

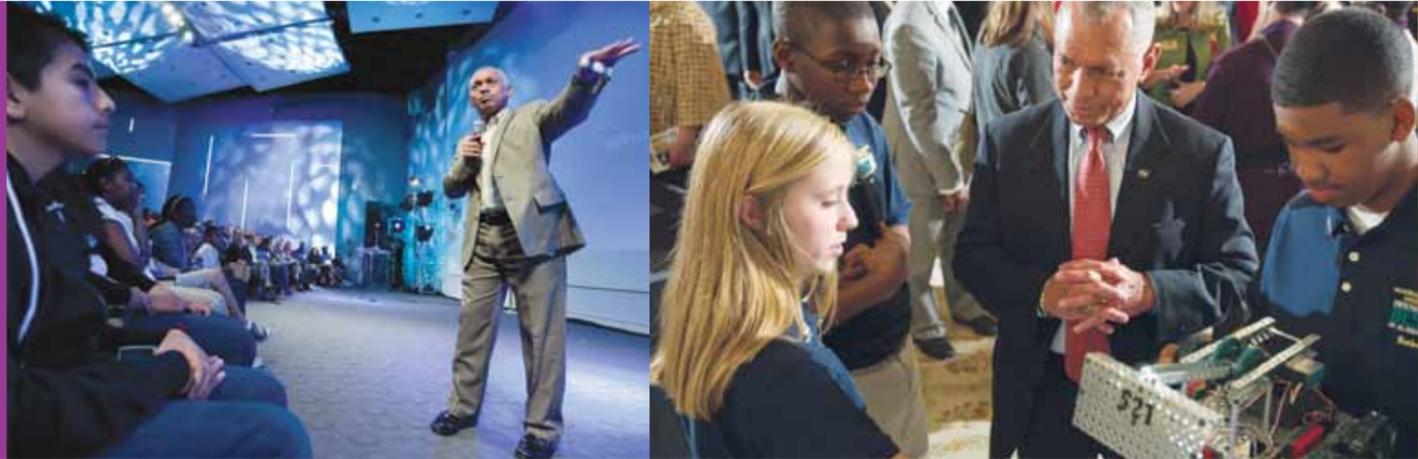


# Inspiring, Engaging, and Educating the Next Generation of Explorers



inspire engage educate employ ...  
the next generation  
of explorers and innovators.

2011 NASA Education Highlights



## Inspiring, Engaging, and Educating the Next Generation of Explorers

“Students educated in science, technology, engineering, and mathematics—the STEM disciplines, as we like to call them—are the keys to America’s technological leadership and economic growth in the 21st century.”

—Charles F. Bolden, NASA Administrator

Read about the innovative ways NASA is creating new activities that spark the interest and imagination of people from all segments of society.



“NASA aims to open the minds of the next generation to the limitless possibilities of education and exploration using our Agency’s unique capabilities.”

—Leland Melvin,  
NASA Associate Administrator for Education  
and NASA Astronaut

<http://www.nasa.gov/education>

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September 2012



A Message from the  
**Associate Administrator for Education**

NASA's Office of Education reached a number of meaningful milestones in 2011. We continued engaging learners, educators, and institutions Nationwide as only NASA can with our unique capabilities while also laying the groundwork for the Agency's new Education portfolio. In addition, 2011 marked the culmination of one of NASA's most significant accomplishments, the Space Shuttle Program, which made long-lasting contributions to science, technology, engineering, and mathematics (STEM) education, from transporting student research projects and educator astronauts to the International Space Station (ISS) to serving as a catalyst for international education collaborations. As an astronaut who flew on two Space Shuttle missions to the ISS, it was astounding to witness the program's impact on the advancement of science, as well as the inspiration it provided to students around the world.

In 2011, NASA's STEM education programs reached more than 700,000 K-12 students and 4,000 students through higher education initiatives such as NASA internship, fellowship, and scholarship opportunities. Additionally, NASA-related exhibits and programming were featured in more than 400 museums and science centers, engaging students with STEM through educational and creative activities.

NASA Education also made great strides in establishing strategic partnerships with public and private organizations to increase our STEM education offerings to learners, educators, and institutions. We will continue to cultivate new partnerships that will play a key role as we search for the most innovative methods of delivering quality STEM education.

As we look toward the future, NASA will actively support our President's goal of building a world-class STEM workforce by contributing to educator and learner experiences. NASA has always been in a unique position to inspire the next generation to excel. Through our Federal Government-wide collaborations and new missions to Mars and beyond, we intend to continue our commitment to excellence.

This publication highlights the work that NASA accomplishes every day to inspire our Nation's future explorers. I hope you will be inspired by our people, resources, and facilities, as well as the exceptional work our students and educators are doing. I know I am. Let us continue working together to ensure a prosperous future for our Nation.

A handwritten signature in black ink that reads "Leland D. Melvin".

Leland D. Melvin

NASA Associate Administrator for Education and NASA Astronaut

# NASA Education Overview



## About NASA Education

Education is a fundamental part of the National Aeronautics and Space Administration's (NASA) vision *to reach for new heights and reveal the unknown so that what we do and learn will benefit all humankind*.

NASA's Offices, Mission Directorates, and Centers are collaborating to implement a single Agency-wide approach to science, technology, engineering, and mathematics (STEM) education. This new approach provides unique NASA experiences to learners, educators, and institutions, as well as streamlined access to our content, Web sites, people, resources, and facilities.

NASA is launching into the future with four Lines of Business that will enable us to ensure our education investments are unique and non-duplicative of other Federal agencies also involved in STEM education:

- STEM Engagement
- Educator Professional Development

- Institutional Engagement
- NASA Internships, Fellowships, and Scholarships

In fiscal year (FY) 2013, we are refining the focus of our STEM education program by

- Focusing competitive opportunities for learners and educators on middle school pre- and in-service educator professional development;
- Providing experiential opportunities, internships, and scholarships for high school and undergraduate students;
- Using NASA's unique missions, discoveries, and assets to inspire student achievement and educator teaching ability in STEM fields; and
- Aligning projects and activities with the 5-year STEM strategic plan issued by the Office of Science and Technology Policy (OSTP) Committee on STEM.



NASA is also playing an active role in national and state STEM policy discussions and placing more emphasis on project evaluation, as well as external, independent evaluation and assessment, to ensure that investments are providing desirable STEM impacts.

Meanwhile, the Office of Education's Infrastructure Division (OEID) is implementing the principles of transparency, participation, and collaboration throughout all of its education activities. The division works to improve education policy and decision making, provide better education services, increase accountability, and ensure more effective administration.

## NASA's Education Goals

- Strengthen NASA's and the Nation's future workforce.
- Attract and retain students in STEM disciplines.
- Engage Americans in NASA's mission.

## Four Lines of Business

**NASA STEM Engagement** addresses national needs in STEM education while also providing exciting and unique opportunities to underrepresented and underserved communities. Our activities utilize NASA-unique resources and include STEM Public Education Events, STEM Experiential Learning Opportunities, and STEM Challenges, which are designed to ignite public interest in NASA's mission while placing emphasis on meeting national needs.

STEM Public Education Events foster interactions with learners to spark an interest in STEM disciplines using NASA materials and resources. Through participatory activities, STEM Experiential Learning Opportunities enable learners to acquire knowledge, understand what they have learned, and apply that knowledge through inquiry-based

and project-based activities. STEM Challenges are creative applications of NASA-related science, technology, engineering, mathematics, and cross-cutting concepts that challenge existing assumptions and enhance innovation, critical thinking, and problem-solving skills.

Through our coordinated and collaborative efforts as an Agency, we aim to change the perception of STEM among learners who will contribute to the economic growth and global competitiveness of the United States.

### **NASA Educator Professional Development**

provides educators with the knowledge, skills, and ability to deliver unique STEM content to learners who will ensure the economic growth and competitiveness of our Nation. NASA is strategic and efficient in managing its efforts to design and deliver stimulating professional development opportunities that will increase educators' confidence in delivering NASA-related STEM materials within their learning environments.

NASA engages the pre-service educator community with face-to-face activities at Centers and remote locations, as well as by infusing NASA content into teaching materials and curriculums within higher education institutions. Opportunities for in-service educators are designed to have a lasting impact on classroom instruction and understanding of NASA-related STEM content. We continue to motivate informal educators to utilize NASA materials in their education environments and help establish linkages between formal and informal education.

NASA also recognizes the strength in collaborating with other entities to maximize the benefits of effective professional development and is executing a targeted partnership strategy to systematically increase the Agency's capacity to deliver these opportunities.

# NASA Education Overview



**NASA Institutional Engagement** supports the advancement and development of STEM personnel, programs, and infrastructure to enable formal and informal institutions to conduct NASA-related research and/or deliver NASA-related STEM content. The opportunities we provide capitalize on the strengths and resources of the Agency, including our scientists and engineers, our mission and technology portfolios, and our world-class facilities.

**Higher Education:** NASA increases the STEM research capacity of institutions to contribute to NASA missions, as well as the capacity of the institutions to provide on-campus research opportunities and experiences that cultivate a higher level of STEM faculty and learners.

**Informal Education:** NASA maintains the NASA Museum Alliance with a goal of increasing the number of museums, science centers, planetariums, and other informal education institutions with which the Agency engages. The intent is to broaden public exposure to exhibits and activities related to NASA content.

**STEM Education Organizations:** NASA collaborates with educational societies, associations, nonprofits, and Government entities to systemically change K–12 STEM education on efforts of national scope. Working with organizations with similar goals allows NASA to advance strategic STEM policy positions and workforce needs.

The Agency’s Institutional Engagement efforts also reflect a commitment to several Presidential Executive Orders regarding Minority-Serving Institutions, including Promoting Excellence, Innovation, and Sustainability at Historically Black Colleges and Universities; the White House Initiative

on Education Excellence for Hispanics; Increasing Participation of Asian Americans and Pacific Islanders in Federal Programs; and Improving American Indian and Alaska Native Education Opportunities and Strengthening Tribal Colleges and Universities.

**NASA Internships, Fellowships, and Scholarships (NIFS)** motivate students to pursue careers in STEM and improve the retention of students in STEM disciplines. We provide opportunities along the full spectrum of the pipeline and remain committed to offering significant, direct student awards in higher education to underserved and underrepresented communities of learners, educators, and researchers.

