three enzymes relevant to *Salmonella* infection, peptic ulcer disease, heart attack, and liver disease
  - HDPCG-1: Crystallization of huntingtin, the protein responsible for Huntington's disease
  - HDPCG-2: Crystallization of high-impact human membrane proteins, including multidrug resistance transporters
- **OGA Payloads:** AMS-02 and ISERV
- **Commercial PCG:** Double-blind study of 100 proteins/complexes
- **Several Projects from NanoRacks**

COMPLETED OR IN POSTFLIGHT ANALYSIS[2]

- **Ants in Space:** Examining ant foraging behavior
- **Story Time from Space 1:** Videotaped astronauts read children's books from the cupola
- **Zero Robotics Middle School Summer Program:** Involving computer programming, robotics, and engineering
- **PCG Experiments:**
  - Merck PCG: Crystallization of a medically relevant monoclonal antibody currently undergoing clinical trials
  - GCF-2a: Crystallization of two proteins relevant to heart disease, hemorrhage, thrombosis, muscular dystrophy, Parkinson's disease, and diabetes
  - GCF-2b: Crystallization of four medically relevant proteins involved in neurodegenerative diseases, squamous cell carcinoma, and prion diseases
- **OGA Payloads Sponsored by CASIS:** T-Cell Activation in Aging
- **Zero Robotics High School Tournament**
- **Several projects from NanoRacks, including Cubesat Deployments**
- **AES-1:** Molecular basis of microgravity-induced reductions in antibiotic efficacy
- **CARA/Petri Plants:** Identification of genes involved in *Arabidopsis* root morphology/adaptive physiology

AES: *Antibiotic Effectiveness in Space*
AMS: *Alpha Magnetic Spectrometer* • **BCAT-KP:** *Binary Colloidal Alloy Test – Kinetics Platform*
CARA: *Characterizing* Arabidopsis *Root Attractions* • **GCF:** *Granada Crystallization Facility*
HDPCG: *High-Density PCG* • **ISERV:** *ISS SERVIR Environmental Research and Visualization System*
OGA: *Other Government Agency* • **SBIR:** *Small Business Innovation Research*

1 As of Sept. 30, 2014, the end of FY14.
2 Completed in-orbit operations does not imply that final reports are complete—postflight analysis is under way for many of these projects.

** The CASIS-sponsored payloads listed here are detailed either later in this report or in Annual Reports from previous years. Payloads are titled using NASA Operations Nomenclature (a standardized naming system) where applicable.*

PLANNED FOR FLIGHT IN FY15

- **Merck PCG-2**
- **Rodent Research-2**
- **NanoRacks External Platform:** Launch of enabling technology for a U.S. external platform for commercial customers
- **Meteor:** A visible spectroscopy instrument to observe meteors
- **Gumstix:** Testing effects of exposure to space environment on a computer-on-module (COM)–based computer design
- **Solar Cell:** Using lightweight carbon nanotubes in a textured pattern to improve photovoltaic cells
- **Flatworm Regeneration:** Examining how microgravity affects healing abilities of planarian flatworms
- **Microchannel Diffusion Experiment:** Gaining insight into nanoscopic diffusive transport relevant for Earth applications, including drug delivery
- **Stem Cell 1-1:** Cardiac stem cell maturation and aging—to model heart disease, improve drug screening, and advance cell replacement therapy
- **Stem Cell 1-3:** Growing stem cells of sufficient quality/quantity for clinical use in treating stroke patients
- **Synthetic Muscle:** Improving durability and function of radiation-hardened and radiation-resistant synthetic muscle
- **Capillary Beverage:** Examining capillary effect mechanics within a new space cup design
- **Zero Robotics Middle School Summer Program (annual)**
- **Zero Robotics High School Tournament (annual)**
- **Story Time from Space 2**
- **National Design Challenge (NDC):** Using ardulabs and NESI boards
  - *NDC Houston = 3 schools, 2 experiments each*
  - *NDC Denver = 3 schools, 1 experiment each*
- **OGA Payloads Sponsored by CASIS:** NIH-Osteo, Osteo-4, and T-Cell-2
- **MUSES:** Multi-User System for Earth Sensing
- **SABL:** Space Automated Bioproduct Lab
- **Several projects from NanoRacks**

RESEARCH & TECHNOLOGY DEVELOPMENT

To maximize receipt of innovative and unconventional project ideas, CASIS fosters relationships with researchers and decision makers through continuous, targeted networking with commercial and academic entities. CASIS engages with these individuals and organizations to fly exciting new projects by matching the ISS National Lab's unique benefits with each entity's research and technology goals. This collaborative model for developing personalized projects promotes utilization and commercialization of the ISS. To facilitate these efforts, CASIS communicates the value of the ISS to new parties, assists in project development, vets high-quality proposals, and offers resulting initiatives support and coordination to succeed.

CASIS has generated a steady influx of research and technology development ideas through this collaborative strategy, particularly in the commercial sector. Dozens of these ideas have developed into flight projects, with many more proposals in development. Furthermore, these business development efforts yield projects that sometimes leverage non-CASIS funding; proposers often bring their own investment and in-kind contributions.

Entering FY15, CASIS will continue to hold informational briefings and brainstorming sessions nationally with new-to-space companies—including Fortune 500 companies across business sectors—to promote the benefits of the ISS and demonstrate the CASIS value proposition. These rigorous efforts by CASIS to infiltrate new markets ensure that the ISS National Lab continues to bolster ISS utilization and the commercialization of low Earth orbit.

These rigorous efforts by CASIS to infiltrate new markets ensure that the ISS National Lab continues to bolster ISS utilization and the commercialization of low Earth orbit.

In addition, the CASIS Science and Technology Advisory Panel recommends key focus areas for research and development. To stimulate interest in these areas, CASIS formally solicits proposals and white papers. CASIS did so on four occasions in FY14, seeking project ideas and hardware information across scientific disciplines. Resulting awarded projects will diversify R&D onboard the ISS National Lab: Projects involving materials science, Earth observation, and technology will complement a portfolio already strongly representing the biosciences.

Request for Proposals No. CASIS 2014-1:
Remote Sensing from the International Space Station
RFP ISSUED JANUARY 13, 2014

4 PROJECTS AWARDED *(see page 17)*

This RFP sought to identify remote-sensing projects to increase use of the ISS National Lab as an advanced platform to (a) test next-generation sensors for future commercial applications and (b) image by using current ISS instrumentation for studies of Earth, Earth's atmosphere, and astronomy and planetary science to benefit life on Earth.

Request for Proposals No. CASIS 2014-2:
Enabling Technology to Support Science in Space for Life on Earth
RFP ISSUED FEBRUARY 26, 2014

3 PROJECTS TO BE AWARDED *in FY15*

This RFP solicited applications for technologies, research platforms, and operational concepts to enable new or improve existing analytical capabilities to benefit space science on the ISS National Lab, ultimately for Earth benefit. Specifically, CASIS sought proposals for enabling technologies in (a) scientific instruments and data collection; (b) materials, structures, and manufacturing; and (c) operational procedures that advance the ISS National Lab's capability as a research and technology development platform to benefit life on Earth.

