2010 Annual Performance Report
NASA Explorer Schools

Administered by the National Science Teachers Association (NSTA) and
Oklahoma State University (OSU)
Type of Agreement: Grant (NSTA) and Cooperative Agreement (OSU)

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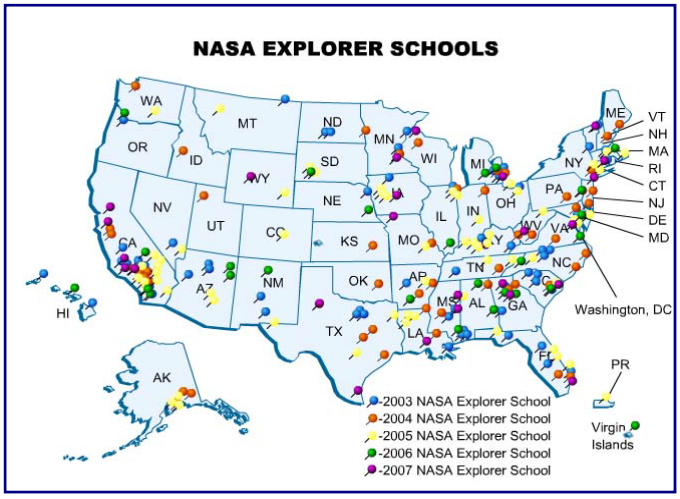
PROJECT DESCRIPTION

The NES Project establishes a 3-year partnership between NASA and schools from diverse communities across the country. The NES Project works primarily with groups of students who are underrepresented in science, technology, engineering, and mathematics (STEM) professions or who are traditionally underserved in rural or urban parts of the country. NES joins educators, students, and families in sustained involvement with NASA's research, discoveries, and missions. The project is designed to assist education communities at the 4-9 grade levels improve teaching and learning in STEM through significant structural techniques such as professional development, stipends, grants, curricular support based on NASA's resources, and the innovative use of instructional technology provided primary by the NASA Digital Learning Network (DLN).

Since the inception of the Project in 2003, NASA has established 200 NES partnerships, representing a total of 249 schools from diverse communities located in all 50 states, Washington D.C., Puerto Rico and the Virgin Islands. The image to the right identifies the location of NES nationwide.



In FY10, NASA provided professional development and student programs to 25 NES (30

schools) in the third year[1] of the 3-year NES partnership with NASA. Additionally, 91 alumni NES (101 schools), who have completed the initial 3-year partnership, actively participated in NES professional development and student opportunities. 70.2% of the 116 NES served in FY10 are considered high poverty and 73.3% served high minority student populations[2].

PROJECT GOALS

NES expands horizons -- opening young minds to the possibilities of what the future holds. NES strives to make the resources, experiences, and tools necessary for effective science and mathematics education available to schools nationwide. The NES project links educators and students to resources and facilities that are normally beyond reach in the public school system. This direct contact plays an integral role in impacting individual students and entire school communities.

NES project goals are as follows:

NES Project Goals	NES Project Performance Objectives
Provide educators with sustained professional development.	Increase the active participation and professional growth of educators in science.
	Increase the academic assistance for and technology use by educators in schools with high populations of under-served students.
Provide all students the opportunity to explore STEM topics in a variety of engaging and interactive NASA contexts.	Increase student interest and participation in mathematics, science, technology and geography.
	Increase student knowledge about careers in mathematics, science, engineering and technology.
	Increase student ability to apply mathematics, science, technology, and geography concepts and skills in meaningful ways.
Build strong family involvement within NES schools.	Increase family involvement in children's learning.

PROJECT BENEFIT TO OUTCOME 2

Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers and faculty.

The goals of the NES Project align to Outcome 2 of the 2006 NASA Education Strategic Coordination Framework, working to "attract and retain students in STEM

[1] The NES Project did not select a new cohort of schools in 2008 and 2009, therefore there were no schools in their first or second year of the NES partnership.