NASA internships support educational work opportunities that provide unique NASA-related experiences for educators and high school, undergraduate, and graduate students. NASA fellowships support independently conceived or designed research, or senior design projects by highly qualified faculty, undergraduate, and graduate students, in disciplines needed to help advance NASA’s missions. NASA scholarships provide financial support to undergraduate and graduate students for studies in science, technology, engineering, and mathematics disciplines to inspire and support the next generation of STEM professionals.

Through its internship, fellowship, and scholarship efforts, NASA is investing in the next generation of leaders who have not only the ability to meet future mission priorities, but also the potential to change the world.



**NASA Centers** are responsible for institutional assets and the execution of components of the Agency's numerous and varied research and development programs across the Nation. Center Education Offices implement NASA education projects and activities for the Mission Directorates and the Office of Education, as well as planning and implementing education programs that are unique to, and funded by, their Centers.

**Ames Research Center (ARC)** specializes in research geared toward creating new knowledge and new technologies that span the spectrum of NASA interests.

**Dryden Flight Research Center (DFRC)** is the lead for flight research and continues to innovate in aeronautics and space technology. The newest, the fastest, the highest—all have made their debut in the vast, clear desert skies.

**Glenn Research Center (GRC)** develops and transfers critical technologies that address national priorities through research, technology development, and systems development for safe and reliable aeronautics, aerospace, and space applications.

**Goddard Space Flight Center (GSFC)** has a mission to expand knowledge of Earth and its environment, the solar system, and the universe through observations from space.

**The Jet Propulsion Laboratory (JPL)**, managed by the California Institute of Technology (Caltech), is NASA's lead Center for robotic exploration of the solar system.

**NASA Mission Directorates** each cover a major area of the Agency's research and development efforts. The Mission Directorates and other NASA Headquarters organizations that fund education efforts are responsible for embedding education components into their research and development programs and flight missions, administering the discipline-/content-specific activities for which they provide funding and resources, and ensuring meaningful collaboration between the NASA science/engineering community and the education community.

**The Aeronautics Research Mission Directorate (ARMD)** works to solve the challenges that still exist in our Nation's air transportation system, such as air traffic congestion, safety, and environmental impacts. Solutions to these problems require innovative technical concepts and dedicated research and development. NASA's ARMD pursues the development of new flight operation concepts and new tools and technologies that can transition smoothly to industry to become products.

**The Science Mission Directorate (SMD)** leads the Nation on a great journey of discovery, seeking new knowledge and understanding of our planet Earth, our Sun and solar system, and the universe out to its farthest reaches and back to its earliest moments of existence. NASA's Science Mission Directorate (SMD) and the Nation's science community use space observatories to conduct scientific studies of Earth from space, to visit and return samples from other bodies in the solar system, and to peer into our galaxy and beyond. NASA's science program seeks answers to profound questions that touch us all.

**Johnson Space Center (JSC)** continues to lead NASA's efforts in human space exploration from the early Gemini, Apollo, and Skylab projects to today's Space Shuttle and International Space Station programs.

**Kennedy Space Center (KSC)** is America's gateway to the universe—leading the world in preparing and launching missions around Earth and beyond.

**Langley Research Center (LaRC)** continues to forge new frontiers in aviation and space research for aerospace, atmospheric sciences, and technology commercialization to improve the way the citizens of the world live.

**Marshall Space Flight Center (MSFC)** is bringing people to space and bringing space to people. MSFC is the world leader in the access to space and use of space for research and development to benefit humanity.

**Stennis Space Center (SSC)** is responsible for NASA's rocket propulsion testing and for partnering with industry to develop and implement remote sensing technology.

**The Human Exploration and Operations Mission Directorate (HEOMD)** provides the Agency with leadership and management of NASA space operations related to human exploration in and beyond low-Earth orbit. HEO also oversees low-level requirements development, policy, and programmatic oversight. The International Space Station (ISS), currently orbiting Earth with a crew of six, represents the NASA exploration activities in low-Earth orbit. Exploration activities beyond low-Earth orbit include the management of commercial space transportation, exploration systems development, human space flight capabilities, advanced exploration systems, and space life sciences research and applications. The directorate is similarly responsible for Agency leadership and management of NASA space operations related to launch services, space transportation, and space communications in support of both human and robotic exploration programs.



## NASA Education: 2011 Accomplishments

NASA's Office of Education is charged with the role of inspiring interest in science, technology, engineering, and mathematics (STEM) among America's students through a variety of programs and initiatives. During FY 2011, the Agency's innovative efforts reached thousands of learners, educators, and institutions Nationwide with unique NASA STEM content. The Agency's four major education outcomes are focused on strengthening NASA's and the Nation's future workforce, attracting and retaining students in STEM disciplines, engaging Americans in NASA's mission, and building strategic partnerships to promote STEM literacy.

NASA's Higher Education projects have engaged more than 4,000 students in STEM fields with exciting and unique internship and fellowship opportunities. Designed in 2010, the One Stop Shopping Initiative (OSSI) for NASA Internships, Fellowships, and Scholarships has been instrumental in attracting highly qualified internship candidates through a single online portal. These NASA experiential education activities have connected NASA to more than 600 universities Nationwide, reaching all 50 states, Puerto Rico, and the U.S. Virgin Islands. They also increase the potential for developing strong and mutually beneficial educational partnerships.

K-12 Education at NASA has reached more than 700,000 students through STEM programs and initiatives, including Summer of Innovation (SoI). Key among them is the redesigned NASA Explorer Schools program, which serves as NASA's classroom-based gateway for middle and high school learners. It engaged

170,000 students in STEM education through 1,300 participating educators across all 50 states. These figures include State Department Schools in Turkmenistan, Mexico, and Turkey, along with a Department of Defense School in Spain. The program delivered 240 hours of high-quality NASA design challenges and lesson plans as well as content from its Web site, tailored to meet the needs of summer and afterschool learners. The interactive "For Educators" section on [www.nasa.gov](http://www.nasa.gov) was named one of the top 10 sites for free resources for educators by eSchool News on its Web site, <http://www.eschoolnews.com>.

NASA-related exhibits and programming were featured in more than 400 museums and science centers through the Museum Alliance, delivering to their respective visitors and curators unique NASA education resources. Space Act Agreements were established with the LEGO Group, the United States Agency for International Development (USAID), Univision, NanoRacks, Mad Science, the Girl Scouts of the United States of America, and Honeywell Hometown Solutions to leverage their audiences and deliver STEM programs. NASA also engaged underserved and underrepresented populations by collaborating with Univision to launch the "NASA y Tú" Web pages on [www.nasa.gov](http://www.nasa.gov), which provide Spanish-language educational video segments featuring Hispanic employees from NASA. NASA received a total of 63 proposals for the NASA Research Announcement for Competitive Program for Science Museums and Planetariums Plus Opportunities for NASA Visitor Centers and other Informal Education Institutions.

NASA collaborated with the U.S. Department of Education during International Education Week (IEW) and hosted a live



downlink to the International Space Station from Headquarters for 200 Washington, DC, students. NASA and the National Science Foundation (NSF) held an informal education stakeholders meeting, and the Agency is actively engaged with the National Science and Technology Council's (NSTC's) Committee on STEM (Co-STEM). Finally, NASA is participating in the U.S. Government Accountability Office (GAO) audit of STEM programs and the Office of Science and Technology Policy (OSTP) review of STEM efforts across Federal agencies.

## NASA Education Launches the Office of Education Infrastructure Division (OEID)

The NASA Office of Education Infrastructure Division (OEID) was formed in 2011 to support NASA's new approach to STEM education by implementing the principles of transparency, participation, and collaboration throughout all of its education activities. The division works to provide support that improves education policy and decision making, provides better education services, increases accountability, and ensures more effective administration.

The OEID provides subject matter expert (SME) services to the broader NASA Education community through a systematic approach. The services offered are interconnected structural elements that provide Education framework support to facilitate, enable, sustain, and enhance informed Education leadership and policy decision making. The OEID is composed of a diverse group of Office of Education civil servants, contractors, and external partners working side by side to support the Education

community at large. The division's four teams offer support in the areas of performance assessment, information technology (IT), business products implementation, communications and event support, Web tools, and dissemination networks. Requesting the services of the OEID is done by the completion of a "Service Request" form found on <https://intern.nasa.gov/>. To access the form, go to the "Administrative Support Tools" section and click on "Launch."

Several Office of Education goals have already been met through the OEID's services such as improved processes for reporting capability, data entry options, and NASA fellowship intake process, among others. A major component of OEID's tasks for NASA Education will focus on IT and Web tools the OEID supports and manages. The division is working towards "one" unified IT system for the OEID applications. Once this task is complete NASA Education will successfully transition all OEID applications including the OSSI LaunchPad, One Stop Shopping Initiative for NASA Internships, Fellowships and Scholarships (OSSI), and the Office of Education Performance Measurement (OEPM) system to a secured, centrally located environment.

The OEID's future efforts will focus on training and support for communications management, data collection, reporting, performance assessment, evaluation planning, and Web innovation, ensuring that the Office of Education successfully transitions into its new portfolio.

“You can teach a student a lesson for a day; but if you can teach him to learn by creating curiosity, he will continue the learning process as long as he lives.”

—CLAY P. BEDFORD



## K–12 Education

### NASA Explorer Schools Invests in Teachers To Inspire Future Leaders

NASA Explorer Schools (NES) annually recognizes exemplary educators from participating schools to work side by side with NASA scientists and engineers during summer STEM research experiences. Teachers are selected based on their creativity, innovation, and use of educational good practice. NES competitively selected 63 teachers to participate in five different Summer STEM Research Workshops at a NASA Center or research facility. Opportunities included “NASA Coastal Ocean Research”; “The Solar System—Inside and Out”; “Water Filtration Research: Water, Earth’s Most Precious Resource”; “Goldstone Apple Valley Radio Telescope Project”; and “Forces and Motion: Physics of Freefall Research—What If No Gravity?”

During these multiday experiences, teachers learned research techniques and were able to make connections to the STEM subjects they teach. In addition to the hands-on research experience, teachers toured a variety of operational facilities and met the individuals directly involved with the missions and research. NES invests in STEM educators to inspire and engage the future scientists, engineers, and technicians NASA needs to continue its journey into the future.