Request for Information No. CASIS 2014-3:
Identification of Hardware and Implementation Partners in Support of Materials Science Experimentation on the International Space Station U.S. National Laboratory
RFI ISSUED MARCH 6, 2014

WHITE PAPERS *informed development of the subsequent RFP*

This RFI sought to identify and gather information from entities that could serve as implementation partners and/or hardware providers to support materials science experimentation on the ISS—specifically, materials exposure to extreme conditions, crystallization and phase transitions, and interfacial phenomena.

Request for Proposals No. CASIS 2014-4:
Materials Science in Space
RFP ISSUED APRIL 28, 2014

PROPOSALS UNDER REVIEW *(awards to be made in FY15)*

This RFP solicited applications directed toward using the ISS National Lab for materials science–based flight research projects. CASIS sought investigations to develop new or improve existing materials and components that will lead to Earth-based applications and increase return on the U.S. investment in the ISS National Lab.

FY14 AWARDED/ SELECTED PROJECTS

The following pages describe projects awarded flight opportunities and/or funding in FY14.

Note: education projects are described in a separate section of this report, beginning on page 19.

ISS Terrestrial Return Vehicle Program
STEPHEN ALTEMUS
Intuitive Machines LLC

Test a Terrestrial Return Vehicle that addresses the need for priority small-payload return from the ISS. With approximately 30 liters of downmass capability per return flight, this technology should attract increased use of the ISS as an in-orbit laboratory and improve the commercialization of in-orbit experiments for terrestrial benefit.

Global AIS on Space Station (GLASS)
ROBERT R. CARLSON
JAMSS America Inc.

Demonstrate the benefits of using the ISS National Lab as a reliable and maintainable platform to acquire and rebroadcast extended-range Automatic Identification System (AIS) signals related to maritime tracking. The project is in collaboration with the University of Hawaii, the Greater Houston Port Bureau, Mare Liberum Consulting L.P., and Shine Micro Inc.

Collaborative Proposal for Protein Crystal Growth in Space to Enable Therapeutic Discovery
MATTHEW CLIFTON, PH.D., *Beryllium*
CORY GERDTS, PH.D., *Protein Biosolutions Inc.*

TWO PROJECTS: Collaboration also involving the Broad Institute. Protein crystallization of two challenging therapeutic targets, PCSK9 and MCL1, implicated in cardiovascular disease and cancer, respectively. Results may enable future drug discovery and disease treatment.

Demonstration and Technical Readiness Level Raising of the Net Capture System on the ISS
RON DUNKLEE
Astrium North America Inc.

Test a net capture system for asteroids and other orbital debris with a diameter of 7–10 meters.

Remote-Controlled Nanochannel Implant for Tunable Drug Delivery
ALESSANDRO GRATTONI, PH.D.
Houston Methodist Research Institute

Develop a versatile, remotely controlled nanochannel drug delivery implant for long-term tunable drug delivery.

Zero-G Characterization, On-Orbit Assembly, and Free Flight Experiments for Cellularized Satellite Technology
TALBOT JAEGER
NovaWurks Inc.

Design and demonstrate a technology for in-orbit assembly and deployment of the HISat system—a Hyper-Integrated Satellite that provides complete satellite functionality in a nanosatellite-scale package. This system should substantially reduce costs of developing satellite systems for space-based R&D.

Cyclone Intensity Measurements from the International Space Station (CIMISS)
PAUL JOSS, PH.D.
Visidyne Inc.

Develop technology to measure maximum wind speeds within mature tropical cyclones from the ISS. This platform technology will have great interest for coastal regions at high risk for tropical cyclone landfalls.

Using the International Space Station to Evaluate Antibiotic Efficacy and Resistance (and Postflight Analysis)
DAVID KLAUS, PH.D.
University of Colorado Boulder

TWO PROJECTS: (1) flight project and (2) postflight analysis. Correlate altered bacterial responses to antibiotics during spaceflight with mechanisms underlying acquisition of drug resistance. Changes in gene expression should reveal which genes are key to reduced efficacy. This endeavor may improve antibiotic testing, identify new targets for antibiotics, and bring about new approaches to reduce antibiotic resistance.

DM Payload Processor TRL7 Validation Flight Experiment
BENJAMIN MALPHRUS, ED.D.
Morehead State University/Honeywell

Design a lightweight, inexpensive, low-power, high-performance Dependable Multiprocessor Payload Processor based on Gumstix technology.

Ultra-Portable Remote-Controlled Microfluidics Microscopy Microenvironment with Time Course Imaging for Space-Based Biological Research
DANIEL O'CONNELL
HNu Photonics LLC

Deliver an ultraportable, remote-controlled, automated microfluidics platform for general biological interrogations and planned stem cell research investigations on the ISS.

Systemic Therapy of NELL-1 for Spaceflight-Induced Osteoporosis
CHIA SOO, M.D., F.A.C.S.
UCLA School of Medicine

Test a drug that is both an anabolic and anti-osteoclastic agent (based on a protein, NELL-1) in mice experiencing spaceflight-induced accelerated bone loss. In general, current therapies for osteoporosis work by preventing bone loss. Because osteoporosis affects more than 200 million people worldwide, we need new, innovative treatments that promote bone formation.

Magnetic 3D Cell Culture for Biological Research in Microgravity
GLAUCO SOUZA, PH.D.
Nano3D Biosciences Inc.

Incorporate magnetic cell culture technology into existing flight hardware and optimize platform operation to support continued 3D growth. This endeavor will lay the foundation for a flight experiment to explore using magnetic nanoparticles and magnetic fields to culture cells on the ISS.

Flame-Retardant Behavior of Modified Cellulose vs. Meta-aramid (Nomex) in Microgravity
JEFF STRAHAN, PH.D.
Milliken & Company

Evaluate flame-retardant and/or -resistant (FR) textiles, whose behavior in microgravity will aid in better designs for future FR textiles and protective apparel, such as that worn by military personnel and civilian workers in the electrical and energy industries.

Evaluation of a Corrosion Inhibitor Exposed to the Extreme Environments in Space
LAUREN THOMPSON
A-76 Technologies

Test metals coated with a line of new corrosion inhibitors and lubricants in the harsh environment of space—extreme conditions that accelerate material degradation. These products are for future use to prevent corrosion in oil and gas lines on Earth.

These diverse projects show that CASIS has made great progress in opening new commercial markets with nontraditional space users by exploiting innovation ecosystems and directly targeting key accounts.