[2] Greater than 50% of students eligible to receive free or reduced lunch indicated high poverty. Greater than 50% minority student population indicated high minority.

disciplines." NES works to effectively compete for the minds, imaginations and career ambitions of America's young people.

Objective 2.1—Short Duration Professional Development
Provide short duration professional development and training opportunities to educators, equipping them with the skills and knowledge to attract and retain students in STEM disciplines.

Objective 2.2—Long Duration Professional Development
(Educate) Provide long-duration and/or sustained professional development training opportunities to educators that result in deeper content understanding and/or competence and confidence in teaching STEM disciplines.

Objective 2.3—Curriculum Support Resources
(Educate) Provide curricular support resources that use NASA themes and content to:

a) Enhance student skills and proficiency in STEM disciplines (Educate);
b) Inform students about STEM career skills and proficiency in STEM career opportunities (Engage); and
c) Communicate information about NASA's mission activities (Engage).

Objective 2.4—Student Opportunities
(Engage) Provide K-12 students with authentic first-hand opportunities to participate in NASA mission activities, thus inspiring interest in STEM disciplines and careers; and/or provide opportunities for family involvement in K-12 student learning in STEM areas.

NES primarily reaches students by engaging teams of teachers and administrators at partner schools. The Project provides teachers with unprecedented access to NASA's unique mission content, resources, and technology. During 1-week professional development workshops at NASA Centers, educators gain first-hand knowledge of NASA research, facilities and educational resources. Customized professional development opportunities are offered throughout the 3-year partnership by NES Coordinators during on-site visits and through e-Professional Development opportunities that utilize on-line collaborative software and Web cast technologies.

417 unique educators participated in either short-duration (2 days or less) or long-duration (more than two days) NES STEM professional development opportunities in FY09. Among those who attended professional development, 83.5% (348 educators) used at least one NASA resource in their classrooms. 99% of NES professional development participants reported that the NASA STEM resources were effective in teaching STEM concepts, and 97% of these teachers reported that they would continue using NASA education resources in the future.[3]

[3] Data Source: Year-end Teacher Involvement Survey, administered May 2010; Reported in Paragon TEC, Inc., September 2010.

The NES Project focuses its efforts on engaging and retaining students in STEM education and encourages them to pursue educational disciplines that are critical to NASA's future engineering, scientific, and technical missions. 76,462 unique students participated in NASA instructional and enrichment activities. Students in grades 4-9 reported statistically significant increases in interest in science, math and robotics following participation in NES.[4] 79% of NES students reported that they were interested in learning more about STEM content after participating in NASA educational activities.[5]

As a result of participation in NES, students are exposed to career related activities throughout the K-12 pipeline. 96% of NES educators reported they believed the activities developed knowledge about STEM[6] and 97% of NES teams reported that they believed NES increased student interest in STEM careers[7]. 79% of NES students reported that they would rather use NASA resources to learn STEM concepts and 76% reported that it is easier to learn and they learn more using NASA resources[8]. 79% of NES students reported they wanted to learn more about STEM topics following participation in NES activities[9].

PROJECT ACCOMPLISHMENTS

FY10 NES Partner School Accomplishments

NES provided 1,285 total professional development opportunities, student learning activities, and family involvement events in FY10, reaching a total of 102,310 educator, student, family and community member participants.[10]

Total Number of Programs and Participants per Service Provided	Student Development	Short Term Profession Development	Family Involvement Events	Conferences	Special Opportunity Workshops	Other Events	**TOTAL FY10 Participation** [10]
Programs	**1,083**	**90**	**86**	**9**	**5**	**12**	**1,285**
Educators	4,477	1,465	1,208	72	105	63	**7,390**
Students	73,245	21	11,572	0	0	8	**84,846**
Family Members	1,246	2	7,025	0	0	0	**8,273**
Community Members	673	2	1,118	0	0	8	**1,801**
Total	**79,641**	**1,490**	**20,923**	**72**	**105**	**79**	**102,310**