### NASA WISH Program Highlighted by White House Council on Women and Girls Web Site

The Women in STEM High School Aerospace Scholars (WISH) project, funded by the Education Flight Projects Office and established in 2011, was a success. This first-year offering received 214 applications and was highlighted on the White House Council on Women and Girls Web site. Through WISH, female high school juniors were immersed in learning as they became members of the interactive online community facilitated by NASA. As part of their interactive learning experience, students completed lessons covering past, current, and future space exploration. The lessons included an essay, math problem, and quiz, which were graded by certified teachers. To enhance their studies, students also chatted with NASA subject matter experts (SMEs). After completing the lessons, each student submitted a final project based on a leading female STEM professional who is developing cutting-edge technology or performing new research. Students then competed to attend a summer workshop at Johnson Space Center, where they worked alongside female NASA engineers and interns to design a mission to Mars. Approximately 40 WISH students worked in collaborative teams doing hands-on activities and presenting their projects to NASA personnel and community leaders.



## NASA's CORE Provides Thousands of Resources Nationally and Internationally

NASA's Central Operation of Resources for Educators (CORE) provided educators with thousands of STEM resources in 2011, including the 2011 Sun-Earth Day kits for the Sun-Earth Connections Project. Fifteen thousand kits were distributed to educators who requested them through Sun-Earth Connections. The theme was "Ancient Mysteries Future Discoveries." CORE also provided support and materials to 21 international partners. Of special note, CORE provided educational materials to a U.S. Army Reservist Judge Advocate General's (JAG's) Corps service member who was doing educational outreach with schools in Afghanistan while serving there.

CORE, established in cooperation with the Lorain County Joint Vocational School in Ohio, serves as the worldwide distribution center for NASA-produced multimedia materials. Through CORE's distribution network, the public has access to more than 200 video, slide, CD-ROM, and DVD programs chronicling NASA research and technology. For a minimal charge, CORE provides a valuable service to educators unable to visit one of the many NASA Educator Resource Centers across the country by making these educational materials available through its mail-order service.

## NASA Partners with Will.i.am To Celebrate Launch of the Mars Science Laboratory (MSL) Rover

On November 26, 2011, entertainer Will.i.am joined NASA Administrator Charles Bolden and Associate Administrator for Education Leland Melvin at the Kennedy Space Center (KSC) during several prelaunch events for NASA's MSL Curiosity rover. Will.i.am participated in a "Tweetup" with more than 150 followers at KSC's press site in Florida, which focused on the mission and STEM education. He tweeted about the importance of getting involved in STEM education and the positive impact of science in today's society and for the future. He also challenged followers to be curious about science: "If it wasn't for NASA research we wouldn't have any of these laptops or any of these smartphones. I wouldn't be able to make music on computers and share them around the world if it wasn't for the research that NASA has led."

Following the launch of MSL, NASA reached out to Will.i.am to write a song that was broadcast back to Earth when MSL landed on the planet on August 28, 2012. The Mars Curiosity rover will investigate whether the planet has ever offered conditions that would sustain microbial life, including the chemical ingredients for living organisms. Since Will.i.am became involved with MSL, he has participated in several NASA videos and public service announcements. In addition to his involvement with MSL, Will.i.am



is also active with the For Inspiration and Recognition of Science and Technology (FIRST) program, which inspires students to become science and technology leaders.

## NASA and the LEGO Group Partner To Inspire Children To Build and Explore the Future

On February 24, 2011, a LEGO Space Shuttle headed to orbit with the crew of Discovery on its STS-133 mission to help mark the signing of a Space Act Agreement between NASA and the LEGO Group to spark children's interest in STEM. The partnership marked the beginning of a 3-year agreement that will use the inspiration of NASA's space exploration missions and the appeal of the popular LEGO bricks to spur children's interest in STEM. The LEGO Group will release four NASA-inspired products in their LEGO CITY line, which will contain NASA-inspired educational materials.

As part of this Space Act Agreement, NASA sent special LEGO sets to the International Space Station aboard Shuttle Endeavour's STS-134 mission in May 2011. The LEGO sets were assembled by astronauts on orbit and by children and student groups across the country. The construction process and activities with the sets demonstrated the challenges faced when building things in the microgravity environment of space. NASA Education-managed Web sites will continue to feature these partnership efforts to educator and student audiences.

## NASA's Focus on Sustainability Education

In June 2011, a small group of educators attended a pilot workshop focused on sustainability (the three R's, alternative forms of energy, and transportation). While attending the workshop, educators designed the beginning stages of a project-based learning unit that emphasized NASA education and sustainability. As teachers resumed school in the fall with their students, they began facilitating the project-based learning units focusing on sustainability by assisting students with understanding NASA's role and the importance of sustaining Earth's environment.

As the NASA Glenn Research Center (GRC) joined with corporate and private entities specializing in various forms of sustainability, students and teachers presented their studies at the culminating Student Sustainability Conference held on October 21, 2011. During the conference, students presented their sustainability projects directly alongside professionals from Cleveland-area sustainability businesses. Before leaving GRC, students were introduced to astronaut Michael J. Foreman and given a behind-the-scenes tour of the Center's world-renowned facilities.



## “Sector 33” Mobile App Teaches Math Concepts on Arrival

Nearly every minute of every day, air traffic controllers perform instantaneous computations of rate, distance, and time to safely merge and space aircraft on arrival at airports.

Now students of all ages are doing the same thing and having fun while doing it. In 2011, NASA completed the development of “Sector 33,” a mobile app game where players act as air traffic controllers by guiding airplanes through a sector of airspace spanning Nevada and California. Players must think on their feet, using math and problem-solving skills to adjust airplane speeds and routes to safely reach their destination. “Sector 33’s” different skill levels allow students of all ages to play. Those who achieve the highest levels feel a real sense of accomplishment because the game allows access only to those who have reached certain goals.

Downloads of “Sector 33” averaged 1,500 per week. The mobile app has been popular at events such as the Girl Scouts’ “Girls Go Tech” activity and during outreach activities that focus on STEM.

## Summer of Innovation Forms Collaborations To Provide STEM Activities for Middle School Students and Teachers

NASA developed collaborations with eight organizations in FY 2011 to help implement the Summer of Innovation (Sol) education program. The awardees were Chester County Intermediate School District–Pennsylvania, Albany State University, the Nebraska Department of Education, the Dorothy Jemison Foundation for Excellence, the Puerto Rico Institute of Robotics, Inc., the Rio Grande Valley Science Association, the Indiana Association of United Ways, Inc., and the South Dakota Discovery Center and Aquarium.

The awardees developed strong collaborations between school districts and informal education providers to excite and engage thousands of students in high-quality learning experiences. NASA supported these partner institutions as they engaged local teachers in professional development to support high-quality instruction in STEM disciplines.

In 2011, Sol also piloted the “mini-grant” component of the project. Mini-grants are designed to engage a wide variety of education partners—such as museums, schools or school districts, and youth organizations—to infuse STEM content into existing summer and afterschool student programs. The maximum award value for each 2011 mini-grant is \$2,500.



The NASA Centers and Jet Propulsion Laboratory also continued their successful engagement with Sol, reaching over 18,000 learners and 1,400 educators in 2011. Through 2011 implementation, new strategic partnerships were created with a variety of organizations including military entities, corporations, educational institutions, and nonprofit organizations.

Sol began as NASA's response to President Obama's Educate To Innovate initiative. Targeted at middle school students, the program uses a variety of experiences to engage students in STEM.

## NASA Brings the Stars to Students in North Carolina for Astronomy Days

In May 2011, students and visitors at the North Carolina Museum of Natural Sciences in Raleigh got the full "NASA Experience," complete with a life-size replica of a Mars rover and a visit by former astronaut José Hernández. NASA Langley Research Center partnered with the Morehead Planetarium and Science Center and the Raleigh Astronomy Club to bring 2 days of free, interactive exhibits and educational stations to the museum. All four floors were transformed into a world of "planetary exploration," which was the theme of the event.

In addition to the Mars rover replica, provided by NASA's Jet Propulsion Laboratory in Pasadena, CA, visitors had the opportunity to make comets out of dry ice; make rockets; take

imaginary trips to Jupiter, Saturn, Mercury, and the Moon; and see the GeoDome, which projects clear, high-definition images and movies that create a virtual space experience.

Former astronaut José Hernández, whose parents were migrant workers, gave a talk entitled "An Astronaut's Journey Through the Stars." Hernández gave a special presentation to a group of 100 children of migrant workers, encouraging them to set their goals high and reach for the stars. Hernández was a part of the STS-128 Space Shuttle mission to the International Space Station in 2009 and recorded 13 days, 20 hours, and 54 minutes in space.

Univision Communications Inc., the largest Spanish-language network in the country, covered Hernández's interaction with the students for a segment that was used as part of a program about NASA's Sol. The segment aired on the show *Despierta America*, Univision's national morning show.

NASA's Summer of Innovation began in 2010 as a response to a national need for improvement in STEM education. This NASA project is designed to improve the skills and enhance the engagement of American students in STEM.

## Two Endeavor Fellows Win Presidential Award for Excellence in Math and Science Teaching

On April 28, 2011, two NASA Endeavor Fellows received the Presidential Award for Excellence in Mathematics and Science Teaching. The Endeavor Online STEM Certificate provides the comprehensive training educators need to effectively teach STEM content and integrate strategies within the core curriculum. Endeavor graduates become champions in their schools and districts, leading efforts for STEM education and enacting change in their classrooms and beyond.

To become an Endeavor educator, one may compete and apply for a NASA Endeavor Fellowship or register with NASA's partner Houghton Mifflin Harcourt. A new partnership agreement between NASA and Houghton Mifflin Harcourt was official on June 17, 2011, when Houghton Mifflin Harcourt became an exclusive distributor of sponsored Endeavor Fellowships. As part of the agreement, Houghton Mifflin Harcourt will widely promote Endeavor as a solution for STEM professional development.

Endeavor awards 50 fellowships each year to educators contributing to the development of a STEM workforce based on NASA content and educational materials.

## NASA Joins Forces with Military Families for Education Programs

NASA Education kicked off a new campaign on April 28, 2011, to reach out to America's military families and engage them in Agency activities that promote STEM education. This initiative supports the 2011 Joining Forces campaign announced by Michelle Obama, First Lady, and Jill Biden, wife of Vice President Joe Biden.

During the NASA Education Pre-Launch Summit at the Peabody Hotel in Orlando, FL, NASA Administrator Charles Bolden and Associate Administrator for Education Leland Melvin provided an overview of the Agency's plan to share educational resources and programs with students from military families.