FY14 AWARDED/ SELECTED PROJECTS

Investigating the Impact of Increased Venous Pressure on Cerebral Blood Flow Velocity Morphology for the Greater Understanding of Noninvasive Intracranial Pressure Detection
ROBERT HAMILTON, PH.D.
Neural Analytics Inc.

Improve a portable ultrasound device that measures intracranial pressure (ICP) related to traumatic brain injury (TBI). The experiment will compare characteristic ICP changes in astronauts with data from TBI patients—to refine data measurements and show the utility of this noninvasive device.

Testing TiSi2 Nanonet-Based Lithium Ion Batteries for Safety in Outer Space
SONG HAN, PH.D.
EnerLeap Inc.

Test improved lithium ion battery technology by exposing it to high-energy radiation, atomic oxygen, vacuum, micrometeorites, and extreme temperatures outside the ISS. Results will validate the technology to improve traction in the commercial market for the lightweight, fast-charging, long-lasting, and safe battery.

Reducing Signal Interruption from Cosmic Ray Background in Networked Neutron Detectors
ANDREW INGLIS, PH.D.
Silverside Detectors Inc.

Use the radiation environment to improve a detector for identifying small, shielded amounts of nuclear material. Results will improve algorithms used to distinguish true measurements from background readings—making the detector a more effective tool to identify and track nuclear material.

Utilize ISS Energy Systems Data for Microgrid Design and Operation
EVAN KANTOR
Raja Systems Inc.

Use the ISS as a testbed to improve efficiency of power systems used in parts of the world without access to reliable grid electricity. The experiment will analyze ISS Electrical Power System data to improve software algorithms for microgrid operation and design.

Viral Infection Dynamics and Inhibition by the Vecoy Nanotechnology
EREZ LIVNEH
Vecoy Nanomedicines

Improve design of nanoscale virus traps, a new generation of nanotechnology-driven treatments to treat viral infections. The experiment will evaluate virus–trap and virus–host interactions to examine how the traps mimic human cells to lure and destroy virus particles in a patient's blood.

Microbead Fabrication Using Rational Design Engineering
BRIAN D. PLOUFFE, PH.D.
Quad Technologies LLC

Improve a technology to isolate specific cell types from a mixed population (such as cancer cells in the blood). Microgravity allows evaluation of very tiny details involved in the synthesis of the microbeads used in the technique, enabling optimization of the beads for cell sorting while preserving cell function.

Synthetic Muscle for Prosthetics and Automation
LENORE RASMUSSEN, PH.D.
Ras Labs LLC

Examine how synthetic muscle stands up to the extremely hostile radiation environment outside the ISS. Improving the durability and function of radiation-hardened and radiation-resistant synthetic muscle will advance realistic prosthetics and humanlike robotics.

Optimizing Jammable Granular Assemblies in a Microgravity Environment
RAMIN ABRISHAMIAN
Benevolent Technologies for Health

Improve an adjustable component for prosthetic sockets necessary to attach artificial limbs. The socket design exploits properties of granular materials. Reduced fluid movement in microgravity offers advantages in measurement accuracy and sample preparation—enabling creation of lighter and stronger socket components.

LIFE SCIENCES/STEM CELL BIOLOGY—RFP NO. CASIS 2013-3 AWARDEES

Superior Methods to Examine Bone–Tumor and Host–Tissue Interactions by Using Microgravity Bioreactors
CARL GREGORY, PH.D.
Texas A&M Health Science Center

Develop a system to coculture and analyze stem cells mixed with bone tumor cells in microgravity. Between 35% and 50% of cancers metastasize to bone, and this system may allow identification of potential molecular targets for drugs specific to these cancers.

Effects of Simulated Microgravity on c-kit+ Cardiac Stem Cells
JOSHUA HARE, M.D., F.A.C.C., F.A.H.A.
University of Miami

Examine growth and differentiation of cardiac stem cells in simulated microgravity to develop new, less invasive, and less expensive stem cell therapy for use in individuals with heart failure.

Functional Effects of Microgravity on Cardiovascular Stem Cells
MARY KEARNS-JONKER, PH.D.
Loma Linda University

Study aging of neonatal and adult cardiac stem cells in microgravity to improve cardiac cell therapy.

Generation of Mesendoderm Stem Cell Progenitors in the ISS National Laboratory
ROBERT SCHWARTZ, PH.D.
University of Houston

Examine how simulated microgravity affects two critical genes involved in reprogramming fibroblasts into cardiac progenitor cells, toward potential cell therapies.

Effects of Microgravity on Stem Cell–Derived Heart Cells from a Diverse Patient Population
JOSEPH WU, M.D., PH.D.
Stanford University School of Medicine

Examine how cardiomyocytes mature and age in microgravity, toward cardiovascular disease modeling, drug screening, and cell replacement therapy.

Partnerships with business accelerators are a part of the portfolio development strategy within the commercial sector. In FY14, these partnerships included MassChallenge and Rice Alliance (discussed on page 25 of this report).

FY14 AWARDED/ SELECTED PROJECTS

Generation of Cardiomyocytes from Human iPS Cell–Derived Cardiac Progenitors Expanded in Microgravity
CHUNHUI XU, PH.D.
Emory University School of Medicine

Develop small-scale tissue engineering technology to study growth and differentiation of cardiac tissue in microgravity—toward cardiac disease modeling, drug discovery and toxicity testing, and ultimately cell replacement therapy.

Application of Microgravity-Expanded Stem Cells in Regenerative Medicine
ABBA ZUBAIR, M.D., PH.D.
Mayo Clinic, Jacksonville

Grow stem cells of sufficient quality and quantity to treat stroke patients (stroke is the third leading cause of death in the U.S.). Results may also have downstream applications in tissue engineering/regenerative medicine.

REMOTE SENSING/TECHNOLOGY DEVELOPMENT—RFP No. CASIS 2014-1 Awardees

Development and Deployment of Charge Injection Device Sensors for Space-Based Extreme-Contrast Ratio Imaging
DANIEL BATCHELDOR, PH.D.
Florida Institute of Technology

Test how the harsh space environment affects a new type of charge injection device sensor for Earth and space imaging that will improve existing charge-coupled device technology. Future commercial use of this sensor could serve purposes from astronomy initiatives to Earth observation enterprises, including environmental monitoring and defense interests.

Hyperspectral Mapping of Iron-Bearing Minerals Associated with Dry and Ephemeral Lakes
WILLIAM H. FARRAND, PH.D.
Space Science Institute

Evaluate how well the Hyperspectral Imager for the Coastal Ocean (HICO) on the ISS can characterize and map minerals associated with playas. Results could mitigate public-health issues stemming from dust storm impacts, enhance agricultural efforts to counter soil salinity problems, and improve use of playas for vehicular transport.