[4-5] Data Source: Year-end Student Interest Survey as reported in NES Final Report, Paragon TEC, Inc. September 2010.
[6] Data Source: NES e-folio reflection questionnaire, as reported in NES Final Report, Paragon TEC, Inc. September 2010.
[7] Data Source: NES Team End of Year Survey, as reported in NES Final Report, Paragon TEC, Inc. September 2010.
[8 - 9] Data Source: Year-end Student Interest Survey as reported in NES Final Report, Paragon TEC, Inc. September 2010.

[10] Data Source: NES Site Status Report System. Total number of participants does not represent unique individuals. Individuals may have participated in multiple NES events throughout the school year.

Participation							

NES Provided Grants to Purchase Instructional Technology

NES provided technology grants to support the purchase of instructional technology, including video conferencing equipment, necessary to implement the school's approved action plan. In FY10, NASA awarded twenty-five, $2,500.00 technology grants to NES in the final year of their 3-year partnership with NASA through the Project's fiscal agent, NSTA. Total amount of all FY10 technology grants awarded was $62,500.00.

NES Coordinators Provided On-Site Support and Services

In FY10, NES Coordinators conducted 109 site visits to NES, directly engaging 25,501 students, educators, family members and community members[11] in NASA educational activities. During site visits, NES Coordinators met with NES team members to develop a strategic action plan for enhancing STEM teaching and learning within their school. While at the schools, coordinators also provided professional development for educators, led hands-on NASA educational activities for students, and provided family night activities.

NES Website Usage

The NES website is an online resource and collaborative tool for NES educators and a resource for information about the NES Project for non-NES educators, NASA staff and the public. The NES website is a central repository for all NES resources, forms, and the school technology budgets. The NES website also has links to other NASA educational projects. The NES website received 347,494 page views in FY10.

FY10 NES Educator Accomplishments

Short-duration (less than 2 days) Professional Development

NES provided a total of 90 short-duration professional development opportunities reaching 1,465 educator participants[12]. Professional development was provided during on-site training at schools and follow-up educational advisory sessions with NES staff.

Long-duration (2 or more days) Professional Development Workshops

179 educator participants participated in 14 long-duration professional development opportunities[13]. Long –duration Professional development was provided during professional education conferences and special opportunity workshops.

[11] Data Source: NES Site Status Report System. Total number of participants does not represent unique individuals. Individuals may have participated in multiple NES events throughout the school year.

[12] Total number of participants does not represent unique educators. Individuals may have participated in multiple professional development opportunities throughout the school year.

[13] Data Source: NES Site Status Report System. Total number of participants does not represent unique individuals. Individuals may have participated in multiple NES events throughout the school year.

NES provided an opportunity for educators to participate in 5 professional education conferences in FY10.

- 8 educators participated in the National Science Teacher's Association Area Conference, Phoenix, AZ.
- 6 educators participated in the National Middle School Association Conference, Indianapolis, IN.
- 18 educators participated in the National Science Teachers Association National Conference, Philadelphia, PA.
- 14 educators participated in the National Council of Teachers of Mathematics Annual Conference, San Diego, CA.
- 7 educators participated in the International Society of Technology Educators (ISTE), Denver, CO.

NES provides unique Special Opportunity Workshops to educators and administrators throughout the school year. These workshops provide an opportunity for participants to explore specialized content in-depth at NASA Centers or on-site locations through field research experiences and inquiry-based activities. In FY10, NES provided four special opportunity workshops: *Coastal Observations – From Satellites to Microscopes, Reduced Gravity Flight Opportunity, Winter's Story Workshop,* and *Weather on Earth and Other Planets.*

Coastal Observations: From Satellites to Microscopes held at Wallops Flight Facility, VA

The Coastal Observation Workshop focused on the study of coastal oceanography from space, shipboard and in the laboratory. The workshop integrated science observations from space with science presentations, shipboard research cruises, and laboratory analysis of oceanographic research including phytoplankton, chlorophyll, and water chemistry. Participants gained first-hand experience with NASA science and education materials to be used in the classroom.