Bolden delivered the keynote luncheon presentation and then joined invited military families for hands-on STEM education activities. Military families also attended the launch of Space Shuttle Endeavour as NASA's guests. This outreach to military families is just one of many programs NASA Education offers using the excitement of exploration to engage the Nation's youth in STEM studies. The goal is to open the door to exciting future career options in STEM disciplines.



## Mission X International Closing Event

The Mission X Multiyear Campaign Project, sponsored by the Human Research Program and HEO Mission Directorate, began in September 2011 and finished the last major event for its initial 3-year effort in late April 2012. The project's objective is to reach out to children and adults alike to try to enhance their daily physical activity and improve their awareness of good nutrition while learning about human space exploration and trying to "Train Like an Astronaut!" The Mission X (MX) 2012 international fitness challenge took place January through March 2012 in 15 participating countries and included more than 10,500 children. The MX Web site and 18 MX activities, located at <http://www.trainlikeanastronaut.org>, were central to the challenge, and Web content was provided to participants in 13 languages.

The NASA Human Research Program Education and Outreach Project held the first MX International Closing Event in London, England, April 26–28, 2012. To help celebrate the event, 12 of the 15 participating MX 2012 countries came together at the site of the Summer Olympic Games. The juxtaposition of athletic excellence and astronaut well-being highlighted the importance of excellent health and fitness for both disciplines. The events—hosted by local London schools and Cambridge University—included Olympic Summer Games participants, European Space Agency (ESA) astronaut Paolo Nespoli, and Olympic athletes, as well as MX and human space flight lectures at the Royal Aeronautical Society. NASA EDGE documented the proceedings in a global Web-streaming event on April 27, 2012, and in a NASA EDGE program. Next steps for MX are to grow the global community that seeks to "Train Like an Astronaut" and stay fit in both body and mind. Go, Mission X!



## NASA Rockets to Racecars (R2R) Makes Its Debut at the Atlanta NASCAR Event

The new Rockets to Racecars (R2R) exhibit made its debut at NASA's STEM education event at the Atlanta Motor Speedway on Labor Day weekend, September 2–4, 2011. More than 4,000 people visited the NASA display area, where they explored the R2R interactive display to learn about NASA technologies in National Association for Stock Car Auto Racing (NASCAR) racing. NASA Langley Research Center educators and aerospace education specialists engaged families and children with hands-on STEM activities related to the principles of aerodynamics and Newton's laws. NASA's exploration trailer was on site to allow participants the opportunity to learn more about NASA spinoff technologies through interactive 3D displays.

NASA partnered with TEN80 Education, Inc., NASCAR's STEM Education Initiative, to bring 100 underserved middle school students to the display. NASCAR driver Ryan Newman came to race with the students on TEN80's 1/10th scale radio control (RC) track and then visited the NASA R2R exhibit. NASCAR is the most highly attended sporting event in the United States. It attracts an audience with a broad range of ethnic, cultural, and economic backgrounds, and it is the only sport where the engineering takes place during the competition.

## INSPIRE Develops Virtual Activities for Individuals and Teams

The Interdisciplinary National Science Project Incorporating Research and Education Experience, or INSPIRE, is a multitier, year-round project designed for students in 9th to 12th grade who are interested in STEM education and careers. In 2011, INSPIRE conducted many exciting activities involving individuals and teams.

A design competition was held to create an INSPIRE team patch. Students voted for the winning design, which was made into patches and decals and distributed to all online learning community members. Another activity of note was the RealWorld-InWorld James Webb Telescope Engineering Design Competition, in which students learned the engineering design process to solve a problem related to the telescope. One of five INSPIRE teams was awarded second place. The first-place team included an INSPIRE student who participated as a member of her school's team.

Additionally, an INSPIRE alumnus attending the Georgia Institute of Technology (Georgia Tech) invited students to participate in planning research and activities for the Mars Desert Research Station. Twenty-six INSPIRE team proposals were submitted, and four were selected for actual research.



## NASA Performs Student Experiments for World To See

NASA announced its support of Space Adventures, Ltd., of Vienna, VA, to conduct a global competition for students to design experiments that will be performed in space and broadcast around the world.

The Agency entered into a non-reimbursable Space Act Agreement with Space Adventures for astronauts aboard the International Space Station, 250 miles above Earth, to conduct the winning experiments on the orbiting outpost. The experiments will be performed on the U.S. portion of the Space Station that has been designated as a national laboratory.

The National Laboratory Education Initiative seeks innovative ways to use the unique microgravity environment of the Space Station to promote STEM education. The contest is designed to encourage students from 14 to 18 years old to develop STEM skills through practical experience.

NASA representatives joined a panel of internationally renowned scientists, astronauts, and teachers to judge the entries with input from the YouTube community. Public voting began in early 2012, and two global winners were announced in March 2012. Both winning experiments will fly aboard the Japan Aerospace Exploration Agency's HTV-3 mission. Regional finalists received a flight on a NASA ZERO-G aircraft.

## NASA Selects Teachers for Students' Reduced-Gravity Experiments

Teachers from 14 NASA Explorer Schools (NES) were selected for the 2011 School Recognition Award for their contributions to STEM education. A team of NASA personnel reviewed applications and recognized the schools for demonstrating exemplary classroom practices and finding innovative uses of NES resources to engage a broad school population. These schools were selected from more than 1,300 schools that have registered participants in the NES project.

Three selected teachers from each school traveled to NASA's Johnson Space Center in Houston to conduct experiments in microgravity aboard the Agency's reduced-gravity aircraft. The experiments examined how fluids with different viscosities behave in microgravity, the acceleration and inertia of objects, and how the absence of gravity affects mass and weight. NES is the classroom-based gateway for students in grades 4 through 12 that is focused on stimulating STEM education using Agency content and themes.

## NASA Internship Exposes Teachers to Aerospace Engineering

An innovative summer internship program gave 42 U.S. middle and high school teachers a unique opportunity to gain hands-on experience with NASA's latest aerospace engineering technologies while working closely with Agency technical mentors.

During the summer of 2011, selected educators for the Simulation-Based Aerospace Engineering Teacher Professional Development program learned about virtual technology to excite their students about real-world STEM applications. NASA's Office of Education and Aeronautics Research Mission Directorate sponsored the program. Simulation-based aerospace engineering relies on computer models and simulations of aerospace structures, materials, atmospheric flight conditions, and system operations to design improvements for the next generation of flight vehicles and systems.

"The greatest engineering accomplishments today are made possible because of modeling and simulation," said Behzad Raiszadeh, technical manager for the modeling and simulation initiative at NASA's Langley Research Center in Hampton, VA. "These highly qualified educators will see firsthand how simulation is used to solve some of the most challenging NASA problems using the basic math and physics principles they teach in school."

During the program, teachers worked alongside NASA mentors in various Agency laboratories and had the opportunity to tour NASA facilities. They also participated in NASA's Digital Learning Network, learned about other Agency educational resources, and developed lesson plans incorporating modeling and simulation concepts.

## Students and Educators Attend NASA's Rocket University

NASA's Wallops Flight Facility in Virginia became Rocket University in the summer of 2011, with nearly 125 high school educators and university students and instructors who spent the week learning about rocketry and conducting science experiments in space. During the week, NASA conducted the fourth annual "RockOn!" workshop for university-level participants and the Wallops Rocket Academy for Teachers and Students (WRATS) for high school teachers.

"RockOn!," conducted with the Colorado and Virginia Space Grant Consortia, is designed to provide participants with an introductory session in building small experiments that can be launched on sounding rockets. Workshop participants built standardized experiments that flew on a NASA Terrier-Improved Orion suborbital sounding rocket. This 35-foot-tall rocket flew at an altitude of 75 miles. After launch and payload recovery, the participants conducted preliminary data analysis and discussed their results.

This inaugural WRATS program gave high school teachers a technical flight experience to reinforce the STEM concepts they teach in their classrooms.

## Stennis Space Center ISS Downlink Grants Students a Chance To Speak Live with Astronauts

Fifth- through seventh-grade students gathered at NASA's John C. Stennis Space Center in Mississippi to place a long-distance call to astronauts aboard the International Space Station (ISS) on August 18, 2011. They asked Expedition 28 Flight Engineers Ron Garan, Mike Fossum, and Satoshi Furukawa questions related to mass and weight and life in space. The experience was designed to enhance the students' understanding of scientific principles in physics and space. Stennis's education office hosted the call, which included a videolink with the three astronauts and was broadcast live on NASA Television.

This in-flight education downlink was one in a series with educational organizations in the United States and abroad to improve teaching and learning in STEM studies. It is an integral component of NASA's Teaching From Space education program, which promotes learning opportunities and builds partnerships with the education community using the unique environment of space and NASA's human space flight program.

## NASA Organizes First Year of Spaced Out Sports Competition

NASA's first Spaced Out Sports Design Challenge included more than 55 teams and 400 middle school students from across the United States, Turkey, and a Department of Defense Education Activity (DoDEA) school in Japan who designed games for the astronauts to play on the ISS. This Teaching From Space project involved students submitting a game playbook and video to demonstrate Newton's laws of motion applied to sports on Earth and in space.

Students prepared for the challenge through Spaced Out Sports Curriculum Guide and Career Video activities that included Olympic gymnast Nastia Liukin, NASCAR driver Juan Pablo Montoya, Women's National Basketball Association player Temeka Johnson, the National Football League's New Orleans Saints, and the National Hockey League's Colorado Avalanche player Ryan O'Reilly. Additionally, all teams participated in a Digital Learning Network (DLN) Webcast with astronaut Clay Anderson demonstrating sports on the ISS. The top three winning games were played and recorded by astronaut/Commander Dan Burbank on the ISS. The first-place winners from Arlington, VA, received a NASA-sponsored school-wide celebration with astronaut Roger Crouch.

## NASA Partners with Tor/Forge Books for Themed Science Fiction Works

In an effort to introduce readers to NASA and inform and inspire them about the Agency's work, the Agency's Goddard Space Flight Center has partnered with Tor/Forge Books to develop and publish a series of science-fiction-themed books. Referred to as "NASA Inspired Works of Fiction," these books will be based on concepts pertinent to current and future Agency missions and operations.

The enormous popularity of science fiction is a key element in this collaboration to make the books a gateway to the general public and generate awareness of the significant role NASA plays in our everyday lives. NASA is pairing scientists



and engineers with Tor/Forge writers to enhance the STEM component of the books. The Aerospace Education Services Project is providing expertise for this effort.