Utilizing Hyperspectral Remote Sensing to Determine Terrestrial Ecosystem Carbon Fluxes
K. FRED HUEMMRICH, PH.D.
University of Maryland, Baltimore County

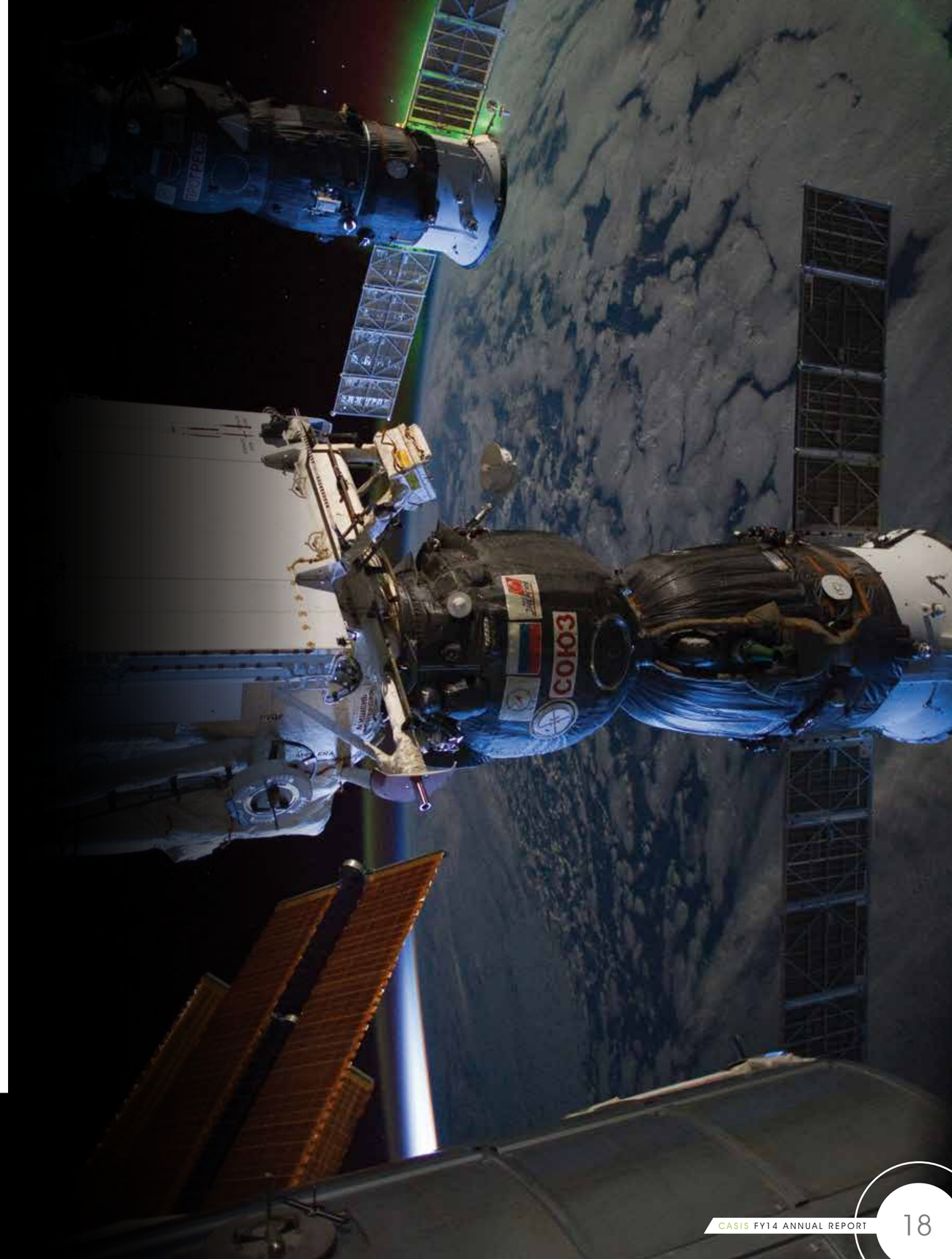
Use of HICO to monitor behavior (carbon fluxes and efficiency of light use) of terrestrial vegetation under varying environmental conditions. Results should improve understanding of ecosystem responses to environmental stress—for example, in agriculture and forestry.

Development of Great Lakes–Specific HICO Water Quality Algorithms
ROBERT SHUCHMAN, PH.D.
Michigan Technological University
HICO Identification of Harmful Algal Blooms
RICHARD BECKER, PH.D.
University of Toledo

TWO AWARDS for a collaborative project: Use HICO data to develop algorithms for monitoring water quality and algal species in the Great Lakes—with one project (Becker) to focus on Lake Erie. Results may influence assessment of Great Lakes ecosystem and drinking/recreational water sources and aid in determining the extent of algal blooms that pose health risks in this region.

In FY14, CASIS awarded 12 institutions in response to two research solicitations:

- **RFP No. CASIS 2013-3:** *The Impact of Microgravity on Fundamental Stem Cell Properties: A Call for Spaceflight and Ground-Based Experiments (Issued May 22, 2013; detailed in the FY13 CASIS Annual Report)*
- **RFP No. CASIS 2014-1:** *Remote Sensing from the International Space Station (Issued January 13, 2014; discussed on page 12 of this report)*



EDUCATION

The CASIS goal to provide return on U.S. investment in the ISS does not stop with efforts to improve health care, commercial products, and technological advancements. At CASIS, we also understand—and are charged with—pursuit of long-term investment in the future of U.S. science, excellence, and leadership. This investment begins with our youth—tomorrow's inventors, thought leaders, humanitarians, teachers, and the workforce that has an opportunity to bring U.S. science and engineering to the forefront of the global market.

Space has always inspired student interest in science, technology, engineering, and mathematics (STEM). CASIS exploits this robust effectiveness by using ISS science to complement existing curricula, engaging students in STEM learning activities. CASIS leverages the unique asset of the ISS to both support existing space STEM education programs and build our own legacy of STEM initiatives. By capitalizing on the richness of U.S. space history and developing new, out-of-the-box programs, CASIS hopes to bolster science literacy while building credibility within the education community. Below is an overview of CASIS FY14 education activities—a diverse group of activities designed to maximize our reach, impact, and success.

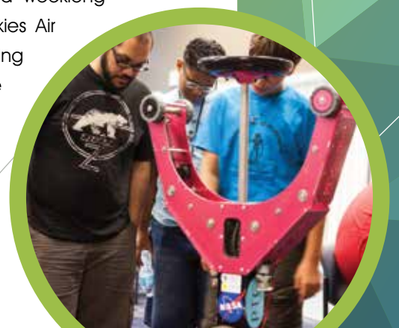
STEM PROJECTS AND PROGRAMS

NATIONAL DESIGN CHALLENGE: CASIS developed the National Design Challenge, a national STEM education campaign that affords teachers and their students the opportunity to design and implement an authentic research experiment on the ISS.