Reduced Gravity Flight Opportunity held at Johnson Space Center, TX

The NES Reduced Gravity Flight Opportunity provided a unique academic experience for NES teachers and students to successfully propose, design, fabricate, fly and evaluate a reduced gravity investigation of their choice. This investigation related to the educator's classroom curriculum. Students designed and tested the investigation in 1G and wrote a hypothesis of what they thought would happen in a reduced gravity environment. Educators brought the investigation to Johnson Space Center where it was flown in a reduced gravity environment. Educators collected data during the flight for the students to analyze to prove or disprove their hypothesis.

Winter's Story Workshop held at Yellowstone National Park, MT

Winter's The Winter Story Workshop explored ways in which climate and the requirements for life connected are connected. Teachers conducted research on how the cycling of water in and out of the atmosphere plays an important role in

determining climatic patterns and the relationship of ecosystems with climate change. During this opportunity participants learned from NASA scientists how they study ice and snow on Earth and the search for life (and consequently water) in the Solar System by going to Yellowstone National Park region in the depth of the winter season.

Weather on Earth and Other Planets held online via Oklahoma State University, Desire to Learn (D2L) and at the National Science Teachers Association National Conference, Philadelphia, PA

The Weather on Earth and Other Planets workshop was deliver online using the Desire to Learn (D2L) system through Oklahoma State University. The 90-minute class sessions were held weekly for 5 weeks and culminated with an in-person component held at the National Science Teachers Association National Conference. The on-line sessions focused on characteristics of Earth that play a major role in our weather, elements of weather, weather maps, predicting weather with the National Weather Service, weather on other planets, and NASA education resources to support weather instruction. The in-person component featured a half-day session on the impact of climate change on oceans with NOAA and forests with the U.S. Forest Service.

FY10 NES Student Accomplishments

NES provided opportunities for active engagement of students in STEM content to increase their ability to apply STEM and to learn about career paths. Typically done with teacher support and training, these project elements offer direct uses of NASA mission data to solve investigative questions posed by students. Multiple efforts provided educators and students with content-specific activities that use the NASA mission as a context to enhance a school's curricula by adding real world applications and relevance.

NES provided 1,083 student learning opportunities and 86 family involvement events engaging 84,817 student participants[14] in FY10. Student learning opportunities involve content-specific activities that use NASA missions as a context to enhance a school's curricula by adding real world applications and relevance. Typically done with teacher support and training, these project elements offer direct uses of NASA mission data to solve investigative questions through hands-on activities.

Regional Virtual Student Symposia and National Student Symposium

Fifty-one schools participated in regional virtual symposia held February through March, 2010 by NASA Centers using the Digital Learning Network. The regional symposia challenged students to present their investigations that focused on a wide-range of NASA missions or research interests, including science, aerospace, reduced gravity, robotics, plant growth in space, or living and working in space, to a panel of

[14] Data Source: NES Site Status Report. Total number of participants does not represent unique students. Individuals may have participated in multiple NES career events throughout the school year.

NASA experts via videoconferencing. NES staff then selected students to represent their schools at the national symposium based on ratings of their investigations at the regional virtual symposia.

Seventy students representing 35 schools participated in the NES National Student Symposium, held at Kennedy Space Center, May 5-7, 2010. During the Symposium, students presented the results of research investigations, participated in facility tours, hands-on activities, and learned about STEM careers at NASA and participated in presentations from NASA researchers.

81% of the students reported they were more interested in a career at NASA or in STEM following participation in the Symposium[15]. Students attending the symposium left feeling more interested in NASA or STEM careers, learned about NASA, enjoyed learning with NASA materials, and think that NASA does important and exciting work. NES school teams report they plan to have students present their investigations to additional groups, support students in continuing these specific investigations, and offering them other opportunities to pursue their STEM interests through NASA materials[16].