## Stennis Space Center Partners with the 4-H Club To Deliver Summer of Innovation Camps Across Mississippi

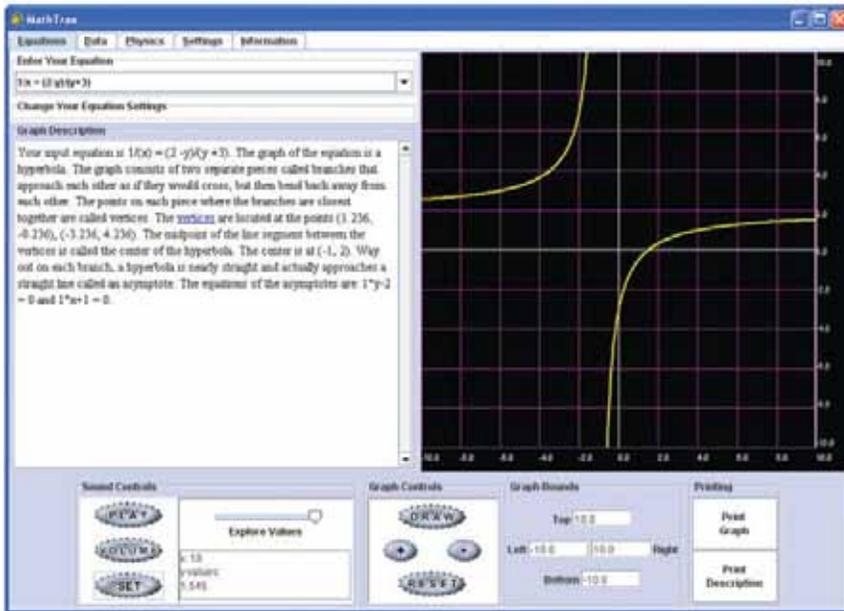
In summer 2011, NASA's Stennis Space Center partnered with Mississippi 4-H as part of NASA's Summer of Innovation. The 4-H Youth program, which stands for Head, Heart, Hands, and Health, strives to improve the quality of life for Mississippi youth by providing educational programs. Titled "4-H Blasts Off With NASA!" the partnership engaged 675 students from 26 counties across the state of Mississippi, including 30 military youth from Keesler Air Force Base in Harrison County, MS, and students from the Oprah Winfrey Boys' and Girls' Club in Kosciusko, MS.

The curriculum for the program included rocketry, space science, robotics, and Newton's laws of motion. One 4-H agent said, "It is always rewarding when youngsters discover concepts and begin to speak the 'science language' on their own rather than [as] a result of memorized facts from the test. The youngsters really began to grasp the concepts of gravity as well as Newton's laws by seeing and experiencing the concepts in action!"

## NASA's Electronic Professional Development Network Supports Georgia's Race to the Top

In 2011, the NASA Electronic Professional Development Network (ePDN), which offers online NASA content-related courses for educators, was adopted by the Georgia Department of Education in its implementation of the Obama administration's Race to the Top initiative. Initially, funds from the Georgia Race to the Top Award will allow for additional sections of the ePDN Robotics Certificate Program. Other certificates such as Statistics, Project-Based Inquiry Learning, and Instructional Technology Integration may also be considered in the future.

The ePDN program, located at the Georgia Institute of Technology, develops effective electronic professional development courses for use in NASA programs and by STEM teachers across the Nation. ePDN provides modular-based ePDN courses, as well as shorter self-paced courses and events.



## Georgia Tech Sonification Lab Uses MathTrax for Blind and Vision-Impaired Students

The Georgia Institute of Technology (Georgia Tech) Sonification Lab is using MathTrax to improve the usability of mathematics software for blind and vision-impaired students. Its primary audience is secondary and postsecondary students studying algebra, precalculus, and calculus. It particularly serves blind and vision-impaired math students but can be advantageous for many students who enjoy/require multisensory input, such as students with learning disabilities.

“MathTrax provides a different perspective on math for blind students. Blind students are frequently counseled away from math careers because of negative perceptions that it is too difficult to understand without vision. MathTrax presents them with a different, empowering perspective,” said National Federation of the Blind President Marc Maurer.

MathTrax is an educational technology tool, developed under the NASA Learning Technologies program, that demonstrates equations and graphs via sonification. Learning Technologies is NASA’s educational-technology incubator providing funded research and development opportunities, innovative technology tools for the classroom, and applied technology services for NASA education programs.

MathTrax is free of charge and available for download at <http://prime.jsc.nasa.gov/MathTrax/faq.htm>. For more information about NASA’s learning technologies, go to <http://www.nasa.gov/offices/education/programs/national/ltp/home/index.html>.

## NASA Partners with the Cleveland Clinic To Promote National Lab Day

NASA demonstrated its commitment to STEM and to extending its reach through a partnership with the Cleveland Clinic of Cleveland, OH, to initiate a National Lab Day experience for Cleveland-area youth. During the months of January–April 2011, NASA and Cleveland Clinic SMEs presented their careers and assisted students and teachers with STEM projects in

the classroom. The SMEs were able to promote a deepened understanding of STEM subjects as they worked with students and served as a professional resource to educators. A culminating event held in May highlighted the work of 74 students, 8 teachers, and 5 schools as students presented their research before NASA and Cleveland Clinic SMEs. The event concluded with a NASA facilities tour for all students and educators.

## NASA Education Specialists Partner with 21st Century Community Learning Center Program Educators

The 21st Century Community Learning Center Program with the Wisconsin Department of Education Public Instruction hosted a conference at Kalahari Wisconsin Dells for 100 educational leaders providing programming to students in after-school programs who attend underserved schools. NASA’s Aerospace Education Services Project (AESP) education specialists from Glenn Research Center participated in coordinating the professional development event to provide educators with a wide array of NASA education resources.

The daylong conference included breakout sessions aimed at exciting educators about the importance of STEM subjects and engaging them in online NASA educational content. Additionally, a STEM workshop guided the participants through hands-on and inquiry-based learning activities related to rocketry engineering challenges, robotics, and astronomy.

## NASA Establishes Two New Science, Engineering, Mathematics, and Aerospace Academy (SEMAA) Sites

The NASA SEMAA project is an innovative national project designed to increase participation and retention of underserved and underrepresented youth in the fields of STEM. In FY 2011, two new SEMAA sites were established at the University of Texas at El Paso (UTEP) and Hartnell College, CA. The installation of the two locations brings the total number to 15 SEMAA sites located in 14 states across the Nation. SEMAA implements a series of unique hands-on, inquiry-based classroom curriculum enhancement activities aligned with national math, science, and technology standards, encompassing the research and technology of each of NASA's Mission Directorates. Each site is also equipped with an Aerospace Education Laboratory (AEL) that puts cutting-edge technology at the fingertips of NASA SEMAA students.

The two new sites at UTEP and Hartnell College will serve predominantly Hispanic populations, increasing SEMAA's reach to this audience as recommended by the National Research Council. In FY 2011, the two sites combined served more than 1,800 participants and all SEMAA sites combined served more than 61,000 participants.



## NASA Digital Learning Network Features Launchcasts Live from Kennedy Space Center

NASA's Digital Learning Network (DLN) featured a series of launchcasts during 2011 to virtually connect students and educators with NASA staff. DLN launchcasts count down launches live via a Webstream on the DLInfo Channel and usually begin streaming live at T minus 60 minutes to launch. Launchcast content includes vehicle, payload, crew, and mission overviews. Participants submit questions and receive answers during the program live via e-mail. The prelaunch program includes special guests such as NASA engineers, scientists, program managers, and celebrity guests including Neil deGrasse Tyson, director of the Hayden Planetarium in New York and host of *Nova scienceNOW*, as well as Elmo of Sesame Street fame.

## NASA Educational Technology Services Receives Wide Recognition

In 2011, the NASA Educational Technology Services (NETS) Web sites were selected for several prestigious awards. The NASA Kids' Club Web site was selected as the "Best Kids Site" by *Physics.org*, operated by the Physics in Society team at the Institute of Physics. The Institute of Physics is a scientific charity devoted to increasing the practice, understanding, and application of physics by all audiences. The "For Educators" section of [www.nasa.gov](http://www.nasa.gov) was named one of the top 10 sites with free resources for educators on <http://www.eschoolnews.com>, which has more than 500,000 unique visitors each month, including 250,000 registered members. NETS also received inquiries from the Library of Congress regarding the NASA Kids' Club. The Library of Congress was seeking advice on ways to reach younger readers.

NETS is a crosscutting NASA education technology project that prepares and delivers educational content on the NASA portal and maintains both the Office of Education Web site and the Central Operation of Resources for Educators Web site.



## Informal Education

### NASA Selects Projects for Funding Through the NASA Research Announcement 2011 Competitive Program for Science Museums and Planetariums Plus Opportunities for NASA Visitor Centers and Other Informal Education Institutions

Exhibits, planetarium shows, and community-based programming are among 18 projects NASA has selected to receive Agency funding in 2012. The selected projects consist of 11 informal education institutions and 7 NASA visitor centers that will share \$10 million in funding through NASA's Competitive Program for Science Museums and Planetariums Plus Opportunities for NASA Visitor Centers and Other Informal Education Institutions. A proposal solicitation that was open for 3 months in early 2011 received 63 proposals from institutions in 30 states and the District of Columbia. The 18 selections will join 31 other projects funded in 2008, 2009, and 2010.

The selected projects' topics will feature NASA missions in engineering, astronomy, human space flight, aeronautics, technology, and Earth science. They will also partner with NASA's Museum Alliance, a Nationwide network of informal education professionals at more than 500 museums, science centers, planetariums, NASA visitor centers, Challenger Centers, visitor centers at observatories and parks, nature centers, aquariums, and zoos.

The program will reach learners of all ages and educators who deliver formal or informal STEM education. Some projects will include partnerships with elementary and secondary schools, colleges and universities, and community-based organizations.

The Challenger Center, museums, science-technology centers, and planetarium selected for project funding are located in California, Georgia, Hawaii, Massachusetts, Minnesota, North Carolina, Pennsylvania, Texas, and Wisconsin. The 11 grants have a maximum 5-year period of performance and range in value from approximately \$370,000 to \$857,000.

The selected NASA visitor centers are located in Alabama, California, Maryland, Mississippi, Ohio, Texas, and Virginia. The seven visitor center projects have a maximum 5-year period of performance and range in value from approximately \$200,000 to \$900,000.