NDC Denver officially launched in January 2014 with a solicitation for proposals from schools in the Front Range of Colorado. Wings Over the Rockies Air and Space Museum is the local implementation partner for the program. Of six applications submitted in March 2014, CASIS chose three to participate in the program:

- ***Bell Middle School***—*Vermicomposting in a closed system*
- ***Chatfield High School***—*How microgravity affects the growth rate of hydrogen-producing algae*
- ***Centaurus High School***—*How microgravity affects bacterial lag phase*

Educator teams, students, and industry mentors attended a weeklong professional development workshop at Wings Over the Rockies Air and Space Museum. Participants learned about the engineering design process, prototype build procedures, programming the NESI+ hardware, and sensors and actuators.



STUDENT SPACEFLIGHT EXPERIMENTS PROGRAM (SSEP):

The National Center for Earth and Space Science Education created SSEP to give students the ability to design and propose flight experiments for the ISS. CASIS sponsors Missions 3–6 of this program.

In FY14, CASIS funding supported Missions 5 and 6 of the SSEP program.

In FY14, CASIS sponsored

19

COMMUNITIES

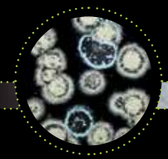
reflecting

8,045

STUDENTS

CASIS-Sponsored SSEP Mission 5 Experiments

1. Affected Efficacy of Sprayed Enamel Coating as a Corrosion Inhibitor—Teachers in Space & Space Frontier Foundation
2. Triops as a Protein Source
3. Growth of a Radish Plant In Microgravity
4. Will Microgravity Conditions Increase the Rate of Yeast Fermentation in Honey?
5. The Production of Antibiotics from *Bacillus subtilis* in Microgravity
6. *Penicillium* Growth Rate in Microgravity
7. What is the Effect of Microgravity on Mold Growth on White Bread?
8. Lettuce Growth
9. Artificial Ear



CASIS-Sponsored SSEP Mission 6 Experiments

1. Composting in Microgravity
2. Effects of Microgravity on Early *Musca domestica* Growth
3. Microgravity's Effects on Dry Lake Fairy Shrimp
4. Biocides and Bacteria
5. Hydroponics vs. Microgravity
6. Milk in Microgravity
7. How Does Spaceflight Affect the Formation of Tin Whiskers on Lead-free Solder?
8. Reishi Mushroom vs. Chronic Myeloid Leukemia
9. How Microgravity Affects Yeast Cell Division and How It Relates to Human Cancer Cells
10. Crystal Formation

EDUCATION

STEM PROJECTS AND PROGRAMS *(continued)*

NASA HUNCH: The NASA HUNCH (High School Students United with NASA to Create Hardware) program partnership between high schools and NASA allows students to design, build, and implement an experiment in microgravity. HUNCH also allows students to build supplies and tools used to store, transport, and facilitate space research. CASIS is sponsoring the Extreme Science Experiment titled *Omega Hydrofuge Plant Growth Chamber* that was awarded for research on the ISS. The experiment is designed to be an efficient method of growing plants in a microgravity environment, within the parameters of a 10×10×15 cm NanoLab using a combination of hydroponics with a centrifuge spin.

ZERO ROBOTICS: CASIS has partnered with the Massachusetts Institute of Technology to support the SPHERES Zero Robotics Competition, a fun and flexible STEM technology challenge for middle school students. During the 5-week summer program, students work with MIT mentors, prominent scientists, and program staff to learn about programming, robotics, and space engineering. Students use their knowledge to program SPHERES (Synchronized Position Hold Engage and Reorient Experimental Satellites). The program culminates in a tournament in which each team's SPHERES will compete for spots to operate on the ISS. Participants get to see their SPHERES in space via live feed and talk with ISS crewmembers.

SPACE STATION ACADEMY: CASIS sponsored a prototype of the Space Station Academy Project, a 6-week, online program that engaged students with a simulated mission to the ISS as "virtual" astronauts. CASIS will fund phase 2 of the project to develop a semester-long version of Space Station Academy that will be delivered through the Virtual High School in FY15.

CASIS ACADEMY LIVE: An interactive STEM program, CASIS Academy Live educates students about the importance of ISS research and brings greater awareness to STEM careers. CASIS arranges for researchers, NASA astronauts, and STEM advocates to interact with participating students. Students can also conduct hands-on experiments that help shed light on some of the research that CASIS is facilitating on the ISS National Lab. Through a partnership with NASA's Digital Learning Network, CASIS Academy Live reached classrooms across the country.

BIOSERVE ANTS IN SPACE: CASIS sponsors 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 analyzes foraging ant behavior. For each experiment conducted, teachers receive a standards-based curriculum to use.

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 5-day golf summer camp for underprivileged students in grades 7 and 8. The program engages 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.

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 National Lab. The Fellows also provide a base group of educators who will pilot test materials, serve as a focus group, and train their local community on CASIS Education programs.

ON CAMPUS WITH CASIS STEM

Numbers represent individuals reached

PROGRAMS

- National Design Challenge—Denver: 105 STUDENTS
- SSEP: 8,045 STUDENTS
- CASIS Academy Live: 321 STUDENTS
- Space Station Academy: 25 STUDENTS, 20 EDUCATORS
- BioServe Ants In Space: 8,814 STUDENTS
- Zero Robotics: 550 STUDENTS, 110 EDUCATORS
- NASA Hunch Extreme Science: 10 STUDENTS, 1 EDUCATOR
- PGA STEM Golf Camp: 63 STUDENTS
- CASIS Fellows Program: 450+ STUDENTS/EDUCATORS

CONFERENCES & EVENTS

- National Science Teachers Association Conference: 55 EDUCATORS
- Student Spaceflight Experiments Program National Conference: 400 STUDENTS
- Daytona State College STEM Expo: 300 STUDENTS
- NASA Family Exploration Night: 775 ATTENDEES
- USA Science and Engineering Festival: 325,000 ATTENDEES
- NASA Robotic Mining Competition: 135 STUDENTS
- Space Exploration Educators Conference Innovation Day: 100 EDUCATORS
- International Future Problem Solving Program: 1,342 STUDENTS
- Brevard Space Week: 252 STUDENTS
- National Museum of the U.S. Air Force: 1,000 STUDENTS

CLASSROOM VISITS

- DNA Extraction: 36 STUDENTS REACHED
- Meet an Astronaut: Greg Johnson visit (7 locations): 3,086 STUDENTS REACHED

WEBCASTS

- CASIS and Research on the ISS (NASA DLN): 63 STUDENTS REACHED
- Camp Challenger: 100 STUDENTS REACHED
- Meet an Astronaut: Greg Johnson Presentation (Skype call): 54 STUDENTS REACHED

EXPANDING THE CASIS NETWORK

As manager of the ISS National Lab, CASIS seeks to increase utilization of the ISS and elevate the caliber of R&D initiatives, results, and downstream impact on the U.S. public. The CASIS team believes we can only achieve this task through strong relationships with implementation partners, the research community, philanthropic organizations and venture capitalists, traditional space organizations and researchers, and many others—all of whom share in our passion to reinvigorate the public about our country's rich space legacy and bring space science to a whole new level. In FY14, CASIS had many successes in expanding the network of individuals and organizations that support our mission—through targeted outreach, conference/event attendance, and partnership formations. Here is a snapshot of CASIS successes in FY14 outreach.