PROJECT CONTRIBUTIONS TO PART MEASURES

PART MEASURE – Educator Professional Development (Short-duration):
Percentage of elementary and secondary educators who obtain NASA content-based education resources or participate in short-duration NASA education activities and use NASA resources in their classroom instruction.
288 unique teachers participated in NES short-duration (two days or less) professional development opportunities in FY10. 78.8% (227/288) of the teachers who attended short-duration professional development used at least one NASA STEM resource in their classroom instruction.

PART MEASURE – Educator Professional Development (Long-duration):
Percentage of elementary and secondary educators who participate in NASA training programs and use NASA resources in their classroom instruction.
129 unique teachers participated in NES long-duration (more than two days) professional development opportunities in 2010. 93.8% (121/129) of the teachers who attended long-duration professional development used at least one NASA STEM resource in their classroom instruction[17]. Teachers who attended long-duration professional development were 14.9% more likely to have used at least one NASA STEM resource in their classroom, compared to teachers who had participated in short-duration professional development.

[15] Data Source: Student end of event survey as reported in Student Symposium Evaluation, Paragon TEC, Inc. June 2010.
[16] Data Source: Student end of event survey as reported in Student Symposium Evaluation, Paragon TEC, Inc. June 2010.
[17] Data Source: Year-end Teacher Involvement Survey as reported in NES Final Report, Paragon TEC, Inc. September 2010.

PART MEASURE – Student Involvement: ***Number of elementary and secondary student participants in NASA instructional and enrichment activities.***
76,462 unique students from 116 NES (131 schools), located throughout the country, participated in NES instructional and enrichment activities in 2010[18].

Year	Number of NES Student Participants	Percent Change
FY09	85,004	-
FY10	76,462	- 10.0%

PART MEASURE – Student STEM Career Interest: ***Percentage of students expressing interest in science, technology, engineering, and math (STEM) careers following their involvement in NASA elementary and secondary education programs.***
60.5% (2,326/3,847) of NES students reported that they were interested in a career that involves science, technology, engineering or mathematics[19].

Year	Number of Participants Surveyed	Number of completed surveys	Number of Students interested in STEM careers	Percent Interested in STEM careers
FY09	5,579	5,189	4,017	77.0%
FY10	3,847	3,847	2,326	60.5%

PART MEASURE - ***Cost per participant for NASA elementary and secondary education programs***
76,462 unique students[20] and 417 unique educators[21] participated in NES educational programs in FY10. The cost per participant was $57.14.

IMPROVEMENTS MADE IN THE PAST YEAR

Pilot of NES New Model

In 2008, NES began an extensive internal and external review of the project goals, model, implementation and results. The process was initiated as a result of the recommendations received from The National Research Council of The National Academy of Science's external evaluation of NASA's Elementary and Secondary Education Program Quinn, H. R., Schweingruber, H. A., and Feder, M. A. (Ed.). (2007) The National Academy of Science, National Research Council, Board on Science Education. NASA's Elementary and Secondary Education Program: Review and

[18] Data Source: National Center for Educational Statistics, U.S. Department of Education, school enrollment data.
[19] Data Source: Year-end Student Interest Survey as reported in NES Final Report, Paragon TEC, Inc. September 2010.
[20] Data Source: National Center for Educational Statistics, U.S. Department of Education, school enrollment data.
[21] Data Source: Year-end Teacher Involvement Survey as reported in NES Final Report, Paragon TEC, Inc. September 2010.

Critique (ISBN: 0-309-11552-3). Washington, D.C: National Academies Press. In 2009, NES continued to refine and retool the NES model through external focus groups. NES also conducted an external review of the historic NES model Booz Allen Hamilton. (2009, July). External Review of the Historic NES Model. McLean, VA. and completed a benchmarking review of High School Best Practices Booz Allen Hamilton. (2009, August). High School Best Practices Benchmarking Review. McLean, VA.