### Elmo Joins Space Shuttle Crew as NASA Highlights Where We've Been, Where We're Going

Elmo, *Sesame Street*'s red, "not scary" monster, appeared at a public event in August at the Eventi Plaza in New York City alongside the STS-135 Space Shuttle mission crew. The focus of the event was to engage the public with STEM education activities and inform them of NASA's future direction. The Eventi Plaza was transformed into a miniature space outpost filled with displays, demonstrations, interactive exhibits, video segments, and children's activities. Astronauts and other NASA representatives explained



how NASA's missions, scientific discoveries, and aerospace technologies are influencing and improving the way we live.

In tribute to the incredible accomplishments of the Space Shuttle Program over the past 30 years, adults and children who attended experienced Astro Camp activities, learned the basics of rocketry, and experienced what it's like to live and work in the near-gravity-free environment of space. Using LEGO hardware, visitors were able to build airplanes, Shuttles, rovers, a Moon base, and the International Space Station.

## NASA and the Museum of Science and Industry in Chicago Partner To Engage Middle School Students in STEM Education

NASA, the Museum of Science and Industry in Chicago, and Challenger Learning Centers in Normal and Woodstock, IL, partnered to offer a unique experience to engage underserved middle school students in STEM education. "Mission to Mars: An Urban/Rural Collaborative To Inspire NASA's Next Generation" is an interactive videoconference program that gives students the chance to launch a rocket to Mars, explore the surface of Mars, or send humans to live on Mars.

The program consisted of having students complete a series of inquiry-based activities, such as designing a launch vehicle that has more thrust than mass or building a habitable base on Mars. They also had the opportunity to connect live via videoconference with NASA experts at Marshall Space Flight Center, the

Jet Propulsion Laboratory, or Johnson Space Center to debrief their Mars mission and explore NASA careers. The program has empowered students to take complex mission planning into their own hands. In the 2012 pilot year, the program reached more than 1,000 students in 16 missions. In 2013, "Mission to Mars" will double to 32 missions and will continue to provide world-class programming to local communities.

## NASA Provides Summer Astro Camp to Military Children at Keesler Air Force Base

In June 2011, Stennis Space Center's (SSC's) Astro Camp staff presented a 4-day STEM camp for children ages 9–12 of military families at Keesler Air Force Base in Biloxi, MS. Students participated in a variety of NASA-themed activities including designing crew patches; viewing a Starlab portable planetarium show; launching straw rockets, pop rockets, and Estes rockets; and building LEGO robotics. The camp culminated with a field trip to SSC to tour the NASA visitor center and launch model rockets.

Astro Camp, which is also supported by NASA's Johnson Space Center Teaching from Space Office, is part of the White House initiative "Strengthening Our Military Families." SSC's Astro Camp conducts high-quality STEM programs with an emphasis on rocketry, propulsion, and the space sciences. The program operates year-round, conducting weeklong summer camps, 1-day Saturday camps, and special events.



## Higher Education and Minority University Research and Education Program (MUREP)

“Education is the most powerful weapon which you can use to change the world.” —*Nelson Mandela*

### NASA Education Hosts International Space Education Board (ISEB) at the 62nd International Astronautical Congress (IAC) in Cape Town, South Africa

The IAC is the largest space-related conference worldwide and is organized by the International Astronautical Federation (IAF), the International Academy of Astronautics (IAA), and the International Institute of Space Law (IISL). In 2011, NASA Education had the pleasure of hosting the ISEB, which was created to enhance collaborative space education efforts among its members, the Canadian Space Agency, the European Space Agency, the Japan Aerospace Exploration Agency, the Victorian Space Science Education Centre, Centre National d'Études Spatiales, and NASA. Through NASA Education Associate Administrator Leland Melvin's role as chair of the ISEB, NASA was granted the ability to oversee several of the education activities held at the

IAC. The 2-week event took place in Cape Town, South Africa, and engaged thousands of learners and educators with NASA education content while celebrating the country's newly opened South African National Space Agency (SANSA).

NASA's role with the IAC began by making a “Call for Abstracts” inviting graduate students in the United States to submit abstracts for the opportunity to be sponsored by NASA and participate in the IAC as “Space Ambassadors.” Eighty abstracts were received, and nine were selected from a wide array of higher education institutions including the University of Wisconsin-Milwaukee, the University of Colorado at Boulder, Stanford University, George Washington University, Prairie View A&M University, the University of Puerto Rico, Texas Southern University, the University of Pennsylvania, and Montana State University. NASA's Space Ambassadors participated in a variety of activities such as presenting their research papers to the heads of the space agencies in technical sessions and networking with other students, hosting professional development workshops for approximately 40 South African educators through the Space Education and Outreach Committee (SEOC), and facilitating activities for a special outreach event titled “You Are the World's Future in Space.”

The SEOC professional development workshops gave the Space Ambassadors an opportunity to present educators at the primary, middle, and secondary levels from South Africa with unique NASA content. Workshop topics were aligned with the South African science curriculum and included topics such as “Climate and Seasons,” “Building the Spacecraft,” “How



To Explore Mars,” and “Year of the Solar System.” The “You Are the World’s Future in Space” event reached more than 600 African learners in 8th grade with hands-on activities, which introduced them to space-related concepts such as alternative energy, astronomy, and robotics. In addition to interacting and sharing their career paths with the learners, the Space Ambassadors hosted three workshops titled “LEGO Build the Future,” “Renewable Energy,” and “Astronomy,” which provided them with an unforgettable educational experience with NASA.

NASA’s participation in the 2011 IAC provided a successful international forum for sharing knowledge and passion for science, as well as fostering dialogue and connections among members of the next generation of space leaders. The 2012 IAC is set to take place in Naples, Italy, in October, and NASA Education will be participating again.

## 2011 NASA Lunabotics Mining Competition

NASA’s Second Annual Lunabotics Mining Competition took place in 2011 with a total of 36 teams from all over the world competing for the coveted “Joe Kosmo Award for Excellence.” The Lunabotics competition is open to university-level students, who are challenged to design and build an excavator, called a Lunabot, that can mine and deposit a minimum of 10 kilograms of lunar simulant (BP-1) within 15 minutes. The complexities of the challenge include the abrasive characteristics of the BP-1, the weight and size limitations of the Lunabot, and the ability to telerobotically or autonomously control the Lunabot from

a remote mission control center. Approximately 1,500 people attended NASA’s 2011 Lunabotics Mining Competition, and NASA Edge broadcast the competition using UStream for viewers at home.

## NASA Student Ambassadors Take Center Stage at the Second Annual Education Stakeholders’ Summit

NASA’s Office of Education convened the Education Stakeholders’ Summit held November 29–December 2, 2011, in Chantilly, VA, where more than 225 education stakeholders gathered. A focus of the Summit was to address enhancing the infrastructure through “Creating the Foundations,” “Building the On-Ramps,” “Building Bridges,” and “The Road Ahead.”

During this 4-day training event, NASA Student Ambassadors and members of the One Stop Shopping Initiative (OSSI) for NASA Internships, Fellowships, and Scholarships community shared their roles in STEM education, giving attendees personal insight on their experiences. Additionally, five NASA Student Ambassadors gave inspiring presentations to the audience about how they got their start in the STEM fields, their academic backgrounds, how they connected with NASA, and their long-term professional goals. The NASA Student Ambassadors Virtual Community (NSAVC) is a network of 398 students who are top-performing NASA interns and fellows. This network of students is supported by the NSAVC Web site, which fosters greater interaction among other interns of NASA’s higher education projects.

Other Summit highlights included a workshop about the International Space Station National Lab Education Project and presentations from the University Research Centers Annual Meeting. The plenary session featured presentations by John Berry, Director of the United States Office of Personnel Management; Dr. Gilbert L. Rochon, President of Tuskegee University; Wanda Sigur, Vice President of Engineering at Lockheed Martin; Dr. Woodrow Whitlow, Associate Administrator for Mission Support at NASA; and Leland Melvin, Associate Administrator for NASA Education. Each presenter discussed why working in his or her field was “cool,” inspiring attendees to deliver that same message to the STEM fields’ future workforce.

## NASA Celebrates Its Longest Running Research Internship Program

In August 2011, NASA’s Langley Research Center celebrated the 25th anniversary of its longest running research internship program, the Langley Aerospace Research Summer Student (LARSS) program. Starting with 20 students in 1986, more than 4,500 high school, undergraduate, and graduate students (31 percent female, 28 percent minority) from prestigious institutions in 48 states and U.S. territories have participated in the LARSS program.

NASA’s Chief Technologist, Bobby Braun, a LARSS participant of 1986, said, “LARSS provided my first glimpse of NASA, first practical knowledge of engineering, and an introduction to other aerospace professionals, many of whom I am happy to still call colleagues today.”

LARSS has set a precedent for research internship, mentoring, and development programs for other NASA Centers and was recently ranked sixth in the “10 Best Internships for 2011” list by Vault Career Intelligence.

## Aeronautics Scholars Have NASA Backing In and Out of School

Through the NASA Aeronautics Scholarship Program, scholarship recipients receive a stipend to help them focus on their studies and also have the opportunity for an inside look at real-life science during the summer as interns at NASA aeronautics Centers. Undergraduate and graduate students spend 2 months working side by side with NASA researchers on topics ranging from alternative aviation jet fuels and engine acoustics to lightweight wing structures and better weather prediction for aircraft in flight.

When asked to identify the best part of the internship, one student replied: “Meeting all the brilliant minds that work at NASA. There are so many people working on exciting, complicated, and game-changing technologies there. And everyone loves talking about their work.”

Giving young, curious, and dedicated students a window into the world of the researcher is an experience that the NASA Aeronautics Scholarship Program is especially designed to provide.

## NASA Wins Educational Engagement Award Through Vanderbilt University’s “Take ME to School” Program

In addition to designing, building, testing, and flying high-power rockets, NASA Student Launch Projects (SLP) teams are required to engage younger students in STEM subjects. Fifty-six university, college, informal organization, and high/middle school SLP teams reached more than 45,000 other students, educators, and community members in 2011–12 through educational engagement events. This year’s SLP Educational Engagement Award winner, Vanderbilt University in Nashville, TN, took an innovative approach and developed a model to promote STEM education in local underserved middle schools. Vanderbilt Engineering’s Aerospace Club partnered with the Peabody College of Education and Human Development to build the “Take ME to School” program. Six pre-service educators worked with “Vandy’s” Aerospace Club to design a rocketry unit that incorporated engineering design as well as Tennessee state education standards. More than 500 students from three middle schools in the Nashville area participated in the workshops and demonstrated marked improvement in the areas of assessment. The workshops concluded with a rocket launch contest. The winners from each school were invited to a special event highlighting the Vanderbilt Engineering program and facilities.