EXPANDING THE CASIS NETWORK

LEGEND

- CONFERENCES & EVENTS
- PARTNERSHIPS

AWARDED PROJECTS

- PHYSICAL SCIENCES
- LIFE SCIENCES
- TECHNOLOGY DEVELOPMENT
- EDUCATION
- REMOTE SENSING

REDMOND, WA

- Space Angel Network

- Materials Research Society Spring Meeting
- Silicon Valley Space Center

CALIFORNIA ECOSYSTEM

- Frontiers in Science & Technology with CONNECT
- BIO International Conference
- Destination Station – San Diego
- Destination Station – Los Angeles
- World Stem Cell Summit
- U.S. Navy/National Marine Mammal Foundation Clinical Research Workshop

SoCal

- NDC Denver Design Meeting
- 30th Space Symposium
- Payload Integration TIM

COLORADO ECOSYSTEM

- International Symposium for Personal and Commercial Spaceflight

LAS CRUCES, NM

- The American Chemical Society ACS 2014 Annual Spring Meeting

DALLAS, TX

- Rice Alliance Annual Energy and Clean Technology Venture Forum
- Rice Alliance & Rice Business Plan Competition
- Space Exploration Educators Conference Innovation Day

- Houston Angel Network
- Texas Emerging Technology Fund
- Rice Alliance for Technology and Entrepreneurship
- Black Moon Corporation
- Boeing

COLLEGE STATION, TX

HOUSTON ECOSYSTEM

- Texas Commercial Space Workshop
- Texas A&M University

- ISS Research & Development Conference
- National Geographic Learning

CHICAGO, IL

IOWA STATE UNIVERSITY

- Future Problem Solving Program International

- Destination Station

INDIANAPOLIS, IN

- National Museum of the U.S. Air Force

DAYTON, OH

- American Society of Photogrammetry and Remote Sensing

LOUISVILLE, KY

- National Science Teachers Association Conference
- The Light Foundation

CHARLOTTE, NC

SPARTANBURG, SC

- 2nd Annual Space, Cancer, and Personalized Medicine Conference

HUNTSVILLE, AL

- Protein Crystal Growth Summit
- Payload Operations Interface Working Group

- CASIS ISS Workshop at University of Florida
- CASIS Academy Live

GAINESVILLE, FL

ROLLINS COLLEGE, FL

ORLANDO, FL

- American Society for Gravitational and Space Research
- SPACE 2014

SPACE COAST ECOSYSTEM

- "Your Research In Space" Workshop at Florida Institute of Technology
- PocketQube 1.0 Microsatellite Workshop
- Daytona State College Expo
- NASA Robotic Mining Competition
- CASIS Academy Live (5 events)
- Brevard Space Week
- NASA Family Exploration Night
- Professional Golfers' Association of America STEM Golf Camp
- Kennedy Space Center Community Leaders Briefing
- Zero Robotics Middle School Program Florida Finals Event

- Merck—CASIS Workshop

NEW JERSEY

D.C. ECOSYSTEM

- geneLAB Steering Committee Meeting
- Future Space
- The American Institute for Aeronautics and Astronautics SciTech 2014
- USA Science & Engineering Festival
- Student Spaceflight Experiments Program National Conference
- materialsLab Workshop

- National Geographic Society

- MassChallenge
- Zero Robotics Middle School Program National Finals Event

- Boston Red Sox Foundation

BOSTON ECOSYSTEM

EXPANDING THE CASIS NETWORK

SPOTLIGHT: EXAMPLE OUTREACH INITIATIVES

MASSCHALLENGE

CASIS and MassChallenge continued their partnership to promote space-based entrepreneurship through the CASIS Prize for Technology in Space. This initiative challenges startups to develop projects that use the ISS to develop intellectual property and/or applications that offer significant benefit to the U.S. The grant funding awards are divided among the most promising companies each year. (Awardees listed on page 15/16 of this report.)

RICE ALLIANCE & RICE BUSINESS PLAN COMPETITION

CASIS has joined the Rice Alliance for Technology and Entrepreneurship as a Gold Underwriter, which includes the $25,000 CASIS ISS National Lab Space Flight Prize for the startup that shows the most promise for developing a technology or business that would benefit from access to the ISS National Lab. This partnership also gives CASIS access to the Rice Alliance venture forums and entrepreneurship programs throughout the year to identify prospects for ISS National Lab utilization. (Awardee listed on page 14 of this report.)

DESTINATION STATION

CASIS and NASA continue to partner throughout the year to leverage the Destination Station traveling exhibit to facilitate brainstorming events with major companies and research institutes across the country. FY14's events included sessions with Qualcomm, Scripps Research Institute, Synthetic Genomics, the National Marine Mammal Foundation, Purdue University, Dow Agrosciences, and Eli Lilly & Company. Each organization is either evaluating or developing ISS flight projects for CASIS as a result of the Destination Station interactions.

CASIS Academy Live

CASIS Academy Live (described on page 21) educates students about the importance of ISS research. CASIS hosted six events in FY14, in which researchers and NASA astronauts met with students and discussed ISS research and STEM careers in general. Through a partnership with NASA's Digital Learning Network, CASIS Academy Live also reached classrooms across the country in addition to those students in attendance.

ECOSYSTEM PROGRESS IN FY14

As detailed in the CASIS FY13 Annual Report, CASIS continues to leverage geographic concentrations of industry, academia, and entrepreneurial innovation (following an "ecosystem model") to create new opportunities for nontraditional ISS utilization.

IN HOUSTON, the first CASIS award through the Rice Business Plan Competition went to an energy sector startup—and four additional potential project ideas emerged from the Rice Alliance Energy Forum.

IN CALIFORNIA, partnerships with CONNECT in San Diego and the Alliance of CEOs in the San Francisco Bay Area opened relationships with eight new industry leaders in life sciences and information technology.

IN COLORADO, the first CASIS exhibition at the Space Symposium validated interest in the ISS National Lab for commercial aerospace applications.

IN BOSTON, the second year of CASIS participation in MassChallenge yielded seven finalists whose proposals will be considered for award.

Upcoming in FY15:

JULY 7-9 • BOSTON

ISSR&D CONFERENCE 2015

SPOTLIGHT: EXAMPLE NEW PARTNERSHIPS

TOTAL NUMBER OF NEW PARTNERSHIPS ESTABLISHED IN FY14: **13**

45 TOTAL NUMBER OF PARTNERSHIPS ESTABLISHED BY CASIS TO DATE

EXAMPLES OF NEW PARTNERSHIPS FROM FY14:

NATIONAL GEOGRAPHIC LEARNING

CASIS formalized an agreement with National Geographic and Cengage Learning to create a next-generation digital science teaching tool for early-grades students in the U.S. This product could reach hundreds of thousands of students, teaching basic science concepts through examples from the ISS.