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NES completed the rigorous redevelopment of the project by conducting a small scale pilot of key features with 57 teachers from 48 schools in the spring of 2010. This pilot was intended to test Curriculum support materials and teachers implementation support, IT infrastructure, outreach and communications and staff workloads. NES leveraged the skills and expertise of strategic partners to help refine and improve the pilot project features and functionality. NES engaged the International Center for Leadership in Education, International Technology and Engineering Educators Association, and the National Science Teachers Association to lend their expertise to the effort. Strategic partners supported the evaluation and validation of NES content, pilot school recruitment, and project evaluation and review. Additional schools were identified by working with internal NASA Education efforts and with State level Dept of Education Math and Science Partnership coordinators in Texas, Louisiana and Georgia.

The pilot reached 3062 students in 57 classrooms across 16 states. Of the 48 schools involved, 25 had student populations that receive greater than 50% free and reduced lunch, 17 were in urban settings and 15 were in rural settings.

Evaluation findings from the pilot were overwhelmingly positive:

- 90% of teachers agreed or strongly agreed that modules were a good fit in the classroom
- By a 3:1 margin students agreed that the NES experience inspired them to learn more about STEM
- 88% of participants agreed or strongly agreed that NES professional development made them feel more comfortable in presenting NES modules
- 87% of teachers agreed or strongly agreed that NES virtual experiences could directly related to STEM topics that they teach in the classroom

Based upon pilot user feedback and evaluation data collected through surveys, phones interviews and a focus group, NES modified key project features to support ease of implementation to support full scale launch in September 2010:

- Provide additional curriculum support materials around a cross-section of middle and high school STEM topics

- Support each module with a digital playlist of multimedia to support classroom delivery of content (scientific images, introductions to topics from Subject matter experts, answers to common misconceptions)
- Continue process of external review for content selection
- Redeveloped product pages to aid content selection and alignment
- Expanded help desk functionality through phone and email
- Align curriculum modules to additional internal and external student and teacher opportunities
- Add online community to support teacher collaboration and sharing of ideas
- Create weekly 7 minute podcast to engage students in NASA careers and current research
- Develop a Recognition Program to incentivize and acknowledge in-depth participation, innovative use of NES materials, and demonstration of educational best practices

PROJECT PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

External Education Partner – National Science Teachers Association (NSTA), Grant number NNX07AU68G

NSTA provided project management and logistical support for the NES project in FY10. As an external education partner in the NES project, NSTA provided key support services including:

- Database maintenance, documentation and communications,
- Administration of NES Technology grants and educator stipends,
- Promotional support and products,
- Logistical support for summer workshops, special opportunity workshops and the student symposium, and
- Design, delivery, and logistical support for external and user focus groups for the development of the new NES model.

External Education Partner – Oklahoma State University (OSU), Cooperative Agreement number NNX07AV66A

OSU provided a highly trained professional staff including NES Coordinators and Project Assistants who are fully engaged in NASA content to provide needs based services to schools since the project inception in 2003. NES Coordinators are the primary interface between NASA and NES Sites. Working with the Center NES Project Manger, the NES Coordinator is responsible for day-to-day project operations, implementation and communications. The NES Coordinators assisted NES teams in their region develop action plans for reaching school STEM improvement goals, and monitored the progress of NES teams as they implement their action plans. NES Project Assistants worked in collaboration with NES Coordinators to ensure completion of project requirements by maintaining project records, tracking key documents, and assisting NES team members access online systems.

OSU also provided project management support and implementation services including:

- Assistance in development and implementation of NES strategic action plans for enhancing STEM teaching and learning at NES Sites,
- Needs-based professional development and student programs to NES,
- Support of integration of NASA educational resources and educational Technology tools at NES, and
- Support for the development of additional partnerships to enable project sustainability beyond the 3-year NES partnership with NASA.

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