## Lost in Space No More...

The University of Nebraska (UN), through the NASA Experimental Program to Stimulate Competitive Research (EPSCoR), developed a process to greatly ease some of the International Space Station’s logistic burdens such as locating, tracking, and maintaining inventory. To accomplish this task, UN’s Dr. Erick Jones led research into using Radio Frequency Identification (RFID) technologies as a Real-Time Location System (RTLS), which has proven to be successful on board the ISS and is now being used by both the astronauts and controllers on the ground.



RFID is a technology that uses electromagnetic tags to uniquely identify and track a product, vehicle, or person. Future RFID research includes expanding its capabilities into the tracking of medical supplies on Earth to the point where they are received by the patient and supporting deep space initiatives such as remotely tracking astronaut medicine use (telemedicine tracking).

## Annual NASA Great Moonbuggy Race Engages Future Explorers

More than 70 student teams from 22 states, Puerto Rico, Canada, Germany, India, and Russia competed in the 18th Annual NASA Great Moonbuggy Race. The event, which was held April 1–2, 2012, at the U.S. Space & Rocket Center in Huntsville, AL, inspired and engaged America’s next generation of scientists, engineers, and explorers. Teams were challenged to design, build, and race lightweight rovers, or “moonbuggies,” capable of traversing a grueling course that simulated the harsh lunar surface. Vehicles had to be exclusively propelled by two students—one female and one male. Prizes were awarded to the three teams in the high school and college division that posted the shortest times in assembling their vehicles and navigating the course.

Participation and interest in the race has increased annually from the original eight college teams in 1994. More than 40,000 people watched the live race on UStream, a Webcasting service.

## Team of Three NASA Summer Student Researchers Improves Reliability of Data Acquisition on SSC’s Test Stands

Three summer interns worked as a team at the John C. Stennis Space Center (SSC) on the NASA Data Acquisition System (NDAS), which is designed to replace the existing low-speed data- and event-monitoring systems. Although each intern focused on his particular area of the project, mutual collaboration and understanding of each other’s work was required to accomplish the goal of improving the reliability and accuracy of data acquisition in order to successfully test rocket engines and analyze the results.

Ryan Nazaretian, a Mississippi Space Grant recipient majoring in computer engineering at Mississippi State University, focused on developing the interfaces to the data-acquisition and signal-conditioning hardware used at the A1 and A2 test stands. His work created the foundation for the facility-independent NDAS hardware abstraction layer. In addition to his computer engineering studies, Mr. Nazaretian has been very active in FIRST robotics while in high school and in college. Jason Warren, an Undergraduate Student Research Program (USRP) recipient majoring in computer engineering at Mississippi State University, focused on testing and enhancing the networking capabilities of NDAS and on creating software to simplify the distribution of real-time test data to offsite customers. Mr. Warren is interested in using his programming skills to design robots, high-level operating systems, high-performance sensors, and much more. Harvest Zhang, majoring in computer science at Princeton University, focused on procedures for the NASA Instrumentation Roadmap Database (NIRD), which is a module within NDAS that



contains test program data and metadata for the rest of NDAS and is designed to be deployable to any test stand configuration with no modification of its table structure. Mr. Zhang presented at the NDAS Intermediate Design Review and the USRP Symposium, and he wrote a technical paper on NIRD. In addition to studying computer science, Mr. Zhang is also interested in physics and aerospace engineering. He is currently participating in Princeton's interdisciplinary Program in Information Technology and Society, which examines the effect that information technology, public policy, and society have on each other.

Mr. Nazaretian, Mr. Warren, and Mr. Zhang worked well together as a team and made a significant contribution to the NDAS project. Upon the completion of their internships, each of them wrote a technical paper and gave a presentation at SSC on their research.

## MUST Graduates Positioned for STEM Career Success

Motivating Undergraduates in Science and Technology (MUST) graduates from the 2011–12 academic year have excellent plans on the horizon. More than 70 percent are enrolled in master's and doctoral degree programs for fall 2012—the majority in mechanical, aerospace, or computer engineering disciplines. The institutions where these scholars will continue to advance their STEM education include Imperial College London, Purdue University, the Georgia Institute of Technology, North Carolina State University, and 10 others. They received a myriad of awards such as the Marshall Scholarship, the National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc. (GEM) Fellowship, and the NASA Space Technology Research Fellowship, in addition to numerous research assistantships and institutional fellowships. Twenty percent of the scholars have secured STEM employment following graduation, and less than 10 percent are continuing to search for employment. More than 80 percent of alumni since 2009 report that their experiences in MUST increased their awareness of career options and gave them a competitive edge when applying for positions. MUST alumni continue to be active in the NASA community as Student Ambassadors, INSPIRE mentors, and MUST mentors.



## NASA's Professional Development Training for MUST Scholars Proves To Be a Success

The NASA MUST Orientation and Leadership Symposium brought together 115 students from across the Nation to prepare them for the global workforce while creating a support system of resources and encouragement in their pursuit of a STEM degree. Scholars participated in training sessions offered by individuals such as Dr. Freeman Hrabowski, a national leader in minority STEM education, and Dr. Tony Wagner, a world leader in skills necessary for the 21st-century knowledge-based economy. More than 90 percent left the symposium inspired to excel academically and with a plan to develop their skill sets. Students strongly praised the new information they gained about employment and graduate school opportunities in the STEM fields. Scholar retention rates have increased sharply since the symposium began in 2008, from 77 percent to 94 percent in 2011, demonstrating the success and impact of the program.

## NASA's Ames STEM Symposium Focuses on Innovation and Discovery

The NASA Ames Research Center STEM Symposium was held in San Jose, CA, July 25–29, 2011, and highlighted participants and activities of the NASA Harriett G. Jenkins Pre-doctoral Fellowship Project (JPPF), the NASA Science and Technology Institute (NSTI), and the NASA Astrobiology Institute (NAI). The theme, “Renewing the Spirit of Innovation and Discovery,” reflected NASA’s efforts to create a vigorous path of innovation and technological development, leading an array of challenging and inspired missions designed to increase the next generation of human space flight system development. The annual symposium provided undergraduate, graduate, and faculty fellows with professional development, networking, and additional exposure to NASA. In addition to a myriad of activities, select student and faculty fellows presented their research to the NASA Ames scientific community during the NASA Ames Diversity Day.

## NASA Education Goals and Framework



### Strengthening NASA and the Nation's future workforce

NASA will identify and develop the critical skills and capabilities needed in aeronautics, Earth and space science, and space operations to ensure achievement of U.S. space exploration policy. To help meet this demand, NASA will continue contributing to the development of the Nation's science, technology, engineering, and mathematics workforce of the future through a diverse portfolio of education initiatives that target America's students at all levels, especially those in traditionally underserved and underrepresented communities.



### Attracting and retaining students in STEM disciplines

NASA will pursue the minds, imaginations, and career ambitions of America's youth. The Agency will focus on engaging and retaining students in STEM education programs to encourage their pursuit of educational disciplines critical to NASA's future in aeronautics, Earth and space science, and space operations and for participation in engineering, scientific, and technical missions.



### Engaging Americans in NASA's mission

NASA will build strategic partnerships and linkages between STEM formal and informal education providers. Through hands-on interactive educational activities, NASA will engage students, educators, families, the general public, and all Agency stakeholders to increase Americans' science and technology literacy.



## The Guiding Education Strategic Framework

The Education Strategic Coordination Framework is an Agency portfolio approach to education that builds upon the above education goals that were identified in the Agency 2006 Strategic Plan. It aligns NASA's total education portfolio with the strategic plan; provides a coordination structure; and creates an Agency-wide strategic planning, implementation, and evaluation framework for the Agency's investments in education.

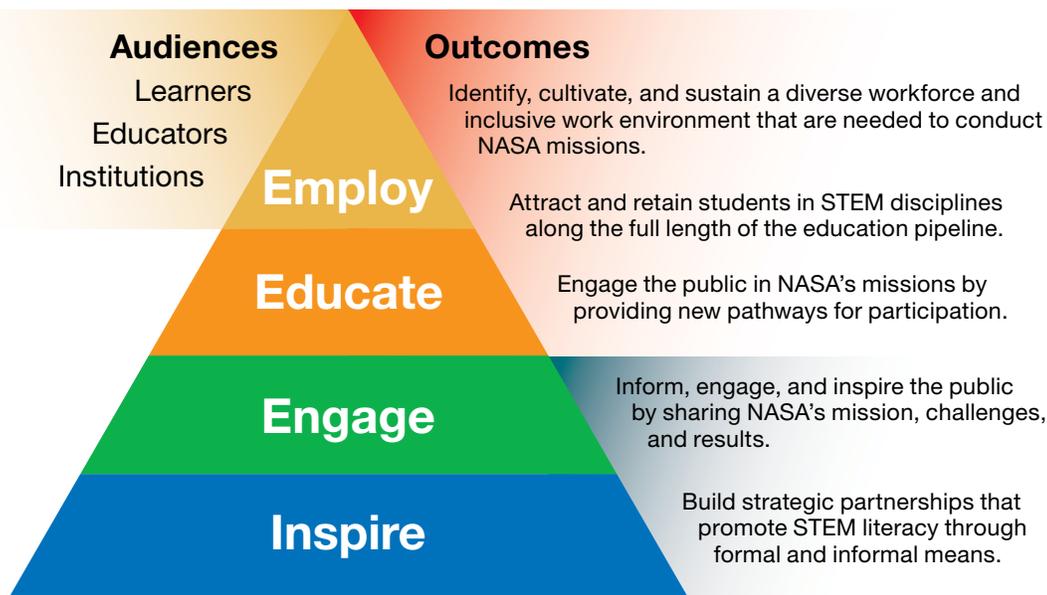
NASA delivers this comprehensive portfolio through its Office of Education, Mission Directorates, and Field Centers and contributes to our Nation's efforts in achieving excellence in STEM education.