NATIONAL GEOGRAPHIC SOCIETY

In September 2014, CASIS announced a partnership with the National Geographic Society to utilize Earth observation data produced onboard the ISS. Through this and other partnerships, CASIS may expand the use of Earth imaging from the ISS to include multiple next-generation sensors to improve the value of images obtained from the ISS for use in humanitarian relief as well as other commercial applications.

TEXAS EMERGING TECHNOLOGY FUND

A unique collaboration with the Texas Emerging Technology Fund (TETF) will make funding available for certain startup enterprises interested in using the ISS National Lab research platform. Created by Gov. Rick Perry's office, the TETF is a $100 million state-supported fund dedicated to encouraging innovative business startups in Texas and is interested in supporting Texas-based commercial space companies.

HOUSTON ANGEL NETWORK

In a collaboration with the Houston Angel Network, CASIS will present ISS commercial space projects for angel investment funding. CASIS will review and present the best opportunities for investment, arranging pitches for an average of eight commercial space companies each year.

UNITAR (NOT INCLUDED ON THE MAP)

In FY14, CASIS announced a collaboration with the United Nations Institute for Training and Research (UNITAR). The collaboration will seek to enable utilization and improvement of high-resolution, multiband hyperspectral imaging onboard the ISS. Such imaging can support a variety of applications, including water and forest management, humanitarian relief, recovery after disaster, disaster risk reduction, disaster prevention, and in-country planning and development. From this collaboration, CASIS and UNITAR hope to also make portions of the data stream available for academic institutions, the UN, other government agencies, and nonprofit organizations to develop new hyperspectral applications.

EXPANDING THE CASIS NETWORK

CASIS-SPONSORED COMMERCIAL UTILIZATION OF THE ISS NATIONAL LAB

These logos represent CASIS successes to date in enticing commercial companies to join our expanding community of ISS National Lab users.

IMPLEMENTATION PARTNERS

These service providers perform invaluable tasks for CASIS investigators, helping us achieve our mission to increase ISS National Lab utilization.

LAUNCH VEHICLES

In FY14, all awarded projects were delivered to the ISS on one of two launch vehicles:

Antares

Engine: Two AJ26-62 LOX/ Kerosene Fueled

Launch Locale: Wallops Flight Facility, VA

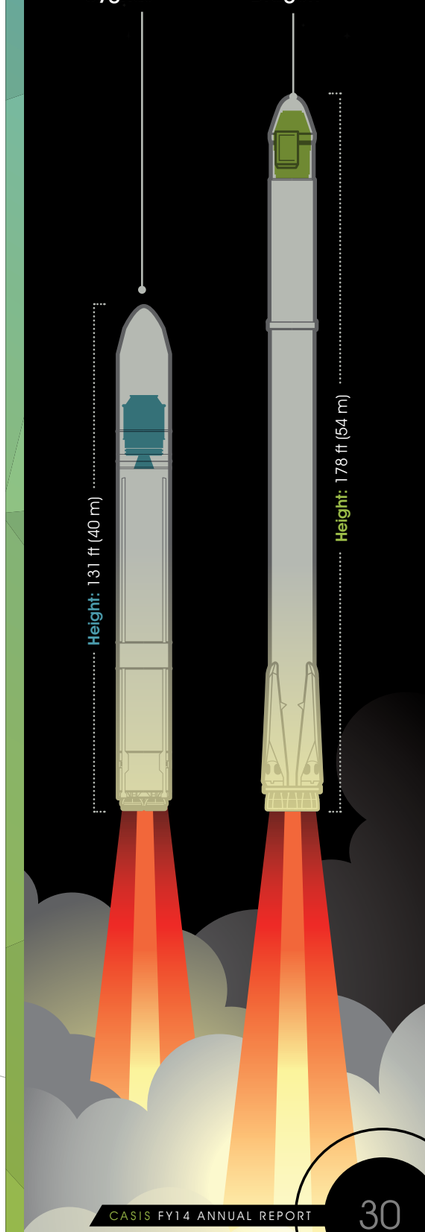
Spacecraft: Cygnus

Falcon 9

Engine: Nine Merlin 1D/ Kerosene Fueled

Launch Locale: Kennedy Space Center, FL

Spacecraft: Dragon



OUTREACH & AWARENESS

CASIS conducts outreach programs promoting the remarkable value of the ISS National Lab as a resource for education as well as science and technology development. Outreach efforts are essential for CASIS to increase the awareness of the ISS as an innovation platform and to cultivate new user communities within commercial, government, and academic centers. In FY14, CASIS marketing and communications efforts significantly increased exposure of the ISS to both national and targeted audiences.

Bloomberg The Washington Post Forbes

CASIS President and Executive Director Greg Johnson met with Bloomberg West reporter Emily Chang, discussing the benefits of conducting research through CASIS.

CASIS was featured in *Fast Company's* "The World's 50 Most Innovative Companies" annual issue highlighting commercial successes on the ISS.

Stemming from the CASIS partnership with Baylor College of Medicine, the July/August 2014 issue of *IEEE Pulse* magazine was dedicated entirely to space science with Earth benefits. CASIS staff contributed four articles.

A CASIS representative joined prominent NASA figures to discuss all potential research opportunities on the ISS with a live studio audience at the Destination Station: International Space Station Science Forum.

ARK2
Mission Patch

OUTREACH FY14

- American Association for the Advancement of Science
- American Society for Gravitational and Space Research
- BIO International Conference
- Destination Station, Indianapolis
- Destination Station, Los Angeles
- Destination Station, San Diego
- International Symposium for Personal and Commercial Spaceflight
- ISS Research & Development Conference
- Kennedy Space Center Community Leaders Briefing
- MassChallenge
- National Space Symposium
- Space, Cancer, and Personalized Medicine Conference
- USA Science and Engineering Festival
- World Stem Cell Summit

PRINT ADVERTISEMENTS

- BIO International Conference Program
- Mary Ann Liebert, Inc.
- *New Scientist*

MEDIA REACH FY14

30 NEWS RELEASES

30 MEDIA EVENTS

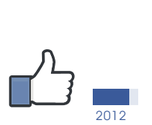
3,891 NEWS MENTIONS (CLIPS, BLOGS)

211,219 WEBSITE VISITORS

24 YOUTUBE POSTS — **25,440** VIEWS

54,273 TWITTER FOLLOWERS AMASSED — **3,002** TWITTER MENTIONS

2,371 LIKES AMASSED



248 FY14 POSTS

SPACECRAFT

In FY14, all awarded projects were delivered to the ISS on one of two spacecraft:

Dragon

Storage Capacity:
13,228 lbs (6,000 kg)

Dimensions:
14.4 ft (4.4 m) tall &
12 ft (3.66 m) in diameter

Launch Vehicle:
Falcon 9

Cygnus

Storage Capacity:
5,952 lbs (2,700 kg)

Dimensions:
12 ft (3.66 m) tall &
10.1 ft (3.07 m) in diameter

Launch Vehicle:
Antares

FINANCIALS

Statements of Financial Position as of September 30

ASSETS	2014	2013
CASH AND CASH EQUIVALENTS	$1,354,322	$1,485,647
INVESMENTS, RESTRICTED	–	50,126
DEPOSIT	3,281	1,350
PREPAID EXPENSES	340,058	259,867
PROPERTY AND EQUIPMENT AT COST, NET OF ACCUMULATED DEPRECIATION OF $340,990 AND $179,046, RESPECTIVELY	174,061	266,896
INTANGIBLE ASSETS AT COST, NET OF ACCUMULATED AMORTIZATION OF $20,759 AND $10,530, RESPECTIVELY	10,687	11,836
TOTAL ASSETS	$1,882,409	$2,075,722

LIABILITIES AND NET ASSETS	2014	2013
LIABILITIES		
ACCOUNTS PAYABLE AND ACCRUED EXPENSES	$238,293	$199,564
DEFERRED GRANT REVENUE	252,765	396,400
TOTAL LIABILITIES	$491,058	$595,964
NET ASSETS		
UNRESTRICTED NET ASSETS	206,433	294,960
TEMPORARILY RESTRICTED NET ASSETS	1,184,918	1,184,918
TOTAL NET ASSETS	1,391,351	1,479,878
TOTAL LIABILITIES AND NET ASSETS	**$1,882,409**	**$2,075,842**

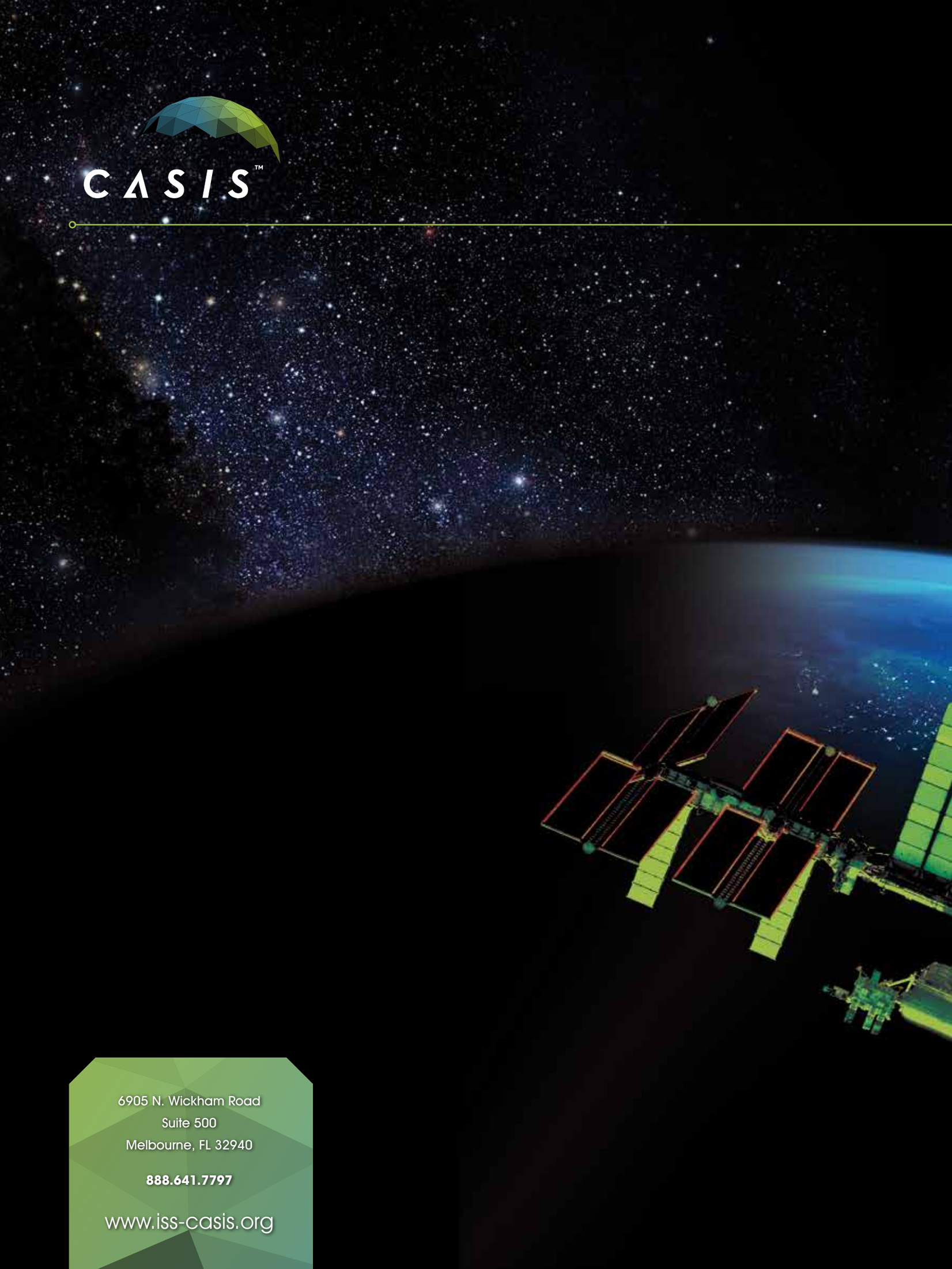
Statements of Activities for the Years Ended September 30

REVENUES AND OTHER SUPPORT	2014	2013
FEDERAL GRANTS	$15,273,635	15,274,726
CONTRIBUTIONS	9,193	5,000
MEMBERSHIPS	35	210
DONATED FACILITY	75,750	75,750
INTEREST INCOME	2,525	2,414
TOTAL REVENUES AND OTHER SUPPORT	$15,361,138	$15,358,100

EXPENSES	2014	2013
PROGRAM SERVICES	12,453,484	12,498,010
SUPPORTING SERVICES	2,996,181	2,964,114
TOTAL EXPENSES	$15,449,665	$15,462,124
LOSS ON DISPOSAL OF INTANGIBLES AND EQUIPMENT		(35,125)
CHANGE IN NET ASSETS	(88,527)	(139,149)
NET ASSETS, BEGINNING OF YEAR	1,479,878	1,619,027
NET ASSETS, END OF YEAR	**$1,391,351**	**$1,479,878**

Summarized financial statements from CASIS fiscal year 2014. 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 2014.

CASIS™



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