The Education Strategic Framework chart depicted in Appendix B provides a conceptual basis for examining, guiding, and coordinating the NASA education portfolio. It is a strategic management tool that allows the Agency to monitor participant movement through education activities, with each category leading to the next. Education programs and projects draw from the category below them as a key source for participants, and they connect participants to the category above them, providing a more experienced and focused group and creating a measurable pipeline.

More information about the NASA Education Strategic Framework can be found at <http://education.nasa.gov/about/strategy/>.

# NASA Education Strategic Framework

A Clearly Defined and Coordinated Portfolio Approach



## NASA’s Planned Investments in Education

NASA Education provides unique opportunities for learners of all ages to explore and develop their full learning potential. We are responding to the challenge of preparing the next generation to remain globally competitive by empowering the future workforce with knowledge.

Our professional development and research opportunities for pre-service, in-service, and informal educators, as well as university professors, continue to strengthen the STEM education pipeline.

The Agency is supporting our Nation’s elementary and secondary schools, universities, colleges, and community colleges by providing exciting research and internship opportunities that will “light the fire” and “fuel the passion” for a new culture of learning and achievement in STEM education.

## NASA Office of Education Performance Assessment Reports

<http://www.nasa.gov/offices/education/performance/index.html>

## Our Partners

At its core, NASA is more than ever about American innovation and ingenuity. We are making substantial and exciting advances in our Earth and space science missions, our space technology and innovation efforts, and our aeronautics research.

While reaching for new heights in space, we are also creating new jobs right here on Earth. NASA education programs continue to fuel an increased interest in STEM among America’s youth, helping the United States remain globally competitive and sustain a strong national economy.

NASA accomplishes its education missions through its strong, mutually beneficial relationships with external partners, which result in educational experiences that engage Americans in NASA’s mission while promoting STEM literacy. These partners play a key role in successfully connecting with learners, educators, and institutions using NASA-unique content.

NASA is inspiring a new era of innovation—we are responding to the challenge of preparing the next generation and empowering the future workforce.

# NASA Education Categories of Involvement

## Four Categories of Involvement

### **Inspire**

Activities focused on promoting awareness of NASA's mission among the public, primarily through informal education and outreach activities. This category is heavily supported by the outreach activities of other NASA organizations, such as the Office of Public Affairs. Inspire-level efforts are broad, with the goal of reaching a large number of people. This category forms the base of an education structure that becomes more focused at progressively higher levels of the framework pyramid.

### **Engage**

Education activities that in some manner incorporate participant interaction with NASA content for the purpose of developing a deeper understanding. Participants are strategically identified and targeted.

### **Educate**

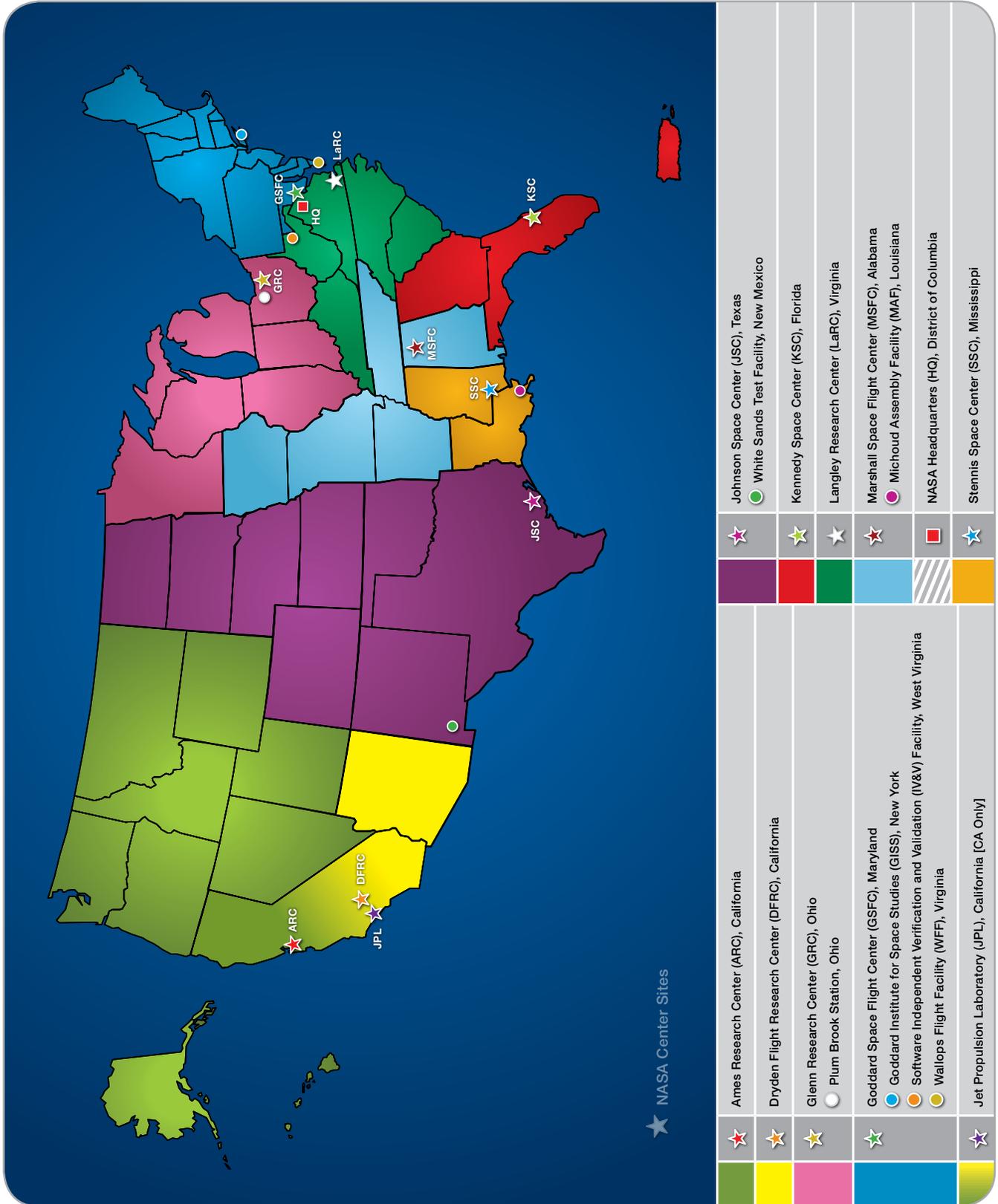
Focused education support that promotes learning among targeted populations. Education activities focus on student learners or pre- and in-service educators and are designed to develop and/or enhance specific STEM knowledge and skills using NASA resources. These activities promote new knowledge acquisition and strengthen an individual's skills. NASA's elementary and secondary education efforts are supplementary to formal classroom instruction. NASA's higher education efforts may include development of specific university curricula in support of the NASA mission and student-built instruments.

### **Employ**

Targeted development of individuals who prepare for employment in disciplines needed to achieve NASA's mission and strategic goals. Through internships, fellowships, and other professional training, individuals become participants in the U.S. space exploration policy and NASA science and aeronautics research. At the apex, they have acquired sufficient mastery of knowledge for employment with NASA, academia, or industry or within STEM fields of teaching.



# NASA Education K-12 Service Areas



## Connecting with NASA Education

### How Do I Contact NASA Education?

NASA Education points of contact for networking can be found online at <http://www.nasa.gov/offices/education/contacts/index.html>.

### How Do I Participate in NASA Education Programs?

Visit the Education Web site of the NASA Center in your region for information about local programs and activities. The list can be found at <http://www.nasa.gov/offices/education/centers/index.html>.

To find out about opportunities Nationwide, students should visit <http://www.nasa.gov/audience/forstudents/current-ops-index.html>. Internships, scholarships, and fellowships can be found at <http://www.intern.nasa.gov>. Educators should visit <http://www.nasa.gov/audience/foreducators/current-ops-index.html>.

### How Do I Get NASA Education Materials?

#### Companies and Nonprofit Organizations

- Please contact the NASA Education Office in your region. The points of contact can be found at [http://www.nasa.gov/offices/education/programs/national/ercn/home/ERCN\\_Field\\_Center\\_Listing.html](http://www.nasa.gov/offices/education/programs/national/ercn/home/ERCN_Field_Center_Listing.html).

#### Educators, Schools, and Families

Please utilize the following resources:

- The NASA Educator Resource Center in your region: [http://www.nasa.gov/offices/education/programs/national/ercn/home/ERCN\\_Field\\_Center\\_Listing.html](http://www.nasa.gov/offices/education/programs/national/ercn/home/ERCN_Field_Center_Listing.html).
- Regional Educator Resource Centers in your state: [http://www.nasa.gov/offices/education/programs/national/ercn/home/ERCN\\_State\\_Listing.html](http://www.nasa.gov/offices/education/programs/national/ercn/home/ERCN_State_Listing.html).
- NASA Central Operations of Resources for Educators: <http://core.nasa.gov>.
- NASA online education materials: <http://search.nasa.gov/search/edFilterSearch.jsp?empty=true>.

#### Visitors to NASA Headquarters

The Headquarters library is open to the public and has an information center with a variety of free education and outreach materials.



## NASA Education EXPRESS Mailing List

Sign up to receive e-mail announcements about NASA products, activities, workshops, events, and opportunities to bring NASA educational resources into your classroom: [http://www.nasa.gov/audience/foreducators/Express\\_Landing.html](http://www.nasa.gov/audience/foreducators/Express_Landing.html).

### Other Ways To Connect with NASA

- **NASA Careers:** Review job listings, post a résumé, and even apply for a NASA job online at <http://www.nasa.gov/about/career/index.html>.
- **Business Opportunities:** Find services related to NASA contracts, small business programs, partnerships, and submission of an idea or proposal to NASA at <http://www.nasa.gov/about/business/index.html>.
- **Research Opportunities:** NASA offices and Field Centers offer a wide variety of opportunities for researchers. Visit <http://www.nasa.gov/about/research/index.html> for more information.

## For More Information

**For more information, please visit [www.nasa.gov](http://www.nasa.gov).**

The NASA Web site is the single point of entry to NASA public content and the most popular Government site on the Web. It serves as the gateway for information regarding content, programs, and services offered by NASA for the general public and, specifically, for the education community.

Visit [www.nasa.gov](http://www.nasa.gov) to find out more information about NASA's mission, research, and activities; NASA Education strategy and programs; and NASA Mission Directorates and Field Centers.





“We know that the progress and prosperity of future generations will depend on what we do now to educate the next generation.”

—President Barack Obama

